8 KEY ENVIRONMENTAL ISSUES

8.1 Dust

SLR Consulting (2014) prepared a detailed air quality impact assessment, which is provided in full at Appendix 6, and informs this section of the EIS.

8.1.1 Methodology

The United States Environmental Protection Agency 'CALPUFF' model was used to predict dust deposition and concentration. The CALPUFF modelling system is a model for assessing long range transport of pollutants and their impacts involving composite meteorological conditions. As part of the modelling inputs, The Air Pollution Model (TAPM version 4.0.4) and 'CALMET' (a diagnostic 3-dimensional meteorological model) were used to generate synthetic meteorological conditions, modified with data from the nearest BOM stations at Holsworthy Range Control, Bankstown Airport, Horsley Park Equestrian Centre and Camden Airport.

Dust is most commonly measured and modelled in the following units:

- Deposited dust, measured in grams per square metre per month (g/m^2/month). This is the dust that residents would commonly see on window sills or other flat surfaces in a house, and it can be generated from within and outside the house;
- Concentrations of total suspended particulates (TSP), measured in micrograms per cubic metre ($\mu g/m^3$);
- A subset of TSP are those particles with an aerodynamic diameter of 10 microns or less (PM_{10}) measured in $\mu g/m^3$. Particles between 10 and 2.5 microns in diameter are generally categorised as 'inhalable coarse materials', meaning the particles of dust would not be seen but can be inhaled; and
- A subset of TSP are those particles with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$) measured in $\mu g/m^3$. Particles measuring 2.5 microns or less in diameter are categorised as 'fine particles'. These particles can be found in smoke and haze, or they can form when gases emitted from power plants, industries and automobiles react in the air. $PM_{2.5}$ particles are inhalable.

To model and measure dust concentration (TSP, PM_{10} and $PM_{2.5}$), different averaging periods are used. In the case of deposited dust, monthly averages are used. In the case of TSP, annual averages are reported, while for both PM_{10} and $PM_{2.5}$, annual and 24 hour averages are used.

8.1.2 Existing environment

No dust deposition data is available on or near the PAA and a background dust level of 2 g/m^2/month has been assumed.

The following background dust concentrations were sourced from the OEH monitoring station at Liverpool, which provides a representative environment:

- Maximum 24-hour average PM_{10} concentration measured during 2012 was 42.5 µg/m^3. The annual average PM_{10} concentration was 19.8 µg/m^3; and
- Maximum 24-hour average $PM_{2.5}$ concentration measured during 2012 was 24.9 µg/m^3. The annual average $PM_{2.5}$ concentration was 8.5 µg/m^3.

No relevant TSP data is available. TSP concentrations are not measured in the vicinity of the site, however the SIMTA EIS (Hyder 2014) notes that "*historical measurements of TSP and* PM_{10} *in Sydney (*based on NSW EPA quarterly monitoring reports*) indicate that* PM_{10}*/TSP ratios in urban areas typically range from 0.4 to 0.5. These ratios can be applied to the* PM_{10} *concentration data to derive an annual average TSP concentration.*"

Further, the Moorebank Intermodal EIS (Parsons Brinkerhoff 2014) notes the following *"No publicly available TSP monitoring is conducted in the vicinity of the Project site. Historically, the NSW OEH recorded concurrent 24-hour average TSP and PM10 concentrations on a one-in-six day sampling regime at Earlwood, Rozelle and the Sydney CBD. This monitoring was discontinued in 2004. NSW OEH quarterly air quality monitoring reports for 2003 and 2004 were reviewed for concurrent* PM_{10} *and TSP concentrations. These data highlighted that, on average,* PM_{10} *concentrations recorded by the NSW OEH were 48% of TSP concentrations.*

On the assumption that ambient PM_{10} concentrations are half the TSP ambient concentrations, the TSP ambient concentration (annual average) has been estimated at 39.6 µg/m^3.

8.1.3 Impacts

Dust Deposition

Modelling predicts deposited dust at all receptors to be well below the relevant criterion of 4 g/m^2/month, with the maximum at just 2.4 g/m^2/month, of which 2 g/m^2/month is assumed background.

TSP

The relevant criterion for TSP annual average is 90 µg/m^3, and predictive modelling show that this criterion will not be exceeded. The highest cumulative prediction under the modelling undertaken for this project is 42.6 µg/m^3, of which 39.6 µg/m^3 is background dust.

PM_{10}

The relevant criterion for PM_{10} 24 hour average is 50 µg/m^3, which is met at all but one receptor, R2 to the south of the PAA.

Figure 8-1 identifies the location of the R2 receptor. This receptor has a prediction of 50.2 µg/m^3 of which 42.5 µg/m^3 is background; 7.6 µg/m^3 is the increment due to the Project; and less than 0.1 µg/m^3 is due to operations on the adjacent landfill.

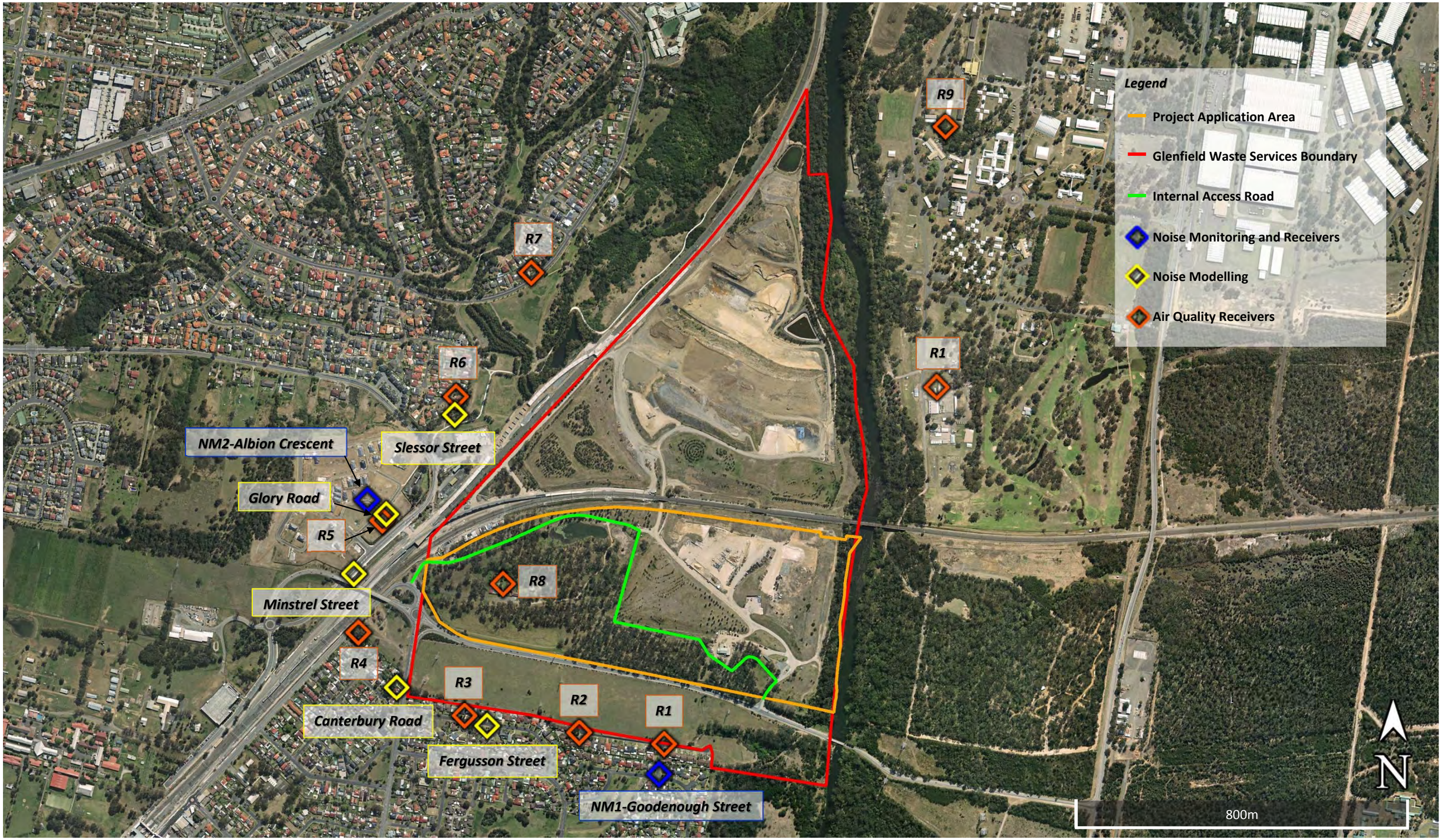
PM_{10} 24 hour modelling is carried out using contemporaneous background dust statistics. To gain a clear understanding of impacts, predictions are firstly calculated for days when background dust is highest, to which are added Project predictions. Secondly, another set of predictions is calculated for the days when the Project increment is predicted to be highest, to which is added the corresponding day's measured background dust level. The PM_{10} modelling adopts worst case scenario to enable a conservative precautionary outcome. Accordingly, the marginal exceedance at R2 is predicted for the day in the EPA background dust dataset that has the highest 24 hour recording, 18/10/2012. Of the total prediction, 85% of the dust is from background sources. The very minor predicted exceedance (0.2 µg/m^3) is not considered a significant impact. For all other receptors, for all days of operation and background dust, the predictions are below relevant criteria.

The relevant criterion for PM_{10} annual average is 30 µg/m^3, which is met at all receptors. The highest total prediction is 21 µg/m^3, of which 19.8 µg/m^3 is background dust, again showing that existing dust sources will be the predominant contributor.

$PM_{2.5}$

As for PM_{10}, modelling for $PM_{2.5}$ uses contemporaneous background dust statistics. Again like for PM_{10}, $PM_{2.5}$ predictions are firstly calculated for days when background is highest, to which are added Project incremental predictions. Secondly, another set of predictions is calculated for the day when the Project increment is predicted to be highest, to which is added the corresponding day's background recording. The relevant criteria for $PM_{2.5}$ 24 hour and annual averages are 25 and 8 µg/m^3 respectively. Modelling predicts a marginal exceedance of the 24 hour criterion at R10, where 25.2 µg/m^3 is predicted for the situation of highest cumulative impact. Consistent with its location in South Western Sydney, almost all of this prediction, 24.9 µg/m^3, is due to measured background dust. Secondary predictions for the situation of maximum contribution from the Project, show a highest cumulative prediction of 16.4 µg/m^3, of which 15.9 µg/m^3 is background dust.

Predictions for $PM_{2.5}$ annual average range from 8.6 to 8.7 µg/m^3 for all receptors, all of which are slightly above the criterion of 8 µg/m^3. However, the calculated increment due to the Project and adjacent landfilling are very small (0.1 to 0.2 µg/m^3), with background measured concentrations again consistent with the location, at 8.5 µg/m^3, again being the overwhelmingly dominant source of dust. These minor predicted exceedances are not considered a significant impact.



Map Title:	Figure 8-1: Noise and Dust Receptor Locations							**Date:**	30 July 2015
Location:	Glenfield, NSW Australia	**Author/ Reviewer:**	AT/MS	**Version No:**	V01	**Map/ DWG No:**	**1** of **1**	**Job Ref:**	11009

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Summary

The Project, when combined with existing landfilling operations has little effect on the predicted dust environment, either as deposited dust or suspended dust concentrations. The overwhelming contribution to predicted dust levels are due to measured background dust, with the Project predicted to provide a very small incremental increase.

8.1.4 Mitigation and Monitoring

The following measures have been incorporated into dust modelling and will be implemented:

- Area sprayers will be activated when winds are higher than 5 m/s and there is visible dust;
- 550 metres of the main access road will be sealed;
- Sealed roads will be regularly swept; and
- Unsealed roads will be managed with a water cart.

Additional mitigation measures that will be implemented, that were not part of modelling are:

- A weather station and wind sock will be installed to inform operators of the need to trigger sprays;
- A watercart will be used as required on manoeuvring areas; and
- Sprays will be fitted to conveyor discharges.

8.2 Odour

SLR Consulting (2014) prepared a detailed air quality and odour impact assessment, which is provided in full at Appendix 6, and partially informs this section of the EIS.

8.2.1 Methodology

People's reactions to odours are varied, and depend on the odour itself and the receiving audience. For example, agricultural odours usually have a higher threshold of nuisance than industrial odours. There is also a significant variation in individual's sensitivity and response to odours.

The Technical Framework (Department of Environment and Conservation 2006) provides guidance on acceptable odour goals, related to the local population size. In the case of the Project, it is surrounded by sizable urban areas and therefore the lowest goal of 2 odour units (OU) is recommended by the Framework. The OEH Air Policy Unit has historically applied this goal to projects in the Sydney metropolitan area.

Odour modelling is dependent on the estimation of accurate emission factors for each potential odorous activity. The Project will accept and process waste produced by the construction and demolition, and commercial and industrial sectors. The following materials are expected to be processed:

- Concrete and masonry;
- Tree and timber waste;
- Clean glass (not kerbside recyclables);
- Cardboard and paper;
- Plastics and metals; and
- ENM and VENM.

Of these, only the green waste can reasonably be expected to have the potential to cause odours. Clean glass will be accepted and crushed, but it is important to note that soiled kerbside recycle jars and bottles will not be accepted. The clean glass sources are expected to include car windscreens, reject clean bottles and window glass, none of which have the potential to generate odours. There will be green waste stored and processed, primarily consisting of tree loppings and sawn timber scraps.

Water seepage from the green waste stockpiles was considered with regards to odour generation potential. The incoming raw material stockpiles will consist of large pieces of unseasoned and seasoned wood.

Unseasoned wood that is chipped or shredded into small pieces will generate tannin rich water after rain, due to each chip's large surface area. At the Project site, raw material stockpiles are not expected to generate tannin rich water, but the processed stockpiles are.

The rate of tannin rich water production is dependent on rainfall, the type of timber (only hardwoods generate tannin staining), the volume of the stockpile, and the length of time the stockpile remains. Commercial pressures generally mean that raw material is not processed until a buyer is confirmed, however, for the purposes of analysis, it has been assumed that processed stockpiles are present on site during rain, and so tannin rich water will be generated and will flow into the adjacent sediment control dam.

Anecdotal evidence suggests that tannin rich water flowing from facilities such as hardwood chip stockpiles do not produce noticeable odours, even when the runoff has high tannin content. There are though, numerous press reports of odours emanating from green waste composting facilities.

The US EPA CALPUFF was used to model odour. As part of the modelling inputs, The Air Pollution Model (TAPM version 4.0.4) and CALMET were used to generate synthetic meteorological conditions, modified with data from the nearest BOM station at Holsworthy Range Control, Bankstown Airport, Horsley Park Equestrian Centre and Camden Airport.

Dispersion models such as CALPUFF report in periods of minutes to one hour, and given that human responses to odour are commonly instantaneous, a correction method called a peak to mean ratio is applied. A factor of 2.3 to 2.5 (depending on atmospheric stability) was used in this case.

Model inputs include estimated emission rates from odour sources. A review of recent assessments failed to identify an accurate emission source, so a conservative approach was taken to use the highest reported emission rate for a more odorous activity, that of green waste maturation. To be clear, green waste is not proposed to be matured as part of this Project, but this emission rate gives a worst case. The emission rate used was 0.46 OUm^2/s.

For modelling purposes, emission rates are multiplied by source areas, in this case the two separate stockpiles totalling approximately 4,000 m^2. The area of the sedimentation basin adjacent to the processed green waste stockpile is 200 m^2. The stockpile emission rate allows for waste maturation rather than the proposed simple processing and despatch, and further, the modelled area source includes the raw material stockpile, which is not expected to produce odours given the material's small surface area. Accordingly, the assessment allows for potential odours from the stockpiles and tannin rich water from the processed stockpile and sedimentation dam.

8.2.2 Existing Environment

There are no nearby operations that can be expected to generate odours similar to those from the Project, so it has been assumed that background odour for the purpose of assessment is negligible.

8.2.3 Impacts

Odour modelling predictions are all well less than the criteria of 2 OU 99th percentile 1 second average at all receptors.

8.2.4 Mitigation and Monitoring

No specific mitigation measures are required to control odours from the Project.

8.3 Noise

A detailed Noise Impact Assessment prepared by SLR Consulting (SLR 2014) is provided at Appendix 7 and summarised in this section.

8.3.1 Methodology

Construction noise has been assessed in accordance with the Interim Construction Noise Guideline (DECCW, 2009) (ICNG), while operational noise has been assessed in accordance with the industrial Noise Policy (INP). Traffic noise was assessed in accordance with the NSW Road Noise Policy. The potential for sleep disturbance has been assessed using the guidance provided in the INP Application Notes and by reference to the Road Noise Policy.

8.3.2 Existing Environment

The nearest sensitive residential receivers are in the Glenfield residential area to the south of Cambridge Avenue and to the west of the PAA in the Glenfield Road residential development (see Figure 8-1. Receptors with the greatest level of exposure to road traffic noise are located on Glenfield Road with the nearest houses being approximately 8 m from the road.

Background noise was measured by both operator-attended and long-term logging at two of the closest representative receptors to determine project specific noise criteria. Project specific noise criteria are listed below:

- 44 LAeq (15min) during morning shoulder (6.30 am to 7.00 am Monday to Saturday) at residences on Goodenough Street, Ferguson Street and Canterbury Road;
- 47 LAeq (15min) in the day (7.00am to 6.00pm Monday to Saturday and 8.00 am to 6.00 pm Sunday and public holidays) at residences on Goodenough Street, Ferguson Street and Canterbury Road;
- 42 LAeq (15min) during morning shoulder at residences on Slessor Road, Glory Road and Minstrel Street; and
- 44 LAeq (15min) in the day at residences on Slessor Road, Glory Road and Minstrel Street.

Construction noise goals have been calculated as follows:

- 52 LAeq (15min) for noise affected residences and 75 LAeq (15min) for highly noise affected residences on Goodenough Street, Ferguson Street and Canterbury Road; and
- 49 LAeq (15min) for noise affected residences and 75 LAeq (15min) for highly noise affected residences on Slessor Road, Glory Road and Minstrel Street.

Sleep disturbance goals have been calculated as follows:

- 54 dBA LA1 (1minute) for residences on Goodenough Street, Ferguson Street and Canterbury Road; and
- 52 dBA LA1 (1minute) for residences on Slessor Road, Glory Road and Minstrel Street.

Relevant traffic noise criteria are 60 dBA LAeq (15hour) for day and 55 dBA LAeq (15hour) for night, both measured external to the house.

8.3.3 Impacts

Construction

Construction noise predictions at the nearest potentially affected residences are provided in Table 8-1 and are compared to relevant criteria. Modelling predicts that construction noise will be lower than the goal in all cases, and significantly lower in most. The highest predicted received construction noise (at a residence on the eastern end of Goodenough Street) is 50 dBA, as compared to the noise goal of 54 LAeq (15min).

Table 8-1: Construction Noise Predictions

Location	Predicted Construction Noise, LAeq(15minute)	Noise Goal (LAeq,15minute) dBA	
		Noise Affected	Highly Noise Affected
Slessor Road	38	52	75
Glory Road (north)	41	52	75
Glory Road (south)	40	52	75
Minstrel Street	39	52	75
Canterbury Road	41	54	75
Fergusson Street (west)	41	54	75
Fergusson Street (central)	44	54	75
Fergusson Street (east)	48	54	75
Goodenough Street (west)	47	54	75
Goodenough Street (central)	47	54	75
Goodenough Street (east)	50	54	75

Due to the lower morning shoulder project specific noise criteria as compared to daytime, modelling was carried out under two separate operational scenarios. The daytime scenario had the entire fixed and mobile plant fleet operating, along with several road trucks delivering and loading. Preliminary noise modelling showed that this scenario would not meet the morning shoulder criteria, and so during these periods less equipment would be operated. Table 8-2 lists the equipment used in each operational scenario.

Synthetic weather data generated for the air quality impact assessment noted that temperature inversions were likely to occur from 6.30 am to 7.00 am during May to August, inclusive. Preliminary noise modelling indicated that adverse noise impacts would be likely during the morning shoulder during temperature inversions, even during restricted operations. Accordingly, the Project will not operate during the morning shoulder in these months unless monitoring shows that it can comply with the project specific criteria.

Operations

Due to the lower project specific noise criteria for the morning shoulder as compared to the day, the Project will operate less equipment in the morning, and only outside of predicted inversion periods unless monitoring shows that it can comply with the project specific criteria.

Table 8-2: Operational Scenario Considered in Noise Model

Representative Plant and Equipment	Morning shoulder	Day
Front End Loaders (Cat 972 or similar)	✓ (3)	✓ (4)
Wheel Loader (Cat 950 or similar)	✓	✓
45t Excavator		✓ (2)
Excavator with Pulveriser		✓
8 t Excavator		✓
Water Cart	✓	✓
Jaw Crusher		✓
Cone Crusher		✓
Mobile Screen		✓
Shredder		✓
Product despatch/delivery trucks	✓ (4)	✓ (4)

Intrusive noise levels predicted at the nearest potentially affected residential locations are provided in Table 8-3.

Table 8-3: Predicted Intrusive Noise Levels

Location	Period	Predicted Noise Level, LAeq(15minute)	Project Specific Criteria LAeq(15minute)
Slessor Road	Morning Shoulder	36	42 dBA
	Day	41	44 dBA
Glory Road (north)	Morning Shoulder	38	42 dBA
	Day	41	44 dBA
Glory Road (south)	Morning Shoulder	37	42 dBA
	Day	40	44 dBA
Minstrel Street	Morning Shoulder	36	42 dBA
	Day	39	44 dBA
Canterbury Road	Morning Shoulder	37	42 dBA
	Day	40	44 dBA
Fergusson Street (west)	Morning Shoulder	37	44 dBA
	Day	40	47 dBA
Fergusson Street (central)	Morning Shoulder	40	44 dBA
	Day	43	47 dBA
Fergusson Street (east)	Morning Shoulder	43	44 dBA
	Day	47	47 dBA
Goodenough Street (west)	Morning Shoulder	44	44 dBA
	Day	47	47 dBA
Goodenough Street (central)	Morning Shoulder	43	44 dBA
	Day	47	47 dBA
Goodenough Street (east)	Morning Shoulder	44	44 dBA
	Day	47	47 dBA

Noise emissions are predicted to meet the project specific noise criteria at all the nearest potentially affected residential locations with the mitigation measures implemented.

Sleep disturbance was considered by modelling noise from specific events such as the initial load into empty truck bodies and front end loader buckets scraping along the ground. Table 8-4 provides the results of sleep disturbance modelling for the morning shoulder and shows that all sleep disturbance goals will be met.

Table 8-4: Maximum Noise Predictions

Location	Predicted Maximum Noise Level LAmax, dBA	Sleep Disturbance Noise Goal LA1(1minute), dBA
Slessor Road	46	52
Glory Road (north)	47	52
Glory Road (south)	45	52
Minstrel Street	45	52
Canterbury Road	46	54
Fergusson Street (west)	46	54
Fergusson Street (central)	50	54
Fergusson Street (east)	52	54
Goodenough Street (west)	53	54
Goodenough Street (central)	52	54
Goodenough Street (east)	50	54

Traffic Noise

The total predicted future traffic generation is expected to be approximately 600 vehicle trips per day; 38% light vehicles and 62% heavy vehicles. This is an increase of approximately 350 vehicle trips per day compared to existing traffic volumes. It is expected that vehicle trips will be evenly split between the east and west.

The nearest residences potentially affected by an increase in road traffic noise are approximately 8 m from Glenfield Road.

It is expected that the Project will increase daily traffic volumes by approximately 175 on Glenfield Road of which approximately 109 are heavy vehicles and 66 are light vehicles. Further, it is likely that the Project could generate a maximum hourly increase of approximately 33 heavy vehicles on Glenfield Road. Annual average daily traffic (AADT) was not available for Glenfield Road at the time of reporting, however, based on the assumption that predicted AM/PM peak volumes are approximately 10% of daily volumes then Glenfield Road is expected to currently experience in the order of 14,000 vehicle trips per day.

Total traffic predicted to be generated by the GWS site represents less than 2% of the estimated existing daily traffic on Glenfield Road. The corresponding increase in road traffic noise would largely be unnoticed.

Furthermore, there is a number of other significant developments occurring or planned in and around Glenfield that will have a significantly greater impact on the road traffic network. These projects include the Glenfield Road Urban Release Area, Campbelltown Road Upgrade, Glenfield Link Road and the Moorebank Intermodals.

8.3.4 Mitigation and Monitoring

The following mitigation measures have been incorporated into the noise model:

- The 1.8 m fence on the bund along Cambridge Avenue with a proposed 100 m extension of the fence towards the entry gate;
- Localised noise barriers approximately 2.5 m high adjacent to the processing plant in Areas 2 and 3 and the shredder in Area 1. These have been oriented to provide shielding to the south and the west; and
- A 4 m stockpile for processed product in Area 3.

Given that preliminary noise modelling predicted that the proposed morning shoulder operational scenario would exceed project criteria during inversions, it is planned to not operate during the winter morning shoulders (May to August inclusive before 7.00 am) unless monitoring shows that operations can meet the criteria. A noise management plan will be prepared as part of a site operations plan to detail the various operational arrangements and monitoring procedures.

8.4 Geology, Soils and Contamination

8.4.1 Geology and Soils

Existing Environment

The majority of the PAA is overlain by Quaternary alluvial deposits over Ashfield Shale Bedrock of the Wianamatta Group. The Quaternary alluvium is medium grained sand, clay and silt and the Ashfield Shale is dark-grey to black claystone-siltstone and fine sandstone-siltstone laminae. Soils consist of Freemans Reach soil landscape unit, which comprise alluvial soil, soloth and dark podzolic soils.

The Department of Infrastructure, Planning and Natural Resources, Salinity Potential in Western Sydney, 1:100 000 Scale, 2002 indicates moderate salinity potential on hill slopes and crests on Ashfield Shale and on raised and abandoned alluvial terraces. The Liverpool Acid Sulfate Soil Risk Map-Edition Two, 1:250 000 Scale, 1997 indicates no known occurrences of acid sulfate soils in the area. The soils encountered during the contamination investigation drilling were consistent with the map sheet and did not indicate the presence of acid sulfate.

Impacts

The proposal is not expected to have an effect on salinity or acid sulfate soils. The nature of the facility means that it can easily obtain topsoil in the later stages of operations should it be needed for rehabilitation. The topsoil removed from the PAA will be used on other parts of the GWS site for rehabilitation.

8.4.2 Contamination

Consulting Earth Scientists (CES) prepared a contamination assessment of the Project, entitled Environmental Report for Proposed New Waste Facility at Glenfield Waste Services (CES, 2014). This report is provided in full at Appendix 8 and informs this section of the EIS.

A desk top assessment was carried out to initially understand potential contaminants and contamination pathways. This assessment sourced historical records, land title information and aerial photos to draw together the site's historical background. This initial assessment found that:

- Permeable alluvials may provide subsurface pathways to the Georges River;
- Deeper Ashfield shales are expected to severely limit downward migration of any potential contaminants;
- No underground storage tanks occur on the site of the proposed facility; and
- Adjacent quarrying and landfilling may have provided contaminants in the form of oil and fuel spills and unknown hazardous wastes.

Four bores were drilled around the periphery of the proposed facility to obtain samples for analysis. Table 8-5 summarises the laboratory reports of these analyses. Results were below the adopted criteria in all samples and the Project poses a low risk to human health.

Table 8-5: Summary of Soil Contamination Test Results

Contaminants of Potential Concern	Lowest Adopted Criteria (mg/kg)	Minimum Concentration (mg/kg)	Maximum Concentration (Mg/kg)	Samples above criteria
Toluene	135 (ESL)	<0.5	<0.5	None
Ethlybenzene	64 (HSL –vapour)	<1	<1	None
Xylenes	180 (ESL)	<1	<1	None
Napthalene	9 (HSL –vapour)	<0.1	<0.1	None
Benzene	3 (HSL)	<0.2	<0.2	None
F1 (C6-C10)-BTEX	215 (ESL)	<25	<25	None
F2 (C10-C16)Napthalene	170 (ESL)	<50	<50	None
TRH >C16-C34	1700 (ESL)	<100	<100	None
TRH >C34-C40	3300 (ESL)	<100	<100	None
Total PAH's	4000 (HIL)	0.0	0.0	None
PAH's (as Bap TEQ)	40 (HIL)	<0.5	<0.5	None
Benzo(a)pyrene	1.4 (ESL)	<0.05	<0.05	None
Organochloride/ organophosphorous pesticides	45 (Aldrin and Dieldrin) (HIL)	<0.1	<0.1	None
PCB's	7 (HIL)	<0.1	<0.1	None
Arsenic	160 (EIL)	<4	10	None
Cadmium	900 (HIL)	<0.4	0.5	None
Chromium	310 (1% clay)	3	22	None
Copper	140 (CEC of 5)	2	39	None
Lead	1500 (HIL)	5	26	None
Mercury	730 (HIL)	<0.1	<0.1	None
Nickel	55 (CEC 5)	2	40	None
Zinc	360 (CECb pH 7)	3	120	None
Asbestos	0.001% (friable)	None	None	None

Footnote: Health investigation levels (HIL); health screening level (HSL); ecological screening level (ESL); ecological investigation level (EIL); cation exchange capacity (CEC).

8.5 Flooding

8.5.1 Existing Environment

Flood prone land can be defined as that susceptible to flooding by the probable maximum flood (PMF) event. The PMF is the largest flood that could conceivably occur at a particular location and is estimated from probable maximum precipitation coupled with the worst flood-producing catchment conditions.

The Upper Georges River Flood study was prepared by the Department of Land & Water Conservation in conjunction with Liverpool City Council in December 2000. This study examined predicted flood levels at a variety of points along the Georges River, by reference to a calibrated flood model. The study had several cross sections near the GWS Site, including several in or adjacent to the PAA. These sections predicted 1 in 20 year flood levels between 10.7 and 11.1 mAHD, 1 in 50 year levels between 11.4 and 11.9 mAHD, 1 in 100 year levels between 12.0 and 12.5 mAHD and extreme flood levels between 14.7 and 15.2 mAHD. The variation is due to the location of each cross section along the Georges River, with flood heights dropping with distance downriver. It is unclear from the study if extreme flood levels are synonymous with PMF levels, although the significantly higher predicted flood levels between 1 in 100 years and extreme event in that report, suggest a close link.

More recent modelling for the SIMTA project (Hyder 2012) shows a close correlation to the 2000 predictions, with 1 in 100 year estimates at the southern end of the PAA being 12.39 mAHD, allowing for a planned additional railway bridge over the Georges River.

The area on which the facility is proposed, ranges in elevation from 17 to 22 mAHD, well above even the extreme flood level predicted in The Upper Georges River Flood Study.

8.5.2 Impacts

The proposed development is not expected to change the level or frequency of floods, nor are severe floods expected to cover the PAA. Floods would though be expected to isolate access from the east along Cambridge Road due to the low level bridge across the Georges River.

8.6 Surface Water

Consulting Earth Scientists (CES) prepared a surface water assessment of the Project, entitled Environmental Report for Proposed New Waste Facility at Glenfield Waste Services (CES, 2014). This report is provided in full at Appendix 8 and partially informs this section of the EIS.

8.6.1 Existing Environment

The site for the proposed facility generally drains north into a pair of artificial dams that drain under the railway line into Leacocks Creek and eventually into the Georges River. The easternmost section of the site alongside Cambridge Avenue drains generally northeast and, constrained by the old landfill, then drains easterly into the Georges River.

The adjacent GWS landfill conducts daily surface water monitoring with regards to leachate management. In addition sediment dams overflow monitoring consists of analysis of a comprehensive suite of organic and inorganic analytes as well as field measurement of pH, redox, electrical conductivity and dissolved oxygen.

8.6.2 Water Management

The proposed facility will have stockpiles of various materials open to the weather and heavy rain can be expected to generate dirty runoff that will need to be captured and managed. Total storage requirements have been calculated consistent with the publication Managing Urban Stormwater (New South Wales Government 2004) and based on a 90th percentile, 5 day rain event as consistent with typical EPA design requirements for waste facilities. The results of preliminary assessment indicate that a sediment retention dam 1 m deep with a surface area of 1,625 m^2 and a total capacity of 1,625 m^3 would be of sufficient capacity to retain surface water and sediment load. The planned total storage capacity will be 3.4 ML, half being maintained as freeboard capacity for design storm runoff.

Figure 3-1 provides a conceptual layout of water management dams for the separate northerly draining and easterly draining sections of the facility. Table 8-6 provides an annual water balance for the operation for average, dry and wet years.

Table 8-6: Annual Water Balance

Parameter	50%ile	10%ile	90%ile
Mean annual rainfall (m)	0.8733	0.567	1.158
Runoff rate (fraction)	0.5	0.5	0.5
Area (m^2)	75500	75500	75500
Yield (m^3or KL)	32967	21404	43715
Yield (ML)	33	21	44
Rain days	41	25	62
Watering days	271	287	250
Water cart consumption per watering day (ML)	0.028	0.028	0.028
Spray consumption per watering day (ML)	0.056	0.056	0.056
Annual evaporation (ML)	3.4	3.4	3.4
Annual consumption (ML)	26	28	24
Annual balance (ML)	7	-6	19

Annual runoff yield in Table 8-6 has been estimated by analysing rainfall and surface conditions. Rainfall records for 47 years have been analysed for Bankstown to provide mean, 10%ile and 90%ile rainfall years.

The majority of the development site would be highly disturbed and therefore will generate relatively high runoff rates. The effect of material stockpiles on runoff rates is difficult to estimate, as stockpiles tend to absorb significant rainfall before they yield seepage to the ground surface. Accordingly runoff rates have been conservatively estimated at 50%.

Statistical analysis of Bankstown daily rainfall data since 1968 shows that on average, there are 41 days per year when rainfall exceeds 5 mm, which is a reasonable measure of when internal roads and stockpiles would be sufficiently wet to not require watering. The number of over 5 mm raindays varies from 25 to 62 days per year, over the extent of records. Accordingly, allowing for non-working days, the water cart is expected to operate from 250 to 287 days per year, averaging 271 days. The water cart holds approximately 7,000 litres and on average is filled four times per day. Fixed water sprays are estimated to consume up to 0.056 ML per watering day. Accordingly, the water cart and fixed sprays would consume approximately 0.09 ML per watering day.

Pan evaporation in the region is around 1500 mm. Site runoff will flow via a series of drains into several proposed sediment dams. The prime function of the dams is to act as settling dams, with evaporation varying according to weather and water supply. The average depth of the proposed dams is 1.5 m, which is approximately the long term annual evaporation rate.

Accordingly, the dams will lose on average, one entire volume per year at pan evaporation rates, although in all likelihood, pan evaporation rates are an overestimate of dam evaporation rates. Trees will be retained on the southern and western sides of the facility, which will provide a windbreak from the predominant morning winds from the west to south quadrants. Afternoon winds are most frequent from the west, south and east quadrants, and again remaining tees will protect dams from the west and south and so reduce evaporation. The total capacity of the planned dams is 3.4 ML, and this provides a conservatively high estimate of annual average evaporation losses.

Reference to Table 8-6 shows that the annual water balance for a 50%ile year provides a surplus of 7 ML. For the reduced runoff and higher consumption in a 10%ile year, the estimated balance will generate a deficit of 6 ML and for the alternate in a 90%ile year, provide a surplus of 19 ML.

While the proposed facility will be connected to the town water supply, the intention is to minimise the use of potable water in processing. Accordingly, dust suppression water will be sourced primarily from sediment dams, which are expected to provide the majority of annual water demand, while wherever possible, town water will be reserved for potable uses. Runoff from the processing areas will be directed to the sediment dams to maximise on-site recycling of water. The water balance in Table 8-6 shows that only in dry years is it expected that town water will be required for dust suppression, with the on-site sedimentation dams providing the bulk of the required water in all years.

When runoff exceeds the design storm event, and the design freeboard is insufficient for runoff retention, the north western dams will overflow via an existing pipe into a farm dam, located within the GWS landholding. From here, the water will flow generally northwards in existing flow paths under the railway line and eventually into the Georges River. The eastern dams will overflow into the existing flow path into the Georges River, which is approximately 220 m to the east.

8.6.3 Harvestable Rights

The NSW Government Gazette 24 March 2006 defines certain streams as “not rivers” for the purposes of Part 2 of the Water Act, 1912, in reference to dams constructed and used in accordance with a harvestable rights order in accordance with section 54 of the Water Management Act, 2000. Of relevance, first and second order streams are defined as not rivers. The proposed facility has no defined channels that would be considered even first order streams, so by definition there are no rivers in the development site. The Georges River abuts the landholding, but no works will be undertaken within the river buffer and nor is runoff from this buffer to be harvested.

The NSW Government Gazette 31 March 2006 provides a series of orders with respect to Harvestable Rights in the Eastern and Central Division. Of note, orders under Section 54 includes Paragraph 3, which notes a landholder has the right to capture 10% of the average run off on the land by means of a dam (with conditions) on minor streams, and that this water may be used for any purpose (subject to conditions not relevant to this project). The allowable capacity of dams is to be calculated by multiplying the area by a multiplier on the Maximum Harvestable Rights Dam Capacity Map. In accordance with the online dam size calculator (NSW Office of Water), the relevant harvestable right for the 40 ha PAA is 3.4 ML, equal to the proposed aggregate sediment dam capacities. Paragraph 3 though does not apply to dams set out in Schedule 2 of the orders in the Government Gazette 31 March 2006, which list exempt dams, including those "….*solely for the capture, containment and recirculation of drainage and/or effluent, consistent with the best management practice or required by a Government agency or Local Government council to prevent the contamination of a water source.*" The function of the proposed sedimentation dams is for this purpose and to ensure the dams' efficacy, they require regular pump out, and in this case the water will be used for dust suppression. Accordingly, the dams are exempt for the 10% harvestable rights restriction. Accordingly, the 3.4 ML limit does not apply in this case.

In summary, the proposed sediment dam capacity equals the Maximum Harvestable Rights allowance although in any event, the restriction does not apply as the purpose of the dams attracts an exemption.

8.6.4 Impacts

The proposed conceptual surface water management system will be designed in detail in the Stormwater and Erosion Management Plan and will capture, contain and manage the design storm event runoff. Accordingly the predicted impact on the nearest receiving waters, the Georges River and associated riparian areas, will be minimal.

The site is within the area covered by the Greater Metropolitan Water Sharing Plan, which aims to "*provide water to support the ecological processes and environmental needs of the rivers, and direct how the water available for extraction is to be shared*". No water licences or water access licences will be required.

8.6.5 Mitigation and Monitoring

A series of sedimentation dams will be designed, built and used to trap and manage runoff. A volume equal or greater than the design storm runoff will be maintained as capacity between storms, with any excess being stored for dust suppression. Sediment dams will be sampled and tested for EPL listed parameters prior to pump out. Parameters are expected to include pH, TSS and conductivity. In some cases, it is expected that flocculants will be required to settle fines prior to discharge.

8.7 Groundwater

Consulting Earth Scientists (CES) prepared a groundwater assessment of the Project, entitled Environmental Report for Proposed New Waste Facility at Glenfield Waste Services (CES, 2014). This report is provided in full at Appendix 8 and informs this section of the EIS.

8.7.1 Existing Environment

Groundwater monitoring results for the northern (landfilling) parts of the GWS site dating back to 2003 indicate that groundwater is typically present at between about RL5 m and RL6 m with a slight hydraulic gradient to the east and south east towards the Georges River. The absence of groundwater in the boreholes drilled as part of the recent contamination assessment indicates that groundwater at the location of the proposed new facility lies at a depths greater than 12 m below existing ground level.

Monitoring results indicate that the groundwater in the vicinity of the GWS site is of relatively low quality with naturally elevated salinity and ammonia levels and elevated metal ions such as potassium, calcium and magnesium. This is consistent with groundwater associated with the Wianamatta Shale which is characterised by high salinity (Wooley, 1980; Krumins et al., 1998 in CES 2014) and high ammonia concentrations (>10 mg/litre, Old, 1942 in CES 2014). Rates of groundwater movement in the bedrock are assessed to be low as a result of the low relief, and relatively low altitude of the GWS site and the low permeability of the Wianamatta Shale bedrock (Herbert, 1980).

The adjacent GWS landfill site has a series of 18 groundwater monitoring wells, primarily monitoring potential impacts from the landfill. The monitoring programme conforms to the EPA Environmental Guidelines: Solid Waste Landfills Benchmark 5 (Glenfield LEMP, CES 2007). The monitoring programme includes quarterly and yearly monitoring of a comprehensive range of organic and inorganic analytes.

8.7.2 Impacts

The facility is not expected to intercept, nor will it use, groundwater. Accordingly the Greater Metropolitan Groundwater Water Sharing Plan is not relevant to this proposal. The main potential impact to the low quality groundwater resource would be from contamination due to storage of wastes, however, the benign nature of wastes to be accepted means that there is a low risk of harm to the groundwater system. An additional potential impact is from contamination of soil and groundwater from hydrocarbon fuels and lubricants. However, this risk will be minimised by bunding any above ground storage tanks, and when refuelling mobile plant from bulk tanks this will be on impervious pads installed with spill arrestors.

8.7.3 Mitigation and Monitoring

The following management measures will be implemented to protect groundwater resources:

- No groundwater extraction will occur;
- Any bulk fuel will be stored in above ground, bunded tanks; and
- Refuelling from bulk storages will be carried out on impervious pads, supplied with spill arrestors.

Groundwater sampling, analysis and reporting will continue as per the EPL.

8.8 Traffic

A Traffic Impact Assessment (TIA) was prepared by ARC Traffic and Transport (ARC) to examine the traffic and transport related impacts associated with the Project. A copy of the TIA is attached at Appendix 9.

8.8.1 Methodology

As part of developing the TIA, ARC has addressed the SEARs and the specific Roads and Maritime Service (RMS) requirements. ARC consulted with a number of Government agencies during the development of the TIA discussing the Project and the scope of works of this assessment. The agencies included:

- Department of Planning and Environment (DP&E);
- RMS;
- Transport for NSW (TfNSW);
- Campbelltown City Council; and
- Liverpool City Council

The TIA has included:

- Observations of the local road network providing access to the sub-regional and regional road network, including general vehicle flows, types and speeds; sight distances at key locations; and general road and intersection operations;
- A detailed review of traffic survey data;
- A detailed assessment of the traffic generation and distribution characteristics;
- A detailed assessment of sub-regional projects that have the potential to impact traffic flows in the area;
- An assessment of future levels of service at key intersections; and
- Reference to the appropriate traffic and transport guidelines and assessment criteria, including:
    - RTA Road Design Guide;
    - RTA Guide to Traffic Generating Developments;
    - RMS Technical Direction 2013 04a – Guide to Traffic Generating Developments;
    - AustRoads Guide to Road Design Part 4A Unsignalised and Signalised Intersections;
    - Australian Standard 2890.1: Parking Facilities – Off Street Car Parking; and
    - Australian Standard 2890.2: Parking Facilities – Off Street Commercial Vehicle Facilities.

8.8.2 Context

The northern area of the GWS site will remain as an operating landfill with vehicle access and trip generation remaining unchanged.

The GWS site has good access to the broader sub-regional and regional road network, which includes Campbelltown Road, Hume Highway, Hume Motorway, the M7, Cambridge Avenue, the M5 and Moorebank Avenue.

Figure 8-2 shows the local road network and access points to the site. Current entry and exits are via Cambridge Avenue. This main entry is also used for all existing operations for the whole of the GWS site. A second access is located on the western boundary and intersects Railway Parade. This was the principal access during past operations and is used as the access to the residential dwelling and by RailCorp maintenance employees accessing the adjacent rail lines.

8.8.3 Impacts

Traffic Generation

Combined, the Project and GWS landfill will at full capacity generate an average estimated 600 vehicle trips per day (vpd), as compared to an existing rate of 128 vpd for the landfill alone.

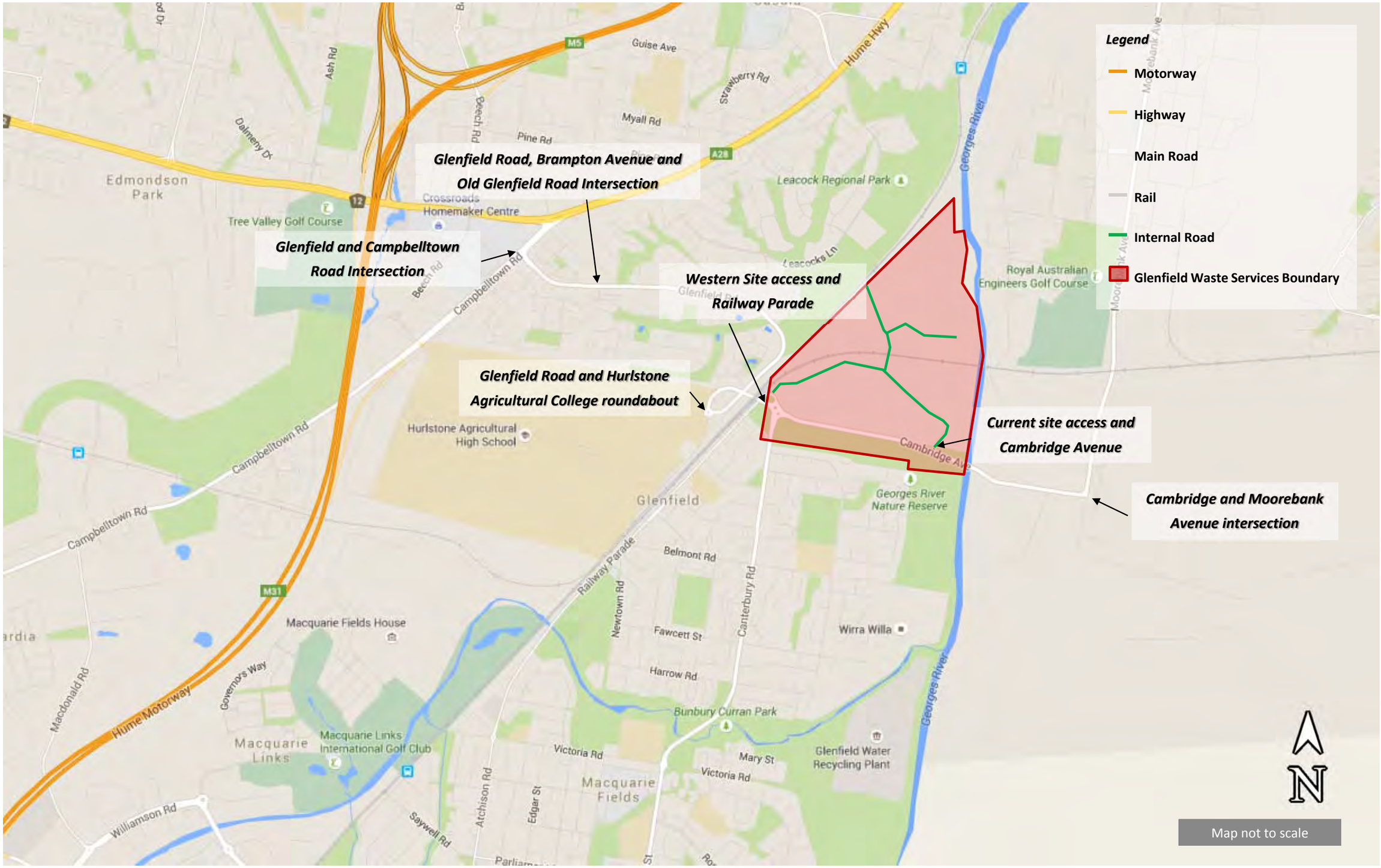
Of the total 600 vpd average, approximately 70% would be heavy vehicles and 30% light.

Intersections

Performance was modelled for the following key intersections:

- Current access and Cambridge Avenue;
- Proposed western access and Railway Parade;
- Cambridge Avenue, Railway Parade, Canterbury Road and Glenfield Road roundabout;
- Glenfield Road and Hurlstone Agricultural College access roundabout;
- Glenfield Road, Brampton Avenue and Old Glenfield Road intersection;
- Campbelltown and Glenfield Roads; and
- Cambridge Avenue and Moorebank Road.

The current ingress is from Cambridge Avenue with either a left or right hand movement inwards. The right movement has a slip lane for vehicles to pass slowing vehicles turning into the GWS Site. Left movements off Cambridge Avenue into the GWS Site have a dedicated deceleration lane.



Map Title:	Figure 8-2: Local Road Network							**Date:**	30 July 2015
Location:	Glenfield, NSW Australia	**Author/ Reviewer:**	AT/MS	**Version No:**	V01	**Map/ DWG No:**	**1** of **1**	**Job Ref:**	11009

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Movements onto Cambridge Avenue are either left or right, with left movements having an acceleration lane towards the causeway. Right movements use the main westbound through lane, but again, faster traffic can pass on the left hand slip lane. The Project proposes an internal one way road network that will facilitate internal movement of Project vehicles, while landfill truck access and egress will remain unaltered.

All inbound access for Project vehicles will be via the existing access. The Project will add 350 vpd but the existing acceleration and slip lanes will continue to operate effectively.

The proposed western access and Railway Parade will operate with a high level of service through the day with Project trips.

The Cambridge Avenue, Railway Parade, Canterbury Road and Glenfield Road roundabout currently has a good level of service and will receive minor traffic from the Project. In the AM peak, the roundabout will receive minor additional traffic from the Project via the proposed Western access to Railway Parade. This is an acceptable condition.

Glenfield Road and Hurlstone Agricultural College access roundabout will operate at a good level of service through to 2024 although the queue lengths will increase and lane capacities will reduce. The Project will have little if any impact at this intersection.

Glenfield Road, Brampton Avenue and Old Glenfield Road intersection will continue to operate with a good level of service with moderate delays. The Project will have little if any impact at this intersection.

Campbelltown and Glenfield Roads intersection will have significantly higher traffic flows by 2024. Even with planned upgrades, it is expected to have significant queue lengths. These increases relate to broader regional traffic generation and the Project will have little if any impact at this intersection.

Cambridge Avenue and Moorebank Road intersection has a poor level of service in the PM peak related to the small number of vehicles turning right onto Moorebank Avenue to access the rear entrance of Holsworthy Military Barracks. The Project will have little if any impact at this intersection.

Queue lengths on Railway Parade at the roundabout intersection with Cambridge Avenue and Canterbury Road may increase slightly due to the Project and at times may extend to the GWS site egress. This queue length is acceptable. The number of merging vehicle movements from GWS are predicted to be low, equivalent to 1 vehicle for every 5 minutes.

The Project, will have no significant impact on the operation of intersections through the local road network.

Parking

The Project will not generate any off-site parking demand. All parking will be accommodated onsite with formal and informal spaces.

Sub-Regional Issues

The local road network will operate with a good level of service through to 2024 with or without the Project.

The Sydney Intermodal Terminal Alliance (SIMTA) TIA reports that there will only be a minor intermodal trip generation on Cambridge Avenue and acceptable delays. Given that the SIMTA report considers a 1 million container capacity, and the final Intermodal will provide 1.7 million capacity, a viable southern route option appears to be essential to the sustainability of the sub-regional road network.

The Georges River Causeway on Cambridge Avenue is predicted to be used by 1800 vehicles per hour in the AM and PM peak in 2024. The Project is estimated to generate 24 trips in the AM peak (1.4% of the two way flow) and 8 trips in the PM peak (0.5% of the two way flow). It is predicted that Project vehicles will constitute less than 1% of two way flows in 2024. The minor additional trip generation added from the Project has no significant impact on the capacity or general operations of the causeway.

The Project will contribute to traffic generation, but will not have any significant impact to the sub-regional road network.

8.8.4 Mitigation Measures

To mitigate the minor impacts, the Project proposes to use the second access point off Railway Parade, as illustrated in Figure 3-1.

The Project vehicles will enter via the main entry gate on Cambridge Avenue and exit via Railway Parade. This proposal will allow the traffic to flow through the Project site and prevent the delay in exiting via a right hand turn onto Cambridge Avenue.

A Restricted Access Vehicle (RAV) route for B-Doubles more than 19 m long and over 50 t weight exists from Campbelltown Road to the existing access but not to and from the proposed western access at Railway Parade. Should the occasional Restricted Access Vehicle be required, they will access and egress via the existing eastern access.

Should the use of these vehicles become commonplace, a RAV route assessment will examine the short section of Railway Parade for RAV suitability. If the section of Railway Parade is suitable, an application will be made to extend the RAV route consistent with current operations. The existing access on Cambridge Avenue remains a viable alternative.

GWS will develop a detailed Construction Traffic Management Plan that will include trip generation, vehicle routes, construction hours, access and other necessary considerations.

The additional traffic movements generated by the Project have no significant impacts due to the moderate trip generations during the peak periods.

8.9 Hazard and Risk Management

Acor Consultants prepared a Fire and Hazard Preliminary Risk Assessment (Acor, 2014), which is provided in full at Appendix 4.

8.9.1 SEPP 33

A qualitative Level 1 preliminary hazard assessment (PHA) prepared in accordance with SEPP 33 Hazardous and Offensive Development found that the Project will not store hazardous materials as defined in the Australian Dangerous Goods Code or NSW Planning-Storage and Handling of Dangerous Goods Code of Practice 2005. The PHA found that that the Project does not pose a significant risk.

8.9.2 Fire Risk Analysis

The PHA found that the Project would store and handle "combustible materials" as defined in the NSW Planning-Storage and Handling of Dangerous Goods Code of Practice 2005. These materials include empty combustible containers, wood, paper, cardboard and green waste.

The existing operation has not recorded any incidents of spontaneous combustion of stockpiles, however, self-heating is theoretically possible and could lead to emissions of steam and smoke. Resulting flames could conceivably consume stockpiles and adjacent structures.

Acor (2014) considered the possibility for processing of combustible materials to cause a build-up of combustible dust, but this risk was defined as minimal, and again this issue has not been observed at the current facility.

Methane can form due to anaerobic maturation of green waste, although given that the Project will not confine green waste inside buildings, the risk of ignition is minimal. Methane though is a greenhouse contributing gas, and its potential for production will be reduced by prompt processing and dispatch.

Acor (2014) considered the possibility of fires in plastics stockpiles, which, while not recorded previously on the GWS Site, could feasibly occur due to accidental ignition.

There exists the external threat of fire, either from bushfires, or from deliberate arson attacks. Such fires could conceivably burn combustible stockpiles.

8.9.3 Mitigation Measures

The following fire and hazard controls are either currently implemented or will be implemented as part of the Project:

- The Project will not store hazardous materials as defined in the Australian Dangerous Goods Code or NSW Planning-Storage and Handling of Dangerous Goods Code of Practice 2005;
- An Emergency Response Plan will be developed, maintained and implemented;
- Employee inductions will cover aspects of fire prevention, such as no-smoking zones, hot work permits;
- A formal facility close down procedure will be prepared and implemented to ensure any smouldering fires are noted and extinguished;
- A Combustible Stockpile Management Plan will be developed, maintained and implemented;
- A water cart will be available;
- The facility will be securely fenced to discourage intruders;
- All fire-fighting systems will be designed and installed to be compatible with NSW Fire Brigade systems; and
- Mobile plant and vehicles will be fitted with appropriate fire extinguishers.

8.10 Biodiversity

8.10.1 Methodology

A detailed ecological assessment was prepared by EPS and is provided in full at Appendix 10. Additionally, a detailed Cumberland Woodland Assessment Report, a BioBanking Credit Assessment and EPBC Act Cumberland Plain Shale Woodlands Assessment, by SLR Consulting (2014 a and b) are also included in Appendices 15 and 16 of the Ecological Assessment in Appendix 10. The SLR reports were prepared to analyse the threatened communities and BioBanking aspects for the Project in additional detail.

This EIS section summarises the key findings of those reports that were prepared in accordance with the requirements of:

- NSW Office Environment Heritage (OEH) "Field survey methods";
- OEH draft "Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities";
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and specifically the requirements of the Commonwealth Department of the Environment provided as attachment A of the SEARs (see Appendix 1);
- NSW *Environmental Planning and Assessment Act 1979* (EP&A Act);
- NSW *Threatened Species Conservation Act 1995* (TSC Act);
- BioBanking Assessment Methodology 2014 (OEH 2014a);
- Framework for Biodiversity Assessment (OEH 2014b);
- BioBanking Assessment Methodology and Credit Calculator Operational Manual (DECC
- 2009a); and
- Assessors guide to using the BioBanking Credit Calculator v.2 (OEH 2012).

A review of ecological studies and various databases (NSW Bionet, Threatened Species, Populations, and Ecological Communities of NSW, Spatial Information Exchange, and Commonwealth Protected Matters search tool) provided a list of threatened species, populations, ecological communities and invasive species that had been previously reported, known or predicted to occur on or adjacent the PAA.

Targeted flora and fauna surveys have been completed over several years, including as recently as February 2015.

8.10.2 Existing Environment

Flora

Investigations identified 86 plant species on the GWS Site, 30 of which are exotic. The Department of the Environment Project Guidelines specify the following plants for assessment:

- Yellow Gnat-orchid (*Genoplesium bauera*) (endangered);
- Illawarra Greenhood (*Pterostylis gibbosa*) (endangered);
- Leafless Tongue-orchid (*Cryptostylis hunteriana*) (vulnerable); and
- Austral Toadflax (*Thesium australe*) (vulnerable).

No threatened plants have been identified, despite several targeted surveys over several years for those species with predicted suitable habitat.

Flora Communities

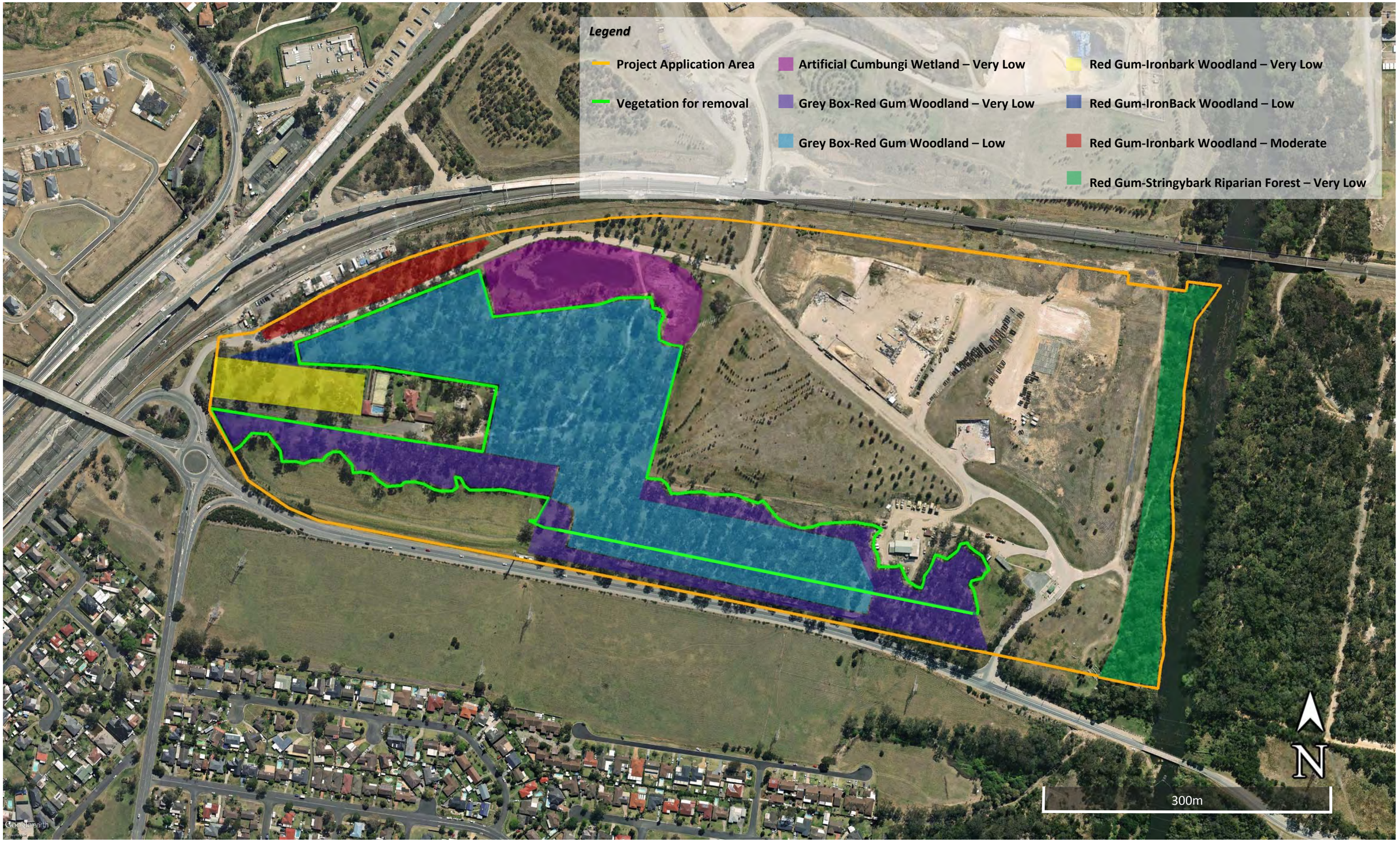
The majority of the GWS Site is disturbed grassland with minimal habitat value. There are no native or derived grasslands.

On the eastern edge of the GWS Site is a long narrow band of native riparian vegetation, heavily infested with a range of weeds such as African Olive, Wandering Jew, Privet and Lantana, with a canopy dominated by Forest Red Gum and Stringybark. This 1.41 ha zone, while highly disturbed, is defined as River-flat Eucalypt Forest on Coastal Floodplains, which is listed as an EEC under the TSC Act but not under the EPBC Act. Figure 8-3 shows the location of this zone. Additional areas of this riparian zone occur north and south of the PAA along the Georges River.

There are two dams with an interconnecting pipe in the north-western part of the PAA. These are used for water treatment and the western-most dam supports native *Typha sp*. (Cumbungi), *Ludwigia peploides subsp. montevidensis* (Water Primrose) and the exotic *Cortaderia selloana* (Pampas Grass). The western dam has open water, while the eastern dam is shallow, generally dry and does not support aquatic plants. While the native species of the western dam are characteristic of Freshwater Wetlands on Coastal Floodplains community listed as an EEC in the TSC Act, this EEC is not present due to the artificial nature of the dams.

The PAA supports 13.77 ha of non-riparian remnant woodland, although most has been modified by grazing and regular slashing for many years for bushfire management in accordance with Campbelltown City Council directions. There is additional woody vegetation with grass understory in landfill rehabilitation areas. The non-riparian remnant woodland area is dominated by *Eucalyptus moluccana* (Grey Box) with *E. tereticornis* (Forest Red Gum), *E. eugenioides* (Stringybark), *E. crebra* (Narrow-leaved Ironbark) and *Angophora floribunda* (Rough-barked Apple) co-dominant. The canopy trees have similar ages, estimated at 60 years. Due to regular slashing, there are few understory shrubs, with common grasses forming much of the groundcover.

Various terms such as Cumberland Plain Woodland and the Shale Plains Woodland have been used somewhat interchangeably in western Sydney. The term Cumberland Plain Woodland correctly identifies the NSW listed critically endangered ecological community (CEEC), while Shale Plains Woodland is a mapping unit used in Tozer's 2003 mapping. On PAA, the two terms are essentially synonymous.



Map Title:	Figure 8-3: Vegetation Mapping							**Date:**	30 July 2015
Location:	Glenfield, NSW Australia	**Author/ Reviewer:**	AT/MS	**Version No:**	V01	**Map/ DWG No:**	**1** of **1**	**Job Ref:**	11009

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Further on nomenclature, Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest is listed as critically endangered ecological community (CEEC) under the EPBC Act, representing very similar vegetation to Shale Plains Woodland and Cumberland Plain Woodland.

The non-riparian woodland canopy trees are characteristic of both the state listed Cumberland Plain Woodland community and federally listed Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest. Figure 8-3 shows separate areas of Cumberland Plain Woodland, being:

- Grey Box-Red Gum woodland with areas in very low and low condition, based on understorey clearing and presence of exotic species; and
- Red Gum-Ironbark woodland with areas in very low, low and moderate condition due to the varying diversity of native understory and groundcover.

Habitats

The main habitat types are:

- Disturbed grasslands and rehabilitated areas, which provide limited foraging habitat;
- The western dam that provides aquatic and semi-aquatic habitat for native frogs, birds and invertebrates;
- The Georges River riparian woodland (River-flat Eucalypt Forest on Coastal Floodplains EEC), which provides foraging and nesting habitat for a range of native animals; and
- The Cumberland Plain Woodland community, which while generally highly disturbed provides foraging and some nesting habitat for native animals.

Thirty-eight (38) trees in the non-riparian remnant woodland portion of the PAA contain an estimated 28 trunk hollows and 81 branch hollows.

Three tree species found in the PAA, Grey Box, Forest Red Gum, and Narrow-leaved Ironbark are listed as koala feed trees in either SEPP 44 Koala Habitat Protection or OEH Koala Recovery Plan in the Sydney Metropolitan Catchment Area. While the PAA may provide potential Koala habitat, the degraded nature of the vegetation, fragmentation from other habitats (due to the Georges River, railways and roadways), both suggest that the PAA is highly unlikely to support the species. No Koalas or their traces have been found on the PAA, despite targeted surveys.

Fauna

Investigations identified three common frog species, 31 common bird species, one Ringtail Possum and several bat species. The bats were detected with ultrasonic recordings during various surveys and due to the vagaries of this method, only five definite identifications were possible, including the threatened species Yellow-bellied Sheathtail-bat, East-coast Freetail-bat, Little Bentwing bat and Eastern Bentwing bat. The threatened species Grey-headed Flying Fox was also recorded on two nights within the woodland at the edge of the large dam.

Another seven bat species may occur on PAA, but were not identified. Of these, three are threatened species being Eastern False Pipistrelle, Large-footed Myotis and Greater Broad-nosed Bat.

Targeted surveys for *Litoria aurea* (Green and Golden Bell Frog) and *Meridolum corneovirens* (Cumberland Plain Land Snail) failed to locate either of these two threatened species. While data searches listed 34 migratory species (listed under the provisions of the EPBC Act) as having the potential to occur in the PAA, more detailed investigations showed that the only Federally listed threatened species and communities likely to occur were the Koala, Green and Golden Bell Frog, Grey-headed Flying Fox and Cumberland Plain Woodland in the Sydney Basin Bioregion.

8.10.3 Impacts

Threatened Flora Species

Notwithstanding that targeted surveys failed to find the Spiked Rice-flower, a 7-part test was conducted for this species based on its predicted occurrence. The 7-part test concluded that the PAA is highly degraded and fragmented and it is unlikely that this species is actually present. The Project is not likely to have an adverse effect on the life cycle of Spiked Rice-flower such that any viable local population will be placed at risk of extinction. No endangered populations are likely to occur and there are no declared areas of critical habitat. No other threatened flora were recorded or known to occur within the PAA.

The four species listed by the Department of Environment for assessment are not likely to occur on the site and they were not observed during detailed surveys. The Yellow Gnat-orchid grows in dry sclerophyll forest and moss gardens over sandstone, neither of which is not present. The species was also not recorded during numerous ecological surveys.

The Leafless Tongue-orchid is not generally thought by the NSW OEH or the Department of Environment to occur in the Cumberland Subregion, within which the site is located. OEH also indicates that larger populations typically only occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*), none of which is present on the site. The Leafless Tongue-orchid was not recorded during numerous ecological surveys on the site.

The Illawarra Greenhood is not generally thought by OEH to occur on the Cumberland Plain as it is apparently extinct in western Sydney. It is still known to occur in the Illawarra and Hunter regions. The species was also not recorded during numerous ecological surveys on the site.

The Austral Toadflax is described by OEH as "*Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time*". Austral Toadflax is a parasitic plant that grows in association with *Themeda australis,* a grass that was identified within a small portion of the site. However, the area and condition of *T. australis* was not sufficient to support a population of this parasitic species. Austral Toadflax was not identified on site during various surveys.

Threatened Flora Communities

The River-flat Eucalypt Forest on Coastal Floodplains EEC alongside Georges River will remain untouched, as will the open water dam in the north-western part of the PAA. While the river can be classified as Class 1-major key fish habitat in the Policy and Guidelines for Fish Habitat Conservation and Management (2013), no works are planned on the River or its riparian fringe and nor are any direct or indirect impacts expected.

The Project will remove 9.5 ha of woodland which is both the state listed Cumberland Plain Woodland CEEC, and Federally listed Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest CEEC (Figure 8-3).

EPS (2015) Appendix 11 provides 7-part tests under the TSC Act and EPBC Assessments for this clearing. In summary, the assessments conclude the following with regard to the Cumberland Plain Woodland community in the PAA:

- The community is disturbed, and has been for some years;
- Areas of the community are highly fragmented from other similar communities;
- The PAA does not form part of the Cumberland Plain Woodland Recovery Plan Priority Conservation Areas;
- The Project is not likely to place the local occurrence of the community at risk of extinction;
- The PAA is not on or near any declared areas of critical habitat;
- The patch of CEEC will be further isolated and fragmented from other areas of Cumberland Plain Woodland, although the patch is quite isolated already;
- The degraded nature of the woodland area and the lack of threatened species limits its importance to the long-term survival of species, population or ecological community in the locality; and
- The Project is expected to have a small contribution to three key threatening processes; these are: "Clearing of vegetation", "Removal of dead wood and dead trees" and "Loss of Hollow-bearing Trees".

In relation to the 7 part test conclusions, the removal of the 9.5 ha of Cumberland Plain Woodland for the Project is unlikely to impact the extent of the CEEC such that its local occurrence is likely to be placed at risk of extinction.

The EPBC assessments concluded that a Referral under the EPBC Act should be submitted in relation to the impacts upon the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. This is primarily due to the total area of the community that is to be removed (despite the condition of the community being disturbed by underscrubbing).

Fauna

The following threatened or migratory species have the potential to occur in the PAA, and were therefore considered to be potentially impacted by the Project. Those species actually recorded are denoted in bold text. Accordingly, 7-part tests were prepared as provided in full as part of the ecological assessment. The species considered were:

- Koala;
- Green and Golden Bell Frog;
- Cumberland Plain Land Snail;
- **Grey-headed Flying-fox;**
- **Yellow-bellied Sheathtail-bat;**
- **East-coast Freetail-bat**;
- Greater Broad-nosed Bat;
- Eastern False Pipistrelle;
- **Little Bent-wing Bat;**
- **Eastern Bent-wing Bat**; and
- Large-footed Myotis.

None of the migratory species listed under the EPBC Act and identified in database searches are likely to occur.

The 7-part tests have been amalgamated by animal guild, so the Koala, Green and Golden Bell Frog, Cumberland Plain Land Snail and Grey-headed Flying Fox were considered separately, while tree hollow dependent bats were considered together.

The 7-part test concludes the following with regard to the Koala:

- The PAA is highly degraded and partially fragmented from larger tracts of vegetation that may be used by this species as part of a larger home range. The Proposal is not likely to have an adverse effect on the life cycle of the Koala such that a viable local population will be placed at risk of extinction; and
- The proposed removal of a small area of native vegetation contradicts the Koala Recovery Plan. However, the PAA is highly degraded and fragmented and through numerous field surveys it has been concluded that presence of the Koala is unlikely.

The 7-part test concludes the following with regard to the Green and Golden Bell Frog:

- The site is highly degraded and partially fragmented and the aquatic habitat is of low quality for this species. Only 5% of the fringing vegetation is suitable for this species; and
- This species was not identified during the targeted diurnal or nocturnal surveys, which were undertaken in accordance with survey guidelines and it is unlikely that it actually occurs on the site. The proposal is not likely to have an adverse effect on the life cycle of *L. aurea* such that a viable local population will be placed at risk of extinction.

The 7-part test concludes the following with regard to the Cumberland Plain Land Snail:

- While no direct or indirect evidence was noted during targeted surveys, the snail may occur. The Project will remove only a small portion of the potential habitat available to the species and it is not likely to have an adverse effect on its life cycle such that a viable local population will be placed at risk of extinction.

The 7-part test concludes the following with regard to the Grey-headed Flying Fox:

- Single Flying Foxes were recorded in the woodland adjoining the dam in February 2015 on two nights. The woodland habitat is expected to comprise a small proportion of available foraging habitat in the expansive foraging habitats in the locality and region. In addition, the River-Flat Forest will be retained, which provides foraging habitat for this species. It is unlikely that the Project would result in a viable local population being placed at risk of extinction.

The 7-part test concludes the following with regard to tree hollow dependent bat species:

- Hollow-bearing trees with small to medium sized hollows and cracks are present within the PAA. The hollows may be used (particularly by the Yellow-bellied Sheathtail-bat and East-coast Freetail-bat) for shelter and breeding; and
- The clearing of the site is not likely to have an adverse effect on the life cycles of these hollow-dependent species such that a viable local population will be placed at risk of extinction. The nearby extensive areas of forest vegetation are likely to contain similar suitable roosting habitat.

The Policy and Guidelines for Fish Habitat Conservation and Management (2013), Section 3.1, lists eight general policies to be considered with regards fish habitat. These policies are briefly addressed as follows:

- Equity: The nearest fish habitat to the project site is the Georges River, which will not be directly or indirectly affected by the Project;
- Precautionary principle: There is no uncertainty with regards potential impacts of the Project and the proposed mitigation measures will ensure that Project impacts are minimal with regards fish habitat;
- Conservation of biodiversity & fish populations**:** Fish habitats will not be affected by the Project;
- Protected and threatened species: No protected or threatened fish species will be affected by the Project;
- Protected areas and critical habitats: There are no fish critical habitats, SEPP 14, Ramsar, JAMBA, ROKAMBA or CAMBA wetlands in or adjacent the site;
- Comprehensive environmental assessment: The nearest fish habitat to the project site is the Georges River, which will not be directly or indirectly affected by the Project;
- No net loss of key fish habitat: The Georges River, adjacent to the PAA is mapped as Key Fish Habitat by the then NSW Department of Primary Industries. The Project will not affect the river and will not lead to net loss of key fish habitat; and
- Adaptive management: This refers to research and monitoring of development impacts, and given the lack of measurable impacts of the Project on fish habitat, is not relevant to this application.

8.10.4 Mitigation and Offsetting Measures

Proposed mitigation and compensation measures consist of the following:

- Site inductions will occur to ensure site worker awareness of ecological sensitivities;
- The construction management plans will have an ecological section to highlight the relevant issues;
- Vegetation disturbance will be limited to the minimum possible footprint;
- Clearing protocols will be implemented including a fauna spotter-catcher being present to reduce the risk of harm to fauna. Protocols will include pre-clearance inspections of the tree hollows;
- Hygiene and weed management protocols will be implemented to avoid pathogen and exotic species spread;
- Disturbance of aquatic habitats will be minimised and erosion and sediment will be managed in accordance with industry standards;

- Nest boxes will be installed at a ratio of 2:1 for each tree hollow removed; and
- The River-Flat Eucalypt Forest EEC will be incorporated for ongoing management as part of the biodiversity offset strategy.

A biodiversity offset strategy to address residual impacts on Cumberland Plain Woodland ecological community is provided in Appendix 10 and is outlined as follows.

The Project will significantly impact 9.5 hectares of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. Ecosystem credits calculated using the NSW Development BioBanking calculator and the Framework for Biodiversity Assessment Major Project calculators provide identical credits of 284 ecosystem credits. These credits are likely to be purchased or retired in a like for like exchange in the Cumberland – Sydney Metro Catchment Management Authority Area, the Project Interim Biogeographic Regionalisation for Australia (IBRA) subregion or adjoining IBRA subregions.

Various options are available to progress towards a final biodiversity offset package and GWS will be guided by the NSW Biodiversity Offsets Policy for Major Projects. GWS commits to working with DP&E, OEH and Department of the Environment towards producing a package that addresses previous advice. The primary commitments in developing the plan are:

- Direct offsets conserving like for like vegetation is the first preference;
- The preferred conservation mechanism for the offset site is BioBanking;
- The river-flat forest along the Georges River will be protected and conserved;
- Supplementary measures or payment into the Biodiversity Offset Fund will only be considered if all other avenues in sourcing appropriate offsets have been exhausted; and
- The plan will be developed in accordance with the criteria outlined in Appendix 10.

Combined, the above measures will ensure that ecological impacts of the project will be adequately addressed.

8.11 Indigenous Heritage

An Aboriginal Heritage Impact Assessment report was prepared by Archaeological and Heritage Management Solutions Pty Ltd (AHMS) and is attached in full at Appendix 11.

8.11.1 Methodology

The heritage report considered Aboriginal heritage constraints and opportunities in accordance with the following:

- Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (Department of Education and Communities 2005);
- Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (Office of Environment and Heritage, April 2011);
- Aboriginal Cultural Heritage Consultation Requirements for Proponents (Department of Environment, Climate Change and Water, April 2010); and
- Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (Department of Environment, Climate Change and Water, September 2010).

8.11.2 Aboriginal Consultation

GWS acknowledges and understands the importance of Aboriginal consultation throughout the Project. The Aboriginal consultation process has two main objectives. These are:

- To consult with knowledge holders to identify cultural places and values that may be affected by the project; and
- Obtain input on the proposed Project assessment methodology and comment on the report findings and management recommendations.

This report adopts the Office of Environment and Heritage (OEH) guidelines as they form the current practice for consultation. Initial informal consultation with Tharawal Local Aboriginal Land Council (TLALC) and Cubbitch Barta Native Title Claimants Aboriginal Corporation (NTCAC) was undertaken during the earlier preliminary assessment. At this consultation, discussions were held regarding proposed re-zoning application and a site visit was undertaken. Representatives of both groups were in attendance.

The first formal step in the consultation process was to identify key Aboriginal people or organisations who have a knowledge of the PAA. The following organisations were contacted as a request for information:

- Office of Environment and Heritage;
- Tharawal Local Aboriginal Land Council;
- Office of the Registrar, *Aboriginal Land Rights Act, 1983*;
- National Native Title Tribunal;
- NTSCorp Limited;
- Campbelltown City Council; and
- Sydney Metropolitan Catchment Management Authority.

From the information supplied by the above organisations, other groups and individuals were identified and are as follows:

- Cubbitch Barta Native Title Claimants Aboriginal Corporation;
- Darug Aboriginal Cultural Heritage Assessments;
- Darug Aboriginal Landcare Incorporated;
- Darug Custodian Aboriginal Corporation;
- Darug Land Observations;
- Darug Tribal Aboriginal Corporation;
- Gandangara Local Aboriginal Land Council;
- Gunjeewong Cultural Heritage Aboriginal Corporation;
- Peter Falk Consultancy; and
- Scott Franks, Yarrawalk/Tocumwall.

Following the identification of relevant Aboriginal parties a notification and invitation to register an interest was sent on 1 June 2012. In addition an advertisement was placed in the Campbelltown Macarthur Advertiser on Wednesday 6 June 2012. After registrations had closed, a total of 8 Aboriginal parties registered an interest. The Registered Aboriginal Parties (RAPs) are as follows:

- Tharawal Local Aboriginal Land Council (TLALC);
- Cubbitch Barta Native Title Claimants Aboriginal Corporation (NTCAC);
- Darug Aboriginal Cultural Heritage Assessments;
- Darug Aboriginal Landcare Inc.;
- Darug Custodian Aboriginal Corporation;
- Darug Land Observations;
- Peter Falk Consultancy; and
- Scott Franks, Yarrawalk/Tocumwall.

In accordance with Section 4.1.3 of the OEH 2010 guidelines, the details of the RAPs were provided to OEH and TLALC on 18 June 2012. A document containing the proposed assessment methodology was sent to the RAPs for comment on the 22 June 2012. In general the RAPs supported the proposed methodology and assessment approach.

Two site investigations were undertaken, the initial visit on the 18 May 2012 with representatives from TLALC and NTCAC. The second visit was undertaken on 25 July 2012 and involved the following RAPs:

- Darug Aboriginal Cultural Assessments;
- Darug Custodian Aboriginal Corporation;
- Darug Land Observations; and
- Scott Franks, Yarrawalk/Tocumwall.

Darug Aboriginal Landcare Incorporated and Peter Falk Consultancy were not present for the site investigation. A later meeting was held with the representatives.

In accordance with Section 4.3.6 of the OEH guidelines 2010, discussions were held with the RAPs regarding the potential heritage management options. These discussion were held throughout and at the completion of the investigations. Any sites identified were discussed in relation to expected and preferred outcomes. The draft report was distributed to the RAPs on the 16 November 2012 for a period of 28 days for comment. Four of the RAPs provided comment, which were all supportive of the findings and recommendations.

On 3 October 2014, further correspondence was forwarded to all RAPs outlining the consultation undertaken up to October 2014, advising of the work being undertaken for this EIS and included an invitation to the community consultation sessions.

8.11.3 Existing Environment

Regional and archaeological records suggest the GWS Site has high potential for archaeological material. However, the past land use shows that significant disturbance has occurred, thereby reducing the likelihood of any sites surviving.

The GWS Site has been used for horticulture, sand extraction, and landfilling and has been managed for bushfire prevention by regular slashing. These activities have significantly impacted several areas and most of the GWS Site is heavily disturbed and the potential for the preservation of archaeological materials over much of the site is low.

A search through the Aboriginal Heritage Information Management Systems (AHIMS) register revealed 93 Aboriginal sites within a 10 kilometre radius of the Project. These recorded site included:

- 51 open camps;
- 25 artefact sites;
- 6 isolated finds;
- 3 grinding grooves;
- 3 artefacts with potential archaeological deposits (PADs);
- 3 PADs;
- One scarred tree; and
- One artefact/PAD/grinding groove.

The less disturbed areas that are more likely to contain Aboriginal objects and/or sites are:

- An area of woodland in the western part of the PAA; and
- The alluvial terrace on the eastern edge of the transmission line, adjacent to the minor tributary of the Georges River (outside the PAA).

Survey confirmed the predictions and the following Aboriginal sites were identified (see Figure 8-4 for sites within the PAA):

- A PAD – GWD 2 outside the PAA;
- An isolated object – GWD 3; and
- An isolated object – GWD 4.

Two other sites were initially identified as Aboriginal sites but subsequently have been re-classified as of natural origin. These were:

- A scarred tree – Glenfield ST (#45-6-2428); and
- A scarred tree – GWD 1.

Site Glenfield 1 (#45-5-3531) is a previously recorded isolated object located on a vehicular access track that is presumed to have been destroyed.

Sites GWD 3 and GWD 4 are shown in Figure 8-4. Due to the extensive past disturbance, the PAA, including GWD 3 and GWD 4, has low scientific value. Responses from the Aboriginal community following the draft report indicate the Darug people would have found the GWS Site to be of importance due to its proximity to the Georges River. No specific cultural values were assigned to any of the sites identified during survey.

Map Title:	Figure 8-4: Aboriginal Site/Object Locations							**Date:**	30 July 2015
Location:	Glenfield, NSW Australia	**Author/ Reviewer:**	AT/MS	**Version No:**	V01	**Map/ DWG No:**	**1** of **1**	**Job Ref:**	11009

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8.11.4 Impacts

The PAA contains two known archaeological sites, GWD 3 and GWD 4. AHMS (2014) notes the following "*However, the archaeological context of GWD 3 and GWD 4, and any further artefacts present in this area, has been destroyed, meaning that the object has little research potential. The proposed development area, including GWD 3 and GWD 4, is therefore assessed as having low scientific value.*" Sites GWD 3 and GWD 4 will be destroyed during construction, however both sites have low scientific significance.

An identified area of potential sub-surface archaeological deposit, GWD 2, is outside the PAA and is therefore not subject to this development application. No other potential sub-surface archaeological deposit are expected.

8.11.5 Mitigation Measures

Sites GWD 3 and GWD 4 will be destroyed during construction but due to the low scientific significance of these sites, no further archaeological work is required in order to mitigate this heritage impact. As the Project is intended to be submitted for development approval in accordance with Division 4.1 of the EP&A Act, it will not be necessary to apply for an Aboriginal Heritage Impact Permit. However an Aboriginal Site Impact Recording form for each site will be completed and lodged.

The RAPs responses provided support and an agreement to the findings of the AHMS report and recommendations. The only additional recommendation made by the RAPs was the inclusion of signage on the Aboriginal history of the region following the completion of the development. This recommendation will be carried out as part of a separate project to dedicate a riparian corridor as signage in this area would be more useful than on the Project site.

The construction management plan will include protocols for training staff and contractors on the relevant heritage issues, legislative requirement and recommendations of the AHMS report.

Consultation between GWS and the RAPs will be maintained throughout the design and construction stages. If any Aboriginal sites are discovered during construction, works in the immediate area will cease and GWS will determine the subsequent course of action in consultation with a heritage consultant, RAPs and relevant State Government Agency.

Should any skeletal material be uncovered, GWS, in accordance with the *Coroner's Act 1980* will cease work immediately within 50 m and will contact the NSW Police and NSW Coroner's Office. If the remains prove to be Aboriginal, GWS will consult with a heritage consultant, the RAPs and relevant State Government Agency.

8.12 Greenhouse Gas

A Greenhouse Gas (GHG) Assessment Report was prepared by SLR Consulting Australia Pty Ltd (SLR). A copy of the full report is attached as Appendix 12.

8.12.1 Methodology

This GHG assessment includes the National Greenhouse Accounts (NGA) Factors, Scopes 1 and 2.1. Scope 3 emissions were considered for the transport of waste and recyclable, materials to and from the site by third party contractors and the transport of non-recyclable material from the facility to adjacent landfill.

The Australian Government Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE) document "National Greenhouse Accounts Factors" Workbook (NGA Factors) (DIICCSRTE, 2014) define two types of greenhouse gas emissions, direct and indirect. This GHG assessment considers both the direct and indirect emissions associated with the Project.

8.12.2 Impact

Scope 1, 2 and key Scope 3 GHG emission estimates are minimal, particularly compared to the emissions from NSW. Annual emissions are predicted to be 2,668 tCO_2-e, which represents approximately 0.0017% of the total state emissions.

Recycling waste has benefits from an energy and greenhouse perspective. In 2010 the then Department of Environment Climate Change and Water prepared a report titled "Environmental Benefits of Recycling". Table 4 of that report quantifies the net benefits of recycling specific segregated wastes delivered to materials re-processors. For example, recycling 100,000 tonnes of concrete waste would save 35,000 Gj of energy consumption and 128,000 kL of water, which would mean that 2,000 tCO_2-e of GHG will not be released into the atmosphere. This greenhouse gas saving equates to taking nearly 500 cars off the road, or replacing the energy used by over 1600 households.

Different waste types have different GHG, energy and water savings factors. Timber and glass for example have GHG very high savings factors. As the actual quantities and types of wastes to be received by the Project are subject to change to due supply and demand, an accurate calculation of savings cannot be easily made. However, a calculation based on mixed waste receival shows that the Project would save approximately 60,000 tCO_2-e, more than half a million Gj of energy and 800,000 Kl of water. These savings would equate to removing 14,000 cars off the road, the energy consumption of 24,000 houses and 320 Olympic swimming pools of water saved.

The total GHG savings due to the Project are estimated to be 22 times the GHG generated by the Project. This net saving will change with changing waste streams, with the result particularly sensitive to the proportion of wood and wood products received. To test the sensitivity of the estimate, if only concrete were received, (the waste type with the lowest saving factor) the net GHG savings would still be three times the GHG generated. Whatever the mix of incoming waste, the Project has a very strong GHG saving.

8.12.3 Mitigation Measures

GWS will consider GHG emissions when selecting diesel and electrical powered plant and machinery, and lighting.

8.13 Visual Amenity

The following section provides an assessment of the existing landscape and examines the potential visual impact of the Project on the landscape and amenity of the surrounding neighbourhood.

The objectives of the visual amenity assessment are to:

- Identify and assess potential viewpoints from which the proposal may have a visual impact;
- Identify and analyse the different character zones within and surrounding the GWS Site;
- Identify and assess the visual absorption capacity of the proposal;
- Assess the suitability of the proposal within its location;
- Identify positive and potentially adverse impacts; and
- Recommend mitigation measures where appropriate.

Key terms used in visual assessment are defined in Table 8-7.

Table 8-7: Visual Amenity Key Terms

Term	Definition
Landscape Values	The existing value of a landscape or its value to present or future generations. Landscape values may include biodiversity, geo-diversity, historic, and aesthetic values, as well as more personal values such as a person's associations, memories, knowledge or experiences of that landscape.
Landscape Character	The term used to describe the physical (e.g. landform, vegetation, water features, landuse) and social / cultural elements that differentiate one landscape from another.
Landscape Impact	A change to landscape values as a result of development. Impacts can be either positive or negative.
Photomontage	A graphic illustration of a proposed development drawn to scale incorporating the background photograph of a location to show how a proposal will look in the landscape.
Surrounding Area	Those areas outside the GWS site that have been identified as relevant for investigation of landscape values and potential impacts.
Visibility	The range to which a particular component of the development may be seen from the surrounding area.
Visual Significance	Used in this instance to describe the weighting that is given to the relative importance of identified *landscape values*. The *landscape values* of an area likely to be significant are those that help understand the past, enrich the present, and which will be of value to future generations. Examples of different levels of significance are 'negligible', 'minor', 'moderate' and 'major'.

8.13.1 Methodology

The methodology for investigating the visual impact of the Project involves consideration of the landscape values, the visual sensitivity and the potential visual effect. The effects of the Project derive from changes in the physical landscape, its character and how this is experienced. Changes to the landscape are more than visual and include a range of physical and perceptual factors. The following methodology has been employed:

- Review of topographic maps and aerial photographs;
- Visit to the PAA and surrounding area;
- Preparation and review of photo images from a range of viewing perspectives; and
- Assessment of the visual catchment via ground-truthing to examine the visibility.

The main investigation relating to the visual assessments was undertaken on 11 August 2014. The weather on this day was fine, with intermittent cloud cover. During this visit, the Project was assessed from a number of different perspectives both onsite and offsite. Visual sensitive receiver locations with a potential for modified visual amenity were specifically assessed. The following quantifiable visual components of the landscape and the proposed development have been considered, taking into account the physical effects of topography, vegetation and built elements:

- Vertical visual effect;
- Horizontal visual effect; and
- Distance of the visual effect.

8.13.2 Existing Environment

Particular combinations of the current landform, geology, vegetation and existing development create character in a landscape. This landscape character gives a particular 'sense of place', which is constantly evolving due to natural and man-made changes. The following section provides a description of the existing landscape and environment of the GWS site and surrounding area.

Landform

The landform is often the main influence on the character of the landscape. The site varies from flat to partly undulating where past landfilling has formed mounds. The elevation of the Project area varies from 17 to 22 mAHD.

Vegetation

The majority of the GWS site has been previously cleared of native vegetation for the purpose of operating as a quarry and waste facility. Native woody vegetation on the GWS site is primarily restricted to the Georges River riparian land and an area of woodland in the PAA. The existing vegetation provides a substantial visual buffer to the GWS site when viewed from Cambridge Avenue, Goodenough Street and Fergusson Street. An existing vegetated bund topped with a metal fence along Cambridge Avenue acts as an additional visual screen. Much of the vegetation located within the southern parcel is proposed to be cleared, although a 25 m wide vegetation buffer will be retained to maintain a visual screen for the proposed facility. This vegetation buffer has been included in the layout and design of the Project, and has been accounted for in the photomontage images and visual assessment.

Land Use

The southern parcel of land has a number of land-use features, including forested riparian vegetation along the Georges River, landfilled areas, non-landfilled areas and remnant woodland. The area south of Cambridge Avenue has high voltage electricity transmission lines and towers, which visually dominate.

There are a number of prominent anthropogenic structures within the landscape of the surrounding area. The most visually significant of these land-uses, including infrastructure and activities, are:

- Cambridge Avenue;
- Southern Sydney Freight Line;
- East Hills Rail Line;
- Main South Rail Line
- Excavations and landfill; and
- Residential areas along Goodenough Street, Fergusson Street and Leacocks Lane.

Based on the above, the GWS Site and surrounding area is characterised by the following landscapes:

- Residential areas – particularly residences located within Goodenough Street, Fergusson Street and Leacocks Lane;
- Transport corridors – including road and rail networks;
- Waterways – including Georges River;
- Vegetated natural areas – including woodland within the PAA; and
- Transmission line – electricity transmission lines located south of Cambridge Avenue.

Scenic Quality

To help quantify the scenic significance of the study area, the visual quality of the landscape is summarised in Table 8-8[1]. The table provides a landscape visual quality rating for a number of landscape characteristics. The rating is divided into low, moderate and high. Each characteristic has a series of criteria to define an appropriate rating for scenic quality. Higher scenic quality is generally associated with variety, uniqueness, prominence and naturalness of landform, vegetation and waterform[2]. Lower scenic quality is generally associated with urban related land uses. The qualitative applicable ratings in the context of the PAA in the landscape are shaded light grey.

The scenic quality of the PAA and surrounding area can be split into two distinct characteristics - natural landscapes and developed landscapes. Based on the visual quality reference in Table 8-8, the scenic quality is rated as low-moderate for the degree of naturalness in the landscape as it has been significantly modified by the land-uses outlined above. Further, the PAA and the surrounding area do not contain any local, regional, national or internationally significant landscapes that are unique for their scenic quality.

[1] Clouston and Brouwer, 1995.
[2] Leonard and Hammond, 1984; Forestry Commission Tasmania, 1990.

Table 8-8: Visual Quality Reference Table

	Low	Moderate	High
Relief/landform **Diversity and contrast**	Flat terrain dominant. Ridgelines not often seen.	Undulating terrain dominant. Little contrast or ruggedness. Ridgelines prominent in only half or less of the landscape unit.	High hills in foreground and middleground. Presence of cliffs, rocks and other geological features. High relief.
Vegetation **Diversity and contrast**	One or two vegetation types present in foreground. Uniformity along skylines.	Patterning in only one or two areas. 3 or 4 vegetation types in foreground. Few emergent or feature trees.	High degree of patterning in vegetation. 4 or more distinct vegetation types. Emergent trees prominent and distinctive to region. Stands of specimen or accent vegetation.
Naturalness	Dominance of development with many parts of a landscape unit.	Some evidence of development but not dominant. Traditional built character. Development in background and / or partially concealed.	Absence of development or minimal dominance within landscape unit. Presence of parkland or other open space including beach, lakeside etc.
Water **Presence, extent & character**	Little or no view of water. Water in background without prominence. Presence of polluted water or stagnant water.	Moderate extent of water. Presence of calm water. No islands, channels, meandering water. Intermittent streams, lakes, rivers, etc.	Dominance of water in foreground and middleground. Presence of flowing water, turbulence and permanent water. Intricate shapes and river edges.
Development **Form & Identity**	Presence of commercial and industrial structures. Presence of large scale development (e.g. mining, infrastructure etc). Newer residential development prominent.	Presence of established residential development. Small scale industrial development etc in middle ground. Presence of sport and recreational facilities.	Presence of rural structures (e.g. farm buildings, fences etc). Heritage buildings and other structures apparent. Isolated domestic scale structures.
Cultural	No evidence presence. Area free of cultural landmarks. Presence of new development.	Presence of established, well landscaped development especially in middle ground and background.	Presence of established, maintained landscapes (e.g. farmland, forest, gardens etc), old towns and buildings etc.

(Source: Clouston and Brouwer, 1995) Footnote: **The qualitative ratings for the proposal are shaded light grey.**

8.13.3 Visual Montage

Potentially sensitive visual receptors

Landscape is more than just 'the view' or shape of the land – it is about the relationship between people, place and nature. Perception of a landscape is a result of the way that different components of the natural and cultural environment interact and how the viewer perceives these components. It follows that visual impacts are dependent upon the values of the viewer. Public attitudes and perceived sensitivities to landscape changes can be difficult to quantify and are generally highly subjective.

People value landscapes for many different reasons. Landowners may view the landscape differently from people who use the landscape for recreational activities and this may differ again for those travelling through. People with an extensive connection to a particular landscape are more likely to have personal associations, memories and connotations that influence the value they place on the landscape or certain aspects of the landscape. Passing travellers may appreciate a landscape but generally have a low sensitivity to the site as they have no stake in the view or little relationship with the landscape.

Accordingly, the visual assessment and photomontages have been prepared based on the potentially sensitive visual receptor locations shown in Figure 8-5.

Residents within Goodenough Street, Fergusson Street and Leacocks Lane are the most sensitive visual receptors for the Project, as marked 1 to 6 in Figure 8-5. The corresponding montages from these numbered sites illustrate the visual impacts of the Project and represent the viewpoints available to the residential community. Vegetation and topography of the area soften the visual impact of the proposal from the immediate and surrounding locations.

Map Title:	Figure 8-5: Camera Locations Key Plan							**Date:**	30 July 2015
Location:	Glenfield, NSW Australia	**Author/ Reviewer:**	AT/MS	**Version No:**	V01	**Map/ DWG No:**	**1** of **1**	**Job Ref:**	11009

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Photomontages

A set of 6 photomontages have been produced by Conybeare Morrison International Pty Ltd to illustrate the Project within the landscape. Photomontages assist in the visualisation of the Project within the existing physical landscape and environment. The montages have been prepared based on photographs taken at each of the viewpoints numbered in Figure 8-5 and represent typical views of the development by the residential community. A3 copies of the photomontages and 3D modelling of the Project are attached at Appendix 13.

Location 1 (Figure 8-6) is a view of the proposal looking north from the eastern end of Goodenough Street. The Project facility is visually unobtrusive from this viewpoint, with the 25m vegetation buffer, existing bunding and fence being the only clearly visible features. Further, the scale of the electricity transmission lines and towers from this viewpoint dominates the landscape.

Location 2 (Figure 8-7) is a north-east view of the proposal from the western end of Goodenough Street at the end of the cul-de-sac. From this viewpoint, the existing bund, fence and 25 m vegetation buffer creates a solid visual barrier. The yellow dotted line indicates the height of the material stockpiles, with little to no visual impact, given the shielding effect of the 25 m buffer.

Location 3 (Figure 8-8) is approximately 100 m east of Railway Parade along Cambridge Avenue with an eastern viewpoint toward the Project. The visual impact from this location is negligible as the height of the Project stockpiles are lower than existing bund and vegetation buffer, as demonstrated by the yellow outline of the material stockpiles.

Location 4 (Figure 8-9) is a north-western view of the proposal from along Cambridge Avenue at the existing GWS entry point. The topography at this location causes the green waste stockpile in the southwestern corner of the Project site to be moderately visible through the existing vegetation. Notwithstanding the slight visibility of the stockpile, the material is visually compatible with the existing vegetation and grassed bund, resulting in an unobtrusive visual impact.

Location 5 (Figure 8-10) is the viewpoint from 88 Leacocks Lane, a locally significant heritage site due to the presence of the 'Glenfield House', a dwelling erected in 1817. As illustrated in Figure 8-10, the outline of the Project is entirely shielded by the existing vegetation and landscape features. The yellow dots illustrate the location of the proposal in the landscape beyond the near ground vegetation. The near ground vegetation however will screen the proposal. The yellow dots are only for locational purposes to illustrate where the proposal is in the landscape. Accordingly, the visual impact is low-negligible.

Location 6 (Figure 8-11) illustrates the Project looking south east from 40 Leacocks Lane across the GWS site. The Project can be seen in the distance from this viewpoint, however vegetation remains dominant in the foreground. Further, the existing landfill and extraction operations are predominant in the middle ground with the Project in the far distance. Therefore, there is little visual impact on the overall landscape from this viewpoint.

The photomontages demonstrate that the Project will be viewed against an expansive landscape capable of absorbing the visibility of the development. The views from Cambridge Avenue, Fergusson Street and Goodenough Street in particular, illustrate the mitigating effects of the vegetation buffer, fencing and grassed bund to screen the proposal within the landscape.

Figure 8-6: Photomontage Location 1 – Goodenough Street View 1

Figure 8-7: Photomontage Location 2 – Goodenough Street View 2

Figure 8-8: Photomontage Location 3 – Cambridge Avenue View 1

Figure 8-9: Photomontage Location 4 – Cambridge Avenue View 1

Figure 8-10: Photomontage Location 5 – Leacocks Lane View 1

Figure 8-11: Photomontage Location 6 – Leacocks Lane View 2

8.13.4 Impact

Scale and Dominance

The scale of the Project in relation to the surrounding landscape is graphically illustrated in the photomontages. The proposal will not be a visually intrusive feature of the landscape, particularly due to the vegetation screen, bund and fence which combine to create a visual buffer. The Project is visible from Leacocks Lane although it is located 1.2 km away, and significant existing visual features such as the landfill and extraction operations and the Southern Sydney Freight line lie between the Project and the viewpoint. Accordingly, the development will have a low visual dominance.

Visual Sensitivity

Visual sensitivity is a measure of the level of concern attached by a user group to a change in the existing landscape. It is largely determined by visibility and the distance from viewing areas, but is also influenced by the disposition of the viewer to development of this type. Importantly, the scenic quality of the PAA and surrounding area is assessed as being low-moderate. This is largely based on the existing infrastructure, land-use features and development within the locality which influence the visual character of the environment. Accordingly, construction of the Project will not transform the visual character, nor does it represent a major change to the local perception of the surrounding area.

Notwithstanding the limited visibility of the Project as illustrated in Figure 8-9 and Figure 8-11 above, the facility will not have a significant impact on the surrounding locality. The Project's backdrop against large-scale infrastructure such as the East Hills passenger rail line, Southern Sydney Freight line and electricity transmission lines, enables the Project to be visually integrated into the surrounding environment.

Lighting and Signage

The Project will be serviced by the existing security lighting. No additional security lighting is proposed for the facility, therefore there will be no additional lighting impacts on the surrounding environment.

Signage similar in colour and scale to the existing GWS landfill facility will be installed for the Project. The signage will identify the name, operating hours and contact details. Additional signage will be installed to direct traffic flow. Traffic signage is anticipated to be of a small size and will be designed in accordance with the existing GWS colour scheme for consistency. The scale and location of the signage will not create an adverse visual impact within the locality.

Community Feedback

The photomontages were displayed at the community information sessions, which were attended by residents of Goodenough Street and Fergusson Street. The general comment regarding the photomontage representation of the prospective view towards the proposal was that it will not be visually dominate and no concerns regarding visual impacts were suggested.

8.13.5 Mitigation Measures

To ameliorate the appearance of the Project, the following mitigation measures will be adopted:

- A 25 m wide vegetation buffer will be maintained along Cambridge Avenue;
- The existing vegetated 2m high bund will be maintained, serving as a practical divider for the southern boundary of the facility and equally as a visual mitigation measure to the south; and
- The existing fence atop the bund will be extended east to the access road.

8.14 Socio- Economic Impact

The Socio-Economic Impact Assessment examined the social and economic impacts associated with the Project and is provided in full at Appendix 14.

8.14.1 Methodology

The social and economic impact assessment is based on an analysis of the existing local area including the wider Campbelltown and Liverpool LGAs and the South West Sydney Region. The methodology identifies the social and economic effects of the Project allowing the positive externalities (an economic activity that has a positive effect on an unrelated third party) to be magnified and any potential negative impacts mitigated.

The methodology included a review of a number of data sources including:

- Socio-demographic data from the Australian Bureau of Statistics (ABS);
- Additional published and publicly available economic, social and demographic data;
- Campbelltown City Council strategies and plans;
- Relevant internet sites and academic publications to identify social and community infrastructure, including community and Council websites, State Government websites and other relevant websites;
- Economic and employment data from the ABS;
- Background literature review on economic impact assessment and the economic impacts of recycling versus landfill activities;
- Technical studies prepared as part of this EIS; and
- Identification of economic impacts of the Project.

Using the above methodology, the objectives of the assessment were to:

- Establish baseline data for the existing social environment including local, regional and special interest groups;
- Assess potential social and cultural impacts during the construction and operational phases;
- Where appropriate, identify mitigation measures for the social, cultural and economic environment;
- Identify the key economic considerations for the local and regional economy; and
- Identify the potential positive and negative economic impacts on the locality and wider region.

8.14.2 Existing environment

The assessment of the key social infrastructure in Glenfield, indicates that there is reasonable social and community infrastructure available for the local residents, including facilities and amenities.

8.14.3 Impacts

The Project will provide positive social and economic outcomes for the region by the way of employment generation and the promotion of recycling as an alternative to landfilling.

The following positive social and economic impacts are expected to result from the Project:

- Direct and indirect employment throughout the construction and operational phases;
- Promotion of sustainable waste recovery and recycling in line with the strategic planning polices, and provide a positive waste management alternative to landfilling;
- A suitable land-use and development option that meets the needs of the community, as well as the wider Sydney region;
- Alignment with the hierarchy of priorities as outlined in the *Waste Avoidance and Resource Recovery Act 2001* (NSW); and
- No substantial shifts in local demographics or population during construction or operational phases.

Notwithstanding the positive outcomes of the Project, the following potential negative impacts have been identified:

- Increase of traffic in the area; and
- Perceived potential for impact on the noise and air amenity of the neighbourhood.

Traffic, noise and air (dust) impacts are addressed in Sections 8.3.3 and 8.1.3 respectively.

The Project will provide significant economic stimulus to the region while the listed mitigation measures will effectively ameliorate any actual or perceived negative social impacts.

8.14.4 Mitigation measures

GWS acknowledges the potential perceived negative impacts identified in the assessment and will provide the following mitigation measures during the construction and operational phases of the Project:

- Project hotline and website will be maintained during construction and operation;
- Continuing community and stakeholder consultation; and
- Consideration of recruitment of construction and operational staff who reside within the region.

8.15 Cumulative Impacts

This section considers the potential cumulative impacts that may arise as a result of the Project at different spatial and temporal scales. The cumulative impact assessment combines the residual impacts of the Project with the impacts of existing and approved development in the immediate locality and wider region. The cumulative impact of the Project necessarily considers the mixed developments and land uses adjacent to the GWS Site, and has been prepared in accordance with the following objectives:

- Identify and assess the cumulative impacts of existing, approved and proposed developments within the locality;
- Determine how the construction and operation of the Project may contribute to the overall impacts on environmental, social and economic values of the region; and
- Identify mitigation strategies to minimise the Project's contribution to cumulative impacts.

8.15.1 Surrounding Developments and Land Uses

Based on information available in the public domain, it is understood that a number of third party developments are located in close proximity to the GWS Site. The following developments are either existing, under construction, approved or currently being proposed or assessed for development approval within the locality:

- **Holsworthy Barracks** - The Holsworthy Barracks, located to the north east of the GWS Site, is part of the military reserve and covers an area of approximately 20,000 hectares. The area has been a training facility for the Australian Army since World War I;
- **Sydney Intermodal Terminal Alliance (SIMTA)** - The SIMTA site comprises 83 hectares of land directly to the east of the GWS Site which is currently occupied by the Defence National Storage and Distribution Centre. SIMTA have recently received concept approval for development of the intermodal facility including warehouse and distribution facilities and an indicative rail link; and
- **Moorebank Intermodal Terminal (MIT)** - The Moorebank Intermodal Company (MIC) and SIMTA have reached an agreement to develop the MIT. The MIT is a proposed freight infrastructure project which includes an import-export terminal to manage shipping container movements between Port Botany and south-western Sydney, and an interstate terminal linked to the national rail freight network via the Southern Sydney Freight Line. The proposal will comprise of a rail yard, trucking terminal and warehouses. The MIT project is currently being assessed for concept approval.

The GWS Site is bounded by the following land uses:

- **Residential** - The suburb of Casula is located to the north west of the GWS Site, and the suburb of Glenfield is located to the south and south-west of the site; and
- **Railway Infrastructure** - The GWS Site is close to an extensive network of rail infrastructure including the Southern Sydney Freight Line, East Hills passenger rail line, Main South passenger rail line, South West passenger rail line and the recently completed Glenfield Interchange Upgrade. The major upgrade of Glenfield station created a single junction for three rail lines and provision of ancillary station and carpark facilities.

8.15.2 Cumulative Assessment

The potential for cumulative impacts to arise from the interaction of the Project and surrounding third party developments has been assessed by the individual technical studies prepared as part of this EIS. In this regard, cumulative impacts have been assessed and incorporated into the mitigation measures from the outset with no potential for significant cumulative impacts identified. Where sufficient primary data was unavailable for third party developments, the technical studies adopted a worst case scenario approach to enable a conservative precautionary outcome.

The following technical studies assessed cumulative impacts within the context of existing industry, facilities under construction and future developments, and found the impacts to be negligible:

- **Visual -** The visibility of the Project is limited, with landscaping features such as a vegetation screen, bund and fence creating a visual buffer. Further, the existing infrastructure, land-use features and development within the locality influences the visual character of the environment. Construction of the Project will not transform the visual character and has a negligible cumulative impact on the surrounding area;
- **Contamination -** Desktop and site assessments were undertaken to consider concentration levels of soil contaminants. An analysis of drill samples collected around the periphery of the site, as well as a review of available background data indicated that there was no exceedance of pertinent concentration levels for soil contaminants. Accordingly, there is a negligible cumulative impact potential;
- **Hydrology -** The facility is not expected to intercept nor will it use, groundwater. Further, predicted impacts on nearby receiving waters, including the Georges River, are minimal. Accordingly, there is a negligible predicted cumulative impact on groundwater and surface water; and

- **Hazards -** A qualitative Level 1 preliminary hazard assessment (PHA) prepared in accordance with SEPP 33 Hazardous and Offensive Development found that the Project will not store hazardous materials as defined in the Australian Dangerous Goods Code or NSW Planning-Storage and Handling of Dangerous Goods Code of Practice 2005. The PHA found that that the Project does not pose a significant risk. The Project will have a negligible cumulative impact with regard to hazard and risk management.

The following technical studies found potentially adverse cumulative impacts resulting from the Project when combined with existing impacts from adjacent developments. Accordingly, mitigation measures have been identified and incorporated into the design of the Project where necessary:

- **Traffic -** The local road network will operate with a good level of service through 2024 with or without the Project. The Project will contribute to traffic generation, but will not have any significant impact to the sub-regional road network. Notwithstanding the limited contribution of the Project to traffic generation, the traffic report has considered the cumulative impact resulting from the proposed SIMTA and MIT developments. Though it is predicted that Project vehicles will constitute less than 1% of two way flows in 2024, a viable southern route option appears to be essential to the long-term sustainability of the sub-regional road network. A detailed discussion of the sub-regional cumulative traffic impacts is contained in the TIA attached at Appendix 9;
- **Dust** - The dust impact assessment sourced data from the OEH monitoring station to consider the background dust concentrations. The assessment added the predicted dust increments resulting from the Proposal to the existing background dust levels. The combination of these levels enabled accurate modelling of the cumulative dust concentrations. The Project has little effect on the predicted cumulative dust environment, either as deposited dust or suspended dust concentrations;
- **Noise -** Background noise was measured by both operator-attended and long-term logging at two representative receptors to determine project specific noise criteria. Based on the existing background noise levels, it is predicted that project specific noise criteria will be met at all the nearest potentially affected residential locations. Further, the total volume of traffic predicted to be generated by the GWS site represents less than 2% of the estimated existing daily traffic on Glenfield Road. The corresponding increase in road traffic noise would largely be unnoticed, representing a negligible cumulative impact;

- **Greenhouse Gas** - The Greenhouse Gas Assessment report considered both direct and indirect emissions associated with the Project. The indirect emissions includes consideration of cumulative GHG impacts. The GHG Assessment report estimated that the direct and indirect emissions are minimal, particularly compared to the emissions from NSW. The GHG emissions will represent a negligible contribution of 0.0017% of the total state emissions. Accounting for the direct benefits of recycling, the Project has a very strong beneficial impact with total GHG savings estimated to be 22 times the GHG generated by the Project. Additionally the Project is estimated to save each year, the equivalent energy required to power over 24,000 houses and will save more than 750,000 cubic metres of landfill space; and
- **Biodiversity -** The Project has a cumulative impact on biodiversity. The Project will remove 9.5 ha of woodland which is both the state listed Cumberland Plain Woodland CEEC, and Federally listed Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest CEEC. The two largest adjacent non-GWS projects are the SIMTA and MIT intermodal developments will both clear native vegetation, none of which is Cumberland Plain Woodland CEEC, or Federally listed Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest. .

The assessment of cumulative impacts has considered all of the relevant existing and proposed projects. Key cumulative impacts are those associated with traffic, dust, noise, greenhouse gas and biodiversity. Detailed assessment of these key issues has been undertaken within the technical studies prepared as part of this EIS. Implementation of the identified mitigation and management measures as outlined in the technical studies and addressed in the relevant environmental assessment chapters of this EIS, will result in both manageable and acceptable cumulative impacts.

9 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The objectives of the EP&A Act are listed in section 5 of the Act, including encouragement of the principles of Ecologically Sustainable Development (ESD). A comprehensive assessment of a proposal in accordance with the principles of ESD should result in a clear justification of the preferred project. Accordingly, the complete integration of ESD principles within the environmental assessment process has remained a paramount consideration for the Project, from inception and concept phases, through to the design and assessment stage.

Supplementary to the EP&A Act objectives, section 7 (1(f)) of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* requires a proponent to include in an EIS the reasons justifying the development, including the principles of ESD. Section 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 defines the principles of ESD as follows:

> *(a) the **precautionary principle**, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*
>
> > *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
> >
> > *(ii) an assessment of the risk-weighted consequences of various options,*
>
> *(b) **inter-generational equity**, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,*
>
> *(c) **conservation of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,*
>
> *(d) **improved valuation, pricing and incentive mechanisms**, namely, that environmental factors should be included in the valuation of assets and services, such as:*
>
> > *(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,*
> >
> > *(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,*
> >
> > *(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.*

The following sections provide the evaluation of the Project with regard to ESD.

9.1 Precautionary Principle

As defined above, the precautionary principle requires careful evaluation of potential environmental damage and risk-weighted consequences of such damage to avoid serious or irreversible harm. In this sense the precautionary principle promotes proactive environmental protection as opposed to reactive measures following environmental damage. In order to satisfy the precautionary principle, the potential for serious or irreversible environmental damage must be anticipated, measured and prevented from the outset to ensure a level of scientific certainty has been achieved in relation to the proposed development.

Accordingly, this EIS has undertaken an evaluation of all key environmental components, as well as secondary components with the potential to influence environmental damage including social and economic considerations. Detailed assessment of all key issues and proposed mitigation and management procedures have been conducted as documented in the previous sections of the EIS. Through the adoption of an anticipatory approach, each potential issue arising from the Project has been identified, evaluated and mitigated through a series of design, monitoring or management solutions.

The assessment process has involved a detailed study of the existing environment and the use of engineering and scientific modelling and study to assess and determine potential impacts as a result of the Project. The process also relied on the experience and expertise of the specialists engaged throughout the assessment phase. To this end, there has been careful consideration to avoid, where possible, irreversible damage to the environment, including the following measures:

- The best available scientific information for the Project area has been relied upon during the assessment process. Where necessary, site investigations and monitoring have been undertaken to ensure a level of scientific certainty consistent with the precautionary principle. Where uncertainty in data has been identified, modelling and assessment have been based on an objectively 'worst-case scenario' case analysis with appropriate contingency measures proposed to manage such uncertainty;
- The location and footprint of the Project is based on an EPA preference for land unencumbered by capped landfill cells;
- A site-wide biodiversity scheme is being developed in correspondence with the relevant stakeholders and agencies; and
- Modelling of worst case scenario air quality emissions, noise emissions, traffic impacts, sediment dispersion, greenhouse gas emissions, waste management and groundwater impacts has provided greater scientific certainty about the potentially adverse impacts of the Project. This has subsequently resulted in conservative mitigation measures to manage and monitor anticipated environmental impacts.

The EIS has anticipated, assessed and managed the potential impacts and uncertainties arising from the Project. There are no uncertainties that pose a risk of serious or irreversible damage to the environment and therefore the Project is in accordance with the precautionary principle.

9.2 Inter-generational Equity

The concept of inter-generational equity requires that the present generation preserves or enhances the health, diversity and productivity of the environment for the benefit of future generations. Essentially it refers to equality between generations. The concept includes both intra-generational equity, i.e. within generations, and inter-generational equity, i.e. between generations. This means that the principle extends beyond the requirement of environmental protection and enhancement for inter-generations, but also requires that the economic and social benefits of the proposal are equally distributed among members of a community intra-generationally.

Throughout the assessment process, the type and extent of potential impacts caused by the Project have been analysed and mitigated. The assessment methodologies have adopted a risk-based and worst case scenario approach to ensure improved environmental, social and economic protection for current and future generations. The environmental management and mitigation measures have been developed to minimise the impact of the Project on the environment for future generations.

It is recognised that the Project includes clearing of Cumberland Plain Woodland. A biodiversity offset scheme is being prepared in consultation with the NSW Office of Environment and Heritage, NSW Office of Strategic Land and the NSW Department of Planning and Environment. The biodiversity offset scheme will provide a balance between biodiversity conservation and the requirement for waste recycling infrastructure and reducing waste to landfill for an increasing populace in South West Sydney.

The Project does have unavoidable short term environmental consequences from clearing of Cumberland Plain Woodland. However, the long term environmental benefits delivered through reducing waste to landfill and recycling of waste materials for construction in South West Sydney has a positive outcome for both current and future generations. The use of recycled materials significantly ameliorates the requirement for development and transport of new resources. With an increasing population size forecast for South West Sydney, the opportunity to reuse processed construction materials, avoid unnecessary landfill and centralise a recycling process close to the future consumer demand, has significant positive intergenerational attributes compared to the alternate of seeking new construction materials and sending recyclable waste to landfill.

One very significant issue around inter-generational equity is human-induced climate change driven by atmospheric emissions. Climate change is directly threatening large human populations, especially in low lying countries, and those where rainfall patterns are expected to change to the detriment of food production. Here the Project has a very strong beneficial impact with total GHG savings estimated to be 22 times the GHG generated by the Project.

Additionally the Project is estimated to save each year, the equivalent energy required to power over 24,000 houses and will save more than 750,000 cubic metres of landfill space.

9.3 Conservation of Biological Diversity

The conservation of biological diversity refers to the maintenance of species richness, ecosystem diversity and health, and the links and processes between them. In accordance with the principle of conservation of biological diversity and ecological integrity, a number of investigations have been undertaken by specialists to assess the extent and nature of ecological values on the GWS Site and the surrounding locality. All environmental components, ecosystems and habitat values potentially affected by the Project are described in the EIS.

As outlined in Section 9.2, the Project is predicted to result in unavoidable short term environmental impacts due to the clearing of vegetation.

Notwithstanding the immediate impact on the local ecosystem as a result of the Project, a site-wide biodiversity offset scheme is being prepared to address the impacts on the overall biological diversity and ecological integrity of the region. The following measures are proposed to maintain or enhance the biological diversity and ecological integrity for the Project:

- Retention of the Georges River riparian corridor to the east of the site as an area of ecological significance;
- Implementation of sediment and erosion control measures during construction and operation to prevent impacts on adjoining areas;
- Maintenance of a 25m wide vegetation buffer along Cambridge Avenue; and
- On-going maintenance of buffer areas to control litter and illegal waste dumping.

Results from the ecological investigations and additional specialist reports have informed the design of the Project as well as the above mitigation and management measures. In summary, whilst the Project would result in unavoidable short term environmental impacts by way of vegetation clearing, the proposed management measures and biodiversity scheme provide positive measures for biodiversity to assist in the amelioration of project impacts.

9.4 Improved Valuation, Pricing and Incentive Mechanisms

The principle of improved valuation and pricing mechanisms refers to the need to determine proper values of services provided by the natural environment. The objective is to apply economic terms and values to the elements of the natural environment. This is a difficult task largely due to the intangible comparisons that need to be drawn in order to apply the values.

The Project optimises the valuation and pricing of natural resources by encouraging diversion away from landfilling and encouraging recycling.

Project feasibility considerations have included the costs of a biodiversity offset scheme and integration of effective management measures to minimise potential environmental impacts.

10 ENVIRONMENTAL MANAGEMENT

While the purpose of the EIS and environmental assessment process is to identify and measure the actual environmental impacts resulting the Project, the role of an ongoing environmental management system is to ensure that the identified controls and commitments are maintained throughout the construction and operational phases of the Project. Further, a formal environmental management system will implement and monitor the objectives and measures outlined in the development consent, relevant licenses and legislation. Accordingly, this section outlines an overall environmental management framework to guide the development and management of the Project.

Following a positive determination and development consent, an Environmental Management Plan (EMP) will be prepared taking into account the following documents:

- This Environmental Impact Statement;
- Issued conditions of consent; and
- Any other approval, licence or permit required, including but not limited to an Environmental Protection Licence.

A suite of EMPs will be prepared including a Construction Environmental Management Plan and an Operational Environmental Management Plan. These EMPs will be drafted and finalised following development consent. Notwithstanding, the EMPs are expected to specify all environmental management activities and measures used to control, prevent or minimise environmental impacts. In addition, the plan will assign responsibility for mitigation measures to specific personnel and allocate quantitative or qualitative criteria to the performance of each measure where applicable. The following matters are likely to be addressed in the suite of EMPs:

- Project Description;
- Environmental management structure and responsibilities;
- Approval and licensing requirements;
- Environmental training requirements;
- Emergency contacts and response procedures;
- Risk assessment;
- Environmental management maps as required;
- Environmental monitoring requirements;
- Environmental auditing;
- Weed monitoring and control;
- Corrective action; and
- Review.

Monitoring protocols will be developed in liaison with the EPA to address requirements of any EPL related to the project. It is expected that monitoring will include operational noise and dust emissions. The existing groundwater and surface water monitoring regimes conducted on the landfill site are expected to continue.

Appropriate environmental management measures will be implemented following a positive determination for the Project in accordance with the following environmental objectives:

- Implement a standard of environmental management that reflects proactive planning and recognition of environmental impact;
- Comply with Commonwealth and NSW legislative requirements;
- Comply with all applicable environmental standards and approvals throughout all phases of the Project;
- Commit to undertake all environmental management practices in accordance with best-practice; and
- Establish, implement and maintain an EMS.

Site management will be in accordance with the GWS Environment Policy, which is reproduced in Appendix 16.

11 Summary of Mitigation Measures

Table 11-1 provides a list of mitigation measures.

Table 11-1: Summary of Mitigation Measures

Summary of Mitigation Measures
Waste Management
• Implementation of waste screening and storage procedures.
Dust
• Area sprayer activated in dry weather with wind speeds >5 m/s and visible dust. • Sealing of main access road (550 m) and regular sweeping of sealed roads. • A weather station and wind sock will be installed on site. • A watercart will be used as required on manoeuvring areas and sprays fitted to conveyor discharges.
Odour
• No specific mitigation measures are required to control odours.
Noise and Vibration
• It is planned to not operate during the winter morning shoulders (May to August inclusive before 7.00 am) unless monitoring shows that operations can meet the criteria. • A reduced suite of machinery will be operated in the morning shoulder outside of the winter months. • A noise management plan will be prepared. • The 1.8 m fence on the bund along Cambridge Avenue with a proposed 100 m extension of the fence towards the entry gate. • Localised noise barriers approximately 2.5 m high adjacent to the processing plant in Areas 2 and 3 and the shredder in Area 1. These have been oriented to provide shielding to the south and the west. • A 4 m stockpile for processed product in Area 3
Soils, Geology and Contamination
• Any bulk fuel tanks will be above ground and bunded.
Hydrology
• Sedimentation dams will have retained capacity for design storms.
Traffic
• Use of a second access off Railway Parade. • One-way flow of traffic with entry via Cambridge Avenue and exit via Railway Parade. • Should the occasional access of a Restricted Access Vehicles (RAV) be required, they will access and egress via the existing eastern access, via Cambridge Avenue. Should the use of these vehicles become commonplace, a RAV route assessment will examine this small section

Summary of Mitigation Measures
of Railway Parade for RAV suitability. If the section of Railway Parade is suitable, an application will be made to extend the RAV route. • GWS will develop a detailed Construction Traffic Management Plan.
Hazard and Risk Management
• The Project will not store hazardous materials as defined in the Australian Dangerous Goods Code or NSW Planning-Storage and Handling of Dangerous Goods Code of Practice 2005. • A Project Emergency Response Plan will be developed, maintained and implemented. • Employee inductions will cover aspects of fire prevention. • A formal facility close down procedure will be prepared and implemented to ensure any smouldering fires are noted and extinguished. • A Combustible Stockpile Management Plan will be developed, maintained and implemented. • A water cart will be available on Site. • The Facility will be securely fenced to discourage intruders. • Fire-fighting systems designed and installed compatible with NSW Fire Brigade systems. • Mobile plant and vehicles will be fitted with appropriate fire extinguishers.
Biodiversity
• Site inductions will occur to ensure site worker awareness of ecological sensitivities; • Construction management plans will have an ecological section to highlight the relevant issues; • Vegetation disturbance will be limited to the minimum possible footprint; • Clearing protocols will be implemented including a fauna spotter-catcher being present to reduce the risk of harm to fauna. Protocols will include pre-clearance inspections of the tree hollows; • Hygiene and weed management protocols will be implemented to avoid pathogen and exotic species spread; • Disturbance of aquatic habitats will be minimised and erosion and sediment will be managed in accordance with industry standards; • Nest boxes will be installed at a compensatory ratio of 2:1 for each tree hollow removed; • The River-Flat Eucalypt Forest EEC will be incorporated for ongoing management as part of the biodiversity offset strategy; and • A biodiversity offset package will be formulated in relation to the project impacts upon the Cumberland Plain Woodland ecological community.
Indigenous Heritage
• An Aboriginal Site Impact Recording form for each site will be completed and lodged. • The inclusion of signage on the Aboriginal history of the region will be carried out as part of a separate project to dedicate a riparian corridor. • The construction management plan will include protocols for training staff and contractors on the relevant heritage issues, legislative requirement and recommendations of the AHMS report.

Summary of Mitigation Measures
• Consultation between GWS and the RAPs will be maintained throughout the design and construction stages. If any Aboriginal sites are discovered during construction, works in the immediate area will cease and GWS will determine the subsequent course of action in consultation with a heritage consultant, RAPs and relevant State Government Agency. • Should any skeletal material be uncovered, GWS, in accordance with the *Coroners Act 1980* will cease work immediately within 50 m and will contact the NSW Police and NSW Coroner's Office. If the remains prove to be Aboriginal, GWS will consult with a heritage consultant, the RAPs and relevant State Government Agency.
Greenhouse Gas
• GWS will consider GHG emissions when selecting plant and lighting.
Visual Amenity
• The 25m vegetation buffer will be maintained along Cambridge Avenue; • The existing 2 m high vegetated bund will be maintained; • Machinery, plant and office buildings located away from the boundary; and • Extension of the existing fence atop the bund toward the east.
Socio-Economic Environment
• Project hotline and website maintained during the construction and operational phases; • Continuing community and stakeholder consultation; and • Where possible, the consideration of recruitment of staff who reside within the region during the construction and operational phases.

12 CONCLUSION

This EIS has been prepared for the proposed materials recycling facility at Cambridge Avenue, Glenfield NSW. The aim of the proposal is to provide South West Sydney with a material recycling facility that reduces waste to landfill and supports the waste strategies and goals set by the NSW State Government.

This EIS has outlined the relevant environmental, social and economic matters associated with the proposal as known at this time. It is considered that the proposed works will not result in any significant impacts with regards social, economic or environmental matters. A biodiversity offset scheme is being prepared with the Department of Planning and Environment as part of the proposal to ameliorate the impact of clearing Cumberland Plain Woodland. Other potential impacts are considered to be managed by the recommended mitigation measures.

The statement provides information as required for assessment pursuant to section 79c of the *Environmental Planning and Assessment Act 1979*, matters for consideration pursuant to Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* and addresses the SEARs.

The proposal is strategically important for waste recovery in NSW and reflective of the principles of ecological sustainable development. On merit it is considered that the proposed development meets all regulatory and environmental assessment criteria and is suitable for a positive development determination.