Kimbriki Environmental Enterprises

Kimbriki Resource Recovery Project

Environmental Assessment

Volume 3 – Appendices H to P

February 2011

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Appendix H
Traffic and Transport Assessment Report

Kimbriki Resource Recovery Project – Environmental Assessment

Transport Impact Assessment

GTAconsultants

Kimbriki Resource Recovery Project – Environmental Assessment

Transport Impact Assessment

Client: Kimbriki Environmental Enterprises Pty Ltd
Reference: IS10871
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Quality Record

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1. Introduction

1.1 Purpose of this Report

Kimbriki Environmental Enterprises Pty Ltd is proposing to construct and operate two purpose-built advanced waste sorting and treatment facilities at the existing Kimbriki Resource Recovery Centre site in Terrey Hills.

This report has been prepared by GTA Consultants as part of the environmental assessment of the project. Kimbriki Environmental Enterprises is the proponent of the project, and the environmental assessment is being prepared by GHD in accordance with the requirements of Part 3A of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act).

This report assesses the potential traffic-related impacts of the project during both the construction and operation of the site, including the existing and future operation of the intersection of Mona Vale Road and Kimbriki Road.

1.2 Project Outline

The Project involves the construction and operation of two main facilities:

- A materials recovery facility
- A resource recovery facility.

The materials recovery facility would receive and process up to 60,000 tonnes per year of dry recyclable materials collected as part of the municipal kerbside collection services provided by Mosman, Manly, Warringah and Pittwater Councils.

The resource recovery facility would sort and treat up to 100,000 tonnes per year of source separated food and garden organics and mixed municipal wastes. The resource recovery facility would include separation equipment and aerobic enclosed tunnel composting technology to produce a variety of compost products and extract valuable recyclables from the incoming waste streams.

The Project also includes the following ancillary infrastructure:

- internal roadways
- weighbridge
- staff amenities and ablutions
- staff parking facilities.

Plans for the Project are provided in Appendix A.

1.3 Location of Project

The site on which the project would be located (referred to as 'the site' for the purposes of this environmental assessment) is within the existing Kimbriki Resource Recovery Centre site in the suburb of Terrey Hills. It is within the Warringah local government area.

The site location is shown in Figure 1.1.

Figure 1.1: Location and key features of the site and surrounds

1.4 Scope and Structure of Report

This report sets out an assessment of the anticipated transport implications of the proposed development during both the construction and operation of the site, including consideration of the following:

i Existing traffic volumes at the site access and the arterial road network (i.e. intersection of Mona Vale Road and Kimbriki Road)

ii The peak number (hourly and daily) and tonnage/size of vehicles accessing the site

iii The duration and staging of the works and hours/days/times that the works would take place

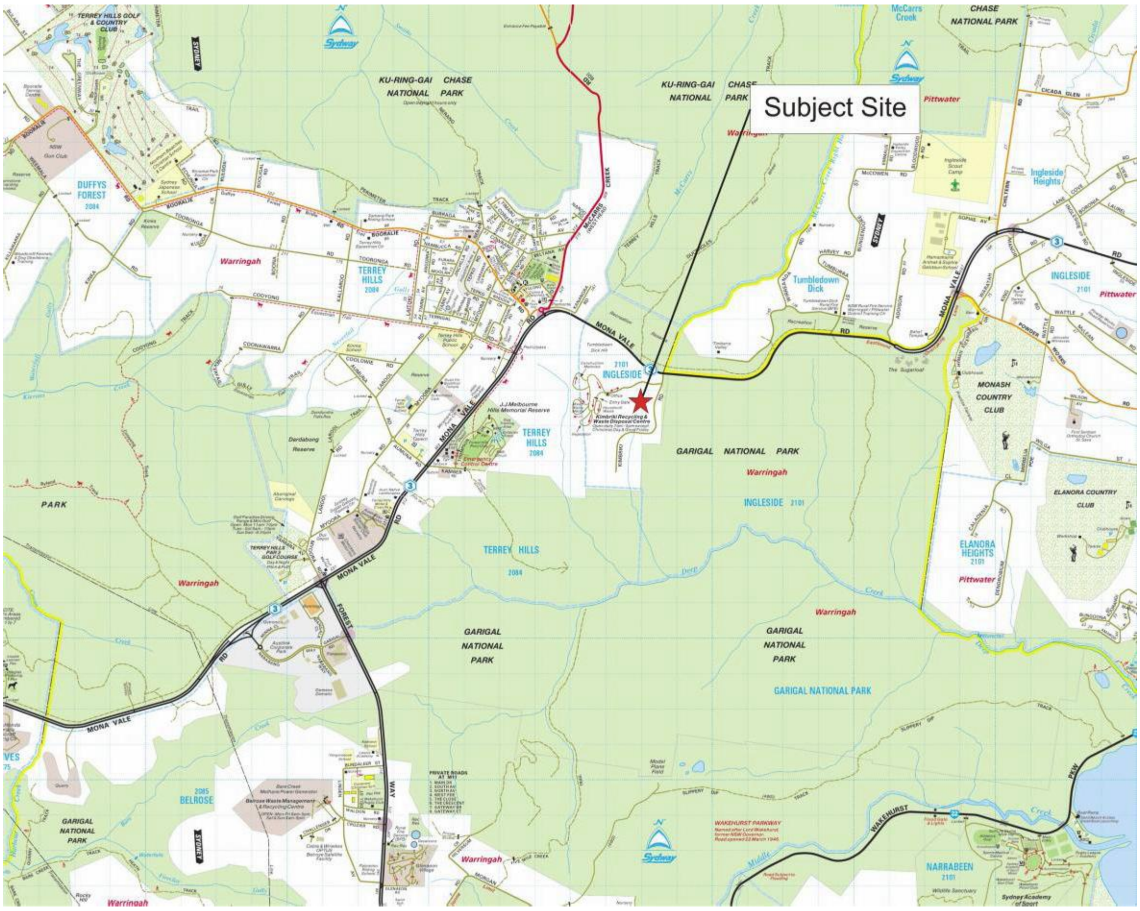
iv The future movements in and out of the site based on incoming and outgoing material tonnage estimates during operation.

2. Strategic Transport Context

2.1 Subject Site

The subject site is located at Kimbriki Road off Mona Vale Road in Ingleside/Terry Hills. The location of the subject site and its surrounding environs is shown in Figure 2.1.

Figure 2.1: Subject Site and Its Environs (Reproduced with permission from Sydway Publishing Pty Ltd)



2.2 Road Network

2.2.1 Mona Vale Road

Mona Vale Road is classified as a State Road between Gordon and Mona Vale and is under the care and control of the RTA. To the east of the Kimbriki Road intersection, Mona Vale Road has an undivided carriageway with one lane in each direction. To the west of the Kimbriki Road intersection, Mona Vale Road is also undivided but with two westbound lanes and one eastbound lane. Mona Vale Road carries approximately 28,500 vehicles per day[1].

1 Based on RTA permanent traffic count station no. 57.017 on Mona Vale Road for the year 2005.

2.2.2 Kimbriki Road

Kimbriki Road is classified as a local road and is under the care and control of Warringah Council. Kimbriki Road has an undivided carriageway with one lane in each direction and primarily serves as an access road to the Kimbriki Waste and Recycling Centre. Kimbriki Road carries approximately 2,000 vehicles per day[2].

2.2.3 Intersection of Mona Vale Road and Kimbriki Road

The intersection of Mona Vale Road and Kimbriki Road currently operates as a “Seagull” intersection as shown in Figure 2.2.

Figure 2.2: Intersection of Mona Vale Road and Kimbriki Road

2.3 Mona Vale to Macquarie Park Corridor Strategy

In September 2009, the RTA published the Mona Vale to Macquarie Park Corridor Strategy, which provides an overview of the road transport system from Mona Vale to De Burghs Bridge at Macquarie Park. This corridor includes the section of Mona Vale Road at Kimbriki Road, which is located within the 8km long eastern section, through residential, light industrial and bushland environs in Mona Vale, Ingleside and Terrey Hills, and consists predominantly of a two-lane single carriageway.

The Mona Vale to Macquarie Park corridor is a key element of the transport network serving the northern beaches and the northern hinterland suburbs of Sydney, and is one of only two east–west arterial corridors in the region. There is no rail service that runs along the corridor, and bus services are limited, resulting in a reliance on the private vehicle as a key mode of transport along this route.

The strategy addresses road safety, transport efficiency and asset maintenance issues, and sets a 25-year framework for management of the corridor.

GTA undertook a review of this document to understand the existing issues and future priorities for the eastern section of the corridor as it relates to Kimbriki Road and the access to the proposed Resource Recovery Centre. The key findings are outlined in the following sections.

2 Based on 24 hour/7 day traffic counts undertaken by GTA Consultants in November 2009.

2.3.1 Current Corridor Performance

Road Design

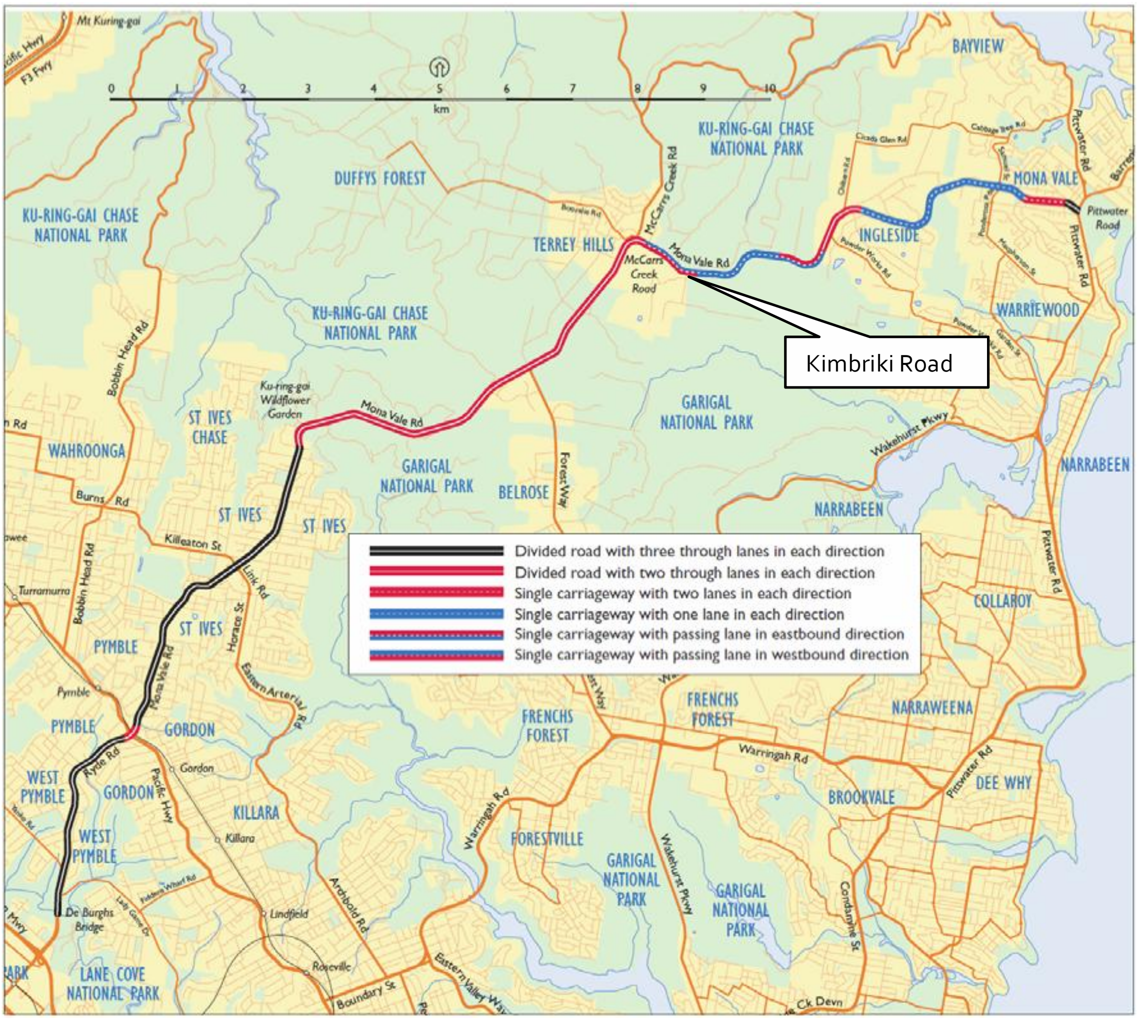
The eastern section of the corridor, between Pittwater Road in Mona Vale and McCarrs Creek Road in Terrey Hills, is 8 km long and predominantly of one lane in each direction.

Within this section there are four signalised intersections, one roundabout and six unsignalised intersections. The posted speed limit is predominantly 70 km/h with a reduction to 60 km/h at the easternmost end.

The lane widths in this section are all below the desired width of 3.5 m, and the shoulders are consistently less than the preferred width for sealed shoulders of 2m.

In the vicinity of Kimbriki Road, there is a single carriageway with a passing lane in the westbound direction, as indicated in Figure 2.3.

Figure 2.3: Number of Lanes on Mona Vale Road and Ryde Road



Source: Mona Vale to Macquarie Park Corridor Strategy, RTA, September 2009

Mid-block traffic operation

The operation of traffic in the corridor has been quantified in terms of mid-block traffic volume to capacity ratios (VCRs), which are used to assign a mid-block level of service (LOS). The relationship between VCRs and their corresponding LOS definitions are shown in Table 2.1.

Table 2.1: Link volume to capacity ratios and level of service definitions

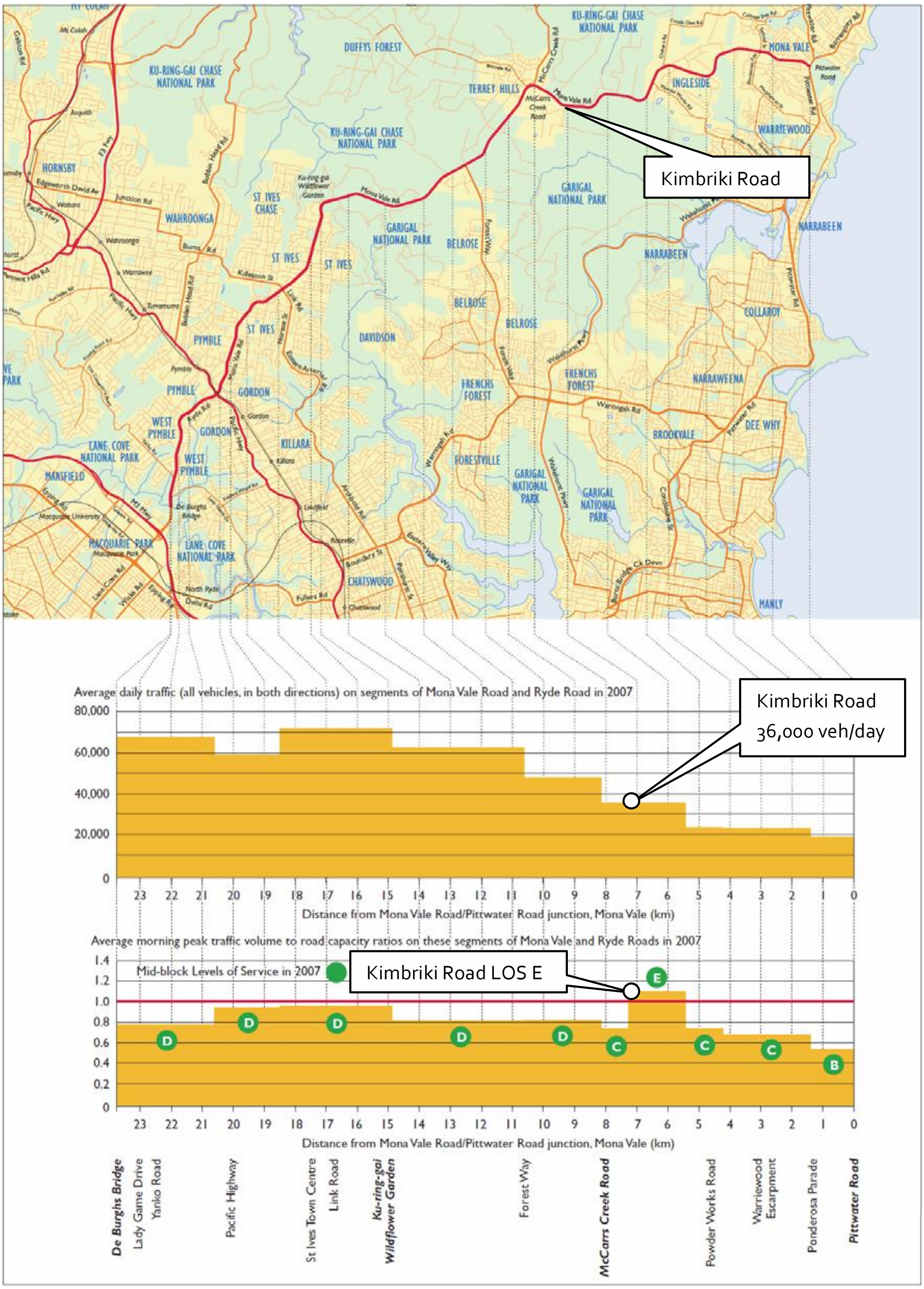
Volume to capacity ratio (VCR)	Level of service (LOS)	Description
< 0.35	A	Free flow with minimal, if any, delays. Individual drivers are unaffected by others.
0.35–0.60	B	Stable flow with slight delays. Drivers have reasonable freedom to select their speed and position.
0.61–0.75	C	Stable flow starts to decline, and many drivers become restricted by other traffic.
0.76–1.00	D	The limit of stable flow, where all drivers become restricted in their speed and ability to manoeuvre.
1.01–1.20	E	Unstable flow, with virtually no freedom to choose speeds or manoeuvre within the traffic stream. Minor disturbances within the traffic stream cause breakdowns in the flow.
> 1.20	F	Forced flow, where breakdowns easily occur and queuing and delays are frequent.

Source: Mona Vale to Macquarie Park Corridor Strategy, RTA, September 2009

The VCR and LOS analysis can be used to determine thresholds beyond which capacity enhancement may be required. The LOS most often used to indicate a road's capacity has been reached and expansion or other action may be required is LOS E, equivalent to a VCR somewhere between 1.01 and 1.20.

With this in mind, the average VCRs and LOSs estimated for the dominant westbound direction during the morning peak (and similarly for the evening peak in the reverse direction) on ten individual segments of the corridor are shown in Figure 2.4. This analysis indicates that the two-lane section east of McCarrs Creek Road in the vicinity of Kimbriki Road has a VCR of 1.1, and suggests that the road's capacity has been reached and expansion or other action may be required.

Figure 2.4: Daily traffic volumes and VCRs and LOSs in the peak direction during weekday peak periods on Mona Vale Road and Ryde Road in 2007



Source: Mona Vale to Macquarie Park Corridor Strategy, RTA, September 2009

2.3.2 Forecast travel growth and performance

The corridor strategy indicates that future traffic levels are expected to continue their current patterns as a result of demographic and land use changes in the corridor. The more significant of the land-use changes that are expected to affect the corridor are:

- Completion of the final 20% of the Warriewood Valley residential and light industrial development by 2012, adding 5,000 dwellings and 1,000 jobs.
- The Ingleside residential release, anticipated to add around 2,400 new dwellings over the next 20 years.
- Expansion of St Ives Town Centre, with 2,000 additional medium-density dwellings and a doubling of commercial/retail floor space to 40,000 m2 being anticipated over the next ten years.
- Growth of the Macquarie Park and Macquarie University precincts, which are expected to nearly double over the next 15–20 years. Employment at Macquarie Park is forecast to grow from 32,200 to 55,300 jobs and the University may grow 32,900 to 42,000 students and staff, generating up to an additional 7,000 peak hour car trips by 2031.

The demographic and land use changes would result in a growth of around 20,000 vehicles per day by 2026 and slightly more than this in the vicinity of Ingleside. In the vicinity of Kimbriki Road, daily traffic volumes are expected to increase from 36,000 to 56,000 vehicles per day.

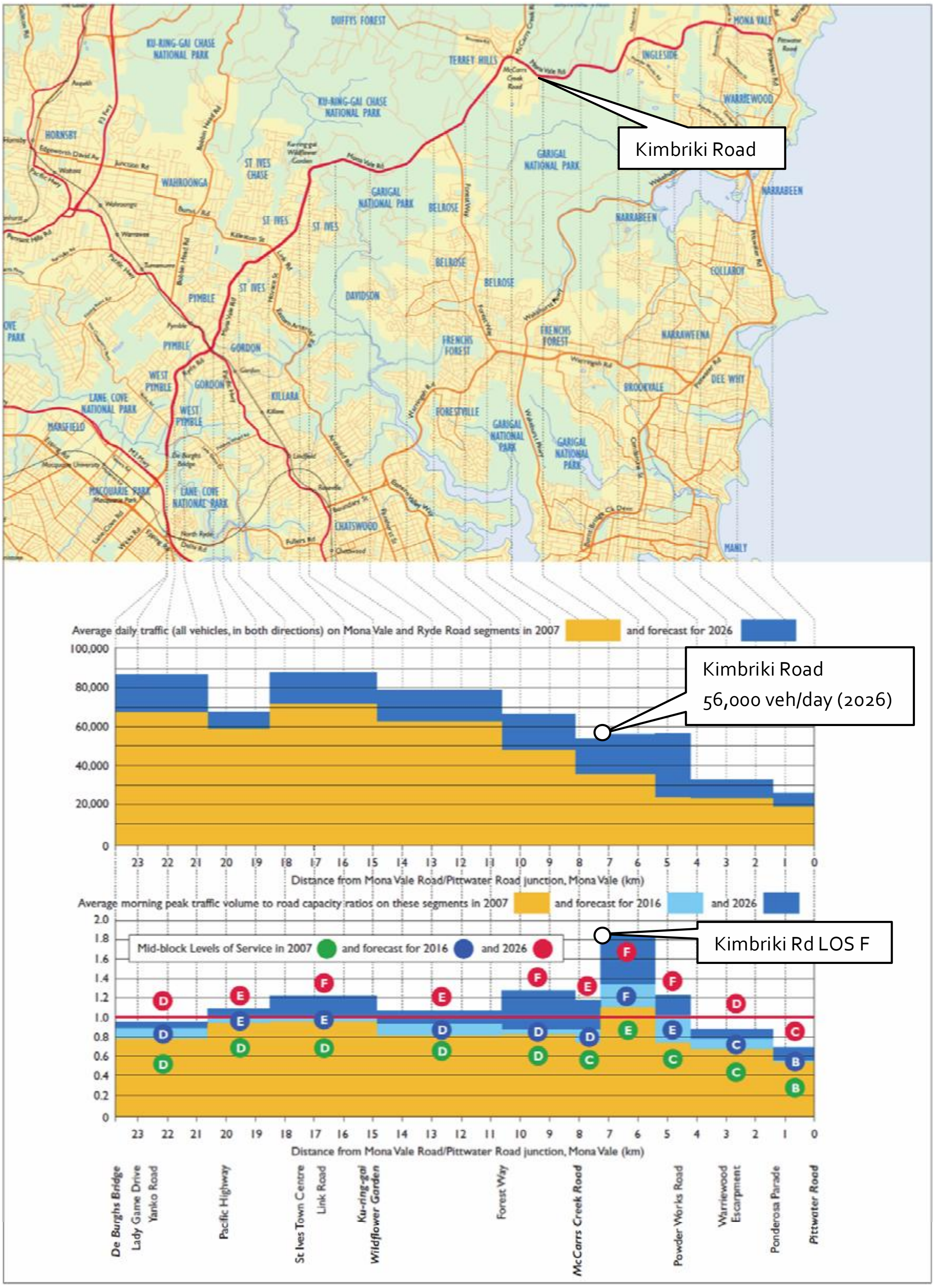
Mid-block traffic operation

Traffic modelling of this corridor in 2016 and 2026 forecasts that morning peak demand will exceed the capacity of the road network on the section between Ingleside and McCarrs Creek Road (i.e. in the vicinity of Kimbriki Road), which has a forecast level of service F for 2016 and 2026, as indicated in Figure 2.5. This is based on the assumption that there is no expansion of network capacity. As such, it was concluded that an increase in road capacity between Ingleside and Terrey Hills would be needed in the medium term in order to support growing demand in this section of the corridor which already experiences issues with capacity.

Intersection Operation

Whilst the intersection of Mona Vale Road and Kimbriki Road was not analysed as part of the RTA corridor strategy, it was concluded that the performance of all intersections along the corridor is expected to worsen by 2026, predominantly as a result of delays to traffic using the side roads rather than along the corridor where priority is given.

Figure 2.5: Daily traffic volumes and VCRs and LOSs in the peak direction during weekday peak periods on Mona Vale Road and Ryde Road in 2007 and forecast for 2016 and 2026



Source: Mona Vale to Macquarie Park Corridor Strategy, RTA, September 2009

2.3.3 Corridor Challenges and Priorities

A summary of the challenges and priorities for the corridor which relate specifically to the section in the vicinity of Kimbriki Road is provided as follows:

Challenges

- The performance of the congested single lane segments between McCarrs Creek Road and Ingleside.
- Delays to general traffic caused by heavy vehicles travelling along the hilly section between Mona Vale and Ingleside.
- Relatively narrow sealed shoulders on single lane and passing lane sections of Mona Vale Road between Mona Vale and McCarrs Creek Road.
- Forecast traffic volumes exceeding capacity, both mid-block and at intersections, along the corridor, particularly around Ingleside.
- Developing traffic management strategies to amplify road capacity and improve travel performance where required without physically widening the road corridor.

Short Term Priorities (2009-2014)

- Commence planning to enhance capacity and efficiency for light and heavy vehicles in the single lane sections between Ingleside and Terrey Hills, including the identification of corridor requirements.

Longer Term Priorities (beyond 2014)

- Monitor the adequacy of the capacity for the single lane sections between Mona Vale and Ingleside and, if appropriate, consider options for enhancing this capacity.

2.3.4 What this means for the Kimbriki Resource Recovery Project?

The review of the corridor strategy document confirms that there are wider traffic operation issues along the whole corridor from Mona Vale to Macquarie Park, suggesting that there are already capacity issues associated with existing operation. If traffic volumes along the corridor increase in the future as predicted, these issues would only worsen.

In terms of the Kimbriki Resource Recovery Project, the strategy findings suggest that there are already operational issues associated with the intersection of Mona Vale Road and Kimbriki Road, with the functionality of the intersection expected to be compromised during peak times in the future if nothing is done to enhance capacity in the single lane sections.

The strategy states that one of the long term priorities for consideration beyond 2014 is to consider options for enhancing this capacity, which is likely to require widening to at least two lanes in each direction. However, until this happens, other short-term measures would need to be implemented to work around capacity constraints and ensure ongoing safety and operation of the intersection of Mona Vale Road and Kimbriki Road.

Treatment measures could include adjustments to the layout of the intersection of Mona Vale Road and Kimbriki Road to improve safety and maximise capacity, improved warning signage on Mona Vale Road to alert motorists approaching Kimbriki Road from the west to truck turning movements and scheduling of construction activities and on-site operations to minimise the number of right-turn movements in both directions (i.e. to and from Kimbriki Road) during the AM and PM peak periods. These are discussed in more detail throughout this report.

3. Existing Conditions

3.1 Traffic Volumes

GTA Consultants commissioned traffic movement counts as follows:

- Peak period turning movement counts at the intersection of Mona Vale Road and Kimbriki Road on Thursday 26 November 2009 and Saturday 28 November 2009 from:
  - 7:00am to 9:00am (AM peak)
  - 12:00pm to 2:00pm (Midday peak)
  - 4:00pm to 6:00pm (PM peak).
- 24 hour/7 day tube counts from Thursday 26 November 2009 to Wednesday 2 December 2009, inclusive, on:
  - Mona Vale Road (east and west of Kimbriki Road)
  - Kimbriki Road.

The peak hour traffic volumes are summarised in Figure 3.1 and Figure 3.2, with full results contained in Appendix B.

Figure 3.1: Mona Vale Road/Kimbriki Road Peak Hour Turning Movement Counts Thursday 26 November 2009

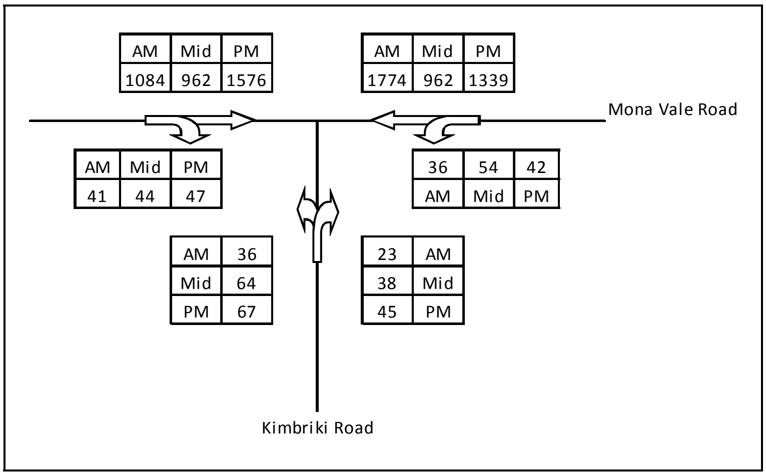
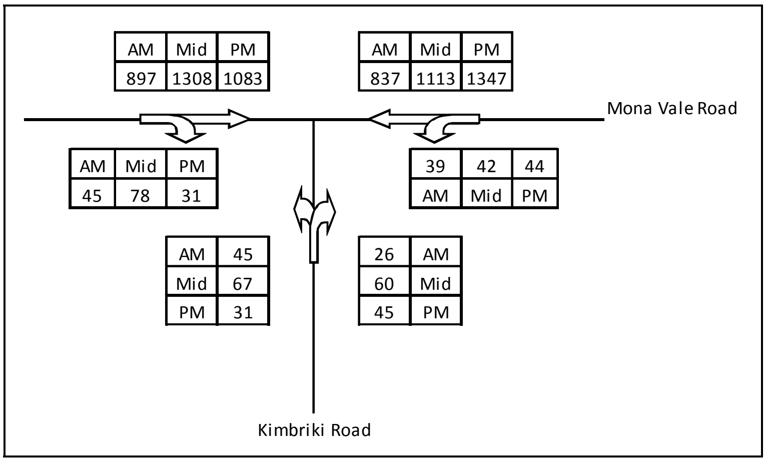


Figure 3.2: Mona Vale Road/Kimbriki Road Peak Hour Turning Movement Counts Saturday 28 November 2009



The turning movement counts include traffic generated by additional regular deliveries of dry recyclables from SHOROC kerbside collection activity, which commenced after the traffic counts were collected. These activities include delivery of an additional 19,000 tonnes of waste each year which equates to around 7,600 trucks per year based on a 5-tonne truck. These activities occur on weekdays only, resulting in an additional 146 truck movements per week and 30 vehicles per day.

The results from the 7-day tube counts for Mona Vale Road in the eastbound and westbound direction are presented in Figure 3.3 and Figure 3.4, with Figure 3.5 and Figure 3.6 showing the results for Kimbriki Road in the southbound and northbound directions.

Figure 3.3: Mona Vale Road Westbound 24 hour/7 day volumes (Thurs 26 Nov to Wed 2 Dec 2009)

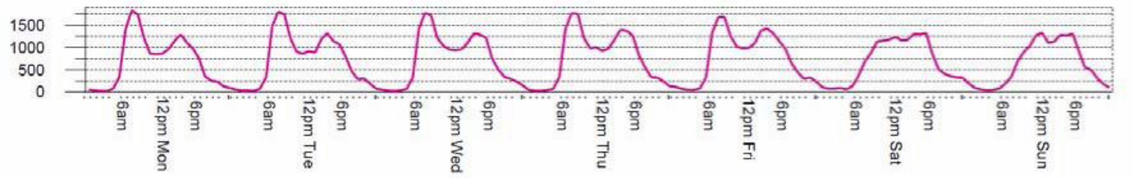


Figure 3.4: Mona Vale Road Eastbound 24 hour/7 day volumes (Thurs 26 Nov to Wed 2 Dec 2009)

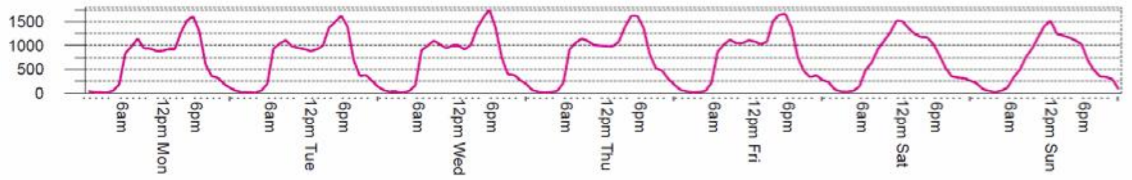


Figure 3.5: Kimbriki Road Southbound 24 hour/7 day volumes (Thurs 26 Nov to Wed 2 Dec 2009)

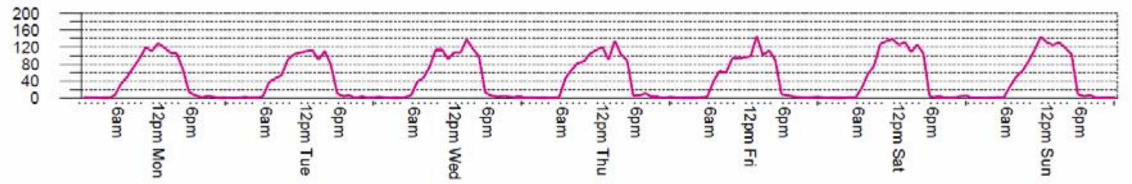


Figure 3.6: Kimbriki Road Northbound 24 hour/7 day volumes (Thurs 26 Nov to Wed 2 Dec 2009)

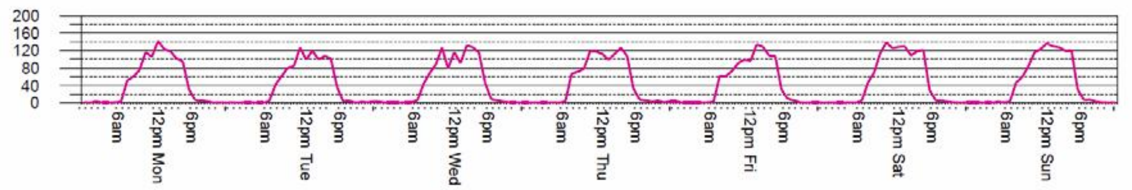


Figure 3.3 and Figure 3.4 show distinctive westbound peak flows on Mona Vale Road during the AM weekday period and distinctive eastbound peak flows on Mona Vale Road during the PM weekday period indicative of the tidal flow operation of Mona Vale Road during weekdays.

On a Saturday the traffic flow on Mona Vale Road typically has a flat peak between 10am and 6pm in the westbound direction with a 12pm peak in the eastbound direction. Saturday overall traffic volumes in November 2009 were approximately 40% less than the weekday traffic volumes.

On Kimbriki Road the traffic flow profiles are similar for weekdays and Saturdays with the peak flow occurring during the lunchtime period with similar levels of traffic flow.

The hourly traffic volumes on Mona Vale Road for a typical weekday (Thursday 26 November 2009) for both the westbound and eastbound direction are shown in Figure 3.7.

Figure 3.7: Mona Vale Road hourly traffic volumes Thursday 26 November 2009

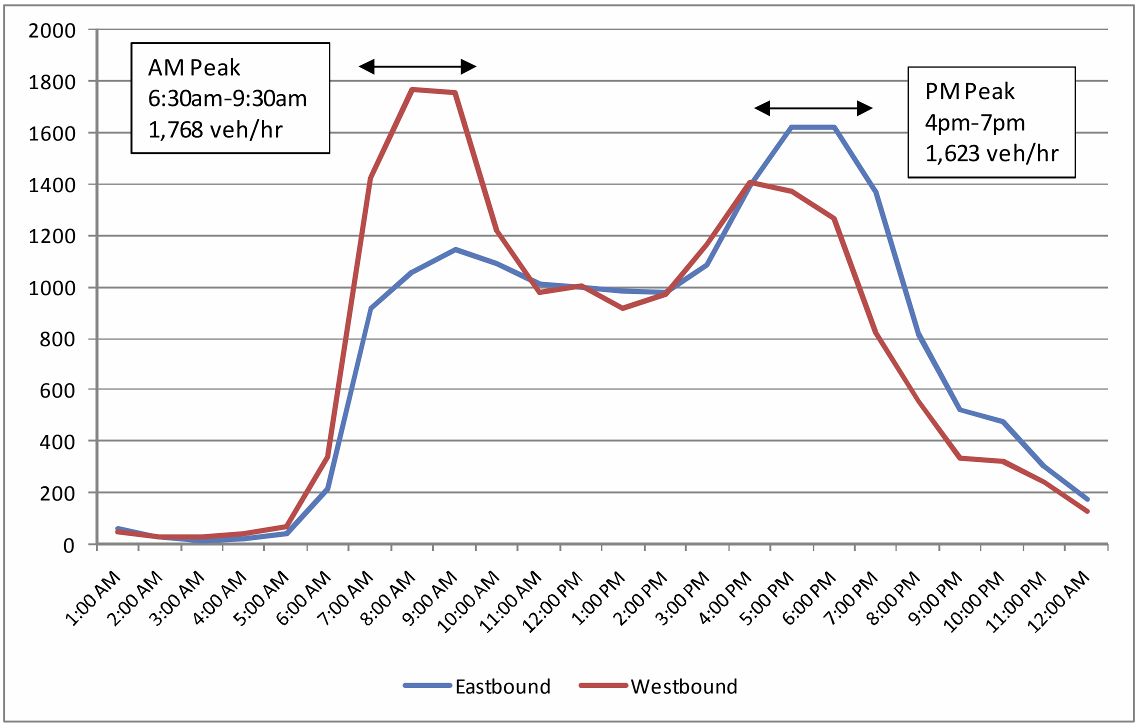


Figure 3.7 indicates the following:

- The AM peak period occurs between 6:00am and 10:00am (westbound/inbound dominant flow), with hourly flows of approximately 1,750 vehicles per hour between 7:00am and 9:00am for a single travel lane.
- The PM peak period occurs between 4:00pm and 7:00pm (eastbound/outbound dominant flow), with hourly flows of approximately 1,600 vehicles per hour for a single travel lane.

3.2 Intersection Operation

The operation of the intersection of Mona Vale Road and Kimbriki Road was assessed using SIDRA INTERSECTION 4.0[3], a computer based modelling package which calculates intersection performance. Data from Thursday 26 November 2009 has been used to represent typical week day traffic conditions.

The commonly used measure of intersection performance, as defined by the RTA, is vehicle delay. SIDRA INTERSECTION determines the average delay that vehicles encounter and provides a measure of the level of service. Table 3.1 shows the criteria that SIDRA INTERSECTION adopts in assessing the level of service.

[3] Program used under license from Akcelik & Associates Pty Ltd.

Table 3.1: SIDRA INTERSECTION 4.0 Level of Service Criteria

Level of Service (LOS)	Average Delay per vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Sign
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

Figure 3.8, Figure 3.9 and Figure 3.10 present a summary of the existing operation of the Mona Vale Road/Kimbriki Road intersection.

The key findings from the existing intersection analysis are as follows:

- The intersection currently operates at its worst during the weekday AM peak hour, with the right-turn movement from Kimbriki Road into Mona Vale Road and the right-turn movement from Mona Vale Road into Kimbriki Road both operating at Level of Service F due to average delays in excess of 70 seconds.
- Whilst these delays are long, the low turning movements result in relatively short queues of less than 25m or 4 vehicles.
- During the midday and PM peak periods, these two right-turn movements operate satisfactorily at Level of Service B or C.
- High volumes of through traffic along Mona Vale Road, particularly in the westbound direction during the Thursday AM peak period, limit the number of appropriate gaps for right-turning vehicles to accept.
- Excessive delays can result in drivers seeking smaller and smaller gaps after waiting long periods of time, increasing the risk of cross-intersection crashes.
- The acceleration lane for westbound traffic turning left from Kimbriki Road into Mona Vale Road is of a sub-standard length to allow adequate acceleration to occur before merging with other westbound traffic on Mona Vale Road (refer to the ***RTA Road Design Guide, Section 4, Intersections at Grade*** and Appendix C).
- There is no physical protection within the intersection for right-turning vehicles travelling east on Mona Vale Road.

Figure 3.8: SIDRA INTERSECTION Results – 2009 (AM Peak Hour)

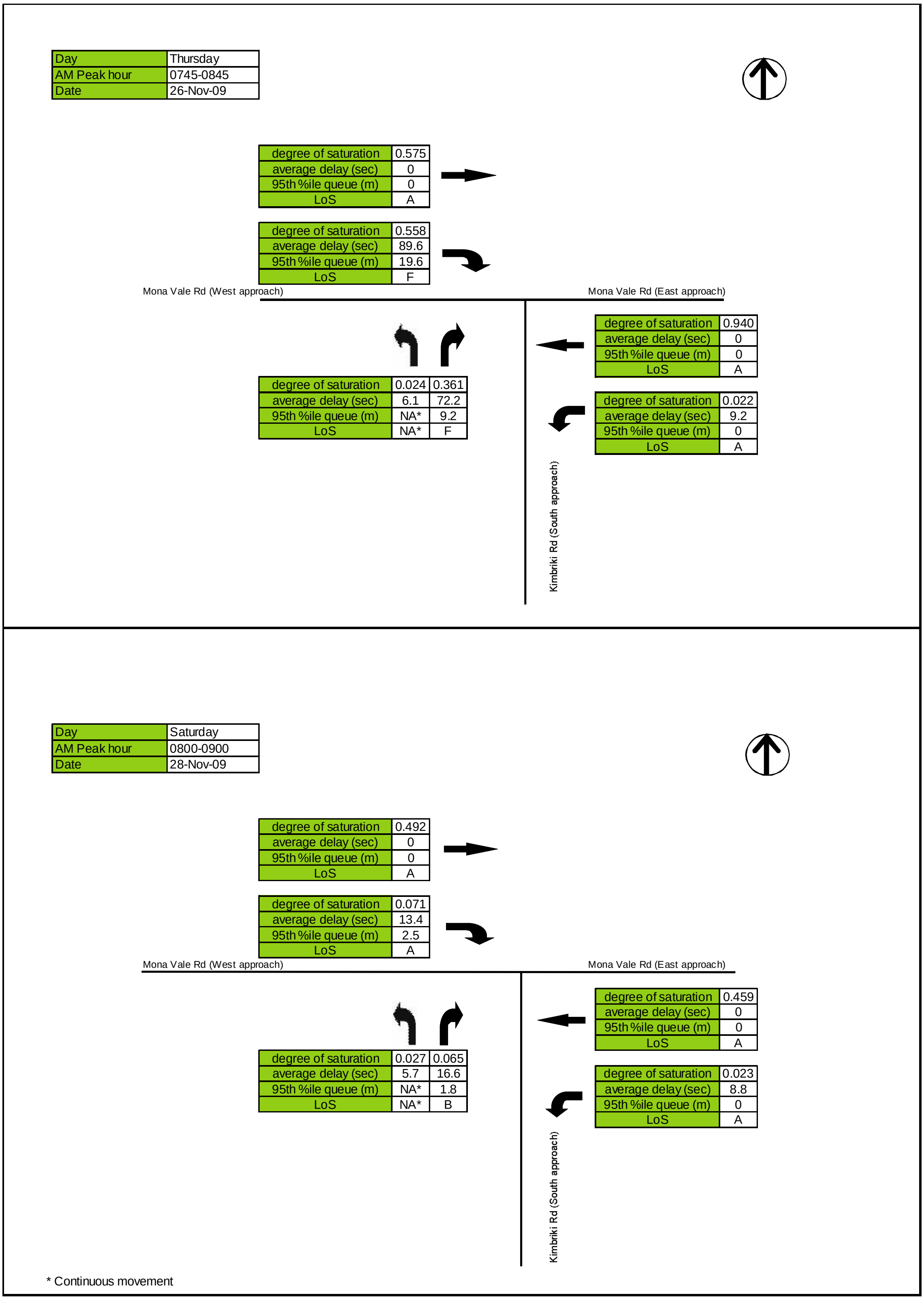
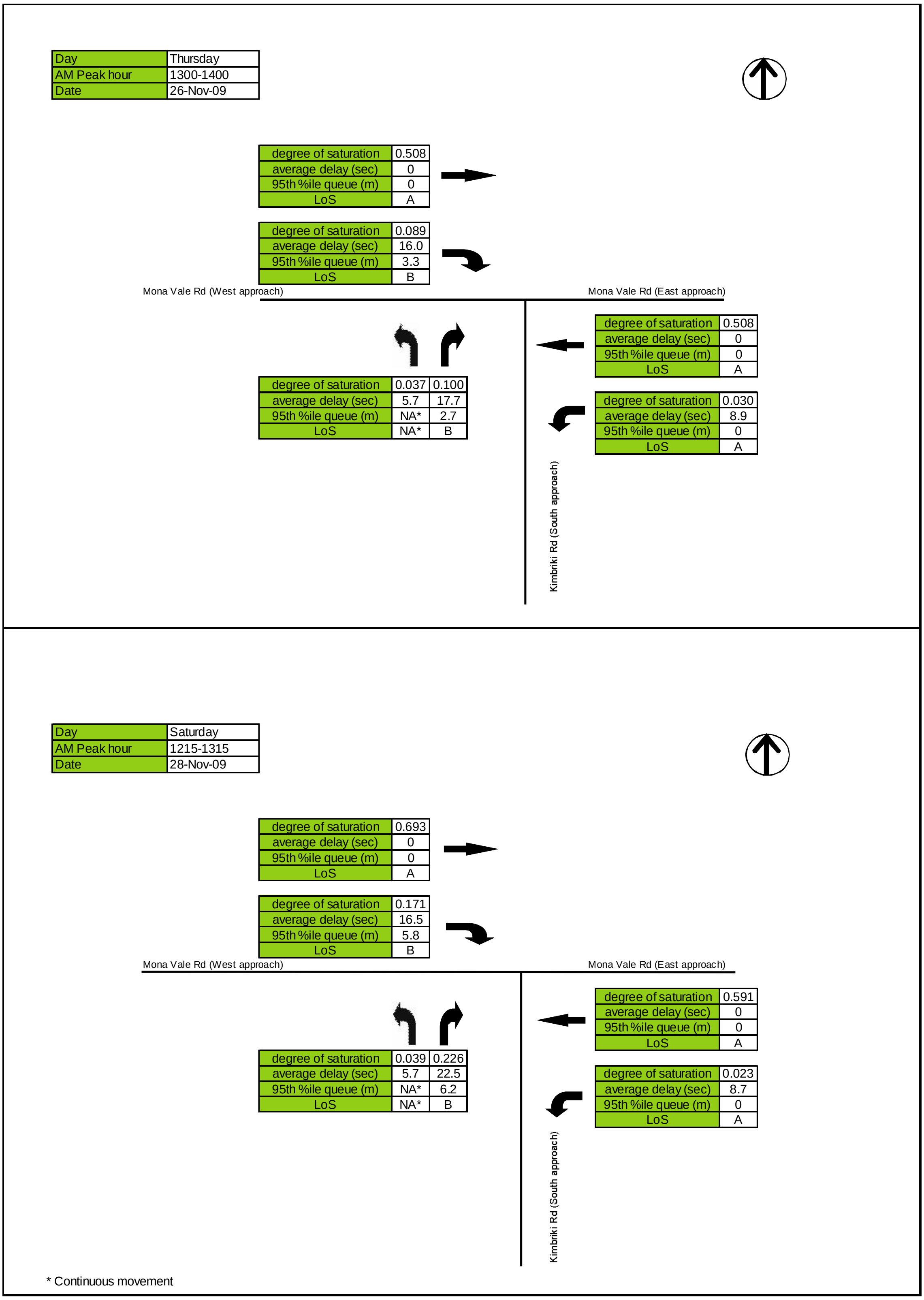


Figure 3.9: SIDRA INTERSECTION Results – 2009 (Midday Peak Hour)



Day	Thursday
AM Peak hour	1300-1400
Date	26-Nov-09

Mona Vale Rd (West approach) – through

degree of saturation	0.508
average delay (sec)	0
95th %ile queue (m)	0
LoS	A

Mona Vale Rd (West approach) – right turn

degree of saturation	0.089
average delay (sec)	16.0
95th %ile queue (m)	3.3
LoS	B

Kimbriki Rd (South approach) – left turn / right turn

degree of saturation	0.037	0.100
average delay (sec)	5.7	17.7
95th %ile queue (m)	NA*	2.7
LoS	NA*	B

Mona Vale Rd (East approach) – through

degree of saturation	0.508
average delay (sec)	0
95th %ile queue (m)	0
LoS	A

Mona Vale Rd (East approach) – left turn

degree of saturation	0.030
average delay (sec)	8.9
95th %ile queue (m)	0
LoS	A

Day	Saturday
AM Peak hour	1215-1315
Date	28-Nov-09

Mona Vale Rd (West approach) – through

degree of saturation	0.693
average delay (sec)	0
95th %ile queue (m)	0
LoS	A

Mona Vale Rd (West approach) – right turn

degree of saturation	0.171
average delay (sec)	16.5
95th %ile queue (m)	5.8
LoS	B

Kimbriki Rd (South approach) – left turn / right turn

degree of saturation	0.039	0.226
average delay (sec)	5.7	22.5
95th %ile queue (m)	NA*	6.2
LoS	NA*	B

Mona Vale Rd (East approach) – through

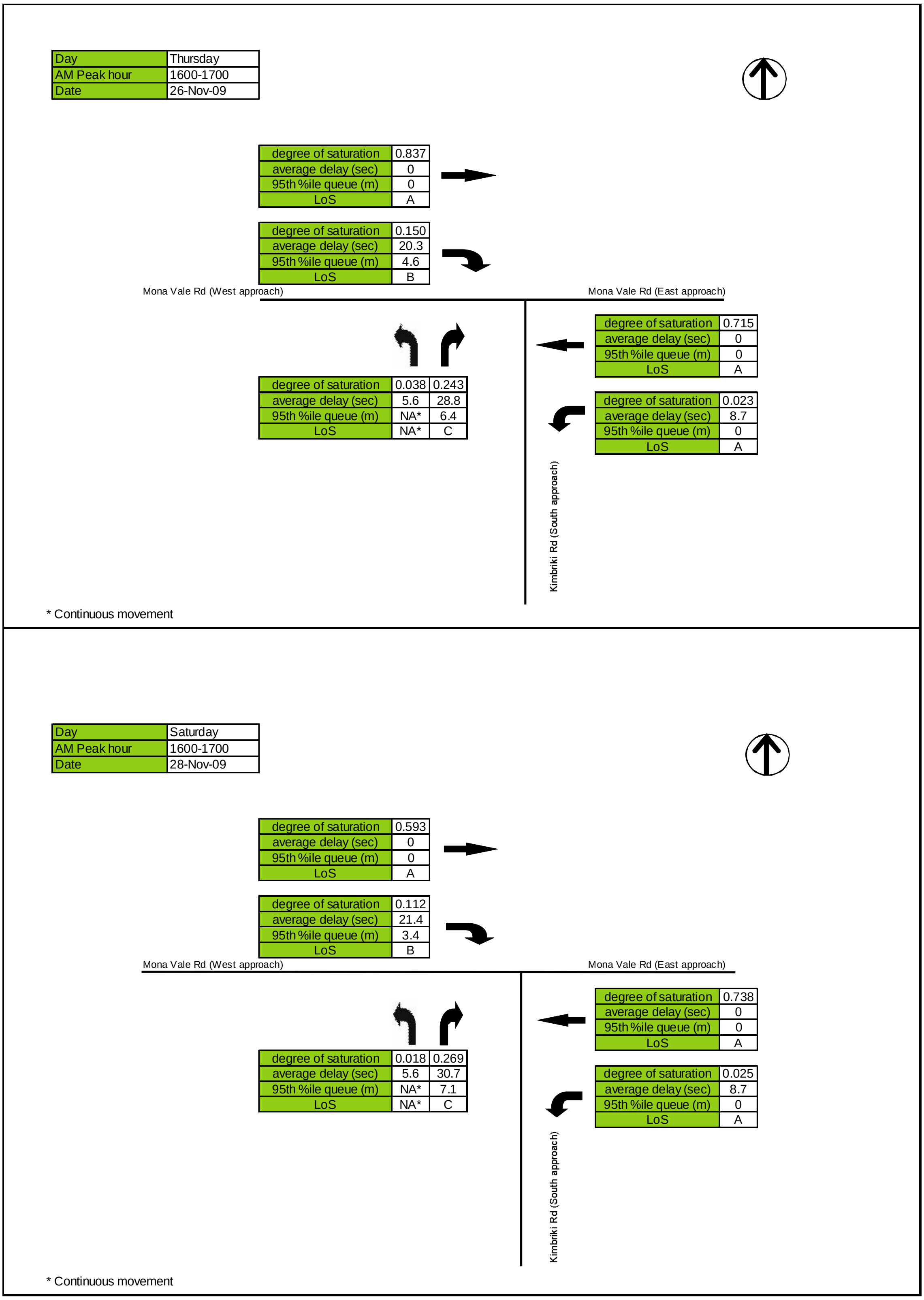
degree of saturation	0.591
average delay (sec)	0
95th %ile queue (m)	0
LoS	A

Mona Vale Rd (East approach) – left turn

degree of saturation	0.023
average delay (sec)	8.7
95th %ile queue (m)	0
LoS	A

* Continuous movement

Figure 3.10: SIDRA INTERSECTION Results – 2009 (PM Peak Hour)



3.3 Crash Analysis

3.3.1 Mona Vale to Macquarie Park Corridor Strategy

As discussed in Section 2.3, the RTA published the Mona Vale to Macquarie Park Corridor Strategy in September 2009, which provides an overview of the road transport system from Mona Vale to De Burghs Bridge at Macquarie Park.

In addition to the operational findings outlined in Section 2.3, the report also contains a summary of crash history and casualty crash rates along the corridor between 2002 and 2006. During this five-year period, a total of 1,010 crashes involving fatalities, injuries and/or tow-away damage were reported to the police for the Mona Vale to Macquarie Park corridor, an average of 202 per year. The average casualty crash rate for the eastern, central and western corridor sections were 2.2, 2.6 and 6.4 crashes per km per year respectively, with Kimbriki Road located within the eastern section. The casualty crash rates along the corridor for 2006 are illustrated in Figure 3.11.

3.3.2 GTA Crash Analysis

Crash data was sourced from the RTA for the most recent five-year period (2005 to 2009, inclusive) for the intersection of Mona Vale Road and Kimbriki Road, including within 200m of the intersection. Figure 3.12 has been prepared to show the crash history details, with full details contained in Appendix D. A summary of the crash history is as follows:

i There were a total of 15 crashes reported, including four casualty crashes and 11 non-casualty crashes. There were no fatal crashes reported.

ii Seven crashes involved a light truck, with five of the seven crashes involving the truck as the first impact vehicle.

iii Fourteen of the crashes occurred on a weekday, with only one recorded on a weekend.

iv There were 11 two-vehicle crashes and four single-vehicle crashes.

v Eight crashes occurred in the wet, whilst seven crashes occurred during dry conditions.

vi Speeding was noted as a factor for two of the crashes, whilst fatigue was noted as a factor for one of the crashes.

The breakdown of crashes by DCA (Definitions for Coding Accidents) codes is provided in Table 3.2.

Table 3.2: Summary of Crashes by DCA Code

DCA Code	No. of Crashes
104 – Intersection, vehicles from adjacent approaches	2
201 – Head-on (not overtaking)	1
202 – Opposing vehicles, turning at intersection	1
301 – Rear-end	7
703 & 704 – Off-road on straight, hit object	2
803 & 804 – Off-road on curve, hit object	2
Total	15

Detailed review of the crash findings highlights the following:

i There was one location which had more than one crash type at the same location, which was a rear-end crash type on the eastbound approach to the intersection. The results indicate that these crashes occurred within the right-turn bay, and that both crashes resulted in injury.

ii Three crashes involved right-turning vehicles either turning into or out of Kimbriki Road. This data could reflect the difficulty in finding an appropriate gap in the westbound travel lane of Mona Vale Road, which was identified through intersection analysis. It is noted that these crashes occurred at different times of the day – 7:15am, 2:55pm and 1:45pm – with all occurring outside of the peak hours.

iii A rear-end crash occurred approximately 100m east of the intersection in the eastbound departure lanes in the vicinity of the merge of the through lane and the right-turn "Seagull" lane. The layout of this merge could have contributed to the crash.

iv A rear-end crash occurred approximately 80m east of the intersection in the westbound approach lanes in the vicinity of the start of the left turn slip lane into Kimbriki Road.

v All of the four single-vehicle crashes occurred during wet conditions. The three single-vehicle crashes that occurred on Mona Vale Road occurred between 6:00am and 7:15am, where it was dark as well as wet. This could suggest issues associated with driving conditions during wet and dark conditions, including lack of lighting and inadequate reflectivity of linemarking and signage. It is noted that these crashes occurred to the east and west of Kimbriki Road, including two crashes located 50m east of Kimbriki Road and one crash located 60m west of Kimbriki Road.

vi There were a total of four casualty crashes at this location. This includes:

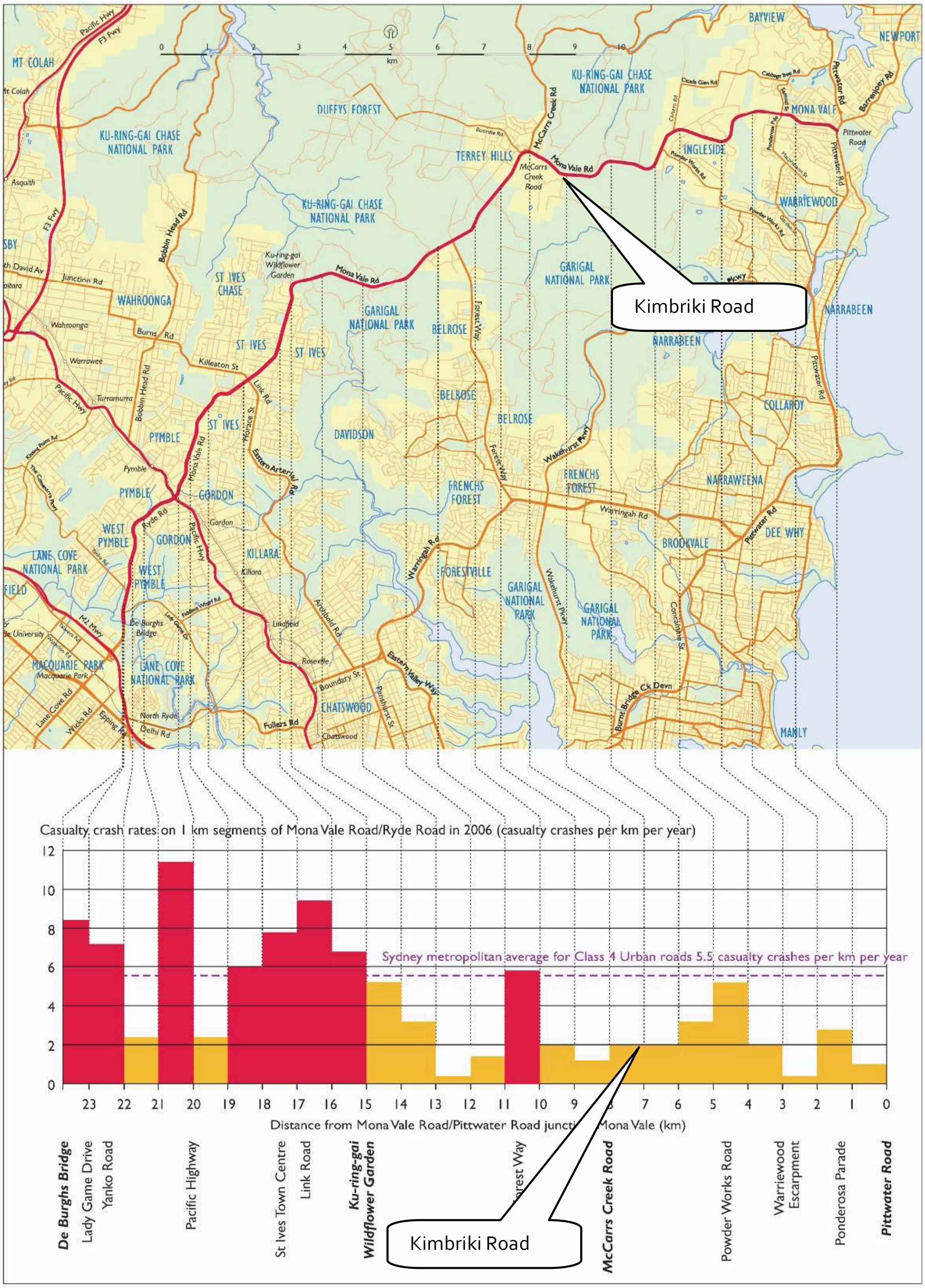
- Two rear-end crashes which occurred in the eastbound approach right-turn bay at the intersection.
- An off-path on straight and impact with an object crash occurred in the eastbound departure lane of Mona Vale Road approximately 50m east of Kimbriki Road.
- An off-path on curve and impact with an object crash occurred on the northbound approach to Kimbriki Road approximately 75m south of Mona Vale Road.

Measures to address the issues identified above have been considered within the proposed intersection improvement works, described in detail in Section 3.4. In particular, measures have been recommended to address the key issues in the following ways:

- Extension of the length of the right-turn bay on Mona Vale Road to accommodate deceleration and queuing. This could address the existing crash history in this lane for rear-end crashes.
- Improvements to linemarking and provision of pavement skid-resistant surfacing to address the issue of run-off road crashes during wet conditions. This would also assist in reducing the potential for head-on crashes due to encroachment into opposing lanes.
- Provision of "Trucks Turning" warning signage (Sign No. W5-205 – refer Figure 4.8) on the Mona Vale Road approaches to Kimbriki Road to alert drivers to the turning movements at the intersection.

It is noted that since there were a total of four casualty crashes at this location, any site improvements may be eligible for National Black Spot Funding. Through the Nation Building Black Spot Program, a Black Spot site is eligible if there were at least three casualty crashes at a location within the most recent five-year period. Nominations for Black Spot locations may be submitted by Sate and Territory Government, local councils, community groups and associations, road user groups, industry and individuals.

Figure 3.11: Casualty Crash Rates on 1km segments of Mona Vale Road and Ryde Road during 2006



Source: Mona Vale to Macquarie Park Corridor Strategy, RTA, September 2009

Figure 3.12: Intersection of Mona Vale Road and Kimbriki Road – Crash Diagram (2005 to 2009)

Base map sourced from www.nearmap.com.

3.4 Proposed Intersection Improvement Works

To address some of the existing operational and safety issues at this intersection, including issues identified through the analysis of crash data, it is proposed to undertake improvements to the intersection as shown in Figure 3.13 and discussed below.

It is noted that these proposed intersection works would improve the overall safety of the intersection for all vehicles, regardless of any impacts associated with changes to the operation of the Kimbriki site. It is also noted that these works would be completed prior to the construction phase of the project.

Continuous Westbound Acceleration Lane

At the Kimbriki Road intersection, Mona Vale Road has a single lane on the westbound approach which becomes two lanes on the westbound departure immediately west of Kimbriki Road. Due to this configuration, the left turn movement from Kimbriki Road to Mona Vale Road operates as a continuous lane and feeds into the additional departure lane, separate to the through vehicle movement.

Whilst this is how these movements currently operate, the existing linemarking does not adequately reflect this situation. The result is an acceleration lane for westbound traffic turning left from Kimbriki Road into Mona Vale Road that is of sub-standard length to allow adequate acceleration to occur before merging with other westbound traffic on Mona Vale Road. As such, there is an increase in the potential for conflict between the two movements as part of the merge.

In order to formalise the left turn continuous lane, it is proposed to separate the through movement and the left turn movement through adjustments to the linemarking. This allows the left-turn movement to operate without any opposing movements, resulting in minimal delays for this movement. This arrangement would also remove the potential merging conflict between westbound vehicles on Mona Vale Road and vehicles turning left from Kimbriki Road.

The proposed linemarking modifications on the southern side of Mona Vale Road are shown in Figure 3.13.

Extension of Right-turn Bay

The length of the existing right-turn bay on the eastbound approach of Mona Vale Road is approximately 70m. This is adequate to accommodate the queue lengths for this movement. However, the crash results indicate that there is a crash history on this approach for rear-end crashes within the right-turn bay.

As such, it is proposed to extend the length of this lane up to a length of approximately 100m. This would provide a longer length that would accommodate deceleration for the avoidance of rear-end crashes where drivers are unable to come to a complete stop within the available length.

The works would involve adjustments to linemarking only and would not require any widening works to be undertaken.

Linemarking and Pavement Surfacing

The crash results indicated that there are potential issues with the delineation and pavement surfacing within and in the vicinity of the intersection. This was highlighted by the number of off-road crashes in wet conditions.

To address these issues, it is proposed to undertake improvements to the linemarking at and in the vicinity of the intersection, including provision of a high level of reflectivity so that linemarking is visible to drivers in adverse weather conditions (e.g. wet, dark, etc).

It is also proposed to undertake improvements to pavement skid-resistance at and in the vicinity of the intersection. This would involve the placement of a high skid-resistant surfacing material which would reduce a vehicle stopping distance and provide greater driver control during wet weather.

PRELIMINARY PLAN
FOR DISCUSSION PURPOSES ONLY
SUBJECT TO CHANGE WITHOUT NOTIFICATION
DATE OF ISSUE:

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FIGURE 3.13 MONA VALE ROAD / KIMBRIKI ROAD
SHORT-TERM MEASURES
CONCEPT LAYOUT

28 JAN '11
SCALE 1:500@A3
IS10871-SK01-P2

4. Construction Impacts

4.1 Overview

The construction period for the Kimbriki Resource Recovery Project is approximately 18 months, during which time approximately 220,000m^3 of soil and sandstone material would be excavated and removed from site (over a longer period beyond the excavation period) and around 125,000m^3 of building materials would be brought to the site.

Construction would take place six days per week with a base level of approximately 40-50 workers for the majority of the construction period and a peak workforce of between 80 and 100 construction workers during specific activities such as during concrete pours. Work would typically take place during the following hours:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 7:00am to 1:00pm.

It is noted that some concrete pours may take place earlier than 7:00am during the summer to avoid hot weather.

The construction period is summarised as follows:

- Site set-up – Month 1
- Excavation and MRF construction – Month 1 to 10
- Civil construction for AWT and Maturation buildings – Month 5 to 14
- Building construction – Month 11 to 14
- Equipment delivery – Month 15 to 17.

The construction period would generate both traffic and parking demand that needs to be addressed so that the impacts on the surrounding network and on existing site operations are minimised.

4.2 Traffic and Transport Impact Appraisal

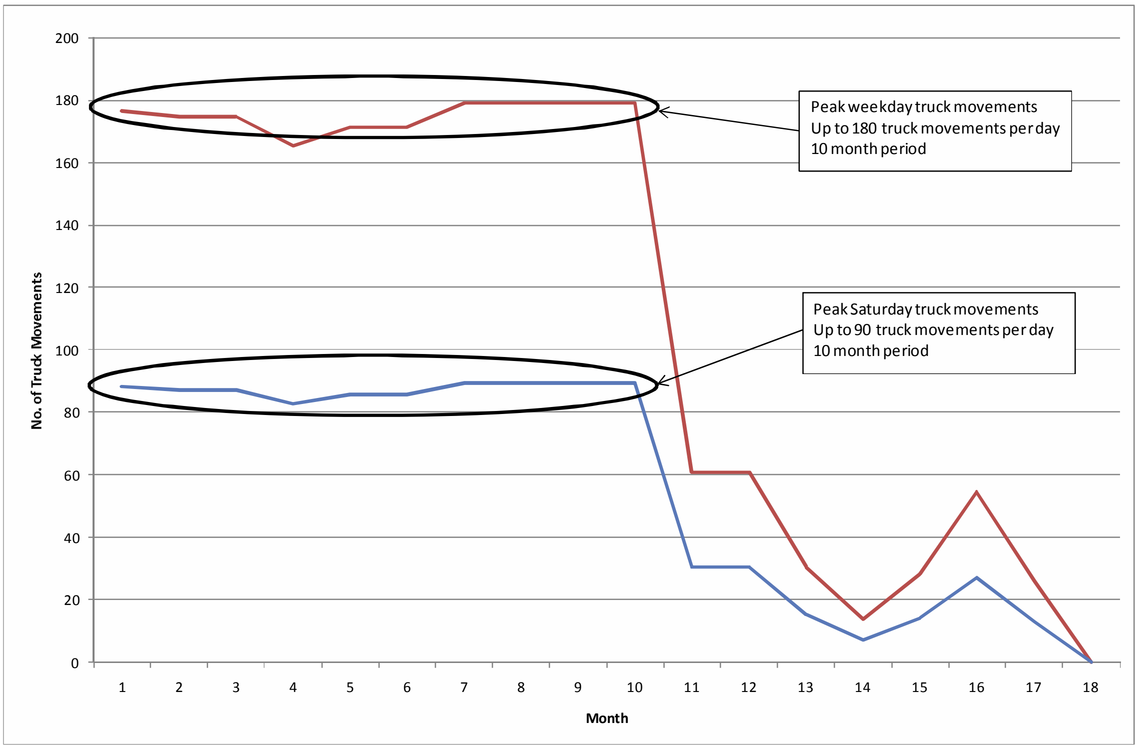
4.2.1 Traffic Growth

GHD has estimated the number of vehicles associated with the various phases of the project, namely excavation, demolition and construction, including an estimate of the number of additional vehicles that would be accessing the site on a daily basis throughout the different stages of the project on weekdays and Saturdays. A summary of the number of daily movements is provided in Figure 4.1.

Figure 4.1 indicates that the peak number of daily vehicle movements is around 180 movements, or 90 trucks per day on a weekday and around 90 movements, or 45 trucks per day on a Saturday. This occurs for the first 10 months of the project during the excavation stage of construction, with some overlap with the civil construction stage which commences in Month 5.

As well as the truck movements, there would also be an increase in light vehicle movements associated with construction workers. Typically the construction workforce of up to 100 persons would arrive at the site by car due to the lack of public transport services to suit construction hours. As such, there could be as many as 200 additional daily movements occurring due to staff arrivals and departures during peak times of specific activities, with up to 100 daily movements expected during the majority of the project construction period.

Figure 4.1: Construction Vehicle Traffic Growth – Daily Movements (weekdays and Saturday)



GTA used the peak daily volume of 180 movements per day, plus staff movements, to estimate the peak number of additional vehicles accessing the site during the AM, midday and PM peak hours on a weekday and Saturday. The following assumptions were adopted:

- Total of 11 working hours per day, with trucks arriving and departing consistently throughout the day. This equates to 17 truck movements per hour.
- All workers are assumed to travel individually by private vehicle.
- Worker arrivals (weekdays and Saturday):
  - 60% would arrive before 7:00am, which is outside of the AM peak hour
  - 40% would arrive between 7:00am and 9:00am, which is during the peak period.
- Worker departures:
  - Weekday:
    - 60% would leave at around 3:00pm, which is outside the peak period
    - 40% would depart between 3:00pm and 5:00pm. The PM peak hour occurs from 4:00pm and 5:00pm, with half of the 40% of workers leaving the site during this period.
  - Saturday:
    - 80% of staff would leave after 1:00pm during the midday peak period
    - 20 % of staff would leave outside of the peak period.
- All truck movements would arrive and depart to and from the west in the direction of Hornsby, with trucks required to make a right turn into the site and a left turn when exiting the site.
- Distribution of the additional staff traffic movements at the intersection of Mona Vale Road and Kimbriki Road are based on existing directional splits.

Based on the above assumptions, the estimated additional site-generated traffic volumes during construction (typical construction and peak special events) in the AM, midday and PM peak hours on a weekday and Saturday are provided in Figure 4.2 and Figure 4.3.

Figure 4.2: Site-Generated Traffic (Construction) – Weekday

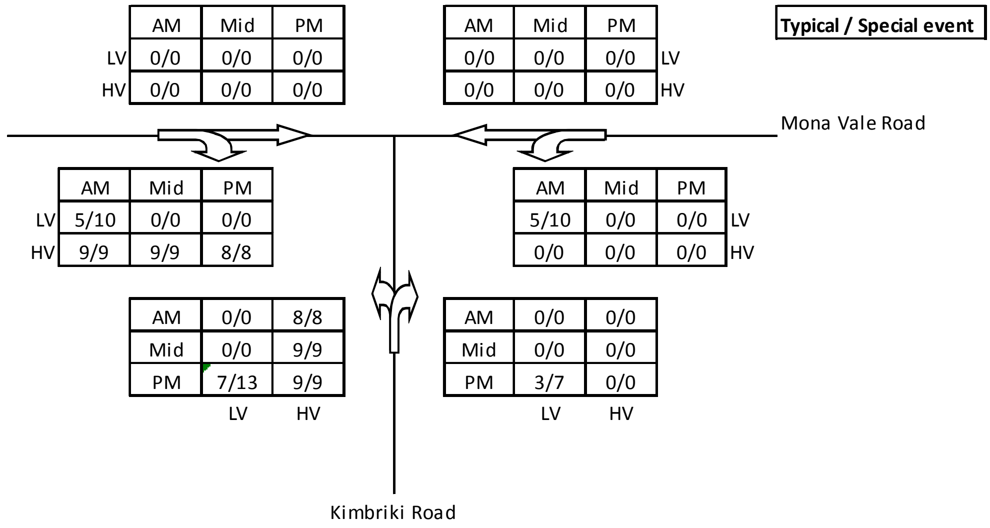
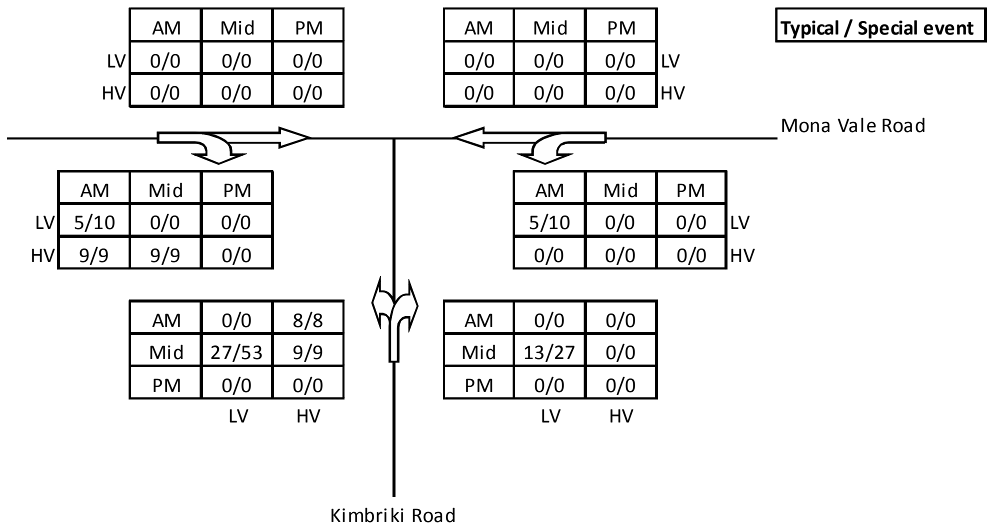


Figure 4.3: Site-Generated Traffic (Construction) – Saturday



4.2.2 Intersection Operation

The impact of the site-generated traffic during typical construction activities and peak times of specific activities on the operation of the intersection of Mona Vale Road and Kimbriki Road was assessed using SIDRA INTERSECTION.

Figure 4.4, Figure 4.5 and Figure 4.6 present a summary of the expected operation of the Mona Vale Road/Kimbriki Road intersection during typical and peak construction periods.

Figure 4.4: SIDRA INTERSECTION Results – 2009 plus Construction (typical and peak) Traffic (AM Peak Hour)

Day	Thursday
AM Peak hour	0745-0845

	Typical	Peak special event
degree of saturation	0.575	0.575
average delay (sec)	0	0
95th %ile queue (m)	0	0
LoS	A	A

degree of saturation	1.002	1.020
average delay (sec)	261.2	258.2
95th %ile queue (m)	63.5	69.0
LoS	F	F

Mona Vale Rd (West approach)

Mona Vale Rd (East approach)

degree of saturation	0.940	0.940
average delay (sec)	0	0
95th %ile queue (m)	0	0
LoS	A	A

degree of saturation	0.032	0.032	0.379	0.379
average delay (sec)	6.4	6.4	75.4	76.6
95th %ile queue (m)	NA*	NA*	9.6	9.7
LoS	NA*	NA*	F	F

degree of saturation	0.024	0.027
average delay (sec)	9.1	9.1
95th %ile queue (m)	0	0
LoS	A	A

Kimbriki Rd (South approach)

Day	Saturday
AM Peak hour	0800-0900

	Typical	Peak special event
degree of saturation	0.492	0.492
average delay (sec)	0	0
95th %ile queue (m)	0	0
LoS	A	A

degree of saturation	0.122	0.130
average delay (sec)	15.9	15.7
95th %ile queue (m)	4.9	5.1
LoS	A	A

Mona Vale Rd (West approach)

Mona Vale Rd (East approach)

degree of saturation	0.459	0.459
average delay (sec)	0	0
95th %ile queue (m)	0	0
LoS	A	A

degree of saturation	0.034	0.034	0.066	0.066
average delay (sec)	5.9	5.9	16.8	16.8
95th %ile queue (m)	NA*	NA*	1.8	1.8
LoS	NA*	NA*	B	B

degree of saturation	0.026	0.028
average delay (sec)	8.8	8.8
95th %ile queue (m)	0	0
LoS	A	A

Kimbriki Rd (South approach)

* Continuous movement

Figure 4.5: SIDRA INTERSECTION Results – 2009 plus Construction (typical and peak) Traffic (Midday Peak Hour)

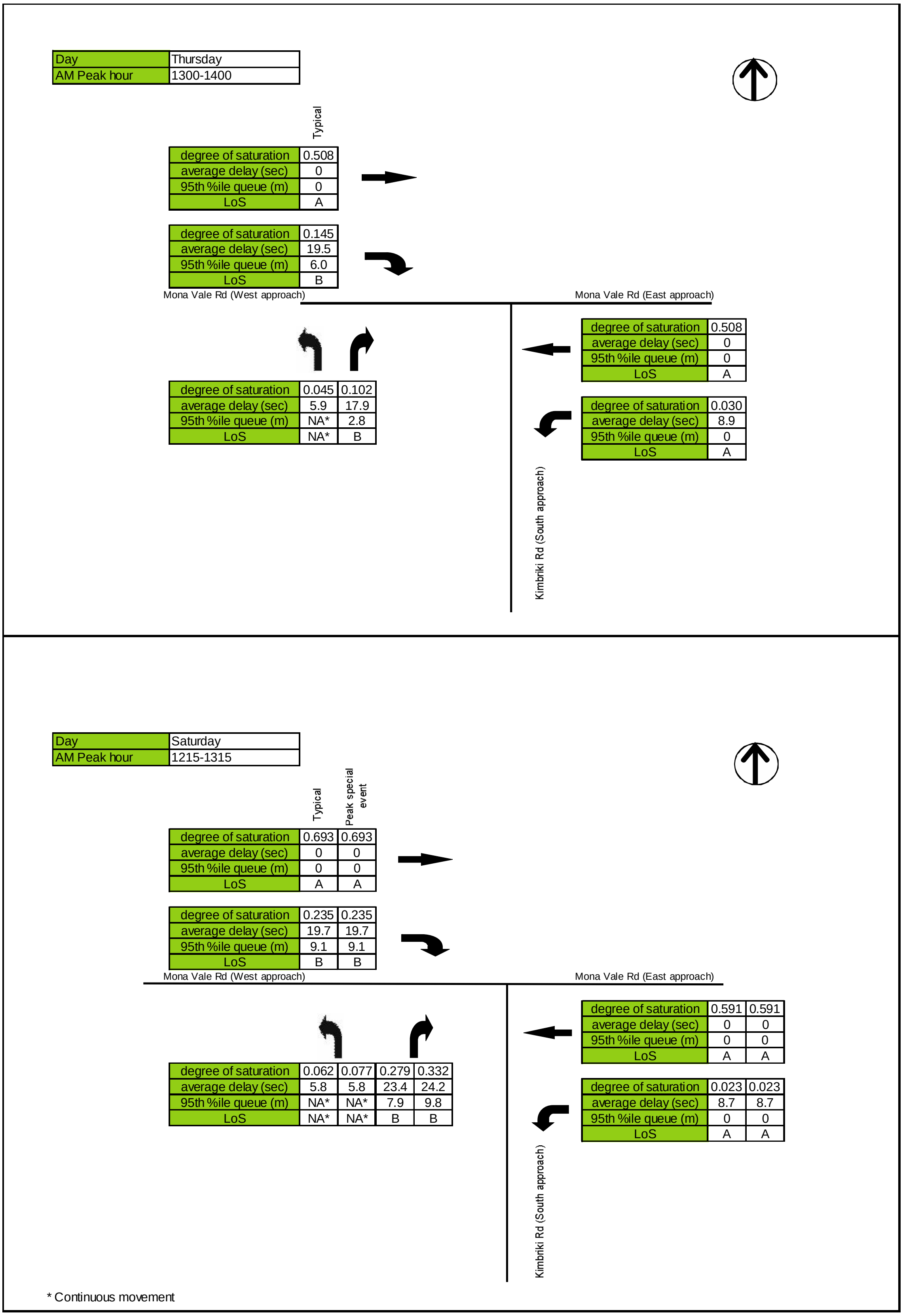
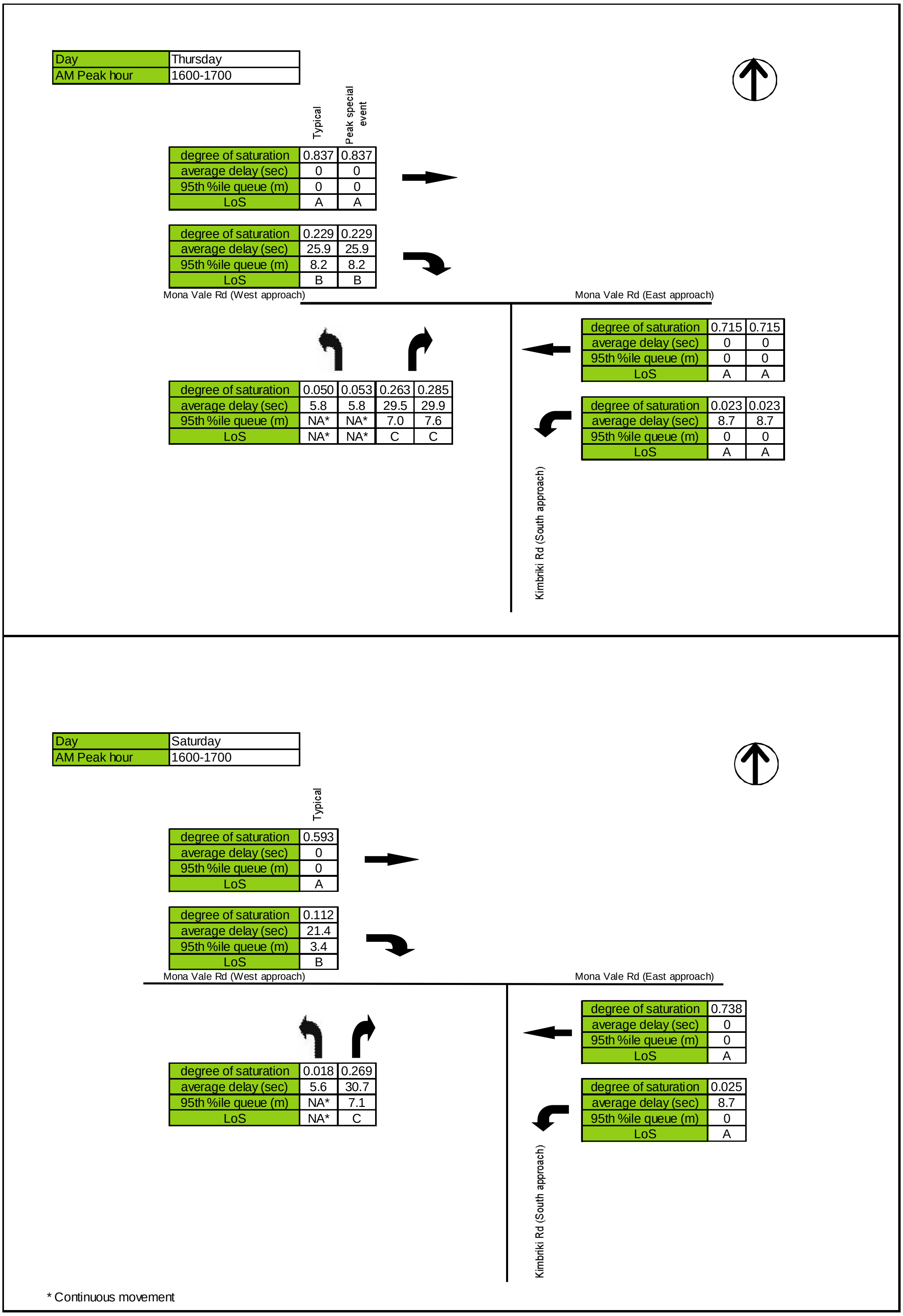


Figure 4.6: SIDRA INTERSECTION Results – 2009 plus Construction (typical and peak) Traffic (PM Peak Hour)



4.2.3 Conclusions

The key findings from the construction phase intersection modelling are as follows:

- The intersection is expected to operate satisfactorily during the weekday midday and PM peak periods and the Saturday AM, midday and PM peak periods for typical and peak events.
- The intersection operation would be adversely affected during the AM weekday peak hour for typical and peak events, with the right-turn movement from Kimbriki Road into Mona Vale Road and the right-turn movement from Mona Vale Road into Kimbriki Road both operating at Level of Service F due to average delays in excess of 60 seconds.
- The degree of saturation for the right turn movement from Mona Vale Road into Kimbriki Road is greater than 1.0 during typical and peak construction activities, which indicates that the capacity is being exceeded. The results indicate that the capacity of this movement would match the demand during typical construction periods and would be exceeded by one vehicle during the peak events. This is reflected in the very high average delay of 258-261 seconds, or more than four minutes.
- There are a limited number of appropriate gaps for right-turning vehicles to accept due to high volumes of through traffic along Mona Vale Road, particularly in the westbound direction during the Thursday AM peak period.

4.2.4 Mitigating Measures

Since the AM weekday peak hour is the only peak hour which operates unsatisfactorily, this peak hour has been remodelled as Scenario 1 with the following modifications:

- Implement a right-turn ban during the AM weekday peak period only which permits vehicles exiting the site to perform a left turn only during a defined time (e.g. 7:00am to 9:00am).

The results of the remodelled intersection during the AM weekday peak hour are shown in Figure 4.7.

Figure 4.7: SIDRA INTERSECTION Results –2009 plus Construction (typical and peak) Traffic (AM Peak Hour Weekday) – Scenario 1

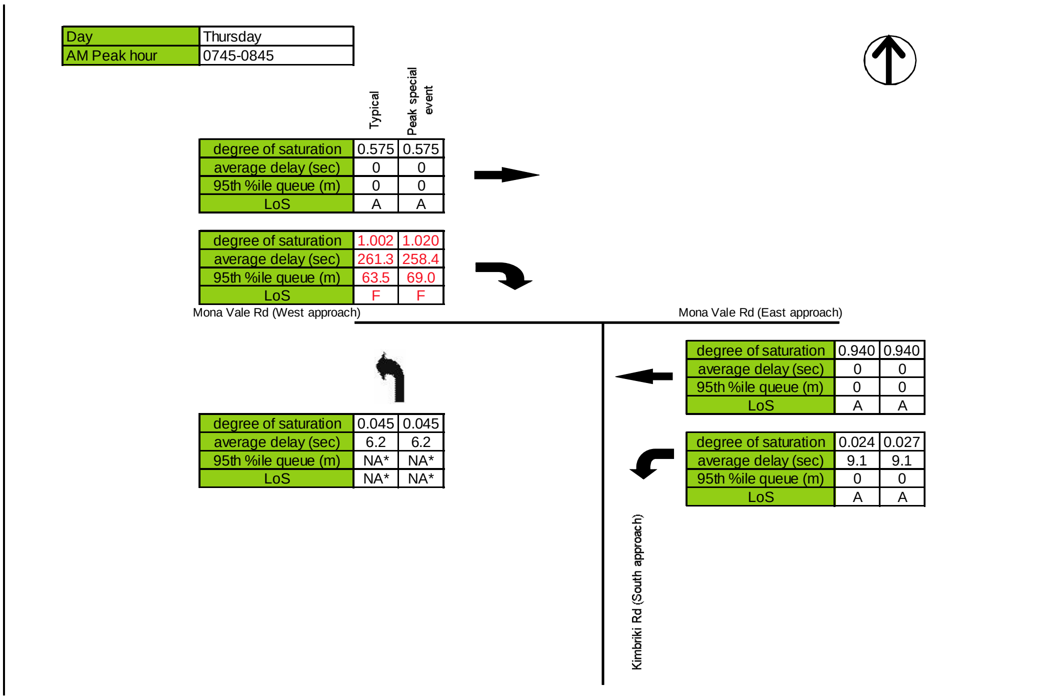


Figure 4.7 indicates that whilst the issues associated the right-turn movement leaving the site have been removed, the capacity issues for the movement into the site have not changed.

To overcome the capacity issues for this movement, construction related vehicles arrivals during the AM weekday peak would be managed by:

- As far as possible, scheduling deliveries of construction materials outside the AM peak to minimise the number of trucks entering the site from the west during this time period.
- Encouraging car-pooling, minibuses and other means to limit the number of construction worker vehicles entering the site during the AM peak;

As an additional safety measure, it is recommended that "Trucks Turning" warning signage (Sign No. W5-205 – refer Figure 4.8) be installed on the Mona Vale Road approaches to Kimbriki Road to alert drivers to the construction vehicle activity at the intersection.

Figure 4.8: Trucks Turning Warning Signage – W5-205

4.3 Cyclists

Mona Vale Road performs the function of a regional bicycle route, with on-road bicycle shoulders provided along the majority of its length.

Any proposed improvement works associated with Mona Vale Road should include provision for cyclists. As a minimum, sealed bicycle shoulder lanes should be provided at a minimum width of 2.0m, which is suitable for a road with a speed limit of 70km/h that carries a relatively high number of heavy vehicles.

4.4 Parking Impact and Appraisal

For most of the project construction period, there would typically be around 50 workers on site each day. It is assumed that all staff would arrive by private vehicle and as such, there should be a minimum on-site parking provision for construction workers of 50 spaces.

Two separate construction parking areas would be required to service the two construction sites, namely the lower construction site (i.e. MRF Building) at the level of the existing resource recovery operations area, and the upper construction site (i.e. AWT/Maturation Buildings). There are separate car parks proposed for the operational phase at both of these locations, as shown on the site plan in Appendix A. This includes 30 spaces in the upper car park and 35 spaces in the lower car park for a total supply of 65 spaces. These car parks would be used to accommodate the parking demand generated by the construction workers.

In order to accommodate the parking demands associated with construction staff during peak events, such as concrete pours, additional temporary parking spaces would be made available to accommodate the demand from up to 100 vehicles.

5. Operational Impacts

5.1 Overview

Following full development of the site, the site is expected to receive and process up to 60,000 tonnes per year of dry recyclable materials and up to 100,000 tonnes per year of source separated food and garden organics and mixed municipal wastes. This includes additional municipal waste deliveries as a result of the closure of the existing Belmore landfill facility, which is expected to close within the next few years. Taking into account some reductions in existing truck and small vehicle activity, the transport of additional materials is estimated to generate a net increase of up to 145 truck movements and 141 light vehicle movements per day.

GTA Consultants has previously undertaken an assessment of the intersection of Kimbriki Road and Mona Vale Road based on first level estimates of the expected traffic generation from the site. This analysis has been revised and updated based on the latest incoming and outgoing material volumes. A detailed assessment of the site access, layout and parking has also been undertaken as part of the operational impact assessment.

5.2 Site Generated Traffic and Distribution

5.2.1 Traffic Generation

A summary of the expected traffic generation for the site during the operational phase was provided by GHD in consultation with Kimbriki Environmental Enterprises Pty Ltd.

The proposed development would result in an additional 79,087 heavy and light vehicle movements per annum, including 38,385 heavy vehicle movements and 40,702 light vehicle movements per annum. The increase in traffic is expected to occur predominantly on weekdays with a small proportion, mostly light vehicles, on Saturdays and Sundays.

5.2.2 Traffic Assumptions and Assignment

Through discussions with GHD and Kimbriki Environmental Enterprises, the following assumptions were adopted in calculating the daily and peak hour traffic for weekdays and Saturdays:

- Weekdays:
  - Movements occurring before 9am = 20% of daily movements (55% in/45% out directional split) – plus staff vehicles arriving
  - Movements occurring between 12pm and 2pm = 25% of daily movements (50% in and out directional split)
  - Movements occurring between 4pm and 6pm = 5% of daily movements (45% in/55% out directional split) – plus staff vehicles departing.

It is noted that on weekdays, it is unlikely that kerbside waste and recyclable collection vehicles would be entering the site until after the morning peak due to the nature of the-work schedules. Workers would typically commence collection work at 6:00 am and would take approximately four hours to fill the vehicle before arriving at the site to discharge their loads. Based on this work schedule, it is also expected that the collection vehicles would have discharged their loads and exited the site prior to the afternoon peak at 4.00 pm. However, the above assumptions have been adopted for modelling purposes and represent a conservative estimate of traffic generation during the three weekday peak periods.

- Weekend days:
  - Movements occurring before 9am = 20% of daily movements (55% in/45% out directional split) – plus staff vehicles arriving
  - Movements occurring between 12pm and 2pm = 40% of daily movements (50% in and out directional split)
  - Movements occurring between 4pm and 6pm = 5% of daily movements (45% in/55% out directional split) – plus staff vehicles departing.
- There would be a reduction in the number of vehicles travelling to and from the site due to a change in the on-site operations. On a weekday, there would be a combination of heavy and light vehicles that would no longer access the site in the future, whilst on the weekend the reductions consist mostly of light vehicles.
- Distribution of the additional traffic movements at the intersection of Mona Vale Road and Kimbriki Road were provided by Kimbriki Environmental Enterprises and are based on truck origin-destination information and existing directional splits.

Based on the above assumptions, the estimated additional site-generated traffic volumes in the AM, midday and PM peak hours on a weekday and Saturday are provided in Figure 5.1 and Figure 5.2. The results take into account the expected reductions in traffic volumes and reflect the net change in traffic volumes.

Figure 5.1: Site-Generated Traffic (Operational Phase) – Weekday

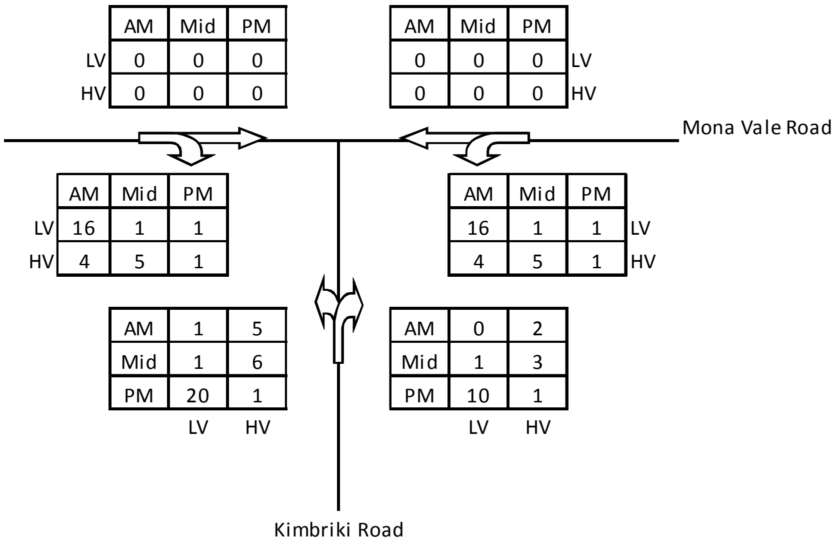
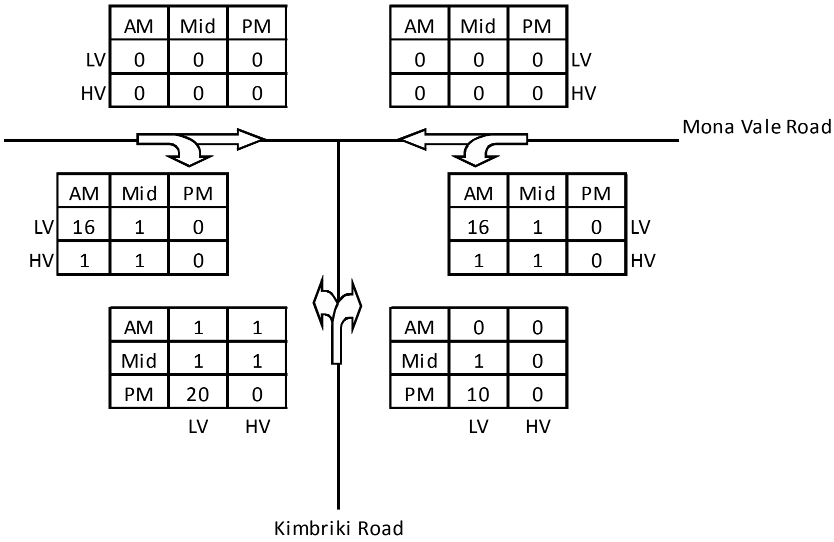


Figure 5.2: Site-Generated Traffic (Operational Phase) – Saturday



5.3 Traffic Modelling

5.3.1 Intersection Analysis – Existing Layout

The impact of the site-generated traffic during the operational phase on the operation of the intersection of Mona Vale Road and Kimbriki Road in its current layout was assessed using SIDRA INTERSECTION. Figure 5.3, Figure 5.4 and Figure 5.5 present a summary of the expected operation of the Mona Vale Road/Kimbriki Road intersection during the operational phase of the project.

The key findings from the operational phase intersection modelling for the existing intersection layout are as follows:

- The intersection is expected to operate satisfactorily during the weekday midday and PM peak periods and the Saturday AM, midday and PM peak periods.
- During the AM weekday peak hour, the intersection operation is expected to be adversely affected. The right-turn movement from Kimbriki Road into Mona Vale Road and the right-turn movement from Mona Vale Road into Kimbriki Road would both operate at Level of Service F due to average delays in excess of 100 seconds.
- As well as unacceptably high delays, the two right turn movements are approaching capacity, particularly the right turn movement from Mona Vale Road into Kimbriki Road, which has a degree of saturation of 0.865. The remaining available capacity for each of these movements once the operational phase traffic volumes have been incorporated is:
  - Right turn from Mona Vale Road into Kimbriki Road:
    - demand flow = 62 vehicles
    - capacity flow = 72 vehicles
    - available capacity = 10 vehicles.
  - Right turn from Kimbriki Road into Mona Vale Road:
    - demand flow = 26 vehicles

- capacity flow = 45 vehicles
- available capacity = 19 vehicles.

- There are a limited number of appropriate gaps for right-turning vehicles to accept due to high volumes of through traffic along Mona Vale Road, particularly in the westbound direction during the Thursday AM peak period.

Figure 5.3: SIDRA INTERSECTION Results – 2009 plus Operational Phase Traffic (AM Peak Hour)

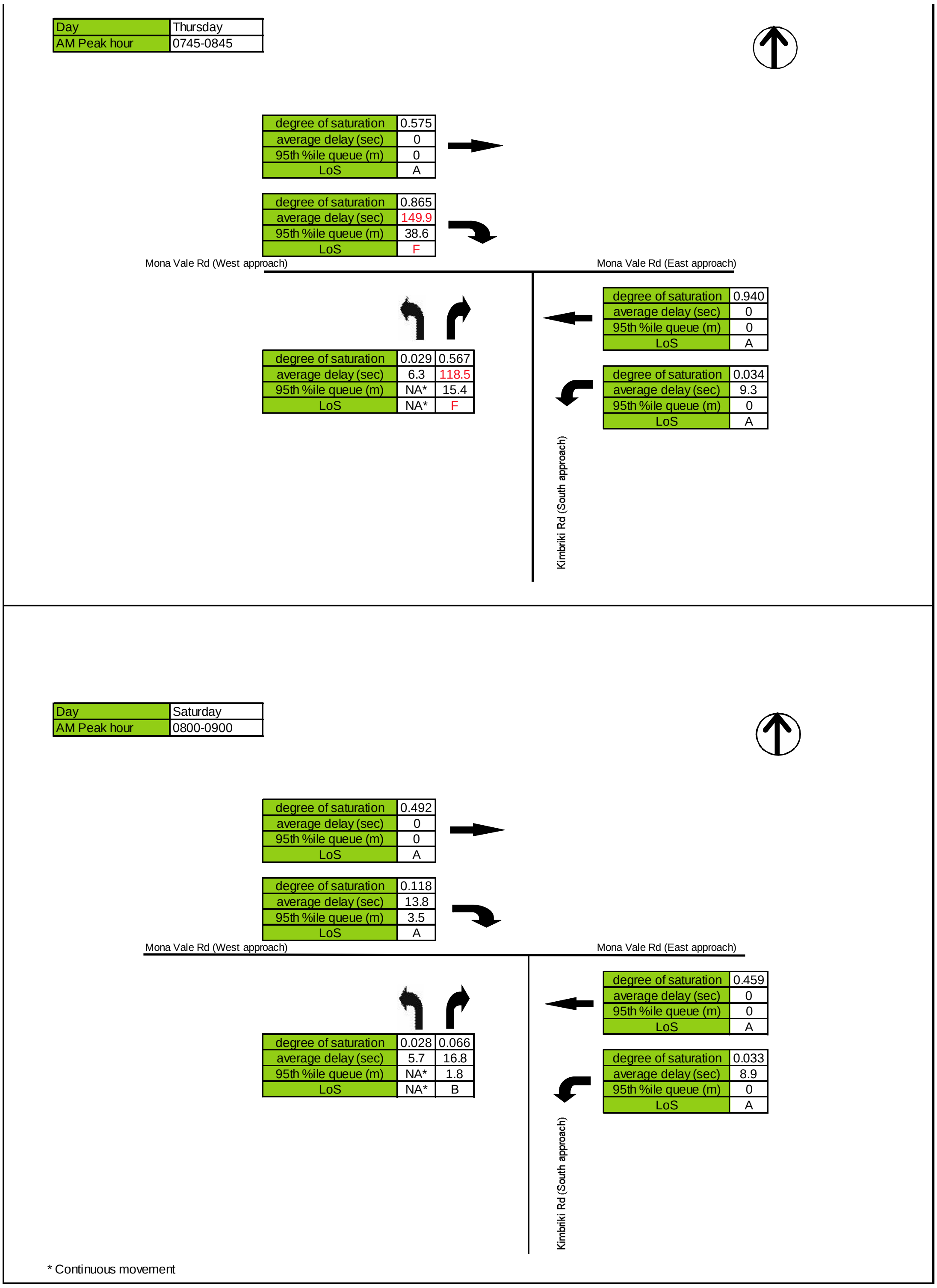


Figure 5.4: SIDRA INTERSECTION Results – 2009 plus Operational Phase Traffic (Midday Peak Hour)

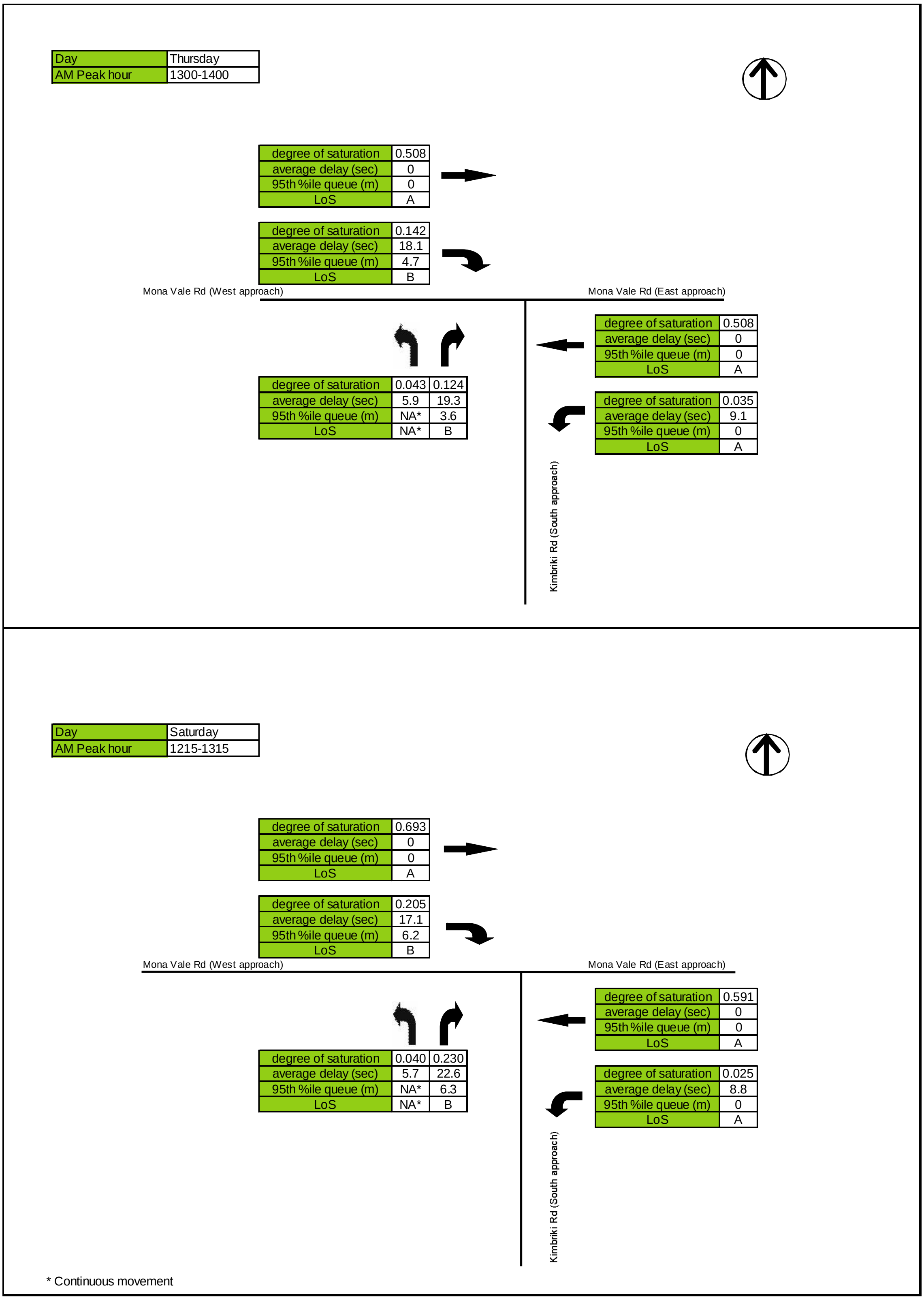
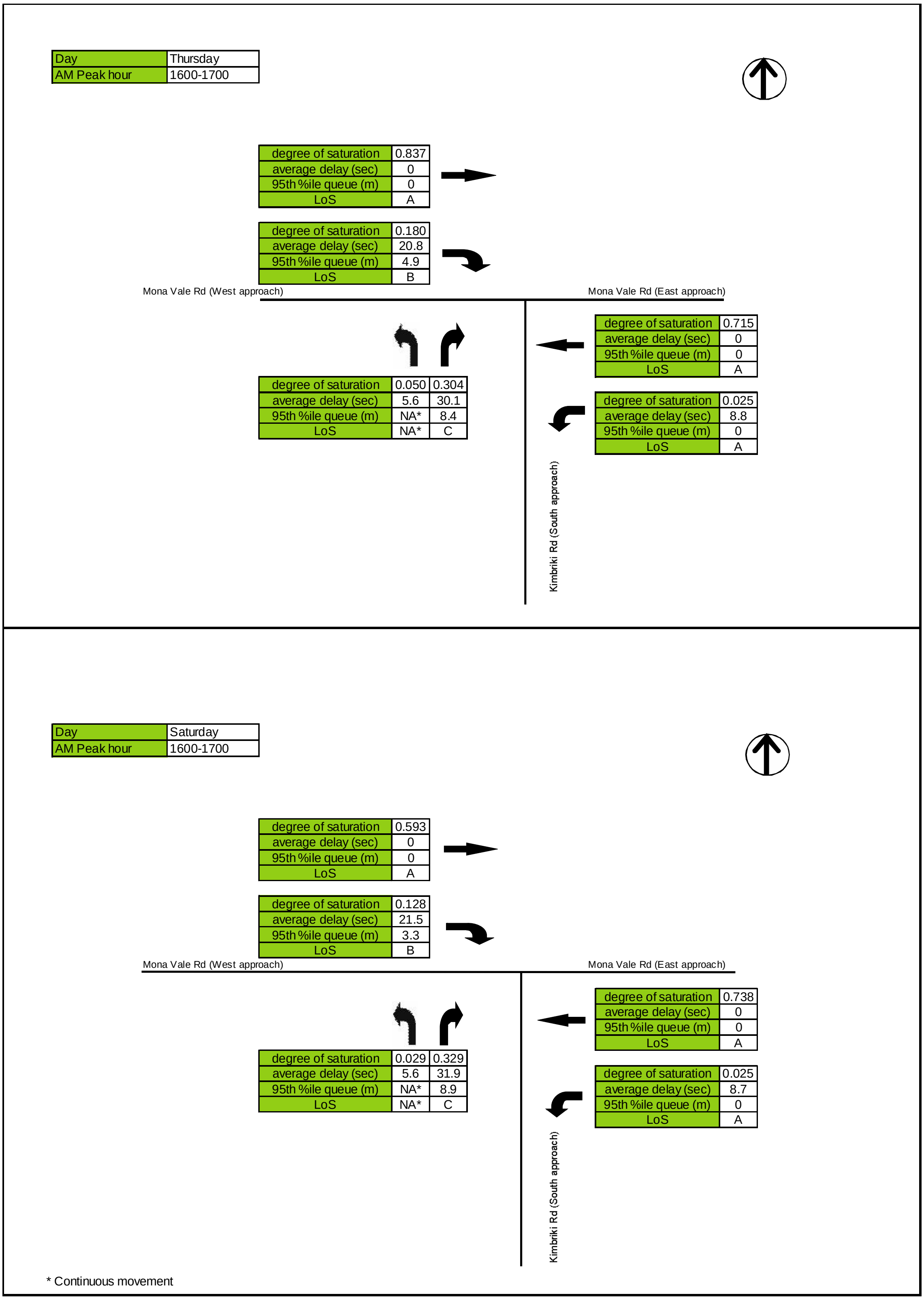


Figure 5.5: SIDRA INTERSECTION Results – 2009 plus Operational Phase Traffic (PM Peak Hour)



5.3.2 Improvement Options Analysis

In order to overcome the issues with the operation of the intersection in its current form, a number of modelling scenarios have been tested as follows:

- Scenario 1 – right turn ban from Kimbriki Road during the AM weekday peak period
- Scenario 2 – right turn ban (Scenario 1), additional westbound approach lane on Mona Vale Road, left turn continuous lane from Kimbriki Road removed
- Scenario 3 – traffic signals with minor localised intersection widening on eastbound approach
- Scenario 4 – traffic signals with duplication of Mona Vale Road.

The result of modelling for each of these scenarios is provided in the following sections.

Scenario 1 – Right turn ban from Kimbriki Road, AM Weekday Peak (Unsignalised)

Since the AM weekday peak hour is the only peak hour which operates below a desired level of service, this peak hour has been remodelled as Scenario 1, as for the construction phase modelling. Scenario 1 includes a right turn ban during the AM weekday peak period which means that vehicles exiting the site can only perform a left turn.

The results of the remodelled intersection during the AM weekday peak hour are shown in Figure 5.6.

Figure 5.6: SIDRA INTERSECTION Results –2009 plus Operational Phase Traffic (AM Peak Hour Weekday) – Scenario 1

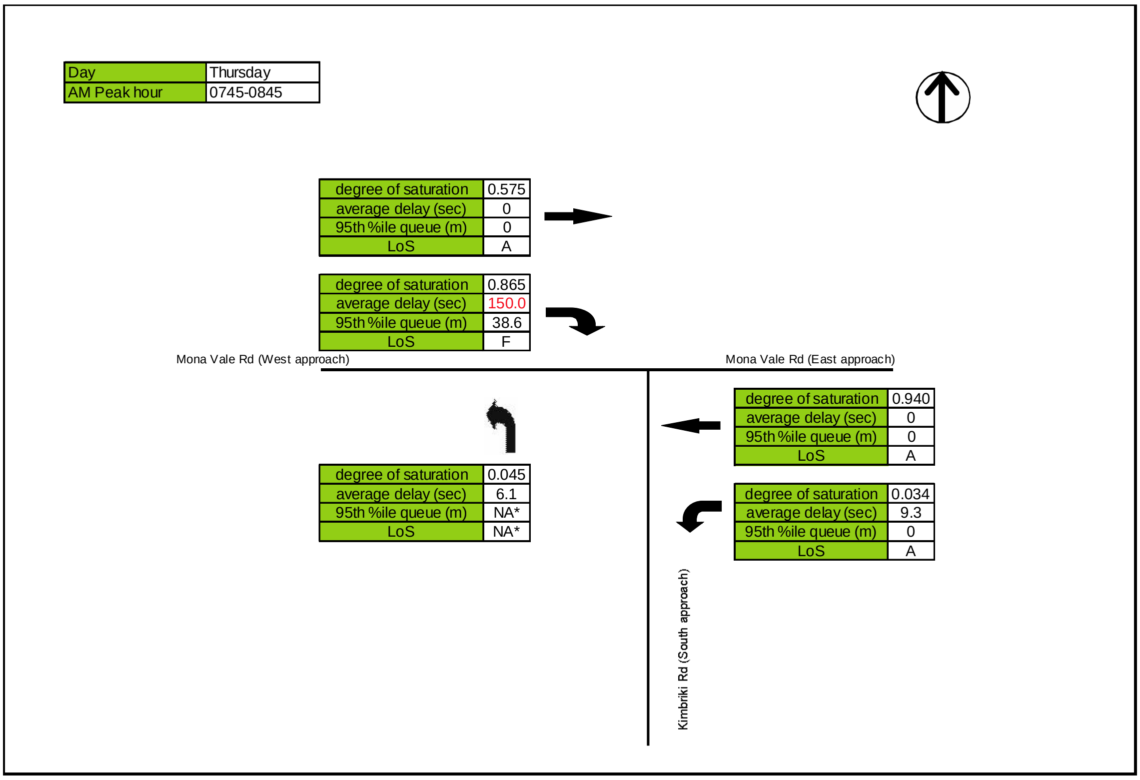
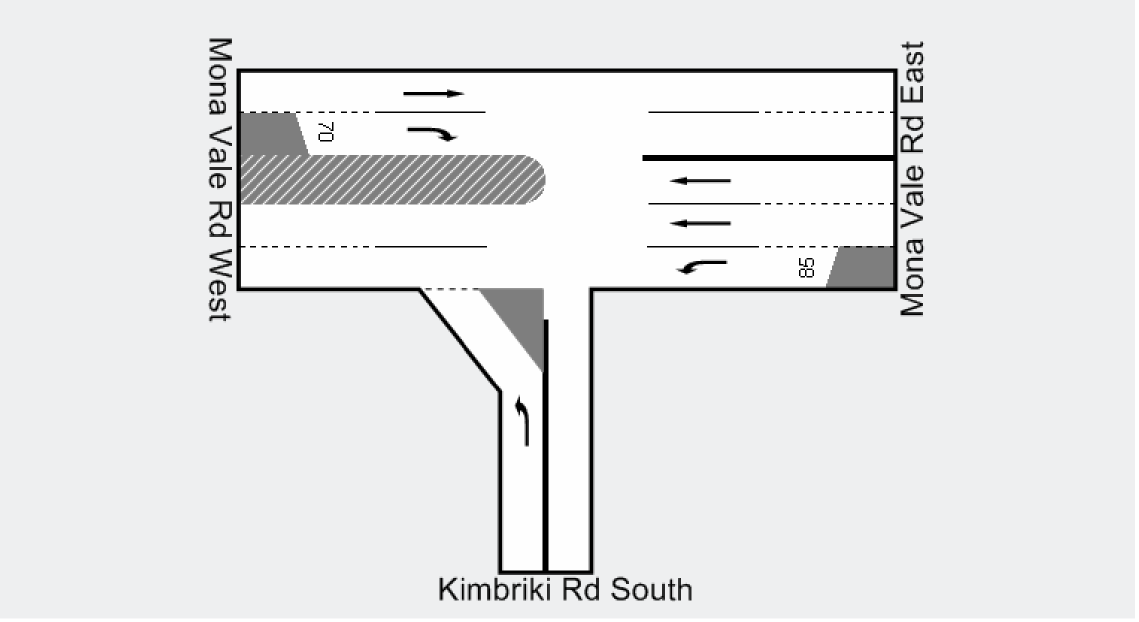


Figure 5.6 indicates that the issues associated with the right-turn movement leaving the site would be resolved. However, the capacity issues for the right turn from Mona Vale Road into Kimbriki Road during the AM peak would not be improved by this action, and would need to be addressed via an alternative solution.

Scenario 2 – Scenario 1 plus additional westbound approach lane on Mona Vale Road (Unsignalised)

Operation of the intersection during the AM peak period has been remodelled as Scenario 2, which allows for two westbound lanes instead of the one currently provided, and a ban on right hand turns from Kimbriki Road during the AM peak. The nearside lane on the westbound departure, which currently allows the left turn from Kimbriki Road to operate as a continuous movement, would be allocated to the additional westbound through lane on the major carriageway. This would result in the left turn movement operating under "Give Way" control. The Scenario 2 layout is shown in Figure 5.7.

Figure 5.7: Mona Vale Road and Kimbriki Road Intersection – Scenario 2 Layout



The results of the remodelled intersection during the AM weekday peak hour are shown in Figure 5.8.

Figure 5.8: SIDRA INTERSECTION Results –2009 plus Operational Phase Traffic (AM Peak Hour Weekday) – Scenario 2

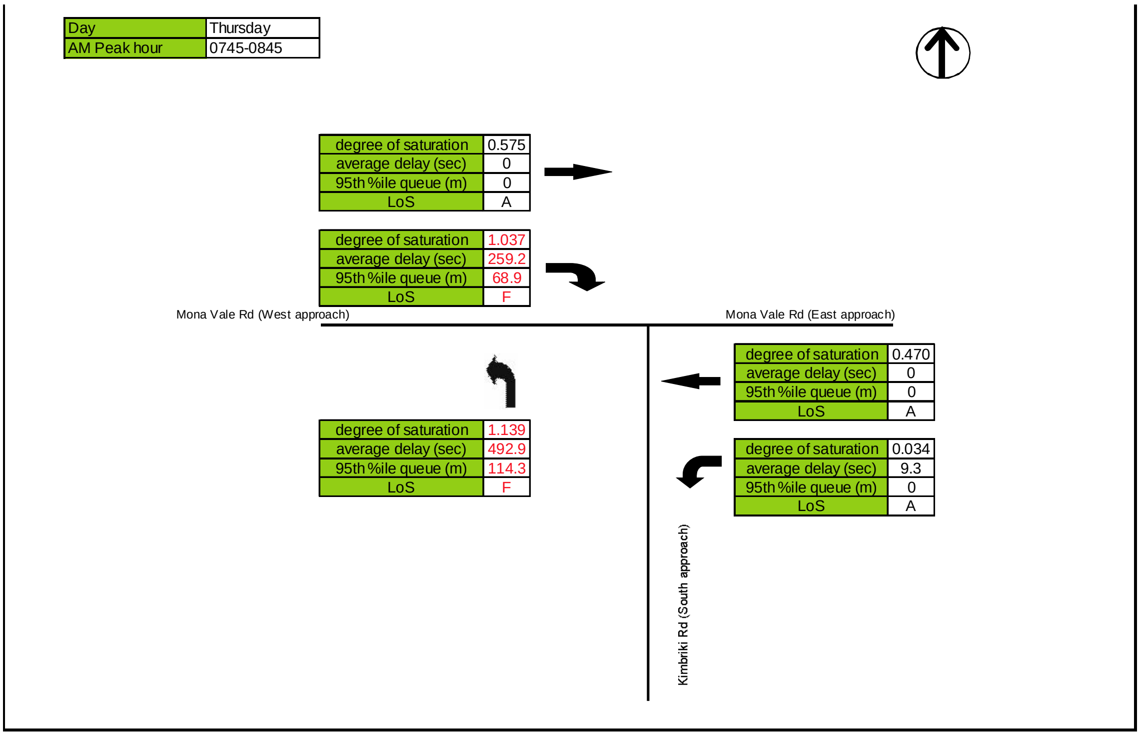


Figure 5.8 indicates that an increase in the capacity of the westbound approach of Mona Vale Road (i.e. duplication of the westbound lanes to increase the overall capacity of Mona Vale Road) would result in unacceptable delays for the right turn movement into Kimbriki Road and the left turn movement into Mona Vale Road.

The delay time for left-turning vehicles exiting the site would be greater than it is currently, as left-turning vehicles would be required to give-way to westbound traffic, which has high volumes during the AM peak hour.

Delays would also increase for vehicles turning right from Mona Vale Road into Kimbriki Road as they would be required to find an appropriate gap to enable crossing of two lanes instead of one lane in the current layout. The gap would need to be larger to get across two oncoming lanes of traffic instead of one and would need to be available in two lanes simultaneously, with fewer gaps available in this situation.

This analysis indicates that it would not be possible for any works that increase lane capacity on Mona Vale Road to occur without an increased level of control of the intersection at Kimbriki Road to facilitate movements into and out of Kimbriki Road. Traffic signals would need to be implemented by the RTA as an important component of any capacity increases on the westbound or eastbound approaches on Mona Vale Road.

Scenario 3 – Full intersection movements with Traffic Signal Control, including minor localised intersection widening

Modelling of Scenario 1 and 2 has indicated that an increased level of control could be required in the future at the intersection of Mona Vale Road and Kimbriki Road in order to improve operation and safety, particularly if an increase in lane capacity is provided on Mona Vale Road. As such, the existing intersection of Mona Vale Road and Kimbriki Road has been modelled as a signalised intersection for the AM, Midday and PM peak periods on a weekday and Saturday.

The lane configuration for the Scenario 3 modelling, as shown in Figure 5.9, includes the following assumptions:

- No duplication of Mona Vale Road, including no widening on the westbound approach
- One long lane on the westbound approach (for through movements) and one short lane (through and left movements), which fits within the existing sealed width of this approach
- Some localised widening on the eastbound approach (as per the short-term mitigating measures recommendations) so that there are two through lanes (one long and one short) on both the approach and departure, together with a short right-turn lane.

Figure 5.9: Mona Vale Road and Kimbriki Road Intersection – Scenario 3 Layout (Traffic Signals)

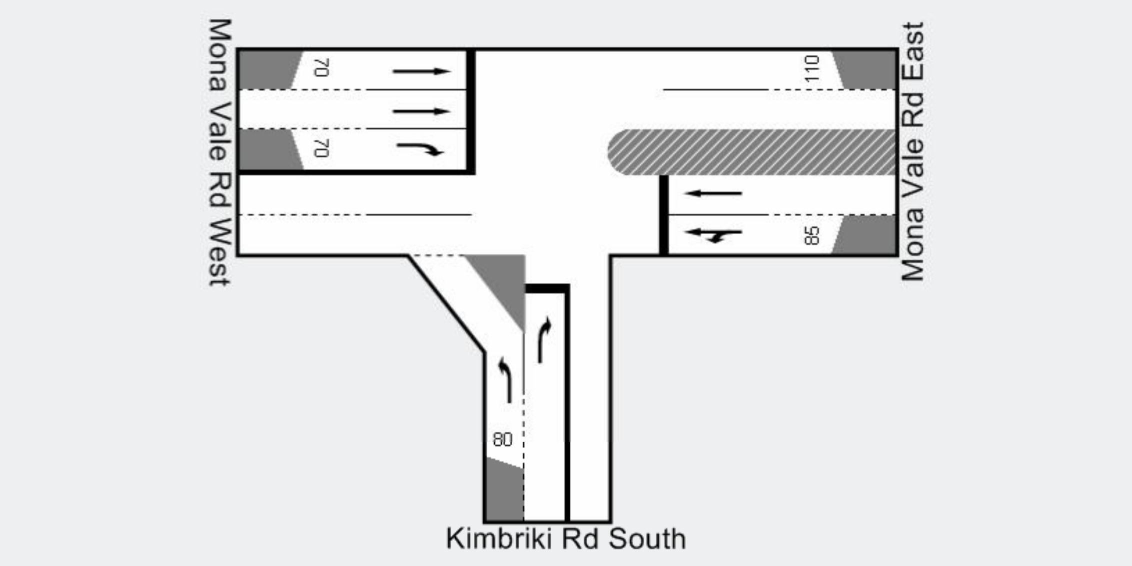


Figure 5.10, Figure 5.11 and Figure 5.12 present a summary of the expected operation of the Mona Vale Road/Kimbriki Road intersection during the operational phase for Scenario 3 based on a cycle time of 100 seconds, whilst Table 5.1 provides a summary of the operation of the intersection as a whole and Figure 5.13 provides a summary of the traffic signal phasing.

Figure 5.10: SIDRA INTERSECTION Results – 2009 plus Operational Phase Traffic (AM Peak Hour) – Scenario 3

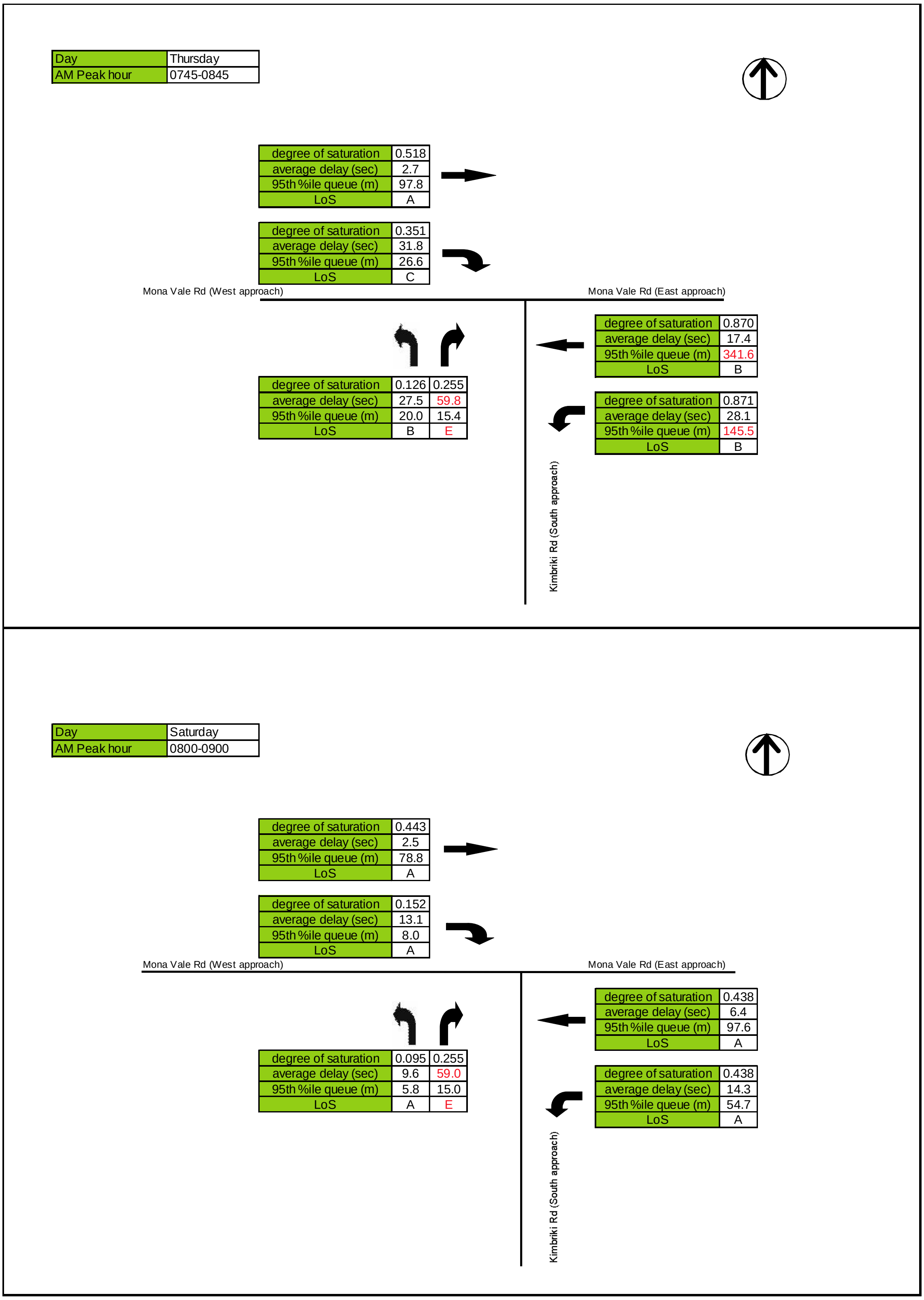


Figure 5.11: SIDRA INTERSECTION Results – 2009 plus Operational Phase Traffic (Midday Peak Hour) – Scenario 3

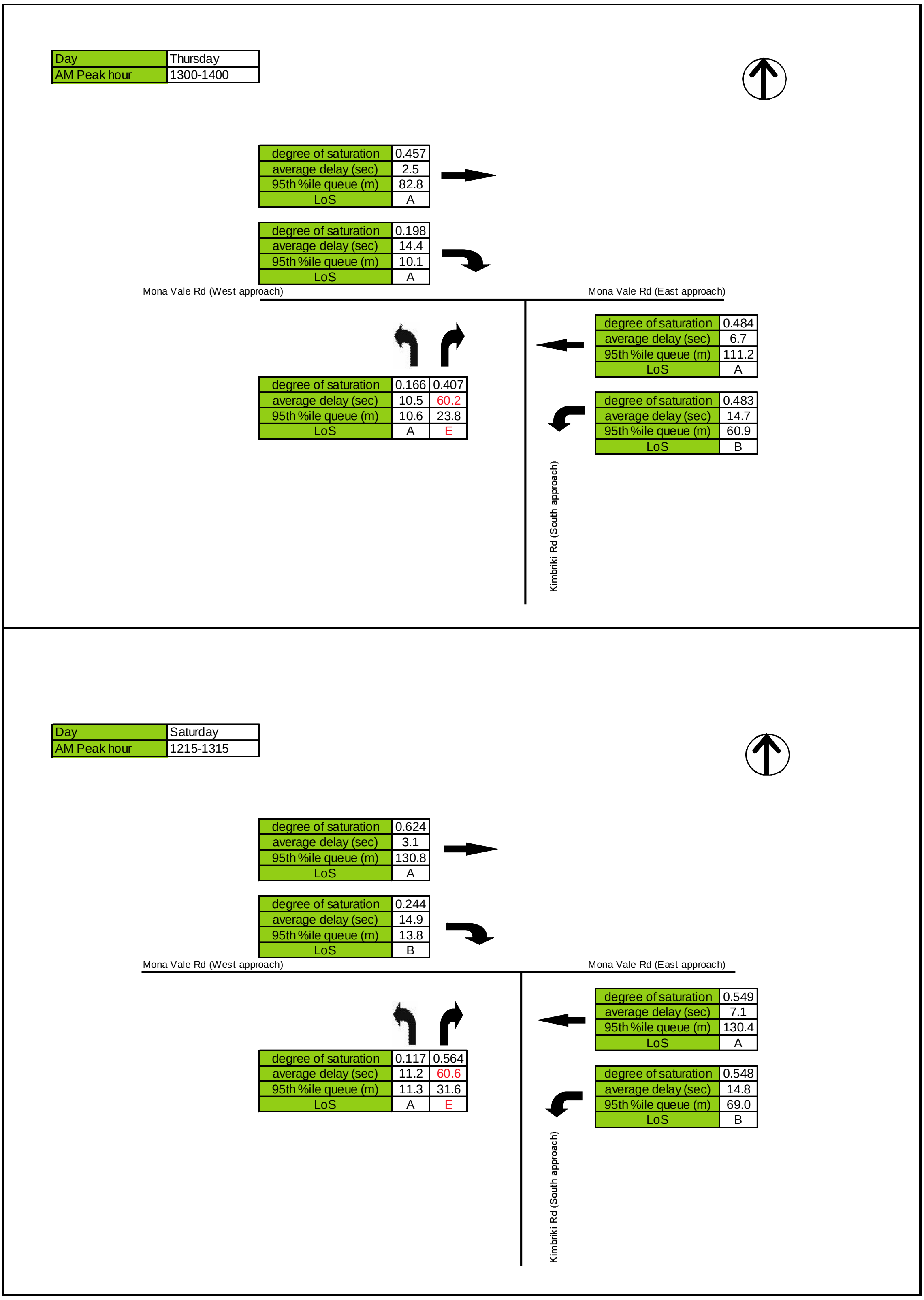


Figure 5.12: SIDRA INTERSECTION Results – 2009 plus Operational Phase Traffic (PM Peak Hour) – Scenario 3

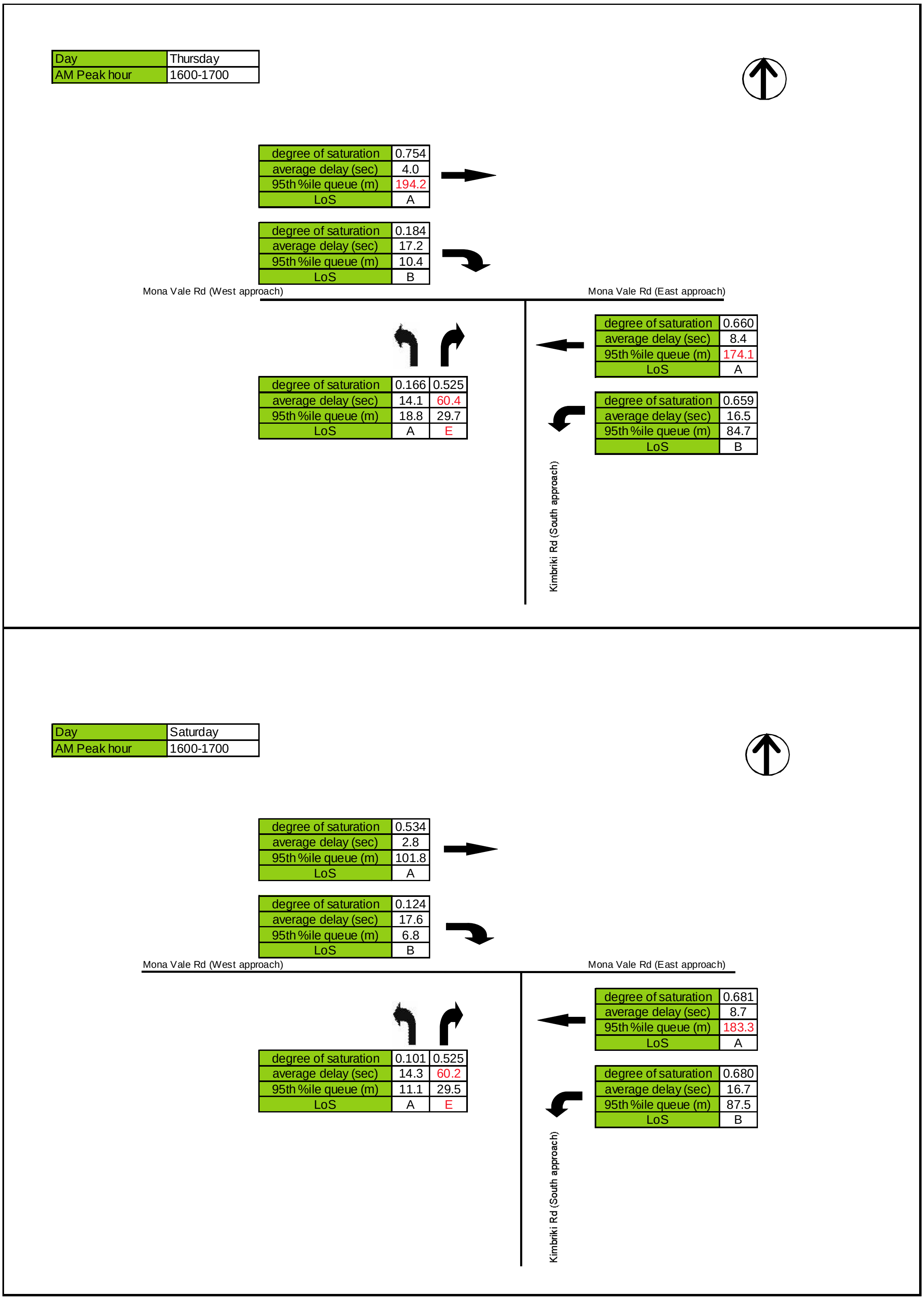


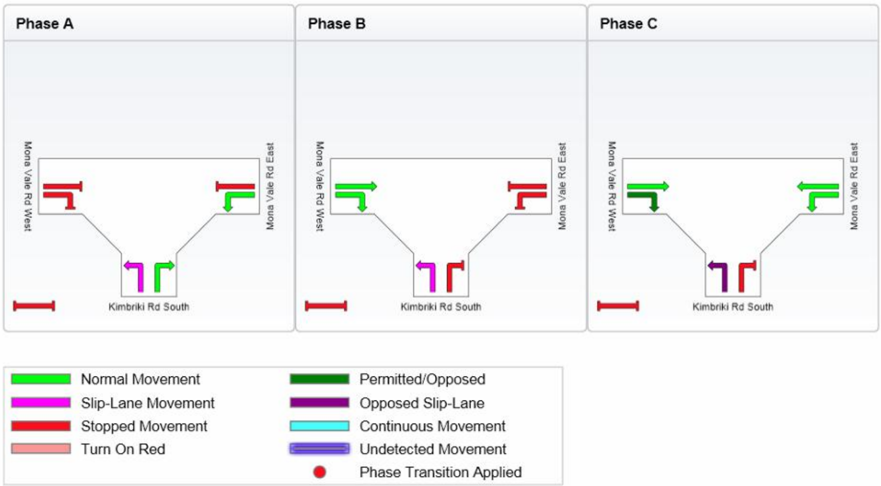
Table 5.1: SIDRA INTERSECTION Results – 2009 plus Operational Phase Traffic – Scenario 3

Day	Peak	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Weekday	AM	0.871	13.2	341.6	A
	Midday	0.484	6.4	111.2	A
	PM	0.754	7.5	194.2	A
Saturday	AM	0.443	5.8	97.6	A
	Midday	0.624	6.8	130.8	A
	PM	0.681	7.7	183.3	A

Figure 5.13: Scenario 3 Traffic Signal Phasing – Cycle time of 100 seconds

Phase Timing Results

Phase	A	B	C
Green Time (sec)	6	6	70
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	12	12	76
Phase Split	12 %	12 %	76 %



The key findings from the operational phase intersection modelling for Scenario 3 indicate that traffic signal control would adversely affect the performance of Mona Vale Road in both directions, as follows:

- For cycle times of 100 seconds and above, the level of service for the Kimbriki Road right-turn movement would be E or F due to average delays above 57 seconds across all of the peak periods. The movement could operate at a level of service D at a 90-second cycle time, with an average vehicle delay of around 54 seconds. However, at a 90-second cycle time, the 95th percentile queue length on the westbound approach is at its highest, particularly during the AM peak period where it is a length of 367m, or approximately 50 vehicles.
- Testing of a range of cycle times (90-150 seconds) for the critical AM weekday peak hour indicates that the 95th percentile queue length on the westbound approach would be in excess of 300m for all the cycle times, despite the average delays indicating a satisfactory Level of Service A or B across the different cycle times.
- Across the different cycle times, there would be a balance between delays on Kimbriki Road (right-turn movement only) and queue lengths/delays on Mona Vale Road. Longer cycle times (greater than 100 seconds) would result in higher average delays on Kimbriki Road and generally shorter queues on Mona Vale Road, whilst shorter cycle times (less than 100 seconds) would result in lower average delays on Kimbriki Road but longer queues on Mona Vale Road.

- Queue lengths would be minimal on Kimbriki Road due to the low traffic volumes, whilst the queue lengths on Mona Vale Road would be quite substantial.
- Based on a practical cycle time of 100 seconds, the 95th percentile queue length on the westbound approach would be in excess of 300m during the AM peak hour whilst the 95th percentile queue length on the eastbound approach during the PM peak hour would be in excess of 190m.
- Table 5.1 indicates that the intersection could be expected to operate at an overall level of service A during each of the peak periods.
- The overall conclusion from this analysis is that the provision of traffic signal control at the intersection in its current configuration would result in unacceptable delays at peak times for motorists using Mona Vale Road.

Scenario 4 – Duplication of Mona Vale Road with Traffic Signal Control

The RTA has acknowledged in its Mona Vale to Macquarie Park Corridor Strategy that there will be a need to increase the capacity of Mona Vale Road in the longer term (refer Section 2.3). If traffic lights were to be installed at the current intersection of Kimbriki Road and Mona Vale Road, without duplication of the Mona Vale Road lanes, the modelling shown as Scenario 3 indicates that there would be high queue lengths and unacceptable delays for motorists using Mona Vale Road and not utilising the Kimbriki site facilities. As such, Scenario 4 has been modelled which assumes duplication of Mona Vale Road, including two through lanes of traffic in each direction and turn bays for left and right turn movements into Kimbriki Road, as shown in Figure 5.14.

Figure 5.14: Mona Vale Road and Kimbriki Road Intersection – Traffic Signal Layout – Scenario 4 (with duplication of Mona Vale Road)

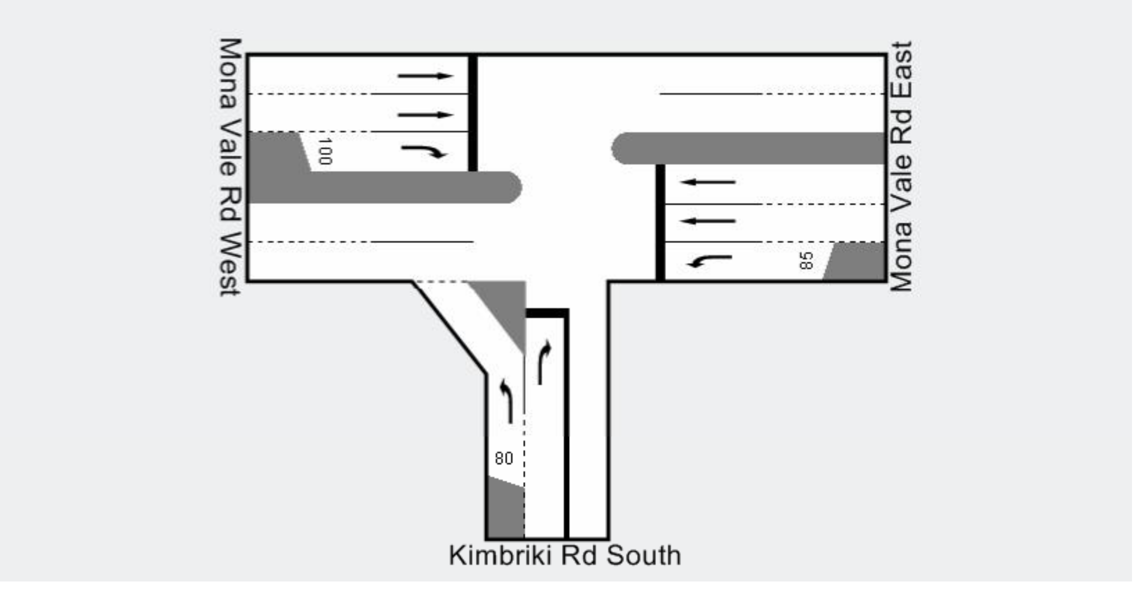


Figure 5.15, Figure 5.16 and Figure 5.17 presents a summary of the expected operation of the Mona Vale Road/Kimbriki Road intersection during the operational phase for Scenario 4 based on a cycle time of 100 seconds, whilst Table 5.1 provides a summary of the operation of the intersection as a whole and Figure 5.13 provides a summary of the traffic signal phasing.

Figure 5.15: SIDRA INTERSECTION Results – 2009 plus Operational Phase Traffic (AM Peak Hour) – Scenario 4

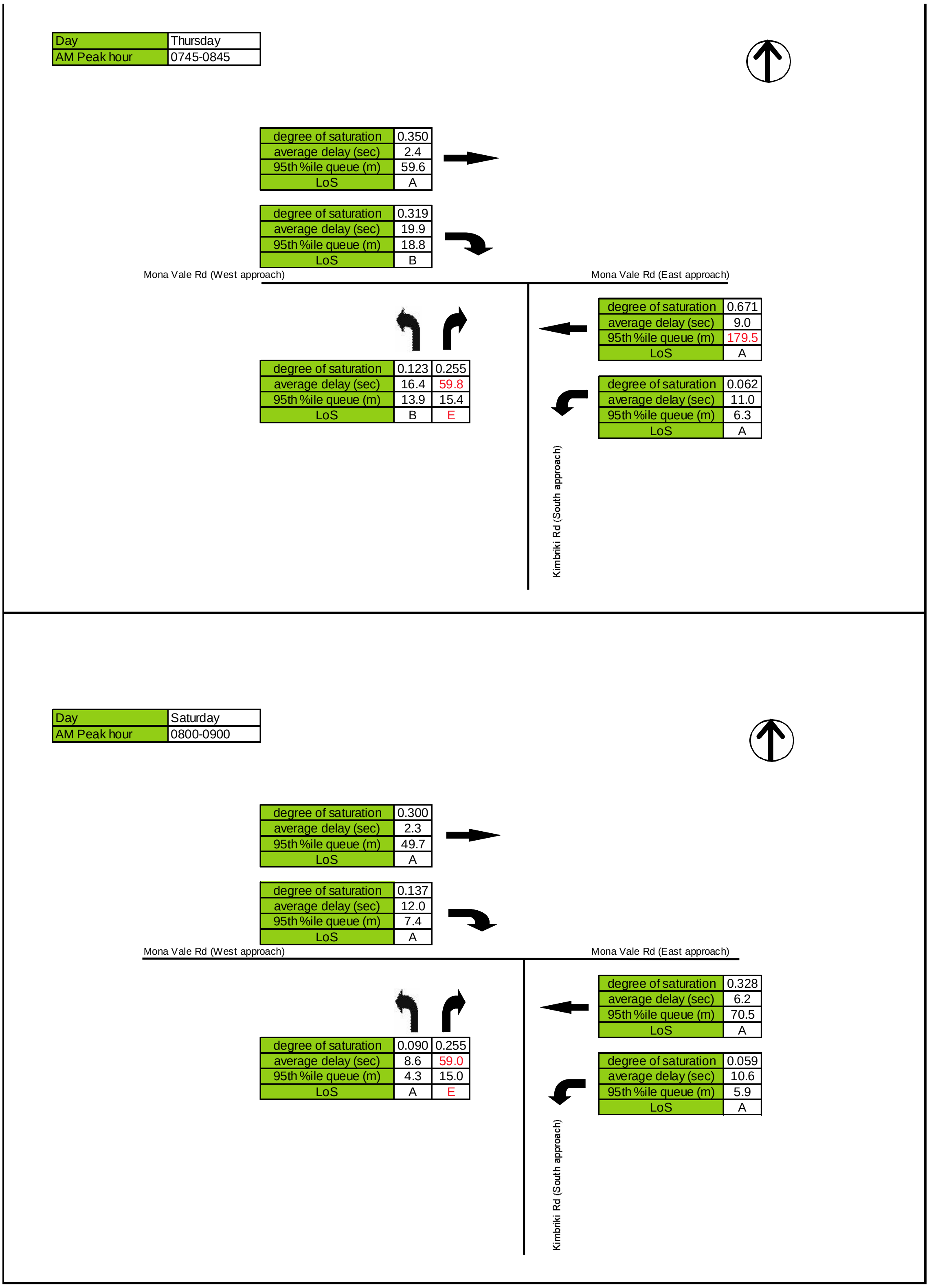


Figure 5.16: SIDRA INTERSECTION Results – 2009 plus Operational Phase Traffic (Midday Peak Hour) – Scenario 4

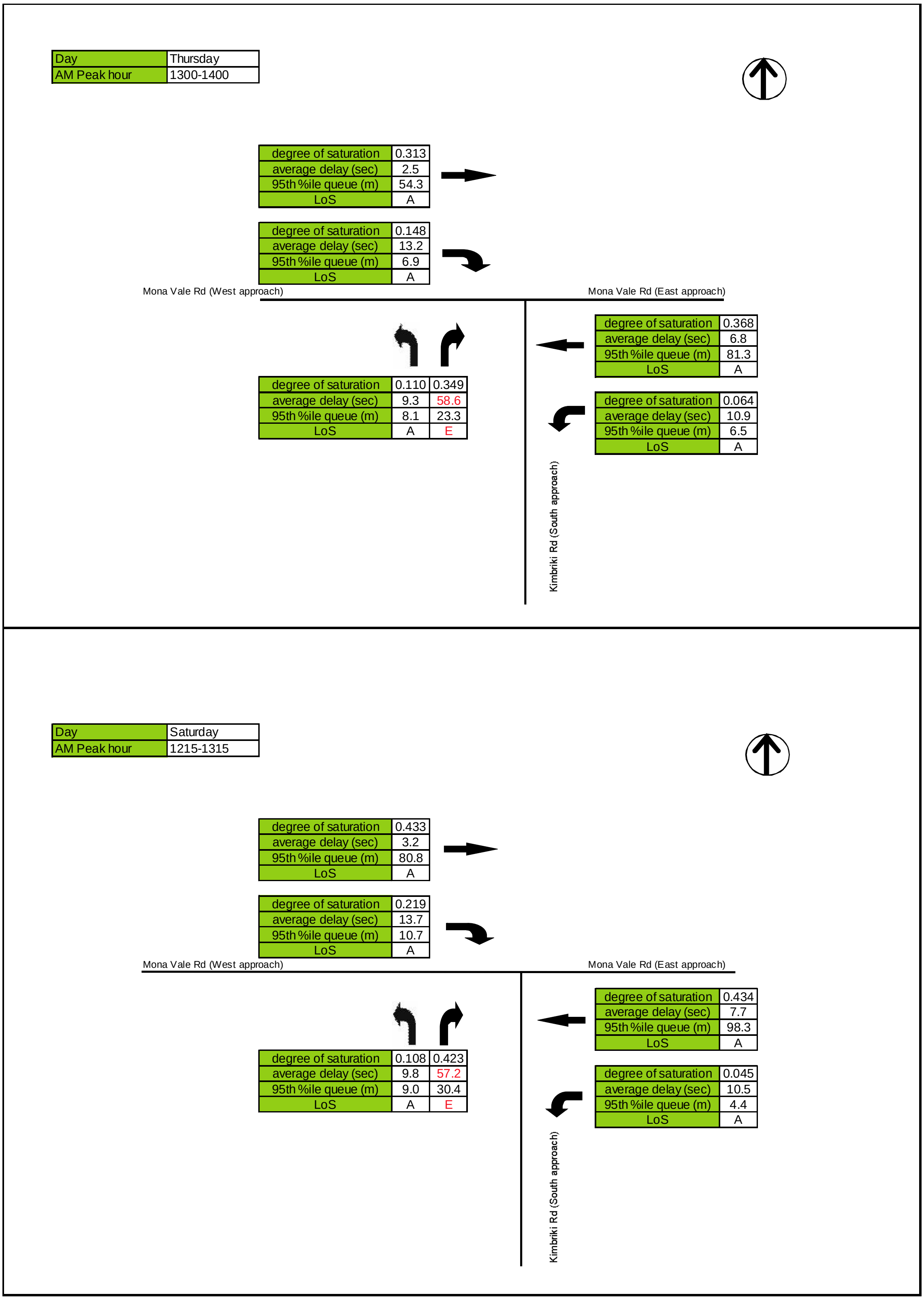
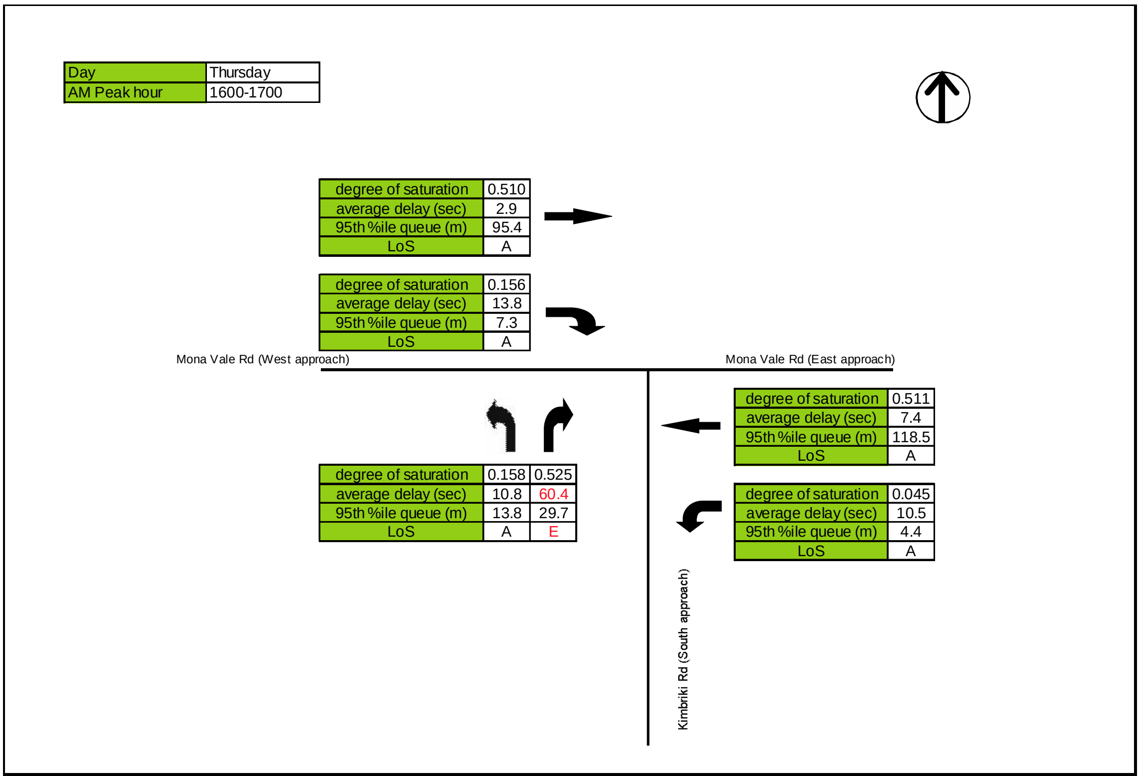


Figure 5.17: SIDRA INTERSECTION Results – 2009 plus Operational Phase Traffic (PM Peak Hour) – Scenario 4



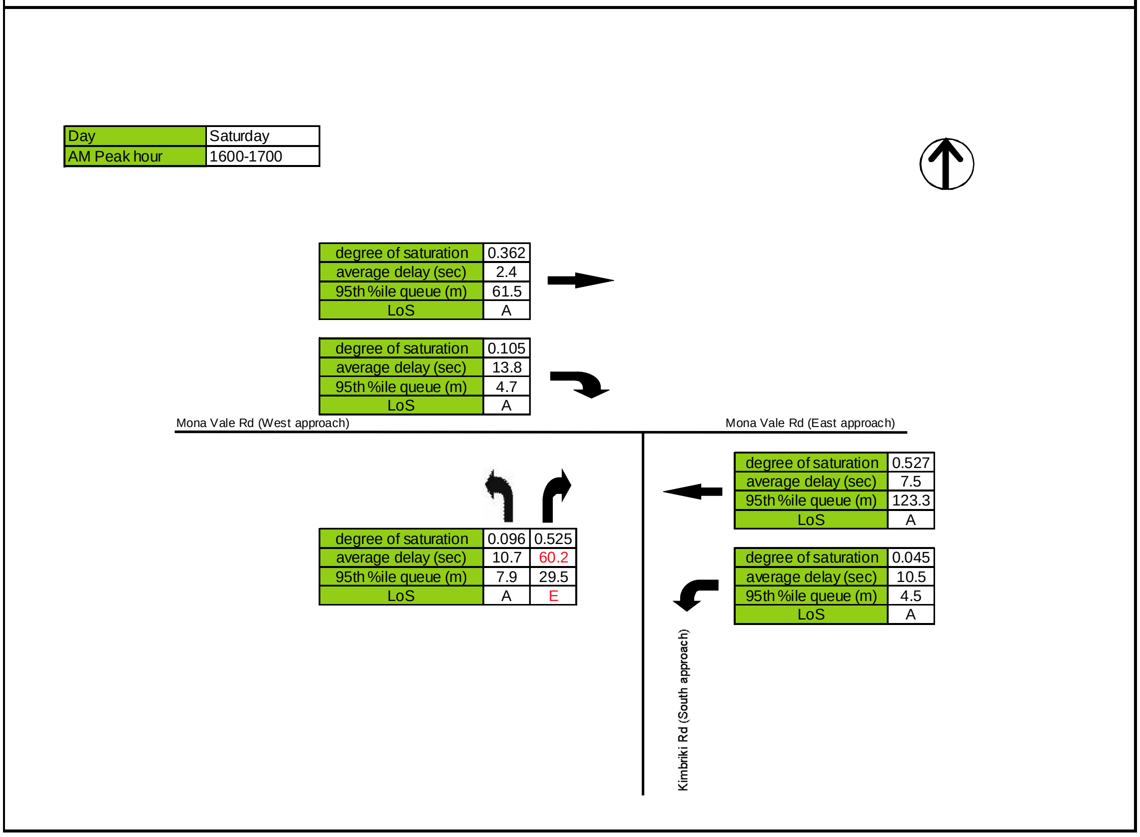


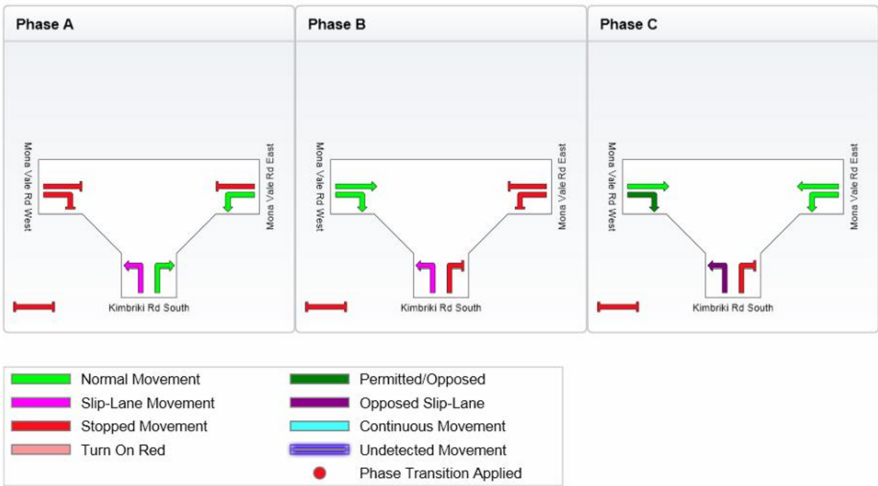
Table 5.2: SIDRA INTERSECTION Results – 2009 plus Operational Phase Traffic – Scenario 4

Day	Peak	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Weekday	AM	0.671	7.4	179.5	A
	Midday	0.368	6.3	81.3	A
	PM	0.525	6.4	118.5	A
Saturday	AM	0.328	5.4	70.5	A
	Midday	0.434	6.9	98.3	A
	PM	0.527	6.7	123.3	A

Figure 5.18: Scenario 4 Traffic Signal Phasing – Cycle time of 100 seconds

Phase Timing Results

Phase	A	B	C
Green Time (sec)	6	6	70
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	12	12	76
Phase Split	12 %	12 %	76 %



The key findings from the operational phase intersection modelling for Scenario 4 are as follows:

- As for Scenario 3, there is a balance between delays on Kimbriki Road and queue lengths/delays on Mona Vale Road. In order for Mona Vale Road to operate as efficiently as possible, a cycle time of 100 seconds or above would need to be adopted, which results in the level of service for the Kimbriki Road right-turn movement to be E or F due to average delays above 57 seconds across all of the peak periods.
- The 95th percentile queue length on Kimbriki Road across all of the peak periods is minimal due to the low traffic volumes.
- Due to the additional through traffic capacity on both approaches of Mona Vale Road, the 95th percentile queue lengths on the eastbound and westbound approaches are generally less than 100m, with the exception of the westbound approach on a weekday during the AM (179.5m) and PM (118.5m) peak hours.
- Table 5.2 indicates that the intersection could be expected to operate at an overall level of service A during each of the peak periods.
- The overall conclusion of this analysis is that the provision of traffic signal control at the intersection with duplicated lanes on Mona Vale Road would increase delays for westbound motorists using Mona Vale Road, but would resolve other safety issues.

5.3.3 Summary of Options Testing

The key findings from the four modelling scenarios are as follows:

i Banning right hand turns from Kimbriki Road during the AM peak, and undertaking associated roadworks to assist vehicles turning left would resolve the issues associated with the right-turn movement leaving the site.

ii Turn bans would be of limited benefit to the operation of the intersection as a whole during the AM peak hour, as there would not be any resultant improvements to the operation of other movements. In particular, there would still be some capacity and safety issues associated with the right turn from Mona Vale Road into Kimbriki Road during the AM peak. However, they do have road safety benefits by restricting vehicles from performing potentially unsafe manoeuvres.

iii Any increases in the capacity of the Mona Vale Road carriageway would adversely affect the operation of the intersection of Mona Vale Road and Kimbriki Road as an unsignalised priority-controlled intersection, particularly during the AM peak as follows:

- An increase in the capacity of the westbound approach of Mona Vale Road would result in unacceptable delays for the right turn movement into Kimbriki Road and the left turn movement into Mona Vale Road.
- It is more difficult for left-turning vehicles exiting the site as the continuous left-turn lane is lost to accommodate the departure lane for the additional westbound approach lane. As such, left-turning vehicles would be required to give-way to the high volume of westbound vehicles.
- Delays also increase for vehicles turning right into the site as they would be required to find an appropriate gap to enable crossing of two lanes instead of one lane in the current layout. The gap would need to be larger and would need to be available in both lanes, with fewer gaps available in this situation.

iv Traffic signals would not be a feasible treatment at Kimbriki Road without widening and duplication of Mona Vale Road. This is due to the unacceptably long queue lengths that could be expected on Mona Vale Road during the AM and PM peak periods.

v If Mona Vale Road were to be duplicated (i.e. two through lanes of traffic in each direction and turn bays for left and right turn movements into Kimbriki Road), the intersection of Mona Vale Road and Kimbriki Road would not operate satisfactorily without the provision of traffic signals.

vi The intersection of Mona Vale Road and Kimbriki Road could be expected to operate at an overall level of service A during each of the peak periods under traffic signal control, with some increases in delays and queuing for vehicles on the major carriageway of Mona Vale Road.

5.3.4 Mitigating Measures

The focus for Kimbriki Environmental Enterprises is on ensuring that the intersection of Mona Vale Road and Kimbriki Road operates efficiently and safely once the site is fully operational.

Based on the above summary, GTA recommends that action be taken to address the issues with right-turn movements expected to be experienced during the AM peak through a number of minor improvements, with a focus on the management of truck activity, with the following mitigating measures recommended for consideration:

Short-term (unsignalised intersection control)

To overcome the capacity issues for the right-turn movements into and out of Kimbriki Road and to minimise the impacts of the project during the operational phase on the intersection of Mona Vale Road and Kimbriki Road, the following restrictions on traffic movements would be implemented during the AM weekday peak period:

i Implement a right-turn ban for vehicles exiting the site between 7:00am and 9:00am on weekdays.

ii Encourage trucks to arrive at the site from the east, wherever possible.

iii Encourage trucks to arrive after 9:00am.

iv Encourage car-pooling as a method to reduce the number of worker vehicles entering the site during the AM peak.

It is assumed that the proposed intersection improvement works outlined in the EA to resolve the existing operational and safety issues at the intersection of Mona Vale Road and Kimbriki Road would be implemented in addition to the above measures.

Long-term (signalised intersection control)

i The RTA corridor strategy indicates that the adequacy of the capacity for the single lane sections between Mona Vale and Ingleside would be monitored, with the potential for future widening and capacity enhancements. Future widening of Mona Vale Road would include provision of at least two lanes in each direction, including turn bays for left- and right-turning vehicles.

In the event that duplication of Mona Vale Road occurs, it is recommended that traffic signal control be implemented at the intersection of Mona Vale Road and Kimbriki Road. Traffic signals would significantly improve safety as well as reduce delay for Kimbriki Road traffic.

5.4 Cyclists

Mona Vale Road performs the function as a regional bicycle route, with on-road bicycle shoulders provided along the majority of its length.

As for the construction phase, any proposed improvement works associated with Mona Vale Road should include provision for cyclists. As a minimum, sealed bicycle shoulder lanes should be provided at a minimum width of 2.0m, which is suitable for a road with a speed limit of 70km/h that carries a relatively high number of heavy vehicles. This would include incorporating bicycle facilities as part of an upgrade to the intersection of Mona Vale Road and Kimbriki Road as a signalised intersection.

5.5 Site Layout and Design

5.5.1 Site Access and Vehicle Circulation

GTA undertook swept path analysis for the proposed site layout as prepared by GHD to ensure that the nominated design vehicles can adequately and safely manoeuvre within the site.

The vehicles expected to use the site are as follows:

- Inbound material – standard kerbside collection vehicles, including rear loaders, from 4 tonne to 8.5 tonne (i.e. approx. 8-10m in length).
- Outbound material – truck-and-dogs, semi-trailers and B-Doubles (i.e. up to 26m in length).

The swept path plans are included in Appendix E, with the B-Double used to assess manoeuvrability at the access road and weighbridge.

It was found that the internal site layout is designed to satisfactorily accommodate the swept paths of the vehicles expected to access the site, including up to a 26m B-Double.

5.5.2 Car Park Layout

There are two car parks that are proposed to be provided on-site. This includes an upper car park on the north side of the site immediately west of the maturation area with capacity for 30 vehicles and a lower car park alongside the MRF building with capacity for 35 vehicles. These car parks would be designed in accordance with AS2890.1 Off-street Car Parking.

5.5.3 Pedestrian Movements

There would be a number of pedestrian desire lines within the site, including the following pedestrian movements:

- Between the staff car park and the AWT building
- Between the staff car park and the maturation building
- Between the AWT building and maturation building
- Between the AWT building and the amenities
- Between the maturation building and the amenities.

The principles for catering for pedestrians on site are as follows:

i Provide all-weather sealed pedestrian footpaths along the key desire lines.

ii Pedestrian crossing points of the internal site road network to be identified with signage.

iii At locations where there are high numbers of pedestrian crossing movements and vehicle speeds have the potential to be high, it would be appropriate to provide a marked crossing (i.e. zebra crossing) or raised platform crossing for safety purposes.

5.6 Parking Impact Appraisal

5.6.1 Council Parking Requirement

Division 5 of the Warringah LEP 2000 – Traffic, Access and Carparking – outlines the required car parking provisions for developments within the Warringah local government area. It states that adequate off-street car parking is to be provided within the subject property boundaries having regard to:

- the land use
- the hours of operation
- the availability of public transport
- the availability of alternative carparking
- the need for parking facilities for courier vehicles
- delivery/service vehicles and bicycles.

Schedule 17 of the WLEP outlines the parking rates for a range of land uses. In terms of the Kimbriki Resource Recovery Centre, the most appropriate land use would be Industrial or Warehouse, which both specify the following parking rate:

- 1.3 spaces per $100m^2$ GFA (including up to 20% of floor area as office space component. Office space component above 20% determined at office rate).

The proposed buildings for the Kimbriki Project include:

- AWT building – approximately 125m by 100m (i.e. 12,500m^2)
- Maturation/final processing building – approximately 100m by 100m (i.e. 10,000m^2)
- MRF building – approximately 55 m by 80 m (i.e. 4,400m^2).

Based on a rate of 1.3 spaces per 100m^2 GFA, this would equate to a requirement of up to 350 spaces, including 163 spaces associated with the AWT building, 130 spaces associated with the maturation building, and 57 spaces associated with the MRF building.

5.6.2 Empirical Assessment

GTA has undertaken an empirical assessment of the predicted parking demand based on the number of additional staff and visitors that would be generated by the increased site operations.

GHD has advised that there is expected to be up to 59 staff associated with the new site operations as follows:

- 26 at the AWT/Maturation building
- 30 at the MRF
- 3 additional at the landfill.

It is assumed that all staff would arrive by private vehicle, which would equate to a staff parking requirement of approximately 59 spaces.

There should also be on-site parking provision for visitors to the site, as well as some spaces to allow the storage of equipment or site vehicles. GHD has suggested a provision of four spaces for these activities.

In summary, the empirical assessment equates to an overall on-site parking requirement of 63 spaces.

5.6.3 Summary of Parking Requirement

The parking demand calculated using the WLEP rate is well in excess of the predicted parking demand based on proposed staff numbers. This is predominantly due to the fact that the 'warehouses' or 'industrial' land use does not accurately represent the characteristics of the Kimbriki project.

As such, it is recommended that the site provide parking for up to 63 vehicles.

5.6.4 Adequacy of Parking Supply

There is capacity to accommodate up to 65 vehicles on-site during the operational phase, including 30 spaces in the upper car park area and 35 vehicles in the lower car park. This is adequate to accommodate the expected peak car parking demand for the site of 63 spaces.

6. Mona Vale Road Traffic Volume Growth

6.1 Predicted Growth

The Mona Vale to Macquarie Park Corridor Strategy (RTA, 2009) provides forecast values for traffic volumes along Mona Vale Road in 2026 as a result of demographic and land use changes in the surrounding areas along the corridor.

It was estimated that there would be an additional 20,000 vehicles per day along the corridor. In the vicinity of Kimbriki Road, daily traffic volumes are expected to increase from 36,000 to 56,000 vehicles per day, which is an increase of 55%, or around 2.5% per annum.

These forecasts were applied to the existing eastbound and westbound volumes on Mona Vale Road recorded at the intersection of Mona Vale Road and Kimbriki Road, which the expected 2026 traffic volumes presented in Figure 6.1 and Figure 6.2.

Figure 6.1: 2026 Turning Movement Volumes – Weekday

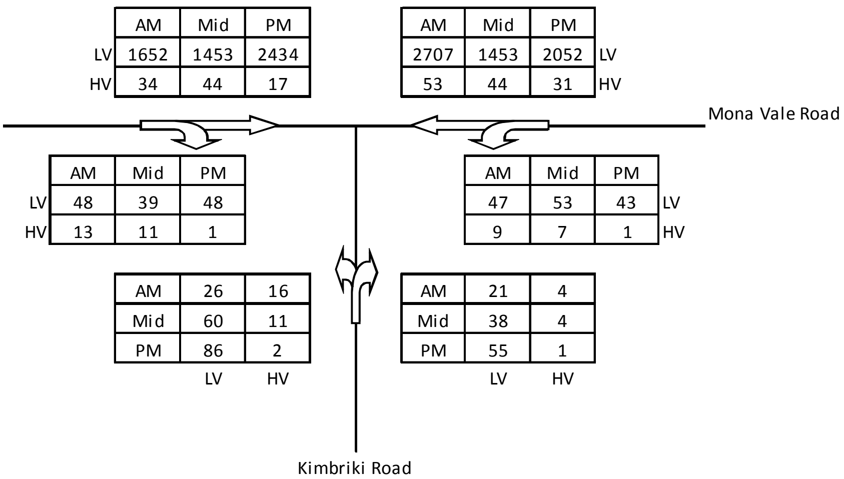
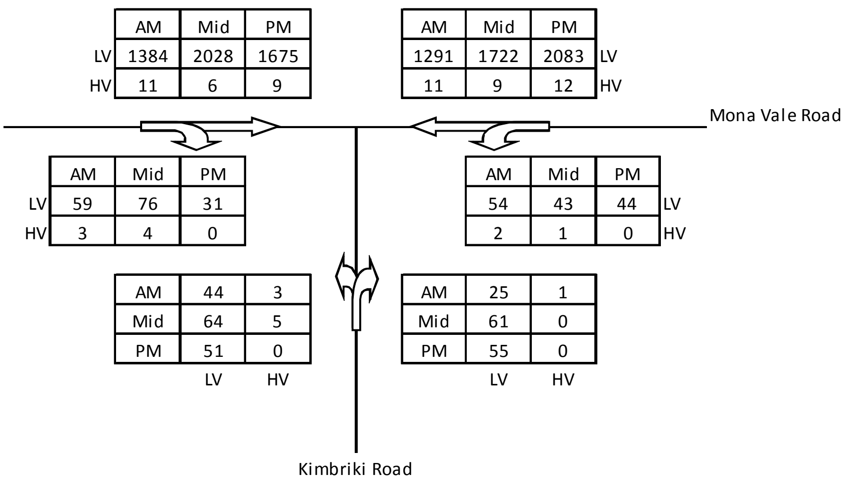


Figure 6.2: 2026 Turning Movement Volumes – Saturday



6.2 Traffic Modelling

The predicted future growth cannot be accommodated within the current road configuration without a combination of Mona Vale Road duplication and traffic signals, with capacity being exceeded within the single lane sections on Mona Vale Road. As such, the expected operation of the intersection in 2026 has been modelled for Scenario 4 only, which includes Mona Vale Road duplication to two through lanes in each direction plus short turn lanes on Mona Vale Road.

The traffic signal modelling using the 2009 base intersection data adopted a 100-second cycle time, which was typically appropriate for balancing the delays of the vehicles exiting Kimbriki Road as well as accommodating the major road through volumes along Mona Vale Road. However, in order to provide additional major road capacity and maximise green time for Mona Vale Road, the cycle times for the 2026 modelling were increased as follows:

- 150 seconds during AM weekday peak hour
- 140 seconds during the PM weekday and Saturday peak hours.

Figure 6.3, Figure 6.4 and Figure 6.5 present a summary of the expected operation of the Mona Vale Road/Kimbriki Road intersection during the operational phase for Scenario 4 in 2026, whilst Table 6.1 provides a summary of the operation of the intersection as a whole and Figure 6.6 and Figure 6.7 provide a summary of the traffic signal phasing.

The key findings from the 2026 modelling are as follows:

- The cycle times of up to 150 seconds are necessary to maximise the capacity for Mona Vale Road through traffic.
- The cycle times of 100 seconds and above result in relatively high average delays for vehicles turning right from Kimbriki Road (up to 89 seconds during the AM weekday peak). However, the delays are significantly lower than for an unsignalised layout and there is a greater level of safety due to the movement being fully controlled as part of a signalised intersection.
- The 95th percentile queue length on the western approach of Mona Vale Road is 531m, which is unacceptably long. The modelled queue length, together with the degree of saturation of 0.914, indicate that there is inadequate capacity on Mona Vale Road within the two westbound lanes to accommodate the predicted volume of traffic during the AM weekday peak.
- There are several other modelled peak hours where there are unacceptably long 95th percentile queue lengths on Mona Vale Road as follows:
  - Saturday Midday peak hour – 144m (eastbound) and 172m (westbound)
  - Thursday PM peak hour – 220m (eastbound) and 246m (westbound)
  - Saturday PM peak hour – 264m (westbound).

  The above queue lengths indicate there are capacity constraints on the Mona Vale Road carriageway, with the traffic signals contributing to restrictions on the ability for vehicles to travel along the corridor.
- Table 6.1 indicates that despite the long queues during some of the peak periods, the intersection could be expected to operate at an overall level of service A during each of the peak periods.

Figure 6.3: SIDRA INTERSECTION Results – 2026 plus Operational Phase Traffic (AM Peak Hour) – Scenario 4

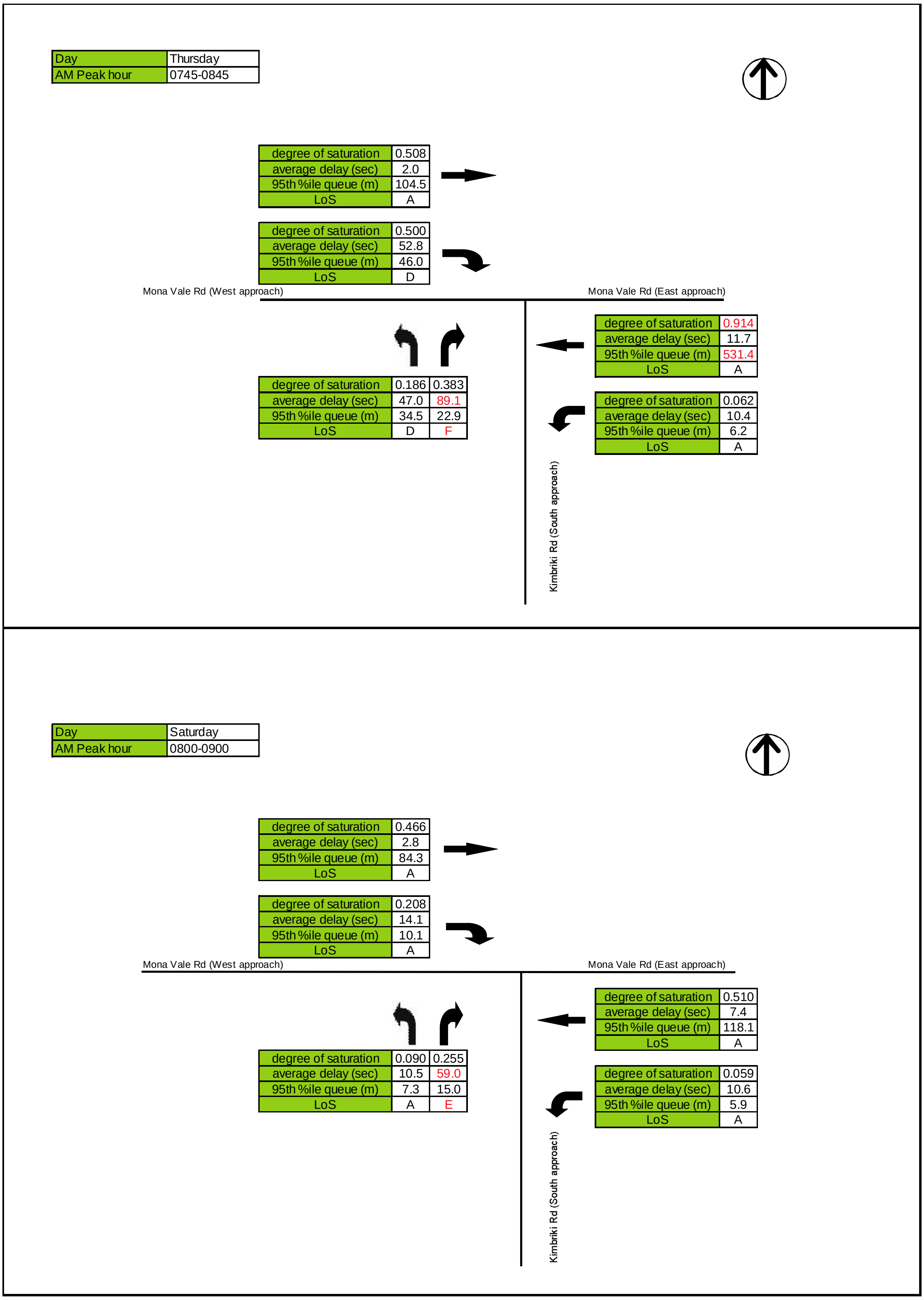


Figure 6.4: SIDRA INTERSECTION Results – 2026 plus Operational Phase Traffic (Midday Peak Hour) – Scenario 4

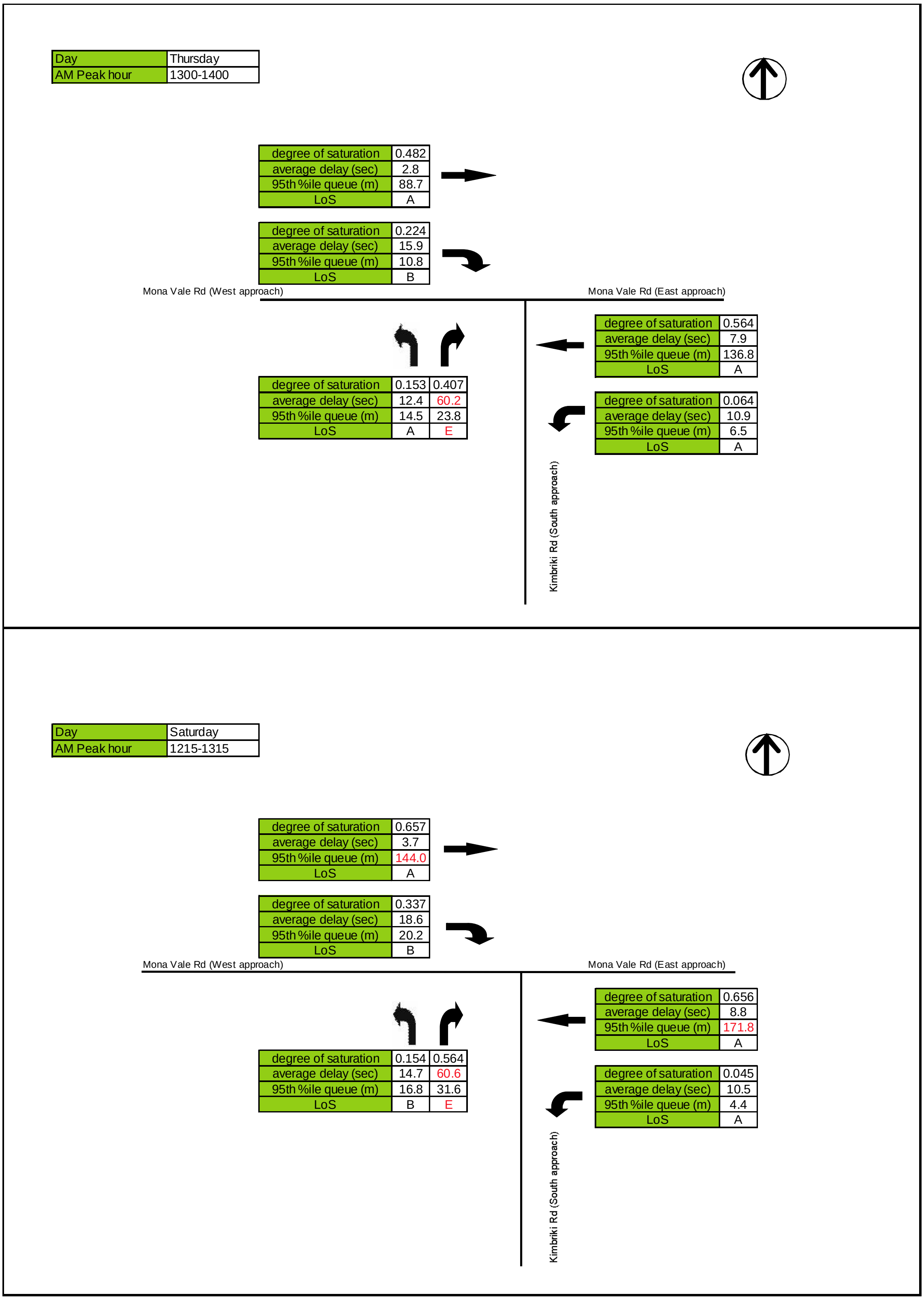


Figure 6.5: SIDRA INTERSECTION Results – 2026 plus Operational Phase Traffic (PM Peak Hour) – Scenario 4

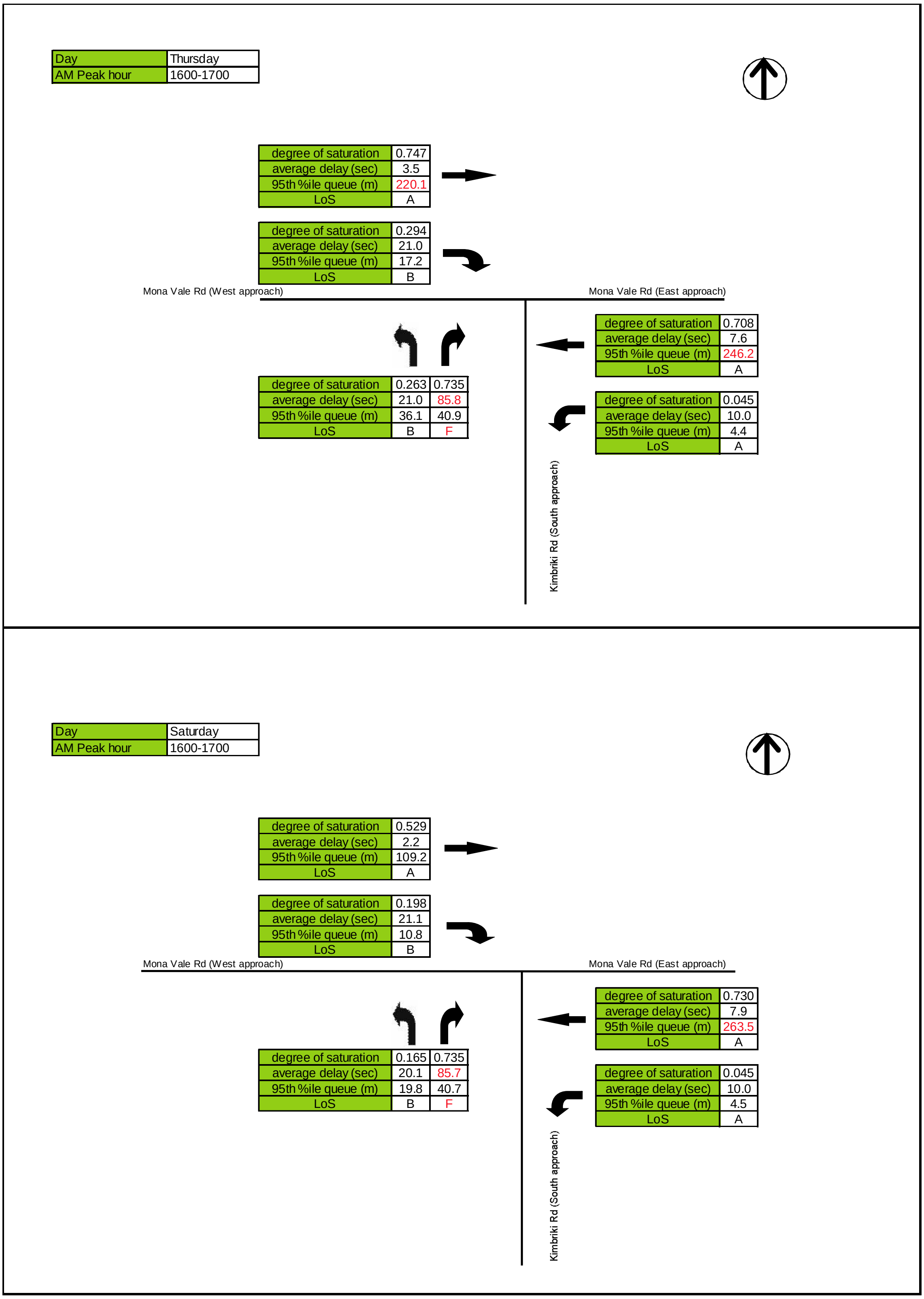


Table 6.1: SIDRA INTERSECTION Results – 2026 plus Operational Phase Traffic – Scenario 4

Day	Peak	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Weekday	AM	0.914	9.4	531.4	A
	Midday	0.564	6.5	136.8	A
	PM	0.747	6.8	246.2	A
Saturday	AM	0.510	5.9	118.1	A
	Midday	0.657	7.3	171.8	A
	PM	0.735	6.9	263.5	A

Figure 6.6: Scenario 4 Traffic Signal Phasing – Cycle time of 140 seconds

Phase Timing Results

Phase	A	B	C
Green Time (sec)	6	6	110
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	12	12	116
Phase Split	9 %	9 %	83 %

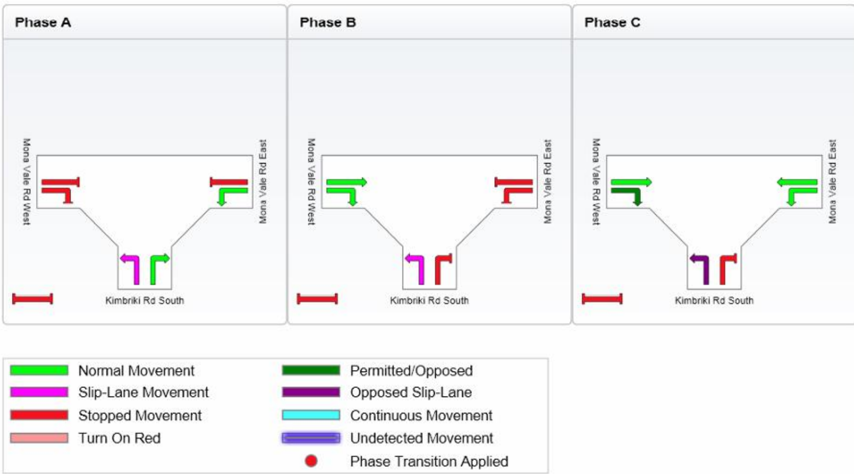
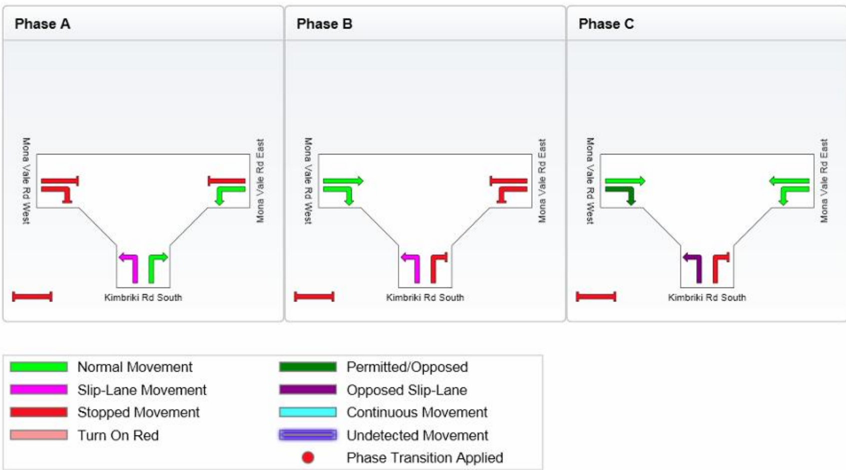


Figure 6.7: Scenario 4 Traffic Signal Phasing – Cycle time of 150 seconds

Phase Timing Results

Phase	A	B	C
Green Time (sec)	6	6	120
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	12	12	126
Phase Split	8 %	8 %	84 %



6.3 Mitigating Measures

By 2026, the RTA should increase the capacity of the single lane sections on Mona Vale Road between Mona Vale and Ingleside through duplication to at least two lanes in each direction. As part of the future widening, the intersection of Mona Vale Road and Kimbriki Road should be controlled by traffic signals.

Where there are capacity issues with the Mona Vale Road carriageway associated with two lanes in each direction, the RTA should consider other mitigating measures to increase road capacity, such as upgrade to include a third lane in one or both directions either along the whole length of the corridor or within the vicinity of signalised intersections. This would address the long 95th percentile queue lengths on Mona Vale Road during several of the modelled peak periods.

7. Conclusions and Recommendations

7.1 Existing Conditions

7.1.1 Conclusions

i The Mona Vale Road to Macquarie Park Corridor Strategy (RTA, 2009) confirms that there are wider traffic operation issues along the whole corridor from Mona Vale to Macquarie Park, suggesting that there are already capacity issues associated with existing operation. The two-lane section east of McCarrs Creek Road in the vicinity of Kimbriki Road has a volume to capacity ratio (VCR) of 1.1, and suggests that the road's capacity has been reached and expansion or other action is required.

ii The short-term (i.e. 2009-2014) priority for the RTA is to commence planning to enhance capacity and efficiency for light and heavy vehicles in the single lane sections between Ingleside and Terrey Hills, including the identification of corridor requirements.

iii GTA traffic counts of Mona Vale Road indicated the following:

- The AM peak period occurs between 6:00am and 10:00am (westbound/inbound dominant flow), with hourly flows of approximately 1,750 vehicles per hour between 7:00am and 9:00am for a single travel lane.
- The PM peak period occurs between 4:00pm and 7:00pm (eastbound/outbound dominant flow), with hourly flows of approximately 1,600 vehicles per hour for a single travel lane.

iv The key findings from the analysis of the existing conditions at the intersection of Mona Vale Road and Kimbriki Road are as follows:

- The intersection currently operates at its worst during the weekday AM peak hour, with the right-turn movement from Kimbriki Road into Mona Vale Road and the right-turn movement from Mona Vale Road into Kimbriki Road both operating at Level of Service F due to average delays in excess of 70 seconds.
- Whilst these delays are long, the low turning movements result in relatively short queues of less than 25m or 4 vehicles.
- During the midday and PM peak periods, these two right-turn movements operate satisfactorily at Level of Service B or C.
- High volumes of through traffic along Mona Vale Road, particularly in the westbound direction during the Thursday AM peak period, limit the number of appropriate gaps for right-turning vehicles to accept.
- Excessive delays can result in drivers seeking smaller and smaller gaps after waiting long periods of time, increasing the risk of cross-intersection crashes.
- The acceleration lane for westbound traffic turning left from Kimbriki Road into Mona Vale Road is of a sub-standard length to allow adequate acceleration to occur before merging with other westbound traffic on Mona Vale Road (refer to the ***RTA Road Design Guide, Section 4, Intersections at Grade*** and Appendix B).
- There is no physical protection within the intersection for right-turning vehicles travelling east on Mona Vale Road.

v Crash data for the most recent five-year period (2005 to 2009, inclusive) for the intersection of Mona Vale Road and Kimbriki Road, shows that there were a total of 15 crashes reported, including four casualty crashes and 11 non-casualty crashes. There were no fatal crashes reported.

vi There were a total of four casualty crashes at this location. This includes:

- Two rear-end crashes which occurred in the eastbound approach right-turn bay at the intersection.
- An off-path on straight and impact with an object crash occurred in the eastbound departure lane of Mona Vale Road approximately 50m east of Kimbriki Road.
- An off-path on curve and impact with an object crash occurred on the northbound approach to Kimbriki Road approximately 75m south of Mona Vale Road.

7.1.2 Recommendations

i To address some of the existing operational and safety issues at this intersection of Mona Vale Road and Kimbriki Road, including issues identified through the analysis of crash data, it is proposed to undertake improvements to the intersection as shown in Figure 3.13 to allow:

- A continuous westbound acceleration lane.
- An extended right turn bay on Mona Vale Road (linemarking adjustments only).
- Improvements to linemarking and provision of pavement skid-resistant surfacing.

It is noted that these proposed intersection works would improve the overall safety of the intersection for all vehicles, regardless of any impacts associated with changes to the operation of the Kimbriki site. These works would be completed prior to the construction phase of the project.

7.2 Construction Phase

7.2.1 Conclusions

i The construction period for the Kimbriki Resource Recovery Project is approximately 18 months, during which time construction would take place six days per week with a base level of approximately 40-50 workers for the majority of the construction period and a peak workforce of between 80 and 100 construction workers during specific activities such as during concrete pours. Work would typically take place during the following hours:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 7:00am to 1:00pm.

ii The peak number of daily vehicle movements is around 180 movements, or 90 trucks, per day on a weekday and around 90 movements, or 45 trucks, per day on a Saturday. This occurs for the first 10 months of the project during the excavation stage, with some overlap with the civil construction stage which commences in Month 5.

iii As well as the truck movements, there would also be an increase in light vehicle movements associated with construction workers. Typically the construction workforce of up to 100 persons would arrive at the site by car due to the lack of public transport services to suit construction hours. As such, there could be as many as 200 additional daily movements occurring due to staff arrivals and departures during peak times of specific activities, with up to 100 daily movements expected during the majority of the project construction period.

iv The key findings from modelling of the intersection of Mona Vale Road and Kimbriki Road during the construction phase are as follows:

- The intersection is expected to operate satisfactorily during the weekday midday and PM peak periods and the Saturday AM, midday and PM peak periods for typical and peak events.
- The intersection operation would be adversely affected during the AM weekday peak hour for typical and peak events, with the right-turn movement from Kimbriki Road into Mona Vale Road and the right-turn movement from Mona Vale Road into Kimbriki Road both operating at Level of Service F due to average delays in excess of 60 seconds.
- The degree of saturation for the right turn movement from Mona Vale Road into Kimbriki Road is greater than 1.0 during typical and peak construction activities, which indicates that the capacity is being exceeded. The results indicate that the capacity of this movement would match the demand during typical construction periods and would be exceeded by one vehicle during the peak events. This is reflected in the very high average delay of 258-261 seconds, or more than four minutes.
- There are a limited number of appropriate gaps for right-turning vehicles to accept due to high volumes of through traffic along Mona Vale Road, particularly in the westbound direction during the Thursday AM peak period.

v The car parks are expected to provide a combined supply of 65 parking spaces during construction. In order to accommodate the parking demands associated with construction staff during peak events, such as concrete pours, additional temporary parking spaces would be made available to accommodate the demand from up to 100 vehicles.

7.2.2 Recommendations

i Implement a right-turn ban from Kimbriki Road between 7:00am and 9:00am on weekdays, which would permit left turns only during this period.

ii As far as possible, schedule deliveries of construction materials outside the AM peak.

iii Encourage car-pooling, minibuses and other means to limit the number of construction worker vehicles entering the site during the AM peak.

iv Provide 'Trucks Turning' warning signage (Sign No. W5-205) on the Mona Vale Road approaches to Kimbriki Road.

7.3 Operational Phase

7.3.1 Conclusions

i The proposed development would result in an additional 79,087 heavy and light vehicle movements per annum, including 38,385 heavy vehicle movements and 40,702 light vehicle movements per annum. Taking into account some reductions in existing truck and small vehicle activity, this equates to a net increase of up to 145 truck movements and 141 light vehicle movements per day.

ii The increase in traffic is expected to occur predominantly on weekdays with a small proportion, mostly light vehicles, on Saturdays and Sundays.

iii The key findings from the operational phase intersection modelling for the existing intersection layout and the four modelled scenarios are as follows:

- The intersection is expected to operate satisfactorily during the weekday midday and PM peak periods and the Saturday AM, midday and PM peak periods.
- During the AM weekday peak hour, the intersection operation is expected to be adversely affected. The right-turn movement from Kimbriki Road into Mona Vale Road and the right-

turn movement from Mona Vale Road into Kimbriki Road would both operate at Level of Service F due to average delays in excess of 100 seconds.

- As well as unacceptably high delays, the two right turn movements are approaching capacity, particularly the right turn movement from Mona Vale Road into Kimbriki Road, which has a degree of saturation of 0.865.
- There are a limited number of appropriate gaps for right-turning vehicles to accept due to high volumes of through traffic along Mona Vale Road, particularly in the westbound direction during the Thursday AM peak period.
- Banning right hand turns from Kimbriki Road during the AM peak, and undertaking associated roadworks to assist vehicles turning left would resolve the issues associated with the right-turn movement leaving the site.
- Turn bans would be of limited benefit to the operation of the intersection as a whole during the AM peak hour, as there would not be any resultant improvements to the operation of other movements. In particular, there would still be some capacity and safety issues associated with the right turn from Mona Vale Road into Kimbriki Road during the AM peak. However, they do have road safety benefits by restricting vehicles from performing potentially unsafe manoeuvres.
- Any increases in the capacity of the Mona Vale Road carriageway would adversely affect the operation of the intersection of Mona Vale Road and Kimbriki Road in its current form as an unsignalised priority-controlled intersection, particularly during the AM peak as follows:
  - An increase in the capacity of the westbound approach of Mona Vale Road would result in unacceptable delays for the right turn movement into Kimbriki Road and the left turn movement into Mona Vale Road.
  - It would be more difficult for left-turning vehicles exiting the site as the continuous left-turn lane would be lost to accommodate the departure lane for the additional westbound approach lane. As such, left-turning vehicles would be required to give-way to the high volume of westbound vehicles.
  - Delays also increase for vehicles turning right into the site as they would be required to find an appropriate gap to enable crossing of two lanes instead of one lane in the current layout. The gap would need to be larger and would need to be available in both lanes, with fewer gaps available in this situation.
- Traffic signals would not be feasible at Kimbriki Road without widening and duplication of Mona Vale Road. This is due to the unacceptably long queue lengths that could be expected on Mona Vale Road during the AM and PM peak periods.
- If Mona Vale Road were to be duplicated (i.e. two through lanes of traffic in each direction and turn bays for left and right turn movements into Kimbriki Road), the intersection of Mona Vale Road and Kimbriki Road would not operate satisfactorily without the provision of traffic signals. In this situation, the intersection could be expected to operate at an overall level of service A during each of the peak periods under traffic signal control, with some increases in delays and queuing for vehicles on the major carriageway of Mona Vale Road.

iv The internal site layout is designed to satisfactorily accommodate the swept paths of the vehicles expected to access the site, including up to a 26m B-Double.

v There is proposed on-site parking of 65 spaces, which is adequate to meet the expected demand for the development of 63 spaces.

7.3.2 Recommendations

The focus for Kimbriki Environmental Enterprises is on ensuring that the intersection of Mona Vale Road and Kimbriki Road operates efficiently and safely once the site is fully operational. GTA recommends that action be taken to address the issues with right-turn movements expected to be experienced during the AM peak through a number of minor improvements, with a focus on the management of truck activity, with the following mitigating measures recommended for consideration:

i **Short-term (unsignalised intersection control):**

- Implement a right-turn ban for vehicles exiting the site between 7:00am and 9:00am on weekdays.
- Encourage trucks to arrive at the site from the east, wherever possible.
- Encourage trucks to arrive after 9:00am.
- Encourage car-pooling as a method to reduce the number of worker vehicles entering the site during the AM peak.

ii **Long-term (signalised intersection control):**

- The RTA corridor strategy indicates that the adequacy of the capacity for the single lane sections between Mona Vale and Ingleside would be monitored, with the potential for future widening and capacity enhancements. Future widening of Mona Vale Road would include provision of at least two lanes in each direction, including turn bays for left- and right-turning vehicles.

  In the event that duplication of Mona Vale Road occurs, it is recommended that traffic signal control be implemented at the intersection of Mona Vale Road and Kimbriki Road. Traffic signals would significantly improve safety as well as reduce delay for Kimbriki Road traffic.

iii Pedestrians should be accommodated on-site through the provision of all-weather sealed pedestrian footpaths along the key desire lines and signage to identify internal pedestrian crossing points.

iv Any works associated with Mona Vale Road should include provision for cyclists, due to its function as a regional bicycle route. As a minimum, sealed bicycle shoulder lanes should be provided at a width of 2.0m (minimum 1.75m), which is suitable for a road with a speed limit of 70km/h.

7.4 Long-term Future (2026)

7.4.1 Conclusions

i As detailed in the Mona Vale Road to Macquarie Park Corridor Strategy (RTA, 2009), it was estimated that there would be an additional 20,000 vehicles per day on Mona Vale Road as a result of demographic and land use changes in the surrounding areas along the corridor. In the vicinity of Kimbriki Road, daily traffic volumes are expected to increase from 36,000 to 56,000 vehicles per day, which is an increase of 55%, or around 2.5% per annum.

ii Traffic modelling of mid-block traffic operation for the corridor in 2016 and 2026 forecasts that peak demand will exceed the capacity of the road network on the section between Ingleside and McCarrs Creek Road (i.e. in the vicinity of Kimbriki Road), which has a forecast level of service F for 2016 and 2026.

iii SIDRA modelling for the intersection of Mona Vale Road and Kimbriki Road in 2026 indicates that there are unacceptably long 95th percentile queue lengths on the westbound and eastbound approaches of Mona Vale Road. This indicates that there would be capacity constraints on the Mona Vale Road carriageway in 2026 associated with a four-lane divided carriageway, with the traffic signals contributing to restrictions on the ability for vehicles to travel along the corridor.

7.4.2 Recommendations

i An increase in road capacity between Ingleside and Terrey Hills would be needed in the medium term in order to support growing demand in this section of the corridor which already experiences issues with capacity. As such, by 2026, the RTA should increase the capacity of the single lane sections on Mona Vale Road between Mona Vale and Ingleside through duplication to at least two lanes in each direction.

ii As part of the future widening, the intersection of Mona Vale Road and Kimbriki Road should be controlled by traffic signals.

iii Signal cycle times of up to 150 seconds at the intersection of Mona Vale Road and Kimbriki Road would be necessary to maximise the capacity for Mona Vale Road through traffic.

iv Where there are capacity issues with the Mona Vale Road carriageway associated with two lanes in each direction, the RTA should consider other mitigating measures to increase road capacity, such as upgrade to include a third lane in one or both directions either along the whole length of the corridor or within the vicinity of signalised intersections. This would address the long 95th percentile queue lengths on Mona Vale Road during several of the modelled peak periods.

7.5 Summary of Key Actions

In summary, the following three points outline the key findings and actions for the project in relation to the project and the intersection of Mona Vale Road and Kimbriki Road:

i Short term measures to redesign the current layout of the intersection should be undertaken immediately to address the existing operational and safety issues.

ii During construction, the safe operation of the intersection should be controlled through the management of truck arrivals and departures, including timing and origin-destination, as well as through the use of a right-turn ban from Kimbriki Road during the AM peak hours.

iii By 2026, the RTA should increase the capacity of the single lane sections on Mona Vale Road between Mona Vale and Ingleside through duplication to at least two lanes in each direction. As part of the future widening, the intersection of Mona Vale Road and Kimbriki Road should be controlled by traffic signals in order to significantly improve safety as well as reduce delay for Kimbriki Road traffic.

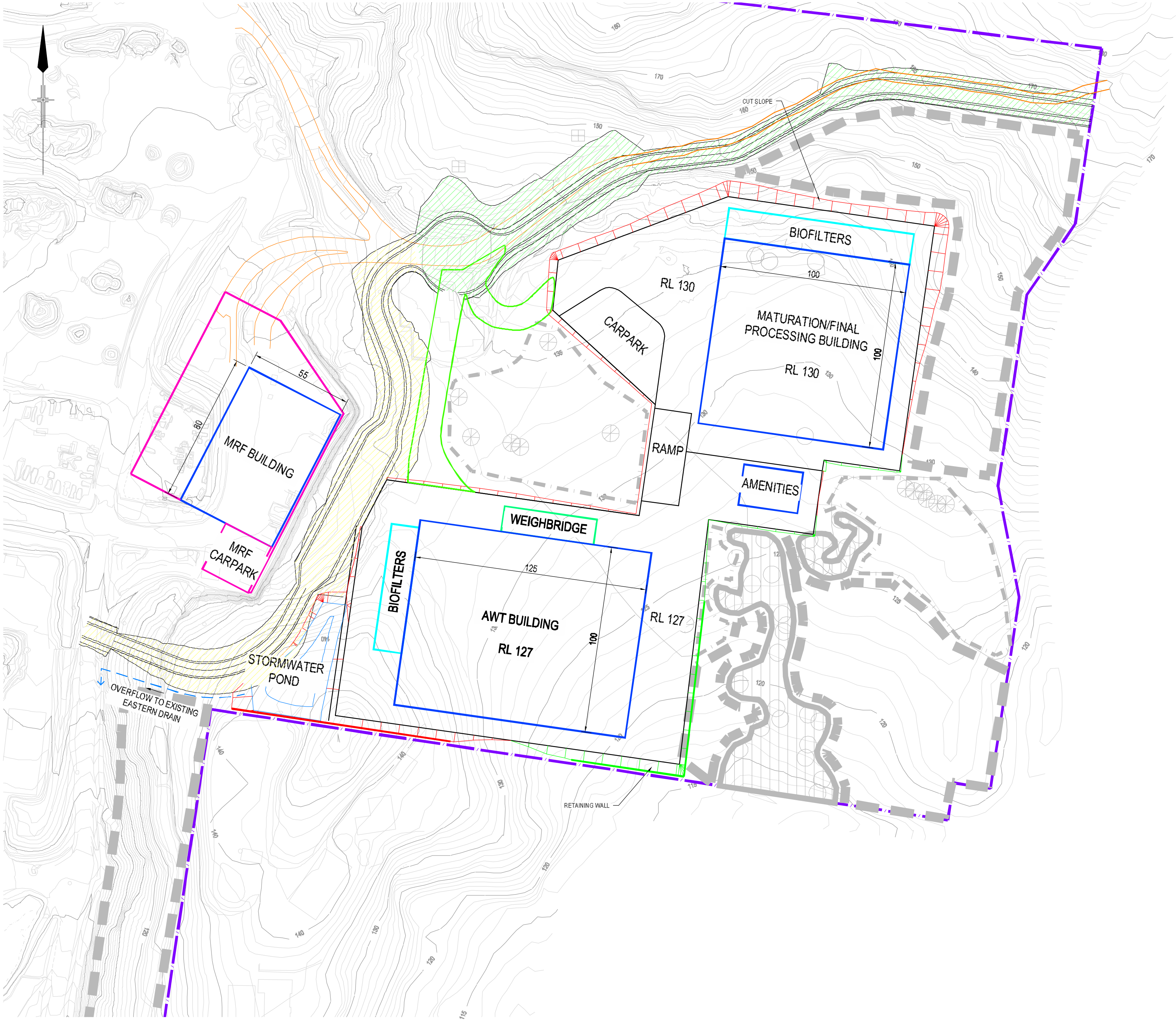
Appendix A

Project Plans

0 20 40 60 80 100m
SCALE 1:2000 AT ORIGINAL SIZE

LEGEND

- PROPOSED DEVELOPMENT AREA
- PROPOSED ROAD
- PROPOSED BUILDING
- PROPOSED WEIGHBRIDGE
- PROPOSED BIOFILTER



LEGEND

EXISTING SURFACE
EXISTING ACCESS TRACK
KIMBRIKI SITE BOUNDARY
PROPOSED BUILDING SLAB
PROPOSED ACCESS ROADS
PROPOSED CUT BATTER
PROPOSED FILL BATTER
FUTURE SITE ACCESS & WEIGHBRIDGE (SEPARATE APPROVAL
ROAD UPGRADING WORKS (SEPARATE APPROVAL)
TETRATHECA GLANDULOSA RETAINED
EUCALYPTUS LEUHMANNIANA RETAINED
NATIVE VEGETATION RETAINED

THREATENED FLORA & SIGNIFICANT VEGETATION

TETRATHECA GLANDULOSA
EUCALYPTUS LEUHMANNIANA
BORONIA SERRULATA

NOTES:

1. BASED ON DECEMBER 2009 SURVEY

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
D	BUILDINGS REVISED	DG	02.09.10
C	MATURATION AREA REDUCED	DG	27.8.10

KIMBRIKI ENVIRONMENTAL ENTERPRISES
KIMBRIKI RESOURCE RECOVERY PROJECT
AWT & MRF CONCEPT DESIGN
SITE LAYOUT - ALL WORKS

GHD CLIENTS | PEOPLE | PERFORMANCE

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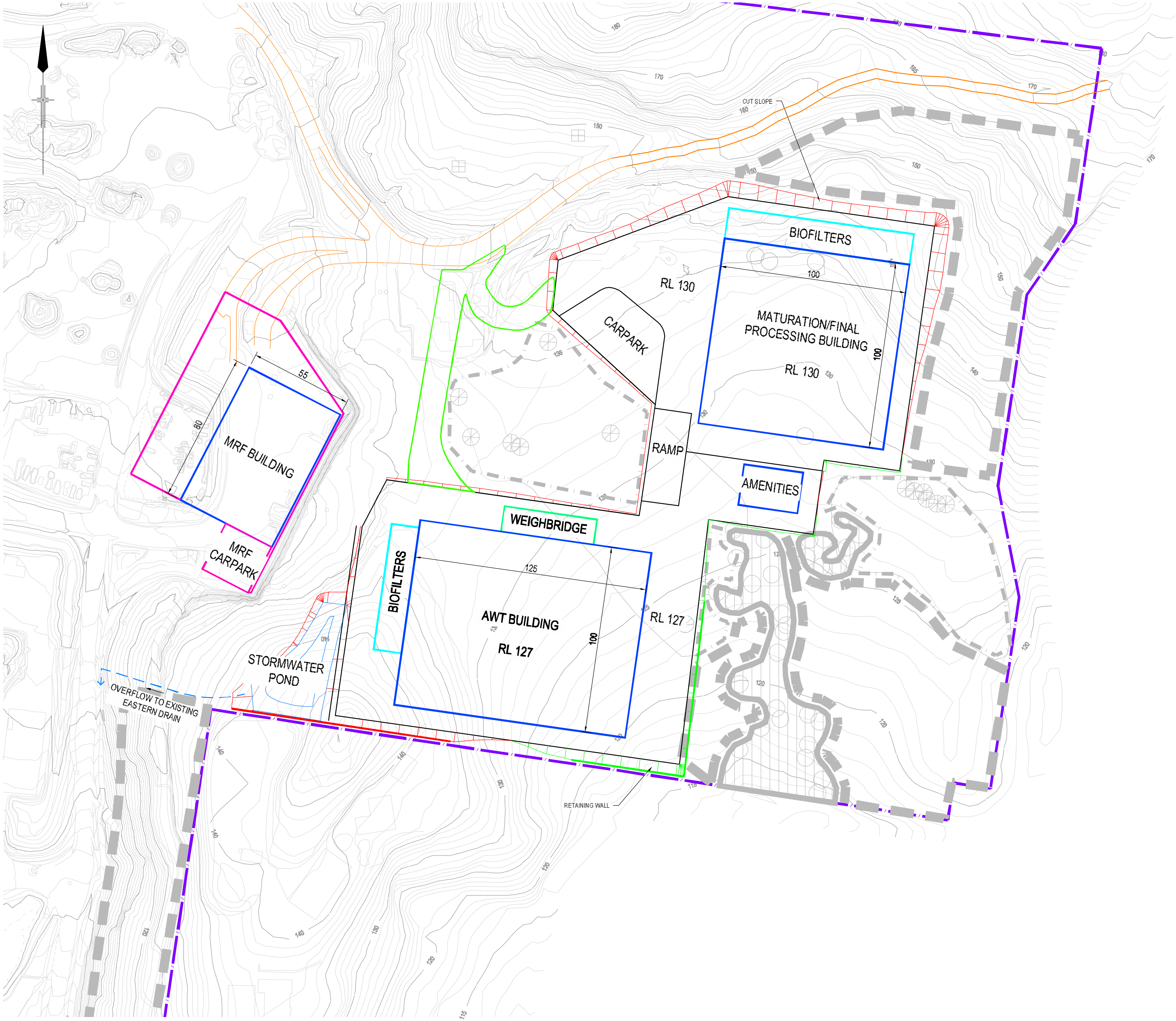
scale 1:1000 for A1 | job no. 21-19757
date SEPT 2010 | rev no. D
approved SK107



LEGEND

- EXISTING SURFACE
- EXISTING ACCESS TRACK
- KIMBRIKI SITE BOUNDARY
- PROPOSED BUILDING SLAB
- PROPOSED ACCESS ROADS
- PROPOSED CUT BATTER
- PROPOSED FILL BATTER
- TETRATHECA GLANDULOSA RETAINED
- EUCALYPTUS LEUHMANNIANA RETAINED
- NATIVE VEGETATION RETAINED

THREATENED FLORA & SIGNIFICANT VEGETATION

- TETRATHECA GLANDULOSA
- EUCALYPTUS LEUHMANNIANA
- BORONIA SERRULATA

NOTES:

1. BASED ON DECEMBER 2009 SURVEY

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	DG	02.09.10

KIMBRIKI ENVIRONMENTAL ENTERPRISES
KIMBRIKI RESOURCE RECOVERY PROJECT
AWT & MRF CONCEPT DESIGN
SITE LAYOUT - RRF WORKS

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scale	1:1000 for A1	job no.	21-19757
date	SEPT 2010	rev no.	A

approved ....

SK110

Plot Date: 2 September 2010 - 6:01 PM Plotted by: Alison J Horlyck/Sydney/GHD/AU Cad File No: G:\21\19757\CADD\Drawings\21-19757-SK107.dwg

Appendix B

Intersection Counts and 24-hour/7-day Tube Counts

R.O.A.R. DATA
Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849, Mob.0418-239019

Client : GTA Consultants
Job No/Name : 2905 Terrey Hills Kimbriki Rd Counts
Day/Date : Thursday 26th November 2009

Lights

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Time Per	T	R	L	R	L	T	TOT
0700 - 0715	237	10	5	1	12	452	**717**
0715 - 0730	248	5	15	12	11	412	**703**
0730 - 0745	261	4	12	9	7	424	**717**
0745 - 0800	260	7	5	2	5	449	**728**
0800 - 0815	241	8	9	8	9	429	**704**
0815 - 0830	289	4	4	5	5	415	**722**
0830 - 0845	272	13	7	6	12	447	**757**
0845 - 0900	271	11	18	6	13	404	**723**
Per End	**2079**	**62**	**75**	**49**	**74**	**3432**	**5771**

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Time Per	T	R	L	R	L	T	TOT
0700 - 0715	10	0	1	0	2	4	**17**
0715 - 0730	8	2	2	0	0	5	**17**
0730 - 0745	3	1	2	0	0	6	**12**
0745 - 0800	6	3	3	0	1	7	**20**
0800 - 0815	5	2	1	0	1	7	**16**
0815 - 0830	9	2	3	0	2	8	**24**
0830 - 0845	2	1	3	2	0	12	**20**
0845 - 0900	3	0	0	0	0	8	**11**
Per End	**46**	**11**	**15**	**2**	**6**	**57**	**137**

Combined

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Time Per	T	R	L	R	L	T	TOT
0700 - 0715	247	10	6	1	14	456	**734**
0715 - 0730	256	7	17	12	11	417	**720**
0730 - 0745	264	5	14	9	7	430	**729**
0745 - 0800	266	10	8	2	6	456	**748**
0800 - 0815	246	10	10	8	10	436	**720**
0815 - 0830	298	6	7	5	7	423	**746**
0830 - 0845	274	14	10	8	12	459	**777**
0845 - 0900	274	11	18	6	13	412	**734**
Per End	**2125**	**73**	**90**	**51**	**80**	**3489**	**5908**

Lights

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Peak Per	T	R	L	R	L	T	TOT
0700 - 0800	1006	26	37	24	35	1737	**2865**
0715 - 0815	1010	24	41	31	32	1714	**2852**
0730 - 0830	1051	23	30	24	26	1717	**2871**
0745 - 0845	1062	32	25	21	31	1740	**2911**
0800 - 0900	1073	36	38	25	39	1695	**2906**
PEAK HR	**1062**	**32**	**25**	**21**	**31**	**1740**	**2911**

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Peak Per	T	R	L	R	L	T	TOT
0700 - 0800	27	6	8	0	3	22	**66**
0715 - 0815	22	8	8	0	2	25	**65**
0730 - 0830	23	8	9	0	4	28	**72**
0745 - 0845	22	8	10	2	4	34	**80**
0800 - 0900	19	5	7	2	3	35	**71**
PEAK HR	**22**	**8**	**10**	**2**	**4**	**34**	**80**

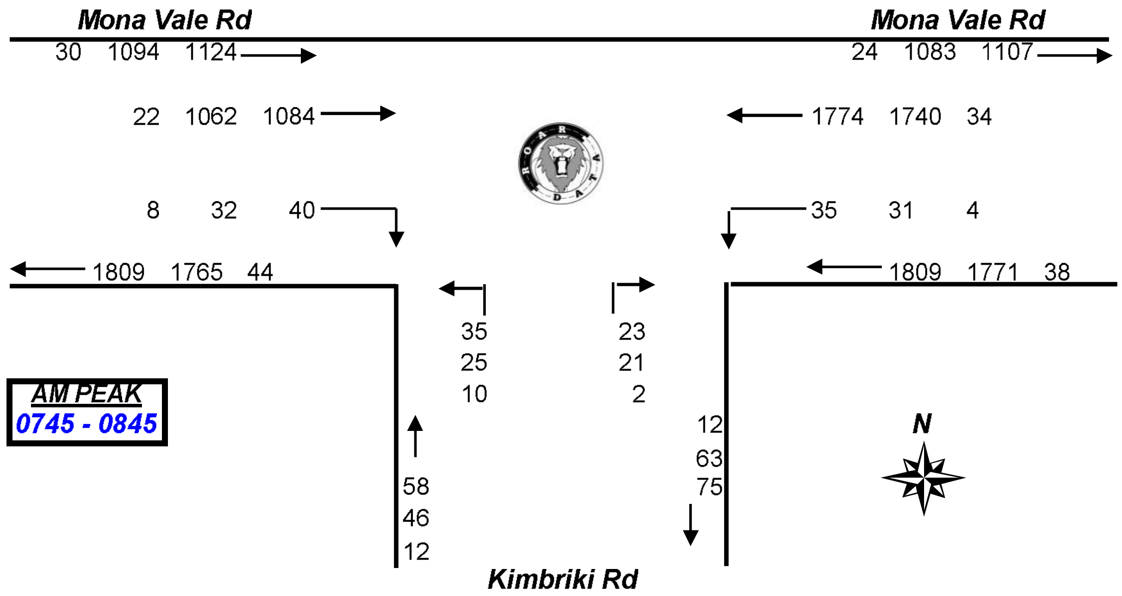
Combined

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Peak Per	T	R	L	R	L	T	TOT
0700 - 0800	1033	32	45	24	38	1759	**2931**
0715 - 0815	1032	32	49	31	34	1739	**2917**
0730 - 0830	1074	31	39	24	30	1745	**2943**
0745 - 0845	1084	40	35	23	35	1774	**2991**
0800 - 0900	1092	41	45	27	42	1730	**2977**
PEAK HR	**1084**	**40**	**35**	**23**	**35**	**1774**	**2991**

Peds

	WEST	SOUTH	EAST	
Time Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
0700 - 0715				**0**
0715 - 0730		NOT		**0**
0730 - 0745		REQUIRED		**0**
0745 - 0800				**0**
0800 - 0815				**0**
0815 - 0830				**0**
0830 - 0845				**0**
0845 - 0900				**0**
Per End	**0**	**0**	**0**	**0**

	WEST	SOUTH	EAST	
Peak Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
0700 - 0800	0	0	0	**0**
0715 - 0815	0	0	0	**0**
0730 - 0830	0	0	0	**0**
0745 - 0845	0	0	0	**0**
0800 - 0900	0	0	0	**0**
PEAK HR	**0**	**0**	**0**	**0**



AM PEAK
0745 - 0845

R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Fax 88196849, Mob.0418-239019

Client : GTA Consultants
Job No/Name : 2905 Terre
Day/Date : Thursday 26th November 2009

Lights

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Time Per	T	R	L	R	L	T	TOT
1200 - 1215	225	19	15	7	17	216	499
1215 - 1230	219	16	18	10	12	254	529
1230 - 1245	243	19	18	8	12	210	510
1245 - 1300	198	13	18	14	8	181	432
1300 - 1315	240	9	17	13	9	211	499
1315 - 1330	241	9	14	6	11	253	534
1330 - 1345	213	10	12	6	15	220	476
1345 - 1400	240	10	16	12	17	250	545
Per End	1819	105	128	76	101	1795	4024

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Time Per	T	R	L	R	L	T	TOT
1200 - 1215	6	1	1	0	1	7	16
1215 - 1230	6	0	1	1	0	9	17
1230 - 1245	6	1	0	0	1	4	12
1245 - 1300	7	1	2	0	0	3	13
1300 - 1315	8	1	0	0	0	4	13
1315 - 1330	7	0	1	0	0	13	21
1330 - 1345	4	2	2	0	0	5	13
1345 - 1400	9	2	1	0	1	6	19
Per End	53	8	8	1	3	51	124

Combined

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Time Per	T	R	L	R	L	T	TOT
1200 - 1215	231	20	16	7	18	223	515
1215 - 1230	225	16	19	11	12	263	546
1230 - 1245	249	20	18	8	13	214	522
1245 - 1300	205	14	20	14	8	184	445
1300 - 1315	248	10	17	13	9	215	512
1315 - 1330	248	9	15	6	11	266	555
1330 - 1345	217	12	14	6	15	225	489
1345 - 1400	249	12	17	12	18	256	564
Per End	1872	113	136	77	104	1846	4148

Lights

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Peak Per	T	R	L	R	L	T	TOT
1200 - 1300	885	67	69	39	49	861	1970
1215 - 1315	900	57	71	45	41	856	1970
1230 - 1330	922	50	67	41	40	855	1975
1245 - 1345	892	41	61	39	43	865	1941
1300 - 1400	934	38	59	37	52	934	2054
PEAK HR	934	38	59	37	52	934	2054

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Peak Per	T	R	L	R	L	T	TOT
1200 - 1300	25	3	4	1	2	23	58
1215 - 1315	27	3	3	1	1	20	55
1230 - 1330	28	3	3	0	1	24	59
1245 - 1345	26	4	5	0	0	25	60
1300 - 1400	28	5	4	0	1	28	66
PEAK HR	28	5	4	0	1	28	66

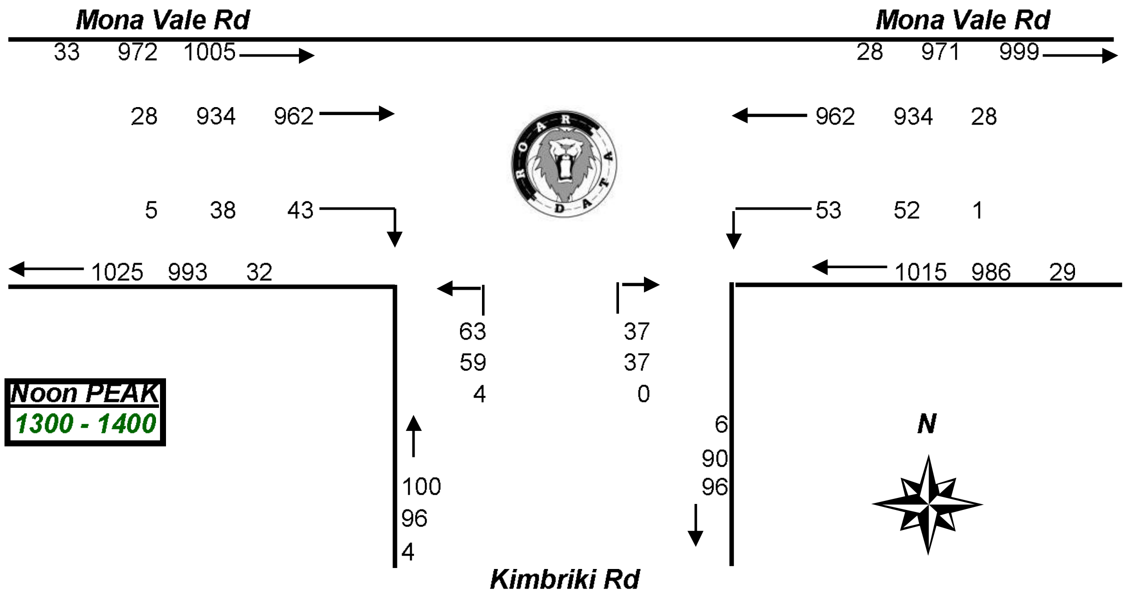
Combined

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Peak Per	T	R	L	R	L	T	TOT
1200 - 1300	910	70	73	40	51	884	2028
1215 - 1315	927	60	74	46	42	876	2025
1230 - 1330	950	53	70	41	41	879	2034
1245 - 1345	918	45	66	39	43	890	2001
1300 - 1400	962	43	63	37	53	962	2120
PEAK HR	962	43	63	37	53	962	2120

Peds

	WEST	SOUTH	EAST	
Time Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
1200 - 1215				0
1215 - 1230		NOT		0
1230 - 1245		REQUIRED		0
1245 - 1300				0
1300 - 1315				0
1315 - 1330				0
1330 - 1345				0
1345 - 1400				0
Per End	0	0	0	0

	WEST	SOUTH	EAST	
Peak Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
1200 - 1300	0	0	0	0
1215 - 1315	0	0	0	0
1230 - 1330	0	0	0	0
1245 - 1345	0	0	0	0
1300 - 1400	0	0	0	0
PEAK HR	0	0	0	0



R.O.A.R. DATA
Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849, Mob.0418-239019

Client : GTA Consultants
Job No/Name : 2905 Terrey Hills Kimbriki Rd Counts
Day/Date : Thursday 26th November 2009

Lights

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Time Per	T	R	L	R	L	T	TOT
1600 - 1615	369	18	16	10	17	314	744
1615 - 1630	353	11	18	15	11	343	751
1630 - 1645	440	11	15	10	9	312	797
1645 - 1700	403	7	17	10	5	350	792
1700 - 1715	409	0	15	12	0	313	749
1715 - 1730	377	1	2	6	1	340	727
1730 - 1745	419	1	1	0	0	345	766
1745 - 1800	413	1	2	0	0	285	701
Per End	3183	50	86	63	43	2602	6027

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Time Per	T	R	L	R	L	T	TOT
1600 - 1615	5	0	1	0	0	7	13
1615 - 1630	3	0	0	0	0	6	9
1630 - 1645	2	0	0	0	0	6	8
1645 - 1700	1	0	0	0	0	1	2
1700 - 1715	1	1	0	0	0	2	4
1715 - 1730	1	0	0	0	0	5	6
1730 - 1745	2	0	0	0	0	0	2
1745 - 1800	2	0	0	0	0	2	4
Per End	17	1	1	0	0	29	48

Combined

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Time Per	T	R	L	R	L	T	TOT
1600 - 1615	374	18	17	10	17	321	757
1615 - 1630	356	11	18	15	11	349	760
1630 - 1645	442	11	15	10	9	318	805
1645 - 1700	404	7	17	10	5	351	794
1700 - 1715	410	1	15	12	0	315	753
1715 - 1730	378	1	2	6	1	345	733
1730 - 1745	421	1	1	0	0	345	768
1745 - 1800	415	1	2	0	0	287	705
Per End	3200	51	87	63	43	2631	6075

Lights

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Peak Per	T	R	L	R	L	T	TOT
1600 - 1700	1565	47	66	45	42	1319	3084
1615 - 1715	1605	29	65	47	25	1318	3089
1630 - 1730	1629	19	49	38	15	1315	3065
1645 - 1745	1608	9	35	28	6	1348	3034
1700 - 1800	1618	3	20	18	1	1283	2943
PEAK HR	1565	47	66	45	42	1319	3084

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Peak Per	T	R	L	R	L	T	TOT
1600 - 1700	11	0	1	0	0	20	32
1615 - 1715	7	1	0	0	0	15	23
1630 - 1730	5	1	0	0	0	14	20
1645 - 1745	5	1	0	0	0	8	14
1700 - 1800	6	1	0	0	0	9	16
PEAK HR	11	0	1	0	0	20	32

Combined

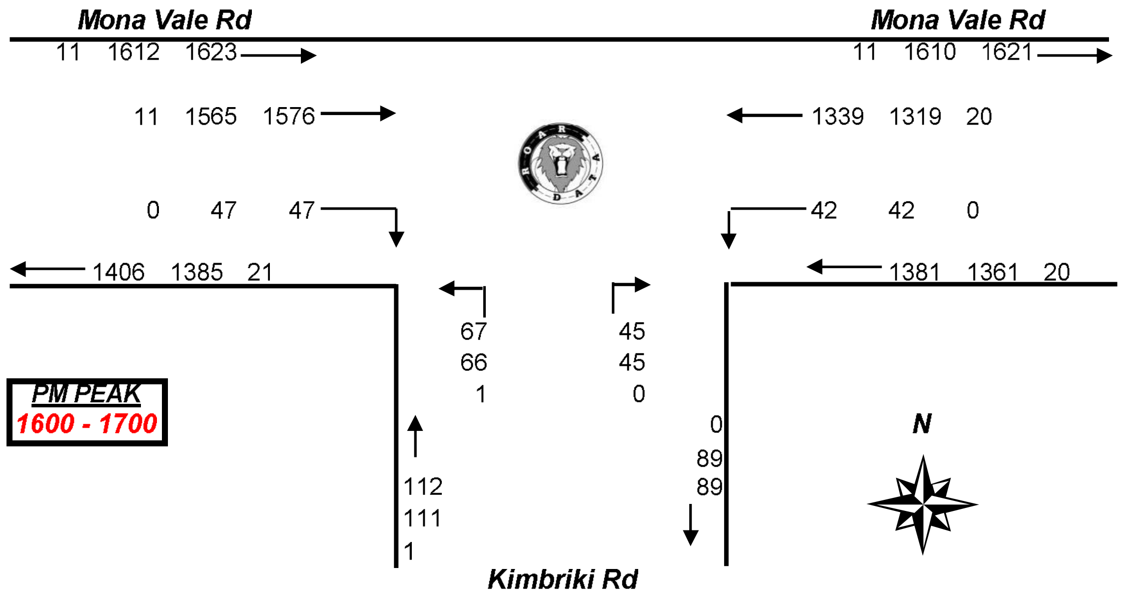
	WEST		SOUTH		EAST		
	Mona Vale		Kimbriki Rd		Mona Vale		
Peak Per	T	R	L	R	L	T	TOT
1600 - 1700	1576	47	67	45	42	1339	3116
1615 - 1715	1612	30	65	47	25	1333	3112
1630 - 1730	1634	20	49	38	15	1329	3085
1645 - 1745	1613	10	35	28	6	1356	3048
1700 - 1800	1624	4	20	18	1	1292	2959
PEAK HR	1576	47	67	45	42	1339	3116

Peds

	WEST	SOUTH	EAST	
Time Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
1600 - 1615				0
1615 - 1630		NOT		0
1630 - 1645		REQUIRED		0
1645 - 1700				0
1700 - 1715				0
1715 - 1730				0
1730 - 1745				0
1745 - 1800				0
Per End	0	0	0	0

	WEST	SOUTH	EAST	
Peak Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
1600 - 1700	0	0	0	0
1615 - 1715	0	0	0	0
1630 - 1730	0	0	0	0
1645 - 1745	0	0	0	0
1700 - 1800	0	0	0	0
PEAK HR	0	0	0	0

PM PEAK
1600 - 1700



R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Fax 88196849, Mob.0418-239019

Client : GTA Consultants
Job No/Name : 2905 Terrey Hills Kimbriki Rd Counts
Day/Date : Saturday 28th November 2009

Lights

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Time Per	T	R	L	R	L	T	TOT
0700 - 0715	127	7	4	3	5	129	275
0715 - 0730	143	7	4	6	10	145	315
0730 - 0745	146	7	8	5	7	160	333
0745 - 0800	194	5	10	7	8	208	432
0800 - 0815	201	10	9	6	9	192	427
0815 - 0830	207	11	9	4	10	208	449
0830 - 0845	226	10	14	6	12	223	491
0845 - 0900	256	12	11	9	7	207	502
Per End	1500	69	69	46	68	1472	3224

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Time Per	T	R	L	R	L	T	TOT
0700 - 0715	3	0	0	0	0	1	4
0715 - 0730	0	0	0	0	0	1	1
0730 - 0745	2	0	0	0	1	5	8
0745 - 0800	1	0	0	1	0	4	6
0800 - 0815	4	0	0	0	0	3	7
0815 - 0830	1	1	0	1	1	1	5
0830 - 0845	1	1	1	0	0	2	5
0845 - 0900	1	0	1	0	0	1	3
Per End	13	2	2	2	2	18	39

Combined

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Time Per	T	R	L	R	L	T	TOT
0700 - 0715	130	7	4	3	5	130	279
0715 - 0730	143	7	4	6	10	146	316
0730 - 0745	148	7	8	5	8	165	341
0745 - 0800	195	5	10	8	8	212	438
0800 - 0815	205	10	9	6	9	195	434
0815 - 0830	208	12	9	5	11	209	454
0830 - 0845	227	11	15	6	12	225	496
0845 - 0900	257	12	12	9	7	208	505
Per End	1513	71	71	48	70	1490	3263

Lights

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Peak Per	T	R	L	R	L	T	TOT
0700 - 0800	610	26	26	21	30	642	1355
0715 - 0815	684	29	31	24	34	705	1507
0730 - 0830	748	33	36	22	34	768	1641
0745 - 0845	828	36	42	23	39	831	1799
0800 - 0900	890	43	43	25	38	830	1869
PEAK HR	890	43	43	25	38	830	1869

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Peak Per	T	R	L	R	L	T	TOT
0700 - 0800	6	0	0	1	1	11	19
0715 - 0815	7	0	0	1	1	13	22
0730 - 0830	8	1	0	2	2	13	26
0745 - 0845	7	2	1	2	1	10	23
0800 - 0900	7	2	2	1	1	7	20
PEAK HR	7	2	2	1	1	7	20

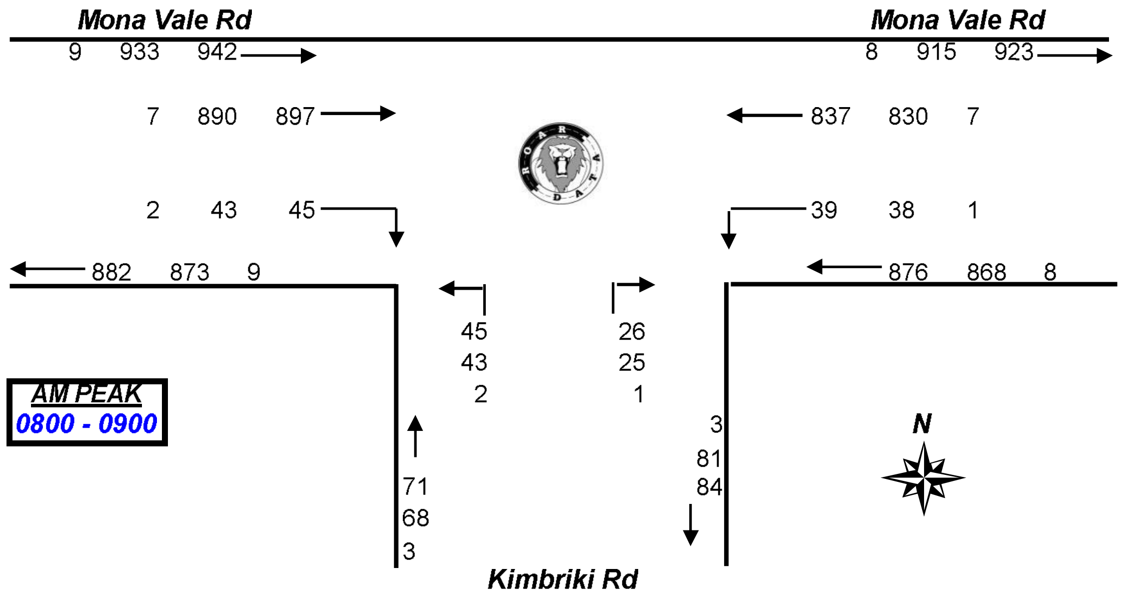
Combined

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Peak Per	T	R	L	R	L	T	TOT
0700 - 0800	616	26	26	22	31	653	1374
0715 - 0815	691	29	31	25	35	718	1529
0730 - 0830	756	34	36	24	36	781	1667
0745 - 0845	835	38	43	25	40	841	1822
0800 - 0900	897	45	45	26	39	837	1889
PEAK HR	897	45	45	26	39	837	1889

Peds

	WEST	SOUTH	EAST	
Time Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
0700 - 0715				0
0715 - 0730		NOT		0
0730 - 0745		REQUIRED		0
0745 - 0800				0
0800 - 0815				0
0815 - 0830				0
0830 - 0845				0
0845 - 0900				0
Per End	0	0	0	0

	WEST	SOUTH	EAST	
Peak Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
0700 - 0800	0	0	0	0
0715 - 0815	0	0	0	0
0730 - 0830	0	0	0	0
0745 - 0845	0	0	0	0
0800 - 0900	0	0	0	0
PEAK HR	0	0	0	0



R.O.A.R. DATA
Reliable, Original & Authentic Results
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Client : GTA Consultants
Job No/Name : 2905 Terrey Hills Kimbriki Rd Counts
Day/Date : Saturday 28th November 2009

Lights

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Time Per	T	R	L	R	L	T	TOT
1200 - 1215	364	11	18	16	10	262	**681**
1215 - 1230	325	25	20	19	9	250	**648**
1230 - 1245	355	18	11	18	9	313	**724**
1245 - 1300	262	17	18	11	8	247	**563**
1300 - 1315	362	15	14	12	16	297	**716**
1315 - 1330	294	20	11	13	19	238	**595**
1330 - 1345	312	25	23	21	9	253	**643**
1345 - 1400	287	26	22	16	11	270	**632**
Per End	**2561**	**157**	**137**	**126**	**91**	**2130**	**5202**

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Time Per	T	R	L	R	L	T	TOT
1200 - 1215	1	1	1	0	0	0	**3**
1215 - 1230	0	2	0	0	0	1	**3**
1230 - 1245	2	0	0	0	0	0	**2**
1245 - 1300	1	1	2	0	0	2	**6**
1300 - 1315	1	0	2	0	0	3	**6**
1315 - 1330	1	0	0	0	0	3	**4**
1330 - 1345	3	0	0	0	0	1	**4**
1345 - 1400	0	0	0	0	0	2	**2**
Per End	**9**	**4**	**5**	**0**	**0**	**12**	**30**

Combined

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Time Per	T	R	L	R	L	T	TOT
1200 - 1215	365	12	19	16	10	262	**684**
1215 - 1230	325	27	20	19	9	251	**651**
1230 - 1245	357	18	11	18	9	313	**726**
1245 - 1300	263	18	20	11	8	249	**569**
1300 - 1315	363	15	16	12	16	300	**722**
1315 - 1330	295	20	11	13	19	241	**599**
1330 - 1345	315	25	23	21	9	254	**647**
1345 - 1400	287	26	22	16	11	272	**634**
Per End	**2570**	**161**	**142**	**126**	**91**	**2142**	**5232**

Lights

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Peak Per	T	R	L	R	L	T	TOT
1200 - 1300	1306	71	67	64	36	1072	**2616**
1215 - 1315	1304	75	63	60	42	1107	**2651**
1230 - 1330	1273	70	54	54	52	1095	**2598**
1245 - 1345	1230	77	66	57	52	1035	**2517**
1300 - 1400	1255	86	70	62	55	1058	**2586**
PEAK HR	**1304**	**75**	**63**	**60**	**42**	**1107**	**2651**

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Peak Per	T	R	L	R	L	T	TOT
1200 - 1300	4	4	3	0	0	3	**14**
1215 - 1315	4	3	4	0	0	6	**17**
1230 - 1330	5	1	4	0	0	8	**18**
1245 - 1345	6	1	4	0	0	9	**20**
1300 - 1400	5	0	2	0	0	9	**16**
PEAK HR	**4**	**3**	**4**	**0**	**0**	**6**	**17**

Combined

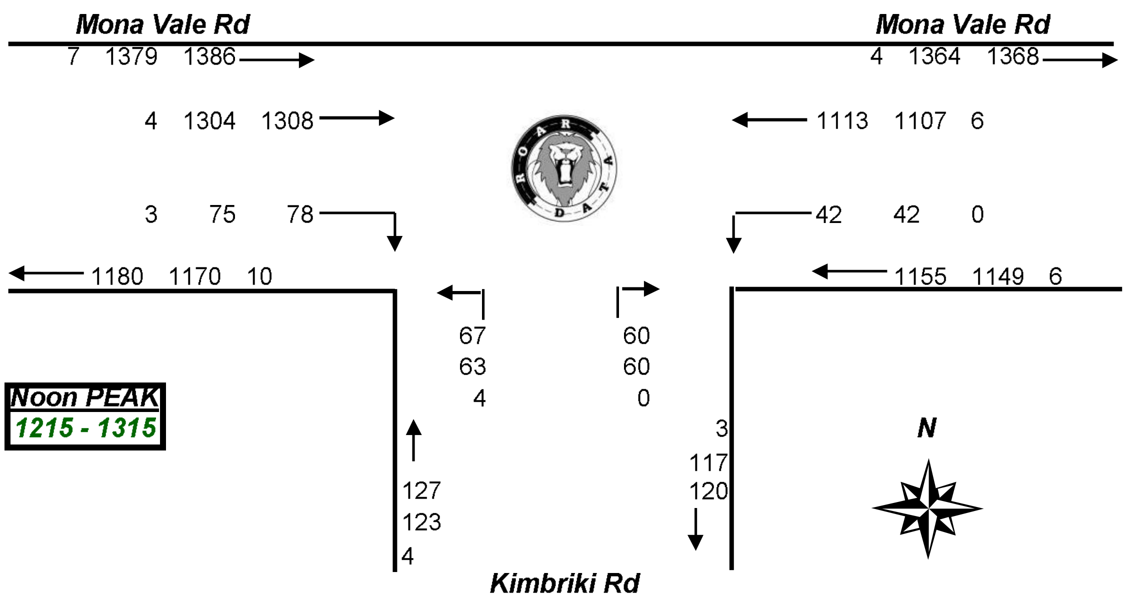
	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Peak Per	T	R	L	R	L	T	TOT
1200 - 1300	1310	75	70	64	36	1075	**2630**
1215 - 1315	1308	78	67	60	42	1113	**2668**
1230 - 1330	1278	71	58	54	52	1103	**2616**
1245 - 1345	1236	78	70	57	52	1044	**2537**
1300 - 1400	1260	86	72	62	55	1067	**2602**
PEAK HR	**1308**	**78**	**67**	**60**	**42**	**1113**	**2668**

Peds

	WEST	SOUTH	EAST	
Time Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
1200 - 1215				0
1215 - 1230		NOT		0
1230 - 1245		REQUIRED		0
1245 - 1300				0
1300 - 1315				0
1315 - 1330				0
1330 - 1345				0
1345 - 1400				0
Per End	**0**	**0**	**0**	**0**

	WEST	SOUTH	EAST	
Peak Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
1200 - 1300	0	0	0	**0**
1215 - 1315	0	0	0	**0**
1230 - 1330	0	0	0	**0**
1245 - 1345	0	0	0	**0**
1300 - 1400	0	0	0	**0**
PEAK HR	**0**	**0**	**0**	**0**

Noon PEAK
1215 - 1315



R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Fax 88196849, Mob.0418-239019

Client : GTA Consultants
Job No/Name : 2905 Terrey Hills Kimbriki Rd Counts
Day/Date : Saturday 28th November 2009

Lights

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Time Per	T	R	L	R	L	T	TOT
1600 - 1615	218	15	15	16	15	323	**602**
1615 - 1630	319	14	14	23	22	256	**648**
1630 - 1645	238	18	18	17	11	302	**604**
1645 - 1700	292	9	9	16	12	297	**635**
1700 - 1715	274	3	3	10	17	346	**653**
1715 - 1730	273	1	1	2	4	394	**675**
1730 - 1745	260	3	3	2	0	317	**585**
1745 - 1800	228	0	0	1	0	328	**557**
Per End	**2102**	**63**	**63**	**87**	**81**	**2563**	**4959**

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Time Per	T	R	L	R	L	T	TOT
1600 - 1615	1	0	0	0	0	0	**1**
1615 - 1630	1	0	0	0	0	0	**1**
1630 - 1645	0	0	0	0	0	1	**1**
1645 - 1700	2	0	0	0	0	2	**4**
1700 - 1715	2	0	0	0	0	2	**4**
1715 - 1730	2	0	0	0	0	3	**5**
1730 - 1745	1	0	0	0	0	0	**1**
1745 - 1800	1	0	0	0	0	1	**2**
Per End	**10**	**0**	**0**	**0**	**0**	**9**	**19**

Combined

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Time Per	T	R	L	R	L	T	TOT
1600 - 1615	219	15	15	16	15	323	**603**
1615 - 1630	320	14	14	23	22	256	**649**
1630 - 1645	238	18	18	17	11	303	**605**
1645 - 1700	294	9	9	16	12	299	**639**
1700 - 1715	276	3	3	10	17	348	**657**
1715 - 1730	275	1	1	2	4	397	**680**
1730 - 1745	261	3	3	2	0	317	**586**
1745 - 1800	229	0	0	1	0	329	**559**
Per End	**2112**	**63**	**63**	**87**	**81**	**2572**	**4978**

Lights

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Peak Per	T	R	L	R	L	T	TOT
1600 - 1700	1067	56	56	72	60	1178	**2489**
1615 - 1715	1123	44	44	66	62	1201	**2540**
1630 - 1730	1077	31	31	45	44	1339	**2567**
1645 - 1745	1099	16	16	30	33	1354	**2548**
1700 - 1800	1035	7	7	15	21	1385	2470
PEAK HR	**1077**	**31**	**31**	**45**	**44**	**1339**	**2567**

Heavies

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Peak Per	T	R	L	R	L	T	TOT
1600 - 1700	4	0	0	0	0	3	**7**
1615 - 1715	5	0	0	0	0	5	**10**
1630 - 1730	6	0	0	0	0	8	**14**
1645 - 1745	7	0	0	0	0	7	**14**
1700 - 1800	6	0	0	0	0	6	12
PEAK HR	**6**	**0**	**0**	**0**	**0**	**8**	**14**

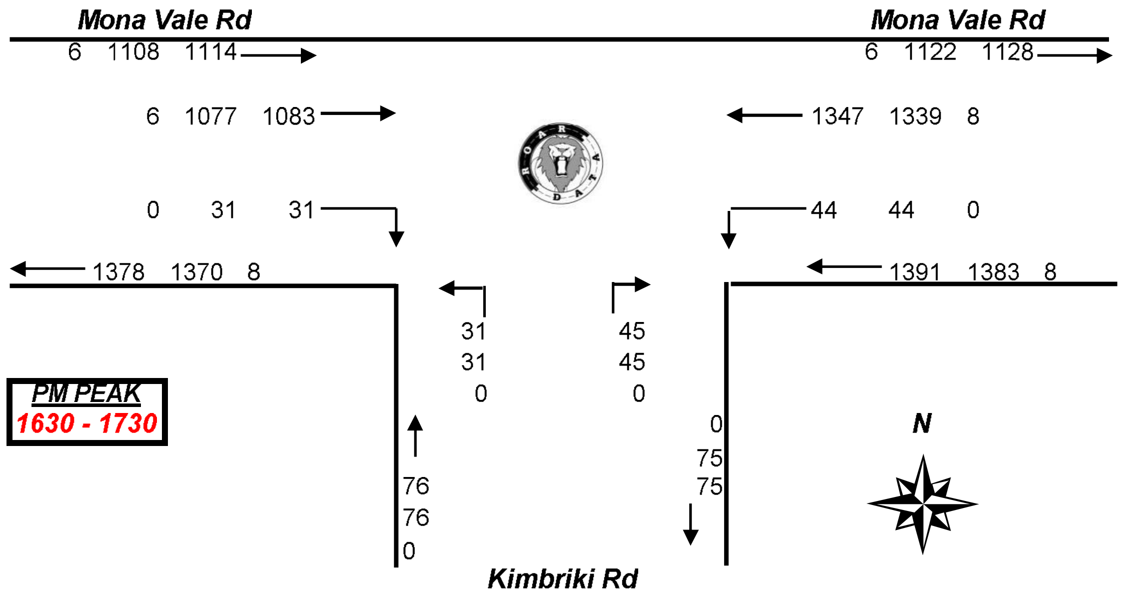
Combined

	WEST		SOUTH		EAST		
	Mona Vale		*Kimbriki Rd*		*Mona Vale*		
Peak Per	T	R	L	R	L	T	TOT
1600 - 1700	1071	56	56	72	60	1181	**2496**
1615 - 1715	1128	44	44	66	62	1206	**2550**
1630 - 1730	1083	31	31	45	44	1347	**2581**
1645 - 1745	1106	16	16	30	33	1361	**2562**
1700 - 1800	1041	7	7	15	21	1391	**2482**
PEAK HR	**1083**	**31**	**31**	**45**	**44**	**1347**	**2581**

Peds

	WEST	SOUTH	EAST	
Time Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
1600 - 1615				**0**
1615 - 1630		NOT		**0**
1630 - 1645		REQUIRED		**0**
1645 - 1700				**0**
1700 - 1715				**0**
1715 - 1730				**0**
1730 - 1745				**0**
1745 - 1800				**0**
Per End	**0**	**0**	**0**	**0**

	WEST	SOUTH	EAST	
Peak Per	Mona Vale	Kimbriki Rd	Mona Vale	TOT
1600 - 1700	0	0	0	**0**
1615 - 1715	0	0	0	**0**
1630 - 1730	0	0	0	**0**
1645 - 1745	0	0	0	**0**
1700 - 1800	0	0	0	**0**
PEAK HR	**0**	**0**	**0**	**0**



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One Page Summary

Count Number 5259 **UBD 137 A-9**

Street **MONA VALE ROAD, INGLESIDE : Between ADDISON ROAD & KIMBIKI ROAD (bidirectional)**

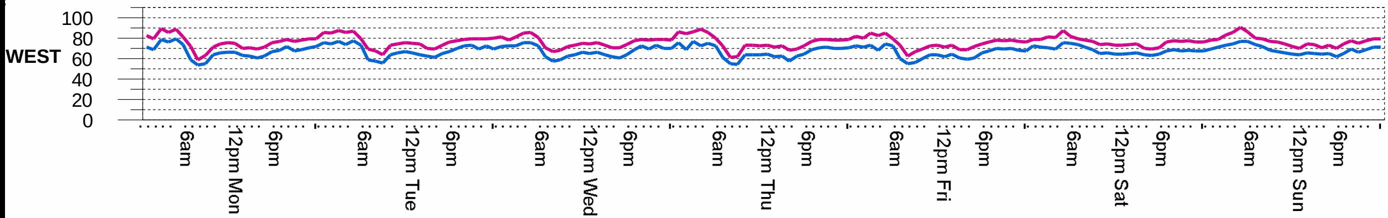
Location Prior to Kimbriki - Westbound

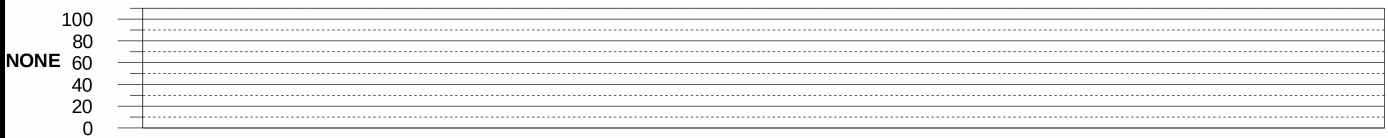
Start Date	26-NOV-09
Start Time	100
Duration	7 DAYS
Interval	1 HOUR

Speed Limit 80	WEST	NONE	COMBINED
Weekly 50th Percentile Speed	**64**	**64**	**64**
Weekly 85th Percentile Speed	**74**	**74**	**74**
Five Day AADT	**17686**		**17686**
Seven Day AADT	**17074**		**17074**

	MON 30-NOV-09			TUE 01-DEC-09			WED 02-DEC-09			THU 26-NOV-09		
	WEST	NONE	BiDir	WEST	NONE	BiDir	WEST	NONE	BiDir	WEST	NONE	BiDir
85%ile	73.1		73.1	74.1		74.1	73.9		73.9	72.8		72.8
50%ile	62.3		62.3	63.4		63.4	63.5		63.5	62.0		62.0
> 90 k	36		36	28		28	21		21	32		32
%age	.2		.2	.2		.2	.1		.1	.2		.2
> 100 k	6		6	0		0	2		2	3		3
%age	.0		.0	.0		.0	.0		.0	.0		.0

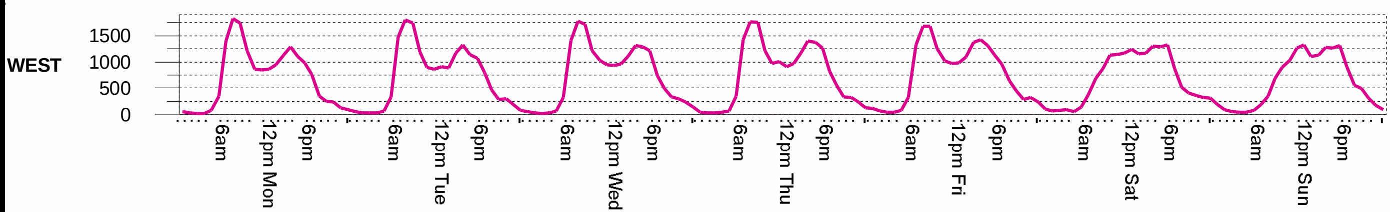
	FRI 27-NOV-09			SAT 28-NOV-09			SUN 29-NOV-09			SEVENDAY AVERAGE		
	WEST	NONE	BiDir	WEST	NONE	BiDir	WEST	NONE	BiDir	WEST	NONE	BiDir
85%ile	72.8		72.8	75.1		75.1	74.8		74.8	73.8		73.8
50%ile	62.4		62.4	65.8		65.8	65.5		65.5	63.6		63.6
> 90 k	19		19	42		42	35		35	30.43		30.43
%age	.1		.1	.3		.3	.2		.2	.2		.2
> 100 k	0		0	7		7	3		3	3		3
%age	.0		.0	.0		.0	.0		.0	.0		.0

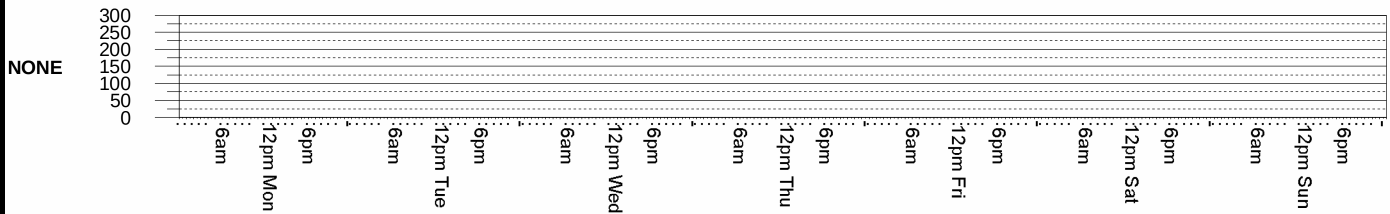




	MON WEST	MON NONE	MON BiDir	TUE WEST	TUE NONE	TUE BiDir	WED WEST	WED NONE	WED BiDir	THU WEST	THU NONE	THU BiDir
Short %	93.8		93.8	93.8		93.8	93.6		93.6	93.6		93.6
Med %	5.5		5.5	5.6		5.6	5.7		5.7	5.7		5.7
Long %	.7		.7	.6		.6	.7		.7	.7		.7
AM Pk Vo	1829		1829	1806		1806	1778		1778	1768		1768
PM Pk Vo	1293		1293	1323		1323	1315		1315	1403		1403
7-7pm	13587		13587	13799		13799	14250		14250	14637		14637
24Hr Tot	16593		16593	17122		17122	17686		17686	18187		18187
Class 0	43		43	45		45	43		43	84		84
Class 1	15272		15272	15797		15797	16293		16293	16711		16711
Class 2	248		248	220		220	220		220	228		228
Class 3	738		738	797		797	825		825	847		847
Class 4	157		157	139		139	160		160	170		170
Class 5	24		24	21		21	22		22	26		26
Class 6	30		30	29		29	33		33	40		40
Class 7	8		8	12		12	6		6	8		8
Class 8	17		17	15		15	27		27	21		21
Class 9	54		54	43		43	54		54	50		50
Class 10	2		2	4		4	3		3	2		2
Class 11	0		0	0		0	0		0	0		0
Class 12	0		0	0		0	0		0	0		0
Class 13	0		0	0		0	0		0	0		0

	FRI WEST	FRI NONE	FRI BiDir	SAT WEST	SAT NONE	SAT BiDir	SUN WEST	SUN NONE	SUN BiDir	SEVENDAY WEST	SEVENDAY NONE	SEVENDAY BiDir
Short %	94.0		94.0	97.9		97.9	98.7		98.7	94.9		94.9
Med %	5.4		5.4	1.8		1.8	1.2		1.2	4.5		4.5
Long %	.6		.6	.3		.3	.2		.2	.5		.5
AM Pk Vo	1686		1686	1175		1175	1271		1271	1616		1616
PM Pk Vo	1424		1424	1324		1324	1331		1331	1345		1345
7-7pm	14915		14915	13368		13368	12582		12582	13877		13877
24Hr Tot	18843		18843	16196		16196	14892		14892	17074		17074
Class 0	82		82	87		87	87		87	67		67
Class 1	17363		17363	15395		15395	14220		14220	15864		15864
Class 2	267		267	371		371	386		386	277		277
Class 3	811		811	253		253	164		164	634		634
Class 4	181		181	28		28	9		9	121		121
Class 5	17		17	11		11	0		0	17		17
Class 6	37		37	19		19	8		8	28		28
Class 7	7		7	2		2	3		3	7		7
Class 8	16		16	11		11	4		4	16		16
Class 9	60		60	17		17	10		10	41		41
Class 10	2		2	2		2	1		1	2		2
Class 11	0		0	0		0	0		0			
Class 12	0		0	0		0	0		0			
Class 13	0		0	0		0	0		0			





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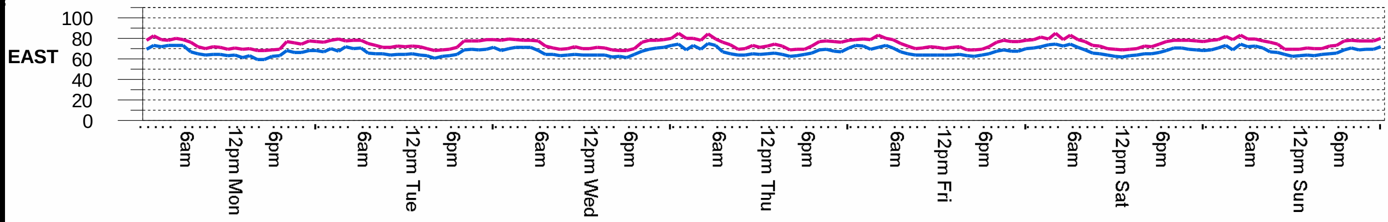
One Page Summary

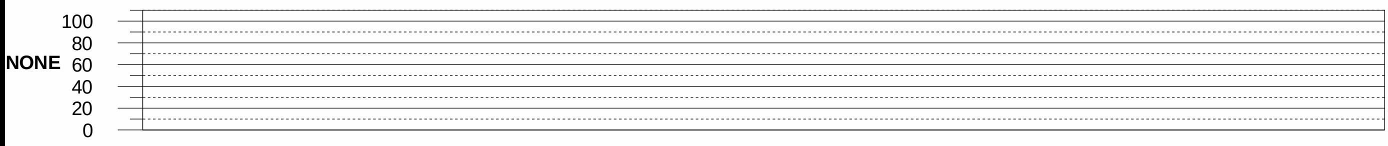
Count Number	5260	Lat/Long : S33 41 12.5 / E151 14 12.2	UBD 136 N-8
Street	MONA VALE ROAD, INGLESIDE : Between KIMBIKI ROAD & MC CARRS CREEK ROAD (bidirectional)		
Location	Prior to Kimbriki - Eastbound		

Start Date	26-NOV-09
Start Time	100
Duration	7 DAYS
Interval	1 HOUR

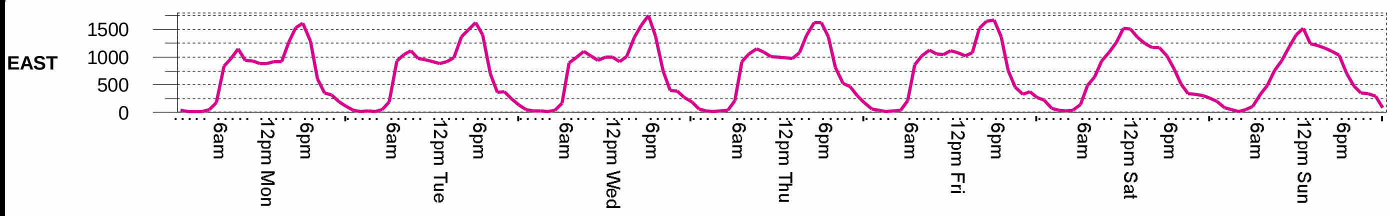
Speed Limit 80	EAST	NONE	COMBINED
Weekly 50th Percentile Speed	65	65	65
Weekly 85th Percentile Speed	73	73	73
Five Day AADT	17250		17250
Seven Day AADT	16847		16847

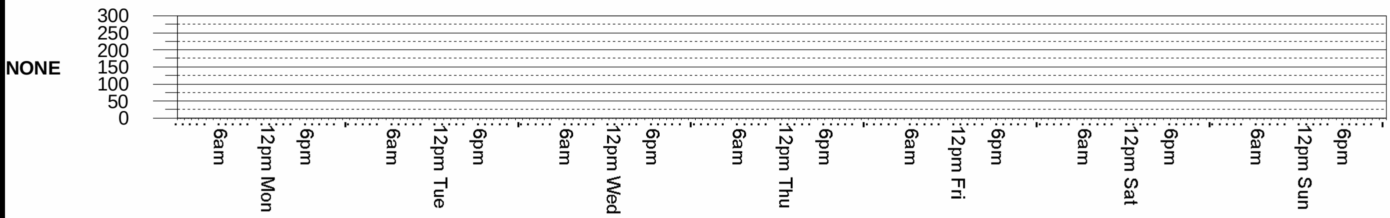
	MON 30-NOV-09			TUE 01-DEC-09			WED 02-DEC-09			THU 26-NOV-09			FRI 27-NOV-09			SAT 28-NOV-09			SUN 29-NOV-09			SEVENDAY AVERAGE		
	EAST	NONE	BiDir	EAST	NONE	BiDir	EAST	NONE	BiDir	EAST	NONE	BiDir	EAST	NONE	BiDir	EAST	NONE	BiDir	EAST	NONE	BiDir	EAST	NONE	BiDir
85%ile	70.9		70.9	72.4		72.4	71.2		71.2	73.0		73.0	72.0		72.0	74.0		74.0	74.2		74.2	72.5		72.5
50%ile	63.6		63.6	64.3		64.3	63.9		63.9	64.9		64.9	64.5		64.5	65.2		65.2	65.4		65.4	64.6		64.6
> 90 k	7		7	13		13	15		15	21		21	18		18	27		27	15		15	16.57		16.57
%age	.0		.0	.1		.1	.1		.1	.1		.1	.1		.1	.2		.2	.1		.1	.1		.1
> 100 k	0		0	0		0	0		0	2		2	1		1	3		3	2		2	1.143		1.143
%age	.0		.0	.0		.0	.0		.0	.0		.0	.0		.0	.0		.0	.0		.0	.0		.0





	MON EAST	MON NONE	MON BiDir	TUE EAST	TUE NONE	TUE BiDir	WED EAST	WED NONE	WED BiDir	THU EAST	THU NONE	THU BiDir	FRI EAST	FRI NONE	FRI BiDir	SAT EAST	SAT NONE	SAT BiDir	SUN EAST	SUN NONE	SUN BiDir	AVG EAST	AVG NONE	AVG BiDir
Short %	94.1		94.1	94.0		94.0	94.1		94.1	94.0		94.0	94.3		94.3	97.8		97.8	98.7		98.7	95.2		95.2
Med %	5.1		5.1	5.3		5.3	5.2		5.2	5.3		5.3	5.0		5.0	1.8		1.8	1.1		1.1	4.2		4.2
Long %	.8		.8	.7		.7	.8		.8	.7		.7	.7		.7	.4		.4	.2		.2	.6		.6
AM Pk Vo	1146		1146	1115		1115	1106		1106	1146		1146	1122		1122	1523		1523	1411		1411	1224		1224
PM Pk Vo	1610		1610	1626		1626	1753		1753	1623		1623	1669		1669	1507		1507	1522		1522	1616		1616
7-7pm	13314		13314	13700		13700	14066		14066	14354		14354	14750		14750	13729		13729	12752		12752	13809		13809
24Hr Tot	16047		16047	16786		16786	17267		17267	17939		17939	18210		18210	16531		16531	15146		15146	16847		16847
Class 0	55		55	35		35	75		75	67		67	79		79	57		57	65		65	62		62
Class 1	14773		14773	15543		15543	15919		15919	16556		16556	16811		16811	15726		15726	14473		14473	15686		15686
Class 2	275		275	201		201	251		251	240		240	279		279	388		388	406		406	291		291
Class 3	632		632	691		691	693		693	717		717	714		714	263		263	159		159	553		553
Class 4	166		166	176		176	169		169	201		201	179		179	31		31	12		12	133		133
Class 5	23		23	22		22	28		28	26		26	19		19	8		8	3		3	18		18
Class 6	35		35	28		28	28		28	49		49	37		37	21		21	10		10	30		30
Class 7	5		5	9		9	3		3	3		3	3		3	0		0	3		3	4		4
Class 8	21		21	19		19	20		20	22		22	13		13	11		11	4		4	16		16
Class 9	60		60	56		56	76		76	56		56	72		72	23		23	9		9	50		50
Class 10	2		2	6		6	5		5	2		2	4		4	3		3	2		2	3		3
Class 11	0		0	0		0	0		0	0		0	0		0	0		0	0		0			
Class 12	0		0	0		0	0		0	0		0	0		0	0		0	0		0			
Class 13	0		0	0		0	0		0	0		0	0		0	0		0	0		0			





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One Page Summary

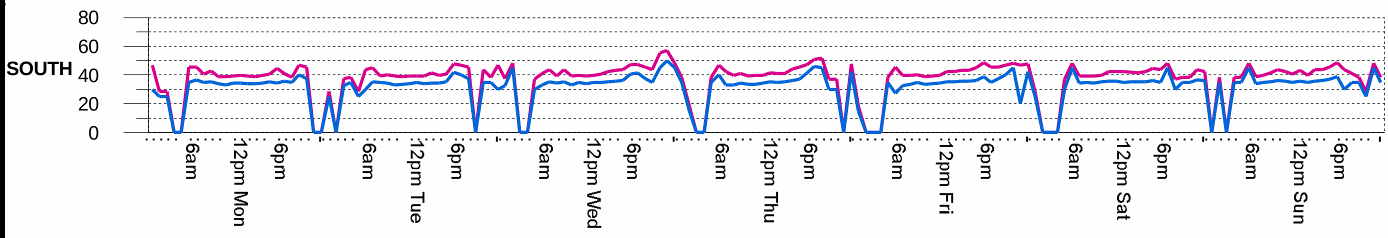
Count Number	5261	Lat/Long : S33 41 17.5 / E151 14 19.2	UBD 136 P-10
Street	KIMBRIKI ROAD, INGLESIDE : Between MONA VALE ROAD & CUL-DE-SAC (bidirectional)		
Location	In straight Section just south of Mona Vale Rd		

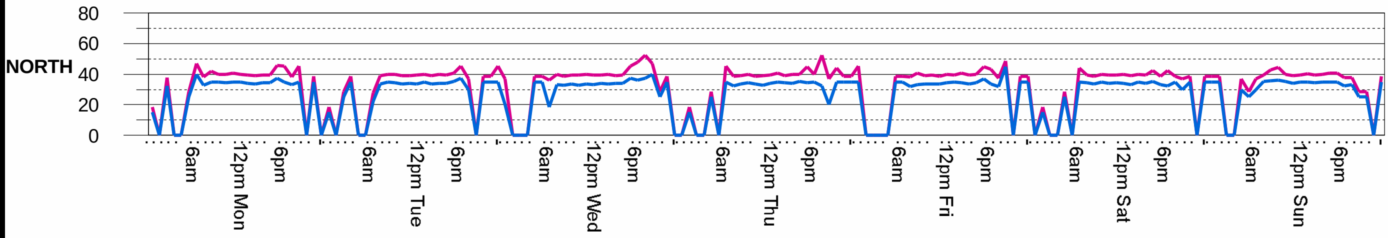
Start Date	26-NOV-09
Start Time	100
Duration	7 DAYS
Interval	1 HOUR

Speed Limit 50	SOUTH	NORTH	COMBINED
Weekly 50th Percentile Speed	35	34	35
Weekly 85th Percentile Speed	42	40	40
Five Day AADT	1042	1029	2071
Seven Day AADT	1071	1058	2129

	MON 30-NOV-09			TUE 01-DEC-09			WED 02-DEC-09			THU 26-NOV-09		
	SOUTH	NORTH	BiDir	SOUTH	NORTH	BiDir	SOUTH	NORTH	BiDir	SOUTH	NORTH	BiDir
85%ile	39.8	39.7	39.7	39.8	39.4	39.6	41.8	39.6	40.3	42.2	39.4	40.1
50%ile	34.4	34.4	34.4	34.4	34.1	34.2	35.0	33.7	34.4	34.9	34.0	34.4
> 60 k	0	0	0	0	0	0	0	0	0	0	0	0
%age	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
> 70 k	0	0	0	0	0	0	0	0	0	0	0	0
%age	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

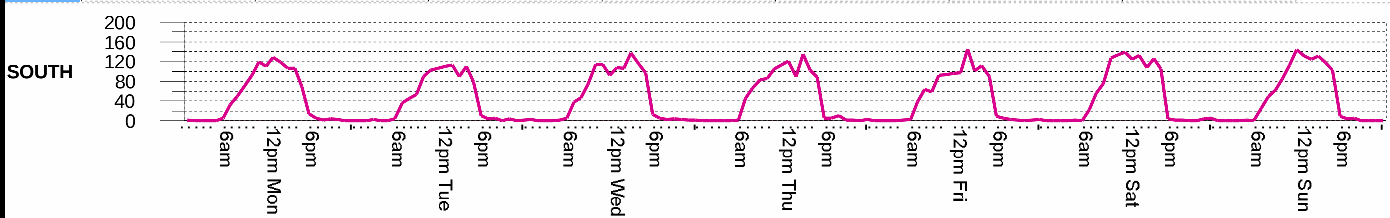
	FRI 27-NOV-09			SAT 28-NOV-09			SUN 29-NOV-09			SEVENDAY AVERAGE		
	SOUTH	NORTH	BiDir	SOUTH	NORTH	BiDir	SOUTH	NORTH	BiDir	SOUTH	NORTH	BiDir
85%ile	41.9	39.6	40.2	41.9	39.6	40.2	42.8	39.8	41.4	41.4	39.6	40.2
50%ile	35.0	34.1	34.6	35.4	34.2	34.8	35.7	34.8	35.3	35.0	34.2	34.6
> 60 k	0	0	0	0	0	0	0	0	0	0	0	0
%age	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
> 70 k	0	0	0	0	0	0	0	0	0	0	0	0
%age	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

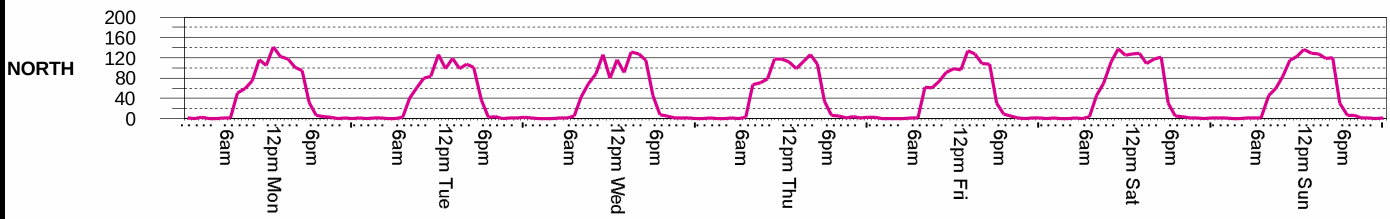




	MON S	MON N	MON BiDir	TUE S	TUE N	TUE BiDir	WED S	WED N	WED BiDir	THU S	THU N	THU BiDir
Short %	82.7	83.7	83.2	81.9	83.2	82.6	80.3	80.9	80.6	83.2	84.7	84.0
Med %	15.2	14.6	14.9	15.7	14.9	15.3	15.8	15.8	15.8	13.9	13.7	13.8
Long %	2.1	1.6	1.9	2.5	1.8	2.2	3.9	3.3	3.6	2.9	1.6	2.2
AM Pk Vo	119	116	235	107	126	233	114	126	240	113	118	230
PM Pk Vo	129	141	270	113	119	232	138	131	269	135	126	247
7-7pm	994	1023	2017	917	957	1874	1026	1038	2064	1002	1047	2049
24Hr Tot	1046	1038	2084	977	973	1950	1090	1056	2146	1071	1067	2138
Class 0	0	2	2	5	2	7	4	1	5	2	0	2
Class 1	692	699	1391	618	631	1249	679	668	1347	707	712	1419
Class 2	173	168	341	177	177	354	192	185	377	182	192	374
Class 3	113	105	218	89	84	173	103	100	203	94	91	185
Class 4	45	44	89	63	59	122	66	63	129	54	54	108
Class 5	1	3	4	1	2	3	3	4	7	1	1	2
Class 6	12	8	20	8	4	12	13	8	21	21	9	30
Class 7	1	1	2	2	1	3	2	5	7	1	1	2
Class 8	3	1	4	4	2	6	5	1	6	2	1	3
Class 9	6	7	13	10	10	20	23	21	44	7	6	13
Class 10	0	0	0	0	1	1	0	0	0	0	0	0
Class 11	0	0	0	0	0	0	0	0	0	0	0	0
Class 12	0	0	0	0	0	0	0	0	0	0	0	0
Class 13	0	0	0	0	0	0	0	0	0	0	0	0

	FRI S	FRI N	FRI BiDir	SAT S	SAT N	SAT BiDir	SUN S	SUN N	SUN BiDir	AVG S	AVG N	AVG BiDir
Short %	85.7	86.7	86.2	93.9	94.2	94.0	96.5	96.6	96.5	86.5	87.4	86.9
Med %	12.6	11.6	12.1	4.9	4.8	4.8	2.9	2.7	2.8	11.3	11.0	11.2
Long %	1.7	1.7	1.7	1.3	1.0	1.1	.6	.7	.7	2.1	1.7	1.9
AM Pk Vo	96	99	195	139	138	272	144	123	267	119	121	239
PM Pk Vo	146	134	280	132	129	261	131	136	267	132	131	261
7-7pm	968	999	1967	1134	1130	2264	1076	1094	2170	1017	1041	2058
24Hr Tot	1024	1013	2037	1174	1144	2318	1117	1112	2229	1071	1058	2129
Class 0	5	1	6	3	1	4	1	2	3	3	1	4
Class 1	678	679	1357	758	746	1504	760	765	1525	699	700	1399
Class 2	195	198	393	341	331	672	317	307	624	225	223	448
Class 3	79	71	150	44	43	87	31	30	61	79	75	154
Class 4	47	42	89	12	12	24	1	0	1	41	39	80
Class 5	3	5	8	1	0	1	0	0	0	1	2	4
Class 6	6	5	11	8	6	14	7	7	14	11	7	17
Class 7	2	1	3	2	0	2	0	1	1	1	1	3
Class 8	0	0	0	0	1	1	0	0	0	2	1	3
Class 9	9	11	20	5	4	9	0	0	0	9	8	17
Class 10	0	0	0	0	0	0	0	0	0			
Class 11	0	0	0	0	0	0	0	0	0			
Class 12	0	0	0	0	0	0	0	0	0			
Class 13	0	0	0	0	0	0	0	0	0			





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Appendix C

RTA Road Design Guide 2000 Extract – Length of Acceleration Lanes

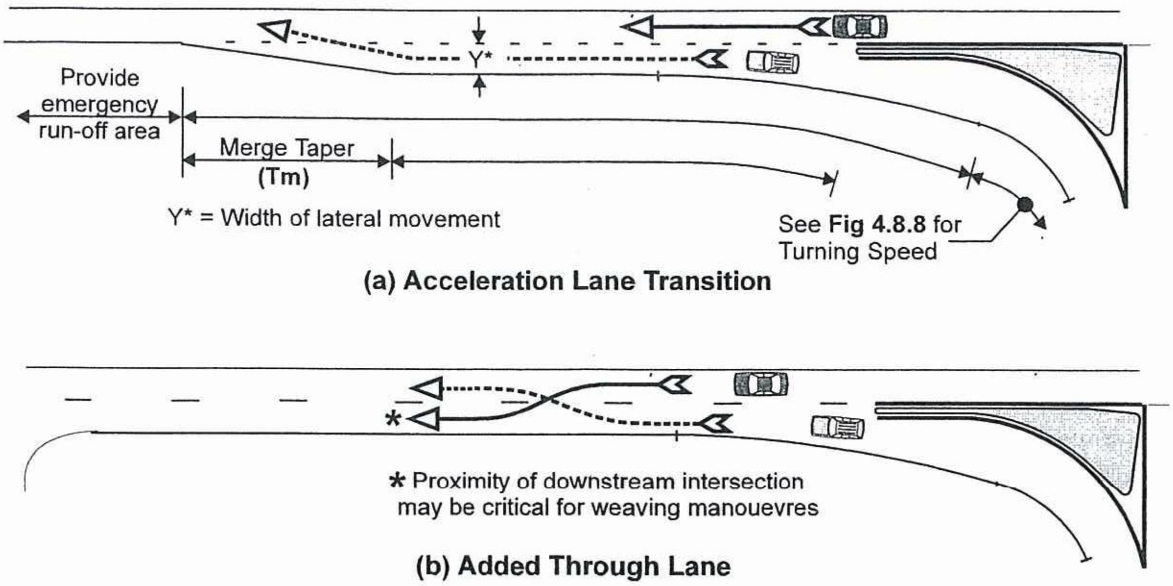


Figure 4.8.12 - Options for Auxiliary Lanes on the Departure Side of an Intersection.

Table 4.8.5 Length of Acceleration Lanes on Level Grade.
*(see **Table 4.8.6** for grade correction)*

Design speed of road entered (km / h)	*Length of acceleration lane **A** (m) (including length of pavement taper) where design speed of entry curve (km / h)is*								4 sec travel (m)	Merge **Tm** (m)	Min desir. length 4 sec +Tm
	0**	20	30	40	50	60	70	80			
50	70	55	45	30	-	-	-	-	55	50	105
60	110	95	85	70	40	-	-	-	65	60	125
70	165	150	140	125	95	55	-	-	80	70	150
80	235	220	210	195	165	125	75	-	90	80	170
90	330	315	305	290	260	220	170	95	100	90	190
100	450	435	425	410	380	340	290	220	110	100	210
110	610	595	585	570	540	500	450	320	120	110	230

(shaded) Adopt minimum desirable length = 4 sec travel + Tm
*** Length required where a vehicle accelerates from zero speed*

Table 4.8.6 - Correction of acceleration distances as a result of grade

Design speed of road entered (km/h)	Ratio of length on grade to length on level * for: Design speed of turning roadway curve (km/h)									
	3 to 4 % upgrade					5 to 6 % upgrade				
	Stop	30	50	60	80	Stop	30	50	60	80
50	1.3	1.3				1.4	1.5			
60	1.3	1.3	1.3			1.5	1.5	1.5		
80	1.3	1.3	1.4	1.4		1.5	1.5	1.7	1.9	
100	1.3	1.4	1.5	1.5	1.6	1.6	1.7	1.9	2.2	2.5
110	1.4	1.5	1.6	1.6	1.8	1.8	2.0	2.2	2.6	3.0

	3 to 4 % downgrade	5 to 6 % downgrade
	All Speeds	All Speeds
50	0.7	0.6
60	0.7	0.6
80	0.65	0.55
100	0.6	0.5
110	0.6	0.5

** Ratio from this Table multiplied by length in **Table 4.8.5** gives length of speed change lane on grade.*

Appendix D

Crash Data

Brief Crash Report - *sorted*

Crash No	Date	Day	Time	Dist	ID	Feature	Loc	Alg	Lgt	Wth	Sfc	SL	DCA	Tus	TU1	S1	D	Manoeuvre1	TU2	S2	D	Manoeuvre2	K	I	Fac S	Fac F
Sydney Region						**Warringah LGA**					**Terrey Hills**							**Mona Vale Rd**								
474844	17/05/2005	Tue	16:45		at	KIMBRIKI RD	TJN	CRV	Off	Raining	Wet	60	202	2	TRK	1	E	Turning right	CAR	1	W	Proceeding in lane	0	0		
Sydney Region						**Warringah LGA**					**Ingleside**							**Mona Vale Rd**								
585535	19/07/2007	Thu	14:55		at	KIMBRIKI RD	TJN	STR	Off	Fine	Dry	50	104	2	TRK	1	E	Turning right	CAR	2	N	Proceeding in lane	0	0		
Sydney Region						**Warringah LGA**					**Ingleside**							**Mona Vale Rd**								
623806	15/05/2008	Thu	13:45		at	KIMBRIKI RD	TJN	STR	Nil	Fine	Dry	70	104	2	CAR	2	N	Turning right	4WD	1	W	Proceeding in lane	0	0		
Sydney Region						**Warringah LGA**					**Terrey Hills**							**Mona Vale Rd**								
480016	26/05/2005	Thu	17:30	10	E	KIMBRIKI RD	TJN	CRV	On	Fine	Dry	70	301	3	CAR	1	W	Proceeding in lane	CAR	1	W	Proceeding in lane	0	0		
604382	25/12/2007	Tue	06:00	50	E	KIMBRIKI RD	2WY	STR	Off	Raining	Wet	70	704	1	WAG	1	E	Proceeding in lane					0	0		F
Sydney Region						**Pittwater LGA**					**Ingleside**							**Mona Vale Rd**								
690245	25/11/2009	Wed	06:20	50	E	KIMBRIKI RD	2WY	STR	Nil	Fog or mis	Wet	70	703	1	CAR	1	E	Proceeding in lane					0	1		
Sydney Region						**Warringah LGA**					**Ingleside**							**Mona Vale Rd**								
559158	28/02/2007	Wed	10:40	80	E	KIMBRIKI RD	2WY	STR	Off	Fine	Dry	70	301	3	CAR	1	W	Proceeding in lane	VAN	1	W	Proceeding in lane	0	0		
Sydney Region						**Pittwater LGA**					**Ingleside**							**Mona Vale Rd**								
494361	20/10/2005	Thu	17:20	100	E	KIMBRIKI RD	2WY	CRV	Nil	Raining	Wet	70	301	2	CAR	1	E	Proceeding in lane	CAR	1	E	Proceeding in lane	0	0		
Sydney Region						**Warringah LGA**					**Terrey Hills**							**Mona Vale Rd**								
477368	17/05/2005	Tue	16:50	10	W	KIMBRIKI RD	TJN	CRV	Nil	Raining	Wet	70	301	3	4WD	1	E	Proceeding in lane	TRK	1	E	Proceeding in lane	0	1		
596511	06/11/2007	Tue	07:15	10	W	KIMBRIKI RD	TJN	STR	Nil	Raining	Wet	80	201	2	TRK	1	E	Incorrect side	CAR	1	W	Proceeding in lane	0	0		
Sydney Region						**Warringah LGA**					**Ingleside**							**Mona Vale Rd**								
608230	27/01/2008	Sun	12:15	10	W	KIMBRIKI RD	TJN	STR	Off	Fine	Dry	70	301	3	CAR	1	E	Proceeding in lane	4WD	1	E	Stationary	0	1		
Sydney Region						**Warringah LGA**					**Ingleside**							**Mona Vale Rd**								
574690	31/05/2007	Thu	13:15	40	W	KIMBRIKI RD	2WY	CRV	Off	Fine	Dry	70	301	2	TRK	1	E	Proceeding in lane	CAR	1	E	Proceeding in lane	0	0		
Sydney Region						**Warringah LGA**					**Ingleside**							**Mona Vale Rd**								
586328	20/08/2007	Mon	07:15	60	W	KIMBRIKI RD	2WY	CRV	Off	Raining	Wet	70	803	L 1	CAR	1	W	Proceeding in lane					0	0	S	
Sydney Region						**Warringah LGA**					**Ingleside**							**Kimbriki Rd**								
551893	08/01/2007	Mon	14:05	5	S	MONA VALE RD	TJN	STR	Off	Fine	Dry	60	302	2	CAR	1	N	Proceeding in lane	TRK	1	N	Waiting turn left	0	0		
549867	15/12/2006	Fri	15:00	75	S	MONA VALE RD	2WY	CRV	Off	Raining	Wet	20	804	R 1	TRK	1	N	Proceeding in lane					0	1	S	

Report Totals: *Crashes:* 15 Fatal Crashes: 0 Injury Crashes: 4 Non-Casualty Cras 11 Traffic Units: 30 Killed: 0 Injured: 4

Brief Crash Report - sorted

Crashid dataset 3904 - All crashes between 2005 and 2009 within a 200m radius of the intersection of Monvale Rd and Kimbriki Rd. Ingleside

Summary Crash Report

# Crash Type		
Car Crash	14	93.3%
Light Truck Crash	7	46.7%
Rigid Truck Crash	0	0.0%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	(0)	(0.0%)
Bus Crash	0	0.0%
"Heavy Vehicle Crash	(0)	(0.0%)
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	0	0.0%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	0	0.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	8	53.3%
Non intersection	7	46.7%

* Up to 10 metres from an intersection
~ 07:30-09:30 or 14:30-17:00 on school days

Collision Type		
Single Vehicle	4	26.7%
Multi Vehicle	11	73.3%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	14	93.3%
Unclassified Road	1	6.7%

Contributing Factors		
Speeding	2	13.3%
Fatigue	1	6.7%

Weather		
Fine	7	46.7%
Rain	7	46.7%
Overcast	0	0.0%
Fog or mist	1	6.7%
Other	0	0.0%

Road Surface Condition		
Wet	8	53.3%
Dry	7	46.7%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	2	13.3%
Daylight	9	60.0%
Dusk	1	6.7%
Darkness	3	20.0%

Crash Movement		
Intersection, adjacent approaches	2	13.3%
Head-on (not overtaking)	1	6.7%
Opposing vehicles; turning	1	6.7%
U-turn	0	0.0%
Rear-end	7	46.7%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	2	13.3%
Out of control on straight	0	0.0%
Off road, on curve	0	0.0%
Off road on curve, hit object	2	13.3%
Out of control on curve	0	0.0%
Other crash type	0	0.0%

Speed Limit					
			~ 40km/h or less	1	25.0%
40 km/h or less	1	6.7%	80 km/h zone	1	6.7%
50 km/h zone	1	6.7%	90 km/h zone	0	0.0%
60 km/h zone	2	13.3%	100 km/h zone	0	0.0%
70 km/h zone	10	66.7%	110 km/h zone	0	0.0%

CRASHES	15	
Fatal crash	0	0.0%
Injury crash	4	26.7%
Non-casualty crash	11	73.3%

CASUALTIES	4	
Killed	0	0.0%
Injured	4	100.0%
^ Unrestrained	0	0.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Time Group			% of Day
00:01 - 02:59	0	0.0%	12.5%
03:00 - 04:59	0	0.0%	8.3%
05:00 - 05:59	0	0.0%	4.2%
06:00 - 06:59	2	13.3%	4.2%
07:00 - 07:59	2	13.3%	4.2%
08:00 - 08:59	0	0.0%	4.2%
09:00 - 09:59	0	0.0%	4.2%
10:00 - 10:59	1	6.7%	4.2%
11:00 - 11:59	0	0.0%	4.2%
12:00 - 12:59	1	6.7%	4.2%
13:00 - 13:59	2	13.3%	4.2%
14:00 - 14:59	2	13.3%	4.2%
15:00 - 15:59	1	6.7%	4.2%
16:00 - 16:59	2	13.3%	4.2%
17:00 - 17:59	2	13.3%	4.2%
18:00 - 18:59	0	0.0%	4.2%
19:00 - 19:59	0	0.0%	4.2%
20:00 - 21:59	0	0.0%	8.3%
22:00 - 24:00	0	0.0%	8.3%

Street Lighting Off/Nil			% of Dark
2	of	3 in Dark	66.7%

Crashes		Casualties
1	2009	1
2	2008	1
7	2007	0
1	2006	1
4	2005	1

~ School Travel Time		
Involvement	4	26.7%

McLean Periods			% Week
A	4	26.7%	17.9%
B	0	0.0%	7.1%
C	5	33.3%	17.9%
D	0	0.0%	3.5%
E	1	6.7%	3.6%
F	2	13.3%	10.7%
G	3	20.0%	7.1%
H	0	0.0%	7.1%
I	0	0.0%	12.5%
J	0	0.0%	10.7%

Day of the Week								
Monday	2	13.3%	Thursday	5	33.3%	Sunday	1	6.7%
Tuesday	4	26.7%	Friday	1	6.7%	WEEKDAY	14	93.3%
Wednesday	2	13.3%	Saturday	0	0.0%	WEEKEND	1	6.7%

# Holiday Periods								
New Year	0	0.0%	Queen's BD	0	0.0%	Easter SH	0	0.0%
Aust. Day	1	6.7%	Labour Day	0	0.0%	June/July SH	0	0.0%
Easter	0	0.0%	Christmas	1	6.7%	Sept./Oct. SH	0	0.0%
Anzac Day	0	0.0%	January SH	2	13.3%	December SH	1	6.7%

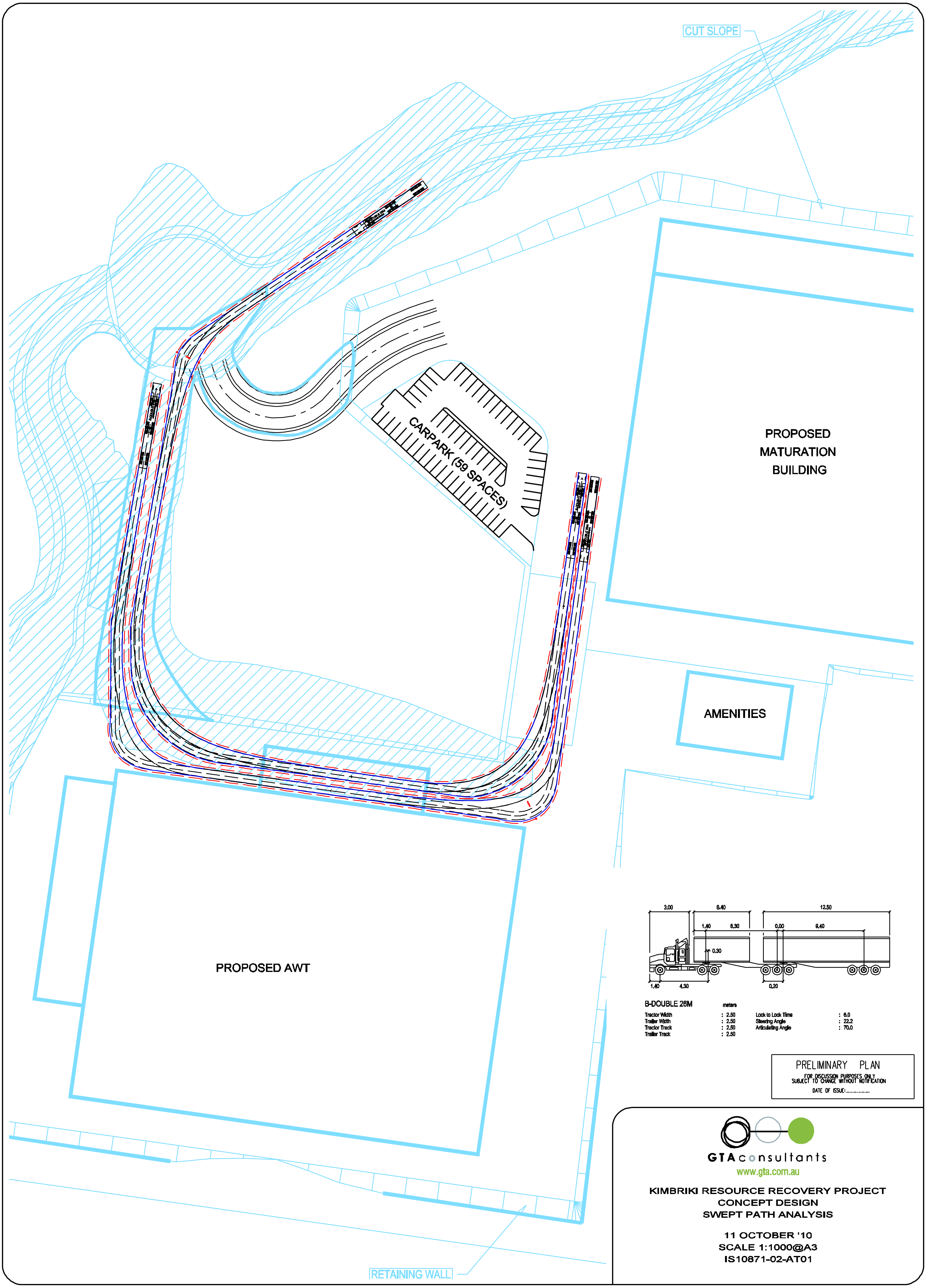
Crashid dataset 3904 - All crashes between 2005 and 2009 within a 200m radius of the intersection of Monvale Rd and Kimbriki Rd. Ingleside

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Appendix E

Swept Path Analysis

Appendix E



B-DOUBLE 26M

	meters		
Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 22.2
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

PRELIMINARY PLAN

FOR DISCUSSION PURPOSES ONLY
SUBJECT TO CHANGE WITHOUT NOTIFICATION

DATE OF ISSUE:...............

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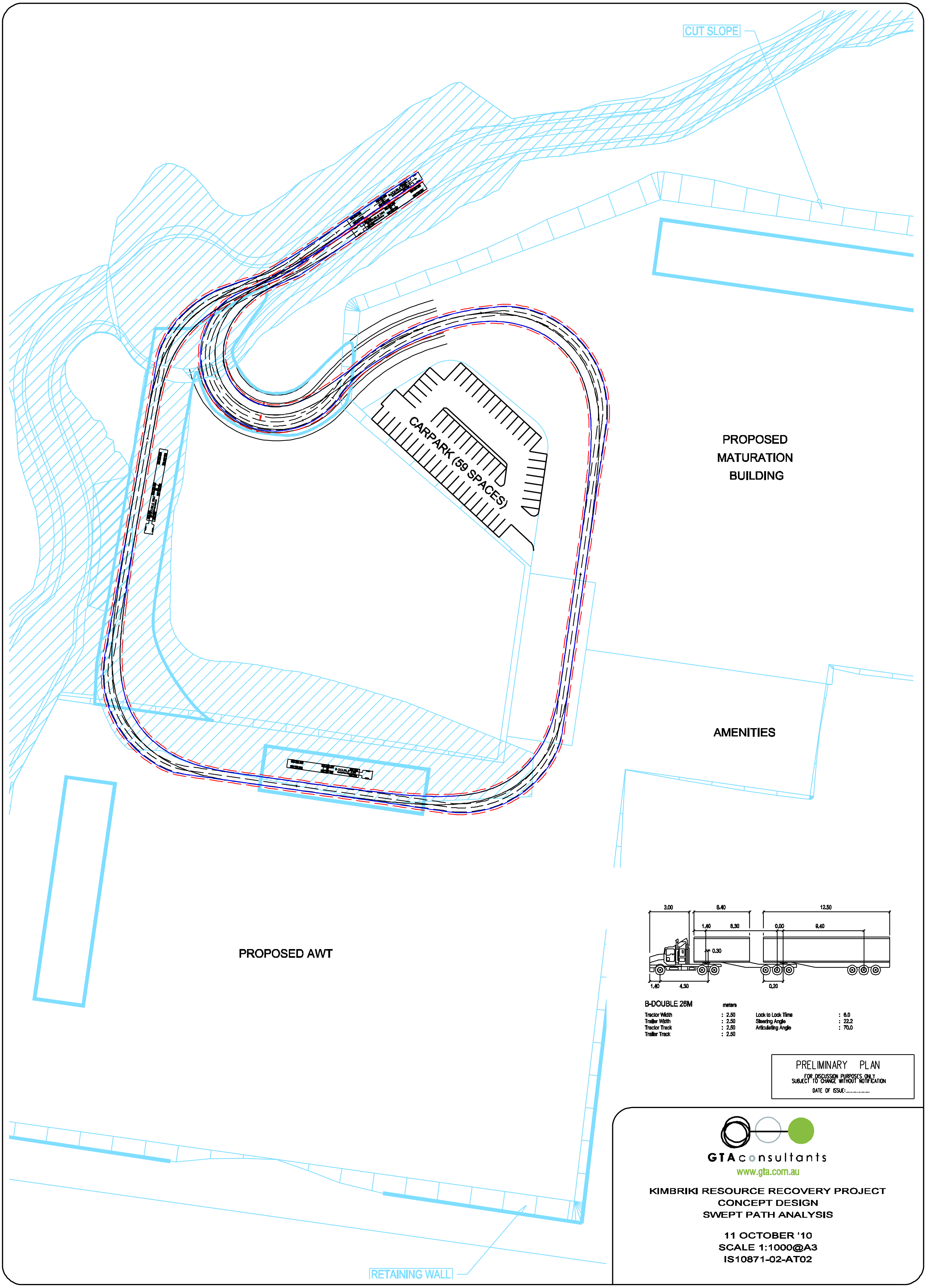
KIMBRIKI RESOURCE RECOVERY PROJECT
CONCEPT DESIGN
SWEPT PATH ANALYSIS

11 OCTOBER '10
SCALE 1:1000@A3
IS10871-02-AT01


CUT SLOPE
PROPOSED
MATURATION
BUILDING
CARPARK (59 SPACES)
AMENITIES
PROPOSED AWT
RETAINING WALL
3.00
8.40
12.50
1.40
8.30
0.00
9.40
0.30
1.40
4.30
0.20
B-DOUBLE 26M
meters
Tractor Width : 2.50
Trailer Width : 2.50
Tractor Track : 2.50
Trailer Track : 2.50
Lock to Lock Time : 6.0
Steering Angle : 22.2
Articulating Angle : 70.0
PRELIMINARY PLAN
FOR DISCUSSION PURPOSES ONLY
SUBJECT TO CHANGE WITHOUT NOTIFICATION
DATE OF ISSUE:.................
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KIMBRIKI RESOURCE RECOVERY PROJECT
CONCEPT DESIGN
SWEPT PATH ANALYSIS
11 OCTOBER '10
SCALE 1:1000@A3
IS10871-02-AT02

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Appendix I
Geotechnical Investigation Report

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Kimbriki Recycling & Waste Disposal Centre

Geotechnical Investigation/Assessment
of
Potential MRF/Transfer/AWT Facility
Kimbriki Terrey Hills

July 2006 50035

TABLE OF CONTENTS

LIST OF FIGURES

1. INTRODUCTION

At the request of Mr Peter Stephenson (on behalf of the Kimbriki Recycling & Waste Disposal Centre) I have carried out a geotechnical assessment of a nominated area of the existing Kimbriki Landfill site to determine its suitability for a potential Alternative Waste Technology (AWT) facility.

I have interpreted the term AWT quite broadly to include such things as a transfer station, drop off centre and materials recycling facility (MRF) as well as an AWT facility as all these operations are intimately related and could reasonably be progressively developed or staged over time.

I have also commented in a preliminary sense in Section 7 of the report on the feasibility/ advantages of relocating the current office/amenity building/parking/weigh bridges and possibly one or more of the other operations to the area uphill of the current access road to the landfill area.

These comments were instigated by various discussions held with and between Messrs Peter Duffy, Peter Stephenson and Keith Simpson over the past 12 months or so.

2. PERTINENT GEOLOGY

The existing landfill site and the potential AWT facility area are located entirely within the Hawkesbury Sandstone Group of rocks which overlie the Narrabeen Group which consists essentially of shales/siltstones/mudstones.

The massively bedded Hawkesbury Sandstone is exposed in major excavations adjoining the landfill footprint area where individual sandstone beds of up to 2 m in thickness can be seen.

This sandstone deposit is composed of near horizontally bedded sedimentary rock with a slight "dip" (bedding slope) downwards to the west of 10° or so.

Jointing in the sandstone formation is generally near vertical and very widely spaced (several metres apart).

Occasional shale beds are encountered within the sandstone sequence as evidenced in the western drain cutting.

Vertical permeability is very low (essentially impervious over depths exceeding 5 m) within the sandstone.

Horizontal permeability is variable from essentially impervious within individual sandstone beds to very pervious on some bedding planes or through joints within some sandstone beds.

3. TOPOGRAPHY/DRAINAGE

3.1 Existing

The site of the possible expansion/development is located on the spine of a broad ridge feature (having an approximate north-south orientation) and includes an eastern/southeastern flank which slopes downwards at about 12.5% to the southeast.

About 25% of the existing site area drains to the west towards the main landfill eastern drain.

The other 75% of the site area drains to an existing gully running down the eastern side of the possible expansion area.

Runoff from above the main landfill access road is intercepted by the roadway and diverted to the main landfill eastern drain.

3.2 Modified Site

Once the site has been developed/modified as illustrated on Figure 10, Possible Excavation Plan, the total developed area would drain to the existing gully to the east of the prepared/ excavated area.

It would also be appropriate to drain a portion of the slope above the main access road to the eastern gully where it has historically drained prior to the development of the main access road.

The implications of this would need detailed assessment at the design stage.

4. SUBSURFACE CONDITIONS

4.1 Soil/Rock Stratigraphy

The detailed soil/rock stratigraphy across the site was investigated by putting down nineteen (19) Test Pits (numbered 1 to 19, inclusive) and three Boreholes (numbered AWT1, AWT2 and AWT3) at the locations shown on Figure 1, Site Plan.

The test pits were dug using a Hitachi Excavator (160LC) and logged by me on a full time basis.

The bores were drilled using an Edson 3000 Drill Rig supplied and operated by Terratest Pty Ltd and logged by me on a full time basis.

Detailed logs of the soil rock stratigraphy encountered in each test pit and bore are given on Figures 2A to 2J and 3A to 3C, respectively.

The Method of Soil Classification used on the logs is given on Figure 4.

An Explanation of Rock Logging Terms used on the logs is given on Figure 5.

Essentially, the possible development area is underlain by between zero and 3 m of silty fine sand over parent sandstone bedrock.

The variation in depth of the silty fine sand overburden is illustrated on Figure 9, Soil Depth Contours.

The colour of the silty fine sand varies from light grey near ground surface to mottled red-brown/cream with depth where it blends into the weathered in place parent bedrock (residual soil).

There is a small organic fibre content within the upper 100 mm or so of this deposit associated with trees, shrubs and plant growth.

Locally, particularly with depth at some locations, there is a trace of clay within the deposit.

The parent bedrock consists of massively bedded sandstone (1 to 2 m+) with occasional generally fine shale seams or partings (< 5 mm).

The depth of weathering of the sandstone is generally less than 2 to 3 m below which the parent bedrock is fresh.

4.2 Groundwater

A groundwater monitoring bore was installed in MB AWT1 and MB AWT2, the details of which are given on Figures 3A and 3B, respectively.

Water was used in coring the bedrock in each bore and hence no stabilised groundwater level was recorded during the field work.

The water level in MB AWT1 (the first bore drilled) was measured at a 25.5 m depth on 12.07.06 but may not represent a stable level.

Two pressure packer tests carried out over the lower 20 m of MB AWT1 under pressures of 380 and 450 kPa resulted in "no take" of water, indicating an essentially impervious ($k < 10^{-9}$ m/s) sandstone mass over this depth.

No pressure packer tests were carried out in MB AWT2 as drill water was continuously lost over most of its depth, indicating highly pervious zones, at least in a horizontal direction.

A falling head permeability test (FHT) carried out between a 3 and 10 m depth in MB AWT3 with a calculated permeability of 2×10^{-8} m/s.

5. POTENTIAL RESOURCES

5.1 Existing Vegetative Cover as Mulch

Virtually all the vegetative cover across the possible development area consists of native trees, shrubs and grasses.

The removal, shredding, chipping and/or tubgrinding of this vegetative matter would produce a mulch product of potentially higher value than the composite mulch produced on site which include a wide variety of vetetation types, including weeds.

The removal of this vegetative cover should be carried out in stages, in advance of the preparatory earthworks, to minimise erosion/siltation.

5.2 Soil Cover as "Brickies Loam"

The depth of soil cover across the possible development area is summarised on Figure 9, Soil Depth Contours.

I estimate that there is approximately 50,000 m^3 of silty fine sand within the possible development area, a high proportion of which would be suitable as mortar in the construction of brick walls and the like.

My understanding from your on site staff (Mr Keith Simpson) is that "brickies loam" is in short supply in the area and is quite valuable.

The sequencing of the preparatory earthworks for the development of this area could be programmed to occur from south to north, completely stripping the soil overburden, leaving exposed parent bedrock on the down gradient side, resulting in reduced erosion/siltation problems.

Further, this stripping could be carried out by Council at a rate consistent with sales from stockpiles developed from direct screening to remove any foreign matter.

Alternatively, the stripping could be carried out under arrangement by Concrete Recyclers or their equivalent who have established marketing experience.

5.3 Sandstone as Landfill Cover/"Brickies Loam"/Rip Rap

A possible excavation plan is shown on Figure 10.

The net volume of sandstone that would need to be extracted to achieve these contours would be of the order of 250,000 m^3.

As the existing landfill continues to grow towards the west the volume of available on site ripped sandstone for future cover requirements will diminish.

The possible development area will be a potentially valuable source of cover over the next several years.

The rock available can be produced at different grades:

- crushed/screened extremely to highly weathered sandstone for "brickies loam"
- ripped sandstone using D10 or equivalent Caterpillar Tractor as cover for the landfill
- fresh sandstone broken up by hydraulic hammer for surface protection works (rip rap)

As with the soil cover, the excavation could be carried out in stages from the south to the north to allow drainage of storm water over a graded rock surface.

6. MAXIMISATION OF POTENTIAL MRF/TRANSFER STATION/AWT SITE

6.1 Excavated/Prepared Area

A maximised potential excavated area is shown on Figure 10 and includes removal of the current office/amenity/parking area.

The total area is approximately 4 Ha and could accommodate either a substantial MRF and transfer station or an AWT facility.

By extending the excavation to "daylight" in the vicinity of the existing recycling/drop off area it is likely that sufficient room is available to provide separate car and truck access at the northwestern corner of the site.

This area is sufficiently large to house a state of the art drop off centre, a materials recycling facility and ample stockpiling/storage space for recyclables awaiting removal.

It is assumed that the greenwaste and construction and demolition recycling areas would be maintained above the landfill footprint area as well as incoming commercial sources of metal waste.

An AWT facility of the size of a Bedminster or Rethmann (Remondis) system could be accommodated within this area although at this stage there appears to be little benefit in moving in this direction as about one half of their saleable product (compost) is currently handled at Kimbriki in a far more cost effective manner through the ANL arrangement.

The very low vertical permeability of the sandstone bedrock (essentially impervious individual beds) and the apparently deep water table (yet to be confirmed) leaves an extensive unsaturated attenuation zone which provides excellent protection to the groundwater in the area.

6.2 Batters

The major portion of the perimeter batters around the possible development area (in the example shown on Figure 10) would be largely in massively bedded stable sandstone bedrock which has a slight dip of about 10°.

Batter slopes of 2V:1H would be feasible in this rock with the upper soil overburden battered back at 1V:2H to allow mulching/vegetating and maintenance.

The high (16 m) cut batter may require local shotcreting or rock bolting but this should be minimal if the batter is "cut" precisely using pre-split drilling techniques.

6.3 Drainage/Surface Water Flow

An open drain cut into parent bedrock would need to be provided above the northern batter to control storm water flow over the exposed rock face as well as divert surface water runoff from above the main entrance road to the eastern gully.

Drainage off the exposed excavation base surface will be towards the southeast but may be locally modified by conventional kerb and guttering, storm drains or the like depending upon the infrastructure layout.

There should be no runoff into the existing landfill area from this possible development area.

Further, re-routing of some of the upgradient surface water runoff away from the landfill area will be an improvement in the overall landfill operation.

6.4 Foundation Conditions

The exposed sandstone bedrock within the suggested excavation area has excellent load carrying capabilities and can nominally accept loadings of at least 1,000 kPa or more, if necessary.

For most large metal framed and clad buildings associated with MRFs, transfer stations or AWTs the foundation pads or slab dimensions will be dictated by minimum dimensions and the excellent bearing capacity of the sandstone at this site will not limit its capacity for development in any way.

6.5 Access (Traffic)

There appears to be adequate space for multiple lanes of separated traffic at the northwestern corner of the possible development area, particularly if the excavation is carried to the maximum extent possible towards the west.

6.6 Restricted Access (Vehicle and Foot) Off Kimbriki Road

There is evidence that individuals are regularly accessing the landfill site through tracks in the native vegetation off Kimbriki Road.

Soil bunds are in place to prevent vehicle traffic access.

It is recommended that a man-proof chain link fence be erected along Kimbriki Road to prevent ready access to the existing landfill and to this potential very valuable development area.

6.7 Buffers

The existing natural native bushland on the north, east and southern sides of the possible development area provides an excellent sight barrier/buffer to adjoining land and Kimbriki Road users.

It also provides an excellent back-up filter for silt and slope wash sediments between the possible development area and downstream water courses.

It is recommended that all tracks through this natural bush buffer be "backfilled" with native shrubs, timber, logs, bushes and topsoil from the possible development area to encourage natural regrowth and assist in preventing easy access to the site.

6.8 Noise Barrier (To the South)

During the recent drilling program a neighbour (No. 5 Kimbriki Road) complained about the noise while we were drilling MB AWT1.

It appears that there is no solid barrier between the southeast corner of the possible development area and this neighbour to the due south (down a natural valley feature).

A solid barrier (soil bund or structural opaque fence) around this corner of the site may reduce/ameliorate this potential problem.

7. RELOCATION OF OFFICE/AMENITY BUILDING/WEIGHBRIDGES

The removal of the existing offices, amenity building and car parking area from their existing position and including this area in the general excavation area for the possible development area considerably simplifies and enlarges the available space.

The gently sloping terrace to the north of the existing office (refer Figure 10) has the potential to accept the office/amenity building/parking areas as well as a recyclables drop off area.

By carrying out major earthworks (mainly rock excavation) it may also be feasible to include a transfer station in this area in conjunction with a drop off centre.

As with the possible development area the major cost of developing/preparing this area is rock excavation and this material will be needed as cover for the long term development of the landfill.

8. SUMMARY

The possible development site is underlain by deposits of silty fine sand and massively bedded sandstone.

This area can be prepared to form a simple, gradually graded rock base which would be suitable for the development of a transfer station, drop-off centre and MRF facility or an AWT facility with no foundation constraints.

An example of an accessible maximised site with extensive natural native vegetation buffers is illustrated on Figure 10.

The excavated material would be composed largely of silty fine sand (50,000 m^3) which will likely have a market as "brickies loam" and ripped sandstone (250,000 m^3) which could be sold or used on site in the continuing development of the landfill.

The groundwater table appears to be quite deep in the area of the possible development site and is protected by large, essentially impervious sandstone beds and a deep unsaturated zone of rock.

By maximising the possible development area the existing office, amenity building and car parking areas would need to be moved.

A suitable site may exist across the access road to the north and may also be capable of housing a drop off centre and transfer station along with the weighbridges which will eventually need to be relocated to complete the final landfill landform.

The preparation of the possible development area could be staged (from south to north) to progressively sell or use the excavated material in the landfill operation.

In my view, the development of a transfer station and upgraded drop off area in conjunction with the relocation of the weighbridges to allow completion of the northern landfill area should take precedence over an AWT facility at this stage.

In the meantime however, the excavation of the possible development area could continue as a borrow area with the eventual aim of utilising it for an AWT or other, yet to be determined, facility.

R H AMARAL

FIGURE 1

SITE PLAN

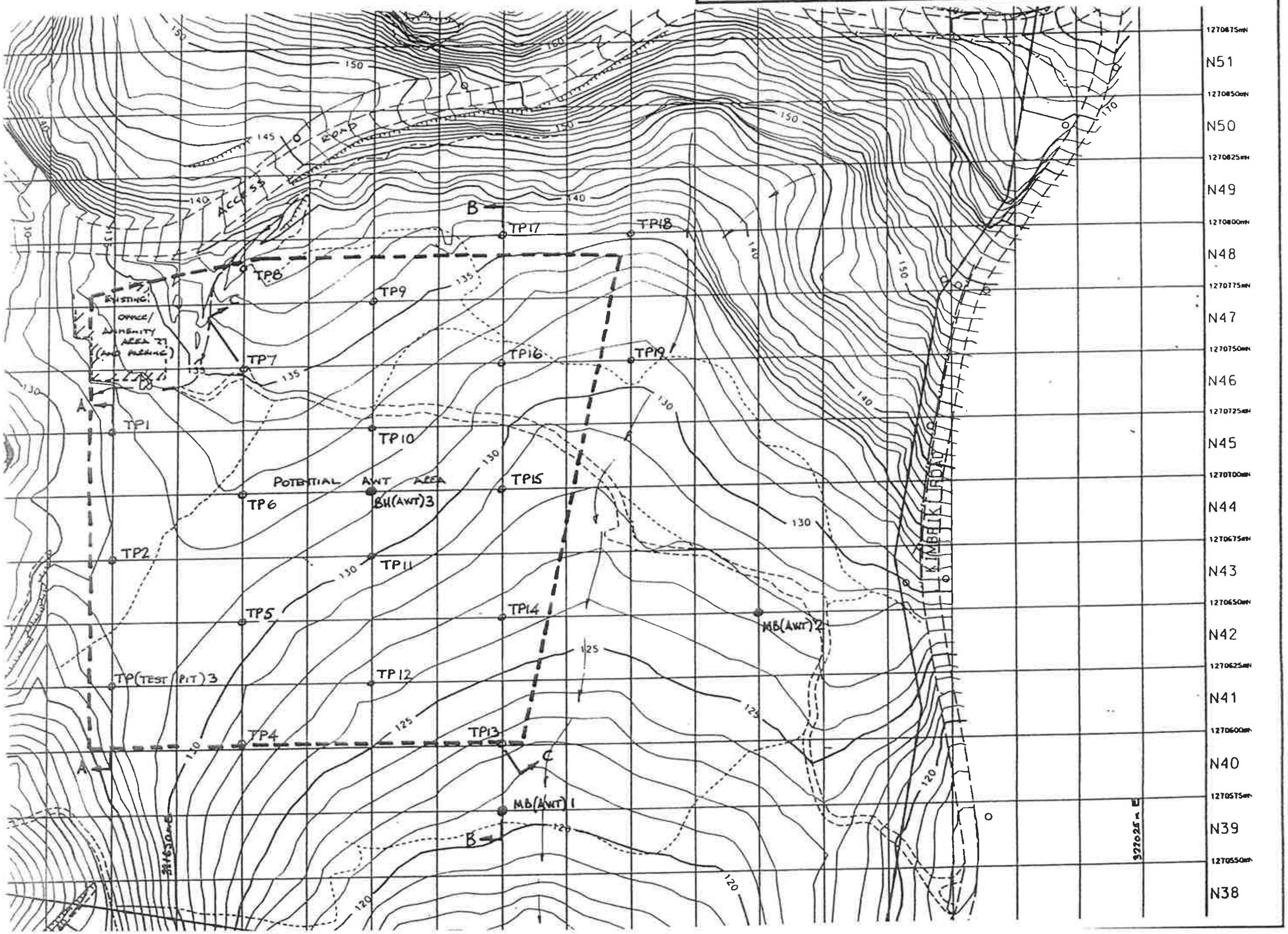

FIGURE 2A

Surface Elevation: 131.3 Datum: AHD

Location: SEE FIGURE 1

Method: 160 LC HITACHI EXCAVATOR Date: 02.06.06

TEST PIT 1

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ORGANICS (SLOPE WASH / TOPSOIL)		DRY										
REFUSAL ON SANDSTONE BEDROCK AT 0.1m	0.5											
	1.0											

Surface Elevation: 131.1 Datum: AHD

Location: SEE FIGURE 1

Method: 160 LC HITACHI EXCAVATOR Date: 02.06.06

TEST PIT 2

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ORGANICS (SLOPE WASH / TOPSOIL)		DRY										
REFUSAL ON SANDSTONE BEDROCK AT 0.2m	0.5											
	1.0											

AMARAL

FIGURE 2B

Surface Elevation: 132.5	Datum: AHD	TEST PIT	3
Location: SEE FIGURE 1			
Method: 160 LC HITACHI EXCAVATOR	Date: 02.06.06		

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
SANDSTONE BEDROCK AT GROUND SURFACE												
0.5	0.5											
1.0	1.0											

Surface Elevation: 128	Datum: AHD	TEST PIT	4
Location: SEE FIGURE 1			
Method: 160 LC HITACHI EXCAVATOR	Date: 02.06.06		

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ORGANICS, ROOTS												
LIGHT BROWN SILTY FINE SAND, SOME GRAVEL / COBBLES	0.5	DRY										
MOTTLED ORANGE BROWN /CREAM XW SANDSTONE												
NEAR REFUSAL ON SANDSTONE BEDROCK AT 1.0 m	1.0											

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FIGURE 2C

Surface Elevation: 130.6	Datum: AHD	TEST PIT 5
Location: SEE FIGURE 1		
Method: 160 LC HITACHI EXCAVATOR	Date: 02.06.06	

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND , TRACE ROOTS												
LIGHT BROWN SILTY FINE SAND	0.5											
MOTTLED ORANGE BROWN / CREAM SILTY FINE TO MEDIUM SAND (COMPLETELY WEATHERED SANDSTONE) BECOMING SANDSTONE (HW)	1.0 1.5	DRY										
NEAR REFUSAL ON SANDSTONE AT 1.7m	2.0											

Surface Elevation: 132.8	Datum: AHD	TEST PIT 6
Location: SEE FIGURE 1		
Method: 160 LC HITACHI EXCAVATOR	Date: 02.06.06	

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND , TRACE ORGANICS , ROOTS												
ORANGE BROWN SILTY FINE SAND MODERATELY DENSE TO DENSE	0.5 1.0	DRY										
MOTTLED ORANGE BROWN /CREAM XW SANDSTONE	1.5											
NEAR REFUSAL ON SANDSTONE BEDROCK AT 1.65m	2.0											

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FIGURE 2D

TEST PIT 7

Surface Elevation: 135.2 Datum: AHD

Location: SEE FIGURE 1

Method: 160 LC HITACHI EXCAVATOR Date: 02.06.06

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ROOTS												
LIGHT BROWN SILTY FINE SAND												
MOTTLED ORANGE BROWN / CREAM SILTY FINE TO MEDIUM SAND (COMPLETELY WEATHERED SANDSTONE)	0.5	DRY										
HIGHLY WEATHERED SANDSTONE (HW)	1.0											
NEAR REFUSAL ON SANDSTONE AT 1.1m												
	1.5											
	2.0											

TEST PIT 8

Surface Elevation: 138 Datum: AHD

Location: SEE FIGURE 1

Method: 160 LC HITACHI EXCAVATOR Date: 02.06.06

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ORGANICS												
LIGHT GREY SILTY FINE SAND	0.5	DRY										
MOTTLED ORANGE BROWN/ CREAM SILTY FINE SAND, TRACE CLAY												
NEAR REFUSAL ON SANDSTONE BEDROCK AT 0.9m	1.0											
	1.5											
	2.0											

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FIGURE 2E

Surface Elevation: 135.8	Datum: AHD	TEST PIT 9
Location: SEE FIGURE 1		
Method: 160 LC HITACHI EXCAVATOR	Date: 02.06.06	

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ROOTS												
MOTTLED LIGHT GREY / ORANGE BROWN SILTY FINE SAND	0.5	DRY										
	1.0											
MOTTLED ORANGE BROWN / CREAM SILTY FINE TO MEDIUM SAND (COMPLETELY WEATHERED SANDSTONE)												
NEAR REFUSAL ON SANDSTONE AT 1.3m	1.5											
	2.0											

Surface Elevation: 132.8	Datum: AHD	TEST PIT 10
Location: SEE FIGURE 1		
Method: 160 LC HITACHI EXCAVATOR	Date: 02.06.06	

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ORGANICS												
ORANGE BROWN SILTY FINE SAND	0.5											
	1.0	DRY										
MOTTLED ORANGE BROWN/ CREAM SILTY FINE TO MEDIUM SAND, TRACE CLAY BECOMING XW SANDSTONE	1.5											
NEAR REFUSAL ON SANDSTONE BEDROCK AT 1.8m	2.0											

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FIGURE 2F

Surface Elevation: 130	Datum: AHD	TEST PIT 11
Location: SEE FIGURE 1		
Method: 160 LC HITACHI EXCAVATOR	Date: 02.06.06	

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ROOTS												
MOTTLED LIGHT GREY / ORANGE BROWN SILTY FINE SAND	0.5											
	1.0	DRY										
	1.5											
MOTTLED ORANGE BROWN / CREAM SILTY FINE TO MEDIUM SAND (COMPLETELY WEATHERED SANDSTONE)	2.0											
BECOMING XW SANDSTONE	3.0											
	3.5											
HARD DIGGING (NOT REFUSAL) AT 3.4m												

Surface Elevation: 126.5	Datum: AHD	TEST PIT 12
Location: SEE FIGURE 1		
Method: 160 LC HITACHI EXCAVATOR	Date: 02.06.06	

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ORGANICS												
LIGHT BROWN SILTY FINE SAND	0.5	DRY										
	1.0											
MOTTLED ORANGE BROWN/ CREAM SILTY FINE TO MEDIUM SAND, TRACE CLAY BECOMING XW SANDSTONE	1.5											
NEAR REFUSAL ON SANDSTONE BEDROCK AT 1.83m	2.0											

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FIGURE 2G

TEST PIT 13

Surface Elevation: 122.4 Datum: AHD

Location: SEE FIGURE 1

Method: 160 LC HITACHI EXCAVATOR Date: 02.06.06

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data Type	Sample Data Number	Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data Laboratory	Strength Data Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ROOTS												
LIGHT GREY (BECOMING WHITE) SILTY FINE TO MEDIUM SAND	0.5											
MODERATELY DENSE TO DENSE	1.0											
	1.5	DRY										
	2.0											
WHITE XW SANDSTONE	2.5											
HARD DIGGING (NOT REFUSAL) AT 2.7m	3.0											

TEST PIT 14

Surface Elevation: 126.5 Datum: AHD

Location: SEE FIGURE 1

Method: 160 LC HITACHI EXCAVATOR Date: 02.06.06

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data Type	Sample Data Number	Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data Laboratory	Strength Data Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ORGANICS												
ORANGE BROWN SILTY FINE SAND, TRACE CLAY	0.5	DRY										
BECOMING MOTTLED ORANGE BROWN/ CREAM SILTY FINE SAND	1.0											
MODERATELY DENSE TO DENSE	1.5											
	2.5											
XW SANDSTONE	3.0											
HARD DIGGING (NOT REFUSAL) AT 3.4m	3.5											

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FIGURE 2H

Surface Elevation: 128.9	Datum: AHD	TEST PIT 15
Location: SEE FIGURE 1		
Method: 160 LC HITACHI EXCAVATOR	Date: 02.06.06	

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ROOTS												
ORANGE BROWN SILTY FINE SAND, TRACE CLAY	0.5											
BECOMING ORANGE BROWN / CREAM	1.0	DRY										
	1.5											
MODERATELY DENSE TO DENSE	2.0											
	2.5											
XW SANDSTONE												
NEAR REFUSAL ON SANDSTONE AT 2.9m	3.0											

Surface Elevation: 131.8	Datum: AHD	TEST PIT 16
Location: SEE FIGURE 1		
Method: 160 LC HITACHI EXCAVATOR	Date: 02.06.06	

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND, TRACE ORGANICS												
ORANGE BROWN SILTY FINE SAND	0.5											
	1.0	DRY										
MODERATELY DENSE TO DENSE	1.5											
MOTTLED ORANGE BROWN/ CREAM SILTY FINE SAND, TRACE CLAY (RESIDUAL SOIL)	2.0											
NEAR REFUSAL ON SANDSTONE AT 2.3m	2.5											

FIGURE 21

TEST PIT 17

Surface Elevation: 136.3 Datum: AHD

Location: SEE FIGURE 1

Method: 160 LC HITACHI EXCAVATOR Date: 02.06.06

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT BROWN SILTY FINE SAND	0.5											
MOTTLED ORANGE BROWN / CREAM SILTY FINE SAND, TRACE CLAY / XW SANDSTONE	1.0											
	1.5	DRY										
XW SANDSTONE (SANDSTONE ROCK LEDGE WITHIN TEST PIT)	2.0											
	2.5											
	3.0											

TEST PIT 18

Surface Elevation: 135.5 Datum: AHD

Location: SEE FIGURE 1

Method: 160 LC HITACHI EXCAVATOR Date: 02.06.06

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data: Type	Sample Data: Number	Classification Data: Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data: Laboratory	Strength Data: Field	Other
LIGHT GREY SILTY FINE SAND	0.5											
	1.0											
MOTTLED ORANGE BROWN/ CREAM CLAYEY SAND (RESIDUAL SOIL)	1.5											
NEAR REFUSAL ON SANDSTONE AT 1.8m	2.0											
	2.5											

TEST PIT LOCATED BELOW EXPOSED ROCK LEDGE

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FIGURE 2J

Surface Elevation: 130.7	Datum: AHD	TEST PIT 19
Location: SEE FIGURE 1		
Method: 160LC HITACHI EXCAVATOR	Date: 06.06.06	

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data Type	Sample Data Number	Classification Data Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data Laboratory	Field	Other
DARK GREY SILTY FINE SAND , TRACE ORGANICS												
LIGHT GREY / BROWN SILTY FINE SAND	0.5											
MODERATELY DENSE	1.0	DRY										
	1.5											
	2.0											
	2.5											
MOTTLED ORANGE BROWN / CREAM SILTY SAND , TRACE CLAY (RESIDUAL SOIL)												
NEAR REFUSAL ON SANDSTONE BEDROCK AT 3.0m	3.0											

Surface Elevation:	Datum:	TEST PIT
Location:		
Method:	Date:	

STRATIGRAPHY	Depth Elev. Meters	Groundwater Seepage	Sample Data Type	Sample Data Number	Classification Data Natural Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	Percent Fines	Strength Data Laboratory	Field	Other

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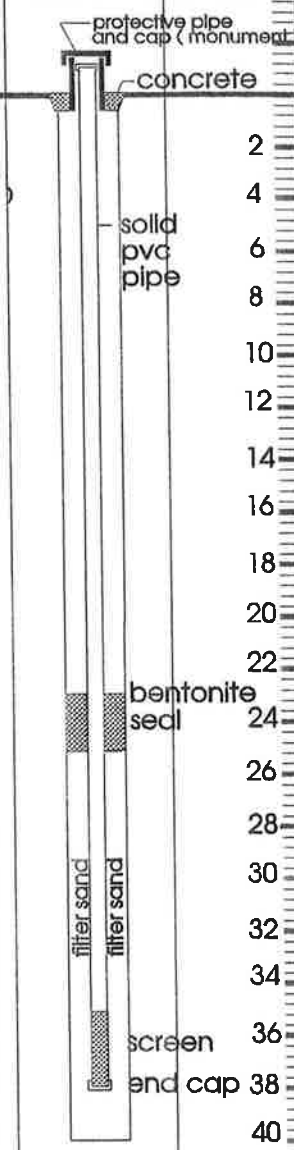
Borehole Log

FIGURE 3A	
Borehole No:	**AWT 1**
Job No:	50035
CLIENT: KIMBRIKI RECYCLING & WASTE DISPOSAL CENTRE	Sheet 1 of 1
PROJECT: SITE ASSESSMENT FOR AWT FACILITY	Location : SEE FIGURE 1
DRILL TYPE/METHOD EDSON 3000 DRILL RIG DIAMOND CORE (NQ) WIRELINE	Collar Level: 120.7

Samples	Water	Casing	R.L. Depth Meters	Material Description ,Structure	Test Results / Degree of Weathering	Obs'n Well Details	R.L. DEPTH METERS
		HQ	0–2	LIGHT BROWN SILTY FINE SAND (DENSE) BECOMING MOTTLED ORANGE / LIGHT BROWN SANDSTONE	CW / XW	protective pipe and cap (monument); concrete	2
			2–5	LIGHT BROWN SANDSTONE (SW) (NEAR REFUSAL TO TC BIT ON LEAD AUGER)			4
			6	LIGHT GREY / WHITE SANDSTONE	F	solid pvc pipe	6
			8	(10mm shale seam)			8
			10	(several 10mm shale seams between 9.7 and 10m)			10
			12	(shale breccia inclusions between11.8 and 12.3m)	F		12
			16	(1-2m ave bedding depths)			16
			20	(occasional shale partings)	F		20
	▼(8AM , 12.07.06)		24	(many fine , 1-2mm , shale partings)		bentonite seal	24
			26	(2mm soft clayey sand seam)	F		26
			30	(bedding depth 2-3m)		filter sand	30
			33	(finely laminated shale / sandstone below 33m)			34
			36		F	screen	36
			38			end cap	38
			40	END OF BORE AT 40.0m			40

PRESSURE PACKER TESTS (380 AND 450 kPa) ' NO TAKE ' K < 10 -9 m/sec



Logged By: R. AMARAL	Date: 10-11.07.06	Checked By: R.AMARAL	Date: 14.07.06

Borehole Log

FIGURE 3B

Borehole No: AWT 2

Job No: 50035

Sheet 1 of 1

CLIENT: KIMBRIKI RECYCLING & WASTE DISPOSAL CENTRE

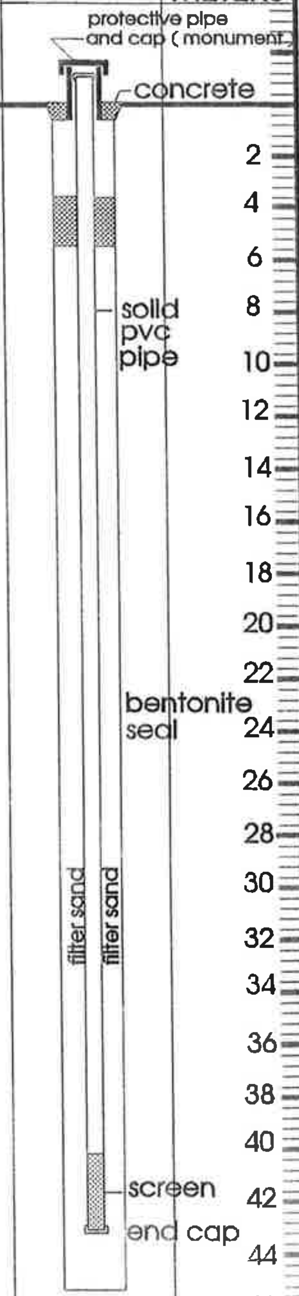
Location : SEE FIGURE 1

PROJECT: SITE ASSESSMENT FOR AWT FACILITY

DRILL TYPE/METHOD EDSON 3000 DRILL RIG DIAMOND CORE (NQ) WIRELINE

Collar Level: 127.2

Samples	Water	Casing	R.L. Depth (Meters)	Material Description ,Structure	Test Results / Degree of Weathering	Obs'n Well Details	R.L. DEPTH METERS
			0–2	LIGHT GREY SILTY FINE SAND — (NEAR REFUSAL TO TC BIT ON LEAD AUGER)		protective pipe and cap (monument); concrete	
	loss of drill water at 4.5m	HQ	2–4	MOTTLED RE-BROWN/WHITE SANDSTONE	XW MW		2, 4
			6	(coarse) (shale seam 6.05 - 6.07)	MW MW/ SW		6
			8	(bedding depth ave 1m)	F	solid pvc pipe	8
			10	(occasional fine shale parting)			10
			14	(bedding depth ave 2m)			14
			20		F		20
			22	(sub horizontal bedding , 10 degrees +/-)		bentonite seal	22, 24
			26		F		26
			29	(2mm clay seam)		filter sand	28, 30
			32	(occasional very fine , < 1mm , shale partings)			32
			36		F		36
			39	(clay seam 39.2 - 39.25)			38, 40
			42–44			screen; end cap	42, 44
			45–46	END OF BORE AT 45.0m			46



Logged By: R. AMARAL Date: 12.07.06 | Checked By: R.AMARAL Date: 14.07.06

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Borehole Log

FIGURE	3C
Borehole No:	AWT 3
Job No:	50035
Sheet	1 of 1
Location :	SEE FIGURE 1
Collar Level:	131.4

CLIENT: KIMBRIKI RECYCLING & WASTE DISPOSAL CENTRE

PROJECT: SITE ASSESSMENT FOR AWT FACILITY

DRILL TYPE/METHOD EDSON 3000 DRILL RIG
DIAMOND CORE (NQ) WIRELINE

Samples	Water	Casing	R.L. Depth Meters	Material Description ,Structure	Test Results / Degree of Weathering	Obs'n Well Details	R.L. DEPTH METERS
		HQ CASING	0 – 2	LIGHT BROWN SILTY SAND (BECOMING RED-BROWN)			
			2 – 3	MOTTLED RED-BROWN / CREAM SILTY FINE SAND (RESIDUAL SOIL)	CW		
			3 – 10	WHITE SANDSTONE (lost 1.7m out of 3.0m run) (coarse) (75mm shale layer at 6m) (sub vertical joint , 70 degrees , 10 - 10.4m)	XW HW SW TO F F	FALLING HEAD TEST k = 2 x 10 -8 m/sec	
			10	END OF BORE AT 10.0m			

Logged By: R. AMARAL Date: 11.07.06 Checked By: R.AMARAL Date: 14.07.06

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METHOD OF SOIL CLASSIFICATION
(UNIFIED CLASSIFICATION SYSTEM)

FIGURE 4

COARSE GRAINED SOILS (less than 50 percent fines)	GRAVELS	GW	Well graded gravels or sand-gravel mixtures, less than 5% fines.
		GP	Poorly graded gravels or gravel-sand mixtures, less than 5% fines.
		GM	Silty gravel, gravel-sand-silt mixtures.
		GC	Clayey gravel, gravel-sand-clay mixtures.
	SANDS	SW	Well graded sands or gravelly sands, less than 5% fines.
		SP	Poorly graded sands or gravelly sands, less than 5% fines.
		SM	Silty sand, sand-silt mixtures.
		SC	Clayey sand, sand-clay mixtures.
FINE GRAINED SOILS (more than 50 percent fines)	SILTS & CLAYS, LL < 50	ML	Inorganic silts, rock flour, sandy or clayey silts of low plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL	Organic silts and organic silty clays of low to medium plasticity.
		MI	Inorganic silts or clayey silts of medium plasticity.
	SILTS & CLAYS, LL > 50	MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of high plasticity, organic silty clay, organic silt.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.

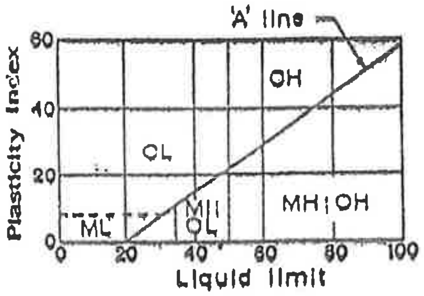
CLASSIFICATION	EQUIVALENT SIEVE SIZE B.S.	EQUIVALENT SIEVE SIZE A.S.
COBBLES	8 in. - 3 in.	200mm - 75mm
GRAVEL,	3 in. - 3/16 in.	75mm - 4.75mm
coarse	3 in. - 3/4 in.	75mm - 19mm
fine	3/4 in. - 3/16 in.	19mm - 4.75mm
SAND,	3/16 in. - No.200	4.75mm - 75 μm
coarse	3/16 in. - No.7	4.75mm - 2.36mm
medium	No.7 - No.36	2.36mm - 425 μm
fine	No.36 - No.200	425 μm - 75 μm
FINES, silt & clay	below No.200	below 75 μm

COHESIONLESS SOILS

RELATIVE DENSITY	'N' (SPT) VALUE, blows/300mm
VERY LOOSE	0 to 4
LOOSE	4 to 10
MODERATELY DENSE	10 to 30
DENSE	30 to 50
VERY DENSE	Above 50

COHESIVE SOILS

CONSISTENCY	UNDRAINED SHEAR STRENGTH, p.s.f.	UNDRAINED SHEAR STRENGTH, kPa
VERY SOFT	0 to 250	0 to 12.5
SOFT	250 to 500	12.5 to 25
FIRM	500 to 1000	25 to 50
STIFF	1000 to 2000	50 to 100
VERY STIFF	Above 2000	Above 100



AMARAL

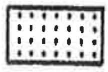
EXPLANATION OF ROCK LOGGING TERMS — FIGURE 5

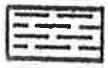
ROCK SUBSTANCE WEATHERING CLASSIFICATION

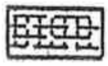
TERM	ABBREVIATION	DIAGNOSTIC FEATURES
RESIDUAL SOIL	RS	Rock is completely changed to a soil in which original rock fabric is completely destroyed.
EXTREMELY WEATHERED	XW	Rock is weathered to such an extent that it has soil properties, i.e. in water it either disintegrates or can be remoulded, but original fabric is mainly preserved.
HIGHLY WEATHERED	HW	Rock strength and hardness clearly reduced by weathering, rock pieces can generally be broken by hand across the rock fabric and the rock material is partly friable; the rock may be highly discoloured, usually by fronstaining.
MODERATELY WEATHERED	MW	Significant change of colour and lustre through the rock fabric, and rock strength is noticeably reduced by weathering, but rock pieces cannot be broken by hand across the rock fabric and the rock material is not briable.
SLIGHTLY WEATHERED	SW	Rock shows slight change of colour and lustre but generally shows little or no change or strength from fresh rock.
FRESH	F	Rock shows no sign of decomposition.

TYPICAL ROCK SYMBOLS

SEDIMENTARY


SANDSTONE


SILTSTONE


INTERBEDDED SANDSTONE AND SILTSTONE


CLAYSTONE


CONGLOMERATE

IGNEOUS


BASALT


DYKE ROCK

BEDDING AND DISCONTINUITY SPACING

BEDDING	SPACING	DISCONTINUITIES
Very Thickly Bedded	>2 m	Very Widely Spaced
Thickly Bedded	0.6 m to 2 m	Widely Spaced
Medium Bedded	0.2 m to 0.6 m	Moderately Widely Spaced
Thinly Bedded	60 mm to 0.2 m	Closely Spaced
Very Thinly Bedded	20 mm to 60 mm	Very Closely Spaced
Laminated	6 mm to 20 mm	Extremely Closely Spaced
Thinly Laminated	<6 mm	–

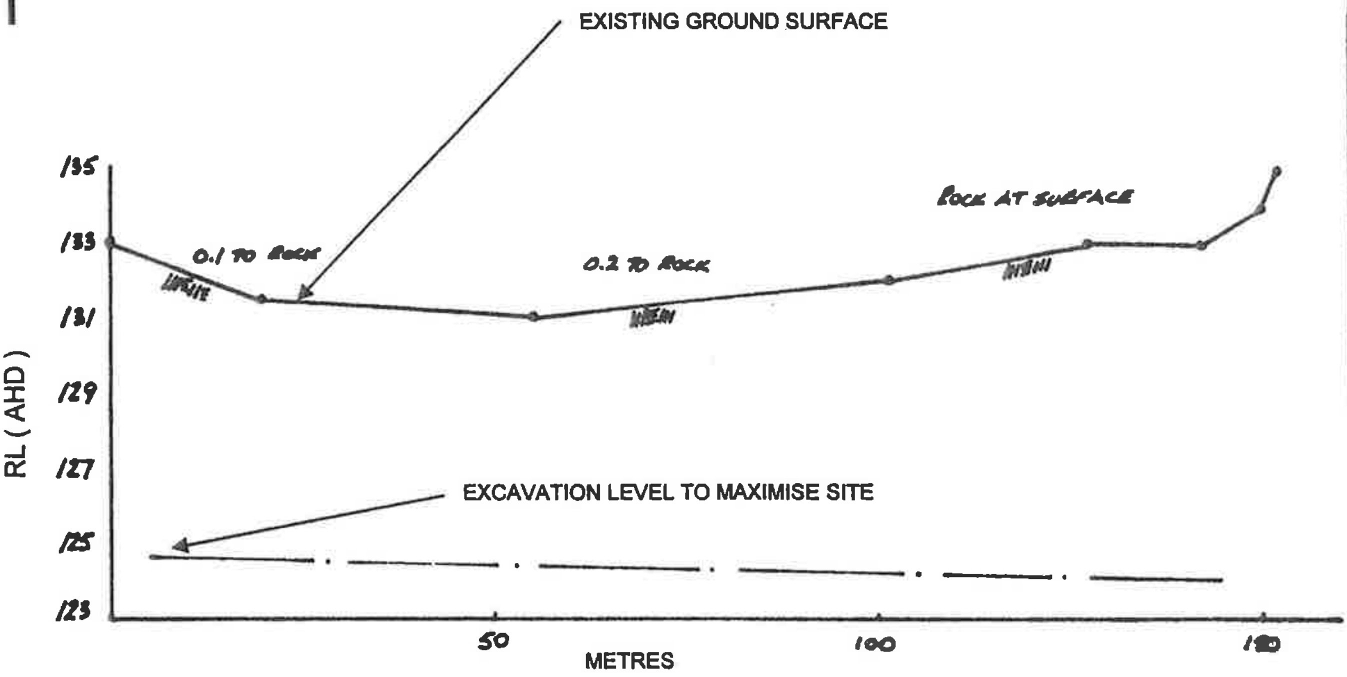
STRENGTH CLASSIFICATION

ROCK STRENGTH	UNCONFINED COMPRESSIVE STRENGTH Qu(MPa)	POINT LOAD STRENGTH INDEX *I_s (50) (MPa)
Extremely Low (EL)		
	0.7	0.03
Very Low (VL)		
	2.4	0.1
Low (L)		
	7	0.3
Medium (M)		
	24	1
High (H)		
	70	3
Very High (VH)		
	240	10
Extremely High (EH)		

* (50) - corrected to reference diameter of 50 mm

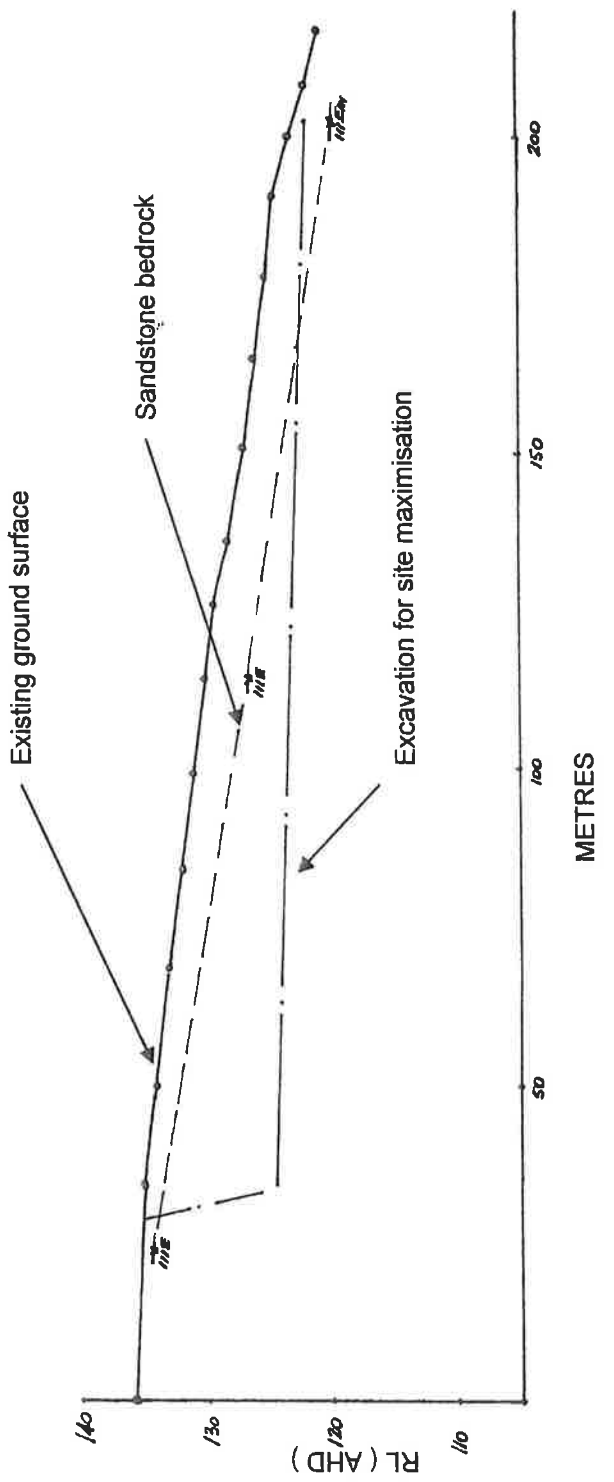
SECTION A - A

FIGURE 6



AMARAL

SECTION B - B	FIGURE 7



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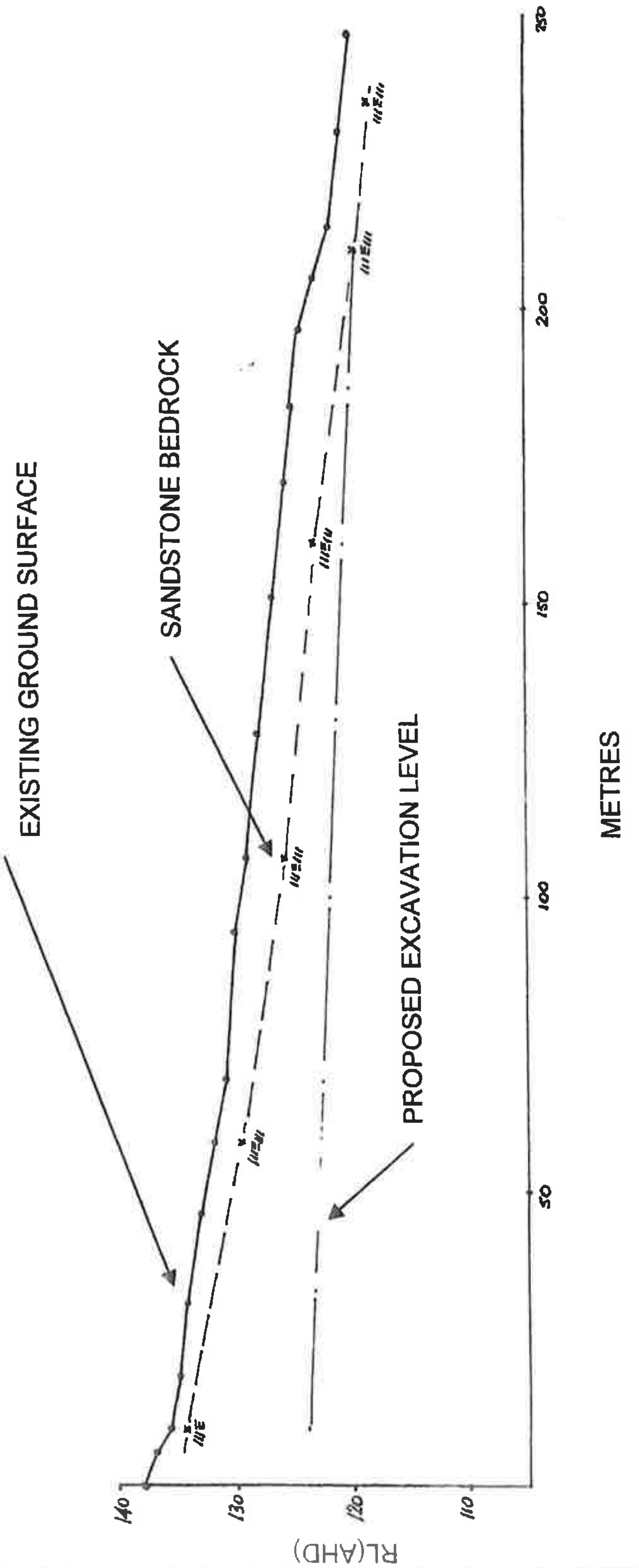
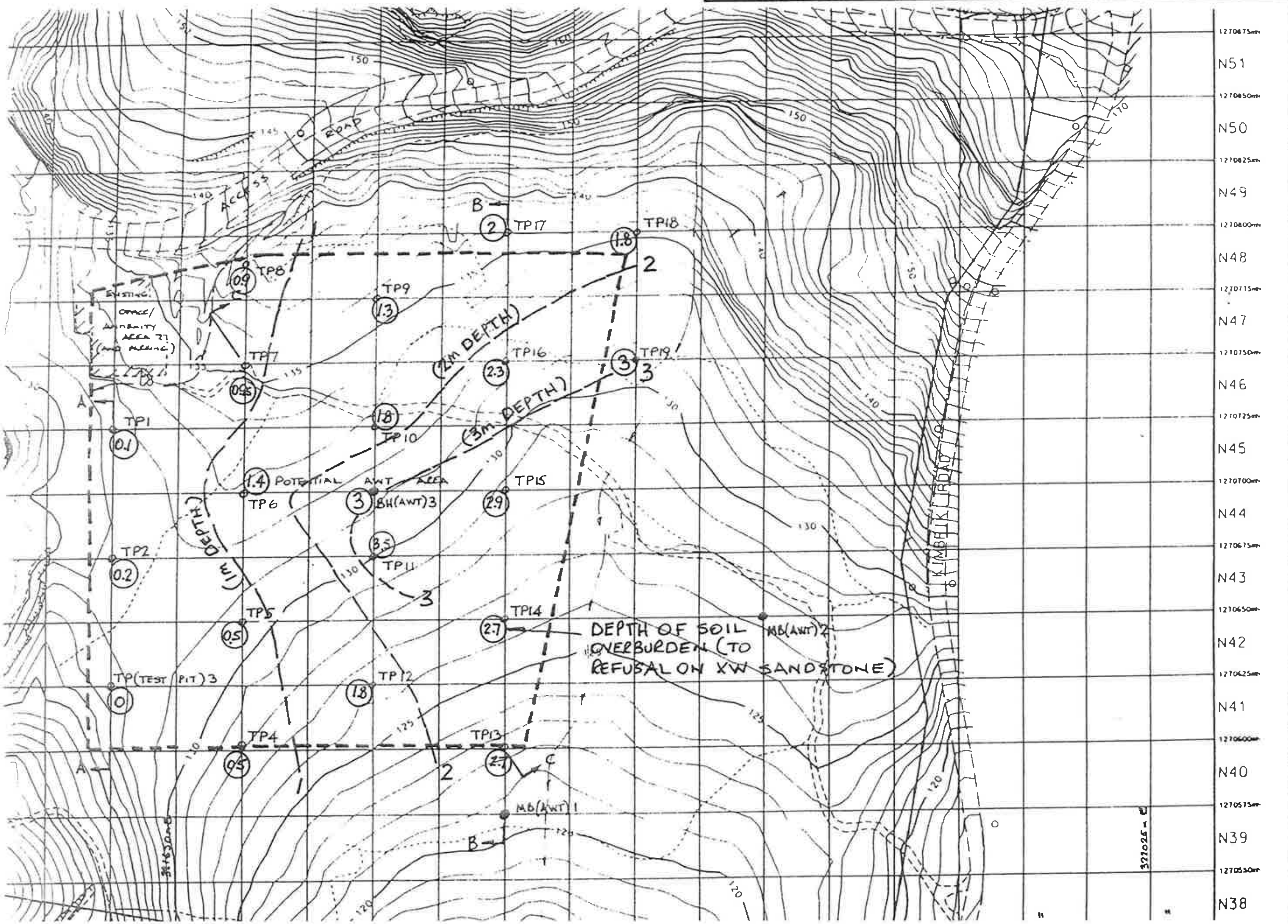
SECTION C - C	FIGURE 8



AMARAL

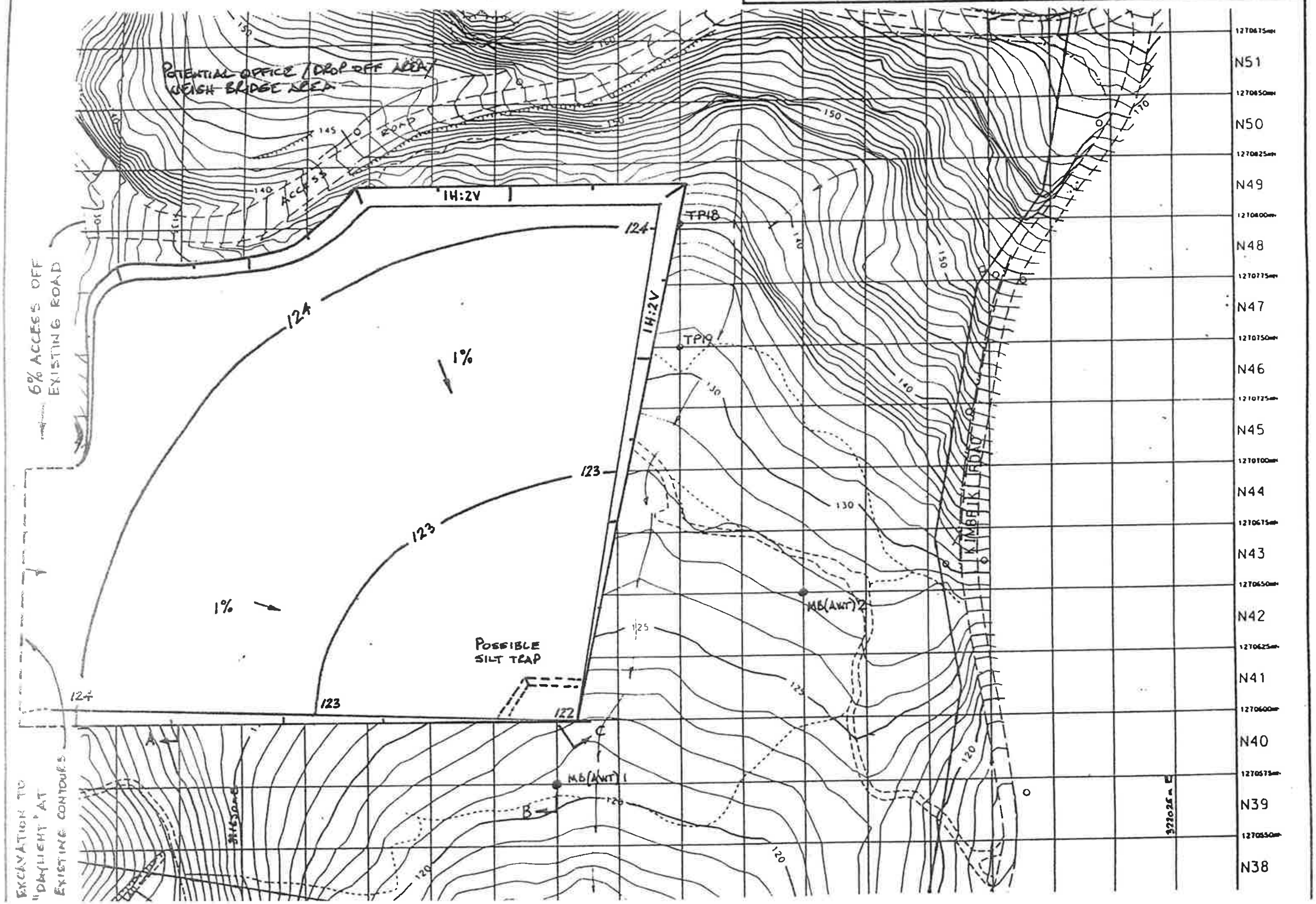
SOIL DEPTH CONTOURS

FIGURE 9



POSSIBLE EXCAVATION PLAN

FIGURE 10



Appendix J
Water Management Report

CLIENTS | PEOPLE | PERFORMANCE

Kimbriki Environmental Enterprises

Kimbriki Resource Recovery Project

Water Management Report

November 2010

Contents

Table Index

Appendices

1. Introduction

1.1 Purpose of this report

Kimbriki Environmental Enterprises Pty Ltd (KEE) is proposing to construct and operate two purpose-built advanced waste sorting and treatment facilities at the existing Kimbriki Resource Recovery Centre site in Terrey Hills.

Kimbriki Environmental Enterprises is the proponent of the project, and the environmental assessment is being prepared by GHD Pty Ltd (GHD) in accordance with the requirements of Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

This report summarises the water modelling work undertaken to assess the potential impacts of operation and construction of the project.

1.2 Project outline

The project involves the construction and operation of two main facilities:

- A materials recovery facility (MRF); and
- A resource recovery facility (RRF).

The MRF would receive and sort up to 60,000 tonnes per year of dry recyclable materials collected as part of the municipal kerbside collection services provided by Mosman, Manly, Warringah and Pittwater Councils.

The RRF would sort and process up to 100,000 tonnes per year of kerbside collected food and garden waste and mixed residual waste. The RRF would include separation equipment and aerobic enclosed tunnel composting technology to produce a variety of compost products and extract valuable recyclables from the incoming waste streams.

The project also includes the following ancillary infrastructure:

- internal roadways;
- weighbridge;
- staff amenities and ablutions; and
- staff parking facilities.

1.3 Location of project

The site on which the project would be located (referred to as 'the site' for the purposes of this environmental assessment) is within the existing Kimbriki Resource Recovery Centre site in the suburb of Terrey Hills. It is within the Warringah local government area.

The site location is shown in Figure 1.

Figure 1 Site Location

It is to be noted that 'the site' referred to in the text below refers only to the proposed AWT and maturation / final processing buildings and surrounding hardstand and related works. The MRF area was not considered to be part of the development area as the existing water management infrastructure already caters for this area.

1.4 Existing Site Conditions

KRRC is located in the upper reaches of Deep Creek, a tributary of the Narrabeen Lagoon catchment, immediately upgradient of Garigal National Park. Water that flows onto the site drains to the south east into the rural residential land rather than into the park itself.

Management of surface water at the KRRC occurs through the use of cut-off drains. This system allows for the prevention of contamination of clean water entering the site by waste materials and recycling operations.

Surface water runoff from the interim capped and revegetated landfill area is collected by two perimeter drains. These drains terminate in sedimentation dams near the southern boundary of the site.

Natural runoff within the proposed location for the RRF flows in a southerly direction. This area has its own sub catchment that is east of the existing areas of KRRC. Runoff from the site flows in a south westerly direction and is located within the main catchment area.

The site has no defined streams, however localised drainage lines are evident to the south of the site.

2. Operational Phase Hydrological Assessment

2.1 General

Management of stormwater will be required during the operation of resource recovery facility. The altered site water management system would aim to provide sufficient runoff to retained vegetation downstream of the site and also to minimise the potential impacts on surface water, nearby creeks and groundwater.

2.2 Proposed site water management system

A concept layout of the stormwater drainage system is shown in SK114. This plan, which aims to minimise the operational impacts of the project, is contained in Appendix A.

2.2.1 Up-gradient diversion

Water that currently falls on the catchment upstream of the development areas would be diverted around the development area so that the water quality would not be affected by site operations. This would be achieved by the construction of a series of diversion bunds and drains around the perimeter of the development area.

Much of the water that enters the site would be diverted past the development area, and would continue to provide water necessary to maintain the ecological systems downstream (to the south) of the site.

A culvert would be constructed to allow clean water to flow under the AWT platform, linking the two retained vegetation areas

2.2.2 Site water usage

Rainwater that falls onto the buildings within the site would be used for process applications. This would minimise the requirement for potable mains water. Water would be used in buildings for regular daily wash down of floors.

Material recovery operations in the MRF, and possibly the AWT buildings, would require water for dust suppression. This would be provided through a misting system. The water would be provided from rainwater tanks after being treated to ensure that it meets health standards.

Roof water would also be used to keep the fire fighting water storage tanks above the minimum level required by regulations. The existing potable water connection would be used to top up fire fighting water storage tanks if no other water could be sourced on site (for example from stormwater dams).

Staff amenities would be supplied by the potable mains water, supplemented with roof water. A maximum of 3,600 L/day of potable water is estimated to be needed to supply the new amenities facilities servicing the AWT and maturation/final processing buildings, based on an estimated 29 workers in the AWT and maturation/final processing buildings over a single shift. The MRF building (located at the lower level) would have its own amenities. These amenities would service 30 workers, which would be a similar level of water demand.

A portion of the overflow from the roof water tanks that is not needed to fill the rainwater or fire water tanks would be directed to the vegetated area located on the southeastern portion of the site. To ensure that this area does not receive significantly increased runoff, some of the roof water would be directed to the existing eastern drain.

It is expected that around 3,200 L/day of domestic wastewater requiring treatment would be produced by the new site facilities. A new onsite aerated wastewater treatment system would be installed, which incorporates a disinfection treatment stage and effluent storage. The system would treat wastewater from the new staff amenities facilities to a level sufficient to meet legislative requirements, to allow reuse for dust suppression activities and/or irrigation.

2.2.3 Collection

Rain falling directly onto hardstand areas would be considered to be potentially polluted.

Stormwater collection drains along the edges of the platform would be used to prevent rain water falling onto paved operational areas entering the preserved vegetation areas in an uncontrolled manner. The drains would be a combination of underground pipes, fed by floor grates, and open channels and swales. Further water would be contributed by the rainwater tank overflows.

The exact configuration of drains would be determined at the detailed design stage of the project, however a possible concept for the stormwater drainage system for the site has been identified in the SK114, contained in Appendix A.

2.2.4 Storage and treatment

Collected stormwater would be directed to the existing stormwater management system within the Kimbriki Resource Recovery Centre site. Future detailed design works may determine that the collected stormwater should pass through an intermediate stormwater basin, which may be located in the southwest corner of the development area, for either flow balancing or water quality reasons.

Alternatively, it may be directly transferred to the existing eastern drain, which would carry it to the existing Kimbriki site stormwater ponds.

The existing stormwater ponds, located at the southern end of the Kimbriki site, already cater for the MRF building.

2.3 Stormwater modelling

A MUSIC model was compiled to simulate the stormwater mass balance and rainwater re-use at the site. MUSIC is a software package that simulates hydrology, stormwater quality and the behaviour of water-sensitive urban design measures, e.g. rainwater storage and re-use.

2.3.1 Objectives

The objectives of the MUSIC modelling exercise were to:

- Gain an understanding of the stormwater and rainwater balance at the site;

- Ensure that the project does not adversely impact on the receiving environment, by either significantly increasing or decreasing the stormwater runoff to the retained vegetation immediately downstream of the site; and
- Model the performance of the proposed rainwater harvesting and re-use system for the site.

2.3.2 Methodology

The site and catchment were divided into appropriate sub-catchments based on the topography and existing and future land use characteristics. Key parameters were determined to represent sub-catchment specific factors, such as rainfall losses, impervious fraction and sub-catchment areas, and were configured in the model for both the pre-development and post-development site layouts.

Bureau of Meteorology rainfall data from the nearby Duffy's Forrest pluviograph (approximately 5 km west-northwest of the site) was used to simulate the site hydrology. The 6-minute rainfall intensity was simulated for the longest available period in the data record (approximately five years).

Rainwater harvesting and reuse was simulated for the MRF, AWT and maturation/final processing buildings, with rainwater yield determined for a number of storage tank sizes. The average demand for rainwater reuse was estimated for each tank, based on proposed site usage:

- AWT building – 2 kL/day;
- Maturation/final processing building – 4 kL/day; and
- MRF building – 4 kL/day.

The results of the hydrological modelling were used to develop the proposed stormwater management strategy for the site and ensure that no adverse impacts are generated in the downstream catchment. As mentioned above, rainwater harvesting and reuse is proposed for the three main buildings on the site.

2.3.3 Results

The modelling shows that rainfall on the roof areas is sufficient to supply a significant proportion of the demand for water for toilet flushing and washdown of hardstand areas. On this basis, rainwater tank sizing relationships have been determined for the three buildings based on the indicative demands outlined above (refer Appendix B).

The large hardstand and roofed area would increase the yearly average volume of runoff at the downstream site boundary by approximately 70% over the existing conditions if discharged directly to the receiving environment. It would therefore be necessary to divert stormwater from hardstand areas, and rainwater tank overflow from the AWT building into the existing stormwater treatment network to the west, to the southern ponds via the existing eastern drain. Under this proposed flow regime, the volume of runoff that would flow to the retained vegetation areas to the south of the site would not be significantly different from existing conditions.

The amount of runoff water currently entering the north-western retained vegetation area has been estimated to be approximately 1,150 kL/yr, and this would not change as a result of the project, as the catchment up-gradient of this area would not be affected by the project. The presence of the development area downgradient of this area means that a culvert or large pipe would need to be provided to allow runoff from this area to follow its natural flow direction, and enter the south-eastern retained vegetation area.

The amount of runoff that currently enters the south-eastern retained vegetation area is 15,140 kL/yr. Directing some of the roof water from the buildings into perimeter drains along the edges of the development area, rather than being discharged into the retained vegetation areas, results in 16,400 kL/yr being discharged over the revegetation area following development.

The amount of runoff water entering both of the retained vegetation areas in the identified layout are therefore approximately the same as existing flows. This would minimise the potential impacts on surface and groundwater dependent ecosystems in the retained vegetation areas within and beyond the site.

The additional operations area would contribute an average of 33 ML per year. Calculations and modelling results are contained in Appendix B.

3. Process Water Requirements/Water Balance

The tunnel composting process would require approximately 35,175 kL of water per year for the tunnel spray system, depending on climatic and input material characteristics. Most of this water would be captured and recycled back into the process (an estimated 34,950 kL per year). Approximately 2,400 kL of water would be lost as steam through the biofilter each year.

To maintain the appropriate moisture levels in the composting process, it is expected that approximately 225 kL per year of make-up water would be required, which would be sourced from the site sedimentation basin/first flush pond.

Table 1 outlines the estimated water balance for the tunnel compost process.

Table 1 Estimated tunnel compost process water balance

Aspect	Volume (kL/yr)
Inputs:	
Moisture in organics	42,675
Recirculated process water	34,950
Make up water from stormwater dams	225
TOTAL INPUTS	*77,850*
Outputs:	
Moisture lost as steam through biofilter	2,400
Process water collected (recycled back as tunnel spray water)	34,950
Moisture in finished compost	40,500
TOTAL OUTPUTS	*77,850*

Source: KEE personal correspondence

The proposed water management system is illustrated in Figure 2. This illustrates the various sources and uses of water on site, including process water makeup, floor washing, dust suppression, fire fighting and amenities.

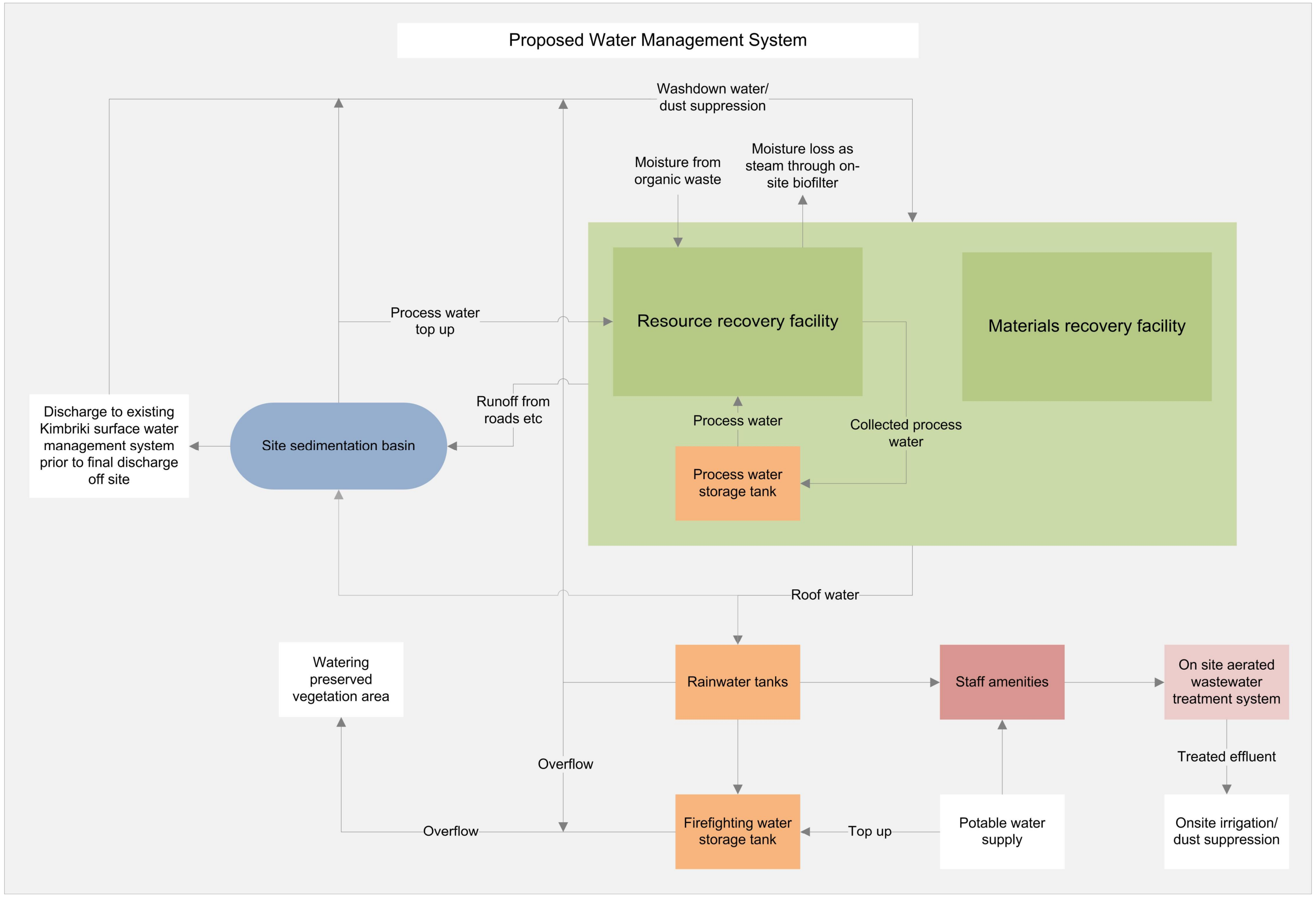


Figure 2 Proposed water management system

4. On-site Detention Assessment

4.1 Design Guidelines for On-site Detention

Warringah Council's *On-site Stormwater Detention Technical Specification* (September 2007) outlines requirements for the design of on-site detention facilities. The specification states that the permissible site discharge (PSD) is to be determined such that:

> *'The runoff from the total site after the development is no to exceed the runoff from the total site prior to the development, for all storm durations for the 5-year, 20-year and 100-year ARI storm events.'*

On-site detention storage must be provided to attenuate the post-development runoff to meet the PSD.

4.1.1 Hydrological Model Development

The site catchment was defined based upon 2 m topographical contour mapping from the NSW Department of Lands, and from design plans of the proposed site layout. The existing site and proposed development were divided into sub-catchments based on topography and land-use, and appropriate sub-catchment properties were determined such as hydraulic roughness, slope and area.

A RAFTS hydrological model was then configured to represent these sub-catchments with regional rainfall intensity-frequency-duration parameters adopted in accordance with *Australian Rainfall and Runoff* (2001). Calculations are provided in Appendix C.

4.1.2 Permissible Site Discharge

The existing conditions hydrological model was simulated for a range of events including all durations of the 5-year, 20-year and 100-year ARI design storms. This allowed determination of the existing site runoff for these ARIs, known as the Permissible Site Discharge (PSD). The PSDs for the subject site are outlined in the table below.

4.1.3 On-site Detention Concept Sizing

Given the PSDs defined above, the post-development hydrological model was simulated to determine the required storage volumes to sufficiently attenuate the site runoff. A linear storage-discharge relationship was assumed for this concept sizing exercise, as this has proven a reliable method for estimation of storage volumes in previous studies and does not require detailed earthworks or outlet design.

On-site detention storage requirements were determined to meet the PSD for the 5-year, 20-year and 100-year ARI design storm events. In addition, a storage volume was determined based on adoption of a three-stage outlet structure to meet the 5-year, 20-year and 100-year PSD.

4.2 Results

The required detention storage volumes to meet the PSD for a range of ARIs are summarised in the table below.

Table 2 Results of Hydrological Investigation

Average Recurrence Interval (years)	Permissible Site Discharge (m^3/s)	Required Storage Volume (m^3)
5	0.77	1,600
20	1.24	1,850
100	1.91	1,950

4.3 Environmental Protection Licence Requirements

Clause L3 of the Environmental Protection Licence for the existing facility (EPL13090 and 13091) outlines concentration limits for pollutant discharges from the site. These concentration limits do not apply to any discharge occurring due to a rainfall event over and above the 5-year ARI 24-hour storm event.

The total volume of this stormwater event has therefore been calculated to inform the development of any future stormwater detention or treatment facilities. The total volume of the 5-year 24-hour storm runoff is approximately 10,500 m^3.

5. Construction Phase

5.1 General

Control of erosion and sedimentation would be required during the construction period, including temporary works. The proponent would implement all practicable measures to minimise soil erosion and discharge of sediments from the site.

During the construction phase, which is estimated to span 18 months, the primary requirement is to ensure that the appropriate infrastructure is in place to control erosion and sedimentation.

A concept stormwater management plan for erosion and sediment control during construction is shown in SK115, which is contained in Appendix A. Calculations and modelling results are contained in Appendix D.

5.2 Site water management

5.2.1 Temporary Basins

Stormwater from the construction areas would be collected by a series of collection drains. The collected sediment and water would be directed into appropriately sized sediment basins to prevent sediment from entering the retained vegetation areas.

Controlled basin release points would be provided to allow water to be released to the Council stormwater system in Kimbriki Road following sufficient settling time.

5.2.2 Surface water diversion

In order to minimise the volume of water required to be treated by the stormwater management system, a series of diversion bunds and drains would be constructed around the perimeter of the disturbed area. These bunds and drains would divert clean water away from the construction area, preventing the water from becoming sediment laden.

5.2.3 Sediment control devices

To minimize the impact on areas downstream, sediment controls would be placed at the downstream extent of the construction area to prevent sediments from being carried into the stormwater systems. This may include cut-off drains, silt fences, hay bales or other erosion controls.

5.2.4 Management Plans

A site sediment and erosion control plan for construction works would be prepared, in accordance with requirements of the Blue Book (*Managing Stormwater: Urban Soils and Construction*, Department of Housing). This plan would consider the specific requirements of the proposed construction sequence and methods.

The erosion and sediment control plan prepared as part of the construction environmental management plan would ensure that:

- Sediment and erosion control measures, such as sediment fences, are installed and maintained, with particular attention where the drainage is towards a natural surface water body;
- Stockpiles are stabilised and remain covered and appropriate sediment and erosion control measures are installed down-slope of all stockpiles; and
- Spill kits are made available to construction vehicles.

The construction environmental management plan would also set out procedures for the management of accidental spills to minimise potential contamination during construction.

These controls would be implemented before any construction commences.

In the planning of the works, a staged approach should be considered to minimise the disturbed area and the volumes of sediment laden water that would require collection and treatment.

5.3 Stormwater Modelling

A model was compiled based on the requirements of the Blue Book (*Managing Stormwater: Urban Soils and Construction*, Department of Housing) to determine the requirements for sediment and water storage during the construction of the development.

In undertaking this modeling, the material recovery facility (MRF) building was not considered as this area lies within the existing site footprint. The existing site drainage infrastructure is assumed to already cater for this area.

5.3.1 Objectives

The objectives of this modelling exercise were to:

- Gain an understanding of the stormwater catchment areas and requirements at the site;
- Ensure that infrastructure can be provided during construction to provide the required level of environmental protection for areas immediately downstream of the site; and
- Provide approximate locations and required capacity of temporary basins as required.

5.3.2 Methodology

In order to retain as much native and protected vegetation as possible, two basin locations were identified, as shown in SK115, in Appendix A.

- An upper basin in the location of the amenities building – the final proposed levels in this area are close to existing ground levels and so would not impact on the primary cutting and filling operations. This basin would collect all surface water generated in areas upstream of RL127, including the road development areas; and
- A lower basin at the south east corner of the AWT building platform – this is the lowest point of the construction area and would collect water from the remaining construction area.

It has been assumed that a permanent pipeline would be constructed to link the areas of retained vegetation as shown in SK115 (Appendix A).

The construction area was divided into two sub-catchments based on the site topography and the location of these basins.

An intensity-frequency-duration (IFD) graph was constructed for the site based on a 5 day, 85th percentile storm event. These basins were sized based on the requirements of the Blue Book (*Managing Stormwater: Urban Soils and Construction*, Department of Housing) for sensitive downstream receptors. As the soil types being used for filling works is unknown, a conservative assumption has been taken with modeling assuming Type D soils (worst case scenario).

5.3.3 Results

The construction area was divided into two sub-catchments:

- Upper catchment area – area 4.5 ha; and
- Lower catchment area – area 0.98 ha.

Based on IFD curves generated for the site, the design rainfall event of 44 mm/h was used to determine the required capacity of the two sediment basins.

Table 3 Sediment basin required capacity

Basin	Total catchment area (ha)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)
1	4.5	1,370	685	2,050
2	0.98	300	150	450

The shape and design of the basins must be sympathetic to the requirements of the Blue Book.

With implementation of appropriate stormwater and erosion controls and mitigation measures, the project would not have significant stormwater/erosion impacts during its construction phase.

6. Summary and Conclusions

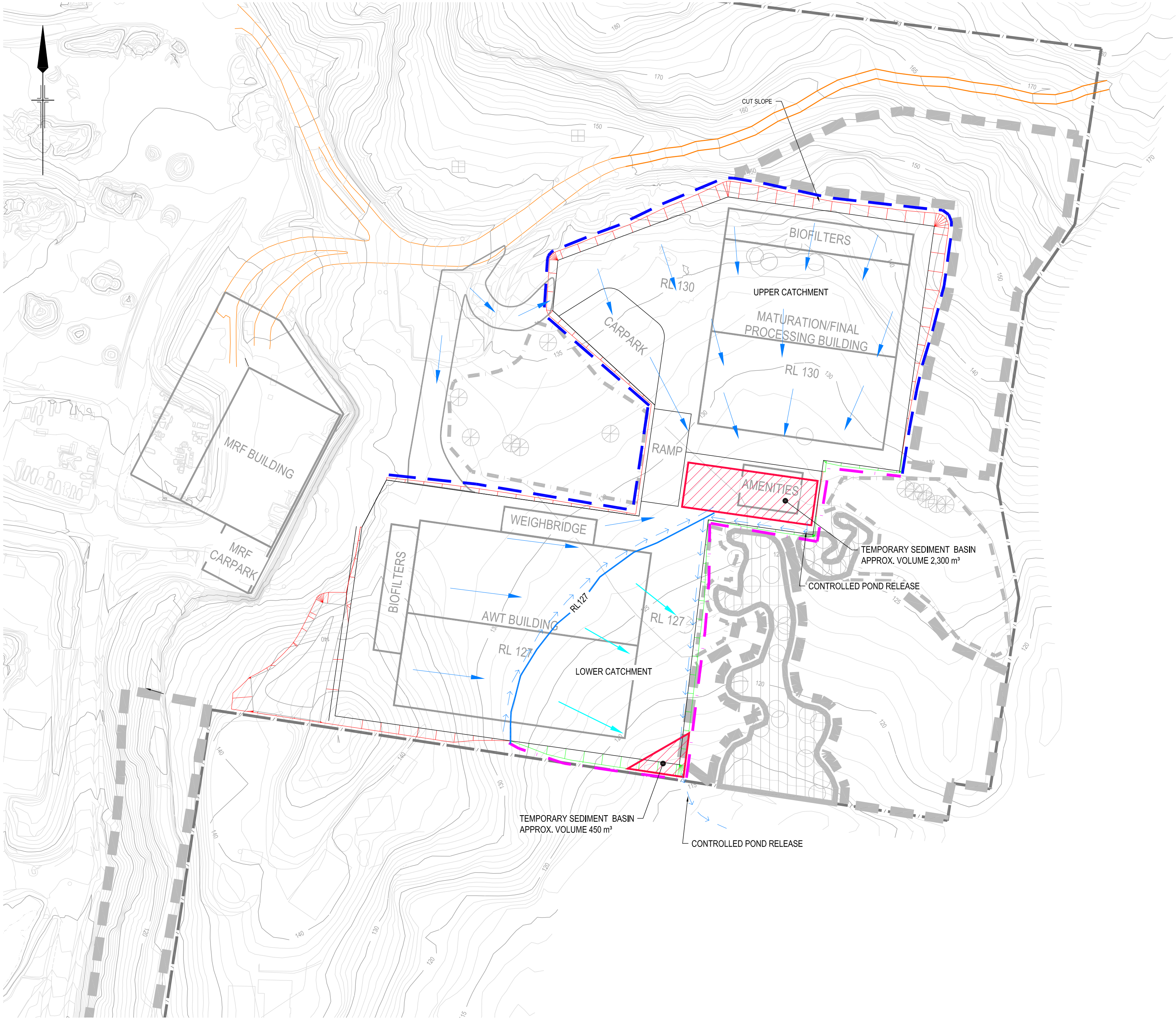
Modeling of surface water management throughout the operation of the proposed Kimbriki Resource Recovery Project indicates that the project would not have significant hydrological impacts, in that post project surface water flows across the site would be similar to current flows.

During the construction phase, clean stormwater diversion measures upstream of the disturbed area sediment laden water would minimize the volume of water affected by construction activities. Any affected water would be directed to two sediment basins of approximately 2,050 m^3 and 450 m^3 capacity. This would control soil erosion and minimize the discharge of sediments from the site.

Environmental management plans would be prepared for both the construction and operation phases of the project.

Appendix A

Concept Plans



LEGEND

- EXISTING SURFACE
- EXISTING ACCESS TRACK
- KIMBRIKI SITE BOUNDARY
- PROPOSED BUILDING SLAB
- PROPOSED ACCESS ROADS
- PROPOSED CUT BATTER
- PROPOSED FILL BATTER
- TEMPORARY SEDIMENT BASIN
- SURFACE WATER DIVERSION
- SEDIMENT CONTROL DEVICE
- TETRATHECA GLANDULOSA RETAINED
- EUCALYPTUS LEUHMANNIANA RETAINED
- NATIVE VEGETATION RETAINED

THREATENED FLORA & SIGNIFICANT VEGETATION

- TETRATHECA GLANDULOSA
- EUCALYPTUS LEUHMANNIANA
- BORONIA SERRULATA

NOTES:

1. BASED ON DECEMBER 2009 SURVEY

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
A	INITIAL ISSUE	DG	04.11.10

KIMBRIKI ENVIRONMENTAL ENTERPRISES
KIMBRIKI RESOURCE RECOVERY PROJECT
AWT & MRF CONCEPT DESIGN
SOIL & WATER CONTROLS

GHD CLIENTS | PEOPLE | PERFORMANCE

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scale	1:1000 for A1	job no.	21-19757
date	OCT 2010	rev no.	A

approved ....

SK115

Plot Date: 5 November 2010 - 10:34 AM Plotted by: Allison J Horlyck/Sydney/GHD/AU Cad File No: G:\21\19757\CADD\Drawings\21-19757-SK115.dwg

LEGEND

- EXISTING SURFACE
- EXISTING ACCESS TRACK
- KIMBRIKI SITE BOUNDARY
- PROPOSED BUILDING SLAB
- PROPOSED ACCESS ROADS
- PROPOSED CUT BATTER
- PROPOSED FILL BATTER
- ROAD/PAVING STORMWATER
- SURFACE WATER DIVERSION
- PIPED SURFACE WATER
- CLEAN ROOF WATER (SOME COLLECTED IN RAINWATER TANKS)
- TETRATHECA GLANDULOSA RETAINED
- EUCALYPTUS LEUHMANNIANA RETAINED
- NATIVE VEGETATION RETAINED

THREATENED FLORA & SIGNIFICANT VEGETATION

- TETRATHECA GLANDULOSA
- EUCALYPTUS LEUHMANNIANA
- BORONIA SERRULATA

NOTES:

1. BASED ON DECEMBER 2009 SURVEY

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

PRELIMINARY

rev	description	app'd	date
B	REVISED	DG	05.11.10
A	INITIAL ISSUE	DG	29.10.10

KIMBRIKI ENVIRONMENTAL ENTERPRISES
KIMBRIKI RESOURCE RECOVERY PROJECT
AWT & MRF CONCEPT DESIGN
OPERATIONAL STORMWATER PLAN

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scale	1:1000 for A1	job no.	21-19757
date	NOV 2010	rev no.	B

approved ....

SK114

Plot Date: 5 November 2010 - 10:09 AM Plotted by: Alison J Horlyck/Sydney/GHD/AU Cad File No: G:\21\19757\CADD\Drawings\21-19757-SK114.dwg

Appendix B

MUSIC Modelling Inputs/Outputs

Kimbriki MUSIC Modelling Results

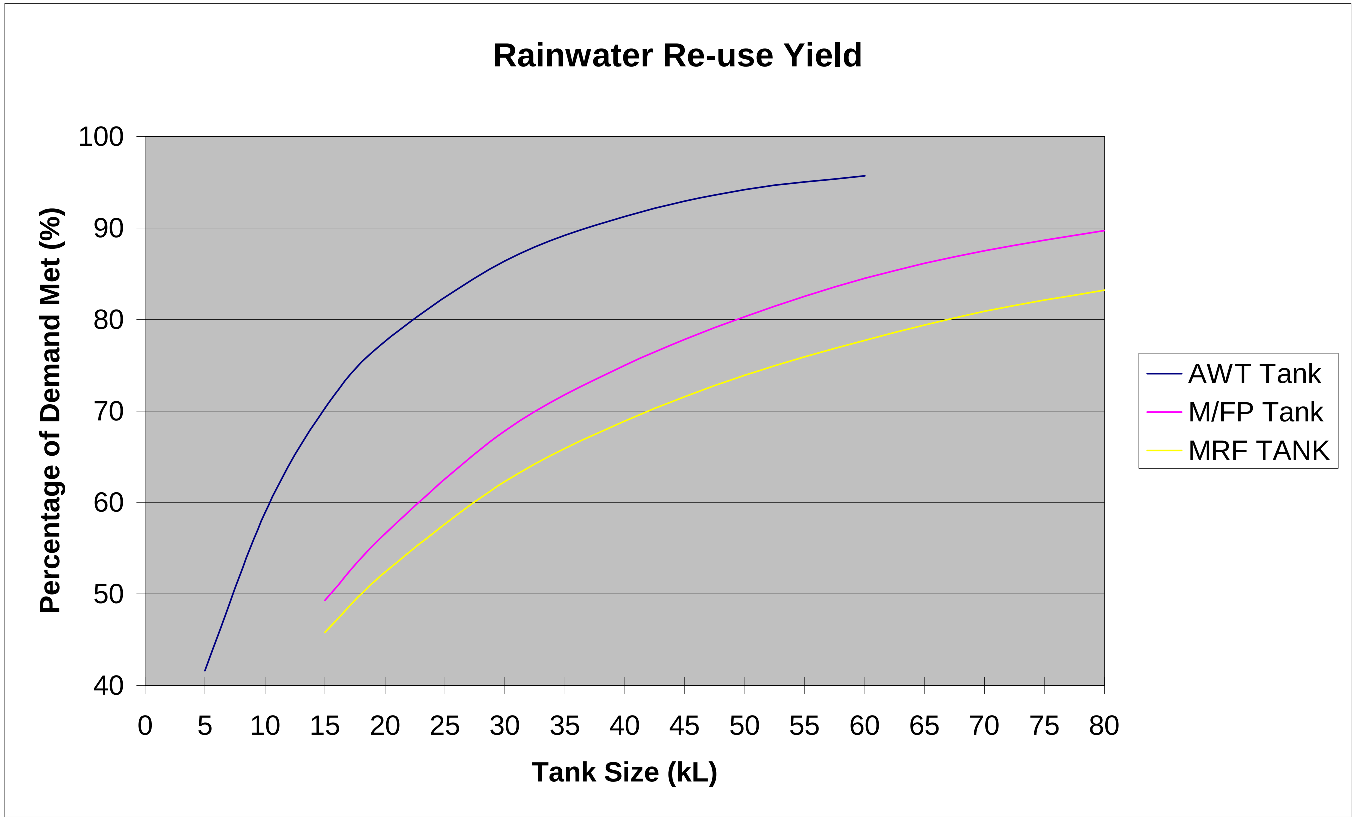
Re-use requirements from D Gamble email:

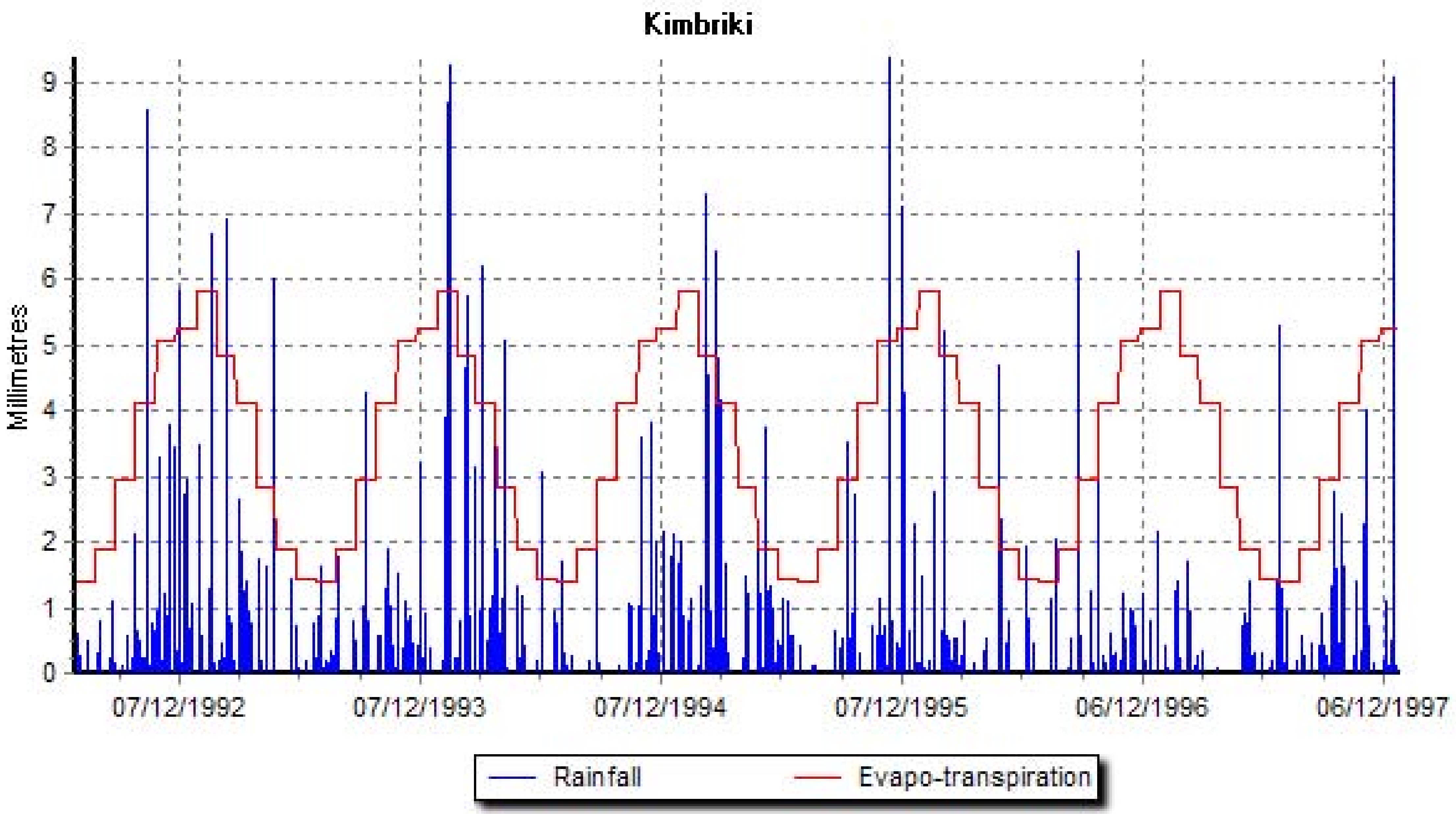
People working in MRF and using water = 30 plus 3 working on landfill = >4kl/day - size rainwater tanks accordingly, and allow for excess roof water to go into eastern drain

People working in RRF (AWT and Maturation Building) = 26 => 3kl/day plus washdown water - allow 5kl/day for this.

Re-use as modelled:

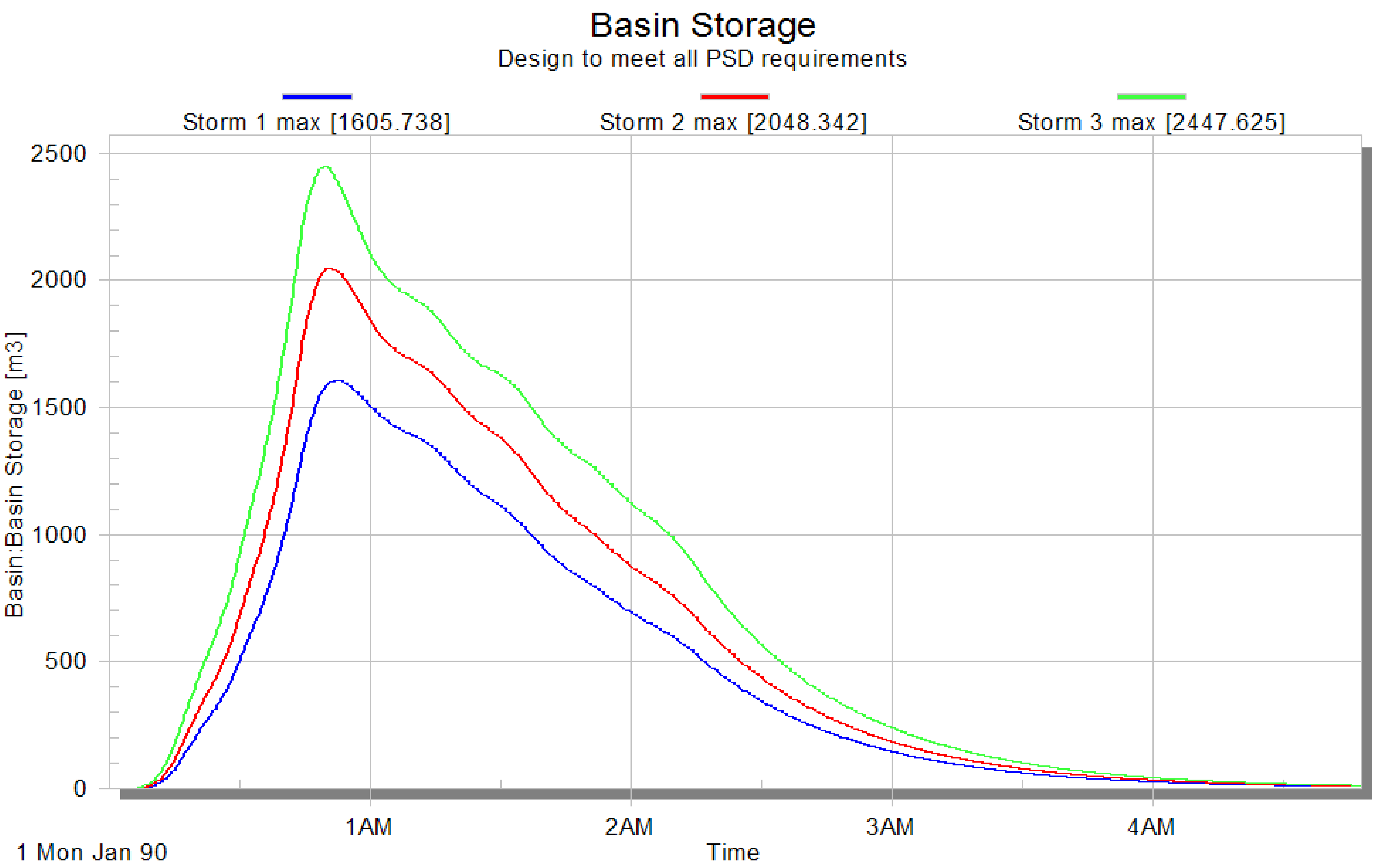
AWT Tank:	2 kl/day	assuming washdown water only
M/FP Tank:	4 kl/day	Assuming that amenities block re-uses water from M/FP tank only
MRF Tank:	4 kl/day	

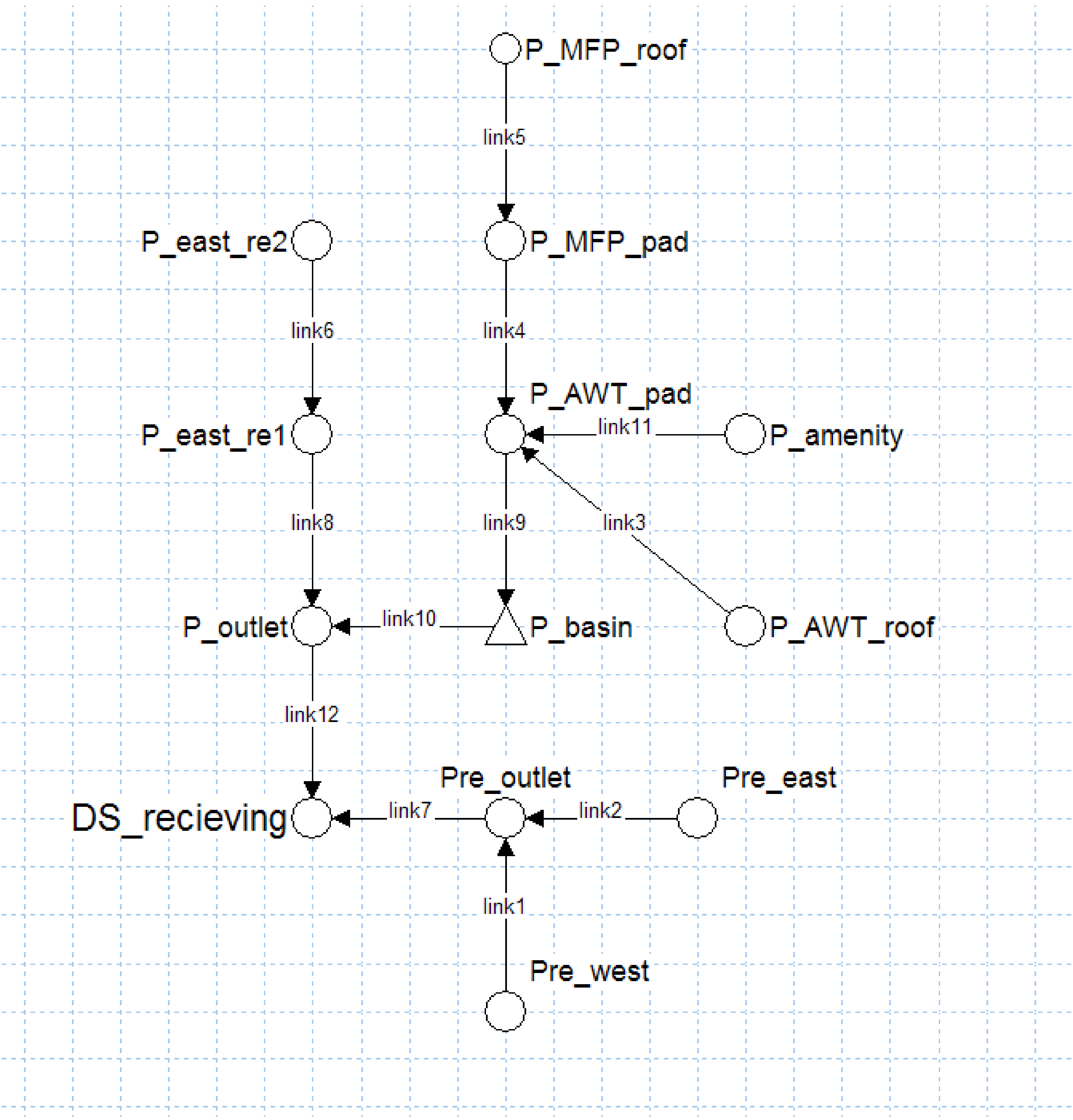



Kimbriki
Millimetres
0
1
2
3
4
5
6
7
8
9
07/12/1992
07/12/1993
07/12/1994
07/12/1995
06/12/1996
06/12/1997
Rainfall
Evapo-transpiration

Appendix C

RAFTS Modelling Inputs/Outputs


Basin Storage
Design to meet all PSD requirements
Storm 1 max [1605.738]
Storm 2 max [2048.342]
Storm 3 max [2447.625]
Basin:Basin Storage [m3]
2500
2000
1500
1000
500
0
1AM
2AM
3AM
4AM
1 Mon Jan 90
Time



P_MFP_roof
link5
P_east_re2
P_MFP_pad
link6
link4
P_AWT_pad
P_east_re1
link11
P_amenity
link8
link9
link3
P_outlet
link10
P_basin
P_AWT_roof
link12
Pre_outlet
Pre_east
DS_recieving
link7
link2
link1
Pre_west

Appendix D

Construction Phase Modelling Inputs/Outputs

Rainfall Intensity-Frequency-Duration Calculation to AR&R

Program : **IFD.xls**
Version : **3.0**

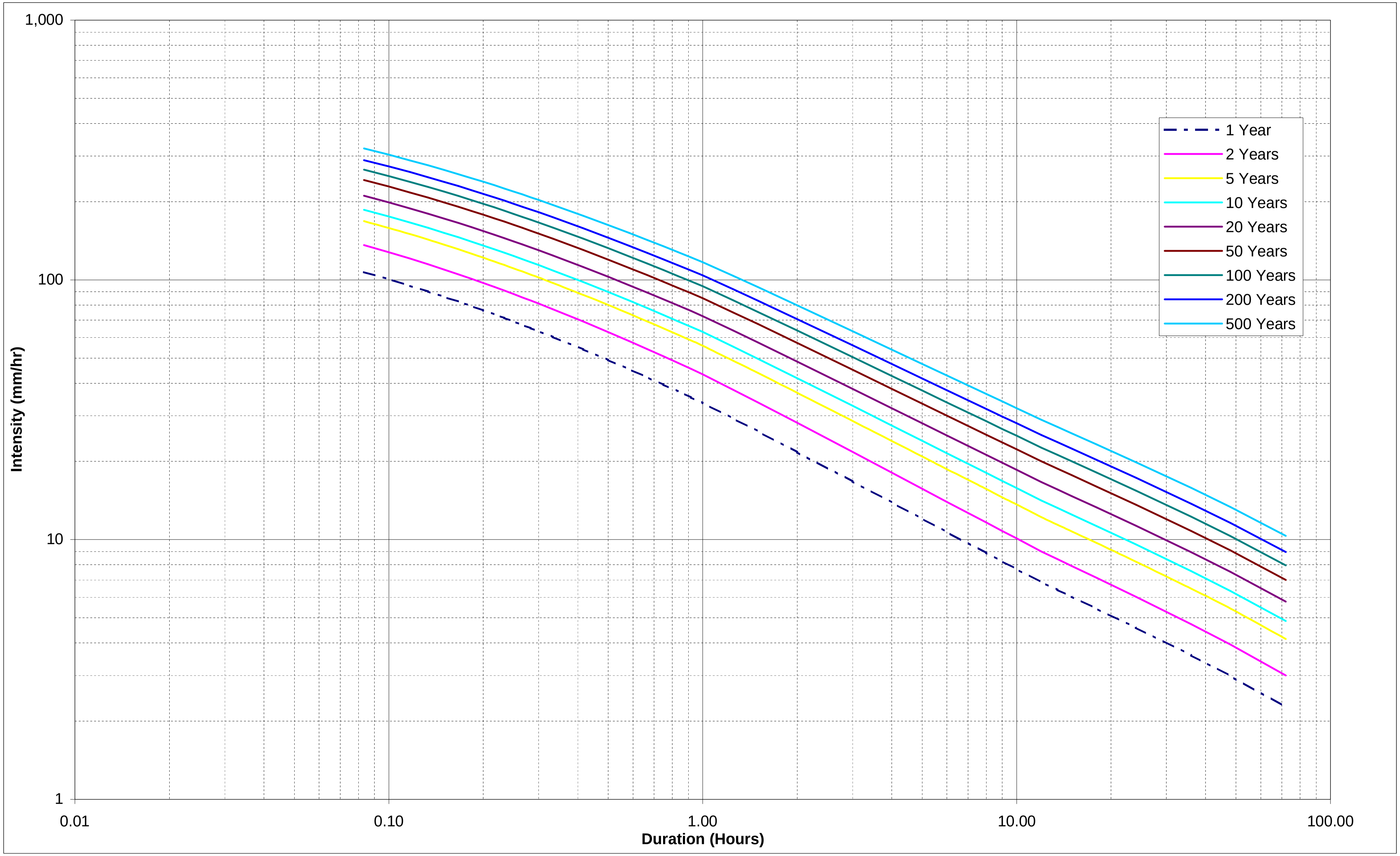
Data

Location : **Mona Vale Rd, Terrey Hills**

1 HR DUR 2 ARI	43.30	mm/hr
12 HR DUR 2 ARI	9.00	mm/hr
72 HR DUR 2 ARI	3.00	mm/hr
1 HR DUR 50 ARI	85.00	mm/hr
12 HR DUR 50 ARI	20.00	mm/hr
72 HR DUR 50 ARI	7.00	mm/hr
G (skewness)	0.00	mm/hr
F2 Geo factor 2 ARI	4.30	
F50 Geo factor 50 ARI	15.90	

Duration		**Design Rainfalls for Average Recurrance Intervals**								
		1 Year	**2 Years**	**5 Years**	**10 Years**	**20 Years**	**50 Years**	**100 Years**	**200 Years**	**500 Years**
(min)	(hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)	(mm/hr)
5	0.083	107.2	136.0	168.3	186.2	210.6	242.1	265.6	289.2	320.4
6	0.100	100.6	127.7	158.4	175.4	198.7	228.6	250.9	273.4	303.2
7	0.117	95.0	120.8	150.1	166.4	188.6	217.2	238.5	260.0	288.6
8	0.133	90.3	114.8	142.9	158.6	179.9	207.3	227.9	248.5	276.0
9	0.150	86.1	109.6	136.7	151.8	172.3	198.7	218.5	238.5	265.0
10	0.167	82.5	105.0	131.2	145.8	165.6	191.1	210.3	229.6	255.3
11	0.183	79.3	101.0	126.2	140.4	159.6	184.3	202.9	221.6	246.5
12	0.200	76.3	97.3	121.8	135.6	154.2	178.2	196.2	214.4	238.6
13	0.217	73.7	94.0	117.8	131.2	149.3	172.7	190.2	207.9	231.4
14	0.233	71.3	90.9	114.1	127.2	144.8	167.6	184.6	201.9	224.9
15	0.250	69.1	88.2	110.8	123.5	140.7	162.9	179.6	196.4	218.8
16	0.267	67.1	85.6	107.7	120.1	136.9	158.6	174.8	191.3	213.2
17	0.283	65.2	83.3	104.8	117.0	133.4	154.6	170.5	186.6	208.0
18	0.300	63.4	81.1	102.1	114.1	130.1	150.8	166.4	182.2	203.2
20	0.333	60.3	77.1	97.3	108.8	124.1	144.1	159.1	174.2	194.4
25	0.417	54.0	69.1	87.6	98.1	112.1	130.3	144.1	158.0	176.6
30	0.500	49.1	63.0	80.1	89.8	102.8	119.7	132.5	145.4	162.7
35	0.583	45.3	58.1	74.1	83.2	95.4	111.2	123.2	135.3	151.6
40	0.667	42.1	54.1	69.2	77.8	89.3	104.2	115.5	127.0	142.4
45	0.750	39.5	50.8	65.0	73.3	84.1	98.3	109.1	120.0	134.6
50	0.833	37.3	47.9	61.5	69.4	79.7	93.3	103.5	114.0	128.0
55	0.917	35.3	45.5	58.5	66.0	75.9	88.9	98.7	108.7	122.1
60	1.00	33.6	43.3	55.8	63.0	72.5	85.0	94.5	104.1	117.0
75	1.25	29.3	37.8	48.9	55.3	63.8	75.0	83.4	92.0	103.6
90	1.5	26.1	33.7	43.8	49.7	57.4	67.5	75.3	83.1	93.7
120	2	21.7	28.2	36.8	41.8	48.5	57.2	63.8	70.6	79.8
180	3	16.8	21.8	28.7	32.8	38.1	45.1	50.5	56.0	63.5
240	4	13.9	18.1	24.0	27.5	32.1	38.1	42.7	47.5	53.9
300	5	12.0	15.7	20.9	24.0	28.0	33.4	37.5	41.7	47.5
360	6	10.7	14.0	18.7	21.5	25.2	30.0	33.7	37.6	42.8
480	8	8.9	11.6	15.6	18.1	21.2	25.4	28.6	31.9	36.4
540	9	8.2	10.8	14.6	16.8	19.8	23.7	26.7	29.8	34.0
600	10	7.7	10.1	13.6	15.8	18.6	22.3	25.1	28.1	32.1
720	12	6.9	9.0	12.2	14.2	16.7	20.0	22.6	25.3	28.9
810	13.5	6.4	8.4	11.4	13.2	15.6	18.7	21.2	23.7	27.2
900	15	6.0	7.9	10.8	12.5	14.7	17.7	20.0	22.4	25.7
1,080	18	5.4	7.1	9.7	11.3	13.3	16.0	18.1	20.3	23.2
1,440	24	4.6	6.0	8.2	9.6	11.3	13.6	15.4	17.3	19.9
2,160	36	3.6	4.7	6.5	7.6	8.9	10.8	12.2	13.7	15.8
2,880	48	3.0	3.9	5.4	6.3	7.5	9.1	10.3	11.6	13.3
4,320	72	2.3	3.0	4.1	4.9	5.8	7.0	8.0	9.0	10.3

Note: Values for 200 and 500 yearARI are approximate only and does not conform to Book 6 of AR&R (1999)


1,000
100
10
1
Intensity (mm/hr)
0.01
0.10
1.00
10.00
100.00
Duration (Hours)
1 Year
2 Years
5 Years
10 Years
20 Years
50 Years
100 Years
200 Years
500 Years

Note: These "Standard Calculation" spreadsheets relate only to low erosion hazard lands as identified in figure 4.6 where the designer chooses to not use the RUSLE to size sediment basins. The more "Detailed Calculation" spreadsheets should be used on high erosion hazard lands as identified by figure 4.6 or where the designer chooses to run the RUSLE in calculations.

1. Site Data Sheet

Site name: Kimbriki RRC

Site location: Mona Vale Rd, Terrey Hills

Precinct:

Description of site: Sediment ponds for construction

Site area	Site						Remarks
	1	2					
Total catchment area (ha)	4.5	0.975					
Disturbed catchment area (ha)	4.5	0.975					

Soil analysis

Soil landscape							DIPNR mapping (if relevant)
Soil Texture Group	D/F	D/F	D/F	D/F	D/F	D/F	Sections 6.3.3(c), (d) and (e)

Rainfall data

Design rainfall depth (days)	5	5					See Sections 6.3.4 (d) and (e)
Design rainfall depth (percentile)	85	85					See Sections 6.3.4 (f) and (g)
x-day, y-percentile rainfall event	44	44					See Section 6.3.4 (h)
Rainfall intensity: 2-year, 6-hour storm	14	14					See IFD chart for the site
Rainfall erosivity (R-factor)	4290	4290					Automatic calculation from above data

Comments:

1. TO POND AT AMENITIES
2. TO SECONDARY POND AT SOUTH EAST

2. Storm Flow Calculations

Peak flow is given by the Rational Formula:

$$Qy = 0.00278 \times C_{10} \times F_Y \times I_{y, tc} \times A$$

where:
- Q_y is peak flow rate (m^3/sec) of average recurrence interval (ARI) of "Y" years
- C_{10} is the runoff coefficient (dimensionless) for ARI of 10 years. Rural runoff coefficients are given in Volume 2, figure 5 of Pilgrim (1998), while urban runoff coefficients are given in Volume 1, Book VIII, figure 1.13 of Pilgrim (1998) and construction runoff coefficients are given in Appendix F
- F_y is a frequency factor for "Y" years. Rural values are given in Volume 1, Book IV, Table 1.1 of Pilgrim (1998) while urban coefficients are given in Volume 1, Book VIII, Table 1.6 of Pilgrim (1998)
- A is the catchment area in hectares (ha)
- $I_{y, tc}$ is the average rainfall intensity (mm/hr) for an ARI of "Y" years and a design duration of "tc" (minutes or hours)

Time of concentration (t_c) = $0.76 \times (A/100)^{0.38}$ hrs (Volume 1, Book IV of Pilgrim, 1998)

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent.

Peak flow calculations, 1

Site	A (ha)	tc (mins)	Rainfall intensity, I, mm/hr						C_{10}
			$1_{yr,tc}$	$5_{yr,tc}$	$10_{yr,tc}$	$20_{yr,tc}$	$50_{yr,tc}$	$100_{yr,tc}$	
1	4.5	14	71.3	114.1	127.2	144.8	167.6	184.6	0.86
2	0.975	8	90.3	142.9	158.6	179.9	207.3	227.9	0.86

Peak flow calculations, 2

ARI yrs	Frequency factor (F_y)	Peak flows						Comment
		1	2					
		(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m3/s)	
$1_{yr, tc}$	0.62	0.476	0.131					Zone B, below 500m
$5_{yr, tc}$	0.88	1.080	0.293					Zone B, below 500m
$10_{yr, tc}$	1	1.368	0.370					Zone B, below 500m
$20_{yr, tc}$	1.12	1.745	0.470					Zone B, below 500m
$50_{yr, tc}$	1.1766667	2.122	0.569					Zone B, below 500m
$100_{yr, tc}$	1.7566667	3.489	0.933					Zone B, below 500m

4. Volume of Sediment Basins, *Type D* and *Type F* Soils

Basin volume = settling zone volume + sediment storage zone volume

Settling Zone Volume

The settling zone volume for *Type F* and *Type D* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$$V = 10 \times C_v \times A \times R_{y\text{-\%ile, x-day}} \ (m^3)$$

where:

10 = a unit conversion factor

C_v = the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period

R = is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. (See Sections 6.3.4(d), (e), (f), (g) and (h)).

A = total catchment area (ha)

Sediment Storage Zone Volume

In the standard calculation, the sediment storage zone is 50 percent of the setting zone. However, designers can work to capture the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(ii)), in which case the "Detailed Calculation" spreadsheets should be used.

Total Basin Volume

Site	C_v	R x-day y-%ile	Total catchment area (ha)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)
1	0.69	44	4.5	1366.2	683	2049.3
2	0.69	44	0.975	296.01	148	444.015

GHD

133 Castlereagh St Sydney NSW 2000

-

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A Horlyck A Dyer	A Roberts		D Gamble		22/11/10

Appendix K
Greenhouse Gas Assessment Report

CLIENTS | PEOPLE | PERFORMANCE

Kimbriki Environmental Enterprises

Report for Kimbriki Resource Recovery Project

Greenhouse Gas Emissions Assessment

November 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

Table Index

Figure Index

Appendices

Abbreviations

AWT	Alternative waste technology
CO_2-e	Carbon dioxide equivalent emissions (emissions of other greenhouse gases are multiplied by their Global Warming Potential (GWP) so that their effects can be compared to emissions of carbon dioxide)
CPRS	Carbon Pollution Reduction Scheme
CH_4	Methane
DCCEE	Commonwealth Department of Climate Change and Energy Efficiency
DGRs	Director General's Requirements
DOC	Degradable organic fraction
EF	Emission Factor
EP&A	Environmental Planning and Assessment Act 1979
FOD	First Order Decay
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
J	Joule
KEE	Kimbriki Environmental Enterprises Pty Ltd, the proponent
kL	kilolitre
km	kilometre
kWh	kilowatt hour
MRF	Materials recovery facility
MSW	Municipal solid waste
NGA	National Greenhouse Accounts
NGER	National Greenhouse Energy and Reporting
RRF	Resource recovery facility
SHOROC	Shore Regional Organisation of Councils
t	tonne
y	year

Executive Summary

Methodology

A greenhouse gas assessment of the Kimbriki Resource Recovery Project was conducted in accordance with the general principles of:

- The recognised international standard – The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard developed by the World Business Council for Sustainable Development (GHG Protocol);
- The Commonwealth Department of Climate Change and Energy Efficiency (DCCEE) National Greenhouse Accounts (NGA) Factors, July 2010; and
- The DCCEE National Greenhouse and Energy Reporting System Guidelines (July 2008 and as amended 2009).

The assessment included Scope 1, 2 and 3 emissions from both construction and operation of the project, including:

- Emissions from fuel use associated with preparation and construction at the site;
- Diesel usage for delivery of construction materials to the site;
- Electricity for construction site sheds;
- Key construction materials;
- Diesel usage by mobile equipment during operation of the materials recovery facility (MRF) and resource recovery facility (RRF);
- Diesel usage for waste collection and transport and export of product and recyclables to market;
- Fuel use (petrol) for light vehicles (employee trips and self-haul drop off of waste);
- Diesel usage for landfill operations and for transfer of residuals from both the MRF and RRF to the Kimbriki Resource Recovery Centre landfill adjacent to the site;
- Emissions from the composting process in the RRF; and
- Landfill gas emissions from landfilling of residuals from the RRF (stabilised waste).

Results

The total scope 1, 2 and 3 emissions during construction amount to 17,690 t CO_2-e or 590 t CO_2-e per annum assuming a design life of 30 years. Total annual emissions during operation amounts to 19,650 t CO_2-e. The estimated annual emissions from the project is 20,240 t CO_2-e (assuming a design life of 30 years).

The total annual NSW emissions for 2008 was 165 Mt CO_2-e. Hence, the estimated annual Scope 1, 2 and 3 emissions from the project would equate to approximately 0.01 % of the state's total emissions. This is a small fraction of the Australian and NSW total emissions.

1. Introduction

1.1 Purpose of this report

Kimbriki Environmental Enterprises Pty Ltd (KEE) is proposing to construct and operate two purpose-built advanced waste sorting and treatment facilities at the existing Kimbriki Resource Recovery Centre site in Terrey Hills.

Kimbriki Environmental Enterprises is the proponent of the project, and the environmental assessment is being prepared by GHD Pty Ltd (GHD) in accordance with the requirements of Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

This report assesses the potential greenhouse gas emissions of the project.

1.2 Project outline

The project involves the construction and operation of two main facilities:

- A materials recovery facility (MRF); and
- A resource recovery facility (RRF).

The MRF would receive and sort up to 60,000 tonnes per year of dry recyclable materials collected as part of the municipal kerbside collection services provided by Mosman, Manly, Warringah and Pittwater Councils.

The RRF would sort and process up to 100,000 tonnes per year of kerbside collected food and garden waste and mixed residual waste. The RRF would include separation equipment and aerobic enclosed tunnel composting technology to produce a variety of compost products and extract valuable recyclables from the incoming waste streams.

The project also includes the following ancillary infrastructure:

- internal roadways;
- weighbridge;
- staff amenities and ablutions; and
- staff parking facilities.

1.3 Location of project

The site on which the project would be located (referred to as 'the site' for the purposes of this environmental assessment) is within the existing Kimbriki Resource Recovery Centre site in the suburb of Terrey Hills. It is within the Warringah local government area.

The site location is shown in Figure 1-1.

Figure 1-1 Site Location

1.4 Scope and structure of report

The scope and methodology for conducting the assessment has been based on the Director-General's Requirements (DGRs) for the project. The DGRs require an assessment of scope 1, 2 and 3 emissions from the project.

The purpose of the greenhouse gas assessment is to calculate the (scope 1, 2 and 3) emissions of the greenhouse gases associated with the project and qualitatively assess the potential impacts of these emissions on the environment. In order to obtain a comprehensive estimate, emission sources were considered associated with:

- Emissions from fuel use associated with preparation and construction at the site;
- Diesel usage for delivery of construction materials to the site;
- Electricity for construction site sheds;
- Major construction materials;
- Diesel usage by mobile equipment during operation of the MRF and RRF;
- Diesel usage for waste collection and transport and export of product and recyclables to market;
- Fuel use (petrol) for light vehicles (employee trips and self-haul drop off of waste);
- Diesel usage for landfill operations and for transfer of residuals from both the MRF and RRF to the Kimbriki Resource Recovery Centre landfill adjacent to the site;
- Emissions from the composting process in the RRF; and
- Landfill gas emissions from landfilling of residuals from the RRF (stabilised waste).

The emissions from these sources were then aggregated into a single greenhouse gas emissions inventory for the project.

This report also provides an assessment of the potential impacts of these emissions on the environment. It also provides an assessment of reasonable and feasible measures that could be implemented to minimise the generation of greenhouse gas emissions associated with the project.

1.5 Methodology

The greenhouse assessment was prepared in accordance with the general principles of:

- The recognised international standard – The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard developed by the World Business Council for Sustainable Development (GHG Protocol);
- The Commonwealth Department of Climate Change and Energy Efficiency (DCCEE) National Greenhouse Accounts (NGA) Factors, July 2010; and
- The DCCEE National Greenhouse and Energy Reporting System Guidelines (July 2008 and as amended 2009).

These are considered to represent current good practice in Australian greenhouse gas accounting.

1.5.1 Emission scopes

Emissions are separated into scopes 1, 2 and 3, in accordance with the Greenhouse Gas Protocol for the project. Scope 1, 2 and 3 emissions have been considered in the assessment, in accordance with the DGRs for the project. These scopes are defined as follows:

- Scope 1: Direct greenhouse gas emissions from sources falling within the operational boundary of the assessment, from sources that are owned and/or operated by the organisation in question.

Scope 1 emissions include direct carbon dioxide emissions from the combustion of stationary or transportation fuels (natural gas, coal, petrol and diesel) in boilers, furnaces, vehicles etc, and fugitive emissions of greenhouse gases from chemical processes, such as wastewater treatment and some product manufacturing.

- Scope 2: Indirect greenhouse gas emissions associated with purchased electricity, heat or steam. These emissions physically occur at the facility where the electricity, heat or steam is generated.
- Scope 3: All other indirect greenhouse gas emissions associated with the activities considered in the assessment. These emissions occur from sources not owned or controlled by the company. Scope 3 emissions include those associated with production of purchased materials, transport and contractor owned vehicles, waste disposal, product usage and the extraction and processing of fuels.

2. Existing Environment

2.1 Australian and NSW greenhouse gas emissions

The latest overview of greenhouse gas emissions estimates for Australia was published by the DCCEE in May 2010. The annual estimates for the four quarters to June quarter 2009 are summarised in Table 2-1. This summary does not include emissions associated with land use, land use change and forestry.

Table 2-1 2008 Australian greenhouse gas emissions estimate

Category	**Emissions ($Mt\ CO_2$-e)**	**Percentage of total (%)**
Energy - Electricity	202	38
Energy – Stationary energy excluding electricity	89	17
Energy – Transport	79	15
Energy – Fugitive emissions	41	8
Industrial processes	27	5
Waste	15	3
Agriculture	84	16
Inventory Total	**537**	**100**

Source: DCCEE (2010) 'Australian National Greenhouse Accounts: National Greenhouse Inventory accounting for the Kyoto target May 2010'

The latest summary of NSW greenhouse gas emissions was produced in 2010 for the 2008 inventory year. This summary is shown in Table 2-2 below.

Table 2-2 2008 Annual NSW GHG emissions estimate

Category	**Emissions ($Mt\ CO_2$-e)**	**Percentage of total (%)**
Energy	123	75
Industrial processes	12	7
Waste	5	3
Agriculture	17	10
Land Use, Land Use Change and Forestry	8	5
Inventory Total	**165**	**100**

Source: DCCEE (2010) 'Australian National Greenhouse Accounts: State and Territory Greenhouse Gas Inventories 2008'.

2.2 Kimbriki Resource Recovery Centre current emissions

The following table shows estimated emissions from current operations at the Kimbriki Resource Recovery Centre (diesel in mobile equipment, electricity consumption and landfill emissions only). This does not include any transport emissions associated with waste deliveries or offsite transfer of recyclables – which would be significant.

Table 2-3 Current annual emissions from the Kimbriki Resource Recovery Centre

Emissions source	Quantity Consumed per year	Scope 1 Emissions (t CO_2-e/y)	Scope 2 Emissions (t CO_2-e/y)	Scope 3 Emissions (t CO_2-e/y)	Total Emissions (t CO_2-e/y)
Diesel in mobile equipment	110 kL	296	0	23	318
Emissions from landfill[1]		56,178	0	0	56,178
Electricity consumption	175.4 MWh	0	158	30	188
Totals		**56,474**	**158**	**53**	**56,684**

Note 1: Emissions from landfill using NGER Method 1 from Golder Associates (2009) *Kimbriki Recycling and Waste Facility: Landfill Gas Emissions Assessment*

Golder Associates (2009) note that, under the NGERs Act for 2009/10 reporting year, landfill gas emissions were estimated at up to 56,178 t CO_2-e under a Method 1 assessment. This triggers the NGERs reporting threshold of 25,000 t CO_2-e and would potentially result in the proponent being financially liable if a Carbon Pollution Reduction Scheme (CPRS) is implemented. As no gas extraction system has been installed at the Kimbriki Resource Recovery Centre, it does not meet the NGER Method 2 legislative requirements.

3. Greenhouse Gas Assessment

3.1 Boundary of the assessment

3.1.1 Life cycle stages for the project

The life cycle stages for the project are:

- Raw materials – products, energy and materials required to produce the construction materials and incoming waste etc;
- Delivery of raw materials such as concrete, reinforcement steel, portal frames and steel cladding etc;
- Collection and delivery of waste to the site during operation;
- Composting and sorting in the RRF and MRF – use of utilities such as electricity, fuels, refrigerants, the generation of waste including solid waste and recycling, and wastewater;
- Transportation of recyclables and compost to points of sale;
- Transfer, placement and compaction of residuals from the RRF and MRF to the Kimbriki Resource Recovery Centre landfill adjacent to the site;
- Emissions from landfill;
- Emissions from composting; and
- Usage – emissions associated with the use of process products such as recyclables and compost.

These life cycle stages are illustrated in Figure 3-1.

3.1.2 System boundaries and geographic limitations

The system boundary is the inputs and outputs of each of the identified life cycle stages, including transportation.

Figure 3-2 illustrates the broad system boundary for the assessment, and details are provided in Figure 3-1.

Figure 3-1 Life Cycle stages for the project

Raw materials & transportation →

Emissions associated with the inputs, outputs and energy use of raw material production and transportation to the site.

Construction raw materials:

- Steel
- Concrete
- Sub base

Operation raw materials and waste:

- Waste transport
- Equipment
- Waste generation

Construction →

Emissions associated with the construction of the MRF and RRF.

Construction equipment:

- Fuel use
- Electricity for site offices

Operation →

Emissions associated with the inputs, outputs and energy usage at the MRF, RRF and landfill.

- Fuel usage from mobile equipment at the MRF, RRF and landfill
- Fuel usage from employee travel to and from the site
- Compost emissions from the RRF
- Electricity for operation of the RRF (including both AWT building and maturation building and equipment)
- Electricity for operation of the MRF
- Electricity for operation of the office/amenities block (including provision of computers, lunch room etc)
- Office resource consumption (e.g. paper) or support services (e.g. business travel)
- Refrigerant leakages

Product distribution

Emissions associated with the transportation of process products to the point of sale.

- Fuel consumption for transport of compost to market
- Fuel consumption for transport of recyclables to market

↓

Product usage

- Diesel (further offsite processing and use of compost and recyclable materials)
- Land application of compost
- Avoided emissions from resource avoidance due to recycling
- Displacement of chemical fertilisers from use of compost

↓

Disposal

- Transfer of residual waste to landfill (Kimbriki Resource Recovery Centre landfill – adjacent to the site)
- Landfill emissions (from stabilised waste)

Note: Items printed in BLUE are excluded from the assessment. Details of exclusions are included in Section 3.3.

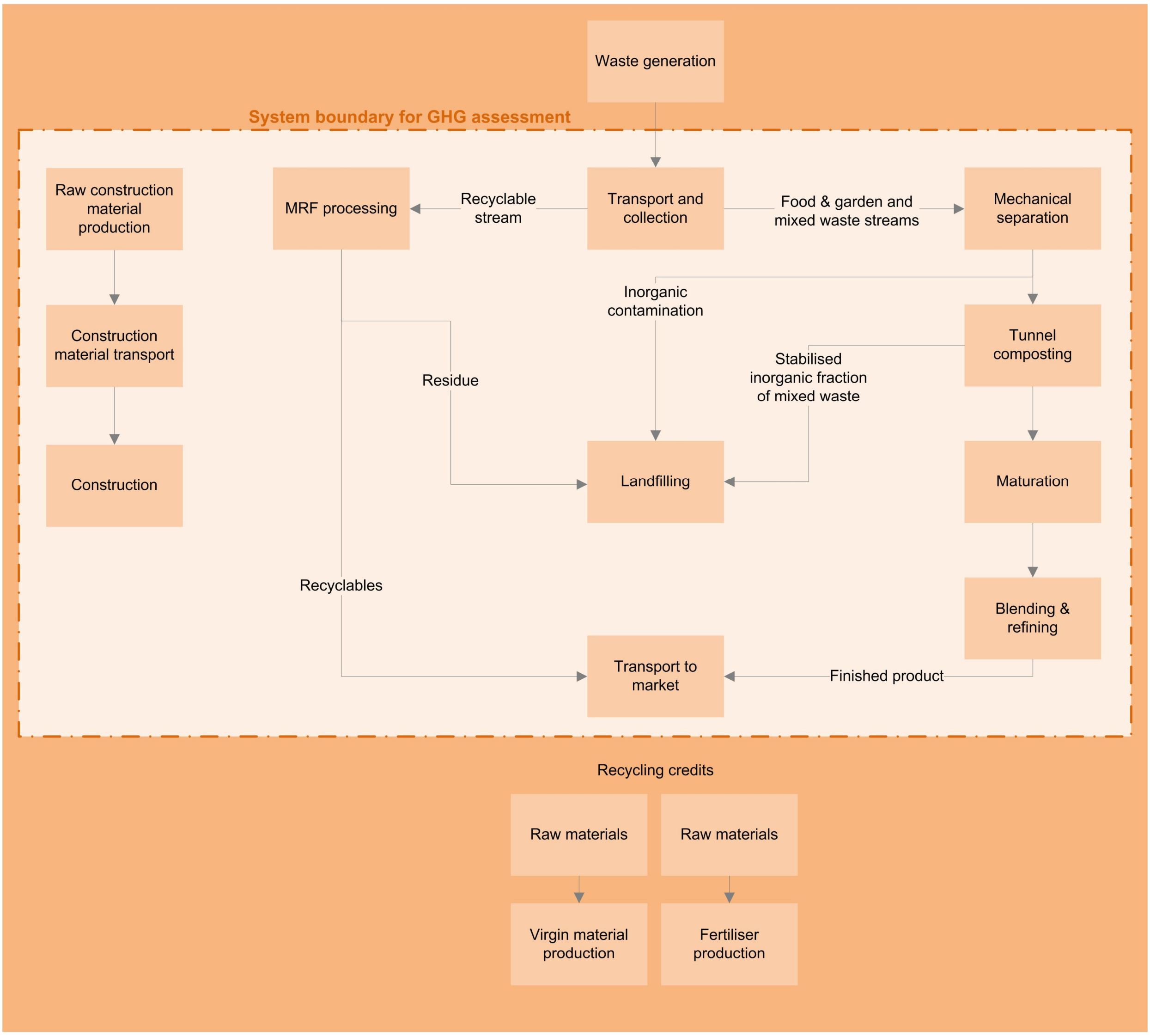

Figure 3-2 System boundary for the assessment

3.1.3 Greenhouse gases considered

The greenhouse gases considered in this assessment are:

- Carbon dioxide;
- Nitrous oxides; and
- Methane.

The proponent would not use, store or generate any perfluorocarbons or sulphur hexafluoride, and would use only negligible quantities of hydrofluorocarbons for refrigeration. These gases have therefore been excluded.

3.2 Data collection and calculation procedures

Emission factors that are used in the greenhouse gas emission calculations are outlined in Appendix A. Where possible, factors have been sourced from the *National Greenhouse Accounts (NGA) Factors,* July 2010. If factors have been sourced elsewhere then source references have been provided in Table 3-1 and Table 3-2.

Wherever possible, estimates with high accuracy were used to calculate greenhouse gas emissions. For example, electricity consumption estimates can be multiplied by the NGA emission factors to calculate greenhouse gas emissions with a high degree of accuracy. When data is unavailable, assumptions and approximations were made in order to obtain a reasonable estimate. For example, fuel consumption for construction equipment was not readily available, and these were estimated based on the best available information from manufacturers' specifications. Recognised standards, such as the World Business Council Greenhouse Gas Protocol, were used to assist in these estimations whenever appropriate.

All energy consumption and emissions data was converted into quantities of carbon dioxide equivalents and summed to reach an estimate of the total greenhouse gas emissions over the project lifecycle.

3.2.1 Modelling emissions from waste

The National Greenhouse Energy and Reporting (NGER) Measurement Technical Guidelines (2008 plus 2009 and 2010 Amendments) outlines several methods available for estimating gas emissions from waste being sent to landfill. Method 1 has been used in this assessment.

Method 1 is based on the Tier 2 First Order Decay Model (FOD) developed in the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. It utilises carbon mass balance and the change in degradable organic carbon stock in the landfill to determine annual methane generation. Methane emissions are then determined by considering the volumes of methane flared, transferred out of the landfill site and captured for combustion. Default state by state data is available for use in this method, but site specific waste stream data and waste mix data can be used and yield results that are more representative of actual methane emissions.

For the purposes of this assessment, it has been estimated that of the 100,000 tonnes of material that would be received at the RRF, 38% (by weight) would find its way to landfill. The recovery of material from source separated supplies is estimated to be around 95% from food and garden waste and 40% from mixed waste. The NGER model has been used to determine the potential capacity for this landfilled waste to generate methane.

The composition of the waste stream landfilled at the site was determined considering the incoming waste stream composition, and the components likely to be removed in the resource recovery process. The waste categories, as defined by incoming sources, were reallocated to be consistent with the waste categories used in the NGER model to provide site specific waste composition data.

3.3 Exclusions and assumptions

3.3.1 Exclusions

The life cycle stages, emissions sources and energy consumption that have been excluded from the study are detailed below:

- Equipment installed in the buildings such as conveyors, grinders etc. The details of the equipment types and quantities cannot be quantified at this stage and will be highly dependent on the technology providers selected the detailed design. The emissions associated with the materials for equipment is also expected to be much less than 1% of the total emissions;
- Emissions associated with support services for the facility including offsite office activities, marketing and promotional materials, staff business travel and/or visitors travelling to and from the site by any means of transport;
- Emissions associated with refrigerant leakages from refrigeration and office air conditioning and emissions associated with office resource consumption. These are negligible compared to emissions from other sources;
- Waste generation. Emissions associated with the generation of waste can not be easily determined;
- Emissions associated with decommissioning of the facilities, including the end of life disposal and vehicles and machinery required for decommissioning. Emissions associated with decommissioning of processing facilities are typically a very small proportion of the annual operating emissions. Furthermore, once total lifetime emissions are annualised, decommissioning typically accounts for less than 1% of the total emissions; and
- Emissions associated with product usage. The downstream uses and associated emissions for the process products can not be easily determined. Recyclables would be used as a raw material in the production of new products and compost could be further blended, refined or applied as produced to land. However, as shown in Figure 3-2, the benefits of avoided emissions from recycling and from application of compost to land (displacing chemical fertilisers) have not been included within the system boundary either.

The materiality of the excluded emission sources is difficult to accurately establish. However, these emissions are unlikely to be significant compared to the total emissions. The discrepancies in the total emissions inventory due to the exclusions and limitations of the assessment are therefore anticipated to be non-material.

In addition, emissions associated with ongoing activities at the Kimbriki Resource Recovery Centre not directly associated with the project (such as operation of the Eco-House and Garden, public waste drop-off areas and receival centre, the resource recovery shop, contractor facilities including the vegetation contractor, concrete recycler, existing weighbridge and office, and other acceptance / processing of materials that would continue as they currently do) have been excluded from the assessment.

3.3.2 Assumptions

Assumptions used in estimating the energy use and greenhouse gas emissions for the construction of the project are listed in Table 3-1.

Table 3-1 Construction energy use and greenhouse gas emissions assumptions

Parameter	Data Source and Assumptions
Diesel used in construction equipment	Construction equipment types and durations of use were estimated. Diesel consumption was estimated based on equipment type and assumed specifications from manufacturers' websites as 1400 kL over the construction period. Diesel is assumed to have an energy density of 38.6 GJ/kL and emissions factor both from Table 4 and 39 of the DCCEE NGA Factors (2010).
Electricity for site offices	Quantity estimated based on typical site shed use as 110 MWh over the construction period. Emission Factor from Table 5 NGA for NSW (scope 2) and Table 40 NGA Factors for NSW (scope 3).
Construction materials	Quantities of key construction materials estimated from concept layout drawings for civil works (concrete, sub-base and bitumen) and buildings (steel and concrete). Emission factors from SimaPro Australian Database.
Construction transport	Estimated heavy vehicle movements based on major construction materials and equipment deliveries including soil and sandstone removal, concrete, retaining wall blocks, bitumen, tilt-up panels, steel columns and beams, steel roof and wall sheeting and sub-base delivery. Trip distances assumed to range from 20 and 50 km (one-way). Diesel energy density is 38.6 GJ/kL (Table 4 NGA Factors). Scope 2 emission factor from Table 4 NGA Factors. Scope 3 emission factor from Table 39 NGA Factors.

Assumptions used in estimating the energy use and greenhouse gas emissions during operation are listed in Table 3-2.

Table 3-2 Operation energy use and greenhouse gas emissions assumptions

Parameter	Data Source and Assumptions
Diesel for collection and delivery of waste, and for transport of finished compost and recyclables	Quantity of diesel consumption from garbage trucks and transfer vehicles estimated to be 520 kL/y based on estimated distances and fuel consumption from: ◗ Nguyen and Wilson 2010, Fuel Consumption Estimates for Kerbside Municipal Solid Waste (MSW) Collection Activities, Waste Management Resources April 2010 vol. 28 no. 4 289-297; and ◗ Volvo Truck Corporation (2008) Emissions from Volvo's Trucks. Diesel energy density is 38.6 GJ/kL (Table 4 NGA Factors). Scope 2 emissions factor from Table 4 NGA Factors. Scope 3 emissions factor from Table 39 NGA Factors.
Petrol for light vehicle deliveries and employee traffic	Quantity of petrol consumption from light vehicles estimated to be 100 kL/y based on estimated distances and fuel consumption of 11.3 L/100 km. Petrol energy density is 34.2 GJ/kL (Table 4 NGA Factors). Scope 2 emissions factor from Table 4 NGA Factors. Scope 3 emissions factor from Table 39 NGA Factors.

Parameter	Data Source and Assumptions
Electricity use	Quantity of electricity consumed by the MRF and RRF and amenities building during operation based on existing electricity consumption at the Kimbriki Resource Recovery Centre and similar MRFs and composting plants in Australia to be 2524 MWh/y. Scope 2 emissions factor from Table 5 NGA Factors for NSW. Scope 3 emissions factor from Table 40 NGA Factors for NSW.
Diesel use in mobile equipment	Quantity of diesel consumption from mobile equipment in the MRF and RRF estimated to be 90 kL/y, based on the existing Kimbriki Resource Recovery Centre landfill operations and similar MRFs and composting plants in Australia. Diesel energy density is 38.6 GJ/kL (Table 4 NGA Factors). Scope 2 emissions factor from Table 4 NGA Factors. Scope 3 emissions factor from Table 39 NGA Factors.
Landfill operation and transfer of residuals	Fuel use for landfill operation and transfer of residuals to landfill was estimated to be 190 kL/y based on existing landfill operator fuel use and estimate of transfer vehicle movements to the Kimbriki landfill adjacent to the site. Diesel energy density is 38.6 GJ/kL (Table 4 NGA Factors). Scope 2 emissions factor from Table 4 NGA Factors. Scope 3 emissions factor from Table 39 NGA Factors.
Landfill emissions	Degradable organic carbon content (DOC) values from the NGER Measurement Technical Guidelines (2010). Default methane generation constants (k values) for the waste mix were used (as per NGER Measurement Technical Guidelines (2010)). The fraction of DOC dissimilated (DOC_F) was assumed to be 0.5 (as per IPCC Guidelines (2006)). The RRF stabilisation process removes 60% of degradable carbon available for decomposition once landfilled, from Bohn & Jager (2009) *Microbial methane oxidation in landfill top covers – process study on an MBT landfill* and US EPA's (1995) *Compilation of Air Pollutant Emission Factors (AP-42)*. From the NGER Measurement Technical Guidelines (2010) (Method 1), methane (CH_4) generated at the landfill was determined by: $CH4\ gen = (\Delta Ca(t) + \Delta Cos(t)) \times F \times 1.336 \times 21$ Where: $\Delta C_a(t)$ is the quantity of degradable organic carbon from newly deposited waste, lost through decomposition (in tonnes) $\Delta C_{os}(t)$ is the quantity of degradable organic carbon from the opening stock of carbon at the landfill, lost through decomposition F is the fraction of CH_4, by volume, generated in landfill gas (equal to 0.5) 1.336 is the conversion factor from a mass of C to a mass of CH_4 21 is the global warming potential of CH_4
Compost emissions	Methane and nitrous oxide emissions factors from Section 4.2 NGA Factors.

4. Greenhouse Assessment Results Analysis

4.1 Landfill gas emissions

Figure 4-1 shows the projected greenhouse gas generation from landfilling of stabilised waste over time. The modelling shows that the greenhouse gas emitted would be approximately 430,580 tCO_2-e in total or 14,350 tCO_2-e per year averaged over the 30 year design life.

It should be noted that these figures do not include emissions from landfilling of non-project related wastes.

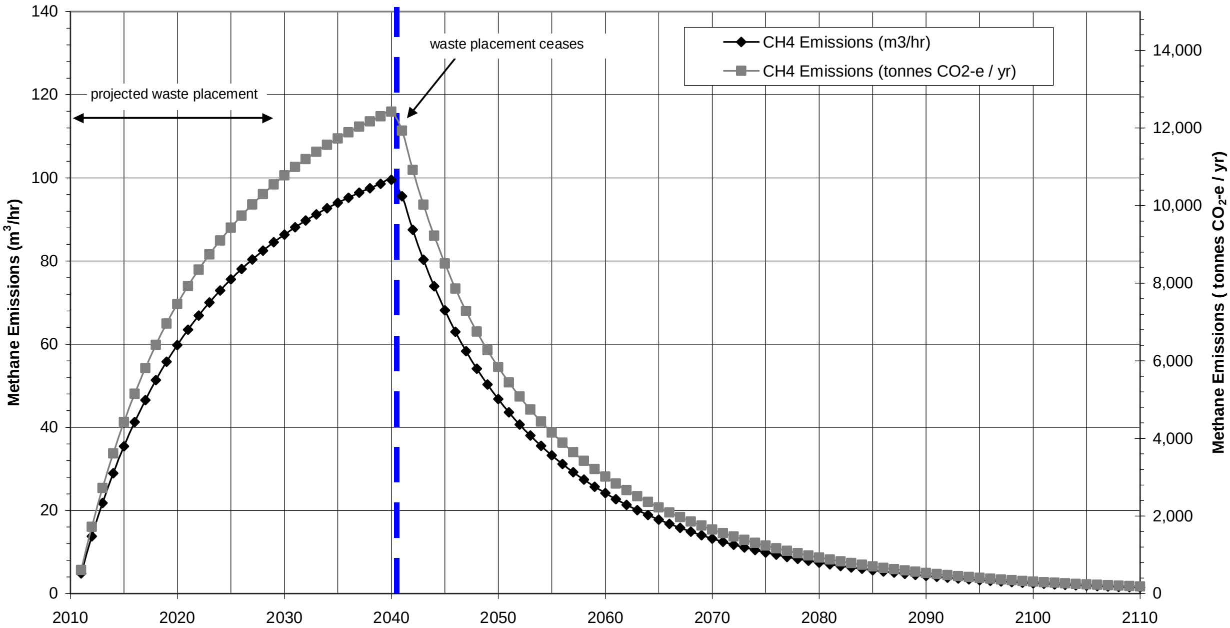

Figure 4-1 Projected greenhouse gas emissions from landfilling stabilised waste

4.2 Scope 1, 2 and 3 emissions

The scope 1, 2 and 3 emissions associated with the construction of the project are listed in Table 4-1.

Table 4-1 Construction scope 1, 2 and 3 emissions

Emissions Source	Quantity Consumed	Scope 1 Emissions (t CO_2-e)	Scope 2 Emissions (t CO_2-e)	Scope 3 Emissions (t CO_2-e)
Diesel use in construction plant and equipment	1400 kL	3,780	0	290
Electricity for site sheds	110 MWh	0	100	20
Construction materials	40,000 t	0	0	12,510
Construction deliveries and transport	340 kL	0	0	990
Subtotal*		**3,780**	**100**	**13,810**
Total construction scope 1, 2 and 3 emissions (t CO_2-e)			**17,690**	

*Note: Figures in table may not sum exactly to total value due to rounding.

The scope 1, 2 and 3 emissions associated with operation of the project are listed in Table 4-2.

Table 4-2 Annual operation scope 1, 2 and 3 emissions

Emissions Source	Quantity Consumed	Scope 1 Emissions (t CO_2-e/y)	Scope 2 Emissions (t CO_2-e/y)	Scope 3 Emissions (t CO_2-e/y)
Diesel in mobile equipment	90 kL	240	0	20
Residual waste transfer, placement and compaction	190 kL	510	0	40
Emissions from landfill (stabilised waste and residuals)	37,895 t	14,350	0	0
Electricity consumption	2.5 GWh	0	2,270	430
Heavy vehicle transport emissions (diesel)	520 kL	0	0	1,510
Light vehicle (petrol) emissions	100 kL	0	0	260
Compost emissions	100,000 t	20	0	0
Subtotal*		**15,120**	**2,270**	**2,260**
Total operation scope 1, 2 and 3 emissions (t CO_2-e/y)			**19,650**	

*Note: Figures in table may not sum exactly to total value due to rounding.

4.3 Greenhouse gas emissions results summary

The results from the greenhouse assessment are summarised in Table 4-3 below.

The total scope 1, 2 and 3 emissions during construction amount to 17,690 t CO_2-e or 590 t CO_2-e per annum assuming a design life of 30 years. Total annual emissions during operation amounts to 19,650 t CO_2-e. The estimated annual emissions from the project is 20,240 t CO_2-e (assuming a design life of 30 years).

Table 4-3 Greenhouse assessment summary

Greenhouse indicator	Note	Value	Units
Net annual emissions	1		
◗ Scope 1		15,246	t CO_2-e/y
◗ Scope 2		2,273	t CO_2-e/y
◗ Scope 3		2,720	t CO_2-e/y
Total		**20,240**	**t CO_2-e/y**
Greenhouse Intensity of the project (Scopes 1, 2, 3)	2	0.13	t CO_2-e/t waste
Total annual NSW emissions	3	165	Mt CO_2-e/y

Notes:

1. See Section 1.5.1 for definitions of reporting scopes. A detailed emissions inventory can be found in Appendix A
2. Greenhouse intensity based on annual Scope 1, 2 and 3 emissions (excluding annualised decommissioning emissions) and 160,000 t/y of waste handled
3. Total annual NSW emissions based on DCCEE (2010) 'State and Territory Greenhouse Gas Inventories 2008'

Greenhouse intensity

The emissions intensity for construction and operation of the project is 0.13 t CO_2-e/t waste processed, including the scope 1, 2 and 3 emissions considered in the assessment.

4.4 Assessment of impacts on the environment

Considering scope 1, 2 and 3 emissions, the project is expected to generate 20,240 t CO_2-e/y of greenhouse gas emissions. The total annual NSW emissions for 2008 was 165 Mt CO_2-e. Hence, the estimated annual Scope 1, 2 and 3 emissions from the project would equate to approximately 0.01 % of the state's total emissions. This is a small fraction of the Australian and NSW total emissions, and should be compared against the greenhouse gas savings that would be delivered by the project.

Implementation of the project would result in diversion of a significant quantity of waste, including organic waste (from source separation of some food and garden organics), from landfill. This waste would otherwise have contributed to landfill gas generation. Furthermore, the mixed residual waste from the Shore Regional of Organisation of Councils (SHOROC) region[1] would undergo stabilisation through the tunnel composting process, significantly reducing the methane generating potential of the residual waste once landfilled.

An assessment was undertaken to compare landfill gas emissions from three alternative scenarios where the mixed waste from SHOROC council collections was immediately landfilled rather than processed at the Kimbriki Resource Recovery Centre through tunnel composting to stabilise the waste prior to disposal of residuals. A description of the scenarios is provided below:

[1] The four shareholder councils belong to a regional organisation of councils referred to as the Shore Regional Organisation of Councils. The organisation that administers this regional organisation is called SHOROC. SHOROC is a partnership between the councils that make up the region of the Northern Beaches and Mosman from Bradleys Head to Barrenjoey – Manly, Mosman, Warringah and Pittwater councils.

For the purposes of the environmental assessment, Mosman, Manly, Warringah and Pittwater Councils are collectively referred to as the 'SHOROC councils', and the four local government areas administered by these councils are referred to as the 'SHOROC region'.

- Scenario 1 – there is no source separation of food waste into a separate food and garden organics collection. All the mixed waste (58,440 tonnes per year) is landfilled without any processing or stabilisation. The landfill has no gas capture system, or the system is ineffective.
- Scenario 2 – there is no source separation of food waste into a separate food and garden organics collection. All the mixed waste (58,440 tonnes per year) is landfilled without any processing or stabilisation. The landfill has a gas collection (and flaring) system which is achieving a 75% capture rate, which is the maximum recovery level considered likely to be achieved by most landfills.
- Scenario 3 – there is source separation of food waste into a separate food and garden organics collection and therefore the amount of waste being disposed to landfill has been reduced to 37,895 tonnes per year. However the waste does not undergo any processing prior to landfilling. The landfill has no gas capture system, or the system is ineffective.
- Scenario 4 – the project – there is source separation of food waste into a separate food and garden organics collection and therefore the amount of waste being disposed to landfill has been reduced to 37,895 tonnes per year. The waste is processed first through an aerobic tunnel composting system which stabilises the waste, achieving a 60% reduction in methane generating potential.

Estimates were calculated based on Method 1 of the NGER Measurement Technical Guidelines (2010), the results are shown in Table 4-4.

Table 4-4 Results of NGER model for methane emissions

Scenarios	1. All incoming mixed waste straight to landfill	2. All incoming mixed waste straight to landfill (with 75% capture)	3. Residual – no stabilisation	4. Residual – stabilised (the project)
tonnes to landfill per year	58,440	58,440	37,895	37,895
Maximum emission rate (2040)				
tonnes CH_4	2,420	610	1,480	590
m^3/hr	410	110	250	100
tonnes CO_2-e	50,860	12,720	31,100	12,420
Total emissions (100 yrs)				
tonnes	81,100	20,270	51,260	20,500
m^3/hr	13,700	3,410	8,630	3,450
tonnes CO_2-e	1,702,800	425,690	1,076,500	430,580
Average annual emission rate (100 yrs / 30)				
tonnes	2,700	680	1,710	680
m^3/hr	460	110	290	120
tonnes CO_2-e	56,800	14,190	35,900	14,350

Table 4-4 shows that the wastes landfilled over 30 years of operation of the project (stabilised residuals) would generate approximately 430,580 t CO_2-e over 100 years.

Averaged over the design life (30 years), the project would generate 14,350 t CO_2-e per year of landfill emissions. The modelling indicates that the greenhouse gas emissions associated with the project (from landfilled waste and processing equipment energy use) are comparable with Scenario 2 - landfilling of mixed waste with 75% gas capture.

However, this does not take into account the emissions associated with avoided transport emissions (to remote landfills), as well as greenhouse gas savings due to the recovery of recyclable materials such as steel, plastics and glass versus use of virgin materials.

All alternative scenarios would also require further transport of the mixed waste materials. It is estimated that for every 10 km (one-way, or 20 km return) distance the 58,440 tonnes per year of mixed waste would be required to be transported, an additional 168 t CO_2-e per year of greenhouse gas emissions would be generated. For a 100 km round trip to one of the existing Sydney landfills, 840 tonnes t CO_2-e per year of greenhouse gas emissions would be generated.

Golder Associates (2009) estimated that, under the NGER Method 1 assessment, the Kimbriki landfill emitted up to 56,178 t CO_2-e in 2009/10. GHD's modelling has indicated that landfilling of the stabilised residual waste from the MRF and RRF could increase cumulative landfill gas emissions to 70,600 t CO_2-e per year, based on this Method 1 assessment.

4.5 Mitigation measures

During operation the project would consume approximately 2.5 GWh of electricity annually (from both the MRF and RRF). During detailed design of the facilities, it may be possible to integrate additional energy efficiency measures to reduce consumption of electricity. For example:

- Wide-panel skylights would be considered for installation on the roof of the baling building to maximise use of natural lighting;
- A variety of efficient lighting alternatives, including fluorescent lamp options would be considered;
- Where feasible and cost-effective, energy efficient lamp and lighting control technologies would be considered in amenities blocks;
- The amenities block would require air-conditioning / heating and components to be installed outside the building would be located in shady areas, or provided with artificial shading to improve efficiency with which heat is rejected from the building; and
- Passive cooling arrangements would be used for the MRF and RRF buildings in order to reduce overall heat load rather than installation of an air conditioning system.

In addition, during the detailed design stage of the project, where possible, energy efficiency would be considered in the selection of equipment.

The most significant contribution of greenhouse gas emissions from the project would come from the degradation of waste in landfill (approximately 73% of the operational emissions).

Although the level of landfill gas generation is relatively low and not sufficient for commercially viable recovery and energy (electricity) generation, installation of a gas collection and recovery system with a gas collection efficiency of 75% at the Kimbriki Resource Recovery Centre would reduce the landfill gas emissions from the stabilised residual waste from an average of 14,350 t CO_2-e per year over the design life to approximately 3,600 t CO_2-e per year.

This would be substantially less than the emissions associated with modelled Scenario 2 - landfilling of mixed waste with 75% gas capture (14,190 t CO_2-e per year).

It should be noted however that the volumes discussed above are based on a Method 1 assessment of emissions. This methodology has been questioned by both industry and DCCEE and is currently undergoing review. Prior to an emissions trading system or carbon tax being implemented by the Commonwealth Government, the current emissions estimation methodologies will need to be reviewed and approved.

If at this time the standardised direct measurement method (Method 4) for landfill gas estimation is not approved by DCCEE the proponent may consider some form of gas extraction system to manage potential liabilities.

5. Disclaimer

This report has been prepared at the request of Kimbriki Environmental Enterprises Pty Ltd and is for the sole purpose of evaluating the Scope 1, 2 and 3 greenhouse gas emissions associated with the construction activities and operation of the project for the environmental assessment.

This report is not for use by any related or third party or for any other project. The information and recommendations are to be read and considered as a whole and the content is not to be used selectively as this may misrepresent the content of the report and provide erroneous project or decision outcomes.

The recommendation, opinions, assessments, analyses and summaries presented in this report are based on preliminary design information, data, assumptions and advice provided by Kimbriki Environmental Enterprises Pty Ltd. This information may not reflect the final design and construction and operational activities and where assumptions are identified and recommendations made these need to be verified and tested.

Appendix A

Greenhouse Gas Emissions Inventory

Construction	Value	Units	Scope 1 Emission Factor	Scope 2 Emission Factor	Scope 3 Emissions Factor	Total Emission Factor	Units	Source	Method	Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions	Total Emissions	Proportion of Total Inventory
	(Q)		(EF)	(EF)	(EF)	(EF)				(t CO_2-e)	(t CO_2-e)	(t CO_2-e)	(t CO_2-e)	%
Diesel use in construction plant and equipment	1,400	kL	2698.14		204.58	2902.72	kg CO2-e/kL	NGA Factors 2010	Q x EF / 1000	3,780	0	290	4,070	23.0%
Electricity for site sheds	109,540	kWh		0.9	0.17	1.07	kg CO2-e/Wh	NGA Factors 2010	Q x EF / 1000	0	100	20	120	0.7%
Construction materials								Refer construction materials (below)		0	0	12,510	12,510	70.7%
Construction deliveries and transport	340	kL			2902.72	2902.72	kg CO2-e/kL	NGA Factors 2010	Q x EF / 1000	0	0	990	990	5.6%
Total Construction Emissions										**3,780**	**100**	**13,810**	**17,690**	

Construction materials

Raw Materials	Value	Units	Total Value (Q)	Units	Scope 1 Emission Factor (EF)	Scope 2 Emission Factor (EF)	Scope 3 Emission Factor (EF)	Total Emission Factor (EF)	Units	Source	Method	Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions	Total Emissions	Units
Civil construction materials																
Concrete	8,815	m^3	21,156	t	0	0	0.141	0.141	t CO2-e/tonne	Simapro Australian Database	Q x EF	0	0	2980	2980	t CO_2-e
Sub-base	5,900	m^3	12,154	t	0	0	0.017	0.017	t CO2-e/tonne	Simapro Australian Database	Q x EF	0	0	210	210	t CO_2-e
Bitumen	1,050	m^3	1,581	t	0	0	0.434	0.434	t CO2-e/tonne	Simapro Australian Database	Q x EF	0	0	470	470	t CO_2-e
Buildings																
Steel (galvanised)	537	m^3	4,213	t	0	0	2.070	2.070	t CO2-e/tonne	Simapro Australian Database	Q x EF	0	0	8720	8720	t CO_2-e
Concrete (tilt up panels)	388	m^3	931	t	0	0	0.141	0.141	t CO2-e/tonne	Simapro Australian Database	Q x EF	0	0	130	130	t CO_2-e
										TOTAL		**0**	**0**	**12,510**	**12,510**	

Operation	Value	Units	Scope 1 Emission Factor	Scope 2 Emission Factor	Scope 3 Emissions Factor	Total Emission Factor	Units	Source	Method	Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions	Total Emissions	Proportion of Total Inventory
	(Q)	per year	(EF)	(EF)	(EF)	(EF)				(t CO_2-e/y)	(t CO_2-e/y)	(t CO_2-e/y)	(t CO_2-e/y)	%
Diesel in mobile equipment	90	kL	2682.7		204.58	2887.28	kg CO2-e/kL	NGA Factors 2010	Q x EF / 1000	240	0	20	260	1.3%
Residual waste transfer, placement and compaction	190	kL	2682.7		204.58	2887.28	kg CO2-e/kL	NGA Factors 2010	Q x EF / 1000	510	0	40	550	2.8%
Emissions from landfill (stabilised)								GHD LFG Calculator	Method 1 NGER	14,350	0	0	14,350	73.0%
Electricity consumption	2,524,000	kWh		0.9	0.17	1.07	kg CO2-e/kWh	NGA Factors 2010	Q x EF / 1000	0	2,270	430	2,700	13.7%
Heavy vehicle transport emissions (diesel)	520	kL			2902.72	2902.72	kg CO2-e/kL	NGA Factors 2010	Q x EF / 1000	0	0	1,510	1,510	13.7%
Light vehicle (petrol) emissions	100	kL			2561.58	2561.58	kg CO2-e/kL	NGA Factors 2010	Q x EF / 1000	0	0	260	260	1.3%
Compost emissions	100,000	t	0.17			0.17	t CO2-e/t	NGA Factors 2010	Q x EF	20	0	0	20	0.1%
Total Operational Emissions										**15,120**	**2,270**	**2,260**	**19,650**	

Appendix B

Landfill Gas Emissions Modelling Scenario Results

Figure B-1 shows the projected greenhouse gas emissions from landfilling all incoming mixed waste at a landfill with no gas capture system, or the system is ineffective.

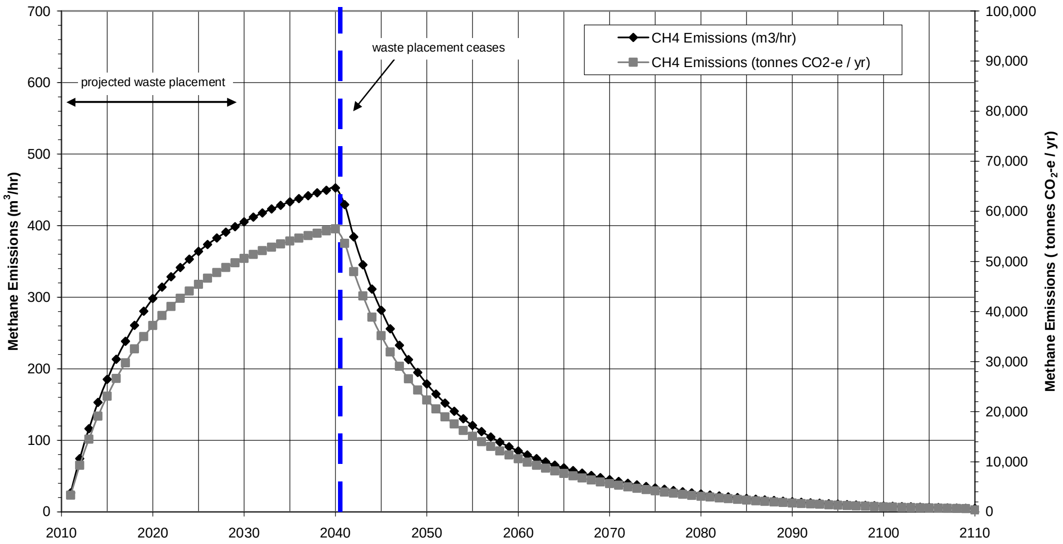

Figure B-1 Projected greenhouse gas emissions from landfilling all incoming mixed waste with no gas capture system (or ineffective system)

Figure B-2 shows the projected greenhouse gas emissions from landfilling all incoming mixed waste at a landfill with 75% gas capture.

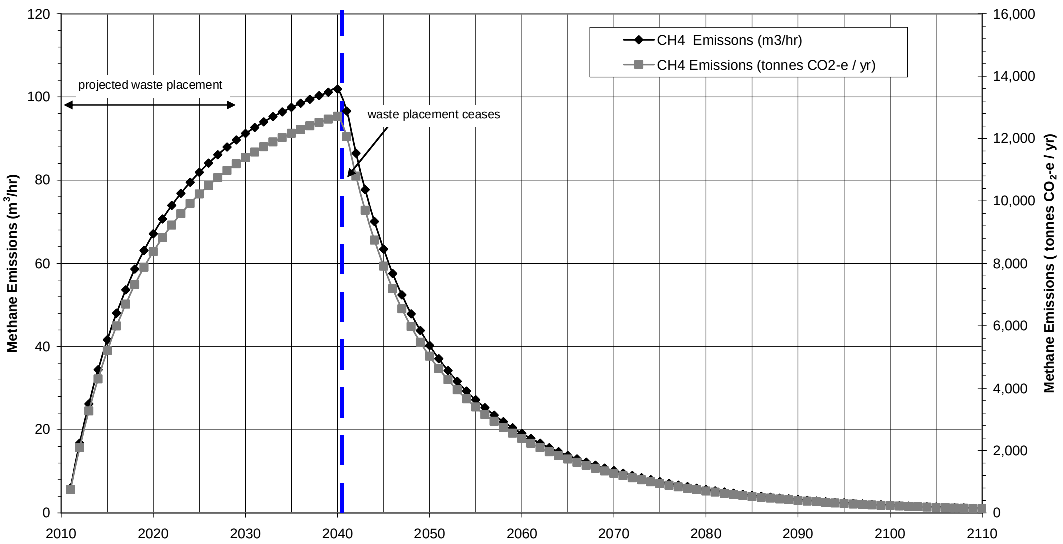

Figure B-2 Projected greenhouse gas emissions from landfilling all incoming mixed waste with 75% gas capture

Figure B-3 shows the projected greenhouse gas emissions from landfilling unstabilised residual waste at a landfill with no gas capture system, or the system is ineffective.

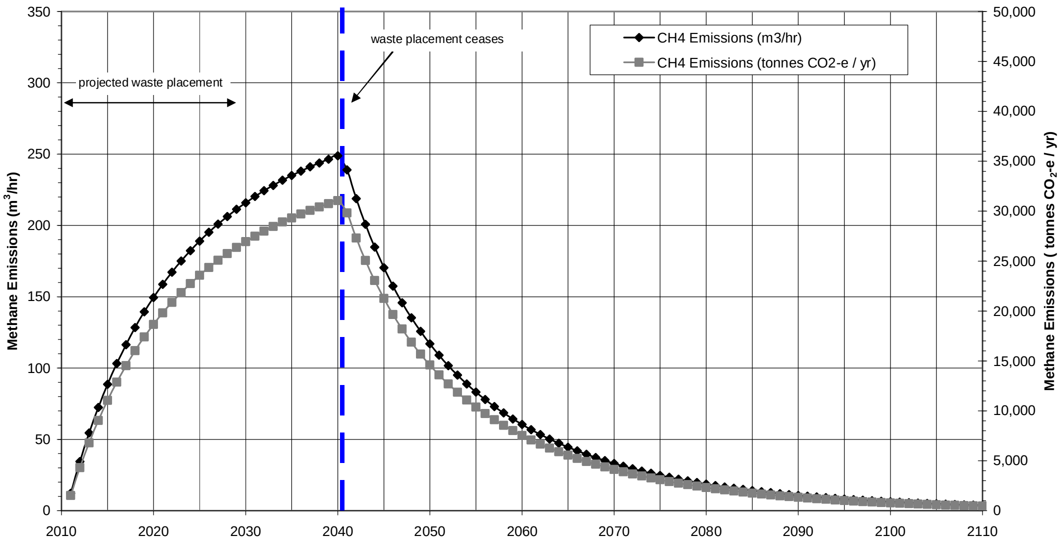

Figure B-3 Projected greenhouse gas emissions from landfilling residual waste with no gas capture system (or ineffective system) and no stabilisation

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A Montgomery, A Horlyck	S Trahair	Sue Trahair	D Gamble	David Gamble	22/11/10

Appendix L
Aboriginal Heritage Assessment Report

The archaeological investigation for sites of Indigenous cultural significance for an Environmental Assessment

KIMBRIKI RESOURCE RECOVERY PROJECT

Terrey Hills, north of Sydney, NSW

John Appleton

ARCHAEOLOGICAL SURVEYS & REPORTS PTY LTD

Project No. 502/10

OCTOBER 2010

For

GHD

On behalf of

KIMBRIKI ENVIRONMENTAL ENTERPRISES PTY LTD

**This report has been compiled in 'Plain English',
but presented in a format suitable for developing policies
for the management of the cultural resources,
and as a basis for scientific reference
in future research studies.**

Project No. 502/10

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EXECUTIVE SUMMARY

Kimbriki Environmental Enterprises Pty Ltd (KEE) is proposing to construct and operate two purpose-built advanced waste sorting and treatment facilities at the existing Kimbriki Resource Recovery Centre site in Terrey Hills, hereafter referred to as the “project site”.

KEE has engaged GHD Pty Ltd (GHD) to prepare an environmental assessment in accordance with the requirements of Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). GHD engaged Archaeological Surveys & Reports Pty Ltd (ASR) to provide an archaeological assessment of the Project Site.

The scope of works was for ASR to report on the preliminary inspection of the site that took place in September 2009 for R.W. Corkery & Co. Pty Limited on behalf of Kimbriki Environmental Enterprises Pty Ltd for a Preliminary Environmental Assessment; and to report on the additional consultation with all registered Aboriginal stakeholders with an interest in the project, to comply with the “Interim Community Consultation Requirements for Applicants”, to support an application for “Part 3A Major Projects” approval

This report assesses the potential impacts of the project on the Aboriginal cultural and archaeological resources in the Project Site.

The preliminary site inspection was undertaken by John Appleton (consultant archaeologist) with Allen Madden, Sites Officer, Metropolitan LALC, on 30th September 2009 for the purpose of identifying any factors or constraints of cultural or archaeological significance to the further development and expansion of the existing Kimbriki Waste Facility in line with the proposed Kimbriki Resource Recovery Project. No sites or PADs were recorded on the site.

Subsequently in compliance with the requirements of “Interim Community Consultation Requirements for Applicants” a list of registered Aboriginal stakeholders was compiled and letters were sent to each of the stakeholders inviting their input, and giving them an opportunity to visit the site, however only one response was received and that was to advise that the Aboriginal Heritage Office was not aware of any Aboriginal heritage issues.

Subsequently, in accordance with the requirements of the "Draft Code of Practice for Archaeological Investigation in NSW, 2010" (DECCW) copies of the draft of this report were sent to each of the registered Aboriginal stakeholders for their review and comment. No responses were received.

ASR recommends that in the absence of any Aboriginal sites in the proposed development site that there are no constraints on Indigenous cultural or archaeological grounds to the proposed development.

However, DECCW makes the following recommendations in relation to any earthworks operations as additional Statements of Commitment or as conditions of approval as appropriate:

1. If Aboriginal cultural objects are uncovered due to the development activities, all works must halt in the immediate area to prevent any further impacts to the object (s). A suitably qualified archaeologist and Aboriginal community representatives must be contacted to determine the significance of the object(s). The site is to be registered in the AHIMS (managed by DECCW) and the management outcome for the site included in the information provided to the AHIMS. It is recommended that the Aboriginal community representatives are consulted in developing and implementing management strategies for all sites, with all information required for informed consent being given to the representatives for this purpose.

2. If human remains are located during the project, all works must halt in the immediate area to prevent any further impacts to the remains. The NSW Police, the Aboriginal community and DECCW are to be notified. If the remains are found to be of Aboriginal origin and the police consider the site not an investigation site for criminal activities, DECCW should be contacted and notified of the situation and works are not to resume in the designated area until approval in writing is provided by DECCW. In the event that a criminal investigation ensues, works are not to resume in the designated area until approval in writing (*has been received*) from NSW Police and DECCW.

3. All reasonable efforts must be made to avoid impact to Aboriginal cultural heritage values at all stages of the development works. If impacts are unavoidable, mitigation measures are to be negotiated with the Aboriginal community and DECCW.

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1 INTRODUCTION

1.1 Purpose of this report

Kimbriki Environmental Enterprises Pty Ltd (KEE) is proposing to construct and operate two purpose-built advanced waste sorting and treatment facilities at the existing Kimbriki Resource Recovery Centre site in Terrey Hills, hereafter referred to as the "project site".

KEE has engaged GHD Pty Ltd (GHD) to prepare an environmental assessment in accordance with the requirements of Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). GHD engaged Archaeological Surveys & Reports Pty Ltd (ASR) to provide an archaeological assessment of the Project Site.

This report assesses the potential impacts of the project on the Aboriginal cultural and archaeological resources in the Project Site.

1.2 Project outline

The Project involves the construction and operation of two main facilities:

- A materials recovery facility
- A resource recovery facility

The materials recovery facility would receive and process and sort up to 60,000 tonnes per year of dry recyclable materials collected as part of the municipal kerbside collection services provided by Mosman, Manly, Warringah and Pittwater Councils.

The resource recovery facility would sort and treat up to 100,000 tonnes per year of source separated food and garden organics and mixed municipal wastes. The resource recovery facility would include separation equipment and aerobic enclosed tunnel composting technology to produce a variety of compost products and extract valuable recyclables from the incoming waste streams.

The Project also includes the following ancillary infrastructure:

- internal roadways
- weighbridge
- staff amenities and ablutions

- staff parking facilities

1.3 Location of the project

The site on which the project will be located is within the existing Kimbriki Resource Recovery Centre site in the suburb of Terrey Hills. The irregularly shaped Project Site of approximately 65ha occurs on Lot 301 in the Warringah Local Government area. It is bounded by Community Land to the north and west, by Garigal National Park to the south, and by residential property fence lines on Kimbriki Road to the east. Access to the Project Site is via a sealed road connecting the Project Site with Mona Vale Road, Terrey Hills. The site location is shown on **Figure 1.1**

1.4 Methodology of the study

The methodology of the study was in accordance with best practice and followed the following procedure (it should be noted that the field investigation of the project site had previously been undertaken with the assistance of the Sites Officer, Metropolitan LALC for the Preliminary Assessment for this project).

The previous investigation of the project site for the Preliminary Assessment of the project site included the following procedure:

- Making a search of the AHIMS Site Register (maintained by DECCW)
- Obtaining Topographic map and aerial photograph of the project site.
- Obtaining a plan showing the proposed extensions and the development footprint.
- Obtaining a Metallogenic map of the project site.
- Reviewing any reports or references in the literature to previous studies in the general area.
- Developing a predictive model for site location in the project site.
- Undertaking a field investigation of the project site with the Sites Officer, Metropolitan LALC

Subsequently when the proponents elected to apply for Part 3A approval ASR took the following additional steps to comply with Part 3A requirements:

- Advertising the proposed development in the local press, inviting Aboriginal stakeholders to register their interest.

Figure 1.1

Site Location

- Sending letters to Government agencies requesting they provide ASR with lists of registered Aboriginal stakeholders.
- Sending a letter to each registered Aboriginal stakeholder informing them of the investigation previously undertaken of the project site for the Preliminary Assessment, and inviting them to contribute any additional cultural information relevant to the project site.
- Amending the draft report to reflect the additional Aboriginal consultation.

1.5 Scope and structure of the report

Scope
The scope of works was for ASR to report on the preliminary inspection of the site that took place in September 2009 for R.W. Corkery & Co. Pty Limited on behalf of Kimbriki Environmental Enterprises Pty Ltd for a Preliminary Environmental Assessment; and to report on the additional consultation with all registered Aboriginal stakeholders with an interest in the project, to comply with the "Interim Community Consultation Requirements for Applicants", to support an application for "Part 3A Major Projects" approval

The objectives of this report are to describe the consultation that took place with the Metropolitan Local Aboriginal Land Council (LALC) during the preliminary archaeological inspection of the site, and to document the results of the investigation. In addition the report documents the additional consultation that took place for the current Environmental Assessment to meet the requirements necessary for the lodgement of an application for approval of the project as a Part 3A "Major Project". Finally, the report includes a statement as to the recommendations for the future development of the proposed Kimbriki Resource Recovery Project.

Report Structure
This report is structured to include both the report of the field investigation for the Preliminary Environmental Assessment (Part 1), and the additional consultation required for Environmental Assessment as required by the "Interim Community Consultation Requirements for Applicants" (Part 2).

The structure of the report is as follows:

i Executive summary
ii Contents

1. Introduction

Part 1: Preliminary Environmental Assessment

2 Aboriginal Consultation
3 The Environmental Context
4 The Archaeological Record

PART 1: PRELIMINARY ENVIRONMENTAL ASSESSMENT

2. ABORIGINAL CONSULTATION

In accordance with the brief for the investigation Appleton (ASR) contacted the Metropolitan LALC to firstly confirm that the Project Site was within its management area, and secondly, to arrange for a Sites Officer to assist in the site inspection. As a consequence Allen Madden, Sites Officer, Metropolitan LALC assisted Appleton in the site inspection which was undertaken on 30th September 2009. Subsequently Metropolitan LALC provided Appleton with its recommendations, a copy of which is included as **Appendix i**.

3. THE ENVIRONMENTAL CONTEXT

Any discussion of the likely presence of Aboriginal cultural remains or of the basis why such remains might be discovered must be within the context of the environment and the resources that would have been available to any Aboriginal occupants of the area.

3.1 The general geology and topography

The project site occurs on the eastern rim of the Sydney-Bowen Basin, a major structural basin, which extends from Batemans Bay in the south, to Collinsville, Queensland in the north. The New South Wales portion of the basin is divided into northern and southern sections by a transverse structural high to the north of Narrabri. The southern section of the Sydney-Bowen Basin has been divided into two lower category structural basins, the Sydney Basin and the Gunnedah Basin (Menzies 1974). The project site occurs in the Sydney Basin. The Sydney

Basin is composed of Hawkesbury Sandstone and Wianamatta and Narrabeen Groups, comprising sandstone, shale and claystone (Department of Mineral Resources 1980).

The area north of Sydney is known as the Hornsby Plateau and is part of the Sydney Basin. The Hornsby Plateau rises from about 213m near Mount Kuringai and gradually reaches an elevation of 580m before terminating at the southern edge of the Hunter River valley. The Hornsby Plateau is composed of Hawkesbury Sandstone, a quartz-rich rock of medium to coarse grains of sand cemented together with small quantities of other materials. Studies have shown that up to 60% of Hawkesbury Sandstone is composed of quartz, 20% of clay, and the remainder is of small quantities of feldspar, mica, siderite, and rock fragments including shale, chert, slate, phyllite, and acid volcanics (Fairley 1976).

The Project Site occupies a southerly-facing steep-sided valley that drains southwards into Deep Creek a kilometre to the south.

The 'Pittwater Spot Height" immediately to the north of the Project Site is at 217m AHD, and the drainage line egresses the site at the southern boundary at 60m AHD. The existing Waste Facility occupies the floor of the valley which has been significantly altered to provide a steep-sided, roughly lozenge-shaped basin, the axis of which trends north to south.

3.2 Vegetation

The Project Site has been partly developed and the only surviving natural vegetation occurs on the steep eastern slopes and at most levels surrounding the site above the 110m contour. Typically the natural vegetation is of the dry sclerophyll type that includes Hakea sp., Old Man Banksia, Red Bloodwood, Smooth-barked Apple, Sydney Peppermint, Grey Gum, Scribbly Gum, Narrow-leafed Stringybark, Geebung sp., Waratah, and various Wattles.

3.3 Water resources

As referred to previously the existing waste facility occupies a steep-sided valley that drains southwards into Deep Creek. The plateau is surrounded by numerous steep-sided drainage lines many of which contain a trickle of water seeping from natural springs for most of the year, and so water was never a factor that determined whether or not Aboriginal people occupied the area in the past.

3.4 Stone resources

As referred to in **Section 3.1** the Project Site occurs on the *Hawkesbury Sandstone* unit which contains very little stone that might be knapped into tools or weapons, and so any stone artefacts that might be present would have been sourced from a material found elsewhere other than in the Project Site.

Figure 3.1
The designated survey area comprised all of the undeveloped area inside the Site Boundary.

Surface exposures of the Hawkesbury Sandstone frequently include outcropping 'platforms' that provided ideal surfaces for engraving; and where the exposures occur in the vicinity of water they frequently exhibit axe-grinding grooves. Numerous engraving sites have been recorded in both Kuring-gai Chase National Park to the west and Garigal National Park to the south, and both parks also contain many shelters in which there are both painted 'pictures' and occupation deposits. But the project site subject of this report contained neither shelving sandstone surfaces nor shelters nor overhangs.

3.5 Previous impacts.

As the aerial photograph (**Figure 3.1**) shows there has been significant alteration to the ground surface within the existing waste facility and to its immediate surrounds, both from quarrying of the sandstone, the excavation of drainage channels, and from the accumulation of landfill. A number of areas within the site have been landscaped, some to facilitate administration buildings, car parks, a gate house, and an "Eco House and Garden". Other areas have been levelled or infilled for storage areas of the different recycled products, such as quarried sandstone boulders, recycled brick aggregate, pebbles, sand, and mulch. The site is also criss-crossed by tracks and roads, and the site entrance road in the north-eastern corner.

As referred to previously the lower slopes of the surrounding northern, western and eastern valley walls have been cut-back to provide a greater space on the valley floor and there is very little surviving evidence of the original natural valley profile. Run-off from the site and the surrounding slopes is channelled via an excavated channel into a series of sediment collection basins at the southern end of the site.

One area, and the one in which expansion of the facility is most likely to occur (Peter Stephenson, Kimbriki Operations Manager, pers. comm.), is to the south of the entry road in the north-eastern section. This area, seen in the aerial photograph in **Figure 1.1** as a "TV aerial" like feature, occurs on a rock-free bench of weathered sand. The aerial-like feature consists of a series of tracks cleared for fire-truck access tracks into a fire-prone area of scrub dominated by wattles, banksias and bottle-brushes.

4. THE ARCHAEOLOGICAL RECORD

4.1 AHIMS search

A search was made of the Aboriginal Sites Register (Aboriginal Heritage Information Management System – AHIMS) for all sites in the area described by Eastings 334000 and 338000, and Northings 6269000 and 6273000, centred on the project site. The results showed that 20 sites had been recorded in the 16 sq.km area. A copy of the letter evidencing the search of the AHIMS Site Register is included as **Appendix ii** (details of the sites have been omitted at the request of the Culture and Heritage Division, DECCW for site security reasons).

While several of the listed sites occur on the plateau surrounding the project site, none occur within the area subject of this report.

Of the 20 sites listed, 14 were rock engravings (two of which also contain axe-grinding grooves), and six were shelters containing "art".

Allen Madden was present during the previous survey for the overhead powerline that crosses the southern section of the waste facility, and he advised Appleton that no sites had been recorded in the vicinity of the project site.

4.2 Relevant previous investigations

In 1993 Margrit Koettig ("Archaeological Services") undertook a field investigation for Kinhill Engineers Pty Ltd on behalf of the Joint Services Committee (comprising the Councils of Warringah, Manly, Mosman and Pittwater) which had been engaged to produce an Environmental Impact Statement for the "present and future operations" of Kimbriki Recycling and Waste Disposal Centre. Koettig undertook an intensive investigation of the survey area, inspecting rock surfaces in both early morning and afternoon light, using a mirror to reflect light across the surfaces, a technique used to create shadows within an engraving to make it more visible.

Koettig reported that she had not found any rock surfaces suitable for engraving, or shelters suitable either as shelter or containing surfaces suitable for rendering paintings, stencils or drawings, and that no sites had been found in the survey area. She also noted that the nearest site to the survey area was a PAD, comprising a shelter with potential archaeological deposits, approximately 150m from the south-eastern corner of the survey area. A second site, a shelter with charcoal drawings, which had been recorded by Beth Rich in 1988 during an investigation for a previous extension to the Kimbriki facility, was a similar distance away but further to the south.

In an unrelated investigation Gunn (1992 – cited by Koettig) stated that 31 sites had been recorded in the Garigal National Park and that the total number of visible sites would probably be about 60. Of the 31 sites 22 were rock engravings, four were shelters with arts, five were shelters with occupation deposits, one was an axe-grinding groove, and one was an isolated stone artefact. Gunn also stated that 215 sites had been recorded in the Kuring-gai Chase National Park, of which 200 were rock engravings and 15 were shelters with occupation deposits. Gunn added that, "the area south of Kimbriki is currently one of the most carefully surveyed areas within Garigal National Park".

In March 2009 Phil Hunt, archaeologist with the Aboriginal Heritage Office, inspected a proposed drainage line along the 140m contour line at the Kimbriki waste facility. Hunt stated that, "Overhangs below this were inspected and found to have little potential for art or archaeological deposit". A copy of his report is included as **Appendix iii.**

While the above would appear to indicate that everything there is to know about the Kimbriki area is already known it should not be interpreted as being totally representative of the frequency or distribution of sites in the area. Apart from the sites recorded in the mid to late 1970s, after the enactment of the *National Parks and Wildlife Act* 1974, sites are usually only found and recorded during investigations for proposed developments, and as there have been few new developments in the search area since before the 1970s no sites have been found.

Also, unfortunately, many of the site references on the AHIMS Site Register are inaccurate. Since the first sites were recorded on the Sites Register in 1974 the computer programme written for the site register has been rewritten and/or upgraded at least three times, and each time the data was re-entered into the system there were transposition errors, both in site names and in map references.

Also during that time there were considerable changes to the maps available to field workers, firstly from 1:63,360 (inch) scale (Imperial) military Topographic maps, to 1:250,000 military Topographic maps (printed in 1942), and then to 1:250,000 scale Topographic maps (printed at various times), and then to 1:100,000 and 1:25,000 scale Topographic maps (printed in 1983), and then more recently to 1:25,000 scale maps (printed in 2001). Features that were apparent in the earlier maps and may have been used as reference points for provenancing sites were changed or destroyed and the features removed from the maps.

Archaeologists have used various strategies to locate sites on maps, from compass and line-of-site, to sight referencing to topographic features, to using hand-held or vehicle-mounted Global Positioning Systems of varying degrees of accuracy. The current (2001) Topographic Map Series warns that “Satellite (GPS) derived values may be in error by up to 20 metres”, but during the late 1980s and 1990s the satellite signals were deliberately ‘warped’ by the American controllers, to avoid the use of the satellites by enemy forces, and GPS readings during that period were out by as much as two-hundred metres. While there were computer programmes that could correct the warped references very few people went to the trouble to correct them.

It is also worth noting that of the 246 sites referred to by Gunn only one contained a stone artefact and that was an isolated find.

It is true to say that most of the sites recorded in the years between 1974 (when the National Parks & Wildlife Act 1974 was enacted) and the early 1990’s were those “easily found” sites recorded by enthusiasts and NPWS rangers looking for art sites and rock engravings and who had no interest in stone artefacts. Very little attention if at all was made to recording stone artefact scatters unless they occurred in shelters and so this created an imbalance in the representativeness of the different site types in the AHIMS Site Register up to the early 1990s, and this was particularly so in the sites recorded in National Parks and State Forests.

More recently as Local Governments and Town Planners have become more responsible and legislation has been tightened to prevent, avoid or mitigate the impact of development on the archaeological and cultural record, consultant archaeologists have recorded many thousands of stone artefact sites, and proportionally fewer less “obvious” sites, simply because development generally avoids environments in which there are known art sites and rock engravings. As a consequence the early recordings overstated the representativeness of art sites and rock engravings; and the recordings of the 1990s and since have overstated the representativeness of stone artefact sites. The result of all this is that art sites and engravings are over-represented in proportion to stone artefact sites in protected areas, and stone artefact recordings in the 1990s and since were only representative of the frequency and distribution of their site types in areas in which development was approved.

5. MODELS FOR SITE LOCATION

5.1 Site types and their location

In order to design an investigative strategy, it is firstly necessary to develop a predictive model for site location. This is not to determine where the investigation should be conducted, but to establish a theoretical model for the distribution of archaeological material against which the effectiveness and subsequent analysis of the survey results can be tested, compared and reasoned. The basis upon which the predictive model is developed is dependent upon which archaeological material might realistically be expected to not only be present, but also detectable.

The first objective of any archaeological investigation must be to observe and record sufficient of the archaeological record that is present to be able to propose that it is representative of the record as a whole. The investigative strategy is therefore directed and designed to detect that which is representative of the record in the particular project site, and naturally, as different project sites will comprise variations in environment, vegetation, topography, etc., so the investigative strategy must be designed to best suit the circumstances. The objective must be to detect material evidence, and so it is necessary to consider the extent to which artefactual material may be present, and the degree to which it is visible or might be discovered.

There are several factors, which are likely to affect, firstly, where Aboriginal people are most likely to have been, secondly, where they have left evidence of their activities, and thirdly, the degree to which that evidence is observable in the present record.

People visited places mainly to obtain resources, and in general places that were richest in resources were more likely to have been visited by people than those places with fewer resources. Important resources were permanent water, ephemeral water, food resources, stone raw material sources, shelter (from sun, wind, and rain), and perhaps suitable surfaces for rock art, and proximity to mythological natural features. Those resources may have been a factor in the suitability of a location for particular ceremonial activities but cultural boundaries also influenced the choice of ceremonial grounds. Also sites frequently occurred along preferred access routes and particularly where that route coincided with a watercourse. However, the resources of such an environment frequently resulted in the archaeological record becoming discontinuous or significantly disturbed, as stock and vehicles impacted upon it in the post-European contact phase.

Frequency of visits and use of particular locations was also determined by the 'accessibility' or freedom from environmental constraints in the area. For example, whether there were alternative, preferred or easier ways to travel around or over natural barriers, be they geological, geographical, cultural, or imposed by fauna or flora, or whether they were only seasonally accessible, such as mounds on flood terraces, or the availability of water during periods of drought, or whether or not floods, fire or snow hindered access.

Few past Aboriginal activities are represented by surviving material evidence. This in part is because many activities did not leave material evidence (eg. tools were reused), but it is also because very little cultural material survived. An exception to this was shellfish, which was very durable.

The survival of material that is durable was also affected by recent European land use. Cultivation has destroyed many archaeological sites. However, cultivation can also help expose sites that might otherwise be covered. This brings us to the other important point about site distribution, which is that to a great extent site distribution recorded by archaeologists reflects the distribution of places where the ground surface is sufficiently eroded to expose artefactual material.

By far, the majority of recorded sites have been stone artefact scatters or isolated stone artefacts, and in the vast majority of sites they were found in one or more of the following contexts:

i) On or adjacent to deposits containing quartz, quartzite, jasper, silcrete, chert, chalcedony, metamorphosed greywacke, and other indurated or siliceous sedimentary rocks, or redeposited fine-grained volcanics, or

ii) On river banks or adjacent to river banks where the watercourse contains river pebbles of quartz, quartzite, jasper, silcrete, chert, fine-grained volcanics, basalts, etc., and particularly at the junctions of watercourses, or

iii) On ridges and spurs overlooking watercourses or on high vantage points affording uninterrupted views of swamps, water holes, saddles, passes, and any other likely access path into the observer's area, or

iv) In the vicinity of outcrops of suitable raw material such as basalt, silcrete, chert, or other highly silicified sedimentary rock.

Other site types do occur and perhaps because of their lower and less predictable profile, are present in far greater numbers than we are aware of. People die but there are few recorded burials. One reason may be that in many instances the soils are too acid for the preservation of bone, but a far more likely reason is simply that burial frequently entailed subsurface internment, and a surface survey will only discover a burial where there has been erosion of significant disturbance to the surface deposits. As a consequence many burials have only been discovered when exposed by erosion of a sand body or river terrace.

Other site types such as carved trees, scarred trees, stone arrangements, Bora rings, etc., may once have been present, but are unlikely to have survived in easily accessible country from the attention of non-indigenous people. Thus, much of what might have existed is now lost or destroyed, and the archaeological record has become biased by the post-contact utilisation of resources, and by the selective exploitation and preservation of particular environments.

Other factors which affect the degree to which sites are recorded during an investigation include the time of year at which the fieldwork is performed (the seasonality of some vegetation growth) and the conditions under which the survey is performed – (wet, dry, cold, windy, poor light, etc.).

A brief description of site types such as isolated artefacts, open scatters, camp sites, knapping floors, quarries, middens, mounds, hearths, carved trees, scarred trees, stone arrangements, Bora rings, burials, engravings, paintings, grinding grooves, occupation deposits (and PADs), and ceremonial and mythological sites is included as **Appendix iv**.

5.2 A predictive model for the project site

Based on all of the above, the following model for site distribution was proposed for the project site, in which there had been significant disturbance, and in which there are no overhangs, no surviving old growth trees, no exposed sandstone platforms, no permanent water source, and no source of stone suitable for knapping into tools or weapons.

- Isolated artefacts may be present and visible in erosion features.
- Low-density artefact scatters may be present and visible in erosion features, but it is unlikely that any debitage will be visible
- It is unlikely that there are any surviving trees of more than 150 years old on which there will be deliberately scarred surfaces.
- It is unlikely that there are any surviving trees of more than 150 years old on which there will be deliberately carved surfaces
- It is unlikely there will be any engravings, and/or grinding grooves, which if present, would be on the surrounding plateau, but outside the project site.
- It is unlikely there will be any PADs given that there are so few undisturbed areas.
- In the absence of shelters or overhangs there is no potential for shelters to exist and therefore no potential for art sites, and therefore no potential for undisturbed occupation deposits.
- There will be no Aboriginal stone quarries.
- There will be no shell middens
- There will be no visible evidence of burials
- There will be no surviving Bora rings
- There will be no stone arrangements
- There are no known cultural associations with the area.

6. THE SURVEY

6.1 The survey strategy

Having studied the aerial photograph of the project site the archaeologist determined that the objective of the site inspection was to undertake as full and as comprehensive a survey of the undisturbed parts of the project site as possible. There appeared to be easy access to all parts of the area that were to be inspected, and so the only constraints to an effective survey would be any constraint the groundcover would be to archaeological visibility.

Upon arriving at the site Aaron Hudson, CEO, Kimbriki, arranged for Pen Jacobs, Marketing Co-ordinator to induct the investigators in site safety issues. Having been inducted the investigators were about to set off on foot when it was pointed out to them that some of the undeveloped areas within the designated survey area indicated in **Figure 3.1** would not be developed and that the proposed area of development was in the north-eastern section. Peter Stephenson, Kimbriki Operations Manager, suggested that he should drive Madden and Appleton around the waste facility in order to explain the workings and development of the facility and to point out the areas of proposed future development and expansion of the operations.

Following the vehicle tour of the facility and project site, and in view of his previous survey in the area and with the knowledge of where sites had previously been recorded in the surrounding area, Allen Madden stated that he was satisfied that there were no environments within the project site in which Aboriginal sites were likely to occur.

Appleton then walked the perimeter of the existing facility and surrounds on foot, to make a photographic record of the project site, and to inspect the tree-covered slopes surrounding the site to ensure that no overhangs had been overlooked.

6.2 Details of the survey

The field survey took place on 30th September 2009 in dry, sunny conditions, in light ideal for observing any artefactual material present and observable. The preliminary archaeological investigation was performed as a full archaeological field survey of the site of the proposed development with Allen Madden, Sites Officer, Metropolitan LALC.

The inspections were made in dry, sunny conditions, in light ideal for observing any artefactual material present and observable.

6.3 Methodology

The initial inspection was made in a 4WD. Subsequently Appleton undertook a further off-road inspection of the site on foot, to make a photographic record and to ensure there were no overhangs that had not been visible from the vehicle. All of the areas shown shaded in pink in **Figure 6.1** were inspected on foot by Appleton.

6.4 Site recording

All relevant observations as to the topography, vegetation cover, and conditions, were recorded with an Olympus Camedia SP-510UZ Zoom Digital Camera, to record the character of the survey area, and to witness survey conditions.

6.5 Effectiveness of the survey technique

The survey technique to find sites in those locations and environments in which artefacts were most likely to occur was the most appropriate technique in the circumstances. Particular attention was made to the sandy bench in the north-eastern section during the foot-survey. While ground cover was a constraint to complete effectiveness of the survey technique the cleared fire trials provided ideal transects of the area providing excellent archaeological visibility.

6.6 Limitations

As in any archaeological field survey archaeological visibility is the major issue. Most artefacts are less than 40mm maximum dimension and so unless the artefacts occur on exposed ground surfaces they are unlikely to be visible. However, to some extent the location of where sites will occur can be predicted, although isolated artefacts can occur in any environment either having been dropped in transit between sites, or redeposited as a consequence of mechanical disturbance or introduced as landfill.

Figure 6.1 shows the effective survey coverage based on the assumption that most artefactual material if exposed and visible can be observed for up to 5 metres to either side of the path of the observer. Clearly, this would vary significantly between a path walked through dense vegetation, and a path across a clay pan, and is given as a guide only. The **table** following is divided into units delimited by observed topographical features, environments, and/or land use, briefly described in terms of ‘horizontal’ or map area, soil, and archaeological visibility, and the percentage of the area actually surveyed. The photographic record that follows provides a visual reference for the survey conditions and various aspects of past impacts to the project site.

Figure 6.1 - Aerial photograph showing the effective survey coverage
(shaded in pink)

Area	Description	Survey area (very approx. surface areas)	Rock/soil	Vegetation	Average surface visibility	Exposures	Approx area surveyed on foot	Average arch. visibility of exposures	Archaeology
1	Eastern valley slopes	25,000 sqm	Very steep scarp of exposed Hawkesbury Sandstone bedrock (excavated at southern end)	Banksia dominant dry eucalypt scrub	95% on track, 80% on rock, 0% elsewhere	Vehicle tracks	5%	85%	Nil
2	Western valley slopes	37,500 sqm	Steep scarp of exposed Hawkesbury Sandstone bedrock (excavated at northern end)	Banksia dominant dry eucalypt scrub	95% on track, 80% on rock, 0% elsewhere	Vehicle tracks	15%	85%	Nil
3	Southern section	45,000 sqm	Colluvial sand derived from weathered Hawkesbury Sandstone (excavated?)	Mostly cleared and highly disturbed with some regrowth	?	Vehicle tracks, dams and infrastructure	0%	N/A	Nil
4	North-eastern section	120,000 sqm	Colluvial sand derived from weathered Hawkesbury Sandstone	Banksia, wattle and bottle brush scrub	95% in exposures, 5% elsewhere	Fire trails, vehicle tracks and banks of drainage line	35%	95%	Nil

Table showing the Effective Survey Coverage

Plate 6.1 – Entry to the Kimbriki Waste Facility.

Plate 6.2 – Rocky slope typical of the mid-eastern slopes of the project site.

Plate 6.3 – Excavated face typical of the south-eastern section.

Plate 6.4 – Looking southwards over the sedimentation basin at the southern end of the project site.

Plate 6.5 – Looking westwards across the southern section of the project site.

Plate 6.6 – Looking southwards down the western section showing the slope profile.

Plate 6.7 – Mechanically-excavated drainage channel along the western boundary.

Plate 6.8 – Looking eastwards across the mulch storage area in the southern section.

Plate 6.9 – Looking north-eastwards across the mulch storage area towards the main entry road.

Plate 6.10 – Excavated benches in the north-western section.

Plate 6.11 – Looking southwards down the central drainage channel in the north-western section.

Plate 6.12 – "Entry" to the north-eastern bench area to the north of the Administration Centre.

Plate 6.13 – Looking southwards along one of the fire trails in the north-eastern section.

Plate 6.14 – Looking northwards along a drainage line in the north-eastern section.

Plate 6.15 – Looking eastwards at the end of a fire trail, with the sloping sealed surface of Kimbriki Road visible beyond the rocks right of centre.

Plate 6.16 – Sand deposits typical of the bench area in the north-eastern corner.

7. THE RESULTS

No sites of Indigenous origin or places of potential archaeological interest (PADS – Potential Archaeological deposits) were identified during the inspection of the project site.

8. DISCUSSION

The absence of artefactual material in the project site was not surprising given that there had been significant and extensive disturbance to the vast majority of the project site; and the absence of any sites previously recorded in the project site despite there having been archaeological interest in the area since the 1960s (when Fred McCarthy of the Australian Museum began the first of many studies of the area undertaken by both him and subsequently by many other researchers); and the absence of environments in which sites were likely to occur.

That is not to suggest that the project site was never used by Aboriginal people, as it is highly probable that they used the valley now occupied by the waste facility, as a natural corridor when travelling between the higher levels of the plateau to the north, west and east, and Deep Creek to the south.

Another factor in the visibility of sites is the likely site density of stone artefact scatters. As referred to previously in this report the Hawkesbury Sandstone seldom contains stone material such as might be found in conglomerates, suitable for knapping into stone tools or weapons, and so there was unlikely to be a suitable material source within, or in the immediate vicinity of the project site. As a result good stone material was valued and not readily discarded, and so not only would there be no knapping sites but the sites that might exist would be of isolated or very low density artefact scatters, and probably of very small trimming or tool maintenance waste of flakes of less than 10mm maximum length, flakes that would only be opportunistically found and then in only contexts in which there was very good to perfect archaeological visibility.

While the inspection of the project site was of a cursory nature and with the objective of only providing a predictive model of where sites might exist, both Appleton and Allen Madden (Metropolitan LALC) were of the opinion that no sites existed within the project site.

9. SIGNIFICANCE ASSESSMENT

9.1 Introduction

DECCW policy to safeguard all sites, Aboriginal places, and archaeological material of significance wherever possible requires that some means of assessing the significance of the sites is necessary. This is not only for the purpose of determining whether sand extraction can proceed as proposed, but also to provide Cultural Resource Managers with the information for future management of the area.

9.2 Cultural significance

The Aboriginal or cultural significance of Aboriginal relics and sites can only be assessed by the Aboriginal community, and in particular, the Elders. It is the responsibility of the archaeologist to ensure that the Elders or elected representatives of the Aboriginal community are advised of the survey results, and are consulted as to their knowledge and opinion of the significance of the area, and to transcribe and present those expressions in report form.

In this instance Metropolitan LALC has stated that in its opinion no sites occur within the survey area and did not state any they had any reservations on cultural grounds to the development of the site (**Appendix i**).

9.3 Research potential

In the absence of any archaeological material, or environments or contexts in which artefactual material might occur, the research potential of the project site was assessed to be very low.

9.4 Educational potential

In the absence of any archaeological material, or environments or contexts in which artefactual material might occur, the educational potential of the project site was assessed to be very low.

9.5 Aesthetic value

In the absence of any archaeological material, or environments or contexts in which artefactual material might occur, the aesthetic value of the project site was assessed to be very low.

9.6 Rare and/or uniqueness

In the absence of any archaeological material, or environments or contexts in which artefactual material might occur, the project site was assessed as containing neither rare nor unique artefactual material.

PART 2: ENVIRONMENTAL ASSESSMENT

10 THE REQUIREMENTS FOR Part 3A (Major Projects).

In 2005 DECCW published "Interim Community Consultation Requirements for Applicants" intending to lodge an application with an Environmental Assessment for approval of a proposed development as a Part 3A (Major Project). The effect of Part 3A approval is that it negates any other potential constraints there might otherwise have been arising from existing legislation such as the *National Parks and Wildlife Act 1974* (as amended) – which provided protection against the wilful or neglectful damage or destruction of cultural material and archaeological sites. However, to ensure that a culturally or archaeologically significant site is not destroyed unnecessarily consultation with Aboriginal stakeholders is undertaken with all registered Aboriginal stakeholders to allow them the opportunity to identify places of cultural significance so that where possible the proposed development can be planned to avoid the site or mitigate the impact to the site.

The "Interim Community Consultation Requirements for Applicants 2005" requires the proponent (in this case the archaeologist) to "actively seek to identify stakeholder groups or people wishing to be consulted about the project and invite them to register their interest". The search for registered interested Aboriginal stakeholders takes two forms. In the first the proponent (or his representative) should write to the Local Aboriginal Land Council; the Registrar of Aboriginal Owners; Native Title Services; the Local Government Council; and to DECCW requesting that they provide lists of registered Aboriginal stakeholders. In addition an advertisement is to be placed in the local press inviting Aboriginal stakeholders to register their interest.

11 IDENTIFYING REGISTERED ABORIGINAL STAKEHOLDERS.

Previously in February 2010 ASR had sent letters to various prescribed Government agencies requesting that they provide lists of registered stakeholders; but as in the meantime there had been a change to the company compiling the Part 3A application Appleton believed it was the correct procedure to repeat the request and provide the new information and to the government agencies.

On 28th June 2010 ASR sent letters to NTS Corp. Native Title Services; Office of the Registrar, ALRA; Warringah Council; and DECCW requesting they provide lists of registered Aboriginal stakeholders (Appleton had spoken to Allen Madden during the preliminary fieldwork and had been advised by Allen that there were no other Aboriginal groups or people with an interest in the project, and so there was no point in sending a letter to the Land Council requesting a list of other stakeholders) – an example of the letter is included as **Appendix v**.

On 2nd July 2010 ASR placed an advertisement in the Public Notices section of the Manly Daily – a copy of the advertisement is included as **Appendix vi**.

As a result of the letters to the Government agencies the following stakeholders were identified:

STAKEHOLDER	CONTACT	ADDRESS
METROPOLITAN LALC	ALLEN MADDEN	PO BOX 1103, STRAWBERRY HILLS, 2012
ABORIGINAL HERITAGE OFFICE	DAVID WATTS	39/137-145 SAILORS BAY ROAD, NORTHBRIDGE 2063
ABORIGINAL EDUCATION CONSULTATIVE GROUP	CAROLINE GLASS-PATTISON	
ABORIGINAL EDUCATION CONSULTATIVE GROUP	JULIE HENDICOTT	1375A PITTWATER ROAD, NARRABEEN 2101
COMMUNITY MEMBER	SUSAN MOYLAN-COOMBS	14 DEAKIN STREET, FORESTVILLE 2087

No responses to the newspaper advertisement were received.

12. FURTHER CONSULTATION WITH THE ABORIGINAL STAKEHOLDERS

On 10th August ASR sent a letter to each of the registered Aboriginal stakeholders - a copy of the letter is included as **Appendix vii**. The letter included a brief summary of the background of the project, a description of the project site, the results of the investigation for the Preliminary Environmental Assessment, and details of the recommendations. The letter also explained that as the proponent was applying for Part 3A approval that further consultation with registered Aboriginal stakeholders had become necessary. The letter stated further that the stakeholders had an opportunity to visit the site and/or provide any additional cultural information relevant to the site. Finally each stakeholder was requested to respond to the letter.

The only response received was from the Aboriginal Heritage Office which stated that it was not aware of any Aboriginal Heritage issues. A copy of the letter is included as **Appendix viii**.

On 27th October 2010 a draft copy of the archaeological report was sent to each of the registered stakeholders requesting them to review the report and to provide any "additional cultural information ... relevant to the project" – see a copy of the letter included as **Appendix ix**.

No responses were received

13 DISCUSSION

The results of the field investigation were as had been predicted given that there has been significant disturbance to the surrounds to the existing waste facility, and significant disturbance in the north-eastern corner where a grid of fire trails has been cleared. While there are a number of sites that have been recorded within a kilometre radius of the facility they all occur either on the plateau, or in undisturbed contexts, or in National Parks (in which sites are protected), and for the most part are directly associated with exposed sandstone bedrock or with shelters and overhangs. The gully in which the existing facility is located has no exposures of sandstone bedrock, nor does it have any overhangs or shelters, and it has been subjected to significant mechanical alteration.

Thus the absence of sites in the project site may be an artefact of land use in which sites were destroyed prior to 1974 after which the enactment of the *National Parks and Wildlife Act 1974* provided protection for Aboriginal sites; or it may actually represent the absence of sites, a hypothesis that can never be tested.

However ASR is confident that the absence of sites is representative of the current situation and that there are no constraints on archaeological grounds to the proposed development.

As stated previously only Aboriginal people can assess the cultural significance of a place, and in this instance the only recommendations received were from the Metropolitan LALC, which were that it had no objections to the proposed development (see **Appendix i**). No responses had been received from the other stakeholder organisations to which a draft copy of the report had been sent up to the completion of this report on Tuesday 23rd November 2010 (28 days after the draft report had been sent to them for comment).

The lack of response from the stakeholders either to the advertisement in the *Manly Daily* or to the letter sent out to each of them was disappointing but perhaps to be expected. Each of the stakeholders are probably familiar with the site as users of the waste facility and so they would already be aware that there is very little likelihood of any Aboriginal sites occurring in what is a highly disturbed environment. Also, of the registered stakeholders, two are in an Aboriginal Education Consultative Group and so unlikely to have a direct interest in Aboriginal sites. Another stakeholder was with the Aboriginal Heritage Office which would not have a direct interest in sites, and having been informed that the investigation had been undertaken with the Metropolitan LALC (the only stakeholder group that the organisation listed as a stakeholder) its role had been fulfilled. Of the two remaining stakeholders the Metropolitan LALC had participated in the investigation, and as it had already made its recommendations (**see Appendix i**) there was nothing further for it to add. The remaining stakeholder was a community member and individual members seldom become involved in cultural and archaeological issues.

14 CONCLUSIONS

As a result of the archaeological investigation of the project site, and after open consultation with the listed Aboriginal stakeholders for the region, ASR concludes that there are no cultural or scientific constraints to the proposed development.

15 RECOMMENDATIONS

The recommendations are that there are no cultural or scientific constraints to the proposed development. However while there are no archaeological constraints to the development the proponents are advised that the following provisions apply:

DECCW makes the following recommendations in relation to any earthworks operations as additional Statements of Commitment or as conditions of approval as appropriate:

1. If Aboriginal cultural objects are uncovered due to the development activities, all works must halt in the immediate area to prevent any further impacts to the object (s). A suitably qualified archaeologist and Aboriginal community representatives must be contacted to determine the significance of the object(s). The site is to be registered in the AHIMS (managed by DECCW) and the management outcome for the site included in the information provided to the AHIMS. It is recommended that the Aboriginal community representatives are consulted in developing and implementing management strategies for all sites, with all information required for informed consent being given to the representatives for this purpose.

2. If human remains are located during the project, all works must halt in the immediate area to prevent any further impacts to the remains. The NSW Police, the Aboriginal community and DECCW are to be notified. If the remains are found to be of Aboriginal origin and the police consider the site not an investigation site for criminal activities, DECCW should be contacted and notified of the situation and works are not to resume in the designated area until approval in writing is provided by DECCW. In the event that a criminal investigation ensues, works are not to resume in the designated area until approval in writing (*has been received*) from NSW Police and DECCW.

3. All reasonable efforts must be made to avoid impact to Aboriginal cultural heritage values at all stages of the development works. If impacts are unavoidable, mitigation measures are to be negotiated with the Aboriginal community and DECCW.

GENERAL GLOSSARY:

The definitions that follow are for terms used in this and other reports written by the author, and do not necessarily apply to their use in different contexts.

ADZE : A modified flake with at least one steeply-retouched working edge. While all adzes are generally considered to be wood-working tools it is probable that some also served as cores and others as scrapers. Adzes with a uniform butt were frequently hafted to make a chisel-like tool, but the intended use of the adze determined the size of the adze and whether it was hafted (Flenniken and White, 1985).

AHD: Australian Height Datum

ARCHAEOLOGICAL DEPOSIT :
Sediments which contain evidence of past Aboriginal use of the place, such as artefacts, hearths, burials etc.

ARTEFACT :Any object that has attributes as a consequence of human activity (Dunnell, 1971). In this report 'artefacts' has been used generally to describe pieces of stone that have been modified to produce flakes, flaked pieces, cores, hammerstones, or axes.

BACKED BLADE :
A stone tool manufactured from a flake on which one margin has been modified by the removal of small flakes to blunt the edge or margin opposite the cutting edge.

BORA GROUND :
A ceremonial site comprising of one or two connected circles composed of compacted or mounded earth, or defined by an arrangement of stones, of 2 to 30m diameter, generally used in male initiation rites.

CAMPSITE : A place at which the density of artefacts and the variety of material indicates that people ‘frequently’ used the place as a stopping or resting place. Such places are also likely to contain or be close to water resources, food resources, or stone material resources. In this report a campsite is used to describe artefact scatters that are associated with hearths or fireplaces, as distinct from scatters that are not associated with hearths or fireplaces, which are described as Open Scatters.

CHALCEDONY :
A form of silica (partially translucent), which occurs as linings in cavities in rocks. When banded it is known as AGATE (Department of Mines, 1973). Chalcedony is uniformly coloured and agate has curved bands or zones of varying colour (Cook & Kirk, 1991).

CHERT : Another name for sedimentary chalcedony. It occurs most frequently in limestones, or in marine sedimentary rock, or as pebbles in sedimentary rock. In its depositional context it is often concentrated in bedding planes. Chert found in deep-water limestones is formed from radiolaria and diatoms (siliceous planktonic micro-organisms) (Cook & Kirk, 1991).
Chert is a form of amorphous or extremely fine-grained silica, partially hydrous, found in concertions and beds. It is classified as a chemical sedimentary rock although it may be precipitated both organically and inorganically (Department of Mineral Resources, n.d.).

CONGLOMERATE :
Naturally cemented gravel. Conglomerate is a coarse-grained clastic sedimentary rock composed of generally rounded fragments of other rock types larger than 2 mm in diameter, set in a fine-grained matrix of sand, silt, or any of the common natural cementing materials (Department of Mineral Resources, n.d.).

CORE : A piece of stone from which flakes have been removed, that cannot otherwise be described as a retouched or modified artefact.

CORTEX : The naturally altered surface of stone – eg. the water-worn surface of river pebbles.

DEBITAGE : The small waste material observed in knapping floors. Generally, waste material is described as all those fragments having a maximum dimension of less than 10mm

FLAKE : A fragment of stone exhibiting features indicating that it has been deliberately removed from a core piece. These features are evident as:

i) Platform: Plane or point at which a blow was delivered to remove the flake.
ii) Bulb of Percussion: Convex surface that occurs on the face or ventral surface of a flake, radiating from the point of impact, produced as a consequence of the force pattern.
iii) Eraillure: see below.

Other terms:

i) Dorsal: The back or outer face of a flake as it would have been prior to removal from a core. Frequently either ridged or exhibiting negative flake scars when removed in secondary flaking, with a natural weathered cortex when removed in primary flaking.
ii) Ventral: The ‘chest’ or inner face of a flake as it would have been prior to removal from the core. The surface upon which the Bulb of Percussion occurs.
iii) Platform Preparation: The removal of flakes from a surface to produce a level platform. May be evidenced by retouch scars to the platform.
iv) Retouch: The removal of small flakes from an edge or margin of an artefact to modify its shape or resharpen its edge.
v) Proximal: The end of a flake closest to the striking platform.
vi) Distal: The end of a flake furthest from the striking platform.
vii) Margin: The edge of an artefact.
viii) Eraillure: A small circular to elliptical negative flake scar occurring on the surface of the bulb of percussion on flakes of very fine-grained or highly silicified material. It occurs ‘naturally’ as a consequence of internal forces generated at the time of flake removal.
ix) Split Cone: Occurs when the flake splits down its axis frequently removing part of the striking platform. Generally believed to be produced by faulty knapping technique, but is also probably a consequence of flawed material.
x) Transverse Snap: Occurs when a flake snaps across its axis. Generally believed to be caused by post-depositional impacts such as human or stock treadage, or vehicular traffic.

FLAKED PIECE :
A fragment of stone exhibiting flake scars indicating that it is an artefact, but not displaying diagnostic features, such as a Bulb of Percussion, Striking Platform, or an Eraillure.

GREYWACKE :

A type of sandstone, grey or greenish-grey in colour, tough and well indurated and typically poorly sorted (Clark & Cook, 1986).

A generally poorly sorted, dark sandstone containing feldspar and sand-sized rock fragments of metamorphic or volcanic rocks (Department of Mineral Resources, n.d.).

Usually a dark and coarse-grained rock compared to mudstones and siltstones that are much finer-grained and better sorted.

HOLOCENE PERIOD :

The period from 10,000 years ago to the present.

IGNEOUS ROCK :

Rock formed by the cooling and solidification of magma on or below the earth's surface (Geography Dictionary, 1985).

In situ : In its original place – as deposited.

ISOLATED ARTEFACT :

A solitary stone artefact, at least 50m from its nearest neighbour. This is based on NPWS policy that two artefacts within 50m of each other constitute a site.

KNAPPING FLOOR:

A discrete scatter of artefacts in which at least two artefacts are recognisably of the same material, and derive from the same piece of stone. Also described as a stone tool manufacturing site or floor.

LOCATION : The place at which an artefact is found, or a place identified as having either archaeological or Aboriginal significance.

MEASUREMENT :

I) Flake:
- i) Length: Measured along the percussion axis at right angles to the platform.
- ii) Width: The greatest width measured at right angles to the percussion axis.
- iii) Thickness: The greatest thickness measured at right angles to the percussion axis.

II) Flaked piece:
- i) Length: The longest dimension
- ii) Width: The greatest width measured perpendicular to the length.
- iii) Thickness: The greatest thickness measured perpendicular to the length.

III) Core:
- i) Length: The longest dimension.
- ii) Width: The greatest width measured perpendicular to the length.
- iii) Thickness: The greatest thickness measured perpendicular to the length.

MIDDEN : A refuse heap or stratum of food remains, such as mollusc shells, and other occupational debris (Dortch, 1984 – see also Meehan, 1982).

MUDSTONE : A fine-grained detrital rock, usually quite massive and well consolidated. May be black through grey to off-white, browns, reds and dark blues/greens. Frequently found in association with sandstones (Cook & Kirk, 1991).

Identification is often aided by colour variations in layering. A source for stone material tool manufacturing material found as river pebbles in creek beds, and artefacts often display a water-worn cortex.

NEGATIVE FLAKE SCAR :
A concave surface resulting from the removal of a flake, occurring on the surface of the rock from which a flake has been removed.

PLEISTOCENE PERIOD :
The period from about 10,000 years ago to 2 million years ago.

POTENTIAL ARCHAEOLOGICAL DEPOSIT (PAD) :
Synonymous with Potentially Archaeologically Sensitive : Having the potential to contain archaeological material although none is visible.

QUARTZITE :
Quartzites are formed by the regional or contact metamorphism of quartz arenites, siltstones, and flints (cherts). They are composed essentially of quartz, and usually have a fine-grained granoblastic (grains are roughly the same size) texture. Generally massive, but may sometimes show sedimentary structures (Cook & Kirk, 1991).

ROTATION :
The removal of flakes from a core by blows directed at different angles, to different platforms. May be evident on the dorsal surface of a flake as negative flake scars, which do not follow the same direction as the percussion axis of the flake. This may be confused with scars produced during core preparation.

SCAT : The solid waste material produced by an animal – dung, droppings, manure (Triggs, 1985).

SCATTER : Two or more artefacts occurring within 50 metres. Scatter may also be used in the context of ‘background scatter’, meaning the general distribution of artefacts across the landscape that cannot be recognised as discrete concentrations.

SILCRETE : A near surface or surface siliceous induration (Desen & Peterson, 1992).
A conglomerate consisting of surficial sand and gravel cemented into a hard mass by silica. A siliceous duricrust (Bates & Jackson, 1980).
Crusts may form as a result of low, infrequent rainfall, on reasonably flat surfaces. These are known as duricrusts – those cemented by silica are known as silcretes (Clark & Cook, 1986), sometimes referred to locally as ‘billy’ (Gentilli, 1968), or ‘grey billy’.
Silcrete on the northern tablelands of NSW forms at the surface contact between sediments of the Sandon Beds and the Armidale Beds with overlying basalt, where groundwater (more rich in silica than surficial water) interacts with surficial water and precipitates new quartz as the matrix to the sediments (N.D.J. Cook, Dept. of Geophysics, UNE, pers. Comm.).
In softer formations of quartz sands, groundwater has apparently been responsible for the formation of concretionary layers of silcrete. Under altered climatic conditions, the less competent beds erode away leaving concretions. Since they are often the size of old-fashioned woolsacks and are greyish and white, they are popularly known as gray billy (slang for billy goat) (Fairbridge, 1968).

SITE : A discrete area or concentration of artefactual material, place of past Aboriginal activity, or place of significance to Aboriginal people.

SOIL SCIENCE TERMS (taken from Banks, 1995, and others as referenced).

BEDROCK : Outcrop of *in situ* rock material below the soil profile.

BENCH : A strip of relatively level earth or rock breaking the continuity of a slope.

BLOWOUT : A closed depression formed in the land surface by wind eroding sands and depositing them on adjacent land.

CHERT: A very fine-grained amorphous silicate sedimentary rock, commonly a layer of chemical precipitate or micro-organism skeletal remains (Milford 1999).

CLAY: Soil material composed of very fine particles less than 0.002 mm size. When used to describe a soil texture group, such a material contains more than 35% clay (Milford 1999).

CLAYPAN : A depression caused by the aeolian deflation of sediments, or by the presence of a prior lake.

CONGLOMERATE: A poorly-sorted detrital sedimentary rock composed of rounded gravels, stones or cobbles in a matrix of much finer material (Milford 1999).

DUNE : A ridge built up by wind action composed of sands, silts, or sand-sized aggregates of clay.

FLOODPLAIN : A large flat area, adjacent to a watercourse, characterised by frequent active erosion and aggradation by channelled and overbank stream flow.

GIBBER : A level surface covered by a thick deposit of gravel or broken siliceous pebbles, occurring in the more arid parts of the continent, thought to have been formed from the break-up of a siliceous (silcrete) surface crust, and termed gibber plains (Whittow, 1984) – see also silcrete.

GILGAI : Surface microrelief associated with soils containing shrink-swell clays. Gilgai consists of mounds and depressions, or irregularly distributed small mounds and subcircular depressions varying in size and spacing. Vertical interval usually <0.3m; horizontal interval usually 3-10m, and surface almost level.
Sometimes called ‘crab-hole’ soils.

GREYWACKE: A tough, well-indurated type of sandstone distinguished by detrital quartz crystals and rock fragments set in a finer-grained matrix (Milford 1999).

GULLY : An open incised channel in the landscape generally greater than 30cm deep and characterised by moderately to very gently inclined floors and steep walls (Milford 1999).

HUMMOCK : A small raised feature above the general ground surface.

LANDFORM ELEMENTS :

Crest : Landform element standing above all points in the adjacent terrain.
Flat : Neither a crest or a depression <3% slope.
Upper slope : Adjacent to and below a crest or flat but not a depression.
Midslope : Not adjacent to a crest, a flat or a depression.
Lower slope : Adjacent to and above a flat or a depression but not a crest.

LITHOSOLS : Shallow soils showing minimal profile development and dominated by the presence of weathering rock and rock fragments.

METAMORPHIC: Rocks whose composition, texture and/or structure have been altered through tectonic pressure and/or heat (Milford 1999).

METASEDIMENTARY: Partially-metamorphosed sedimentary rock (Milford 1999).

MUDSTONE: A fine-grained dark-coloured sedimentary rock, formed from lithified mud; similar to shale but more massive (Milford 1999).

pH A measure of the acidity or alkalinity of a soil. A pH of 7.0 denotes neutrality, higher values indicate alkalinity, and lower values indicate acidity. The pH scale is logarithmic, i.e., a pH of 4.0 is ten times as acid as a pH of 5.0, and one hundred times as acid as a pH of 6.0. (DLWC 1999).

RILL : A small channel cut by concentrated runoff through which water flows during and immediately after rain.
A small ephemeral channel, generally no more than 30 cm deep, created by concentrated runoff (Milford 1999).

RUNOFF : That portion of precipitation not immediately absorbed into or detained upon the soil and which thus becomes surface flow.

SCARP/CLIFF : A steep slope terminating a plateau or any level upland surface.

SCRUB : vegetation structure consisting of shrubs 2-8m tall.

SHEET EROSION : The removal of the upper layers of soil by raindrop splash and/or runoff.

SOIL PROFILE :

"A HORIZON": The top layer of mineral soil. This may consist of two parts:
A_1 HORIZON: Surface soil and generally referred to as the topsoil.
A_2 HORIZON: similar in texture, but paler in colour, poorer in structure, and less fertile.

" B HORIZON": The layer below the A Horizon. This consists of 2 parts:
B_1 HORIZON: A transitional horizon dominated by properties characteristic of the underlying B_2 horizon.
B_2 HORIZON: typically contains concentrations of silicate clay and/or iron, and/or aluminium and/or translocated organic material.

"C HORIZON": The parent rock. Recognised by its lack of pedological development, and by the presence of remnants of geologic organization.

"R HORIZON": Hard rock that is continuous (Charman & Murphy, 1993; 350-1).

SPUR : A ridge which projects downwards from the crest of a mountain as a water-parting (Whittow, 1984).

SUBSOIL : Sub-surface material comprising the B and C Horizons of soil with distinct profiles; often having brighter colours and higher clay contrasts.

SURFACE CONDITION :
Gravelly : Over 60% of the surface consists of gravel (2-69mm).
Hardsetting : Soil is compact and hard.
Loose : Soil that is not cohesive.
Friable : Easily crumbled or cultivated.
Self-mulching : A loose surface mulch of very small peds forms when the soil dries out.

SWALE : A linear level-floored open depression excavated by wind or formed by the build-up of two adjacent ridges.

SWAMP : Watertable at or above the ground surface for most of the year.

TOPSOIL: The surficial layers of the soil profile, typically the A Horizon, which is usually darker, more fertile, better structured and contains more organic matter than underlying soil materials (Milford 1999).

TERRACE : A flat or gently inclined surface bounded by a steeper ascending slope on its inner margin and a steeper descending slope on its outer margin (Whittow, 1984).

TOPSOIL : A part of the soil profile, typically the A_1 horizon, containing material that is usually darker, more fertile and better structured than the underlying layers.

UNDERSTOREY : A layer of vegetation below the main canopy layer.

WEATHERING: The physical and chemical disintegration, alteration and decomposition of rocks and minerals at or near the earth's surface by atmospheric and biologic agents (Milford 1999).

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APPENDICES

Appendix i – Correspondence from Metropolitan LALC

Appendix ii – Results of the search of the AHIMS Site Register

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Appendix i – Correspondence from Metropolitan LALC

Friday, 20th November 2009

METROPOLITAN LOCAL ABORIGINAL LAND COUNCIL
36-38 George Street, Redfern NSW 2016
P.O. Box 1103 Strawberry Hills, NSW 2012
Telephone: (02) 8394 9666 Fax: (02) 8394 9733
Email: metrolalc@metrolalc.org.au

John Appleton
Archaeological Surveys & Reports Pty Ltd
16 Curtis Street
ANNANDALE NSW 2350

Re: Aboriginal Site Assessment for Kimbriki Waste Centre, Mona Vale Road Terrey Hills NSW 2084

Dear John

An Aboriginal site assessment was undertaken for the purpose of identifying any Aboriginal heritage constraints to the proposed expansion of the existing Kimbirki Waste Centre for the proposed Kimbirki Resource Recovery Project.

The survey was undertaken by Allen Madden Cultural Education Officer for the Metropolitan Local Aboriginal Land Council (MLALC) and John Appleton of Archaeological Survey & Reports Pty Ltd.

Prior to any work commenced a registered search was undertaken with the Aboriginal Heritage Information Management System, subject to this there where no recorded sites.

The Aboriginal site assessment was conducted on foot and vehicle due to the large scale of the site. All undisturbed ground inside the site boundary was carefully examined for any Aboriginal cultural materials or relics.

There where no Aboriginal cultural materials or relics found within the surveyed area.

MLACL have no objections or concerns with the proposed development, if there are any Aboriginal sites, cultural material or relics unearthed during any stages of the development then all work is to cease and the MLALC and National Parks and Wildlife are to be contacted immediately.

If you require any further information please do not hesitate to contact me on 02 8394 9666 or 0411 229 217.

Regards

Allen Madden
Cultural Education Officer

Appendix ii – Results of the search of the AHIMS Site Register

Department of
Environment
and Climate Change (NSW)

AHIMS
Aboriginal Heritage Information Management System

Your reference : Hornsby
Our reference : AHIMS #27263

Archaeological Surveys and Reports
16 Curtis Street
Armidale NSW 2350

Monday, 14 September 2009

Attention: John Appleton

Dear Sir or Madam:

Re: AHIMS Search for the following area at Hornsby;Z:56;E:334000-338000;N:6269000-6273000

I am writing in response to your recent inquiry in respect to Aboriginal objects and Aboriginal places registered with the NSW Department of Environment and Climate Change (DECC) at the above location.

A search of the DECC Aboriginal Heritage Information Management System (AHIMS) has shown that *20* Aboriginal objects and Aboriginal places are recorded in or near the above location. Please refer to the attached report for details.

The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not to be made available to the public.

The following qualifications apply to an AHIMS search:

- AHIMS only includes information on Aboriginal objects and Aboriginal places that have been provided to DECC;
- Large areas of New South Wales have not been the subject of systematic survey or recording of Aboriginal history. These areas may contain Aboriginal objects and other heritage values which are not recorded on AHIMS;
- Recordings are provided from a variety of sources and may be variable in their accuracy. When an AHIMS search identifies Aboriginal objects in or near the area it is recommended that the exact location of the Aboriginal object be determined by re-location on the ground; and
- The criteria used to search AHIMS are derived from the information provided by the client and DECC assumes that this information is accurate.

All Aboriginal places and Aboriginal objects are protected under the *National Parks and Wildlife Act 1974* (NPW Act) and it is an offence to destroy, damage or deface them without the prior consent of the DECC Director-General. An Aboriginal object is considered to be known if:

- It is registered on AHIMS;
- It is known to the Aboriginal community; or

PO Box 1967 Hurstville NSW 2220
43 Bridge Street Hurstville NSW 2220
Telephone (02) 9585 6345
Facsimile (02) 9585 6094
ABN 30 841 387 271
ahims@environment.nsw.gov.au
www.environment.nsw.gov.au

- It is located during an investigation of the area conducted for a development application.

If you considering undertaking a development activity in the area subject to the AHIMS search, DECC would recommend that an Aboriginal Heritage Assessment be undertaken. You should consult with the relevant consent authority to determine the necessary assessment to accompany your development application.

Yours Sincerely

Freeburn, Shannon
Administrator
Information Systems & Assessment Section
Culture & Heritage Division
Phone: 02 9585 6471
Fax: 02 9585 6094

Appendix iii – The Hunt report (26/3/2009)

Phil Hunt <phil108@bigpond.net.au>
26/03/2009 04:58 PM

To Lauren_Branson@URSCorp.com
cc amadden@metrolalc.com.au
bcc
Subject Kimbriki

Lauren,,

On 17th March 2009 the proposed drainage line along the 140m contour line at Kimbriki was inspected by Phil Hunt, Archaeologist with the Aboriginal Heritage Office. Allen Madden, Metropolitan Local Aboriginal Land Council, rang in the morning to say he was no longer available to do the inspection but would like to be advised of the outcomes of the survey.

The route and suitable locations were examined above and below the proposed drain alignment. Despite thick bush, the inspection showed that the steep nature of the land to be generally unsuitable for Aboriginal sites, excepting shelter sites associated with overhangs. No suitable overhangs or rock outcrops lie along the 140m contour. Overhangs below this were inspected and found to have little potential for art or archaeological deposit. One area was identified as having potential for overhangs with deposit, but these are well above the 140m line (refer attached map).

Therefore the AHO considers there to be no Aboriginal sites issues for the proposed drain alignment, provided that the rock outcrops in the vicinity as marked on the map are not affected and no other overhangs over 1m in height or flat rock exposures over 1 square metre are impacted by the drain.

On another note, a Powerful Owl was seen flying from a steep cliff area. No scats or other signs were seen in the vicinity but a thorough search was not made (see square on map).

Your sincerely

Phil Hunt

--
Phil Hunt
c/- Aboriginal Heritage Office
PO Box 12 North Sydney NSW 2059
9949 9882

DA-Kimbriki-drain alignment-March2009.pdf

Appendix iv - Site Types

Site types associated with Indigenous activities and culture

The definitions that follow are for terms used in this report, and do not necessarily apply to their use in different contexts.

Art sites are defined as places where any medium has been applied to a rock surface either as symbols, characters, drawings, paintings, or any other rendition, recognisable as not being a natural discolouration or feature. They also include markings to a rock surface, either by engraving, abrading, or pecking, and which cannot be identified as being a natural feature.

Bora rings are circles of 2-30 metres diameter of compressed earth (from repeated treading or dancing), or stone arrangements, at which men performed initiation ceremonies, and are the most frequently recorded ceremonial sites. Sometimes they occur as two rings joined by a central track in a barbel configuration. They usually occur on level or low-lying country, which is usually the first topographical unit to be cultivated, or utilised for highways and roads, but they may also occur as circular stone arrangements on elevated rock platforms and hilltops. If they are or were present then they are usually either already known and have been recorded, or they have long since been destroyed.

Carved trees are readily recognised by even the untrained observer. The carving is incised either into the outer bark, or more commonly, into the living wood after removal of a section of the bark. The designs frequently consist of ‘diamond cross-cuts’, but may also consist of stylised animal motifs. Previously unrecorded carved trees are still discovered in relatively remote or inaccessible areas. Carved trees frequently occur near burial sites and/or Bora rings, but in some regions they may have been tribal boundary markers.

Fish traps may occur either in rivers or on seashores. They are recognisable as unnaturally formed stone arrangements that were constructed to trap fish (or eels or turtles) carried into the enclosure in deep water, and which are left stranded within the enclosure as the water level drops. The fish were then caught by nets, hand, or by spear.

Grinding grooves are usually observed on the surfaces of large sedimentary boulders or exposed shelves and outcrops of sedimentary rock along creek banks and beds, or near water. They have been produced by Aborigines using the rock surface to shape and sharpen the edges of stone to produce ground-edged axes, or to sharpen wooden spears (the latter tend to be narrow and deep). Water was used to lubricate the surface of the rock. The grooves frequently occur as linear abraded depressions in the rock, and may each be between 10 and 50 centimetres long, up to 15 centimetres wide, and 2 to 5 centimetres deep. Some sedimentary rock surfaces may exhibit shallow ground depressions of roughly round or elliptical shape, and these are more likely to be associated with seed grinding, root crushing, or other food preparation.

Middens may be identified variously as beach, lagoon, lacustrine, or estuarine, and are most likely to be observed at or above the water line where erosion, topsoil removal, or mining has exposed the shell. The size of the midden can vary enormously, with the smallest comprising a ‘one off’, “dinner-time camp” (Meehan. 1982), with as few as two or three shells, or a shallow lens of only a few centimetres. The largest middens may extend for many kilometres and may comprise of a number of lenses and layers of shell and ash up to several metres deep. These large middens may be evidence of continuous exploitation of the resource over many thousands of years. Middens of fresh water mussel shell may be found in eroding creek banks or in eroding terraces, particularly near both existing and defunct water holes.

Isolated shell or fragments may occur on any surface and in any situation. A single shell may have been discarded by a bird, but the presence of use-wear would indicate Aboriginal use of the shell as a tool, which was discarded after use. Such occurrence is likely to be where there is no immediate source of stone material suitable for tool manufacture.

Natural Mythological sites are places of significance to Aborigines, either because they are described in mythological stories or songlines, or because they were used in religious ceremonies. They may occur anywhere and while some are more predictable than others – as for example, permanent water holes, waterfalls, rock promontories, etc., others may have no particularly remarkable features. Seldom is there any recognisable artefactual evidence or anything to distinguish it from similar features in the vicinity. These sites must of necessity be identified by Aboriginal people with an association with the place.

Open sites, campsites, knapping floors, scatters, and isolated artefacts, are most likely to occur on eroded and exposed creek banks, particularly where slope wash or stock trails has removed the humic layer, or on eroded ridges and spurs, particularly near the junctions in watercourses.
Open sites are most likely to be present in greatest numbers near a source of either raw stone material, or potential food resources, or in a natural corridor between two differentially preferred environmental zones, or at the contact between two environmental zones containing different resources.
Artefacts in open scatters are likely to be manufactured from the dominant raw material available; i.e. Greywacke on greywacke-sourced soils, quartz on granite-sourced soils, silcrete and chert on relict sedimentary soils.
Artefact assemblages in open scatters are likely to consist predominantly of discard material, i.e., cores, flakes, flaked pieces, and debitage.
Artefacts exhibiting retouch scars and backing are most likely to occur in sites where secondary activity took place peripheral to the central camp site, although this is a generality and can only be observed where there is sufficient surface visibility to identify peripheral sites.
Fragments of flakes with retouch or backing may occur on knapping floors indicating breakage occurring during manufacture, or maintenance areas in which damaged tools have been replaced and discarded.

Isolated artefacts are likely to be most frequently observed where the groundcover obscures all but the larger artefacts, such as cores, and large flakes, or where there is little contrast between the texture of artefactual material and the surface upon which it lies. Artefacts of materials contrasting with the matrix may be visible regardless of size; eg. quartz artefacts may be far more visible than much larger basalt artefacts against a background of dark humic terrace soils.

PADs or Potential Archaeological Deposits are deposits, usually in shelters (but they may also be identified where there are intact deposits in open areas), which although not containing any visible archaeological material, are considered likely to contain archaeological material below the surface. These ‘sites’ are not recorded as sites on the Aboriginal Site Register, but are identified as places that require subsurface testing to establish whether a site exists or not.

Rock shelters with art or occupation deposits, are most likely to occur where the character of the parent rock is sufficiently massive or consolidated for it to retain a structure that weathers differentially to form shelters and overhangs.

Scarred trees are perhaps the most difficult site type to determine as having been caused by deliberate removal of the bark by humans and not as a consequence of natural events; such as abrasion from falling trees or branches, natural branch attrition, fire damage, or contact from vehicles or stock. They may occur in places wherever there are tree species that produce bark suitable for tool and implement manufacture. While some scars are clearly the consequence of deliberate bark removal by Aborigines (either evidenced by stone axe marks, or identified by Knowledge Holders), some scars were made by settlers, and stockmen, and surveyors who frequently blazed trails and property boundaries by scarring the trees, and by timber men who removed a strip of bark to test the suitability of a tree for logging.

Other site types such as hearths, burials, etc., are less easily predicted, although burials are frequently associated with carved trees, and Bora rings, and hearths with campsites, shelters, and shell middens.

Appendix v – Correspondence to government agencies requesting lists of registered Aboriginal stakeholders.

Archaeological
Surveys
&
Reports
Pty Ltd

ABN 67 075 625 722

John Appleton
A.C.I.S., A.C.I.M., B.A. (Hons)

16 Curtis Street, Armidale, NSW 2350
Tel. 02 6772 6512 Fax 02 6772 4567 Mob. 0428 651 789
Email japples@northnet.com.au

Office of the Registrar, ALRA
Tranby Aboriginal College
11-13 Mansfield Street
Glebe 2037

28th June 2010

Re: Aboriginal stakeholder consultation for Part 3A project
Lots 100 & 101, DP 1043940, Terrey Hills.

This is to advise that Archaeological Surveys & Reports Pty Ltd has been engaged by **GHD P/L** on behalf of Kimbriki Environmental Enterprises Pty Ltd to consult with registered Aboriginal stakeholders in compliance with *Part 3A of the Environmental Planning & Assessment Act 1979*.

The Project Site occurs on Lots 100 & 101, DP 1043940, Terrey Hills, Parish of Narrabeen.

Previously searches were made in February 2010 to identify the Aboriginal stakeholders, but the information provided for the search in relation to the proponent's representative has changed, and to ensure that the correct information is on record, it is necessary to repeat the search. Would you please provide me with a list of registered Aboriginal stakeholders with an interest in the area.

Regards.

1

Appendix vi – Advertisement inviting Aboriginal stakeholders to register their interest.

PUBLIC NOTICE

ARCHAEOLOGICAL INVESTIGATION

This is to advise all registered Aboriginal stakeholders with an interest in the Kimbriki Waste Facility at Lots 100 & 101 DP 1043940, Terrey Hills, to register their interest in the project. The site was previously investigated for a Preliminary Assessment with the Sites Officer, Metropolitan LALC in September 2009. No sites were recorded.

The proponents, Kimbriki Environmental Enterprises Pty Ltd, now wish to proceed with an application for Part 3A "Major Projects" approval for the project. The proposal is to expand the existing resource recovery operations within the areas adjacent to the existing operations in land owned by the proponent. The largest portion of the area proposed for the expansion occurs in highly disturbed contexts, while the balance occurs in scrub that has been subjected to fire hazard reduction and the blazing of fire access tracks.

In accordance with the draft "Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation, July 2005", further consultation is required with all registered Aboriginal stakeholders. While it will not be necessary to resurvey the project site you have the opportunity to provide any cultural information pertaining to the site and to participate in the consultation process.

Please register your interest within 14 days with:

John Appleton, Archaeological Surveys & Reports Pty Ltd, Tel. 02 6772 6512; Fax. 02 6772 4567; Mob. 0428 651 789: email: japples@northnet.com.au

Appendix vii – Letter to registered Aboriginal stakeholders.

**Archaeological
Surveys
&
Reports
Pty Ltd**

John Appleton
A.C.I.S., A.C.I.M., B.A. (Hons)

16 Curtis Street, Armidale, NSW 2350
Tel. 02 6772 6512 Fax 02 6772 4567 Mob. 0428 651 789
Email japples@northnet.com.au

ABN 67 075 625 722

The Chairperson/CEO/Aboriginal stakeholder 10TH August 2010

Dear Sir/Madam

Re: Archaeological investigation: Kimbriki Resource Recovery Project, Kimbriki Road, Terrey Hills Information and Management Plan for an Environmental Assessment (Part 3A "Major Project").

This is to advise that Archaeological Surveys & Reports Pty Ltd (ASR) has been engaged by GHD Pty Ltd, to fulfil the requirements for an Environmental Assessment (Part 3A "Major Project"), for the archaeological investigation of the Project Site.

The proponent, Kimbriki Environmental Enterprises Pty Ltd (Kimbriki), proposes to expand the range of waste/resource management facilities on site to better manage the waste generated within the SHOROC Local Government Areas to maximise the recovery of recyclables and other re-usable resources and minimise the quantity of residual wastes destined for landfill.

Background

In September 2009 Kimbriki, contracted R.W. Corkery & Co. Pty Limited (RWC) to prepare a preliminary assessment of the Project Site, and RWC engaged ASR to undertake an archaeological investigation of the Project Site.

The Project Site comprises partly of steep scarps surrounding the existing facility, partly of the highly disturbed areas peripheral to the existing facilities, and partly of a highly disturbed but as yet undeveloped area of bushland immediately to the northeast of the existing facility, on land owned by Kimbriki. Attached are two plans, the first is detail from a Topographic map showing the location of the Kimbriki Waste Facility, and the second is an aerial photograph showing the boundaries of the Project Site and the extent to which it has been disturbed – not that the densely wooded areas occur on extremely steep slopes as can be seen from the contours on the Topographic map.

Subsequently John Appleton ASR), accompanied by Mr Allen Madden, Sites Officer – Metropolitan Local Aboriginal Land Council, undertook an investigation of the Project Site on 30th September 2009. No sites were observed.

Following the field investigation a report was produced of the results, which contained the following recommendations:

While no sites were recorded, and the investigators have assessed the study area as being unlikely to contain cultural or archaeological material, the proponents are advised that they remain subject to the following provisions of the National Parks and Wildlife Act 1974 (as amended).

> The owners, and their employees, earthmoving contractors, subcontractors, machine operators and their representatives, whether working in the survey area or elsewhere, should be instructed that in the event of any bone being unearthed during earthmoving, work should cease immediately in the area of the find.
>
> In the event that any bone cannot be clearly identified by a qualified archaeologist as being of animal remains the police are to be informed of its discovery, and officials and/or their representatives of the Metropolitan LALC, and the Archaeologist, DECCW (Metropolitan) advised that the bone is subject to police investigation.
>
> Work should not recommence in the area of the find, until both the police and those officials or representatives have given their permission to do so. Those failing to

report a discovery and those responsible for the damage or destruction occasioned by unauthorised removal or alteration to a site or to archaeological material may be prosecuted under the National Parks and Wildlife Act 1974, as amended.

That recommendation remains in force.

Since the report was produced the proponents have decided to proceed with lodging an application for approval for the proposed development as a **Part 3A "Major Project"**. This letter is by way of compliance to fulfil the requirements of the guidelines for Aboriginal consultation for Part 3A projects.

Further Aboriginal consultation

In accordance with "Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation" DECC 2005 (which relate to Part 3A "Major Projects"), an advertisement was placed in the *Manly Daily* on 2nd July 2010 inviting interested Aboriginal stakeholders to register their interest in the project. No responses to the advertisement were received.

In addition letters were sent to DECCW, NTSCORP, the Office of the Registrar ALRA, Warringah Council, and Native Title Services requesting that they provide a list of registered Aboriginal stakeholders. As a consequence five registered Aboriginal stakeholders were identified. Your organisation was one of those identified.

Opportunity to visit and/or advise.

In accordance with the guidelines for Aboriginal community consultation this letter is to provide you with the opportunity to visit the site, and/or to provide any cultural information relevant to the Project Site, so that it can be incorporated into the Final report of the archaeological assessment.

It should be stressed that the property is privately owned and that there is heavy vehicular traffic within the site, and that no attempt should be made to visit the site without firstly contacting the author to arrange a date and time for the site visit suitable to both parties. As Appleton lives in Armidale, a round trip of 12 hours, it would be preferable that if there is more than one stakeholder wishing to visit the site that the date and time for the visit is one mutually agreeable to all parties. It should be added that all visitors to the site must undergo site induction to both comply with the operator's OH&S requirements and to ensure the safety of the visitors.

Follow-up

Would you please respond to this letter at your earliest convenience as the author has commitments overseas in September and would like to be in a position to advise the proponents that the registered stakeholders have confirmed their agreement to the findings that there are no constraints on cultural grounds to the proposed development; or alternatively, that cultural issues have been raised that will require further consultation.

Your early response would be appreciated. If you have any questions please feel at ease to contact me either by telephone, fax or email.

Regards.

Appendix viii – Aboriginal Heritage Office.

Aboriginal Heritage Office
Ku-ring-gai, Lane Cove, Manly, North Sydney, Pittwater, Warringah, Willoughby and City of Ryde Councils

PO Box 12 North Sydney NSW 2059
DX 10587
Ph: (02) 9949 9882, **Fx**: (02) 9958 2799
Email: aho@northsydney.nsw.gov.au
www.aboriginalheritage.org

Friday, 12 November 2010

John Appleton
Archaeological Surveys and Reports
16 Curtis St
Armidale NSW 2350

Re: Archaeological Investigation: Kimbriki Resource Recovery Project
Draft Report October 2010

Thank you for forwarding a copy of the above report in relation to a Part 3A Major Project.

The Aboriginal Heritage Office is a part of a partnership of eight local Councils in northern Sydney. The AHO is an advisory arm of the Councils and is not a community group. As such, the AHO is not an Aboriginal community group and is not in a position to speak on culture. However, the AHO is happy to provide information on any Aboriginal heritage issue that it is aware of that may have been overlooked.

In relation to the above project, the AHO is not aware of any Aboriginal heritage issues. However, as previously noted (email to Kimbriki 26/3/09), there are landscape features above the proposed development area that have potential for unrecorded sites and if any works are proposed for these areas, the AHO would recommend full assessment.

If you have any queries, please contact me on (02) 9949 9882.

Yours sincerely,

David Watts
Aboriginal Heritage Manager

Appendix ix – Letter attached to draft report

Archaeological Surveys & Reports Pty Ltd

John Appleton
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The Chairperson/CEO/Aboriginal stakeholder

26th October 2010

Dear Sir/Madam

Re: Archaeological investigation: Kimbriki Resource Recovery Project, Kimbriki Road, Terrey Hills Environmental Assessment (Part 3A "Major Project"). Draft report

Please find enclosed a copy of the Draft Report of the archaeological investigation for the Kimbriki Resource Recovery Project, Kimbriki Road, Terrey Hills: Environmental Assessment (Part 3A "Major Project"). As required by the "Draft Code of Practice for Archaeological Investigation in NSW, 2010", and AACA Inc. best practice a copy of the draft report is to be forwarded to all registered Aboriginal stakeholders with an interest in the area, regardless of whether or not they took part in the investigation.

Would you please read the draft report and provide me with any additional cultural information that you think is relevant to the project. If you have no comment to make would you please respond in writing stating that you have read the report and that you have nothing further to add. This is an opportunity for you to contribute to the cultural content of the report and to express any reservations you have to the proposed development on cultural grounds.

Regards

Appendix M
Hazard Analysis Report

CLIENTS | PEOPLE | PERFORMANCE

Kimbriki Environmental Enterprises

Kimbriki Resource Recovery Project

Hazard Analysis

October 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Purpose of this report

Kimbriki Environmental Enterprises Pty Ltd is proposing to construct and operate two purpose-built advanced waste sorting and treatment facilities at the existing Kimbriki Resource Recovery Centre site in Terrey Hills.

This report has been prepared by GHD Pty Ltd (GHD) as part of the environmental assessment of the project. Kimbriki Environmental Enterprises is the proponent of the project, and the environmental assessment is being prepared by GHD in accordance with the requirements of Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

This report provides a preliminary risk screening and hazard identification for the project.

1.2 Project outline

The project involves the construction and operation of two main facilities:

- A materials recovery facility; and
- A resource recovery facility.

The materials recovery facility would receive and process sort up to 60,000 tonnes per year of dry recyclable materials collected as part of the municipal kerbside collection services provided by Mosman, Manly, Warringah and Pittwater Councils.

The resource recovery facility would sort and treat up to 100,000 tonnes per year of source separated food and garden organics and mixed municipal wastes. The resource recovery facility would include separation equipment and aerobic enclosed tunnel composting technology to produce a variety of compost products and extract valuable recyclables from the incoming waste streams.

The project also includes the following ancillary infrastructure:

- internal roadways;
- weighbridge;
- staff amenities and ablutions; and
- staff parking facilities.

1.3 Location of project

The site on which the project would be located (referred to as 'the site' for the purposes of this environmental assessment) is within the existing Kimbriki Resource Recovery Centre site in the suburb of Terrey Hills. It is within the Warringah local government area.

The site location is shown in Figure 1-1.

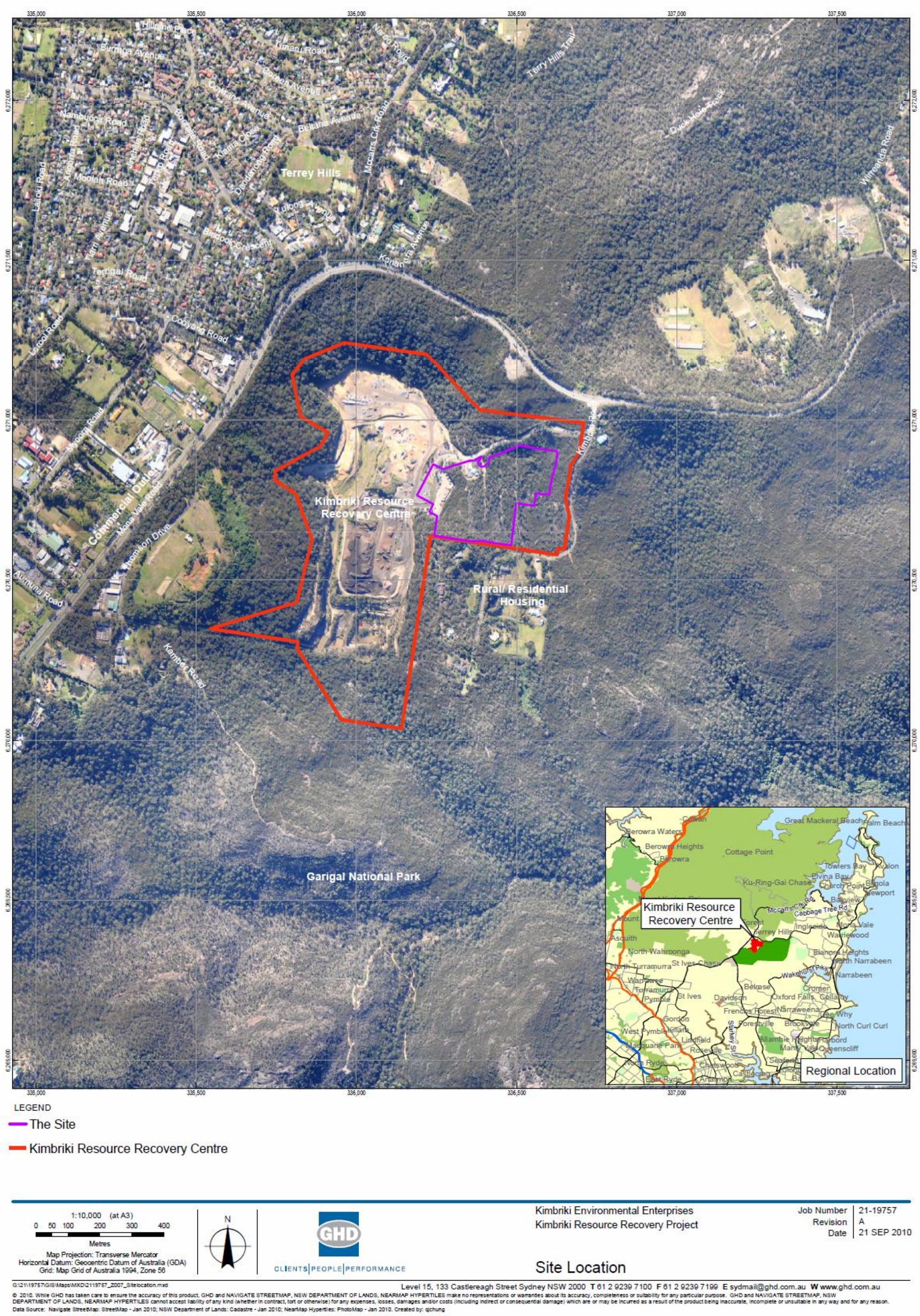

Figure 1-1 Location and key features of the site and surrounds

1.4 Statutory Requirements

The Director-General's Requirements for approval require a Hazard Analysis as per *State Environmental Planning Policy No.33 – Hazardous and Offensive Development* (SEPP 33). A Hazard Analysis broadly examines the likely potential hazards that may occur as a result of a hazardous or offensive development.

SEPP 33 requires developments that are potentially hazardous to be the subject of a Preliminary Hazard Analysis (PHA) to determine the risk to people, property and the environment at the proposed location and in the presence of controls. Should such risk exceed the criteria of acceptability, the development is classified as 'hazardous industry' and may not be permissible within most industrial zones in NSW.

This Hazard Analysis was prepared applying SEPP 33, and generally in accordance with the NSW Department of Planning (DoP) publications Hazardous Industry Planning Advisory Paper No. 6 'Guidelines for Hazard Analysis' (HIPAP 6) and HIPAP No. 4 'Risk Criteria for land Use Safety Planning'.

1.5 Objectives

The aim of this Hazard Analysis is to determine off site and on site impact from the proposed project and ensure that the criteria of the NSW DoP Land Use Planning are complied with.

The primary objectives of the Hazard Analysis are:

- Identify all credible hazardous scenarios associated with the proposed project;
- Determine the consequence of each hazardous event;
- Assess the impact to the people, property and the environment in the surrounding vicinity; and
- Identify risk reduction and mitigation measures to ensure risk is 'As Low As Reasonably Practicable' (ALARP).

2. Methodology

A Hazard Analysis is to provide sufficient information and assessment of risks associated with the proposed development to show that it satisfies the risk management requirements of the proponent company and the relevant public authorities. Within this brief, the main objective of the Hazard Analysis is to show that the residual risk levels are acceptable in relation to the surrounding land use, and that risk will be appropriately managed. This is done systematically by:

- Identifying intrinsic hazards and abnormal operating conditions that could give rise to hazards;
- Identifying the range of safeguards;
- Assessing the risks by determining the probability (likelihood) and consequence (effects) of hazardous events for people, the surrounding land uses and environment; and
- Identifying approaches to reduce the risks by elimination, minimisation and/or incorporation of additional protective measures.

The Hazard Analysis needs to be carefully and clearly documented with the assumptions and uncertainties of final design and operation defined.

2.1 Preliminary Risk Screening

The need for a Preliminary Hazard Analysis (PHA) under SEPP 33 is determined by a preliminary risk screening of the proposed development. The preliminary screening methodology concentrates on the transport and storage of specific dangerous goods classes that have the potential for significant off-site effects. Specifically the assessment involves the identification of classes and quantities of all dangerous goods to be transported, used, stored or produced on site with an indication of storage depot locations. Details of the methodology are described in DoP's - Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (1994).

2.2 Analysis and Assessment Levels

The hazard analysis and quantified risk assessment regime promoted in NSW relies on a systematic and analytical approach to the identification and analysis of hazards and the quantification of off-site risks to assess risk tolerability and land use safety implications.

Multi-Level Risk Assessment (1997) prescribes three levels of risk assessment that can be undertaken. The choice of an appropriate technique is based on the results of preliminary screening, risk classification and prioritisation and the potential for significant off-site consequences arising from hazards identified for the proposed development.

Level 1 - This is a qualitative assessment using word descriptions to approximately assess and rank risks. This is used when risk screening, classification and prioritisation indicate no major off-site consequences, adequate controls exist, and surrounding land uses are not sensitive to the hazards posed.

Level 2 - A semi-quantitative assessment that utilises the hazards identified in Level 1 and provides a focused quantification of key potential off-site risk contributors to demonstrate that risk criteria will be met.

Level 3 - This involves a full quantitative risk assessment and is undertaken whenever the scale and nature of an activity creates a significant risk of a major accident. A full-scale analysis should also be carried out if partial quantification cannot sufficiently demonstrate that relevant criteria will be met.

The rationale for the multi-level risk assessment approach is that:

- Preliminary analyses that indicate minor land use safety outcomes may only require qualitative assessment (Level 1). The emphasis in such instances should be on the identification of key risk elements and optimising safety management controls, therefore fulfilling objectives of Level 1 above.
- Preliminary hazard analyses that indicate significant potential risk impacts to surrounding land uses should be subjected to a more detailed level of analysis including partial or total quantification (Levels 2 and 3). For such cases there should be increased emphasis on objectives of level 2 above, relating to land use safety and risk tolerability.

2.3 Qualitative Analysis

The objective of the qualitative hazard analysis is to develop a comprehensive understanding of the hazards and risks associated with the proposed facility and its operations, the adequacy of the safeguards. A hazard has the potential to cause harm to people, damage to property and harm the biophysical environment.

The key elements to hazard analysis are:

- Identification of hazards and development of credible incident scenarios;
- Analysis of the consequences of these incidents on people, property and the biophysical environment (Table 2-1);
- Evaluation of the likelihood of such events occurring and the adequacy of the safeguards (Table 2-2); and
- Qualitative evaluation of the resulting risk levels of the facility based on a risk matrix (Table 2-3); and
- Comparison of these risk levels with established risk criteria and identification of risk reduction measures.

Table 2-1 Consequences of occurrence

Consequence		Catastrophic	Major	Moderate	Minor	Minimal
Magnitude	Spatial	Whole of Region	The Site and surrounding areas	The whole Site	A part of the site	A small isolated area
	Intensity	Lethal/extreme. For individuals or communities	Lethal impacts on some species	Acute/ Moderate. Impact on growth, recruitment or survival rates	Acute impacts on some species	Chronic/low Level behavioural, lifespan or condition effect

Consequence		Catastrophic	Major	Moderate	Minor	Minimal
Temporal	Duration	Permanent	Long term effect (multiple generations)	Medium term	Short term impact (single generation)	Single incident. transient event
	Timing (periodic events)	Permanent interruption of ecosystem cycle	Regularly interrupts life cycle	Interrupts one life cycle	Occasional interruption of feeding or breeding	Occurs outside breeding times
Ecological	Values	Wilderness or nationally threatened Species	Conservation area or listed Species	Native flora or fauna	Parkland	Previously disturbed areas
	Sensitivity	Will not recover	Significant change to ecosystem function	Moderate change to ecosystem function	Will recover with some changes	Will recover completely.
Social	Number of People	Loss of life	Large number of people directly impacted	Several people directly impacted, or many indirectly	Some people directly impacted, or several indirectly	Some people indirectly affected
	Heritage Considerations	Major degree of impact on place(s) or object(s) with an exceptional level of significance	Major degree of impact on significant place(s) or object(s) with a high level of significance	Substantial degree of impact on significant place(s) or object(s)	Impact on place(s) or object(s) with limited levels of significance, or, minor impact to significant place(s) or object(s)	Impact on place(s) or object(s) assessed below significance threshold
Economic	General	Several million dollars in lost revenue or remediation costs	A million dollars in lost revenue or remediation costs	Half a million dollars in lost revenue or remediation costs	Several thousands of dollars in lost revenue or remediation costs	Minimal losses
	Financial/ Business Cost	>$10,000,000	<$10,000,000	<1,000,000	<$100,000	No Loss

Table 2-2 Likelihood and probability of occurrence

Likelihood	Description	Probability	Community Attitude
Almost Certain	Expected to occur	>85%	Almost everyone affected
Likely	Probably will occur	50-85%	Most people affected
Possible	May occur	21-49%	Many people affected
Unlikely	Not expected to occur in most circumstances	1-20%	Some people affected
Remote	May occur in exceptional circumstances	<1%	Few people interested

Table 2-3 Risk assessment matrix

	Consequence				
Likelihood	Catastrophic	Major	Moderate	Minor	Minimal
Almost Certain	Significant	Significant	Very High	High	Medium
Likely	Significant	Very High	High	Medium	Low
Possible	Very High	High	Medium	Low	Very Low
Unlikely	High	Medium	Low	Very Low	Negligible
Remote	Medium	Low	Very Low	Negligible	Negligible

2.4 Quantitative Analysis

Quantitative analysis is conducted using numerical data values for both likelihood and consequences. The objectives of a consequence analysis are to:

- Determine relevant toxic and flammable inventories;
- Analyse a representative set of spill or loss of containment cases;
- Determine the consequences of each release with regards to the potential of fire and explosion and offsite impact to people, environment and properties.

The processes used to complete the analysis are;

- Discharge rate modelling;
- Dispersion modelling; and
- Fire and explosion impact modelling.

3. Preliminary Risk Screening

3.1 Dangerous Goods Transport and Storage Screening

A preliminary screening of the proposed development is required by SEPP 33, to determine if there is a need for a PHA. The methodology is described in DoP's Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (1994).

Due to the nature of the proposed Resource Recovery Project the proposed inventories of hazardous substances and dangerous goods to be stored and utilised on site is negligible and does not exceed any transport or storage limits as defined in SEPP 33. The process followed is demonstrated in Figure 3-1.

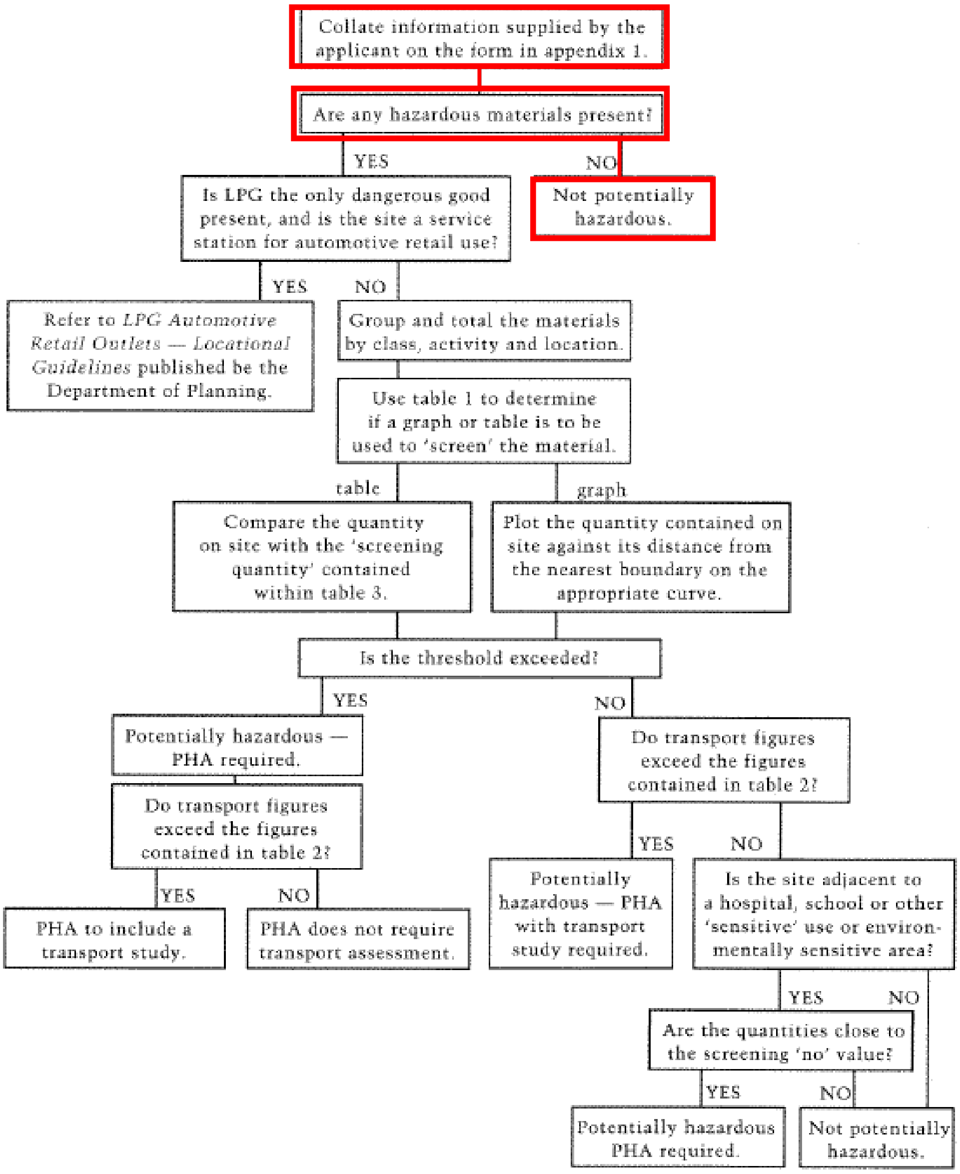

Figure 3-1 SEPP 33 Risk Screening Process

Based on this assessment, there are no requirements for a PHA as per SEPP 33.

If any changes are to occur in the type or quantity of dangerous goods used on site, it is recommended that the dangerous goods screening is repeated to ensure no thresholds are exceeded.

3.2 Level of Risk Assessment

According to SEPP 33, if any of the screening thresholds are exceeded then the proposed development should be considered potentially hazardous and a PHA is required. Also, if the quantities are close to the screening threshold values and the development site is near a sensitive receiver then the proposed development is also considered to be potentially hazardous and a PHA is required.

Based on the above assessment, the proposed development does not require a PHA as all materials, including transportation frequencies do not exceed the respective thresholds, thus are not considered as potentially hazardous as per SEPP 33. However, to demonstrate potential hazards have been identified and control measures are in place, a hazard identification process has been completed, as given in Table 4-1.

4. Hazard Identification

Hazard identification represents a Level 1 or qualitative risk assessment and involves documenting all possible events that could lead to a hazardous incident. It is a systematic process listing potential causes and consequences (in qualitative terms). Reference is also made to proposed operational and organisational safeguards that would prevent such hazardous events from occurring, or should they occur, that would mitigate the impact on the plant, its equipment, people and the surrounding environment. This process enables the establishment, at least in principle, of the adequacy and relevancy of proposed safeguards.

The aim of the hazard identification study process is to highlight any residual risks associated with the interaction of the facility (as a whole) with the surrounding environment. A range of possible hazard scenarios were developed but the consequence and likelihood assessment was not completed as none of the hazardous scenarios were considered credible for offsite impact. The results of this hazard identification are demonstrated below in Table 4-1.

Table 4-1 Hazard Identification

Hazard Scenario	Causes	Consequences	Recommended Safeguards
Hazardous waste	Hazardous waste enters resource recovery facility and reacts with other materials	Generation of toxic fumes Personnel exposure to toxic substances	Hazardous materials sorting and screening Operational procedures for management of hazardous waste
Hazardous waste	Significant volumes of hazardous material enter the resource recovery facility	Generation of toxic fumes. Personnel exposure to toxic substances	Hazardous materials sorting and screening Operational procedures for management of hazardous waste
Ignition of incoming materials or finished product.	Stockpiling of incoming material for extended periods Overall power failure or interruption for significant period of time leading to lack of aeration Failure of aeration system for other reasons	Anaerobic decomposition takes place producing methane biogas Potential for destruction of the facility	Minimise storage time of incoming materials prior to processing Gas monitoring Fire extinguishers and suppression systems. Install aeration system for maturation building to maintain ventilation and restrict temperature rise of finished product
Ignition of flammable materials	Ignition of flammable materials stored on site e.g. waste paper, cardboard, plastics etc	Fire develops	Operation procedures for storage of materials Designated storage areas Fire detectors Fire extinguishers and suppression systems
Ignition of toxic flammable materials	Ignition of flammable materials stored on site e.g. waste paper, cardboard, plastics etc	Potential for the generation of toxic fumes	Operation procedures for storage of materials Designated storage areas Fire detectors Fire extinguishers and suppression systems.
Operational / mechanical interactions	Failure of machine guarding / working in close proximity to rotating and moving equipment	Personal injury	Machine guarding Operational / maintenance procedures Operator competency

Hazard Scenario	Causes	Consequences	Recommended Safeguards
Vehicle interactions	Vehicle movements in vicinity of personnel	Personal injury	Traffic management plan including standard traffic rules, signage etc Designated pedestrian areas Driver competency Operational procedures
Particulate generation	Aerobic digestion process generates odour and particulates	Personal health issues	Operational procedures Air filtered through biofilter prior to release
Confined space incident	Access to tunnels	Possible asphyxiation due to atmospheric conditions within confined space	Operational procedures, including confined space entry permit Operator competency in confined space entry Breathing apparatus Aeration of tunnel prior to entry Gas monitoring
Fall from height	Person working at height falls	Personal injury	Operator competency for working at heights Work at heights procedures and work permit Suitable work at heights equipment e.g. fall protection
Electrical incident	Exposure to damaged electrical equipment	Electrocution	Design and maintenance of all electrical systems as per legislative requirements Physical protection (cabinets, bollards etc.) around high risk electrical installations

5. Conclusions and Recommendations

It is concluded that the SEPP 33 threshold screening value for dangerous goods is not exceeded by any of the proposed dangerous goods to be stored or produced at the materials recovery facility or resource recovery facility. Additionally, the transportation screening thresholds are not exceeded by any of the dangerous goods.

The hazard identification study did not identify any significant hazards with the potential for offsite impact that will not be suitably controlled. Adequate safeguards are required to ensure the risk scenarios that were identified are contained or at least controlled to an acceptable level. Therefore it is recommended that all safeguards identified in the hazard identification process are implemented.

One of the most effective means of ensuring the ongoing safe operation of a facility is through implementing a comprehensive Safety Management System. Such a system will ensure that hazards associated with the site are identified and managed, so that all activities are undertaken in a safe manner.

6. References

- Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Safety Planning, Department of Planning (DoP), NSW.
- Hazardous Industry Planning Advisory Paper No 6 – Guidelines for Hazard Analysis, Department of Planning (DoP), NSW.
- Applying SEPP 33: Hazardous and Offensive Development Application Guidelines, D.o. Planning, Editor. 1997, Crown.

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	R. Freeman	R. Chatiar	* on file	D. Gamble	David Gamble	12/08/10
1	A. Montgomery	D. Gamble	David Gamble	D. Gamble	David Gamble	25/10/10

Appendix N
Bushfire Contraints Report

CLIENTS | PEOPLE | PERFORMANCE

Kimbriki Environmental Enterprises

Kimbriki Resource Recovery Project

Bushfire Constraints Analysis

October 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1.1 Purpose of this Report

Kimbriki Environmental Enterprises Pty Ltd is proposing to construct and operate two purpose-built advanced waste sorting and treatment facilities at the existing Kimbriki Resource Recovery Centre site in Terrey Hills.

This report has been prepared by GHD as part of the environmental assessment of the project. Kimbriki Environmental Enterprises is the proponent of the project, and the environmental assessment is being prepared by GHD in accordance with the requirements of Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

This report assesses potential bushfire constraints on the project.

1.2 Project Outline

The Project involves the construction and operation of two main facilities:

- A materials recovery facility; and
- A resource recovery facility.

The materials recovery facility would receive and process sort up to 60,000 tonnes per year of dry recyclable materials collected as part of the municipal kerbside collection services provided by Mosman, Manly, Warringah and Pittwater Councils.

The resource recovery facility would sort and treat up to 100,000 tonnes per year of source separated food and garden organics and mixed municipal wastes. The resource recovery facility would include separation equipment and aerobic enclosed tunnel composting technology to produce a variety of compost products and extract valuable recyclables from the incoming waste streams.

The Project also includes the following ancillary infrastructure:

- Internal roadways;
- Weighbridge;
- Staff amenities and ablutions; and
- Staff parking facilities.

1.3 Location of Project

The site on which the project would be located (referred to as 'the site' for the purposes of this environmental assessment) is within the existing Kimbriki Resource Recovery Centre site in the suburb of Terrey Hills. It is within the Warringah local government area.

The Kimbriki Resource Recovery Centre is comprised of Lot 2 DP 255466, Lot 4 DP 255466, Lot 100 DP, 822376, Lot 200 DP 1044605 and Lot 3 DP 794191 Kimbriki Road, Ingleside (hereafter referred to as the 'subject land'). The site of the proposed works (the 'site') forms the eastern portion of the existing Kimbriki Resource Recovery Centre and is located wholly on Lot 4 DP 255466.

The subject land is situated within land owned jointly by Warringah, Mosman, Manly and Pittwater Councils and is managed by Kimbriki Environmental Enterprises Pty Ltd.

The site location is shown in Figure 1-1.

1.4 Scope and Structure of Report

The report includes a description of the existing location and environment of the study area, an assessment of the potential bushfire hazards and recommended bushfire protection measures for incorporation into the development. The report culminates with an assessment of compliance of the development in relation to the standards presented in Section 79BA of the EP&A Act and Section 4 of *Planning for Bushfire Protection* (PBP) (NSW RFS 2006a) and *Addendum: Appendix 3* of the PBP (NSW RFS 2010).

This report can be used for its intended purpose only. The recommendations made in this report relating to the clearing or modification of vegetation to meet setback requirements do not constitute approval or authority to modify or remove vegetation.

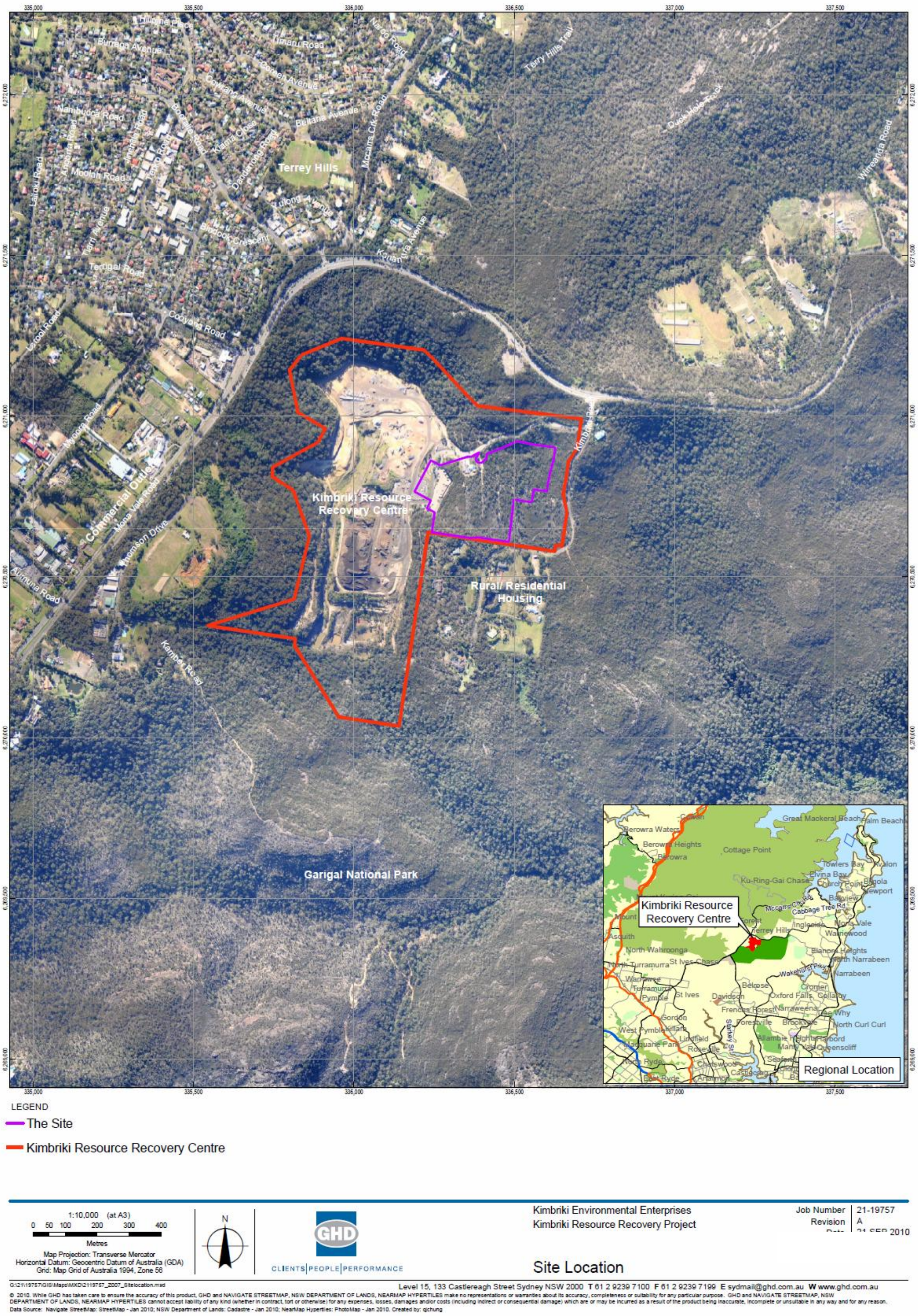

Figure 1-1 Site Location

2. Methodology

2.1 Desktop Assessment

The desktop assessment included collation and analysis of:

- Bushfire Prone Land mapping, sourced from Warringah Council;
- Aerial photography sourced from NSW Land and Property Management Authority; and
- Vegetation, physical relief, tenure, roads and other descriptive feature mapping.

2.2 Field Investigation

A field inspection to assess slope, access and vegetation types was conducted by GHD on 19 August 2010 to determine likely constraints.

Assessments were conducted within the subject land and along the boundaries of the site (of which all except the western sections adjoin natural bushland). Vegetation features (type, predominant canopy height, percentage cover and understorey) and slope were noted. The site was also informally traversed as part of the analysis.

2.3 Analysis

The proposed works is an industrial development (Building Code of Australia – Building Class 8) and the objectives, intent, performance criteria and solutions for bush fire protection measures detailed in PBP are presented below as a guide for:

- Restricting development types;
- Asset protection zone (APZ) setbacks;
- Access – public roads, property access roads and fire trails; and
- Services – water, electricity and gas.

2.4 Consultation

GHD contacted Inspector George Sheppard of the NSW Rural Fire Service (RFS) (Warringah Pittwater) on 19 August 2010 to confirm that the proposal area does not have a specific zoning under the local Bush Fire Risk Plan (2010).

The RFS indicated that an area within the south of the site was burned by prescribed burning in 2007. It was also indicated that areas offset for the conservation of *Tetratheca glandulosa* may be subject to prescribed burning to reduce fuel hazards, providing this is consistent with the ecological prescriptions / burning intervals for the species. The recommended burning interval for *T.glandulosa* is no more than one fire every seven years (NSW RFS 2004).

The general bushfire mitigation options and recommendations discussed with the RFS, in line with the PBP, have been incorporated in this report.

3. Property Description

The subject land is located at the western side of Kimbriki Road, Ingleside, within the Warringah Local Government Area (LGA). It is approximately 300 m south of Mona Vale Road Figure 1-1). Mona Vale Road separates Kimbriki Resource Recovery Centre from Ku-ring-gai Chase National Park to the north. Garigal National Park is located to the east and south of the subject land. A number of residential properties are situated immediately south of the site. The J.J. Hills Memorial Reserve is located to the west, and Terry Hills located north of Mona Vale Road.

The subject land occurs within the catchment of Narrabeen Lagoon and is adjacent to (east of) a tributary of Deep Creek.

Access to Kimbriki Resource Recovery Centre is from Kimbriki Road, off Mona Vale Road.

The subject land covers an area of approximately 65 hectares and is designated as Locality B9 in the *Warringah Local Environmental Plan 2000.* This designation aims to maintain the existing character and landuse of the area, including the subject land.

The site of the proposed works is located within the eastern portion of the subject land and is currently dominated by regrowth natural vegetation. Undeveloped land to the north, east and south of the site constitutes a potential bushfire threat.

Exposed and excavated soils of the operational landfill facility are located to the west of the site.

3.1.1 Environmental Features

The existing Kimbriki Resource Recovery Centre was established as a landfill in 1974 and included the removal of vegetation to form landfill cells throughout the central portion of the subject land, and to the west of the site. Vegetation adjacent to active and historic landfill cells is highly modified, characterised by regrowth trees and shrubs, grasses, sediment stabilising plantings and landscaping. The remainder of the subject land supports natural vegetation, particularly along the margins of the property (dominated by Dry Sclerophyll Forest (Shrubby)).

The site of the proposed works is bordered by Heathland to the north, east and west. Vegetation to the south and particularly in the south-west is dominated by Dry Sclerophyll Forest (Shrubby) (Figure 3-1) (Section 4.2).

Several communities of *Tetratheca glandulosa*, listed as Vulnerable under both the Threatened Species Conservation Act 1995 and the *Environmental Protection Biodiversity Conservation Act 1998* have been recorded on the subject land. Two populations within the site (near Kimbriki Road and adjacent to existing administration buildings) have been designated as offsets, to ensure a portion of the population is retained despite potential disturbance to the species elsewhere on the subject land (Figure 3-1).

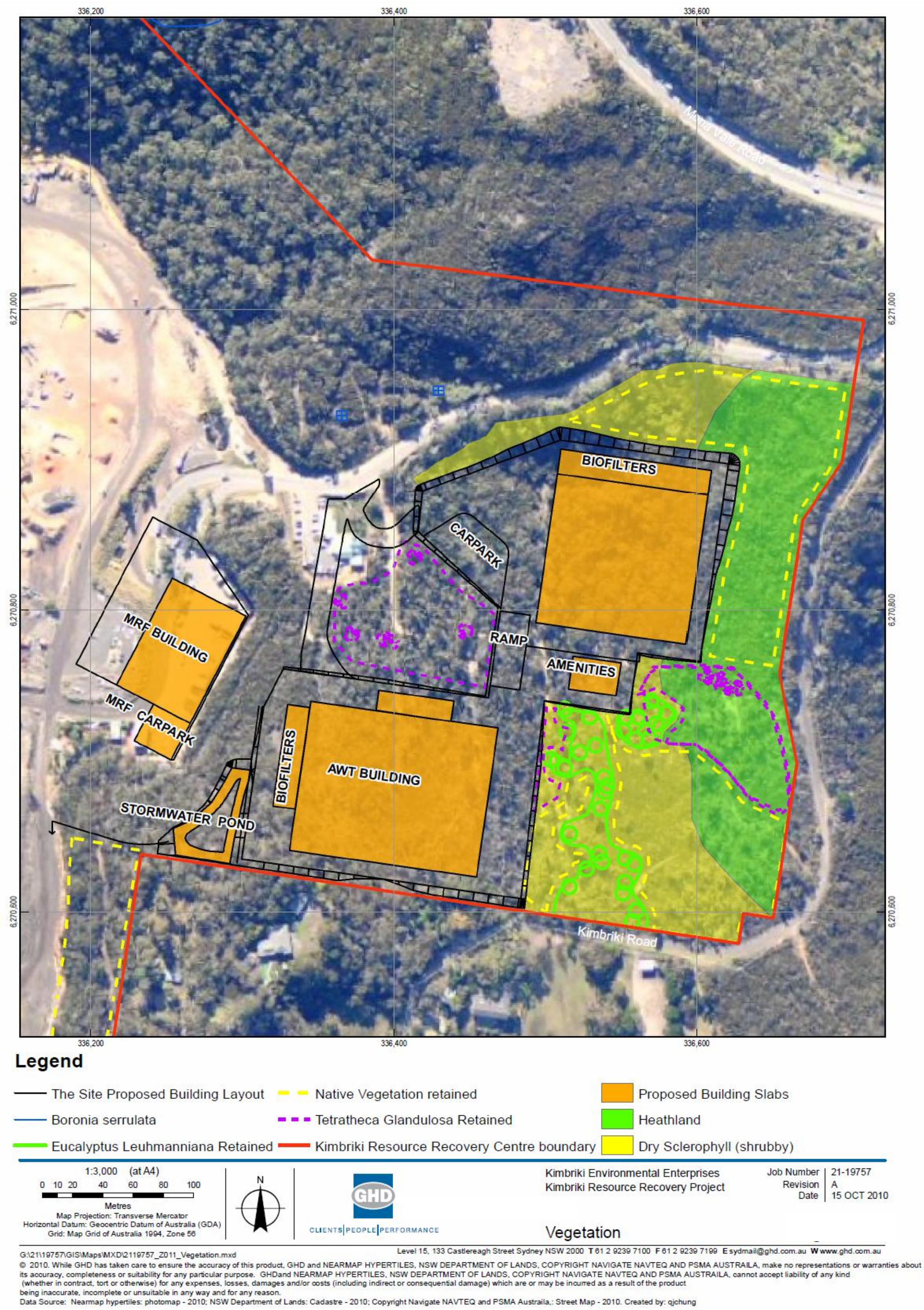

Figure 3-1 Vegetation

4. Hazard Assessment

4.1 Bush Fire Prone Land

The subject land is zoned bushfire prone (Vegetation Category One) according to a Bushfire Prone Land map certified by the Commissioner of the NSW Rural Fire Service for the Warringah LGA (Figure 3-1). Vegetation within and adjoining the subject land and site of the proposed works constitutes a potential bushfire threat, with adjoining lands also classified as bushfire prone or bushfire buffer.

Development of land classified as bushfire prone land is subject to a number of bushfire related planning controls under the NSW EP&A Act and the *NSW Rural Fires Act 1997*. The specific planning controls are detailed in PBP (NSW RFS 2006a) and *Addendum: Appendix 3* of PBP (NSW RFS 2010).

The aims and objectives of *Planning for Bushfire Protection* (NSW RFS 2006a and 2010) apply to industrial developments and are used to guide this analysis.

4.2 Vegetation

Predominant vegetation formations were determined in accordance with A2.3 of PBP (NSW RFS 2006a) and Table A3.5.1 of the addendum to PBP (NSW RFS 2010). Bushland vegetation on or within 100 m of the site has been determined as a mix of Dry Sclerophyll Forest – Shrubby subformation and Heathlands (NSW RFS 2010), described as:

Dry Sclerophyll Forest – Shrubby subformation:

- Dominated by eucalypts 10-30 m with crowns that touch or overlap.
- Canopy foliage cover in many areas is 20-50%; and
- Understorey dominated by shrubs, including banksias.

Heathlands:

- Scattered overstorey trees to 2 m; and
- Understorey predominantly coastal heath, including mallee eucalypts.

These vegetation classifications are synonymous with AUSLIG (1990) Forest and Scrub classifications (respectively) utilised by A3959-2009 – *Construction of Buildings in Bushfire Prone Areas.*

4.3 Effective Slope

Construction of the proposed maturation and AWT buildings and associated infrastructure will require excavation and filling to create level terrain (to approximately 125 m ASL). The site of the proposed facilities is within the eastern portion of the subject land, extending across sloping ground into steeper terrain (a rise from approximately 115 m above sea level (ASL) to 155 m ASL). The north-eastern and south-western portions of the site will be excavated (up to 20 m), with the maturation and AWT buildings adjoining this excavation (Figure 1-1). The south-eastern side will be filled (up to 10 m east of the AWT building) or level with the surrounds (south of the amenities block).

Slope classes are presented in Figure 4-2. Effective slope will significantly influence fire behaviour for the site, and have been used guide APZs determination (Table 5-1).

4.4 Fire Weather

Warringah Council area is within the Greater Sydney Region, and has a corresponding Fire Danger Index rating of 100 (NSW RFS 2006a).

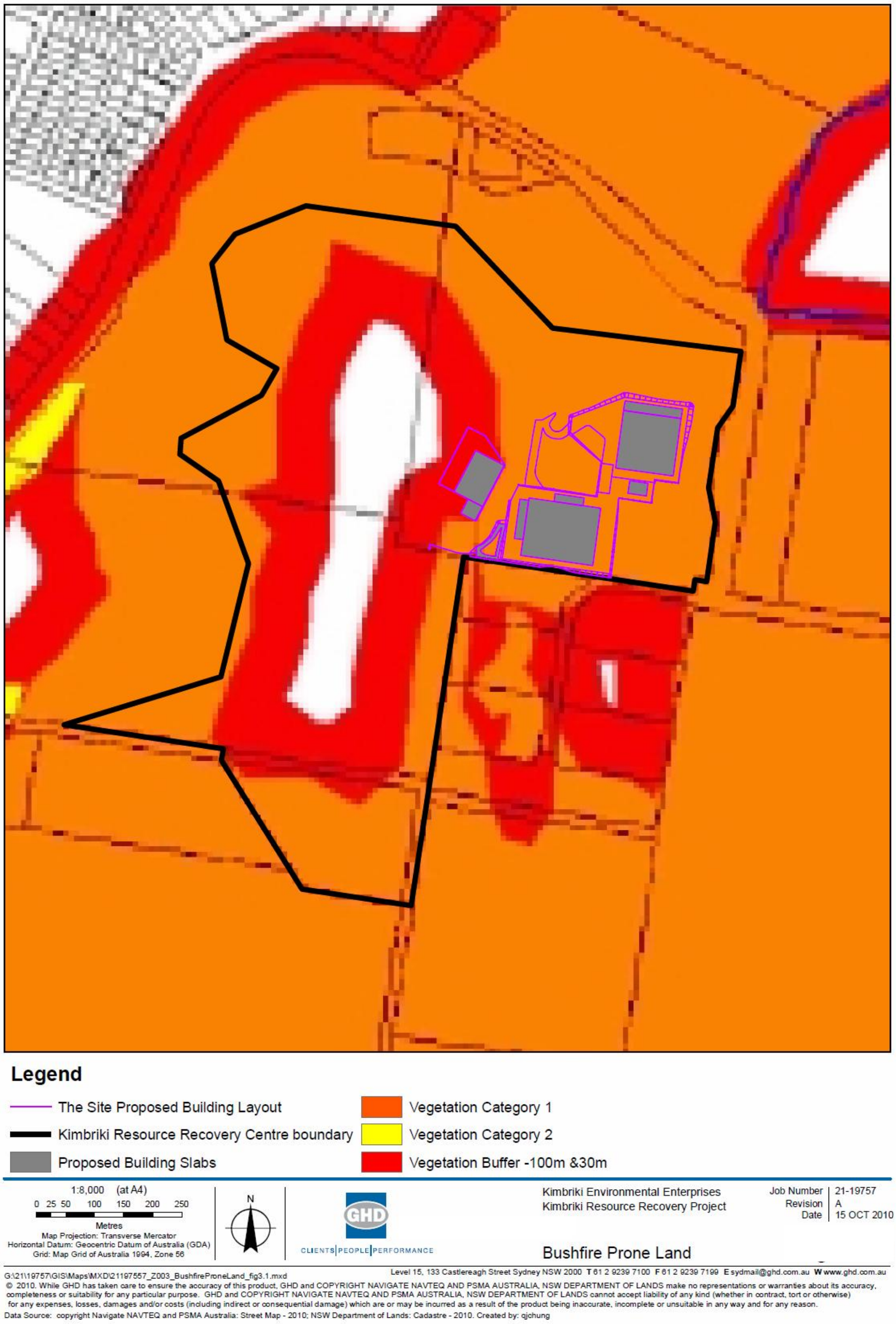

Figure 4-1 Bushfire Prone Land Map

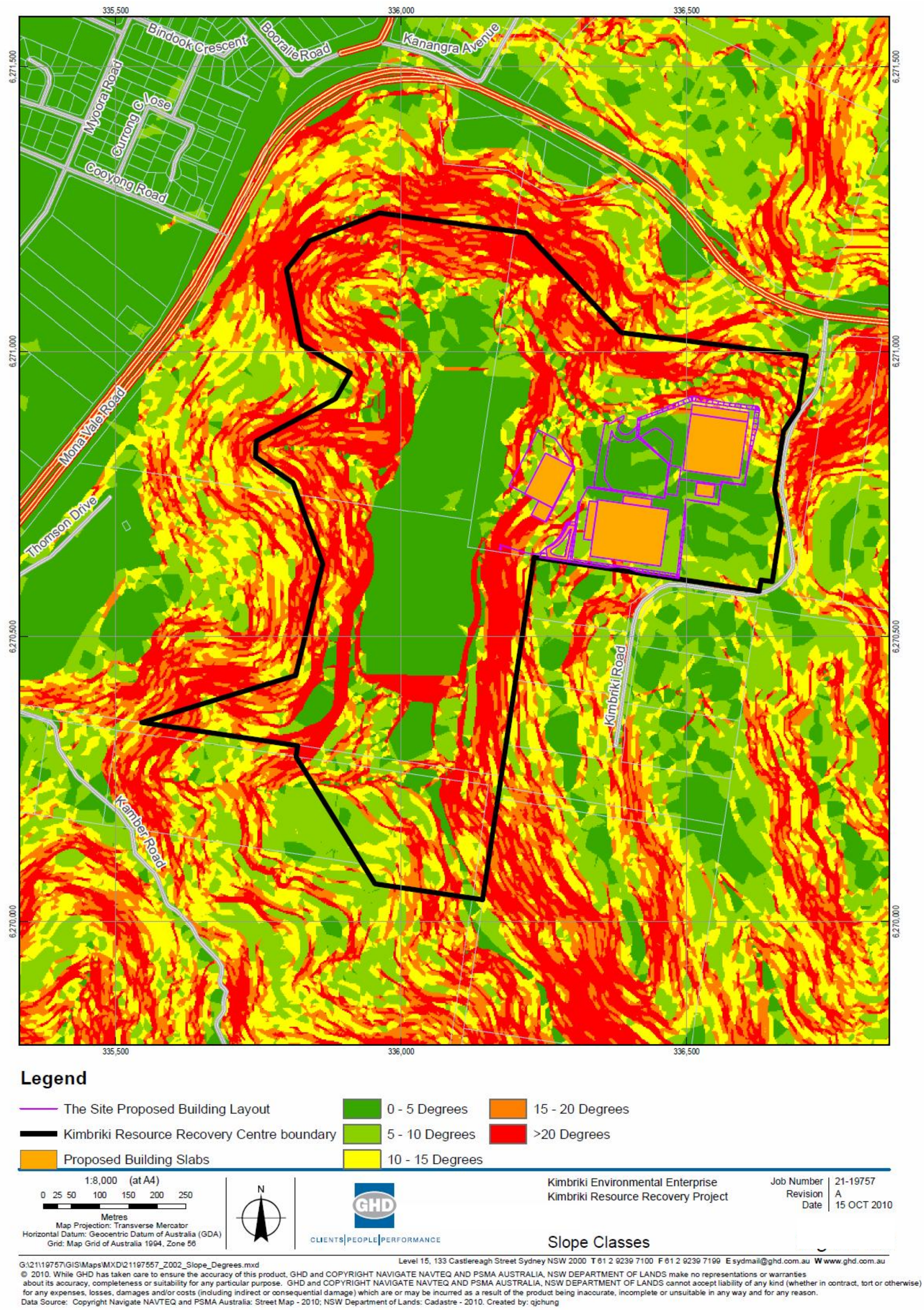

Figure 4-2 Slope Classes

5. Bushfire Protection Measures

The subject land is zoned as bushfire prone (Section 4.1). The subject land does not have a specific zoning under the *Bush Fire Risk Management Plan* (Warringah Pittwater Bush Fire Management Committee (WPBFMC) 2010), however the land immediately to the north of Kimbriki Resource Recovery Centre is designated as a Strategic Fire Advantage Zone.

The aims and objectives of PBP (NSW RFS 2006a) and *Addendum: Appendix 3* (NSW RFS 2010) apply to industrial development. The following bushfire protection measures have been developed from the bushfire assessment to assist in minimising potential impacts from bushfire.

5.1 Asset Protection Zones

An APZ is an area surrounding a residential development or asset, managed to reduce bushfire hazard to an acceptable level. PBP provides a consistent and transparent basis for determining minimum requirements for APZs for residential or special purpose developments in bush fire prone areas in NSW.

While the proposed works are not residential or a special purposes development, as an industrial development the APZ setbacks have been developed to meet the aims and objectives of PBP, with PBP and *Addendum: Appendix 3* used as a guide. Industrial developments are not required to achieve the APZ requirements for a residential or special purposes development sited at the same location, and the construction standards of industrial buildings serve to reduce the impacts of bushfire. The infrastructure is not intended for habitation and it is therefore considered that the planned APZ widths for the site are adequate. The APZ width for the site is 10m, with APZs shown in Figure 5-1 and detailed in Table 5-1.

Table 5-1 Asset Protection Zone Setbacks

Boundary	Vegetation Class	Effective Slope Class	APZ for a residence	APZ Width for Site (actual distance to building)
Northern	Scrub	Upslope	15 m	10 m (11.4 m to Maturation Building)
Eastern	Scrub	>0-5º	15 m	10 m (10.4 to Maturation Building / 10 m to Amenities Building / 28.3 to AWT Building)
South-eastern	Forest	>0-5º	25 m	10 m (10 to Maturation Building/10 to Amenities)
Southern	Forest	>5-10º	35 m	10 m (10 to AWT Building)
Western	Scrub	Upslope	15 m	10 m (24.3 to Maturation Building)

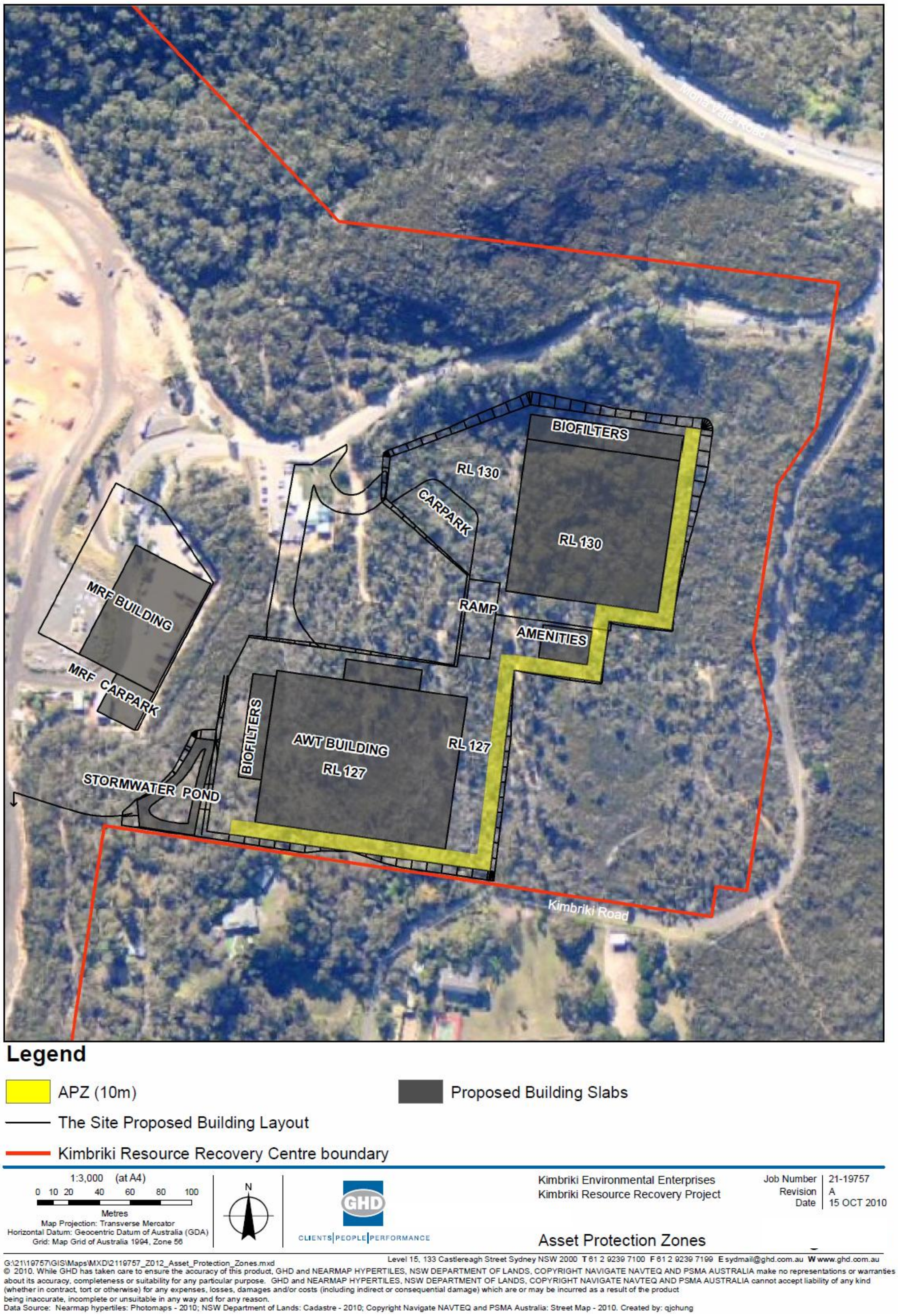

Figure 5-1 Asset Protection Zones

APZs for the site are to:

- Be maintained as cleared or slashed;
- Be of sufficient width between the building interface and boundary to provide space for fire crews to work within;
- Not include garden beds or shrubs located within 10 m from an exposed window or door; and
- Have multiple entry and exit points.

Standards for Asset Protection Zones (NSW RFS 2005) identifies the following requirements to reduce fuels in APZs:

- Raking or removal of surface and near surface fine fuels (fallen leaves and twigs <6 mm diameter) by hand or mechanical means;
- Maintenance of grass (through mowing or grazing) in a short state, and preferably green; and
- Pruning of trees, shrubs and understorey to ensure the tree crown canopy is not continuous (separation between 2-5 m) and native tress and shrubs are retained as clumps occupying no more than 20% of the area.

5.2 Construction Standard

As an industrial development (Class 5,6,7 and 8), the *Building Code of Australia* (BCA) bushfire performance requirements or A3959-2009 – *Construction of Buildings in Bushfire Prone Areas* do not apply, however these construction provisions related to access and services have been addressed as acceptable solutions.

5.3 Access

Site access is via a sealed road leading west from Kimbriki Road into the subject land. This road is formed to ‘Fire Trail – Category 1’ standard (BFCC 2003), with a turnaround point available adjacent to the administration office and carpark. Internal access throughout the existing operational areas of the subject land is of a similar standard and is considered adequate for the provision of fire access, both for existing operations and those outlined in this report.

Two existing gates provide access to informal trails into the south-east portion of the site from Kimbriki Road, and are located along the eastern and southern site boundaries. Vehicular access in and around the proposed buildings would cater for heavy vehicle movements and is considered adequate for the provision of fire access throughout the developed portion of the site.

Natural vegetation adjacent to the carpark would be accessible via the proposed road, while Kimbriki Road would provide access to the eastern and southern boundaries of natural vegetation in the south-east portion of the site.

5.4 Services (Water, Electricity and Gas)

The project is serviced by water storage tanks as well as (low pressure) access to mains water supply.

The leachate pond (located approximately 500 m to the south-west of the site) is accessible to Category 1 fire tankers. The following acceptable solutions relate to the provision of new services:

- Where fire fighting water supply outlets are fitted they have suitable coupling for fire fighting services, are located next to carparks and not located within a carriageway. The main source of water for fire fighting is likely to be from ponds or tanks;
- Electrical transmission lines are to be located underground;
- Reticulated or bottled gas shall be installed and maintained in accordance with AS 1596 and the requirements of relevant authorities;
- Fixed gas cylinders are to be located at a minimum distance of 10 m from all flammable materials and are to be shielded from radiant heat; and
- Gas release valves are to be located a minimum of 2 m from combustible material and be directed away from buildings. All gas connections are to be metal.

5.5 Additional Recommendations

A number of additional recommendations are suggested for bushfire protection during construction and operation of the project. They include:

- Preparation of a site management plan that details bushfire prevention measures to be implemented during construction and later for the operation of the facility including but not limited to:
  - Work involving risk of ignition should not be carried out during total fire bans;
  - Bushfire suppression equipment should be available on site; and
  - Appropriate storage and maintenance of fuels and other flammable materials'
- Emergency procedures should be detailed for any persons located at the site during the bushfire season; and
- Local Rural Fire Service Control Centre should be notified of the dates during which construction is to be undertake and any dates during which 'hot works' are to be conducted should be highlighted, this would enable the Rural Fire Service to advise when weather conditions are not appropriate to carry out the works proposed.

It should be noted that the above recommendations are already in place for existing operations at the Kimbriki Resource Recovery Centre, and it is expected that they will be extended to the new development site for its construction and operation.

In addition it is recommended that retained vegetation within the site (outside the identified APZs) and adjoining the development site (retained as threatened species or native vegetation offset) is managed in accordance with the draft *Bush Fire Risk Management Plan* (Warringah Pittwater Bush Fire Management Committee (WPBFMC) 2010), the burning intervals identified under the *Bushfire Environmental Assessment Code* (NSW RFS 2006b) and the *Threatened Species Hazard Reduction List* (NSW RFS 2004). These burning intervals are:

- for *T.glandulosa* is no more than one fire every seven years (NSW RFS 2004); and
- for Dry Sclerophyll Forest – Shrubby subformation and Healthlands within a designated land management zone (WPBFMC 2010) is 10 years(NSW RFS 2006b).

6. Assessment of Compliance

The bushfire protection measures (Section 4) are designed to reflect the compliance standards Section 79BA of the EP&A Act and Section 4 of PBP (NSW RFS 2006a). The project's compliance is detailed in Table 6-1 below.

Table 6-1 Assessment of compliance

Measure	Assessment of Compliance
Asset Protection Zones	The proposed development can achieve the performance criteria by complying with the acceptable solutions, *i.e.:* ◗ APZs are provided with regard to the *Aims and* Objectives and Appendix 2 of *Planning for Bushfire Protection 2006* (Section 5.1); ◗ The APZ is wholly within the boundaries of the development site (Section 5.1); ◗ The APZ will be managed in accordance with the objectives of *Standards for Asset Protection Zones (RFS 2005)* (Section 4.1); and ◗ The APZ is located on lands with slopes less than 18 degrees (Section 3.3).
Public Roads and Property Access Roads	The proposed development can achieve the performance criteria by complying with the acceptable solutions, *i.e.;* Public roads and perimeter fire trails are two-wheel drive (Section 3) and: ◗ Do not have a crossfall or average road grade exceeding 10 degrees; ◗ Include turning circles of sufficient dimensions (Section 5.3); ◗ Curves are minimal and have the required dimensions (Section 5.3); ◗ Trail and road capacity is greater than 15 tonnes (Section 5.3); ◗ Hydrants will be located outside of parking areas; and ◗ Fire suppression vehicles will operate from internal property access or the public road.
Services – Water, Electricity and Gas	The proposed development will achieve the performance criteria, and aims and objectives of PBP by complying with the following acceptable solutions: ◗ Water supply on site are adequate to meet the needs of fire fighters (and others assisting) (Section 5.3); ◗ Electricity will be underground (Section 5.3); and ◗ Gas supplies will be installed in accordance with AS 1596.

7. Conclusion

The project consists of the construction of non-residential industrial buildings, internal site roads and a carpark. Construction would result in alteration of the physical environment, both through the removal of vegetation and ground disturbance. Two areas of natural vegetation within the site have been identified for conservation as vegetation offsets.

The proposed development would not change the bushfire hazard, and would increase the provision of services and access within the eastern portion of Kimbriki Resource Recovery Centre.

The bushfire protection measures incorporated into the project comply with the *Aims and Objectives*, and the *Acceptable Solutions* of the performance criteria, identified in *Planning for Bush Fire Protection* (NSW RFS 2006a and 2010). This includes the provision of asset protection zones along the boundaries of buildings adjoining natural bushland, and provision of access and egress routes across the site. Any vegetation retained within this APZ is to be managed in accordance with the requirements of *Planning for Bush Fire Protection* (NSW RFS 2006a) and other relevant legislation.

8. References

Bush Fire Coordinating Committee (BFCC). 2007. *BFCC Policy No. 1/2003 – Fire Trails*, adopted by the NSW Bush Fire Coordinating Committee – Minute No. 26/2007

NSW RFS (NSW Rural Fire Service) (2004) *Threatened Species Hazard Reduction List,* NSW Rural Fire Service

NSW RFS (2006a) *Planning for Bush Fire Protection: A Guide for Councils, Planners, Fire Authorities and Developers.* Prepared by NSW Rural Fire Service in cooperation with the Department of Planning

NSW RFS (2006b) *Bush Fire Environmental Code for NSW.* Prepared by NSW Rural Fire Service

NSW RFS (2010) *Addendum: Appendix 3* of the Planning for Bushfire Protection

NSW RFS (undated) *Standards for Asset Protection Zones.* NSW Rural Fire Service, Granville NSW

Standards Australia 1999. *AS3959 – 1999 Construction of Buildings in Bushfire-prone areas.* Standards Australia and the Australian Building Codes Board, Sydney

Standards Australia 2002 *AS/NZS 1596 The Storage and Handling of LP Gas.*

Standards Australia 2005. *AS2419.1 – 2005 Fire Hydrant installations – System design, installation and commissioning*

Warringah Local Environmental Plan 2000

Warringah Pittwater Bush Fire Management Committee (2010) *Draft Bush Fire Risk Management Plan,* prepared for submission to the BFCC

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	Michelle Evans	Dominic Adshead		D.Adshead		24/9/10
1	Michelle Evans	David Gamble		David Gamble		25/10/10

Appendix O
Existing Approvals

ATTACHMENT "B"

Consent 96/371
dated 10/7/97

IN THE LAND & ENVIRONMENT COURT OF NEW SOUTH WALES

No. 10084 of 1997

KEITH TRESTRAIL COCKS and ANNEMARIE COCKS #2155

Applicants

WARRINGAH COUNCIL

Respondent

THE SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES 10/7/97 FLC

BY CONSENT THE COURT ORDERS THAT:-

1: The Appeal be upheld.

2: Development application No. 1994/600, relating to land described as Lot 3, DP794191, Lot 100, DP822376, Lots 2 & 4, DP255466 and Lot 2, DP577611, Kimbriki Recycling and Waste Centre Kimbriki Road, Terrey Hills, for an Existing Waste and Recycling Centre be approved subject to the conditions attached and marked "A".

DATED: 10 JULY, 1997

CONSENT ORDER

GREG HALPIN
Solicitor for the Applicant

NEIL HOWIE by his Partner
ANTHONY HUDSON
Solicitor for the Respondent

Filed by:

WILSHIRE WEBB
Solicitors
379 Kent Street
SYDNEY NSW 2000

DX 13027 SYDNEY MARKET STREET
TEL: (02) 9299 3311
REF: AHL1982

COCKS -v- WARRINGAH COUNCIL
10084 of 1997
Attachment "A" to Court Orders
dated 10 July 1997

1. Development must be carried out generally in accordance with Development Application received 12 October 1994, and as amended by additional information titled "Environmental Impact for Present and Future Operations - Additional Information to Support the Environmental Impact Statement" dated July 1995, "Bat Survey" dated 8 March 1996, and "Report on Leachate Disposal by Injection into Existing Waste" dated October 1996 except where modified by the undermentioned conditions.

2. The existing chain wire security fencing along the entrance route to the site and along Kimbriki Road is to be replaced. This fence is to be maintained at all times to prevent unauthorised access.

3. Trees located adjacent to the areas proposed for future expansion work are to be protected. Proposed means of protecting these trees are to be included in the Environmental Management Plan.

4. Written records shall be kept showing tonnages, origins and fill area of waste loads.

5. Suitable cover material shall be spread over the active landfill face at the end of each operating day. The type and depth of cover is to be to the satisfaction of the Environment Protection Authority.

TRAFFIC

The following conditions have been imposed to minimise the impact on the surrounding road network.

6. The following road works at the intersection of Mona Vale Road and Kimbriki Road are to be carried out in accordance with Roads and Traffic Authority and Council specifications prior to the closure of the Bare Creek landfill:

   i) the right turn bay is to be lengthened to accommodate the peak right turning traffic volumes in five years.
   ii) Kimbriki Road is to be widened to provide an additional north bound lane from the site entry to Mona Vale Road. The additional lane shall be designated an exclusive left turn lane into Mona Vale Road.

7. 25% of the cost of traffic signals required for the intersection of Kimbriki Road and Mona Vale Road are to be contributed. This money is to be put into a trust fund until signals are required.

8. A second inbound lane is to be constructed along the access road to the gatehouse. This work is to be carried out at the applicants expense and prior to the closure of Bare Creek landfill.

9. Appropriate signage is to be erected at the entrance to the site on Kimbriki Road.

THE ENVIRONMENT

The following conditions have been imposed to protect the environment.

10. An Environmental Management Plan shall be prepared and submitted to Council and the EPA by Dec 1997. The plan shall consider the issues raised in the EPA's

    Environmental Guidelines for Solid Waste Landfills. The plan shall include but not be limited to describing:

    i The staging of waste placement (ie waste filling plan showing cell locations and timing), over the life of the landfill.
    ii The staging of quarrying operations over the life of the landfill.
    iii The overall drainage plan showing locations and sizing of storm drains. culverts, sedimentation ponds and related infrastructure.
    iv The leachate management plan.
    v All environmental and occupational health & safety controls, including those required by these conditions of consent.
    vi A long term post closure plan.
    vii Any other details required by these Conditions of Consent.

11. No expansion of the existing operations shall be undertaken until the Environmental Management Plan is approved by Council, the EPA, and other relevant authorities.

12. The Environmental Management Plan shall be updated following major changes to operations or relevant guidelines or legislation, or other circumstances set out by Council or the EPA.

13. An Annual Performance Report covering all matters relating to landfilling and quarrying operations and the topics considered by the Environmental Management Plan shall be submitted to Council and the EPA by December each year.

14. The Environmental Management Plan shall give details of the reporting to be provided in the Annual Performance Report.

15. In addition to the aforementioned Environmental Management Plan, a Landfill Environmental Management Plan (LEMP) shall be prepared in accordance with the EPA's Environmental Guidelines for Solid Waste Landfills and shall be submitted to the EPA by December 1997 or as otherwise stated in writing by the EPA.

16. The Environmental Management Plan is to include details on any archaeological sites on or near the site including a survey of all potential archaeological deposits and the necessary measures to protect the sites if required.

17. Portable screens or mobile fencing shall be used downwind of the operating face of the landfill to capture litter. Screens shall be cleaned daily.

18. A litter capturing device (such as shadecloth fencing or an enclosure) shall be installed downwind and to the east of the recycling area, provided that traffic movement is not impeded.

19. Fortnightly litter collection patrols shall be undertaken around the perimeter of the landfill site.

20. A small access track running around the outer perimeter of the landfill site shall be constructed to allow litter and weed control.

21. Vehicles hauling recyclables, composting material and other matter from the site shall be enclosed or covered.

22. The landfill shall only accept waste of the type specified as "Solid Waste Class 2" in the EPA's *Environmental Guidelines: Solid Waste Landfills*, page 54, January 1996.

23. Signage at the entrance to the landfill shall clearly state unacceptable waste types and fines associated with the dumping of such wastes at the depot.

24. Random load inspections shall be undertaken at a frequency to be determined by Council and specified in the Environmental Management Plan. Load inspections shall be undertaken by spreading a load of material across the ground so that the contents are visible. The contents shall then be checked for unacceptable wastes.

25. Gatehouse operators and load inspectors shall be trained to identify unacceptable wastes.

26. The Environmental Management Plan shall set out fines to be imposed on household, council and commercial carriers who attempt to dump unacceptable wastes at the site.

27. There shall be no composting of green waste - only stockpiling and shredding of green waste shall be carried out on site.

28. A leachate management plan shall be detailed in the Environmental Management Plan and shall include:
i)A description of leacheate management controls over all phases of the life of the site including the sizing and location of treatment/recirculation facilities, pumps, pipework, leachate holding ponds and related infrastructure.
ii)Estimates of leachate volumes over the life of the site following installation of improved surface water drainage
iii) Justification of the capacity of leachate management infrastructure

29. Detailed design of the leachate management system for control of the existing landfill operations shall be submitted to Council and the EPA by September 1997. The approved leachate management system shall be operational within at least 4 months of Council approval. The leachate capture system shall be installed to sufficient depth to capture all leachate migrating downstream.

30. Overflow of the combined leachate/stormwater in the cirrent leachate holding pond may be spray irrigated on the green waste processing area only until the aforementionaed leachate management system for control of the existing landfill is operational.

31. Leachate treatment shall be carried out by deep well injection (as described in "Report on Leachate Disposal by Injection into Existing Waste" dated October 1996 and associated reports) until monitoring indicates that the system is not adequate or best practice technology indicates that a superior system should be installed to the satisfaction of Council and the EPA.

32. Effectiveness of the leachate injection system shall be monitored by:

    i Monthly checking of the landfill area and batters for leachate springs.
    ii Daily monitoring of the quantity of leachate recirculated through the system.
    iii Monitoring of the quality of the leachate recirculating through the system. The frequency and type of testing required shall be set out in the Environmental Management Plan to the satisfaction of Council and the EPA.

33. Written records shall be kept of the leachate monitoring described above and shall be detailed in the Annual Performance Report.

34. Leachate reinjection wells shall be protected from interference from weather, equipment or persons. Covers shall be installed to minimise odour emission and prevent the ingress of rain.

35. The active tipping area shall be minimised to reduce water infiltration and production of leachate.

36. Temporary capping shall be used to minimise water infiltration where areas of the landfill are inactive (yet incomplete) for lengthy periods.

37. The existing pipework under the site which carries leachate and stormwater shall be blocked off to prevent the dilution of leachate with stormwater.

38. Back up leachate holding storage shall be provided to avoid release of leachate to the environment in the event of a system failure. The capacity of this storage shall be to the satisfaction of Council and the EPA.

39. Leachate pits and holding ponds shall be suitably lined to prevent leakage into the surrounding environment.

40. Monitoring of local creeks shall be detailed in the Landfill Environmental Management Plan and shall be carried out to the satisfaction of Council and the Environment Protection Authority.

41. Progressive rehabilitation of filled areas shall be detailed in the Environmental Managemetn Plan and shall undertaken to the satisfaction of Council, and with the aim of minimising water infiltration, dust, odour, disease vectors and adverse

42. Details of landfill gas monitoring during all stages of operation and post-closure shall be included in the Environmental Management Plan.

43. Results of landfill gas monitoring shall be detailed in the Annual Performance Report.

44. If the results of landfill gas monitoring show significant gas movement or concentrations unacceptable to Council or the EPA, a landfill gas collection and treatment system shall be installed. This system must satisfy Council and the EPA or other relevant authority.

45. Details of groundwater monitoring during all stages of operation and post-closure shall be included in the Environmental Management Plan. Groundwater shall be monitored at points both upstream and downstream of the landfill to allow assessment of the landfill impact.

46. Results of groundwater monitoring shall be detailed in the Annual Performance Report.

47. If groundwater monitoring shows contamination unacceptable to Council or the EPA, a groundwater collection and treatment system shall be installed. This system must satisfy Council and the EPA or other relevant authority.

48. All environmental monitoring shall be undertaken by a laboratory registered with the National Association of Testing Authorities for the relevant tests. If NATA registered laboratories are not available to carry out certain procedures, the testing authority shall be approved by Council.

49. A Longterm Closure Plan considering erosion and surface drainage; stormwater collection and treatment; gas and leachate collection and treatment; groundwater quality; environmental monitoring; landscaping; ground settlement; final land forms; and end land use shall be prepared and included in the Environmental Management Plan to the satisfaction of the EPA and Council.

50. The Longterm Closure Plan shall be updated as required by the EPA, Council, or as required by major changes to operations or relevant legislation or guidelines.

51. The landfill surface shall be inspected every quarter for settlement areas. Any settled areas shall be filled and re-graded to prevent ponding of surface water.

52. The management of quarrying operations shall meet all relevant guidelines and policies of the NSW Department of Mineral Resources.

53. Sedimentation controls, dust controls, flyrock controls and noise mitigation measures for all periods of quarrying operations shall be described in detail in the Environmental Management Plan.

54. Sedimentation controls, dust controls and noise mitigation measures shall meet the requirements of Council and the EPA for all periods of quarrying operations.

55. Details of vibration, blast, dust and noise monitoring for each period of quarrying shall be provided in the Environmental Management Plan and shall meet the requirements of Council, the EPA and the Department of Mineral Resources.

56. Results of vibration, blast, dust and noise monitoring for each period of quarrying shall be recorded in writing and summarised in the Annual Performance Report.

57. Any fuel or explosives stored on-site for quarrying shall be appropriately bunded and stored according to the relevant Dangerous Goods guidelines.

58. Stockpiling of overburden, topsoil and quarried materials shall be detailed in the Environmental Management Plan.

59. Safety precautions to be undertaken during quarrying (and especially during blasting) shall be detailed in the Environmental Management Plan and shall meet the approval of Council and the Department of Mineral Resources. Precautions to be considered shall include: isolation of the quarrying area from normal landfill operations, safety equipment for workers, and flyrock safety precautions.

60. Quarrying shall be limited to the areas identified as 2 and 3 and 4b in the Environmental Impact Statement.

61. An independent assessment of the conservation value of the Forest she-oaks in area 4a shall be undertaken prior to consideration of quarrying in this area, as set out in the Environmental Impact Statement. Quarrying shall only occur in area 4a with the approval of Council.

62. A minimum buffer zone of 20 metres to the site boundary shall be maintained around quarrying operations, except for the southern side of the water quality management area where a buffer of 10 metres shall be maintained.

STORMWATER DRAINAGE

The following conditions have been imposed to ensure that the drainage collected on and/or passing the site is conveyed through a controlled system to minimise any impact on the subject land or downstream properties.

63. Stormwater drainage plans shall be detailed in the Environmental Management Plan to the satisfaction of Council and the EPA.

64. Site perimeter stormwater controls shall be installed to minimise run-on from surrounding catchment areas.

65. Stormwater controls shall be installed around the active face of the landfill to collect runoff from the tipping surface.

66. Stormwater controls shall be installed around quarry areas.

67. Sedimentation controls such as fencing and hay bales shall be installed where appropriate in order to minimise silt flow to the sedimentation basins.

68. Run-off from the green waste area shall be directed to the leachate treatment system unless monitoring shows that run-off is suitable for diversion to the sedimentation ponds according to relevant water quality guidelines and the EPA.

69. Sedimentation basins with the capacity to handle all site run-off shall be installed to the satisfaction of Council and the EPA.

70. Energy dissipation measures shall be installed at the outlet of the basins to minimise scouring of the creek bed or other receiving environment.

71. The output of the sedimentation basins shall be monitored according to the requirements of Council and the EPA. Monitoring shall include volume and contaminant data, and results shall be displayed in the Annual Performance Report. Details of the monitoring program shall be set out in the Environmental Management Plan.

71A The excavation of sandstone is to be carried out by bulldozer wherever possible rather than blasting.

THE LANDSCAPE

The following condition has been imposed to ensure adequate provision is made for landscaping and open space in association with the development and the protection of existing trees.

72. Details of ongoing landscaping of filled and closed areas shall be described in the Environmental Management Plan and shall meet the approval of Council.

Landscaping shall be in harmony with the surrounding National Parks and shall use local native species where possible. Landscaping plans shall also take into account the hostile environment of a closed landfill, and the final planned use of the site.

73. (a) A plan addressing the control of subsurface and surface fires within the landfill and bushfire hazards shall be detailed in the Environmental Management Plan. Bushfire hazards shall also be considered.

(b) The vegetation recycling area must not come within 20m of the base of the cliff near the eastern boundary towards the south of the site, the top of which is also the western boundaries of Lots 1, 2 & 3 Kimbriki Road as shown on the plan attached and marked "A".

(c) An access road and drain approximately 7m wide will be constructed near the base of this cliff and the remaining area of 13m between the western edge of this access road/drain and the vegetation and recycling area will be "capped off".

AMENITY

The following condition has been imposed to protect the amenity of the area.

74. (a) Subject to (b), (c), (d),(e) and (f) below the gates of the Recycling and Waste Centre ("the Centre") will be open only between the hours of 7:00am and 5:00pm on any day except Christmas Day and Good Friday when the Centre will be closed with all members of the public, contractors, subcontractors and invitees leaving the site by 5:30pm.

(b) Subject to (d), (e) and (f) below, landfilling operations are restricted to the hours of 7:00am - 5:00pm on any day except Christmas Day and Good Friday when the Centre will be closed.

(c) Subject to (d), (e) and (f) below construction and vegetation recycling activities are restricted to the hours of Monday - Friday 7:00am - 5:00pm and Saturday 7:00 am - 1:00pm with no construction or vegetation recycling activities being carried out after 1:00pm on Saturdays or on Sundays and public holidays.

(d) Employees of the Centre are permitted to enter the site between 6:00am - 7:00am on any day that the Centre is open for the purposes of moving machinery to working sites (but not for the purpose of otherwise operating machinery) and carrying out routine activities which do not create offensive noise in preparation for the opening of the Centre.

(e) Employees of the Centre are permitted to remain on the site between 5:00pm and 6:00pm on any day the Centre is open for the purposes of carrying out routine activities (including the movement of machinery away from working areas) associated with the closure of the Centre and the completion of landfilling activities at the end of each day the Centre is open but not for the purpose of otherwise operating machinery.

(f) Administration, security and emergency/maintenance staff may access the site at any time for non-operational activities.

75. Noise emissions for construction activities are to be addressed in the Environmental Management Plan. The plan is to provide details of noise mitigation strategies to reduce noise from construction activities.

76A (a) Subject to Condition 76B and to (b) and (c) below noise levels from site operations are not to exceed 45dBA as measured at the nearest residential boundary from the site operation.

(b) Noise levels from construction for leachate, drainage and stormwater drainage control works as required by this consent shall comply with the following:-

(i) for a construction period of four weeks and under - the L_{A10} level measured over a period of not less than 15 minutes at the residential dwelling on Lots 1, 2 and 3 Kimbriki Road when the construction site is in operation, must not exceed the background level by more than 20 dBA,

(ii) for a construction period of between four (4) - twenty six (26) weeks - the L_{A10} level measured over a period of not less than 15 minutes at the residential dwelling on Lots 1, 2 and 3 Kimbriki Road when the construction site is in operation, must not exceed the background level by more than 10 dBA, and

(iii) where construction activities extend beyond 26 weeks then for those construction activities that occur after the twenty six week period - the L_{A10} level measured over a period of not less than 15 minutes at the residential dwelling on Lots 1, 2 and 3 Kimbriki Road when the construction site is in operation, must not exceed the background level by more than 5 dBA

(c) Any blasting shall comply with the following restrictions:-

(i) blasting to be confined to the hours of 9am - 5pm Monday to Friday with no blasting on weekends or public holidays,

(ii) noise and vibration from blasting shall not exceed the following limits as measured at the nearest residential boundary from the blasting area:-

BLAST OVERPRESSURE LEVEL	GROUND VIBRATION (PPV)
115dBL Linear 5% of blasts may exceed this limit up to 120 dBL Linear	5mm/s 5% of blasts may exceed this limit up to 10mm/s

(d) Blasting techniques to include measuring, optimising the stemming design, the avoidance of the use of surface detonation cord and the use of matting over the top of the charge hole to reduce the risk of flyrock.

(e) Adjoining residences are to be given 48 hours pre notification of blasting.

(f) All blasts are to be monitored in terms of ground vibration and air blast overpressure at several locations around the site. Details of this monitoring are to be provided in the Environmental Management Plan.

(g) Blasting of a particular area will be commenced as far as possible from the closest residence so that progressive monitoring can be carried out.

76B In relation to Lot 3 Kimbriki Road Terrey Hills noise levels:-

(a) from any landfilling and vegetation recycling activities (including machinery noise) within the site shall not exceed a level of L_{A10} 43dBA as measured in any 15 minute period at the nearest point of the boundary of this allotment to the site operation, and

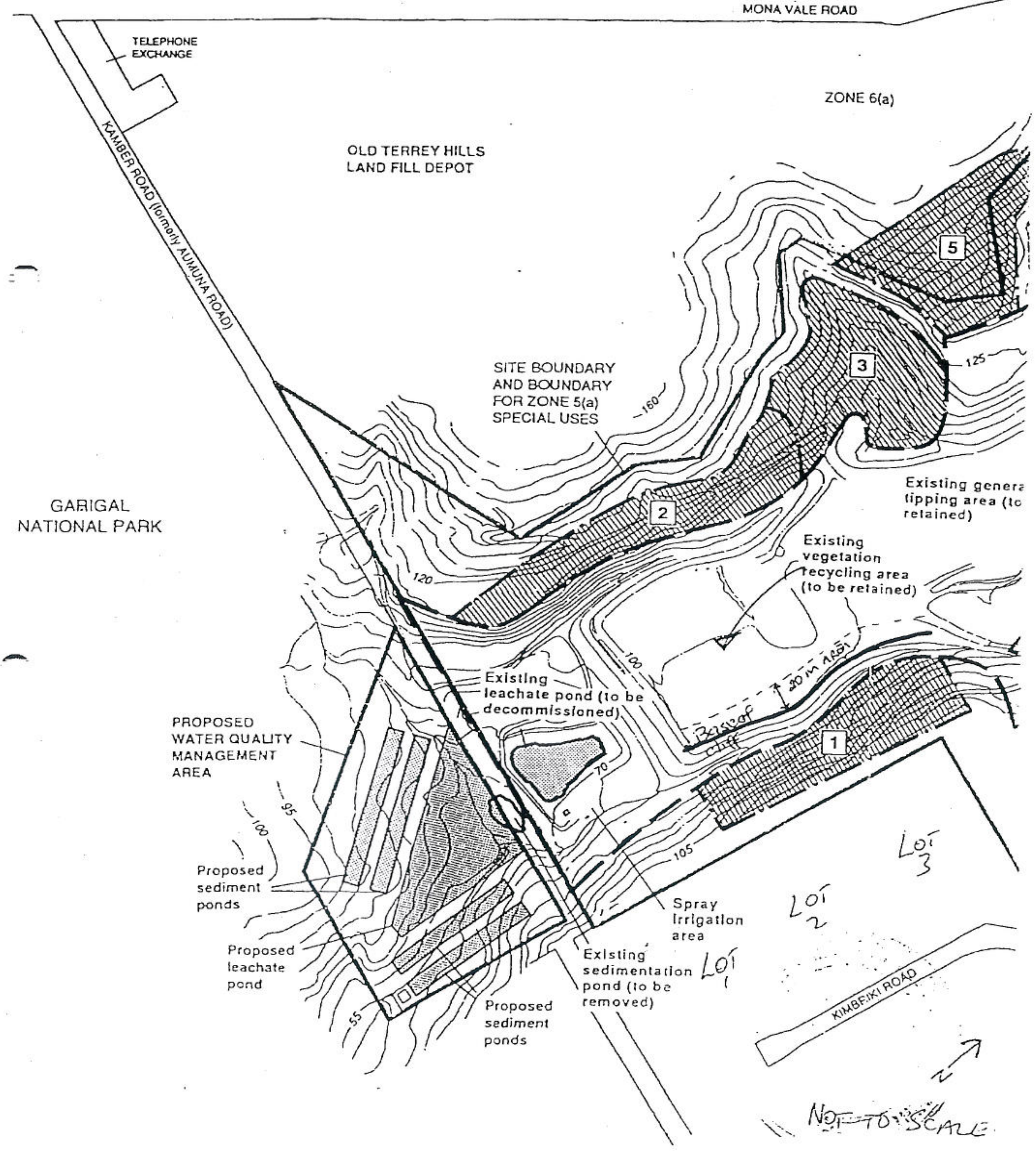
(b) from vehicles on the access road from Kimbriki Road to the administration block shall not exceed a level of L_{Aeq} 44dBA as measured in any 15 minute period at the nearest point of the boundary of this allotment to the access road.

77. All earth moving equipment and mechanical plant is to be fitted with residential class exhaust systems.

78. The Environmental Management Plan for the site is to detail dust mitigation strategies to reduce nuisance dust. The plan should include community liaison, actions to reduce dust and monitoring procedures. It must also provide details of a dust monitoring program to quantify dust fallout at the nearest affected residences.

"A"

Plan referred to in Condition 73(b).



PRECEDENT

(D 47).

Warringah Council

225.003.002 KS.LP/g:\data\em\du\letters\0340PG
Mr Phil Gatenby
Manager, Development Branch North,

16 January, 1997

Joint Services Committee
Four (4) Councils
C/- Warringah Council
Civic Centre, Pittwater Road
DEE WHY NSW 2099

Dear Sir/Madam

re: **Development Application No.1994/600 at Kimbriki Road, Terrey Hills - (Tip) for an existing waste and recycling centre**
Consent No. 96/371

I have pleasure in attaching Consent under Section 91 of the Environmental Planning & Assessment Act, 1979, for the above land and, where relevant, a copy of the appropriately stamped plan to which consent has been granted subject to the conditions set out.

It should be noted that commencement of the land use, work or activity pursuant to this decision implies your acceptance of all the conditions imposed by Council. It is *therefore most important that, prior to proceeding, you satisfy yourself that you are able to comply with all conditions.*

Would you also please note that the effective date of the consent, 14th February 1997, will apply if there is no appeal lodged before that date. If an appeal is lodged by an objector, then this consent is void.

Please note that where any building work is proposed as a result of the attached consent, a Building Application, together with plans and specifications complying with the conditions of the consent, is to be submitted to Council's Health and Building Branch and approval obtained prior to any work commencing.

If there is any aspect of the decision that you are uncertain of or unclear about, or if you would like to discuss further anything in connection with it, I would be obliged if you would contact Mr Phil Gatenby, of Council's Development Branch, who will be pleased to assist you.

Yours faithfully

K Smith
CHAIRMAN, DEVELOPMENT UNIT
Enclosure

Warringah
Council

25.003.002 KS.LP/g:\data\em\du\letters\0340PG
Mr Phil Gatenby
Manager, Development Branch North,

16 January, 1997

Joint Services Committee
Four (4) Councils
C/- Warringah Council
Civic Centre, Pittwater Road
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Yours faithfully

K Smith
CHAIRMAN, DEVELOPMENT UNIT
Enclosure

Warringah Council

PF 1230/L1 - 0340DOC

TP
40832

DESIGNATED DEVELOPMENT CONSENT

ENVIRONMENTAL PLANNING & ASSESSMENT ACT, 1979

NOTICE TO APPLICANT OF DETERMINATION

OF A DEVELOPMENT APPLICANT

Applicant's Name and Address:

Joint Services Committee
Four (4) Councils
C/- Warringah Council
Civic Centre, Pittwater Road
DEE WHY NSW 2099

Being the applicant in respect of Development Application No. 1994/600.

Pursuant to Section 92 of the Act, notice is hereby given of the determination by Warringah Council, as the Consent Authority, of the Development Application No. 1994/600 relating to the land described as follows:-

Lot 3, DP 794191, Lot 100, DP 822376, Lots 2 & 4, DP 255466 and Lot 2, DP 577611, Kimbriki Recycling and Waste Centre Kimbriki Road, Terrey Hills.

For the following development:-

For an existing waste and recycling centre.

Endorsement Date 17 JAN 1997 *Consent to operate from this date*

The Development Application has been determined by granting consent subject to the following conditions:-

1. Development must be carried out generally in accordance with Development Application received 12 October 1994, and as amended by additional information titled "Environmental Impact for Present and Future Operations - Additional Information to Support the Environmental Impact Statement" dated July 1995, "Bat Survey" dated 8 March 1996, and "Report on Leachate Disposal by Injection into Existing Waste" dated October 1996 except where modified by the undermentioned conditions.

2. The existing chain wire security fencing along the entrance route to the site and along Kimbriki Road is to be replaced. This fence is to be maintained at all times to prevent unauthorised access.

3. Trees located adjacent to the areas proposed for future expansion work are to be protected. Proposed means of protecting these trees are to be included in the Environmental Management Plan.

4. Written records shall be kept showing tonnages, origins and fill area of waste loads.

5. Suitable cover material shall be spread over the active landfill face at the end of each operating day. The type and depth of cover is to be to the satisfaction of the Environment Protection Authority.

TRAFFIC

The following conditions have been imposed to minimise the impact on the surrounding road network.

6. The following road works at the intersection of Mona Vale Road and Kimbriki Road are to be carried out in accordance with Roads and Traffic Authority and Council specifications prior to the closure of the Bare Creek landfill:

   i) the right turn bay is to be lengthened to accommodate the peak right turning traffic volumes in five years.
   ii) Kimbriki Road is to be widened to provide an additional north bound lane from the site entry to Mona Vale Road. The additional lane shall be designated an exclusive left turn lane into Mona Vale Road.

7. 25% of the cost of traffic signals required for the intersection of Kimbriki Road and Mona Vale Road are to be contributed. This money is to be put into a trust fund until signals are required.

8. A second inbound lane is to be constructed along the access road to the gatehouse. This work is to be carried out at the applicants expense and prior to the closure of Bare Creek landfill.

9. Appropriate signage is to be erected at the entrance to the site on Kimbriki Road. The signs are to clearly direct landfill traffic into the site and are to be to the satisfaction of Council.

THE ENVIRONMENT

The following conditions have been imposed to protect the environment.

10. An Environmental Management Plan shall be prepared and submitted to Council and the EPA by May 1997. The plan shall consider the issues raised in the EPA's

Warringah Council

Environmental Guidelines for Solid Waste Landfills. The plan shall include but not be limited to describing:

- i The staging of waste placement (ie waste filling plan showing cell locations and timing), over the life of the landfill.
- ii The staging of quarrying operations over the life of the landfill.
- iii The overall drainage plan showing locations and sizing of storm drains, culverts, sedimentation ponds and related infrastructure.
- iv The leachate management plan.
- v All environmental and occupational health & safety controls, including those required by these conditions of consent.
- vi A long term post closure plan.
- vii Any other details required by these Conditions of Consent.

11. No expansion of the existing operations shall be undertaken until the Environmental Management Plan is approved by Council, the EPA, and other relevant authorities.

12. The Environmental Management Plan shall be updated following major changes to operations or relevant guidelines or legislation, or other circumstances set out by Council or the EPA.

13. An Annual Performance Report covering all matters relating to landfilling and quarrying operations and the topics considered by the Environmental Management Plan shall be submitted to Council and the EPA by December each year.

14. The Environmental Management Plan shall give details of the reporting to be provided in the Annual Performance Report.

15. In addition to the aforementioned Environmental Management Plan, a Landfill Environmental Management Plan (LEMP) shall be prepared in accordance with the EPA's Environmental Guidelines for Solid Waste Landfills and shall be submitted to the EPA by December 1997 or as otherwise stated in writing by the EPA.

16. The Environmental Management Plan is to include details on any archaeological sites on or near the site including a survey of all potential archaeological deposits and the necessary measures to protect the sites if required.

17. Portable screens or mobile fencing shall be used downwind of the operating face of the landfill to capture litter. Screens shall be cleaned daily.

18. A litter capturing device (such as shadecloth fencing or an enclosure) shall be installed downwind and to the east of the recycling area, provided that traffic movement is not impeded.

Warringah Council

19. Fortnightly litter collection patrols shall be undertaken around the perimeter of the landfill site.

20. A small access track running around the outer perimeter of the landfill site shall be constructed to allow litter and weed control.

21. Vehicles hauling recyclables, composting material and other matter from the site shall be enclosed or covered.

22. The landfill shall only accept waste of the type specified as "Solid Waste Class 2" in the EPA's Environmental Guidelines: Solid Waste Landfills, page 54, January 1996.

23. Signage at the entrance to the landfill shall clearly state unacceptable waste types and fines associated with the dumping of such wastes at the depot.

24. Random load inspections shall be undertaken at a frequency to be determined by Council and specified in the Environmental Management Plan. Load inspections shall be undertaken by spreading a load of material across the ground so that the contents are visible. The contents shall then be checked for unacceptable wastes.

25. Gatehouse operators and load inspectors shall be trained to identify unacceptable wastes.

26. The Environmental Management Plan shall set out fines to be imposed on household, council and commercial carriers who attempt to dump unacceptable wastes at the site.

27. There shall be no composting of green waste - only stockpiling and shredding of green waste shall be carried out on site.

28. A leachate management plan shall be detailed in the Environmental Management Plan and shall include:
i)A description of leacheate management controls over all phases of the life of the site including the sizing and location of treatment/recirculation facilities, pumps, pipework, leachate holding ponds and related infrastructure.
ii)Estimates of leachate volumes over the life of the site following installation of improved surface water drainage
iii) Justification of the capacity of leachate management infrastructure

29. Detailed design of the leachate management system for control of the existing landfill operations shall be submitted to Council and the EPA by March 1997. The approved leachate management system shall be operational within at least 4 months of Council approval. The leachate capture system shall be installed to sufficient depth to capture all leachate migrating downstream.

Warringah Council

30. Overflow of the combined leachate/stormwater in the cirrent leachate holding pond may be spray irrigated on the green waste processing area only until the aforementionaed leachate management system for control of the existing landfill is operational.

31. Leachate treatment shall be carried out by deep well injection (as described in "Report on Leachate Disposal by Injection into Existing Waste" dated October 1996 and associated reports) until monitoring indicates that the system is not adequate or best practice technology indicates that a superior system should be installed to the satisfaction of Council and the EPA.

32. Effectiveness of the leachate injection system shall be monitored by:

    i Monthly checking of the landfill area and batters for leachate springs.
    ii Daily monitoring of the quantity of leachate recirculated through the system.
    iii Monitoring of the quality of the leachate recirculating through the system. The frequency and type of testing required shall be set out in the Environmental Management Plan to the satisfaction of Council and the EPA.

33. Written records shall be kept of the leachate monitoring described above and shall be detailed in the Annual Performance Report.

34. Leachate reinjection wells shall be protected from interference from weather, equipment or persons. Covers shall be installed to minimise odour emission and prevent the ingress of rain.

35. The active tipping area shall be minimised to reduce water infiltration and production of leachate.

36. Temporary capping shall be used to minimise water infiltration where areas of the landfill are inactive (yet incomplete) for lengthy periods.

37. The existing pipework under the site which carries leachate and stormwater shall be blocked off to prevent the dilution of leachate with stormwater.

38. Back up leachate holding storage shall be provided to avoid release of leachate to the environment in the event of a system failure. The capacity of this storage shall be to the satisfaction of Council and the EPA.

39. Leachate pits and holding ponds shall be suitably lined to prevent leakage into the surrounding environment.

Warringah Council

40. Monitoring of local creeks shall be detailed in the Landfill Environmental Management Plan and shall be carried out to the satisfaction of Council and the Environment Protection Authority.

41. Progressive rehabilitation of filled areas shall be detailed in the Environmental Managemetn Plan and shall undertaken to the satisfaction of Council, and with the aim of minimising water infiltration, dust, odour, disease vectors and adverse aesthetic impact.

42. Details of landfill gas monitoring during all stages of operation and post-closure shall be included in the Environmental Management Plan.

43. Results of landfill gas monitoring shall be detailed in the Annual Performance Report.

44. If the results of landfill gas monitoring show significant gas movement or concentrations unacceptable to Council or the EPA, a landfill gas collection and treatment system shall be installed. This system must satisfy Council and the EPA or other relevant authority.

45. Details of groundwater monitoring during all stages of operation and post-closure shall be included in the Environmental Management Plan. Groundwater shall be monitored at points both upstream and downstream of the landfill to allow assessment of the landfill impact.

46. Results of groundwater monitoring shall be detailed in the Annual Performance Report.

47. If groundwater monitoring shows contamination unacceptable to Council or the EPA, a groundwater collection and treatment system shall be installed. This system must satisfy Council and the EPA or other relevant authority.

48. All environmental monitoring shall be undertaken by a laboratory registered with the National Association of Testing Authorities for the relevant tests. If NATA registered laboratories are not available to carry out certain procedures, the testing authority shall be approved by Council.

49. A Longterm Closure Plan considering erosion and surface drainage; stormwater collection and treatment; gas and leachate collection and treatment; groundwater quality; environmental monitoring; landscaping; ground settlement; final land forms; and end land use shall be prepared and included in the Environmental Management Plan to the satisfaction of the EPA and Council.

50. The Longterm Closure Plan shall be updated as required by the EPA, Council, or as required by major changes to operations or relevant legislation or guidelines.

Warringah Council

51. The landfill surface shall be inspected every quarter for settlement areas. Any settled areas shall be filled and re-graded to prevent ponding of surface water.

52. The management of quarrying operations shall meet all relevant guidelines and policies of the NSW Department of Mineral Resources.

53. Sedimentation controls, dust controls, flyrock controls and noise mitigation measures for all periods of quarrying operations shall be described in detail in the Environmental Management Plan.

54. Sedimentation controls, dust controls and noise mitigation measures shall meet the requirements of Council and the EPA for all periods of quarrying operations.

55. Details of vibration, blast, dust and noise monitoring for each period of quarrying shall be provided in the Environmental Management Plan and shall meet the requirements of Council, the EPA and the Department of Mineral Resources.

56. Results of vibration, blast, dust and noise monitoring for each period of quarrying shall be recorded in writing and summarised in the Annual Performance Report.

57. Any fuel or explosives stored on-site for quarrying shall be appropriately bunded and stored according to the relevant Dangerous Goods guidelines.

58. Stockpiling of overburden, topsoil and quarried materials shall be detailed in the Environmental Management Plan.

59. Safety precautions to be undertaken during quarrying (and especially during blasting) shall be detailed in the Environmental Management Plan and shall meet the approval of Council and the Department of Mineral Resources. Precautions to be considered shall include: isolation of the quarrying area from normal landfill operations, safety equipment for workers, and flyrock safety precautions.

60. Quarrying shall be limited to the areas identified as 2 and 3 and 4b in the Environmental Impact Statement.

61. An independent assessment of the conservation value of the Forest she-oaks in area 4a shall be undertaken prior to consideration of quarrying in this area, as set out in the Environmental Impact Statement. Quarrying shall only occur in area 4a with the approval of Council.

62. A minimum buffer zone of 20 metres to the site boundary shall be maintained around quarrying operations, except for the southern side of the water quality management area where a buffer of 10 metres shall be maintained.

STORMWATER DRAINAGE

The following conditions have been imposed to ensure that the drainage collected on and/or passing the site is conveyed through a controlled system to minimise any impact on the subject land or downstream properties.

63. Stormwater drainage plans shall be detailed in the Environmental Management Plan to the satisfaction of Council and the EPA.

64. Site perimeter stormwater controls shall be installed to minimise run-on from surrounding catchment areas.

65. Stormwater controls shall be installed around the active face of the landfill to collect runoff from the tipping surface.

66. Stormwater controls shall be installed around quarry areas.

67. Sedimentation controls such as fencing and hay bales shall be installed where appropriate in order to minimise silt flow to the sedimentation basins.

68. Run-off from the green waste area shall be directed to the leachate treatment system unless monitoring shows that the run-off is suitable for diversion to the sedimentation ponds according to relevant water quality guidelines and the EPA.

69. Sedimentation basins with the capacity to handle all site run-off shall be installed to the satisfaction of Council and the EPA.

70. Energy dissipation measures shall be installed at the outlet of the basins to minimise scouring of the creek bed or other receiving environment.

71. The output of the sedimentation basins shall be monitored according to the requirements of Council and the EPA. Monitoring shall include volume and contaminant data, and results shall be displayed in the Annual Performance Report. Details of the monitoring program shall be set out in the Environmental Management Plan.

THE LANDSCAPE

The following condition has been imposed to ensure adequate provision is made for landscaping and open space in association with the development and the protection of existing trees.

72. Details of ongoing landscaping of filled and closed areas shall be described in the Environmental Management Plan and shall meet the approval of Council.

Warringah Council

Landscaping shall be in harmony with the surrounding National Parks and shall use local native species where possible. Landscaping plans shall also take into account the hostile environment of a closed landfill, and the final planned use of the site.

73. A plan addressing the control of subsurface and surface fires within the landfill and bushfire hazards shall be detailed in the Environmental Management Plan. Bushfire hazards shall also be considered.

AMENITY

The following condition has been imposed to protect the amenity of the area.

74. Hours of operation are restricted to 6.00 am to 6.00 pm Monday to Friday and 7.00 am to 5.00 pm Saturday and Sunday for general operation of the landfill. Construction activities are limited to 7.00 am to 6.00 pm Monday to Friday, 8.00 am to 1.00 pm Saturday and no work on Sunday.

75. Noise emissions for construction activities are to be addressed in the Environmental Management Plan. The plan is to provide details of noise mitigation strategies to reduce noise from construction activities.

76. Noise levels from the sites operations are not to exceed 45dB(A) as measured at the nearest residential boundary.

77. All earth moving equipment and mechanical plant is to be fitted with residential class exhaust systems.

78. The Environmental Management Plan for the site is to detail dust mitigation strategies to reduce nuisance dust. The plan should include community liaison, actions to reduce dust and monitoring procedures. It must also provide details of a dust monitoring program to quantify dust fallout at the nearest affected residences.

R Kent
Director Services Group

per:

Date: 17.1.97

NCIL REFERENCE NO. 4D432

APPLICANT — BLOCK LETTERS

NAME JOINT SERVICES COMMITTEE COMPRISING THE COUNCILS OF WARRINGAH, PITTWATER, MANLY & MOSMAN

POSTAL ADDRESS:
C/- WARRINGAH COUNCIL
CIVIC CENTRE
PITTWATER ROAD
DEE WHY NSW 2099

PHONE — PRIVATE: N/A

BUSINESS (OFFICE HOURS): (02) 9982 0333

Postal address for notices and correspondence

All applications must be accompanied by a statement on the environmental effects of the proposed development and on the measures proposed to overcome any adverse effects. Some of the matters which should be addressed include noise, operating hours, traffic, parking, effect on adjacent development etc. Additional details may be attached in a separate document. In the case of designated development (as defined), an environmental impact statement must be submitted.

Land Description Check

SUBJECT LAND — BLOCK LETTERS

STREET NAME KIMBRIKI ROAD

NO. (INCL. UNIT NO.)

SUBURB/LOCALITY INGLESIDE & TERREY HILLS

REAL PROPERTY DESCRIPTION

LOT/PORTION	SECTION/PARISH	DP/FP
LOT 3		DP 794191
LOT 10		DP 822376
LOT 2 & LOT 4		DP 255466
LOT 2		DP 577611

It is essential that a complete real property description be provided. Council may require the submission of a Certificate of Title or a recent survey where, in Council's opinion, the details provided by the applicant are incorrect or inadequate.

Provide the full name(s) and postal address of the person(s), company, partnership or trust owning the land to which the application relates. Where the land is owned by more than one person or by a company etc., the person signing on behalf of the company etc. must print his/her name and state the capacity in which or authority by which the consent is signed, e.g. Director, Secretary, joint owner on behalf of, etc. Council may request documentary evidence of authority to sign.

Development Description Check

PROPOSED DEVELOPMENT

DESCRIPTION OF DEVELOPMENT

Proposed development described in detail, Chapter 3 of the accompanying EIS. Existing development also described. In summary, proposed development includes
- Continued use as a non-putrescible landfill.

Describe in full the development proposed to be carried out

Development includes:
- the erection of a building
- the carrying out of a work
- the use of the land, building or work
- subdivision (including strata subdivision)
- where the development involves the erection of a building, the use of that

5 3 5

T.S. Ricc

225 603

booklet

[ENVI]RONMENTAL IMPACT

[A] detailed account of potential environmental [i]mpacts and proposed mitigation measures are [in] the accompanying E.I.S. The following issues [des]cribed.

[Chapter] 2: Project justification, assessment of alternatives and economic analysis.

[Chapt]er 4: Hydrology and water quality.

(Chapter 5: Flora fauna and land management

[C]hapter 6: Noise air and traffic

Chapter 7: Aboriginal archaeology.

Environmental Impact
Adjacent Statement ☐
Attached Statement ☐
E.I.S. (Designated Development) ☐
Check

APPLICATION

I/we, the undersigned, being the applicant(s) nominated in this application, hereby apply to carry out the development described in this application on the land specified in this application. I/we have read the explanatory notes for completing this application contained on this form and understand that if all required details are not provided, the application may be subject to delay or be rejected as incomplete. I also understand that Council may request more information or clarification.

[signature]	MANAGER	12.10.94
SIGNATURE(S)	CAPACITY/AUTHORITY	DATE

Applicants Signature Check

CONSENT OF OWNER(S) OF LAND

NAME(S) OF OWNER(S) OF LAND WARRINGAH COUNCIL

POSTAL ADDRESS CIVIC CENTRE, PITTWATER ROAD DEE WHY 2099

NAME(S) OF SIGNATORY(IES) (PETER PMP 27/9/94)

I/we, the undersigned, being the owner(s), nominated above, of the land to which this application relates, or having the authority to sign on behalf of the owner(s), hereby consent to the making of this application.

[signature]	DIRECTOR TECHNICAL SERVICES	12.10.94
SIGNATURE(S)	CAPACITY/AUTHORITY	DATE

Owner(s) of Land Check

Owner(s) Consent Check

CHECK LIST FOR APPLICANT

This is provided for your assistance. Check that you have:

1. Filled in all the details required on this form. ☐
2. Attached 4 copies of plan(s) of the subject land. ☐
3. Attached 4 copies of plan(s) of the proposed development. ☐
4. Paid correct fee. ☐
5. Provided the consent of the owner(s) if you are not the owner(s) of the land ☐

Plan Check

Correct Fee Check

CAT 3

35

STATUTORY D.A. No.: 600

DATE RECEIVED:

ESTIMATED COST:

ASSESSED FEE:

FEE RECEIPT No.:

ACTION OFFICER: 30/11

TARGET DATE:

Narrabeen Lagoon C'ttee (see Erick for contact)

COMMENTS: Advert per regs. Notify Refer DOP (for assessment & display) Waste Disposal Auth, NPWS, RTA (traffic - SEPP 11), Dept Min Resources, EPA, CALM, H & C

Check History. We need 10-15 more copies

~~[illegible]~~. Visual?

Final Check (Manager)

Appendix P
Warringah Council in Principle Acceptance of Offset Security Process

Warringah Council

Civic Centre 725 Pittwater Road
Dee Why NSW 2099
DX 9118
Telephone (02) 9942 2111
Facsimile (02) 9971 4522

Website www.warringah.nsw.gov.au
Email council@warringah.nsw.gov.au
ABN 31 565 068 406

1 February 2011

Mr Aaron Hudson
Chief Executive Officer
Kimbriki Environmental Enterprises Pty Limited
Locked Bag 6
Terrey Hills NSW 2084

Dear Aaron

Re: Proposed Biodiversity Offset Strategy

I refer to the biodiversity offset strategy proposed to the Department of Planning by Kimbriki Environmental Enterprises Pty Ltd (**KEE**) as part of KEE's application under Part 3A of the *Environmental Planning and Assessment Act* 1979 in respect of the Kimbriki Resource Recovery Project (**Project**).

Thankyou for the information provided at our meeting on 25 January 2011 and in your recent correspondence regarding this matter.

I understand the background to the matter to include the following:

- KEE wishes to undertake the Project on the premises known as the Kimbriki Recycling and Waste Disposal Centre, or the Kimbriki Resource Recovery Centre, (**Site**) which is leased by Council to KEE pursuant to a lease dated 2 July 2009 (**Lease**).

- The Project requires the removal of approximately 5.75 hectares of moderately disturbed vegetation and the affected area contains one vulnerable plant species (being Tetratheca glandulosa) and potential habitat for two threatened fauna species (being the southern brown bandicoot and spotted-tailed quoll)

- The Department requires that KEE compensate for this loss of habitat and vegetation. Offsetting is considered to be the most appropriate way of doing this and the preference of the Department of Environment Climate Change and Water is for other areas on the Site to be offset in perpetuity.

- To compensate for the loss of habitat resulting from the project, KEE proposes that 14.75 hectares of land on the Site be offset as per the Figure 12 – Offset Strategy prepared by GHD (**Proposed Biodiversity Offset Strategy**). At this stage, the Department of Planning requires an indication that Council is aware of the Proposed Biodiversity Offset Strategy and is broadly supportive of it. KEE will then investigate the most appropriate mechanism for the process and present it to Council for consideration.

I am pleased to advise that Council is aware of the Proposed Biodiversity Offset Strategy and is broadly supportive of it in principle, subject to the approval of Council's governing body and the following conditions:

1. KEE is to bear all costs and expenses in connection with the Proposed Biodiversity Offset Strategy (including, without limitation, Council's legal, survey and valuation costs associated with the preparation, negotiation and execution of the necessary documentation; compensation at market value for the land affected by the Proposed Biodiversity Offset Strategy; and, the maintenance costs in perpetuity for the Proposed Biodiversity Offset Strategy).

2. Without limiting 1 and for the avoidance of doubt, KEE will be required to provide funding for the Proposed Biodiversity Offset Strategy for the period after the expiration or termination of the Lease. Further, Council requires appropriate arrangements for the funding for the Proposed Biodiversity Offset Strategy in the event that KEE ceases operation (whether because it is wound up or otherwise). Accordingly, KEE must demonstrate in due course the mechanism/s for the funding of the Proposed Biodiversity Offset Strategy in perpetuity.

3. All land affected by the Proposed Biodiversity Offset Strategy is within the boundary of the Site and is subject to the Lease. KEE will at its cost do all things necessary to enable any necessary amendments to the Lease in relation to the Proposed Biodiversity Offset Strategy. However, KEE is not entitled to any reduction in rent payable by it under the Lease as a result of the Proposed Biodiversity Offset Strategy.

4. The form and terms of the legal mechanism proposed to implement the Proposed Biodiversity Offset Strategy are satisfactory to Council.

5. KEE will at its cost do all things necessary to enable the reclassification of the land affected by the Proposed Biodiversity Offset Strategy to community land, should Council wish to undertake such a reclassification.

I trust that this letter meets the requirements of the Department of Planning. However, please do not hesitate to contact me if you have any queries or require any further information.

Yours sincerely

Rik Hart
General Manager