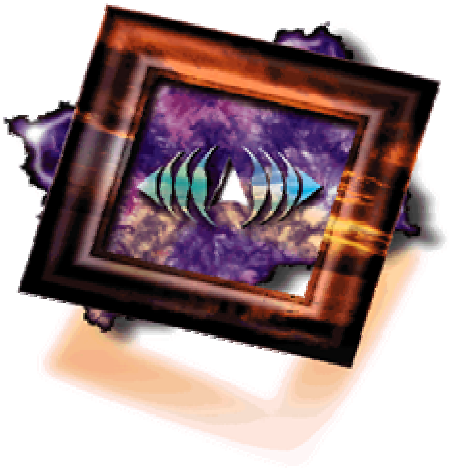
Appendix K

SOCIAL SUSTAINABILITY REPORT - CATHERINE HILL BAY AND MOONEE

PO Box 210
Islington 2296
Tel: 02 49616441 Fax: 02 49614996
E-mail: edm@keyinsights.org



Catherine Hill Bay (Deep Cave Bay)

Gwandalan

Social Sustainability Report

Prepared By

Ellen Davis-Meehan
Julia Cook
Key Insights Pty Ltd

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Overview

This social sustainability research report is in three main sections each addressing proposed development of land owned by the proponent, Rosecorp, in Catherine Hill Bay and Gwandalan. The first section of the report maps the area of influence for both sites and details social infrastructure servicing the area as well as addressing the key influences of The Lower Hunter Strategy and socially sustainable housing. The second section specifically addresses the proposed rezoning and residential development of a parcel of land at Catherine Hill Bay. The third section deals with Lot 3 DP 588206, Kanangra Drive Gwandalan. This research draws on demographic analysis, document review and qualitative research with local stakeholders. The research spans from August 2004 to October 2006. Records of previous community consultation undertaken prior to August 2004 were also analysed together with the outcomes of consultations conducted more recently on the proposal.

The proponent's land at both Catherine Hill Bay (Lake Macquarie and Wyong LGAs) and Gwandalan (Wyong LGA) are geographically close. Each township is located less than fifteen minutes drive from the other and the proximity of these two sites means that many services and facilities are common to both. The geographic area of influence for the purpose of understanding social infrastructure capacity for this report extends from Newcastle to Gosford. While a separate SIA has been prepared for each development, a single map detailing the social infrastructure and services has been provided and forms Section 1 of this report.

The Gwandalan site is currently zoned 7(b) Scenic Protection. However, it has been identified in Wyong Council's residential development strategy as Precinct 1(a), Gwandalan North. This identifies the site to be developed into approximately 270 lots, with a medium term priority.

The total area of the Catherine Hill Bay site is approximately 374 hectares. The proposal aims to develop approximately 60 hectares of the site (including roads), leaving 314 hectares for bushland conservation and secondary wildlife corridors.

Plans for the Catherine Hill Bay site include a residential village with up to 600 dwellings, in low density configurations. This scenario represents full development of the site; however, it is proposed that this occur in stages.

Population Projections Catherine Hill Bay

This report also provides a likely overview of the incoming population for the Catherine Hill Bay site, using Census data to compare NSW and Wyong LGA with two similar coastal village locations, Hawks Nest and Blueys Beach/Pacific Palms.

Key Insights projects that the age profile of the proposed development is likely to mirror, approximately, that of the Pacific Palms and Hawks Nest communities. That is, a higher proportion of people in the older age brackets, and fewer young people. One factor contributing to this will be the substantial costs associated with purchasing quality coastal housing. The self-contained coastal ambience of the proposal will also appeal to older couples in first stage retirement and "sea changers". The rate of unoccupied dwellings

typical of the Pacific Palms and Hawks Nest coastal villages (18%) is also taken into account when making population projections for the proposal.

Assuming an age profile similar to the Pacific Palms population, approximately 20.6% of new residents will be under the age of 15[1]. **This equates to an influx of approximately 227 children / young people.**

In 2001 at Pacific Palms, 8.3% of the entire population was attending infants/primary school. Using this figure, **the projected number of children attending primary school from the completed development would be 91.**

The proportion of the Pacific Palms population attending a secondary school in 2001 was 9.4%. **This figure gives a projected number of 104 young people attending high school from the completed development.**

The new population would also include a number of children under 5 years old. According to the 2001 census, 6.4% of the Pacific Palms population were under 5 years old. **This equates to a projected 71 children under 5 years of age in the completed development.**

The attractiveness of the new development to seniors will depend on the types and levels of services offered within Catherine Hill Bay. While first stage retirees can be very mobile, as they age they may become a lot less mobile and so require most services to be close by, or at least for there to be convenient public transport options. The type of housing created will also influence the demand from senior residents. Assuming that the development attracts seniors in the same proportion as the Pacific Palms average, 19.8% of the new residents would be aged 65 or over. **This equates to approximately 218 people.**

Projected Population Characteristics Catherine Hill Bay

	Estimated % of Population	*At full development (600 dwellings)*	*At half development (300 dwellings)*
Children under 5	6.4%	71	35
Children under 15	20.6%	227	114
Attending Primary School	8.3%	91	46
Attending High School	9.4%	104	52
Residents over 65 years	19.8%	218	109
Total Population		**1102**	**551**

Population Projections Gwandalan

The report also provides a likely overview of the incoming population for the Gwandalan site.

Key Insights projects that the age profile of the proposed development is likely to mirror, approximately, that of the existing Gwandalan / Summerland Point communities. The reason

[1] BCP: Table B03.

for this is that the demographic profile revealed for Gwandalan / Summerland Point shows, in many ways, a more "standard" suburb than the unique profile of Catherine Hill Bay. There is no reason to assume that this will change dramatically in the future, although the population will no doubt be subject to broader ongoing trends, such as an aging population.

Assuming an age profile similar to the existing population, approximately 24.0% of new residents will be under the age of 15[2]. **This equates to an influx of approximately 167 children / young people.**

In 2001 at Gwandalan/Summerland Point, 11.6% of the entire population was attending infants/primary school. Using this figure, **the projected number of children attending primary school from the completed development would be 81.**

The proportion of the Gwandalan/Summerland Point population attending a secondary school in 2001 was 6.1%. **This figure gives a projected number of 43 young people attending high school from the completed development.**

The new population would also include a number of children under 5 years old. According to the 2001 census, 7.5% of the Gwandalan/Summerland Point population were under 5 years old. **This equates to a projected 52 children under 5 years of age in the completed development.**

The attractiveness of the new development to seniors will depend on the types and levels of services offered within the area. While first stage retirees can be very mobile, as they age they may become a lot less mobile and so require most services to be close by, or at least for there to be convenient public transport options. The type of housing created will also influence the demand from senior residents. Assuming that the development attracts seniors in the same proportion as the Gwandalan/Summerland Point average, 16.3% of the new residents would be aged 65 or over. **This equates to approximately 114 people.**

Projected Population Characteristics Gwandalan

	Estimated % of Population	*At full development (312 dwellings)*
Children under 5	7.5%	52
Children under 15	24.0%	165
Attending Primary School	11.6%	81
Attending High School	6.1%	43
Residents over 65 years	16.3%	114
Total Population		**698**

[2] BCP: Table B03.

Combined Population Projections

The table below shows the projected populations for Catherine Hill Bay and Gwandalan, and the aggregated estimate populations.

	Catherine Hill Bay: At full development (600 dwellings)	*Gwandalan: At full development (312 dwellings)*	*Total: Combined Populations*
Children under 5	71	52	123
Children under 15	227	165	392
Attending Primary School	91	81	172
Attending High School	104	43	147
Residents over 65 years	218	114	332
Total Population	**1102**	**698**	**1800**

Qualitative Research

Qualitative research undertaken for this project has identified some strong negative sentiment associated with the Catherine Hill Bay proposal from a number of community groups in the area. However, this negative sentiment was expressed before the dedication of the majority of the Catherine Hill Bay site to conservation. In an interview conducted this year with leaders of the Catherine Hill Bay Progress Association it was stated that their opposition to the proposal was not based on potential negative social impacts. They identified concerns about inconsistency with Council zoning, inconsistency with state and regional planning objectives, heritage concerns and overdevelopment concerns. The Catherine Hill Bay Board Riders Club also raised the issue of overdevelopment and expressed concerns with the town's road, beach and village infrastructure.

The proposed development for Gwandalan, with some 312 dwellings, is far less contentious in the local community. After extensive community consultation when the original social opportunities and constraints research was undertaken in 2004, significant social opportunities were identified in partnership with the Gwandalan Primary School, including creating a "Learning Community" and pursuing community development opportunities within the new sub-division. It also emerged that community members wanted to consolidate the existing town centre rather than create a fragmented dispersal of commercial facilities. Therefore, the proponent has not included any plans for retail or commercial development at Gwandalan. In contrast, older members of the Catherine Hill Bay community remember when Catherine Hill Bay had a Post Office, a General Store and other commercial activity and many older residents have a strong desire to see their village thrive rather than decline. The planned commercial centre for the Catherine Hill Bay site is in part a response to that desire, as well an attempt to create a vibrant focus for village life and to deliver amenity to new residents.

Social Infrastructure and Employment

Wyong Council's Residential Development Strategy identifies two tests that are important in the consideration of rezoning land for residential development. The tests are relevant to this paper and have been investigated accordingly:

1. Whether the rezoning can improve the viability of services (such as public transport, general community service and local convenience services); and
2. Whether the rezoning can provide local employment opportunities.

These two tests go to the heart of social sustainability; where are the gaps in social infrastructure, how will this proposal be able to develop local capacity and where are the employment opportunities? Wyong Council has specific concerns regarding the creation of, or further development of 'isolated communities', and these concerns have impacted upon the decision to proceed with the rezoning of the Gwandalan site in the short term. Our investigations unpack the issue of 'isolation', and question whether Gwandalan and Catherine Hill Bay are indeed physically isolated, and if so, if this physical isolation translates into social isolation. The paper also looks at isolation in the light of moving towards greater self-sufficiency, and holds that rezoning of the proposed development sites would serve to stimulate the internal dynamics of the community in both a social and economic sense. However, for this process to have optimum positive effects, it must be carefully planned and implemented.

From the projected population figures stated above it is clear that the main social infrastructure challenge will be education and in particular school facilities in the medium to long term. **Over time there will need to be improvements in access to public transport (and a shift in community usage patterns), local accessible medical services and expansion of education facilities.** There is an opportunity to creatively address education needs through the development of a "Learning Community", centred on Gwandalan, but including the Catherine Hill Bay site.

The Social Impact Assessments for both Gwandalan and Catherine Hill predict a net positive impact for the communities if the developments were to go ahead. Community development planning and a social strategy will be essential to the success of these developments. With attention to education, transport and medical services the wider area has the capacity to meet the demand created by the increase in population. The wider area will also benefit from related economic growth associated with construction and increased consumer demand.

Key Insights has identified the potential positive social impacts of the development of both sites to be:

- Creation of larger, more vibrant and diverse Catherine Hill Bay and Gwandalan communities.
- Economic stimulus through population growth and housing construction.
- Increased trade and employment in the surrounding area through supplying the higher-order needs of Catherine Hill Bay and Gwandalan residents and visitors.
- Jobs during the construction phase estimated at nine jobs per $1M in construction costs. These jobs would include a range of trades including excavation, landscaping, builders, tilers, roofers, concreters, plumbers,

electricians etc.
- Multiplier effects throughout the region because of construction employment.
- Jobs in the supply industry as a result of construction activity.
- Increased availability of land for housing in the Wyong LGA.
- Enhancement of housing options and lifestyle housing for existing local residents, and people from regional NSW and Sydney.
- Extension of community services, commercial facilities and infrastructure due to increased demand.
- Attractive open space / public space through landscaping existing degraded land for the new Catherine Hill Bay village centre and associated areas.
- Contribution to the social mix of Catherine Hill Bay and Gwandalan areas, therefore helping to maintain a sustainable community. Increased population may provide critical mass for establishment of community facilities and interest groups.
- Potential to target key social groups, active retirees and "sea-changers".
- Increase in eligible volunteers for community service.
- The opening up of a private road to public ownership therefore maintaining two accesses to Catherine Hill Bay from the Pacific Highway.
- Re-use of Catherine Hill Bay degraded former mining site.
- Revitalisation of Gwandalan Town Centre due to increased population utilising existing business and services.

The potential negative social impacts of the rezoning are:

- Resistance from existing community, particularly in Catherine Hill Bay where there is some strong community opposition.
- Division between new communities and existing communities particularly if there are insufficient community development strategies implemented.
- Stress on Gwandalan Primary School.
- Increased noise in the local area, particularly during excavation / construction.
- Increased traffic on the local road system (impacting on amenity for residents).
- Contribution to longer-term stress on government funded and medical services, if extra services are not provided proportionate to increased population levels.

In order to enhance the positive impacts and mitigate the negative impacts of the proposal Key Insights suggests the following for consideration:

- The proponent continues dialogue with the Catherine Hill Bay and Gwandalan communities to ensure existing residents are kept informed.
- That the proponent develop a community development strategy, along the lines of successful strategy they have already employed at their Breakfast Point development in Sydney, to assist integration of the new and existing residents.
- The proponent give consideration to a small convenience outlet within the commercial centre to be constructed within the Catherine Hill Bay site as this will enhance convenience for locals and visitors.
- That one of the on-site professional suites be earmarked for a small medical facility, perhaps offering basic GP services and other therapeutic services. There may be an opportunity to establish a trial "nurse practitioner" service.

- That the proponent offers some incentives to attract operators to the commercial offices/shopfronts during the early stages of the development when the number of residents may not be adequate to support such businesses.
- Encourage the use of local contractors during the subdivision and construction stages.
- Keep the NSW Department of Education and other appropriate government departments informed as the development proceeds so that adequate planning can occur.
- Advice be sought from Catherine Hill Bay Surf Life Saving Club regarding appropriate signage and management of Moonee Beach given that there will most likely be an increase in the number of people who will use the beach recreationally.
- Establish Gwandalan as a 'learning community' that also outreaches to Catherine Hill Bay.

On balance, it is the view of the researchers that the net social and economic benefit of the proposal outweighs the potential negative social impacts. It is considered that the incoming community of Catherine Hill Bay will be largely self sufficient, won't be socially or physically isolated and will place low but manageable demand on existing services. In Gwandalan's case, an increase in population with an accompanying increase in facilitated social programs or other services, would *increase* the efficiency and self-sufficiency of local facilities, mitigate existing social issues such as youth unemployment and enhance the quality of life for residents in general.

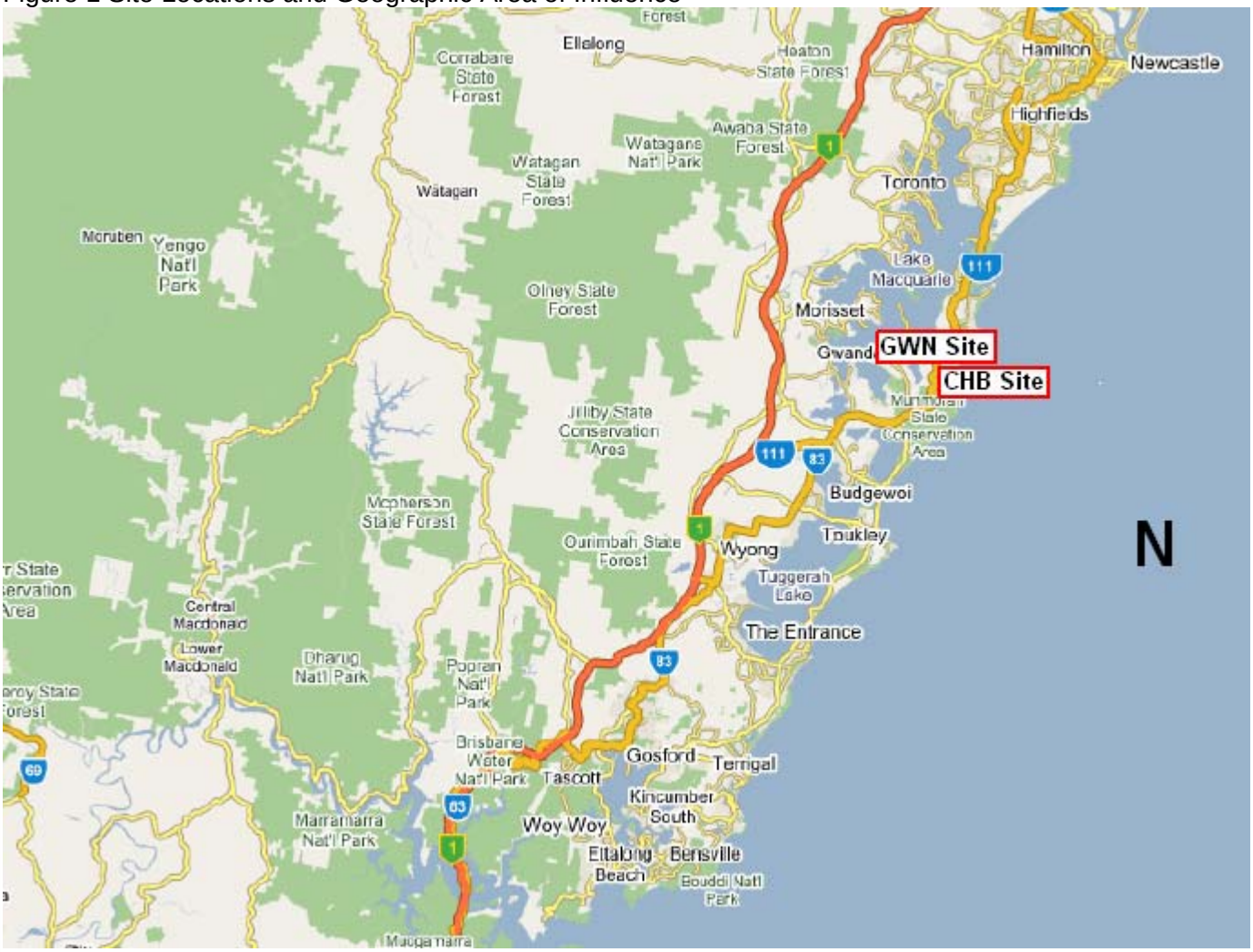
While there is local resistance to population growth, there would certainly be strong uptake of residential lots by people seeking the lifestyle and amenity afforded by this development.

SECTION 1: Social Infrastructure and Capacity

1. Introduction

The proponent's land at both Catherine Hill Bay and Gwandalan are geographically close, each township is located less than fifteen minutes drive from the other. The proximity of these two sites means that they have in common a range of services and social infrastructure. To accurately account for the features common to both developments, the geographic area of influence identified for this report extends from Newcastle to Gosford. Both locations are well serviced while over time there will need to be improvements in access to public transport (and a shift in community usage patterns), local accessible medical services and expansion of education facilities. The development of these sites must be seen in the wider context of social infrastructure challenges for the lower Hunter arising from the Lower Hunter Regional Strategy.

Figure 1 Site Locations and Geographic Area of Influence



2. Services and Facilities

Residents of both Catherine Hill Bay and Gwandalan experience access to a wide range of social infrastructure and facilities. These services may be accessed within the borders of Wyong or Lake Macquarie Local Government Areas. A key to all symbols and facilities and their corresponding numbers is listed below Figure 4.

Figure 1 Services and Facilities Regional View

Figure 1 provides a regional view of the social infrastructure and facilities available in the geographic area of influence. More localised maps for each of the locations can be seen in Figures 3 & 4.

Figure 3 Local Services and Facilities – Catherine Hill Bay

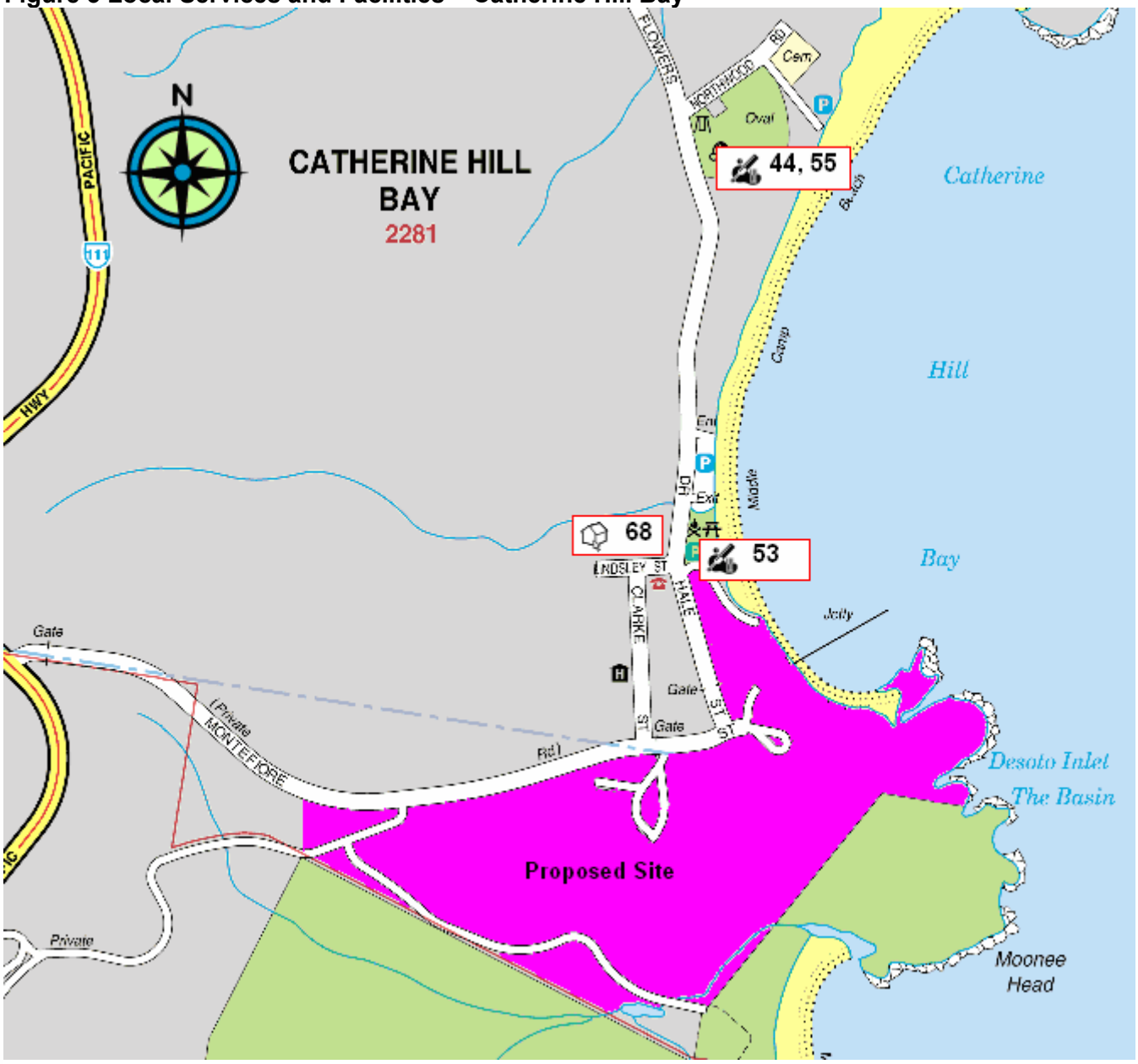
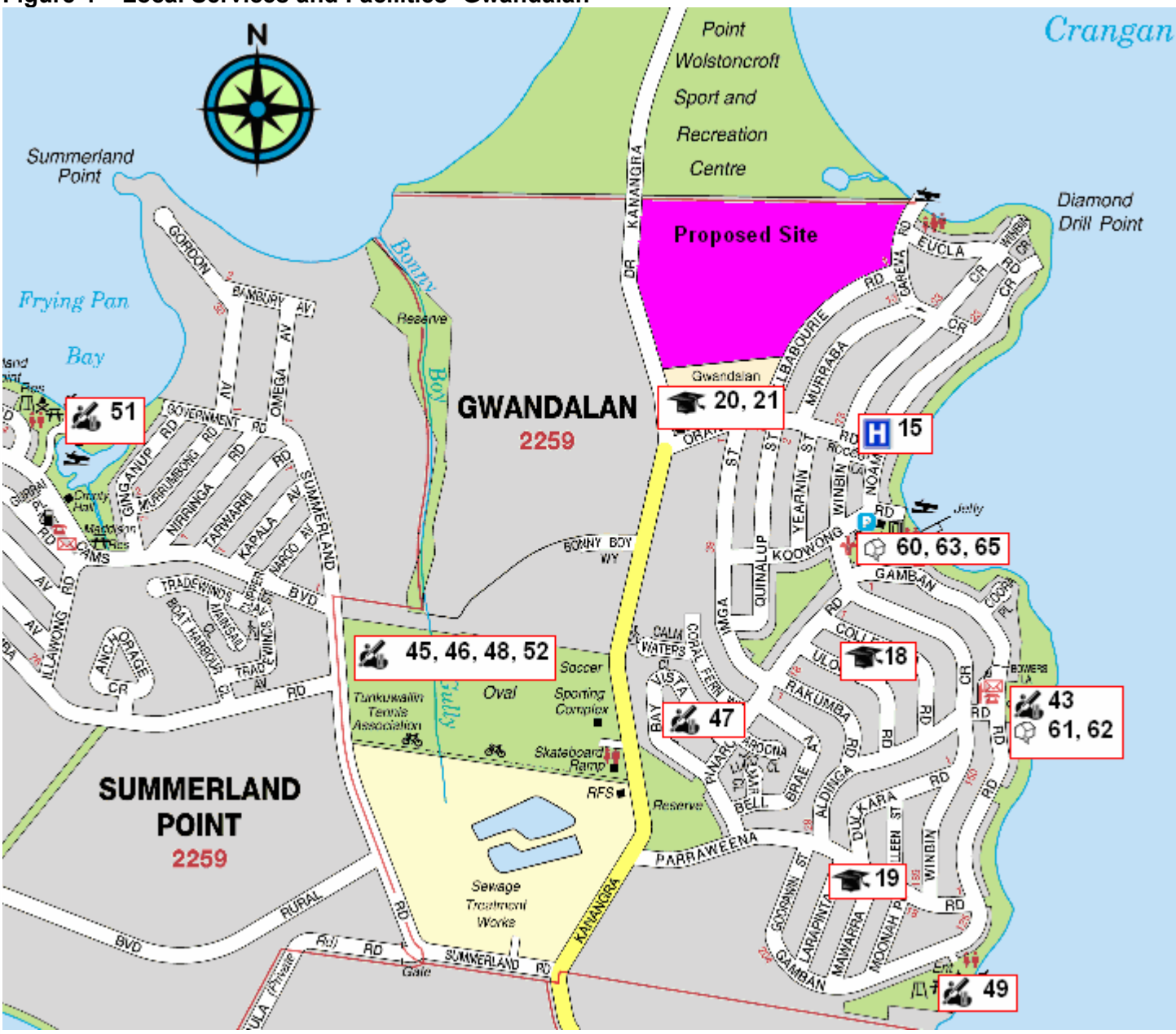


Figure 4 – Local Services and Facilities- Gwandalan



2.1 Education

Key Insights is of the view that, in the initial stages of the development, the proposal at both Catherine Hill Bay and Gwandalan will not place excessive strain on education facilities. However, at the completion of all stages and in conjunction with other current/proposed developments, **there will need to be consideration given to an additional school or expansion of current education facilities.** A full list of education facilities (pre-school – tertiary) and their corresponding number on the map and address follows. Distances from the proposed sites to key school locations also appear in the specific school section below.

Education

18	Gumnut Grove Preschool	Pre-school 3-5years	10 Ulooloo Rd, Gwandalan
19	Gwandalan Pre-school	Long Day Care 0-6years	U10/ 50 Parraweena Rd Gwandalan
20	Gwandalan Public School	Infants &Primary School	Kanangra Drive, Gwandalan
21	Gwandalan Outside School Hours Care	After school care	27 Orana Rd, Gwandalan
22	Lake Munmorah High	High School	Carters Road, Lake Munmorah
23	Lake Munmorah Public School	Infants and Primary School	Pacific Hwy, Lake Munmorah
24	St Josephs Primary School	Infants and Primary School	Carters Rd, Lake Munmorah
25	First Steps Children's Centre	Day care 0-6 years	Elizabeth Bay Drive, Lake Munmorah
26	Lake Munmorah Pre-school	Pre-school 3-5years	44 Diane Street, Lake Munmorah
27	St Patrick's Primary School	Infants/Primary School	Northcote Ave, Caves Beach
28	Caves Beach Uniting Pre-school	Pre-school	52 Park Ave, Swansea
29	Nords Wharf Community Pre-school	Pre-school	44A Government Rd, Nords Wharf
30	Nords Wharf Public School	Infants/Primary School	Marine Pde, Nords Wharf
31	Swansea High School	High School	Park Ave, Caves Beach
32	Swansea Public School	Infants and Primary School	Rawson St, Swansea
33	Swansea Pre-school Kindergarten	Pre-school	19 Milray Street, Swansea
34	University of Newcastle Callaghan Campus	Tertiary Education Facility	Callaghan
35	University of Newcastle Ourimbah Campus	Tertiary Education Facility	Brush Road, Ourimbah
36	Hunter Institute – TAFE Wyong Campus	Technical and Further Learning	Porter Street, Wyong
37	Hunter Institute – TAFE Ourimbah Campus	Technical and Further Learning	Brush Road, Ourimbah
38	Hunter Institute- TAFE Gosford Campus	Technical and Further Learning	Cnr Henry Parry Drive & Margin Street
39	Hunter Institute –TAFE Hamilton Campus	Technical and Further Learning	91 Parry St, Hamilton East
40	Hunter Institute- TAFE Hunter Street Campus	Technical and Further Learning	590-608 Hunter St, Newcastle
41	Hunter Institute –TAFE Newcastle Campus	Technical and Further Learning	Maitland Rd, Tighes Hill

42	Hunter Institute- TAFE Belmont Campus	Technical and Further Learning	647 Pacific Hwy, Belmont

2.1.1 Childcare

The projected incoming population, particularly for the Catherine Hill Bay site, is expected to comprise a smaller than average proportion of children under 5 years of age. This characteristic combined with the relatively small increases in population mean that there will not be a significant extra demand placed on local childcare services. Key Insights' previous research in the Swansea area reveals that childcare providers are stretched, but coping[3]. This is a common situation across most regional and metropolitan areas. The federal budget outlined on May 9th 2006 indicated that the government would remove the limit on the number of subsidised outside school hours care and family day care places. The Government predicts that this measure will see childcare places grow by 25,000 by 2009.

The qualitative research results in the Gwandalan area[4] found that one childcare service was currently running at capacity, another childcare service reported as running at only 50% of its total capacity with the ability to extend even beyond its current total capacity.

Future planning of childcare services in the area will be able to factor-in the increases in population as the development progresses through its stages.

2.1.2 Schools

Within the geographic area of influence, many choices exist for both public and private school education.

The local primary school at Gwandalan is currently at capacity with enrolment numbers at 430. The school was built in 1991 to cater for 250 students. It makes use of demountable buildings to house students. There are also state primary schools at Lake Munmorah and Swansea.

Secondary school students from Catherine Hill Bay may choose to attend either Lake Munmorah (to the south) or the nearby Swansea High. There is a low-fee Anglican school for K-12 that is located in Warnervale and was formerly located at Summerland Point. Incoming residents of the proposal at both Catherine Hill Bay and Gwandalan may reasonably access this private school facility. Mr. Ron Way, Principal, Swansea High School reports that the school has the capacity to respond to incremental increases in population. Lake Munmorah High School has added to the overall capacity of the region in recent years (see interview in Section 2). The closest secondary education facility for residents of Gwandalan is Lake Munmorah High.

The distance from the proposal sites at Catherine Hill Bay and Gwandalan to the centres most likely to be travelled to for education purposes may be seen below.

Site	Swansea	Lake Munmorah	Warnervale
Catherine Hill Bay	9km	14km	32km

[3] Interview with Susan Jenkins, Community Planner, Children and Community, LMCC. 2005.
[4] October 2006

Gwandalan	20km	8km	27km

To allow adequate planning for changes to enrolment numbers it is recommended that the Department of Education and relevant school bodies are kept informed of the progress of the proposal.

2.1.3 Further Education

Residents of the proposal may access one of the campuses of the University of Newcastle for face-to-face delivery of courses at either Callaghan (Newcastle) or Ourimbah (Central Coast). The Ourimbah site is an integrated campus with University, TAFE and Community Adult Education. The closest campus of TAFE to the north is Belmont campus (29 kilometres). There is opportunity to access flexible delivery modes through a learning centre at Gwandalan.

3. Health

3.1 General Practitioners and Hospital Facilities

The nearest major referral centre for both Catherine Hill Bay and Gwandalan is the John Hunter Hospital, located 40km to the north. It is a significant regional facility.

Belmont Hospital is the closest acute facility, located 29 kilometres to the north; it is a 75 bed hospital providing general medicine, surgery, specialist services, a 24-hour emergency department, and a range of allied health services.

The After Hours G.P. Access Service has several locations for consultations, the nearest to both developments being situated in the grounds of Belmont District Hospital. It outreaches to the areas concerned and the Urban Division General Practice reports that the Hunter has the best availability of out-of-hours GP service in the Australia.[5] Other medical services, including nearby Central Coast Area Health (Catherine Hill Bay to Wyong: 34 kilometres. Gwandalan to Wyong: 28 Kilometres), are as follows:

Health

1	Wyong Hospital	Acute Facility	Pacific Hwy, Hamlyn Terrace
2	Gosford Hospital	Acute Facility Principal Referral Service, Central Coast	Holden Dr Cnr Racecourse Rd, Gosford
3	Belmont District Hospital	Acute Facility	Croudace Bay Road, Belmont
4	John Hunter Hospital	Acute Facility Principal Referral Service, Hunter Region	Look out Road, New Lambton Heights
5	North Gosford Private Hospital	Private Hospital/ Day Surgery	Burrabil Ave, Gosford

[5] Dr Annette Caruthers, Board Member, Hunter Urban Division of General Practice. October 2006.

6	Long Jetty Healthcare Centre	Continuing Care Unit	Wyong Road, Killarney Vale
7	Child & Family Health	Community Based Health Service	237 Mann Street, Gosford
8	Wyong Central Community Health Centre	Community Based Health Service	38A Pacific Highway Wyong
9	Wyong Community Health Centre	Community Based Health Service	Pacific Highway , Hamlyn Terrace
10	Swansea Early Childhood Health Centre	Infants/Childhood Health Centre	Grounds of Belmont District Hospital, Croudace Bay Rd, Belmont
11 12 13 14	GP Access After Hours	After Hours Primary Medical Care	JHH, Belmont Hospital, Toronto Polyclinic, Newcastle Community Health Centre
15	Lakeside Surgery	Doctors Surgery	1 /4 Orana Rd, Gwandalan
16	Swansea Medical Centre	Doctors Surgery	45 Josephson St, Swansea
17	Caves Beach Medical Surgery	Doctors Surgery	15 Strathmore Rd, Caves Beach

There is an apparent shortage of general practitioners in both Wyong (1:1,500[6]) and Swansea (East Lake Macquarie 1:1,533[7]). The Commonwealth Department of Health's guide for good doctor-to-patient ratios is 1:1,100 to 1:1,200. The shortage of general practitioners, however, is not only an issue for Wyong and Swansea, it is a national issue.

Key Insights believes that, in the initial stages, the Catherine Hill Bay and Gwandalan proposals will not place excessive strain on the medical infrastructure of the area. The initial increases in population represent very small proportional changes in doctor/patient ratios. Additionally, the projected population, particularly in Catherine Hill Bay, is expected to be affluent and highly mobile. These characteristics ensure that residents will be able to secure access to appropriate medical facilities.

As the development at Catherine Hill Bay reaches full completion, however, there may be the opportunity for the establishment of a medical facility on-site. In addition to a GP, the projected "actively-aging" population may provide demand for a range of associated therapeutic services such as massage, chiropractic, podiatry and naturopathy.

4. Public Transport

Public transport is often reported as limited on this south-eastern side of the Lake; however this is a consequence of demand and private car ownership patterns rather than a function of capacity.

[6] Wyong Community Plan 2002
[7] Hunter Urban Division of General Practice 2006

Busways operates three Route 99 services each way through Catherine Hill Bay on weekdays. Route 99 links Catherine Hill Bay with Charlestown to the north and Lake Haven to the south. Wyong can be accessed by a transfer at Lake Haven. There are typically two services each day, both ways, Monday to Saturday, while no services operate on Sundays. These services utilise Montefiore and Clarke Streets. During the development of the initial stages, most residents will be within an acceptable walking distance of the existing route, where appropriate bus stops could be installed. The provision of bus stops and shelters should be discussed by the proponent and Wyong Council.

Upon completion of the final stages, some Catherine Hill Bay residents will be living up to 750m south of Montefiore Street, therefore, an acceptable road system may be required for buses to travel through the development.

Gwandalan is also serviced by the Busways company, transporting people to the north and south. Wyee station is the nearest train station, followed by Wyong Station. No Busways services go from Gwandalan to Wyee as it is only a minor station. Wyong station has about twice the frequency of trains to Sydney as does Wyee. Therefore, Wyong station is the focal point for all Busways' services from Gwandalan. Busways' services are timed to connect with the Wyong railway timetable.

The future frequency of service and route selection will be influenced by the Ministry of Transport which is currently negotiating contract areas with bus operators on the Central Coast.

5. Commercial Facilities

Catherine Hill Bay is currently poorly serviced in terms of commercial and retail facilities. Residents and visitors are required to do their shopping elsewhere. The last remaining business in Catherine Hill Bay is the local pub. In the past, Catherine Hill Bay was a vibrant mining village, providing a range of services, but these have declined in recent years with the winding-up of mining activity. Gwandalan has immediate access to petrol, convenience shopping and a local pharmacy.

The nearest larger centres for residents to do their shopping are at Swansea or Lake Munmorah, which offer:

Supermarket, e.g. Coles
Range of retail shops, such as butchers
Range of services, such as hairdressers
Range of banks and financial institutions
Restaurants/cafes
Tourism activities such as SCUBA diving and boat hire

More extensive shopping-mall facilities are also available in both Lake Macquarie and Wyong LGAs, notably at Westfield Tuggerah and Charlestown Square. These centres are accessible via public transport.

The proposal offers the opportunity for the establishment of some commercial premises in Catherine Hill Bay to serve both the existing and incoming community. It is likely that Gwandalan residents would also access the Catherine Hill Bay commercial facilities if they

complemented what is already offered in Gwandalan. These facilities are likely to supply predominantly lower order, "convenience" style goods. The village will also attract service and hospitality industry businesses, for example a café, supplying goods and services for locals and visitors. Such businesses may be heavily reliant on visitor trade, especially during the staged construction of the development. The proponent may wish to examine start-up incentives for businesses to attract tenants.

6. Recreational and Community Facilities

Gwandalan and Catherine Hill Bay border Australia's most favoured coastal recreation facilities – large water masses in the form of Lake Macquarie and the Pacific Ocean. These afford sailing, boating, water skiing, fishing, surfing and passive recreation activities. Organised activities are provided through the NSW Department of Sport and Recreation's Point Wollstonecraft site that borders the proposed Gwandalan development and through voluntary community organisations within Catherine Hill Bay. Sporting fields including soccer ovals, tennis courts and skateboard ramp are available at Gwandalan and Swansea with a Council owned swimming pool and a variety of walkways and parks in Swansea as well. A more comprehensive listing of the sporting and recreation facilities that may be enjoyed by residents of both Catherine Hill Bay and Gwandalan are as follows:

Sporting/ Recreation

43	Gwandalan Bowling Club	Sporting/Social Club	Gamban Rd Gwandalan
44	Catherine Hill Bay Bowling Club	Sporting/Social Club	Flowers Dr, Catherine Hill Bay
45	Tunkuwallin Tennis & Sports Club Limited	Sporting Club	Lot 4 DP263 812, Summerland Rd, Summerland Point
46	Gwandalan Skate Park	Sporting Facility	Kanangra Drive, Gwandalan
47	Gwandalan Swim School	Sporting Facility/Club	16 Bay Vista Way, Gwandalan
48	Tunkuwallin Oval	Sporting Ground	Kanangra Drive, Gwandalan
49	Lions Park	Playground, BBQ and Picnic facilities	Gamban Rd, Gwandalan
50	Sandy Beach Reserve	Playground, BBQ and Picnic facilities	Kullaroo Road, Summerland Point
51	Summerland Point Reserve	Playground, BBQ and Picnic facilities, Boat Ramp, Jetty	Cams Boulevarde, Summerland Point
52	Heritage Walk	Cycleway / Bushwalk	Gwandalan to Summerland Point
53	Catherine Hill Bay Surf Life Saving Club	Sporting Club	Off Flowers Drive, Catherine Hill Bay
54	Catherine Hill Bay Boardriders Club	Sporting Club	6 Berncla Ave, Nords Wharf

55	Catherine Hill Bay Oval	Sporting Ground	6 Northwood Rd, Catherine Hill Bay
56	Chapman Oval	Sporting Ground	Channel Street , Swansea
57	Parbury Park	Sporting Ground	Marks St, Swansea
58	Caves Beach Netball Courts	Sporting Facility	104 Park Ave & Strathmore Rd, Caves Beach
59	Swansea Horse & Riders Club	Sporting Club	Off Strathmore Close, Caves Beach

Community infrastructure in Catherine Hill Bay is quite considerable, given the small number of actual residents. The Surf Lifesaving Club, the Bowling Club and the Catherine Hill Bay Board Riders Club have significant membership numbers, most of whom are from nearby towns. Gwandalan is reasonably well served in terms of community infrastructure with local groups utilising the local bowling club, Gwandalan Community Hall and Summerland Community Hall as their meeting places. Wider interests can be met by accessing community groups in nearby Swansea.

Community

60	Gwandalan Combined Pensioners & Superannuants Association	Seniors Social Group	Gwandalan Community Hall
61	Lioness Club of Gwandalan Inc	Social Group	Gwandalan Bowling Club
62	Lions Club of Gwandalan	Social Group	Gwandalan Bowling Club
63	Wyong Shire Library Services – Gwandalan Branch	Library	Gwandalan Community Hall
64	Swansea Library	Library	228 Pacific Hwy, Swansea
65	Gwandalan Community Hall	Community Facility	Koowong Rd, Gwandalan
66	Summerland Point Community Hall	Community Facility	Cams Blvd, Summerland Point
67	Gwandalan/Summerland Point Community Precinct Committee	Community Group	Summerland Point Community Hall
68	Catherine Hill Bay Progress Association	Community Group	17 Lindsay Street, Catherine Hill Bay
69	Swansea Community Cottage	Community Centre	228-234 Pacific Hwy, Swansea
70	The Swansea Centre	Community Hall	228 Pacific Hwy Swansea
71	Craft & Social Group	Social Group	St Stephen's Presbytery Hall,

			Macquarie St, Swansea
72	Neighbour Aid Inc.	Community Organisation	Josephson St, Swansea
73	Plan-IT Youth Mentoring	Community Organisation	Swansea
74	Retired Mine-workers Association	Community Group	Swansea Bowling Club, Swansea
75	Swansea Ladies Probus Club Inc.	Community Group	2/8 Galgabba St, Swansea
76	Swansea Men's Probus Club Inc.	Community Group	Po Box 100, Swansea
77	Swansea Meals on Wheels	Community Service	26 Josephson Street, Swansea
78	Nords Wharf Community Hall	Community Facility	Marine Parade, Nords Wharf
79	Camp Kanangara Scouts Camp	Scout Group	Branter Street, Nords Wharf

An increase in population in the area will result in a larger pool of potential members and volunteers for these and other groups. Additionally, the proposal contains significant allowance for construction of new "hard" community infrastructure, for example open space areas, cycleways and community hall.

Residents of the proposal may chose to attend a place of worship. The places of worship that share a close proximity to both Catherine Hill Bay and Gwandalan are predominantly Christian based, which matches the current demographic profile. An extensive range of religious preferences are catered for in the larger centres of Belmont and Wyong. The closest places of worship are listed in the table below.

Places of Worship

80	Catholic Church	Religious organisation	167 Park Ave, Caves Beach
81	Anglican Church	Religious organisation	28 Jospehson St, Swansea
82	Anglican Church	Religious organisation	15 Strathmore Rd, Caves Beach
83	Summerland Community Baptist	Religious organisation	Koowong Rd, Gwandalan
84	Uniting Church	Religious organisation	52 Park Ave, Caves Beach

Emergency Services

The NSW Ambulance Service has stations located at; Belmont, Doyalson, Toukley and Wyong. The nearest station for Catherine Hill Bay is located Belmont, 16km away. While the closest ambulance station for Gwandalan is 13km away in Toukley.

The NSW Rural Fire Brigade has stations located in close proximity to both of the proposed sites. Nords Wharf is the closest station to Catherine Hill Bay, being located 6km away. Gwandalan has its own Rural Fire Brigade located in the township itself.

The NSW Police Force has a station located at Swansea, which is 9km and 19km away from Catherine Hill Bay and Gwandalan respectively. This is the closest station for both sites of the proposal. However, Toukley station to the south is also of a similar distance from Gwandalan.

7. Lower Hunter Regional Strategy, 2006, NSW Department of Planning

The available social infrastructure and future capacity challenges need to be considered within the context of The Lower Hunter Regional Strategy (LHRS), which replaced the draft document (DLHRS) which was released in November of 2005.

This document (LHRS) has been developed by the NSW Department of Planning with the primary aim of ensuring that adequate land is available and appropriately located to sustainably accommodate the projected housing and employment needs of the region's population over the next 25 years. This strategy is based on the projection of population growth forecasts which indicate that the Region will grow by an additional 160,000 people by 2031.

In the foreword, The Honourable Frank Sartor MP, Minister for Planning, emphasises the following aims of the strategy:

- Ensure that sufficient employment lands are available to cater for 66,000 new jobs
- Plan for an additional 160,000 residents and 115,000 new dwellings
- Establish important green corridors, to protect and even enhance the Region's strong environmental and biodiversity assets

The strategy states that population growth has been closely associated with the costal areas of the region. The strategy outlines the population and housing challenges faced by the region, which are to:

- provide sufficient land and development opportunities for the future growth of the population
- achieve higher residential densities in-and-around major centres to maximise proximity to employment and services and the use of existing infrastructure, while maintaining amenity
- provide housing choice and affordability in the right locations reflecting changes in population and associated reduction in household occupancy rates
- ensure quality urban design and amenity that is sensitive to and complements the character and lifestyle of the Region's towns and new urban areas
- refocus the housing industry in the region to increase the amount of total housing provided in the existing urban areas so that a more sustainable balance between the need for new greenfield releases and the ability of existing urban areas to meet housing demands is created
- provide a framework for planning and delivering new and upgraded regional infrastructure and facilities for the growing population and ageing demographic.

The Catherine Hill Bay and Gwandalan proposals contribute to this planning strategy by increasing the available housing for the anticipated population growth. **It is hoped that they will also be able to capitalise on state government social infrastructure spending associated with the Lower Hunter Regional Strategy.**

The location of both sites being nestled around the existing townships of Catherine Hill Bay and Gwandalan is also in keeping with the aims of the LHRS. The clustering of the developments around the existing townships has the potential of revitalising the commercial

sector of Gwandalan as well as promoting a more efficient use of the existing social infrastructure and services, such as public transport, in both Catherine Hill Bay and Gwandalan alike.

8. Socially Sustainable Housing

A socially sustainable community is one that is socially balanced, socially inclusive, self-regenerative and ecologically sustainable. Housing that supports social sustainability must respond to a wide range of social needs and lifestyle choices.

The process of master-planning a large scale land release allows an opportunity to ensure that the housing needs of the incoming population are met, but also an opportunity to shape the new population for optimum social sustainability via provision of attractive and diverse housing choices.

Housing that supports the creation and maintenance of socially sustainable communities includes:

- Housing that is diverse and offers options to a wide range of housing groups.
- Housing that is adaptable to changing lifecycles and family structures, and supports a range of family life – larger ones for families, sheltered ones for older people, flexible and affordable for one-parent families.
- Housing that is affordable and attractive to all, including low and moderate income groups.
- Housing that is designed upon principles of ecological sustainability, lowers ecological footprint and does not contribute to urban sprawl (e.g. waste recycling, energy efficiency, car usage, BASIX).
- Housing that enables optimum achievement of sustainable lifestyles amongst occupants.
- Housing that is located in areas that are accessible to local services and facilities.
- Housing that responds to a range of needs arising from lifecycle stage, income levels, health status, family type and relationship structures.
- Housing that responds to individual lifestyle choices, aspirations and interests.
- Housing that is well connected, physically, socially and virtually - to other homes, to other people, to social resources.

Local real estate agents have reported that demand is strong at the lower end and higher ends of the market. Realistically it will be difficult to provide lower-end housing in Catherine Hill Bay given the market prices of land there. However, in both locations it will be important

to consider the key sustainability factors detailed above and address affordability across both developments as far as is possible.

Defining Low to Moderate Incomes Housing Groups

According to the NSW Department of Housing's Centre for Housing Affordability[8], low and moderate income household groups are defined according to their position relative to the gross annual median income of an area, specifically:

- Households receiving less than 50% of this gross median income are said to be in receipt of very low incomes.
- Households receiving between 50% and 80% of median income are categorised as low-income earners.
- Households on incomes between 80% and 120% of the median are considered moderate-income earners.

Table 7 shows the Centre for Housing Affordability's figures for very low to moderate income groups for Sydney and elsewhere in NSW[9]:

Table 1 Defining Very Low to Moderate Income Groups (Centre for Housing Affordability)

	Definition	Sydney	Elsewhere in NSW
Very Low	Less than 50% of median	Less than $30,035	Less than $19,224
Low	50 – 80% of median	$30,036 - $48,056	$19,224 - $30 758
Moderate	80 – 120% of median	$48,057 - $72,084	$30,759 - $46,137

Any affordable housing strategy developed for the new release has to take into account these figures as well as the needs of specific groups within the community.

[8] http://www.housing.nsw.gov.au/Centre+For+Affordable+Housing/Frequently+Asked+Questions/ ACCESSED: 27 OCT 2006

[9] The Centre for Affordable Housing advises that it uses Sydney Greater Metropolitan statistics for its 'Sydney' figure and general NSW statistics for 'elsewhere in NSW'. It does not use the ABS' 'balance of NSW' figures as they are comparatively low and generally not appropriate to coastal NSW where much of the states development is occurring.

Housing Needs of Key Social Groups

Housing Group	Population Projections	Typical Characteristics	Housing Needs	Social Risk / Implications
Lone Persons	Lone-persons projected to be fastest growing household in Australia, particularly lone female households (ABS). Lone persons to be part of a broader target market for any higher density housing on the site (Feasibility study).	Highly mobile Often older or younger. Influenced by gender: Females tend to be older, males younger. Least ecologically sustainable due to increased energy use per resident.	Smaller and low maintenance homes Energy efficient homes Easy meeting places Virtual communities Initiatives to increase ecological sustainability, bartering schemes, carpooling, appliance/tool 'library'	Social group most at risk of not accessing site product, even with an affordability scheme targeting moderate income groups. Almost ¾ at risk of unable to access proposal. (Moderate income and below). Potential for alternative affordability scheme, targeting lower rather than moderate incomes, or different eligibility brackets for lone person households.
Couples with Children	Projected to decline as a proportion of family and household types (ABS). Declining levels	May comprise intact, step or blended families. Majority (60% NSW) both parents employed - the older the youngest	Higher number of bedrooms Safe private play areas. Optimum natural surveillance of common play areas (urban design).	Least at risk of not being able to access development. However, Highest likely demand, so there is a social need

	of children decreasing household sizes, and relationship breakdown influence trends.	child, the more likely both parents employed *(ABS Family Characteristics Australia.4442.0 2006)* High aspiration toward home-ownership. *(Housing Aspirations of Australian Households. AHURI, 2001)*	Proximity to green spaces, schools, and playgrounds Ability to respond to changing ages and stages of children, e.g. rooms that can convert between bedrooms, studies, and share-rooms. Driveways with good vision & clear delineation between car access and play areas. Paths for scooters, bicycles, etc Innovative design e.g. common play areas i.e. fence free back yards. Road structures with traffic calming devices and wide footpaths. Housing that facilitates home-ownership (as opposed to unreasonable debt).	arising from demand. Site locations excellent for families with children. Child Friendly community development will address needs and attract families – focus on education and "learning community".
Couples without	2nd fastest growing	In many ways, most flexible social	Less housing space needs but preferences	Empty-nesters identified as important market for any

Children	household group in Australia Expected to overtake couple families with children as the dominant family type by 2025.	group and can match their needs to a number of housing types. Primary constraints appear to be income, lifestyle choice and the effects of aging. May soon become couples with children	may remain with bigger homes. Smaller manageable homes for empty nesters. Housing that adapts to lifecycle shifts – i.e. Birth of child - if not in same home, at least in same housing stock.	higher density housing. Couples without children often older and may contribute to pressure on medical and older peoples' infrastructure.
One Parent Families	Projected to continue to increase in Australia The number of children aged 0-14 years and living in one-parent families is projected to increase from the existing 19% to between 23% and 33%, by the year 2025. Children aged 25 years and	Highly mobile – more likely to move More likely to rent Considerably lower income levels (2003 Australian median income $412 compared to $1167 couple families Less likely to live in separate housing compared to couple families with children.	Smaller lots and dwellings – easy to maintain and affordable. Housing that is close to public transport and schools. Housing that is flexible to respond to changing family structures: e.g. re-partnering, custody/access changes. Housing that is attractive to investors, but of high quality construction and design, for good rental stock.	Key social group for moderate income housing product. At risk of not accessing these developments without affordability scheme. Quality rental market with good tenure will be important for this highly mobile group. Site location excellent for families with children.

	older living with a parent also to increase. Many will be adult children living with an ageing parent. *(ABS Household and Family Projections 2001 – 2006)*	Lake Macquarie one parent families more likely to live in higher density compared to Sydney. Affordability key driver In 2003, 52% of NSW lone parents were employed and just over half employed full time. with children)	Sufficient bedrooms, with some adaptable for use by flatmate/extended family Housing offering good social networks and supportive communities. Bulk-billing health services Private housing ownership Other needs similar to couples with children	
Older People and Retirees	Increasing nationally due to aging population. Older people and empty nesters are a target market for higher density dwelling.	Proximity to lifestyle options may attract retirees looking for a location in which to retire.	Adaptable/universal design Smaller lots Less stairs to allow for decreasing mobility Quiet outdoor spaces for sitting Easy to access utilities, wheelie bins Housing should be located within 400m of services and/or bus route to services *(SEPP*	Risk of increasing pressure on medical and older people's social infrastructure.

			Senior Living)	
Non-resident Parents	As one parent families rise, non-resident parents will rise also.	Majority live in family households, primarily as a husband, wife, or partner. ¼ quarter live alone. Most (82%) are fathers	Adaptable housing – changing family needs, re-partnering etc. Multi-function rooms i.e. rooms that can double as a study/children's bedroom. Supportive communities	Non resident parents likely to be ineligible for moderate housing scheme. Flexible design and supportive communities may be best way of assisting needs.

SECTION 2: Catherine Hill Bay

1. Introduction

This section provides a social impact assessment that specifically addresses the proposed rezoning and residential development of a parcel of land on the former Moonee mine site, nearby the coastal hamlet of Catherine Hill Bay, with a population of less than 196 residents[10]. The site is just within the Wyong LGA, nearby the border of Lake Macquarie. Urban Concept Plans have been prepared that give due weight to design and address the constraints and opportunities presented by the site. The established infrastructure and low ecological value represent a significant brownfields development opportunity.[11]

Plans for the site include a residential village with up to 600 dwellings (the original SIA was for 900 dwellings and much of the qualitative research for this report refers to that upper limit), with 12 dwellings per hectare.

This Social Impact Assessment takes a broad view of the development and assesses its likely impacts on the community at full completion.

Key research methods included:

- Demographic analysis and population projections – This included comparative analysis of NSW, Wyong LGA, Hawks Nest and Pacific Palms. As small coastal villages, the Hawks Nest and Pacific Palms profiles yield insights into the possible future makeup of the Catherine Hill Bay community.
- The Development of facilities and services map inclusive of both Catherine Hill Bay and Gwandalan (See Section 1).
- Assessment of likely interaction of development with existing community culture and likely provision of valued services to the public.
- Review and analysis of previously conducted community consultation.
- Interviews/meetings with a number of key community stakeholders.
- Assessment of and recommendations about, features of the development that enhance benefits or mitigate potential negative impacts.

2. The Development

2.1 Site Description

The site is located on the site of the old Moonee mine, nearby the small coastal village of Catherine Hill Bay. The total area of the site is approximately 374 hectares. The proposal aims to develop approximately 60 hectares of the site (including roads), leaving 314 hectares for bushland conservation and secondary wildlife corridors.

[10] In the 2001 Census, there were 196 residents of the broader collector district 112240. This includes Catherine Hill Bay, Middle Camp and rural areas. This area is the smallest unit of analysis from the census.

[11] Asquith and De Witt, statement of Environmental Effects April 2005, page 6.

Source: Asquith and De Witt, Statement of Environmental Effects, April 2005, p 5.

2.2 Proposed Use

The proponent seeks to develop their site located at Catherine Hill Bay. This development, to be constructed in stages, will consist of predominantly lower density housing, plus a range of infrastructure including roads, open space, commercial space and recreational facilities.

2.3 Access and Traffic

The site is situated in Catherine Hill Bay, off Montefiore Street. Catherine Hill Bay is accessed off the Pacific Highway, either by way of Flowers Drive, or Montefiore Street, part of which is a private road owned by Coastal Hamlets Pty Ltd. Part of the proposal is to dedicate this section to public ownership. From the Pacific Highway, road access is convenient to Newcastle to the north, and the Central Coast and Sydney to the south.

Public transport is limited in the Catherine Hill Bay area. A private bus service, Busways, offers services in the area, but these are somewhat infrequent. Route 99 links Catherine Hill Bay with Charlestown and Lake Haven. Wyong can be accessed by a transfer at Lake Haven. There are typically two services each day, both ways, Monday to Saturday, while no services operate on Sundays.

2.4 Assessment of Economic Impacts

This subdivision will provide land for housing, which will increase Wyong's and Lake Macquarie's capacity for population growth. There is a general link between population growth and economic growth, and this will especially be the case, considering the affluence of the demographic that this development is likely to attract. Wyong Council's Social Atlas[12] identifies population "*growth pressures which are inextricably linked to Sydney*". This feeds the demand for more residential land and in turn, the population growth and building activity stimulates the economy.

[12] www.wyong.nsw.gov.au/wyongshire/social_atlas Chapter 3, p 40.

The establishment of this proposed development will provide:

- **Employment** during the road and lot construction stage, most likely through contracted local earthmoving and road construction companies.
- **Employment** in the commercial areas and community facilities.
- **Stimulus to the building and housing industry across a range of trades** during the housing construction stage, which is likely to occur over a period of a number of years, with flow-on effects to all sectors of the economy. **Construction jobs are estimated at nine jobs per $1M of construction costs.**
- **Stimulus to other businesses and groups in the existing Catherine Hill Bay Village** such as the Pub, Bowling Club and Surf Club.
- **Stimulus to businesses in the surrounding areas.** The increased population will lead to increases in demand for nearby businesses. This will be more the case for goods and services that will not actually be available on-site at Catherine Hill Bay.
- **Potential to stimulate new sectors, particularly those linked to a growing coastal community and related new facilities, as well as sectors associated with coastal tourism.**

3. Demographic Profile and Population Projections

3.1 Preamble

This section of the report has been prepared in order to provide a likely overview of the incoming population. This type of profile is usually built around census data from the surrounding area. The proposal offers some challenges in this regard.

Firstly, the site of the proposal is geographically isolated from other considerable communities. It seems unlikely to exhibit a similar demographic profile to the existing population of Catherine Hill Bay. It is located at the extremity of Wyong LGA, and may not necessarily exhibit the same predominant characteristics of the Wyong LGA community.

Secondly, current Census data is nearing the end of its useful life. The most recent available Census data is from 2001, five years ago. Since then, considerable changes have manifested themselves in Australian communities, and this has occurred very strongly along the Eastern Coastline. A property boom through much of the last five years has drastically changed the coastline, through soaring land prices. In past decades, sleepy coastal villages, many including a beachfront caravan park for camping families and retirees in caravans, have typified the East Coast. This is no longer the norm, with many coastal locations experiencing redevelopment with medium density accommodation.

In order to address the hurdles facing the projection of a likely population, a two pronged approach has been taken in the following section. Firstly, Census data is used to compare NSW and Wyong LGA with two coastal village locations, Hawks Nest and Blueys Beach/Pacific Palms. Notwithstanding the constraints listed above, these profiles yield some insights into the type of community that is likely to be drawn to coastal living. Secondly, the report offers comments of a more qualitative nature, drawing upon recent trends and changes in the nature of coastal living in New South Wales. These comments identify areas where the projected population may differ substantially from the historic coastal villages' data.

3.2 Statistical Sourcing and Overview

This demographic profile analyses the residential populations of Hawks Nest and Pacific Palms/ Blueys Beach, the Wyong LGA and NSW as a whole. The profile relies primarily on census data from the 2001 census.

Hawks Nest and Pacific Palms/Blueys Beach are located on the NSW Hunter Coast and Mid-North Coast, respectively. Both are discreet coastal villages with a strong "lifestyle" focus incorporating beach and estuary activities.

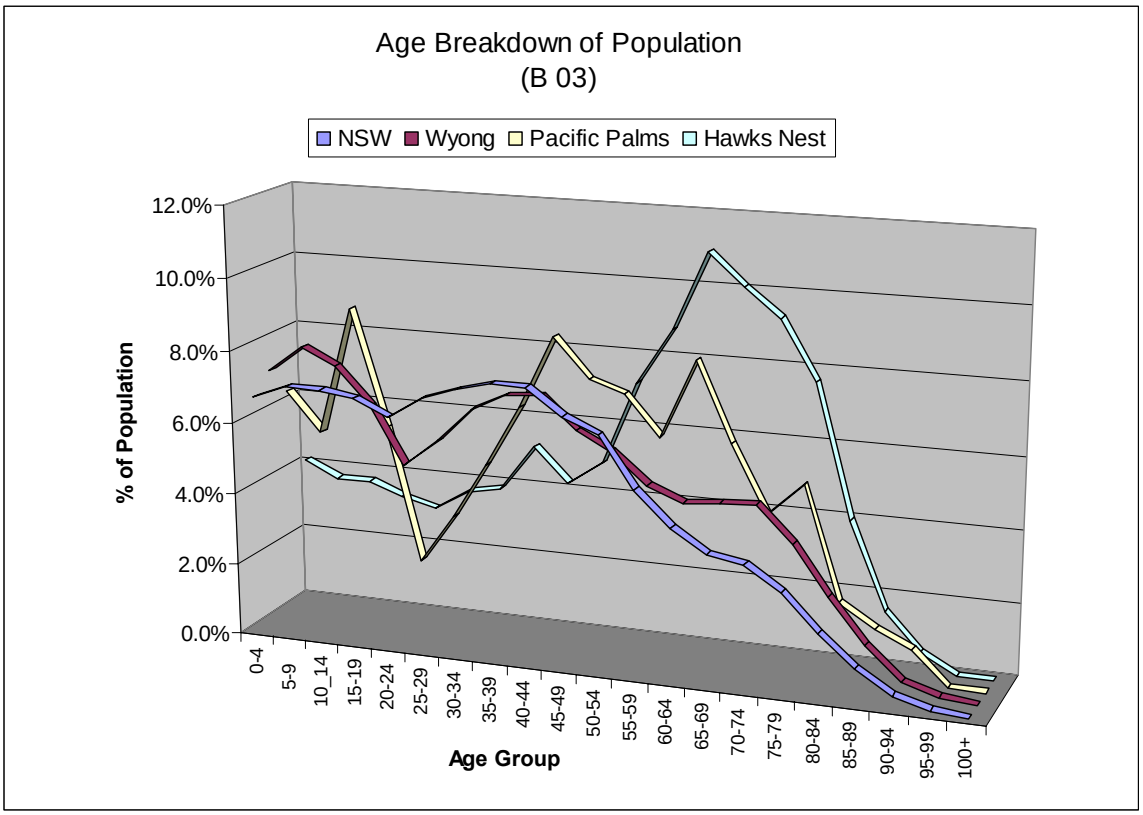
The reason for including these villages as part of the analysis is that it provides a useful glimpse into some of the characteristics that the population of the proposed development may exhibit. It must be noted that the population of the proposed development is not expected to exactly match these village profiles; they are included as a useful starting point for analysis.

The profiles will use the Basic Community Profiles (BCPs) constructed by the Australian Bureau of Statistics from the 2001 Australian Census. Data for "Wyong" is drawn from the Wyong LGA, BCP 18550. Data representing Pacific Palms/ Blueys Beach (hereafter referred

to as “Pacific Palms”) is drawn from the urban centre/locality BCP 163230. Data for Hawks Nest is from the urban centre/locality BCP, 138800.

3.3 Age Distribution

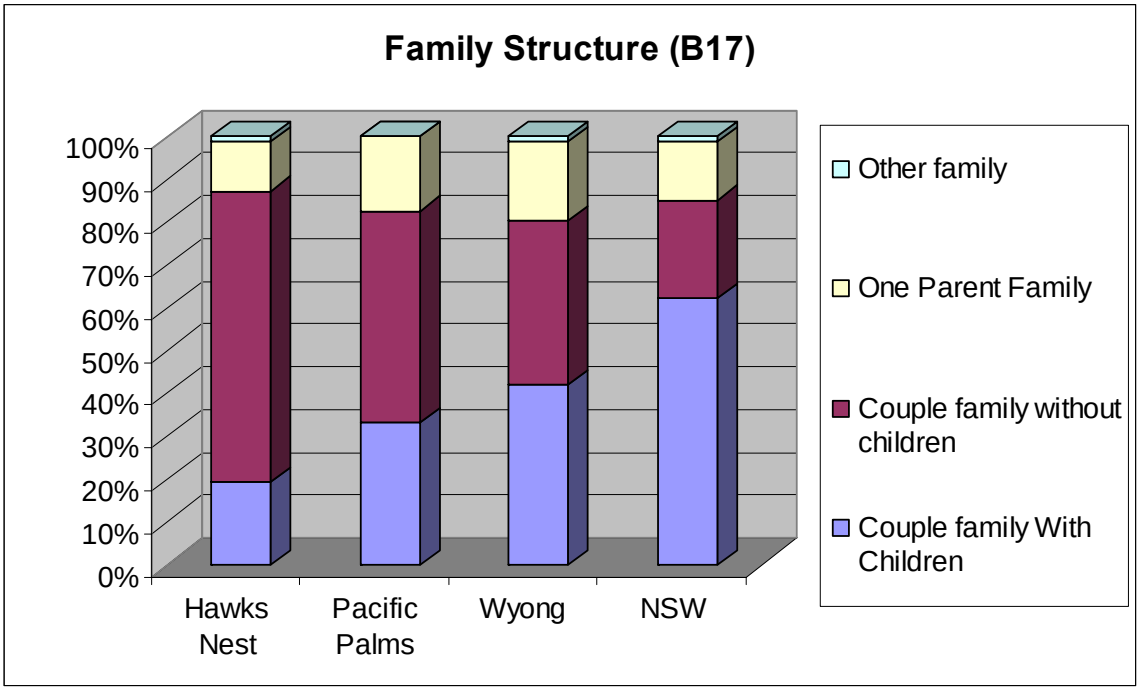
The age profiles in Pacific Palms and Hawks Nest (the “Coastal Villages”) exhibit a markedly different profile to Wyong and the rest of NSW. Most notably, these populations are older than the median NSW population. In Pacific Palms and Hawks Nest, the median ages are 44 and 56, respectively, compared with 35 across NSW. The chart, below, displaying the age distribution clearly shows this pattern. The Coastal Villages generally have a smaller proportion of children and young to middle aged adults or those within the under-40 age brackets (although there is a spike in the number of teenagers in Pacific Palms). This is compensated by a higher proportion of residents in the older age groups, especially through the 50-70 years age brackets.



Comment:
Key Insights projects that the age profile of the proposed development is likely to mirror approximately that of the Pacific Palms and Hawks Nest communities. That is, a higher proportion of people in the older age brackets, and fewer young people. One factor contributing to this will be the substantial costs associated with purchasing quality coastal housing, putting it out of reach of many young families. The self-contained coastal ambience of the proposal will also appeal to older couples wishing to settle down.

3.4 Family Structure

Family structures in the Coastal Villages reflect this age distribution. There are a greater proportion of couple families living without children. Due to the older nature of the population, this probably represents “empty nesters”; couples whose children have grown up and moved out. The proportion of couple families without children is expected to increase over coming years as the population ages and the fertility rate falls. This will presumably increase the demand for alternatives to traditional, large, family oriented housing. An example of the alternative types of dwelling that will increasingly be in demand is the medium density style housing in the proposal.



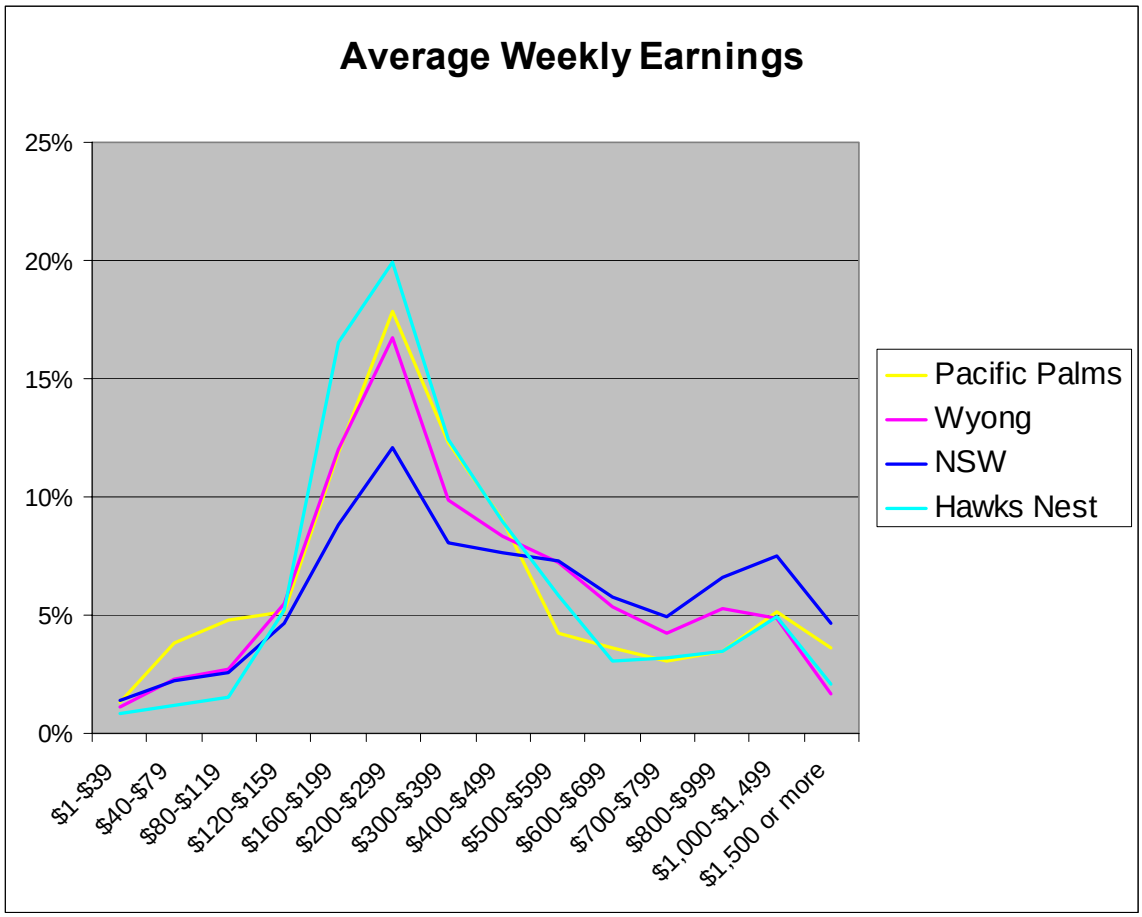
Comment:
The family structures of incoming residents of the proposal are likely to reflect the trends in the Coastal Villages as noted above. A high proportion of “empty nesters” is expected. This trend seems likely to continue across the state and will continue to exert pressure on the demand for more compact housing.

3.5 Incomes

Residents in the Coastal Villages have generally lower family incomes than the state average. The median family income is in the $500-$599 per week bracket. This is somewhat lower than the median family incomes in Wyong and NSW: $700-$799 and $800-$899, respectively.

The chart below shows the proportion of the population throughout each of the income bands. A few key differences can be observed. Firstly, while each of the subject populations have a peak representing people earning in the $200-$299 brackets, the Coastal Villages have a larger spike, representing more people earning in these brackets. Generally, there are much fewer Coastal Village residents in the higher income brackets, while they are strongly represented in the lower income brackets. The Pacific Palms profile shows a higher proportion of residents in the very low income categories, from $1 to $120. This is most likely representative of the spike in teenage population earning money in part-time casual positions.

Comment:
It is envisaged that the incoming population will have a different earnings profile to that of the Coastal Villages in 2001. It is much more likely that they will have above average earnings. The reason for this is that the value of coastal housing has risen such that it is out of reach of many average income earners.



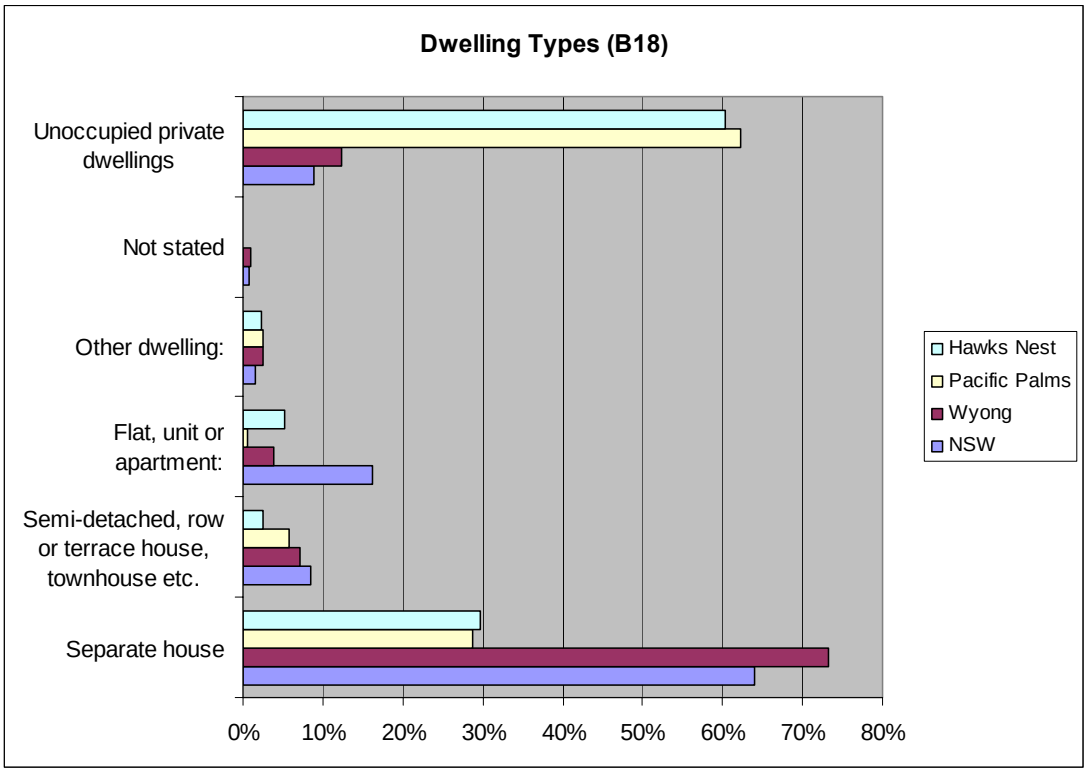
3.6 Housing

The most common type of occupied dwelling in each of the subject populations is the separate house. The proposal at Catherine Hill Bay consists predominantly of a low density

configuration with 12 dwellings planned per hectare. Within these plans a wide diversity of lot sizes will be offered. This diversity of lot sizes is one of the main points of difference between the proposal and the areas being used for comparison.

The chart below outlines the types of dwellings across the subject populations. Of considerable note is the high proportion of unoccupied private dwellings in the Coastal Villages. Presumably, many of these are holiday homes. These may be rented out on a weekly basis to holiday-makers, or kept as weekenders to be used by the owner intermittently throughout the year. The figures below may generally overstate the proportion of unoccupied dwellings; the census was taken on a Tuesday evening in August: one of the quietest periods of the year.

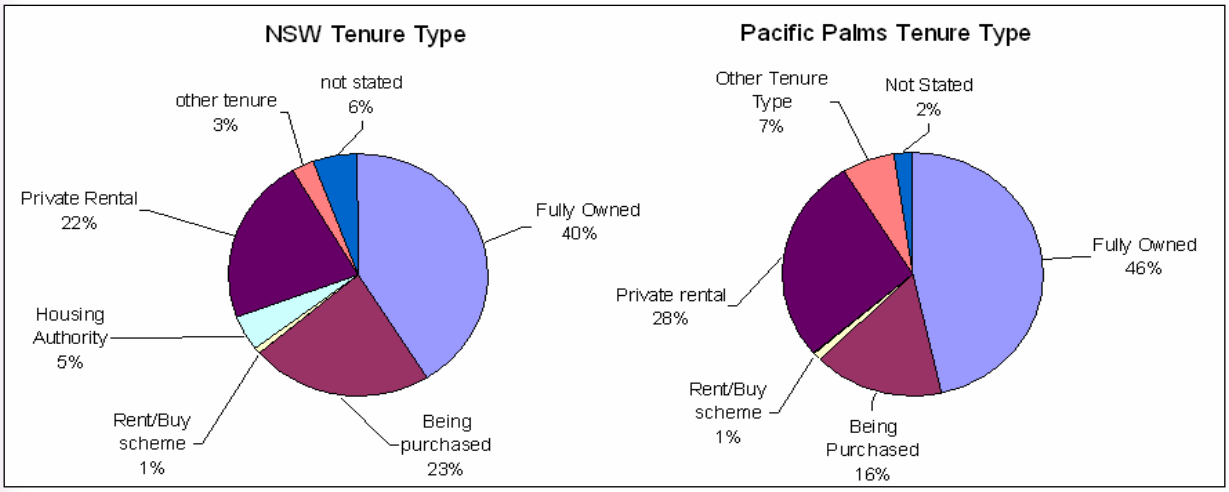
Comment:
The proposed development may tend to be similar to the Coastal Villages in that it will likely consist of a number of unoccupied dwellings. For example, a likely scenario is a couple in their late fifties who spend most weekends at their Catherine Hill Bay house while spending the working week in Sydney. Over time, such couples may eventually spend more time at Catherine Hill Bay.



The following chart shows the tenure types for dwellings in Pacific Palms and NSW as a whole. It reveals a high level of full home ownership in Pacific Palms. Conversely, fewer dwellings in Pacific Palms are in the process of being purchased. Another feature of the tenure profile in Pacific Palms is a higher rate of private rentals. This may be indicative of the area's appeal as a holiday destination.

The high figure of home ownership in Pacific Palms is a reflection of the age profile of residents; home ownership rates are typically a positive function of age.

Comment:
It is likely that the proposal would share a similar tenure profile to that of Pacific Palms. The older demographic will mean that home ownership will most likely be higher than state average. The use of dwellings for holiday purposes will also ensure a strong private rental market.



3.7 Housing Drivers

There is a range of demographic, social and economic factors that impact on housing needs and choices in Australia, and subsequently must influence supply. These are discussed at various points in this report and include:

- A national ageing population.
- Decreasing household sizes
- Changing importance in family structures
- Levels of income and employment.
- Changing lifecycle patterns.
- Delayed lifecycle milestones of young people, including housing careers
- Aspirations and attitudes towards home ownership – homeownership is dropping – choice, necessity or both?
- Decreasing housing affordability for key social service groups
- Declining numbers of children.
- Changing living arrangements of children
- State planning strategies that promote provision of medium density housing and 'population push' into the Regions.

3.8 Employment

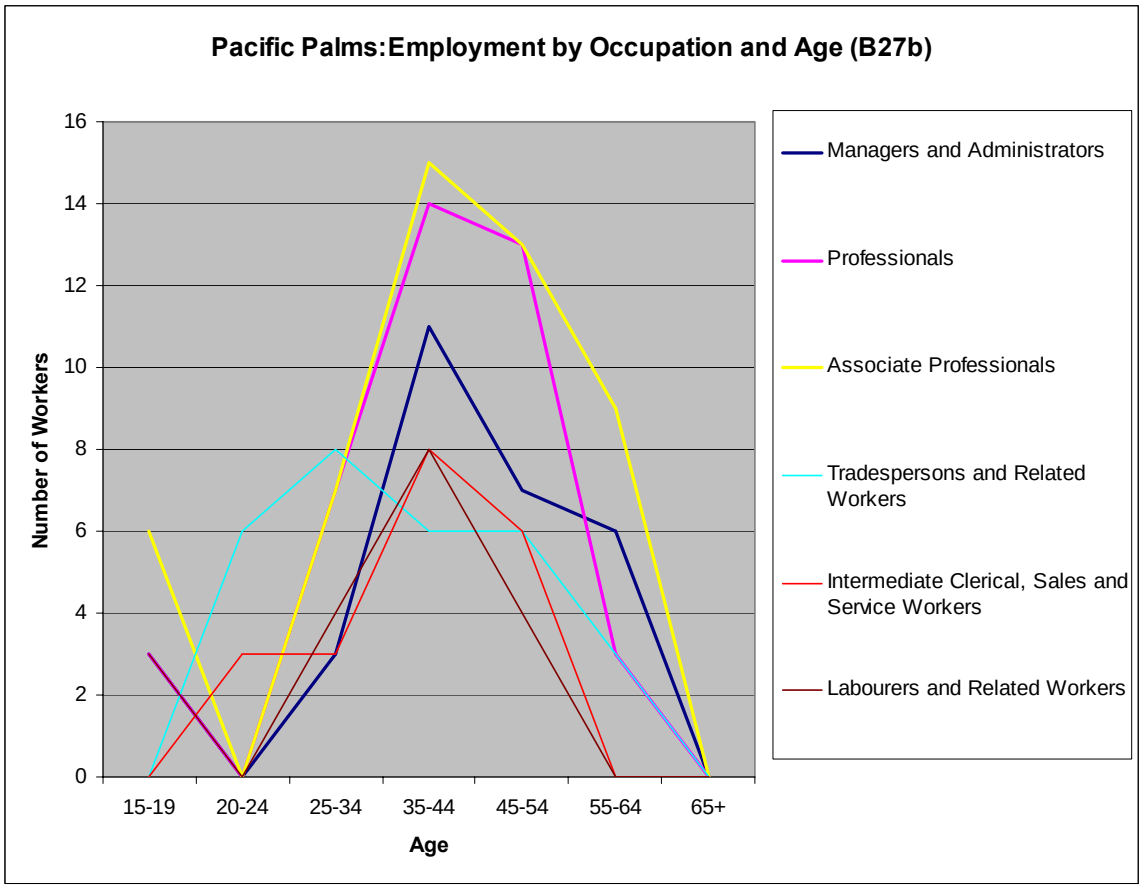
Pacific Palms and Hawks Nest do not exhibit a strong or deep profile in the area of their labour markets. In the 2001 census, the unemployment rates for Pacific Palms and Hawks

Nest were 11.0%[13] and 10.9%, respectively, compared with the NSW figure of 7.2%. Since 2001 unemployment has fallen across the state; in the June 2006 figures released by the Department of Employment and Workplace Relations showed that unemployment across NSW had fallen to 5.3%[14]. Across Great Lakes LGA, unemployment has actually risen from 11.7% in 2001 to 15.0% in the June 2006 quarter. It is unclear whether Pacific Palms and Hawks Nest have shared in this increase in unemployment.[15] At 40.3% and 38.1%, respectively, the Pacific Palms and Hawks Nest workforce participation rates were substantially lower than the NSW rate of 62.2%. It is usual for areas with older populations to have a lower workforce participation rate than a younger area, such as NSW as a whole.

Analysis of employment data reveals that the occupational profile of Pacific Palms workers consists of a strong representation of "white-collar" jobs. Older members of the workforce are much more likely to be engaged in these types of positions than manual, or "blue collar" jobs. The three dominant occupational groupings, from the 25 years age bracket and onwards, are "associate professionals", "managers and administrators" and "professionals".

Comment:
As the incoming population at Catherine Hill Bay is expected to show an older age profile, it seems likely that the workforce participation characteristics will be somewhat lower than state average, in a similar fashion to the Pacific Palms figures. However, the difference is not likely to be so pronounced for a number of reasons. Firstly, the nature of work and retirement has changed considerably since 2001. Improvements in telecommunications technology, notably broadband connectivity, means that many workers are in a position where they can "telecommute", working a few days per week from home and a few days in the office. Secondly, Catherine Hill Bay's close access to both Sydney and Newcastle may mean that commuting to work is appealing for some people.

[13] Care must be taken with these employment figures. The total labour force in Pacific Palms at the time of the census was just 264 people. Small variations in unemployment numbers would make large percentage differences to this measure.
[14] Department of Employment and Workplace Relations: Small Area Labour Markets, June 2006.
[15] Between Censuses, labour market statistics are not available at such detailed levels.

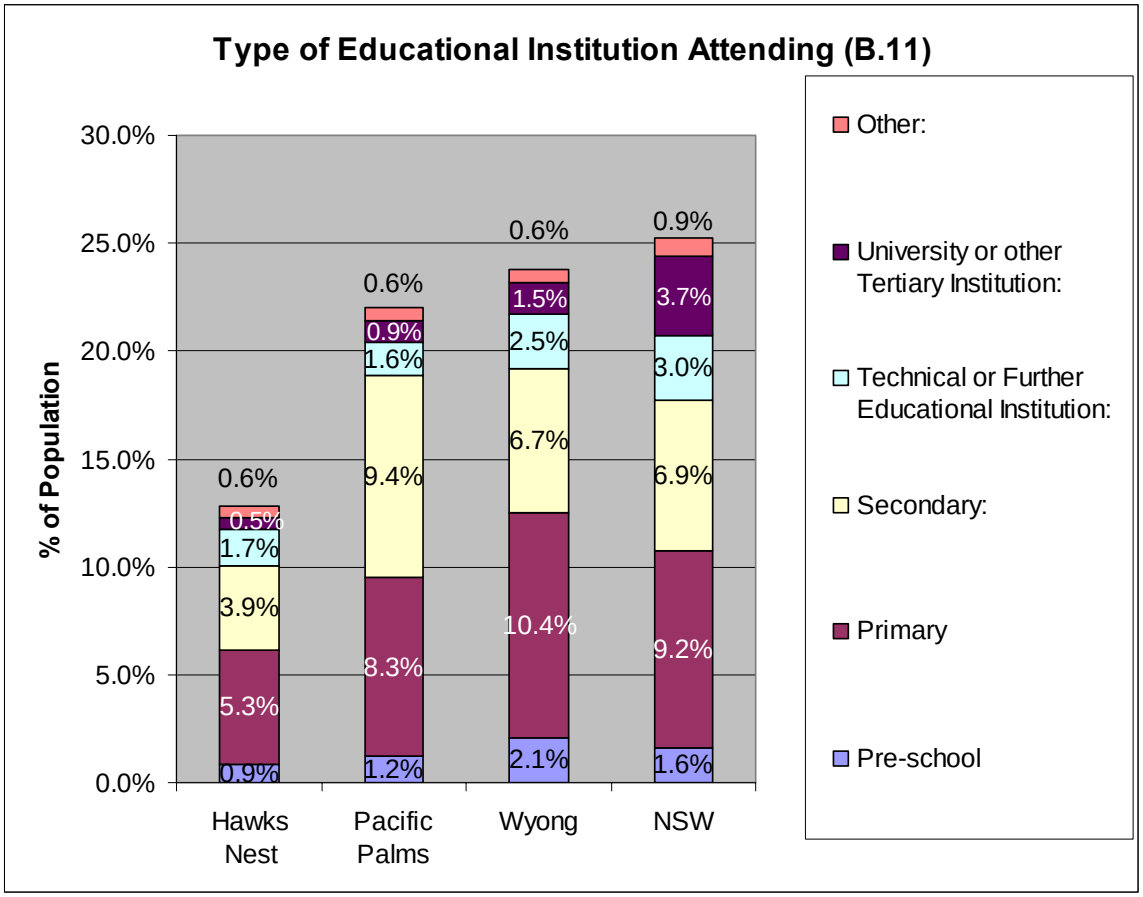


Comment:
Key Insights projects that the incoming Catherine Hill Bay population will share a similar occupational makeup, attracting a high proportion of professionals, associate professionals and managers. There will, however, be a modest demand for elementary and intermediate workers in the clerical, sales and services sector. This demand will flow from service and retail businesses in the village. It is quite likely that these positions will be filled by younger residents of the area.

3.9 Educational Attendance

The proportion of the population attending different educational institutions is a reflection of the age profiles of those populations. The smaller proportion of Pacific Palms and Hawks Nest residents attending pre-school and primary school is unsurprising due to the predominantly older population and small proportion of children.

Differences also occur in the attendance at post-secondary educational institutions. The Coastal Villages experience lower attendance at University and Technical and Further Education institutions. This is not surprising considering their geographical remoteness from such institutions. The proposal site does not experience this remoteness, lying within reach of TAFE and University campuses in both Wyong and Newcastle LGAs. Therefore, Catherine Hill Bay will be more likely to have a higher proportion of the population attending post secondary-school education.



Comment:
Key Insights projects that the incoming population will be similar to Hawks Nest and Pacific Palms, in that there will be a proportionally smaller number of pre-school and primary school children. The proportion of secondary school aged persons in Catherine Hill Bay is projected to be similar to that of Pacific Palms, slightly higher than state average.

Attendance at TAFE and university is still likely to be lower than state average, due mainly to the older age profile of the incoming population. However, the Catherine Hill Bay site is less remote than the Coastal Villages in terms of access to both TAFE and university campuses. This, combined with an increase in distance learning will mean that the incoming population will most likely exhibit higher rates of attendance at TAFE and university than the Coastal Villages.

3.10 Population Projections

Geographically, the proposed development is isolated from the larger bulk of the residential populations, both within the Wyong and Lake Macquarie LGAs. It is the belief of Key Insights that the population that will be drawn to the development would share characteristics closer to those of other coastal villages, such as Pacific Palms, than of the Wyong LGA as a whole. Additionally, recent trends in coastal living such as changing family structures and changes

in work practices will mean that the incoming population of Catherine Hill Bay will be unique in the area.

Accordingly, the following projections will utilise a mix of figures. The incoming population will be assumed to be broadly statistically similar to the profile provided by the 2001 census figures from Pacific Palms. The analysis will, however, use the aggregated NSW figures for housing yields. The Coastal Villages had few units and attached dwellings at the time of the 2001 census, plus a large number of unoccupied private dwellings, making figures statistically unreliable.

Using calculations from the 2001 census[16] estimates can be made as to the average household size, and hence, a projected population for the proposed village at various stages of development. The average number of people per "semi-detached, row/terrace house or townhouse" dwelling was 2.24. It is important to note that these figures are estimated to fall over coming years as the population undergoes shifts associated with an aging population.

Although the first stage is set to have a number of different housing styles, Key Insights is of the view that the above figure represents an appropriate estimation of overall dwelling density.

The following table outlines the projected populations after completion of half development (300 dwellings) and at completion (600 dwellings) at a density of 2.24 persons per dwelling subtracting the 18% which accounts for the expected unoccupied dwellings.

The transitory population of visitors needs to be considered in projecting the population. Such visitors will have different characteristics in terms of spending, and goods and services demanded. Additionally, they are unlikely to put demand on local social infrastructure such as schools, childcare and community organisations. The proportion of the incoming population who are likely to be short-term visitors will depend on the eventual dwelling design and marketing of the village, as well as the nature of commercial facilities that are established. These projections will use the Pacific Palms community as a guide, where visitors make up 18% of the population, leaving 82% as permanent residents.

Proposed Development:	*Dwellings*	*Projected Total Population*	*Projected Population (Net of Visitors)*
Half Development:	300	672	551
Village Completion	**600**	**1344**	**1102**

A new development of this type in the area may be appealing to wealthier families or older families wishing to downsize their home. The self-contained community type structure of the village will be particularly appealing for these types of resident.

The following paragraphs will project the number of residents in key population groups in the new development. These are based on a permanent resident population of 1102 achieved at the full development (600 dwellings) of the Catherine Hill Bay site.

[16] BCP Table B18

A development of this size demands consideration of the numbers of young people that will be moving into the area. Assuming an age profile similar to the Pacific Palms population, approximately 20.6% of new residents will be under the age of 15[17]. **This equates to an influx of approximately 227 children.**

In 2001 at Pacific Palms, 8.3% of the entire population was attending infants/primary school. Using this figure, **the projected number of children attending primary school from the completed development would be 91.**

The proportion of the Pacific Palms population attending a secondary school in 2001 was 9.4%. **This figure gives a projected number of 104 young people attending high school from the completed development.**

The new population would also include a number of children under 5 years old. According to the 2001 census, 6.4% of the Pacific Palms population were under 5 years old. **This equates to a projected 71 children under 5 years of age in the completed development.**

The attractiveness of the new development to senior citizens will depend on the types and levels of services available close by. This sector of the community is traditionally a lot less mobile as it ages, so requires most services to be close by, or at least convenient public transport options. The type of housing created will also influence the demand from senior residents. Assuming that the development attracts seniors in the same proportion as the Pacific Palms average, 19.8% of the new residents would be aged 65 or over. **This equates to approximately 218 people.**

The table below outlines the population projections for different groups at the different levels of development of Catherine Hill Bay. It is important to note that the village will grow to full development over an extended period of time.

[17] BCP: Table B03.

Projected Population Characteristics

	Estimated % of Population	*At full development (600 dwellings)*	*At half development (300 dwellings)*
Children under 5	6.4%	71	35
Children under 15	20.6%	227	114
Attending Primary School	8.3%	91	46
Attending High School	9.4%	104	52
Residents over 65 years	19.8%	218	109
Total Population		**1102**	**551**

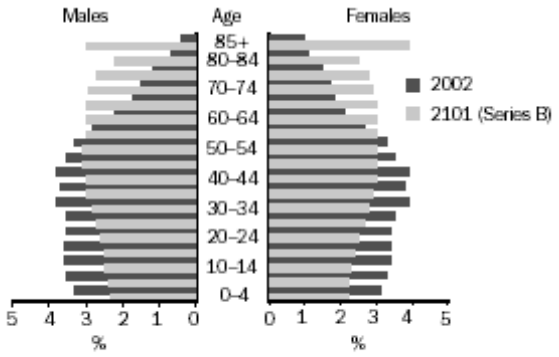
A discreet, village based subdivision, with a variety of housing and lifestyle options would be appealing to a range of people. The following is a selection of hypothetical household profiles of residents who may find the development appealing:

The Andrews family have bought one of the separate houses in the development. It is their third family home. Mark works as a commercial accountant in Gosford, while Jane has returned to teaching at Swansea High School 3 days a week. Their two children, 11 and 14 are still at school, the youngest at Nords Wharf Public, while the eldest attends Swansea High.

Wayne and Jenny are now "empty nesters". Two of their adult children are working and studying in Sydney, while the youngest has just moved into a share house in Newcastle with her uni friends. Wayne still works as a senior adviser in a financial planning company. He commutes regularly to the offices in Newcastle and Sydney, although he sometimes works from home for a couple of days. Jenny is now retired but keeps active through a volunteer position in the Blacksmiths Surf-Lifesaving Club. Their three bedroom home in Blacksmiths had become unnecessarily large, and the garden maintenance was a pain. They are enjoying living in one of the new apartments. They especially enjoy the community feel of the neighbourhood and have quickly made new friends with other couples in the area.

Anne and Peter are self funded retirees. They enjoy an active retirement, the chief pursuit of which is fishing. They have purchased a dual occupancy dwelling in the Catherine Hill Bay development. The village provides the basic amenities they require while providing convenient access to great fishing spots: beach fishing to the east and Lake Macquarie to the west. Anne and Peter use their Catherine Hill Bay home as a "home base"; they often travel for months at a time, for example, road trips to the far north coast of Australia. The discreet, laid back village means provides the perfect location for a home base; maintenance is low, and they know their property will be watched over by the other community members.

A major factor to be considered in the development of residential areas is the changing age structure of the population. Lower fertility rates and a longer life expectancy mean that the population is expected to age considerably over coming decades. In fact, the ABS predicts that by 2101, people in the 85+ age bracket will outnumber any 5 year age bracket, as shown in the graph below. As a result, household sizes are falling, and will continue to fall substantially over the foreseeable future.



Source: Population Projections, Australia, 2002–2101 (ABS cat. no. 3222.0), 2003.

The number of "couples without children" households and lone households are expected to increase dramatically. The ramifications are that communities will need to be designed with this elderly population in mind. Medium density housing, with access to appropriate services is an option that needs to be explored.

This proposal represents an opportunity to satisfy these changing demand patterns. The predominantly medium-density configurations and smaller dwelling spaces mean that a reasonable sized population can be accommodated within a small village footprint, allowing easy access to village amenities.

4. Qualitative Research

Rosecorp has been engaging with the local community over a number of years on overall development plans for Catherine Hill Bay, this social impact assessment is based both on the outcomes of previous consultation and new meetings.

Consultation conducted specifically in relation to the development proposal included meeting with the Catherine Hill Bay Board Riders Club and the Catherine Hill Bay Progress Association. A record of each of these meetings follows.

Update 2006: It should be noted that since these recorded consultations occurred the proponent has negotiated with the NSW government to donate the majority of the parcel of land (314 hectares of the total 374 hectare site) for conservation purposes. This addresses the key conservation issues raised by the respondents earlier this year as documented below. The public opinion as expressed in letters to the Newcastle Herald now seems to have shifted its focus from conservation to the fact that it is the NSW government making the decision on this land.

4.1 Catherine Hill Bay Board Riders Club: "Catho Boardriders"

On Tuesday, 14th March 2006, Key Insights met with representatives of the Catho Board Riders Club. The Club consists of over 100 members who are "united by their passion for surfing and the social aspects of regular meetings, competition and networking". The Club draws its members from a wide stretch of coastline, from Lake Munmorah in the south, to Belmont in the north.

Those present were briefed about the proposal as previously submitted to Wyong Shire Council. Members were aware of the development, but this was the first opportunity that they had had to consider the detail of the proposal. After a brief perusal of the structure plans, members were asked about any issues they felt were relevant to the proposal. A number of issues were raised, and are summarised below:

Infrastructure

There was concern about the level of public infrastructure in the area, and its ability to cope with any more population growth. Many of these infrastructure concerns were divisible into two main areas: beach infrastructure and traffic.

Members reported that beach infrastructure was only just coping with the large influx of visitors, particularly on the weekend. An estimated 900+ people can flock to the beach on a warm day. This leads to major parking concerns, albeit that they occur only during specific times during the day. There are also insufficient beach amenities to cater for the influx of visitors, particularly at the northern end of Middle Camp Beach. Members of the club have been pushing to have amenities such as toilets, changing rooms and bins installed for over 20 years. The problem is that nobody wants to take responsibility for the northern end of the beach. It is private land, so the owners are not interested.

Key Insights asked the group whether the beach was too crowded, in terms of swimmers and surfers, at present. The consensus was that it was “borderline”, although crowds do diminish over the cooler months.

The issue of traffic in the area was a major concern. The group identified the intersection of the road to Catherine Hill Bay and the Pacific Highway as being very dangerous due to the corners in the vicinity of the intersection and cars on the highway travelling in excess of 100km/h. Accidents here are not uncommon. Often, in the case of a serious accident, traffic will be diverted through Catherine Hill Bay, which is a big inconvenience.

There were a number of other concerns about infrastructure. It was commented that they didn’t want to see another “Wyong situation”, where houses were put in first, and infrastructure was worried about later. The capacity of health services was questioned, especially in the presence of a possibly older incoming population. The issue of water and sewer provision was also raised.

Moonee Beach

This section of land previously had access, which was disastrous. Many people camped down there. This led to problems with alcohol, drugs, parties and violence. The amenity of the area has been much improved since this access was removed. Now, it is a pristine area that is accessed from Catherine Hill Bay via walking trails. Moonee Beach is not safe for swimming. There are dangerous undercurrents and rips. It is similar in this way to many of the beaches in Fraser Park. Catherine Hill Bay is the safest spot for families.

Club members were strongly of the opinion that their walking trail access to Moonee Beach must not be compromised by the development in its completed form, or during construction.

Overdevelopment of the site and cumulative impacts

The group was generally of the feeling that the proposal represented overdevelopment of the site. There were concerns that the proposal was "too much for the area". It was thought that such overdevelopment would ruin the amenity of the area.

The group was also concerned with the possibility of future development in the area. They were aware of a number of other proposals for residential development in the surrounding area and expressed their concern about the potential for cumulative impacts as a result.

Crime

Group members reported that crime has begun to be a problem in the area. This is occurring primarily in the form of theft from the parked cars of surfers and beach users. It was commented that such theft was very easy to perform; perpetrators can simply observe where surfers leave their keys, and then steal items from the car. Group members believed that the perpetrators were not locals.

Members of the group understood that the policing resources were already stretched in Swansea, and that the population increase associated with the development would mean that current police resources would not be able to cope.

Positive Impacts

The group was asked about any possible positive impacts that they would see arising from the proposed development. A member of the group commented that if this was just a "one-off" development, then perhaps there may be some positive impacts, but if this were the first of a series of developments, then the cumulative impacts would be overwhelmingly negative. Another group member commented on the possibility of having a shop being a positive impact for the area.

The group was also asked whether there was scope within the development for businesses associated with the surf industry. Members believed that scope for such businesses would be limited. If anything, it might consist of a retail outlet that would be "overpriced and small". Members of the group raised the point that tourists to the area don't really spend too much money, they bring everything in with them.

4.2 Catherine Hill Bay Progress Association

Key Insights arranged to meet with the Executive of the Catherine Hill Bay Progress Association to seek their views on the proposal. On Wednesday 12th April, Key Insights met with the President and Secretary of the Association. A presentation was made on the proposed development, based on the Statement of Environmental Effects and Architectural and Landscape Drawings for the development.

The Progress Association has been actively engaged in commenting on Rosecorp's development proposals for Catherine Hill Bay. They had participated in briefings on Rosecorp's former proposal to relocate the Catherine Hill Bowling Club and the associated apartment development on the Moonee and Wallarah Collieries site and have been aware of the proposal for some time, albeit this was the first opportunity that they had to see the detail of the proposal.

The Progress Association takes an "institutional" view of total opposition to the proposal, raising the following objections:

- It is contrary to the current zoning
- It is contrary to regional and state planning objectives
- It is not in the best interests of the community
- The site is of heritage significance
- The scale of the development is excessive and will "brutalise" the site
- It will destroy the overall amenity of Moonee Beach
- There will be negative cumulative impacts of this development in addition to other developments planned in the local area
- It will overcrowd the village, particularly at weekends when there are already parking problems
- There will be a dangerous increase in traffic flow through the village. The drive through the village from the development site may well be considered by many to be shorter and prettier than taking the Montefiore Street access to the Pacific Highway when seeking to travel north.
- In the short to medium term it will divide the local community many of whom are keen for the area to remain as it is
- They don't accept the staged approach
- They were concerned that the development may become a "gated community" in the future

Indeed, they could not identify anything positive about the development proposal at all and could not identify anything that would make the proposal acceptable.

However, beyond those issues outlined above, they were unable to identify any negative social impacts of the development. They stated that their opposition to the development is not based on potential negative social impacts.

4.3 Interview with Ron Way, Principal, Swansea High School

Key Insights spoke with Mr. Way about the potential increase in population as a result of development in the Catherine Hill Bay area. Points raised by Mr. Way included:

- Current enrolment at Swansea High is approximately 750 students. This has been reasonably consistent over past years, fluctuating, up and down, by 5 or 10 enrolments.
- Incremental increases in school population are no problem for the school. Most likely, demountable classrooms will be used to accommodate growth.
- Up to 800 students would be fine.
- The school has been bigger in the past, before the construction of Lake Munmorah High. Enrolments were up around 1000, more demountables were used to hold the student population.
- In terms of physical infrastructure such as open space and car parking, the school is well serviced and could deal with incremental growth.

4.4 Trevor Jennings, Planning & Infrastructure Manager: Busways Group

Key Insights contacted Mr. Jennings in order to gain his comment upon the proposal from his perspective as the Planning and Infrastructure Manager of the Busways Group. Mr. Jennings made the following points:

- Busways operates 3 Route 99 services each way through Catherine Hill Bay of a weekday. These services utilise Montefiore and Clarke Street.
- During the development of the initial stages, most residents will be within an acceptable walking distance of the existing route, where appropriate bus stops could be installed. The provision of bus stops and shelters should be discussed by the proponent and Wyong Council.
- Upon completion of the final stages, some residents will be living up to 750m south of Montefiore Street, therefore, an acceptable road system may be required for buses to travel through the development. This would involve buses possibly entering between land allocated to Stages 11 and 13, travelling between Stages 9 and 10, and joining Montefiore St again opposite Clarke St.
- For directness and route attractiveness, the road system proposed for Stage 1 should be amended to reflect Busways' desire to travel straight through the development from Clarke St.
- The future frequency of service and route selection will be influenced by the Ministry of Transport which is currently negotiating contract areas with bus operators on the Central Coast.
- These negotiations are expected to be finalised later this year, at which time more positive indications of likely bus servicing arrangements for the subject development could be forthcoming.

4.5 Previous Community Consultation

Development in the Catherine Hill Bay area has been the subject of much coverage, debate and community consultation already.

Both Key Insights and other parties have conducted this community consultation, notably with regard to the proposal to relocate the bowling club and construct a number of apartments in Catherine Hill Bay. Consultations were conducted with the Wallarah Alliance Community Meeting, Catherine Hill Bay Bowling Club Members and Catherine Hill Bay Surf Lifesaving Club.

The following documents are attached:

- Minutes of Wallarah Community Alliance Meeting, 8th August 2003
- Minutes of Catherine Hill Bay Bowling Club Members Meeting
- Community Survey Results
- Catherine Hill Bay Surf Life Saving Club Meeting

The following relevant issues were identified in the Key Insights' social impact assessment report for the original Rosecorp proposal:

- The general feeling is that Catherine Hill Bay does not have too many problems.
- Some existing social issues identified include:
  - Vandalism and security – 'Yobos' driving fast cars come from everywhere and will come regardless of new facility. There has also been some break-ins.

- Road safety – Road in and out needs improving, especially to allow for coaches. In summer, a coach-load of surfers visits the Bay every weekend.
- Clash of cultures and attitudes between 'old' local residents (who live in the Bay full time) and 'new' Sydney people (who tend to own holiday homes and weekenders). The perceived tendency is that Sydney people want Catherine Hill Bay to stay how it is, and locals want it to grow in population and attract more services and facilities into the town, such as sewage and water. Sydney people do not patronise the Bowling Club, and the established community perceives them as not contributing significantly to the local economy.
- The need for survival of the town needs to be balanced against the scale of any proposed development. Locals want to see the unique character maintained, but the long term residents want to see services and activity, reminiscent of busier, healthier days as part of the continuing profile of Catherine Hill Bay.

5. Service Demand and Supply

Catherine Hill Bay is a small, geographically discreet community. With its history as a mining settlement, there are limited facilities in terms of schools, medical infrastructure and commercial facilities. The likely nature of the population, as revealed in Chapter 3, is one of affluence, mobility and a self-contained nature. As such, a certain level of isolation from services and facilities is acceptable to the population, and certainly not a source of social disadvantage.

Catherine Hill Bay, as previously mentioned, shares a close geographic relationship with the proponent's site at Gwandalan. Residents utilise a wider range of services available chiefly in nearby Cams Wharf and Swansea or further a field in Newcastle and the Central Coast.

A list of the social infrastructure and facilities common to both proposals has been provided in Section 1 of this report. However, comments that are specific to the Catherine Hill Bay development are detailed here.

5.1 Public Transport

Given its small existing population and geographical isolation, Catherine Hill Bay enjoys a surprisingly regular bus service provided by Busways. Any increase in population will add to the viability of the service. See the above record of interview (at 4.4) with Trevor Jennings, Planning and Infrastructure Manager, Busways Group.

5.2 Retirement Living

The aging population is a well-documented trend and it will lead to an increase in demand for retirement living of different styles. Wyong LGA currently contains a number of retirement villages and aged-care facilities. However, these are of a markedly different nature to the proposed "Deep Cave Bay" village development at Catherine Hill Bay. **Deep Cave Bay may represent a much needed "normalisation" of the retirement market and support diverse inter-generational living for older citizens who want manageable house lots in attractive areas that are not age-specific.**

While the proposed village will certainly not be a retirement village as such, it may be a highly desirable location for older residents who wish to enjoy an active retirement. It will cater to those seeking the lifestyle benefits that the coastal location provides. This includes

the active beach-based lifestyle, communal open spaces and coastal outlook of the Deep Cave Bay village.

In this way, the proposal contributes toward meeting a section of the Wyong Region's overall needs in terms of retirement living.

5.3 Commercial

Catherine Hill Bay is currently poorly serviced in terms of commercial and retail facilities. Residents are required to do their shopping elsewhere. In the past, Catherine Hill Bay was a vibrant mining village, providing a range of services, but these have declined in recent years with the winding-up of mining activity.

The nearest centres for residents to do their shopping are at Swansea or Lake Munmorah, which offer:

Supermarket, e.g. Coles
Range of retail shops, such as butchers
Range of services, such as hairdressers
Range of banks and financial institutions
Restaurants/cafes
Tourism facilities such as boat hire and SCUBA diving.

More extensive shopping-mall facilities are also available in both Lake Macquarie and Wyong LGAs, notably at Westfield Tuggerah and Charlestown Square.

Key Insights' qualitative research undertaken for this and previous Catherine Hill Bay studies reveals that some people would welcome increased commercial activity in the area. Some older residents remember when Catherine Hill Bay was a thriving village, and would like to see some of that vibrancy return.

The proposal offers the opportunity for the establishment of some commercial premises serving both the existing and incoming community. These facilities are likely to supply predominantly lower order, "convenience" style goods. The village will also attract service and hospitality industry businesses, for example a café, supplying goods and services for locals and visitors. Such businesses may be heavily reliant on visitor trade, especially during the staged construction of the development. The proponent may wish to examine start-up incentives for businesses to attract tenants.

5.4 Community Infrastructure

Community infrastructure in Catherine Hill Bay is quite considerable, given the small number of actual residents. The Surf Lifesaving Club, the Bowling Club and the Catherine Hill Bay Board Riders Club have significant membership numbers, most of who are from nearby towns.

An increase in population in the area will result in a larger pool of potential members and volunteers for these and other groups.

Additionally, the proposal contains significant allowance for construction of new "hard" community infrastructure, for example open space areas, cycleways and community hall.

5.5 Employment

While there is limited scope for employment in Catherine Hill Bay itself, its location provides access to a number of employment centres through its easy access to the Pacific Highway. Residents of Catherine Hill Bay could conceivably commute to employment centres in Lake Macquarie, the Central Coast, Newcastle and even further a field to Sydney or the Hunter Valley.

6. Conclusions

The Catherine Hill Bay proposal provides opportunity to create a desirable residential community sharing close proximity to the existing settlement. It affords the opportunity to increase the number and types of housing stock available in the local area.

Key Insights has identified the potential positive social impacts of this development to be:

- Creation of a larger, more vibrant and diverse Catherine Hill Bay community.
- Economic stimulus through population growth and housing construction.
- Increased trade and employment in the surrounding area through supplying the higher-order needs of Catherine Hill Bay residents and visitors.
- Jobs during the construction phase conservatively estimated at nine jobs per $1M in construction costs. These jobs would include a range of trades including excavation, landscaping, builders, tilers, roofers, concreters, plumbers, electricians etc.
- Multiplier effects throughout the region because of construction employment.
- Jobs in the supply industry as a result of construction activity.
- Increased availability of land for housing in the Wyong LGA
- Enhancement of housing options and lifestyle housing for existing local residents, and people from regional NSW and Sydney.
- Possible extension of community services, commercial facilities and infrastructure due to increased demand.
- Attractive open space / public space through landscaping new village centre and associated areas.
- Contribution to the social mix of Catherine Hill Bay and wider area therefore helping to maintain a sustainable community. Increased population may provide critical mass for establishment of community facilities and interest groups.
- Potential to target key social groups, active retirees and "sea-changers".
- Increase in eligible volunteers for community service.
- The opening up of a private road to public ownership therefore maintaining two accesses to Catherine Hill Bay from the Pacific Highway.
- Re-use of a degraded former mining site.
- Improved provision of water and sewerage services to existing residents as a result of the development.

The potential negative social impacts of the development are:

- Resistance from existing community as the proposal is seen by many to have a

deleterious effect on the ambience of Catherine Hill Bay.
- Increased noise in the local area, particularly during excavation / construction.
- Increased traffic on the local road system.
- Contribution to longer-term stress on government funded and medical services, if extra services are not provided proportionate to increased population levels.

7. Matrix of Social Impacts

Impact	Comments	Significance	Measures
Support Services	• New residents will utilise services provided nearby in both the Wyong and Lake Macquarie LGAs. • Local public primary and secondary schools are stretched, but can accommodate more students. • Increased population will lead to critical mass for on-site provision of basic services, eg convenience store. • Projected demographic of new population reveals a community that will be affluent, active and highly mobile. Population will have a lower demand for social support services, and the ability to travel to services when necessary.	Low	▪ Consider community spaces with rooms for visiting consultants (medical etc) ▪ Keep Department of Education and appropriate government departments informed so that adequate planning can occur.
Conflict within the Community	• Potential sense of loss of exclusivity and coastal amenity by some people who utilise the Catherine Hill Bay area. • Noise and dust impacts during sub division construction.	Medium Short-term	▪ Undertake effective, ongoing community consultation
Cultural Identity	• Important to ensure the continued maintenance and utilisation of significant mine-related structures.	Medium	▪ Maintain intention to utilise existing buildings.
Utilisation of Community Infrastructure	• Significant population growth may increase the future viability of the local community and lead to an expansion of facilities/services. • Services and facilities will be demand driven.	Medium	▪ Undertake consultation of existing and incoming population to ascertain demand levels for different facilities.
Population	• The development will	High	▪ Include diversity of

Impact	Comments	Significance	Measures
	significantly increase the Catherine Hill Bay population. • The market for this development is likely to be people from outside the area. • This development has potential to support diverse population growth and meet a demand for coastal living.		housing options, including different block sizes, to foster a level of diversity within the new population.
Economic Impacts	• This development will directly impact on employment by providing a stimulus to the local economy through housing construction, increased usage of local businesses and the general flow-on effects associated with population growth • Potential commercial uses on site will contribute to developing the local economic sector.	High	▪ Encourage the use of local contractors during the subdivision and construction stages ▪ Encourage and nurture the establishment of on-site businesses
Community Structure, Character, values	• Will add depth to the Catherine Hill Bay community, which has experienced population and services decline. • The proposal maintains the existing Catherine Hill Bay village character by visual and spatial separation and a clearly different design.	Medium	▪ Maintain intention to include public open spaces ▪ Include attractive landscaping and user-friendly pedestrian corridors, especially between existing community and new development.
Health & Safety	• Pedestrian links to broader community will have health benefits, particularly for "active-aged" elements of the community.	Medium	▪ Include pedestrian links throughout the village. ▪ Apply Safety by Design principles.
Housing	• A quality residential development has the potential to attract families and retirees to the area.	High	▪ Development controls to develop strong community character, but also provide for diverse housing options ▪ Include some housing attractive to older people and lone persons.
Accessibility	• This development has the potential to be accessible to a	High	▪ Include a variety of lot sizes to increase lifestyle

Impact	Comments	Significance	Measures
	range of family structures. active retirees, “empty-nest” couples, DINKs (double-income-no kids) • Presently, older people and lone persons experience some degree of exclusion due to lack of suitable housing choice. The inclusion of diverse block sizes within the proposal may go some way to correcting this imbalance.		choice for families and individuals.
Sense of Place and Community	▪ This development has the potential to create strong links between urban and natural environments, particularly the nearby beaches ▪ A number of community groups already exist in the area (Boardriders, SLSC). The proposed development will provide more potential volunteers and members for these groups.	Medium	▪ Building covenants as mentioned above ▪ Provide adequate open space and landscaping to enhance the microenvironment. ▪ Encourage new residents to become involved in existing community organisations
Impact on existing services	• There is likely to be increased demand for on-site convenience facilities. • The modest projected initial population growth will have little significant impact on service ratios such as for medical or educational services. • The staged nature of future developments on the site will mean that planning can occur to meet emerging demands of future populations.	Medium	▪ One of the professional suites on-site could be earmarked for a small medical facility, perhaps offering basic GP services and other therapeutic services. ▪ Council needs to continue its practice of careful social planning
Links with community, i.e. Transport	• This development is unlikely to significantly increase the demand for public transport services due to projected high car ownership rates and geographical isolation.	Low	▪ Ensure that Busways continues to service the area.

8. Recommendations

In order to enhance the positive impacts and mitigate the negative impacts of the proposal Key Insights suggests the following for consideration:

- The proponent continues dialogue with the Catherine Hill Bay community to ensure existing residents are kept informed and can communicate with the developer.
- That the proponent develop a community development strategy, along the lines of successful strategy they have already employed at their Breakfast Point development in Sydney, to assist integration of the new and existing residents.
- The proponent give consideration to a small convenience outlet within the commercial centre as this will enhance convenience for locals and visitors.
- That one of the on-site professional suites could be earmarked for a small medical facility, perhaps offering basic GP services and other therapeutic services. There may be an opportunity to establish a trial "nurse practitioner" service.
- That the proponent offers some incentives to attract operators to the commercial offices/shopfronts during the early stages of the development when the number of residents may not be adequate to support such businesses.
- Encourage the use of local contractors during the subdivision and construction stages.
- Keep the NSW Department of Education and other appropriate government departments informed as the development proceeds so that adequate planning can occur.
- Advice be sought from Catherine Hill Bay Surf Life Saving Club regarding appropriate signage and management of Moonee Beach given that there will most likely be an increase in the number of people who will use the beach recreationally.

On balance, it is the view of the researchers that the net social and economic benefit of the Catherine Hill Bay proposal outweighs the potential negative social impacts. It is considered that the incoming community will be largely self sufficient, won't be socially or physically isolated and will place low but manageable demand on existing services. While there is local resistance to population growth, there would certainly be strong uptake of residential lots by people seeking the Catherine Hill Bay lifestyle and amenity.

SECTION 3: Gwandalan

1. Introduction

This section is based on an "Opportunities and Constraints Report" prepared by Key Insights in 2004 that formed the social and economic component of preliminary investigations undertaken towards the preparation of a concept Masterplan for the residential development of a 25.99 parcel of land in Gwandalan, Lot 3 DP 588206. Social infrastructure capacity information has been updated with interviews with relevant stakeholders for this current report. It is anticipated that the amount of dwellings for this proposal will be 312. The Lot fronts Kanangra Drive which is the access road connecting Gwandalan to the F3 Freeway. It adjoins the local school and the edge of Gwandalan township, Point Wollstonecraft Recreation area and Lake Macquarie.

The site is currently zoned 7(b) Scenic Protection. However, it has been identified in Wyong Council's residential development strategy as Precinct 1(a), Gwandalan North. This identifies the site to be developed into approximately 270 lots, with a medium term priority.

Wyong Council has in place relevant rezoning tests relating to the decision on whether to process specific rezoning requests. These tests are documented in Wyong Council's Residential Development Strategy. The tests relevant to this paper and investigated accordingly, are:

1. Whether the rezoning can improve the viability of services (such as public transport, general community service and local convenience services); and
2. Whether the rezoning can provide local employment opportunities.

Key Insights Pty Ltd investigated the opportunities and constraints associated with residential subdivision development on a portion of the proponent's land in Gwandalan. Research methods included:

- Demographic and social trend research, including reference to relevant local and State government documents.
- The Development of facilities and services map inclusive of both Catherine Hill Bay and Gwandalan.
- Assessment of likely interaction of development with existing community culture and likely provision of valued services to the public.
- Review and analysis of previously conducted community consultation and update of qualitative research.

2. The Development

2.1 Site Description

The site is Lot 3 DP 588206, a 25.99ha parcel of land fronting Kanangra Drive at Gwandalan. The land adjoins the local primary school and the edge of Gwandalan township to the south, and has frontage to Lake Macquarie to the east, Point Wollstonecraft Recreation Area to the north, and Kanangra Drive to the west. There are significant tracts of

bushland in private ownership opposite the site across Kanangra Drive.

The site is currently zoned 7(b) Scenic Protection; however, it has been identified in Wyong Council's residential development strategy as Precinct 1(a), Gwandalan North. This identifies the site to be developed into approximately 270 medium term priority lots.

2.2 Proposed Use

The proposal is to develop a residential subdivision comprising solely residential use. The total lot yield for the proposal will be 312 dwellings.

2.3 Access, Transport and Traffic

Gwandalan township is accessed from the Pacific Highway, via Kanangra Drive, which intersects with the F3 Freeway. Gwandalan residents can access most facilities and services either in Wyong, Swansea, Gosford or Newcastle. Gwandalan is approximately one hour's drive north of Sydney and a half-hour's drive south of Newcastle.

Gwandalan is serviced by the private bus company Busways. The owner of Busways was interviewed several times as part of this research. It is the opinion of Busways' proprietor that its services through Gwandalan are under utilised by Gwandalan residents, despite perceptions of residents that there is inadequate public transport in the area. In consultations with local people, adequate transport is identified as a key issue.

Wyee station is the nearest train station, followed by Wyong Station. No Busways services go from Gwandalan to Wyee as it is only a minor station. Wyong station has about twice the frequency of trains to Sydney as does Wyee. Therefore, Wyong station is the focal point for all Busways' services from Gwandalan. Busways' services are timed to connect with the Wyong railway timetable.

2.4 Economic Impacts

The economic impacts of a residential subdivision typically revolve about the effects of an increased population on the economic inputs and outputs of a town. However, the impact of the residential subdivision proposed by the proponent must be assessed beyond the immediate or direct effects provided by an increase in population growth.

The potential social and economic strategies that are taken up by the proponent will impact upon the effects of the development. Therefore, for the purposes of this assessment, the impacts of the proposal must be looked at in relation to:

1) population growth associated with the subdivision; and
2) the broader context of possible contributions, strategies and innovations by the proponent within the existing Gwandalan community.

The relationship between population growth and economic development relies largely on construction activity in the first instance and then the shopping practices of new residents, particularly regarding levels of patronage to the existing local commercial networks. Anecdotal reports from the Gwandalan business community are that new residents in new subdivisions generally do not support local business, i.e. local population increases are not commensurate with increases in local trade and turnover. This suggests that a residential

subdivision, without a parallel strategy to increase new residents' participation in the economic life of the town, is not a significant stimulator of the local economy in the short term. Community development strategies that foster the spread of a community culture centred on citizenship and participation are key influences fostering local shopping practices.

Complementing the possible effect of new residents spending more locally is the economic impact of population growth leading to a critical mass that attracts businesses and services. The proposed residential subdivision of 312 lots is likely to bring approximately 698 new residents to Gwandalan, assuming an age profile similar to the existing population, approximately 24.0% of new residents will be under the age of 15[18]. This equates to an influx of approximately 165 children / young people of whom may be children. This has implications for the local schools, which will increase their demand for supplies (buildings educational equipment, canteen food and maintenance services). Demand will increase for new local businesses including childcare services and domestic services, and will move Gwandalan towards the necessary population for a small supermarket.

Significantly the proposed residential development does not intend to create any commercial activity on the proponent's land. This is welcomed by local business owners who would prefer the existing Gwandalan town centre (such as it is) to be enhanced rather than other areas springing up in an already disjointed urban area. However, adaptable housing strategies could be implemented that would allow for small home offices, thus capitalising on a trend towards people working from home. It is important to create such opportunities because it decreases the possibility of Gwandalan becoming another commuter suburb which is undesirable in terms of traffic generation and impacts on family lifestyles.

Summary of Impacts

In relation to the direct impacts of residential sub-division and population growth, the development is likely to provide:

- Jobs during the construction phase conservatively estimated at 9 jobs per $1M in construction costs. These jobs would include a range of trades including earth movers, tilers, roofers, concreters, plumbers, electricians. Trade workers are likely to spend money locally (particularly for meals) when working in Gwandalan.
- Jobs in the supply industries as result of construction activity.
- Ongoing stimulus to the local building industry and related supply industries such as real estate and building products.
- **Multiplier effects throughout the region as a result of construction employment. This is particularly significant for Gwandalan as its main industry is construction, and its main occupational group is tradesperson.**
- Increased trade and economic activity in the surrounding area including more customers within walking distance of local shops. The "catchment area" for the proposed development would be from Gwandalan and Summerland Point through to Wyong and Lake Haven.

[18] BCP: Table B03.

This report recommends a key strategy to enhance economic and social outcomes for the proposed residential development. That is that Gwandalan become a "Learning Community" as a way of building social capital and providing economic opportunities and that Rosecorp provide financial support to the community in achieving this aim.

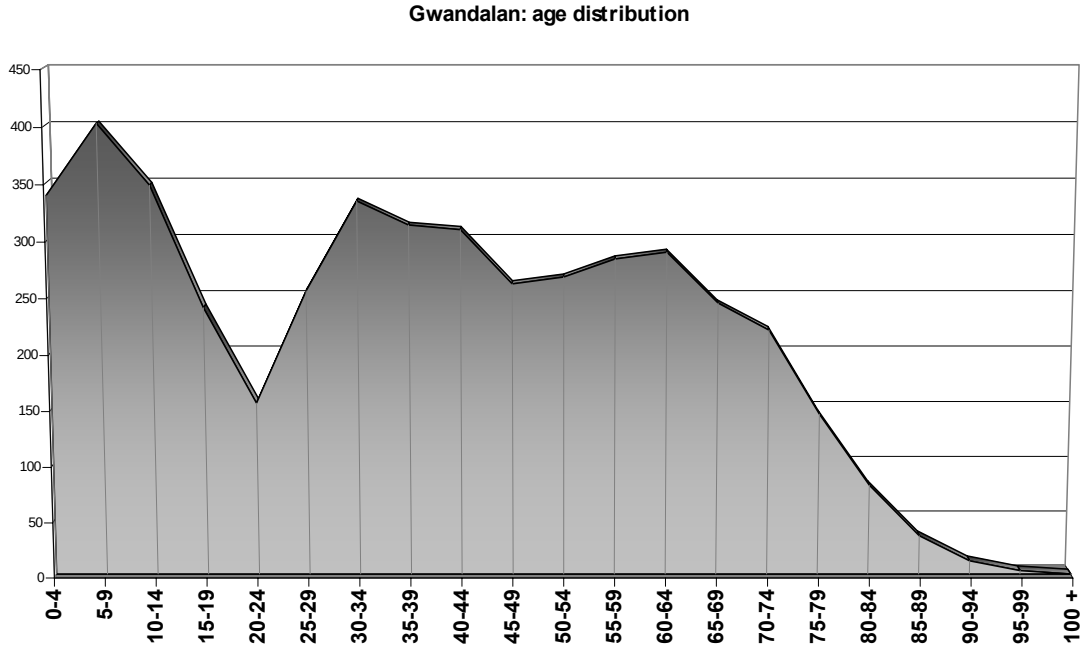
3. Socio-Economic Profile

The following demographic profile is based on figures combining Gwandalan and Summerland Point. Both communities are strongly linked in terms of the availability of services and access to other services via Kanangra Drive. The community of interest between Summerland Point and Gwandalan is evident in Wyong Council strategy documents. For the purposes of this profile, Gwandalan and Summerland Point will be referred to as Gwandalan District.

3.1 General Population Characteristics

Gwandalan District is a settlement of 4,538 people, living on 7.1 square kilometres of Lake Macquarie foreshore within the Wyong Shire. These figures are from Census 2001 and it is anticipated that the latest Census data will show a significant growth in population in the area due to new residential development. Residents in Gwandalan District have a median age of 38.

When compared with the greater Wyong Shire and Lake Macquarie City, Gwandalan District has a greater drop-off in residents at the school-to-work transition age groups, and an elevated percentage of residents in the transition-from-work age groups. The least represented age group is 20-24 years, while the highest represented age-group is 5-9 years followed by 30-34 year olds. The number of school age children in Gwandalan District is significantly higher in the primary school age group than in the secondary school.



The proportion of young people to other age groups is similar to those in other Central Coast areas. However, due to the District's small population, it could be argued that the total

number of young people has not attained the critical mass required to generate a broad range of recreation and leisure facilities locally, nor public transport outside school hours. More appropriate facilities and services for young people could motivate more families to move into the area and increase the numbers of young people.

There is normally a correlation between the educational opportunities available and the secondary school age population. Communities without a high school tend to attract fewer families with children in the high school age group.

3.2 Population Changes and Projections

Gwandalan District has grown steadily since the 1960s. This growth suggests that residents perceive access to services in Gwandalan District as adequate. They can access most services either in Wyong, Swansea, Gosford or Newcastle.

In its 2001 Gwandalan Contribution Plan, Wyong Council predicted a population increase of 890 people by 2011, an expected increase of 22% over 10 years. However the Council's 2001 population projection of 4153 is almost 10% less than the 2001 census population figure of 4538. This suggests that the growth rate is higher than originally anticipated, with almost half of the 2011 prediction being achieved in 2001[19].

Gwandalan District's population appears slightly more mobile than the Wyong population generally. 21 % of Gwandalan residents lived at a different address 1 year prior to the Census. 53% lived at a different address 5 years prior. It is difficult to gauge whether this is transience (residents replacing other residents) or growth (new residents).

3.3 Cultural Diversity

Gwandalan District community comprises a largely homogenous group of Australian born Christian people, with predominantly Australian, English or Irish ancestry. Over 88% were born in Australia, and of the 530 residents born overseas, 300 were born in North Western Europe (236 in the UK, 27 Germany, 16 Ireland) and 55 were born in New Zealand. The next largest group was those born in Malta, followed by very small representations from Asia, Africa and the America. Only 168 people, or 8%, speak a language other than English, with the most common languages being Maltese, Spanish, German and Greek.

There were 111 people of Aboriginal or Torres Strait Island ancestry living in Gwandalan District, over half of which are aged under-18. This group comprises 2.5% of the population.

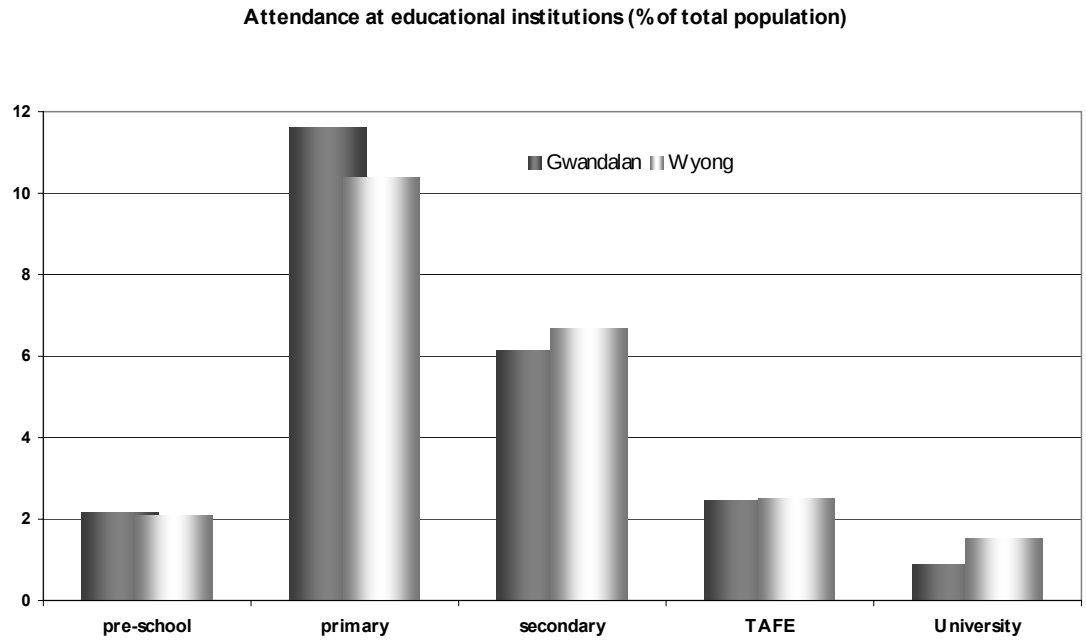
Over 92% of Gwandalan District's population regard themselves as Christian, according to the 2001 census. 48 people are affiliated to a religion other than Christianity, with the largest single group being Buddhist. 543 residents indicated they had no religion.

3.4 Education

Gwandalan District has a higher rate of children attending primary school and a lower rate attending high school when compared to Wyong. TAFE opportunities appear to be equal to

[19] This analysis is based on figures tabled in Table 5.1: Population Growth Projection for the Gwandalan District. *Contributions Plan No 12. Gwandalan District*. December 2001, p3 **(see table 5.1.4 in this report).** However, the original source of population figures is not provided within the plan.

those available throughout Wyong, but there appear to be fewer opportunities to attend university while remaining resident in Gwandalan. This could relate the proximity of Newcastle University's Ourimbah campus to southern Wyong shire; or the convenience of public transport (via rail) from Wyong and Tuggerah to Newcastle or Sydney universities. While private vehicle access is convenient from the eastern side of Lake Macquarie, public transport access is less so.



To appreciate the choices available, it is necessary to draw some distinctions. Some services provided by government are regulated. For example:

- there is a government primary school at Kanangra Drive, Gwandalan, founded in 1961 and an enrolment of 430; but
- for secondary schooling, the NSW Government designates Lake Munmorah High School as the "local" school - not Swansea High School at Caves Beach.

Other services are less regulated:

- For technical and further education, students choose the TAFE facility offering the courses they want to pursue. They can attend Wyong, Ourimbah or Gosford to the south; or, numerous facilities to the north including Belmont, Glendale, Tighes Hill and Newcastle.

3.5 Employment

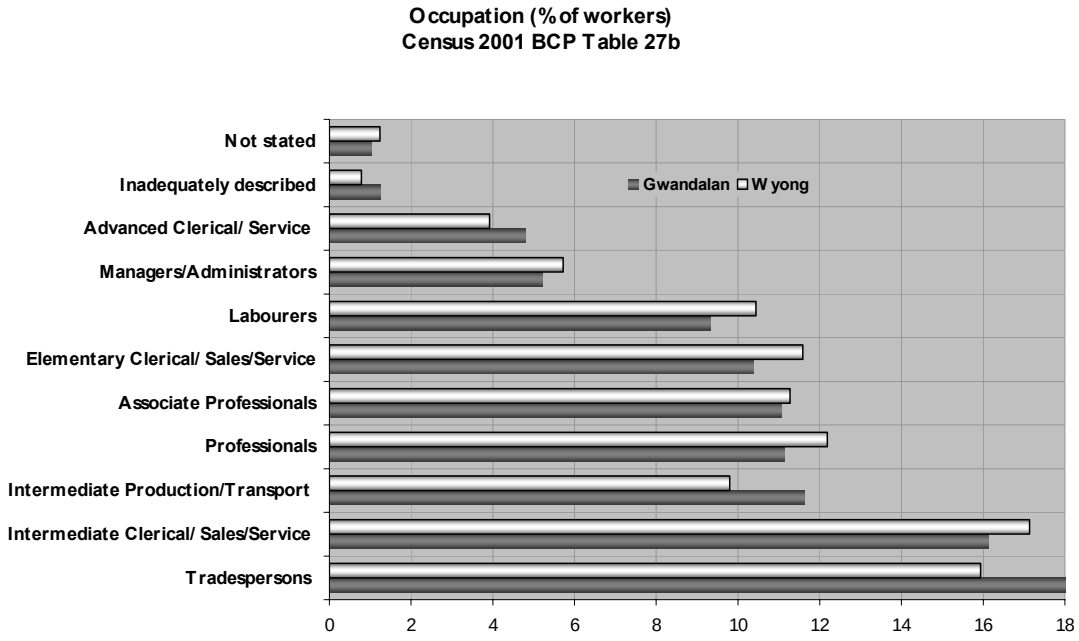
In 2001, 88% of the Gwandalan District labour force indicated they were paid employment, with 55% full time and 30% part time[20]. The principal sector of employment for Gwandalan residents is retail trade, followed by manufacturing, as it is across Australia. The construction sector also employs significant numbers, a higher proportion than in Wyong generally or Lake Macquarie.

[20] 3% did not specify full-time or part-time.

The reported unemployment rate for Gwandalan District in 2001 was 11.9%.

Although still significant, employment is lower than in the surrounding areas among most white-collar sectors: health and community services; property and business services; government administration and defence; and education. Gwandalan, like Catherine Hill Bay, is one of a series of small settlements between Swansea and Wyong that access at those larger centres services such as education, financial services, and health care. The smaller settlements themselves do not constitute self-contained markets able to sustain businesses competing against those larger centres, although collectively they add to the market for the larger centres.

As expected, with such a skew towards manufacturing and construction the principal occupation declared by residents is tradesperson or related employment, as indicated by the figure below.



Patterns of male and female employment are markedly different. Gwandalan District females are employed primarily in retail and the health and community services sector, indicating a high level of part-time employment. These service industries (along with accommodation, cafes and restaurants) typically offer permanent casual employment, which the Census classifies as part-time as it represents less than 35 hours in a week.

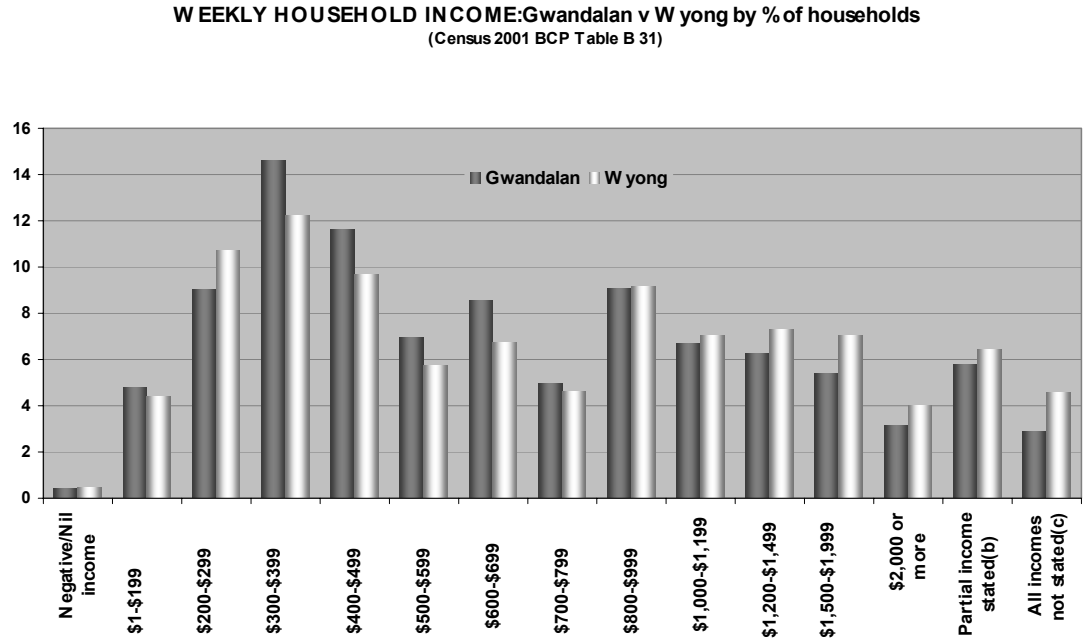
Taken with the strong bias towards tradesperson as an occupation in Gwandalan District, and an overall employment skew towards construction and manufacturing, this means that most female residents of Gwandalan work part-time and most men full-time.

3.6 Income

The median weekly income for a household in Gwandalan District is $500 to $599, compared with $600 to $699 for Wyong Shire (Census 2001, BCP Table B 33). The distribution of income shows more households in the $300-399 band in both Gwandalan and Wyong than in any other band, but generally a higher percentage of Gwandalan households

in income bands below $800 a week, and a higher percentage of Wyong households in the higher income bands.

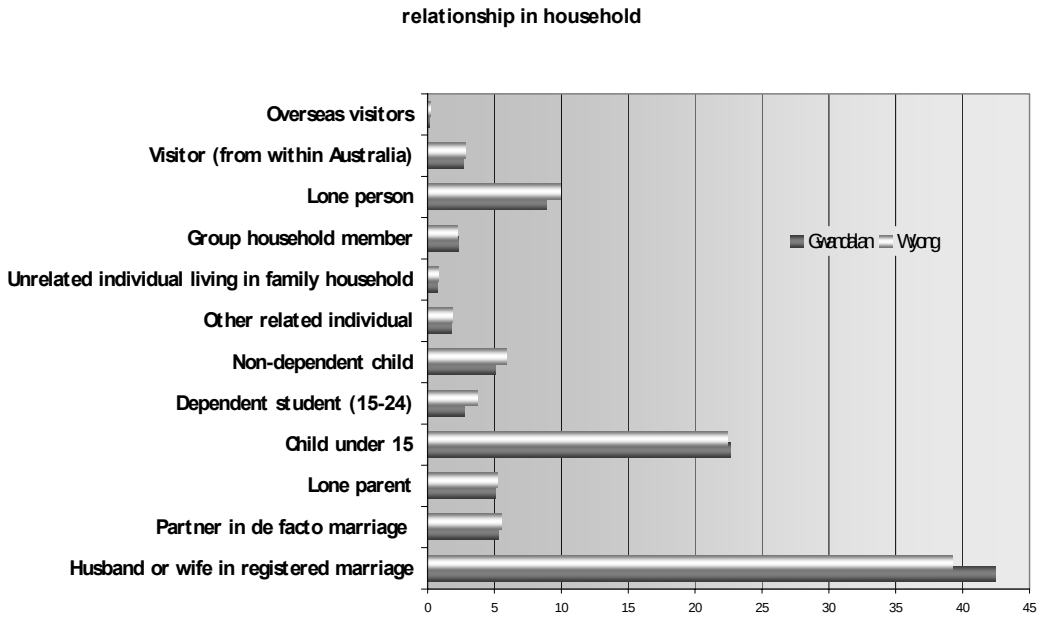
The pattern of mortgage payments in Gwandalan parallels the patterns in income. The median measure mortgage in Gwandalan is between $800 and $999 a month.



3.7 Families

43% of Gwandalan District households comprise a husband and wife in a registered marriage. 5 % comprise couples living in defacto marriages. 5% of households are lone parents with their children, while 9% are lone persons. Almost 25% of households have child under 15, while about 3% have a dependent student aged 15-24.

Unlike Catherine Hill Bay, the composition of households in Gwandalan is remarkably similar to that in Wyong overall, with slightly lower percentages of lone person households and households with children, but more people in registered marriages.



3.8 Housing

Gwandalan District has a very high percentage of separate houses, numbering 1710 such dwellings (not including significant increases as a result of development over the past 5 years). It has only 19 flats, seven of them attached to houses and none in a block over 2 storeys; and it has only 6 semis or townhouses of more than one storey.

76% of Gwandalan's dwellings are fully owned or being purchased, slightly higher than Wyong. 18% are being rented, significantly less than Wyong's 24%. Its is notable that Gwandalan has only three houses where rent is paid to the Department of Housing, which is less than one-fifth of one percent of housing stock (0.02%). In Wyong Shire, 3.25 per cent of dwellings are tenanted to the Department.

What is remarkable is the number of private dwellings unoccupied at the time of the Census. The 586 dwellings represent 25% of the dwelling stock of Gwandalan. In contrast, the figure for Wyong Shire is 12.25% and for NSW 8.86%. This indicates that Gwandalan, like Catherine Hill Bay, is a popular place to own a holiday house.

Clearly a region like the Central Coast has an elevated proportion of weekend and holiday units and beach houses, which would explain the relatively high proportion in Wyong Shire generally, but Gwandalan has a significantly higher percentage. It seems appropriate to assume that it is an attractive holiday or retirement destination within easy reach of major population centres.

Gwandalan	Dwellings
Separate house	**1,710**
Semi-detached, row or terrace house, townhouse etc. with:	
One storey	22
Two or more storeys	6
Total	**28**
Flat, unit or apartment:	
In a one or two storey block	12
In a three storey block	0
In a four or more storey block	0
Attached to a house	7
Total	**19**
Other dwelling:	
Caravan, cabin, houseboat	4
Improvised home, tent, sleepers out	0
House or flat attached to a shop, office, etc.	5
Total	**9**
Not stated	0
Unoccupied private dwellings	586

As detailed above, the most common mortgage in each is between $800 and $999 a month. This is the median measure of housing repayments for both Gwandalan and Wyong. However, more homes in Gwandalan than in Wyong had lower mortgages than this, and more homes in Wyong than in Gwandalan had higher mortgages.

3.9 Transport

Gwandalan District residents are high users of private vehicle transport, and have high levels of car ownership. In the 2001 census, over 90% of households had 1 or more motorcars, almost 10% more than the state average. Predicably, travel to work is predominantly by car, either as driver or passenger.

While private vehicle access to Newcastle or Sydney is convenient from the eastern side of Lake Macquarie, public transport access is less so. There is no railway in Gwandalan. The nearest railway stations are at Wyee and Wyong. There is no bus service to Wyee. Bus commuters to Wyong station must use transfer services at Lake Haven.

3.10 Other Influencing Issues

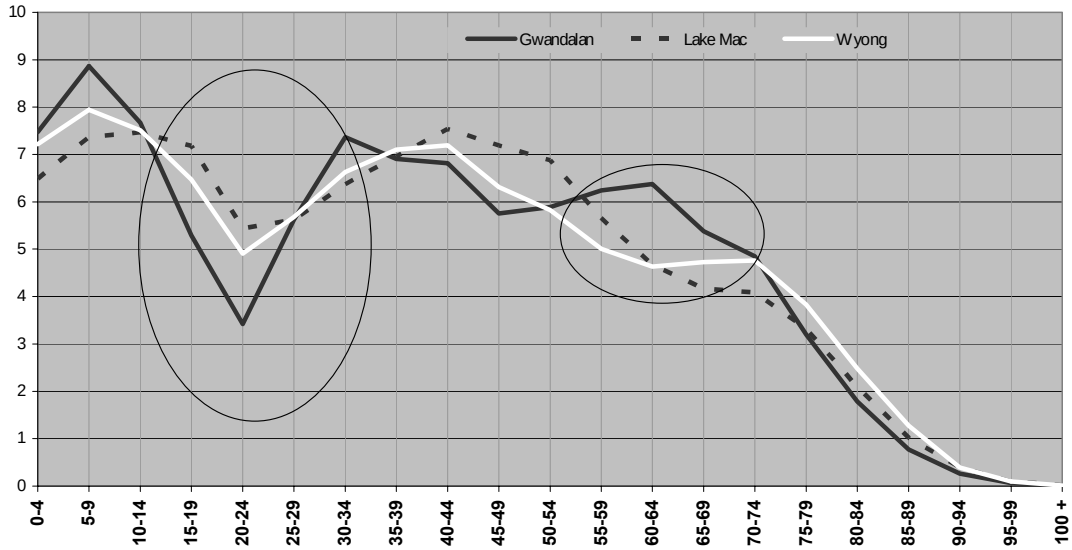
Other factors that contribute to an analysis of the site include:

- National decreasing housing affordability – increasing need for affordability mechanisms
- Rising interest rates – affects homebuyers decisions/perceptions
- Telecommunications – speed and ranges of internet and mobile phones will influence home business, education, etc

4. Social Trends

4.1 Population Characteristics

age: Gwandalan v Wyong v Lake Macquarie (% of population)
Source: ABS Census 2001 Basic Community Profiles Table B 03

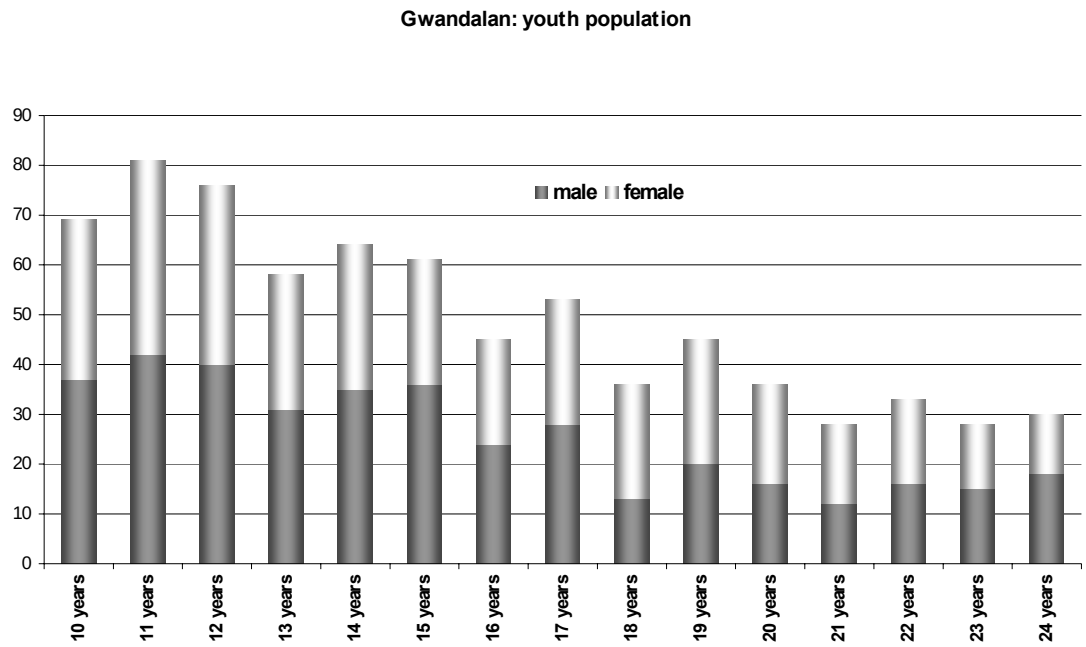


Compared against the distribution for its own LGA, Wyong, and the adjoining City of Lake Macquarie, the principal points of difference are the greater drop-off in residents at the school-to-work transition age groups, and an elevated percentage of residents in the transition-from-work age groups.

These figures indicate that the trend is that young people (15-25) move away from Gwandalan for further study or work. They may return with young families when they are in their 30's, or perhaps the spike in the early 30 year age group represents new residents moving to the area. It is not possible to determine this from ABS data.

It is likely that while people taking early retirement (50 – 60 years) in Lake Macquarie or Wyong may move away from their areas, people in this age group tend to remain in Gwandalan. This would explain the spike in the 55-69 year age group although again, this cannot be claimed with certainty from ABS data.

Remembering that the median age is 38, it may be that the high mobility represents a trend of "thirty-somethings" moving in. This will become more evident with the release of the 2006 Census data. It is also likely that some mobility is attributed to early retirees moving in as well. The data suggests that over time Gwandalan may become quite stable with people tending to stay on in their retirement. There must be an age, however, at which the physical isolation becomes a challenge for elderly people who need to be closer to health services.



While proportions are similar to those in other areas, the total number of young people in Gwandalan has not attained the critical mass required to generate a broad range of recreation and leisure facilities locally, nor public transport outside school hours.

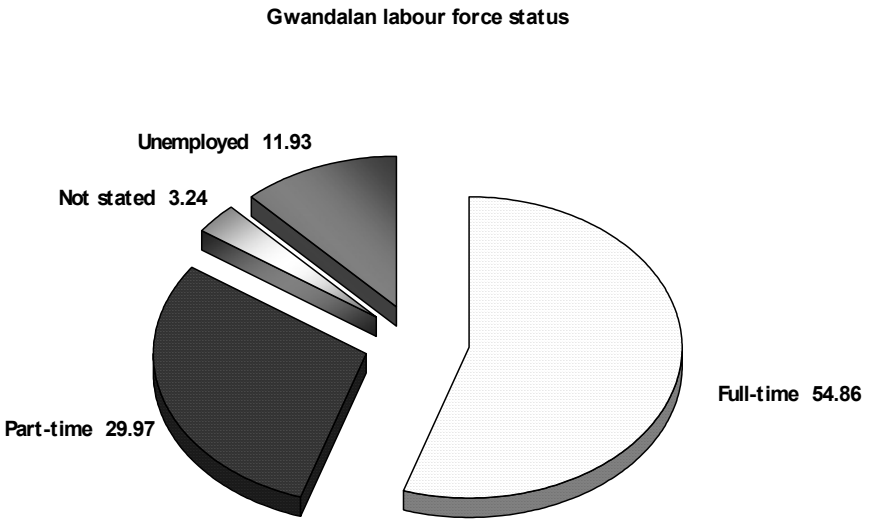
B22 Mobility	Gwandalan	Wyong
Same address 1 year ago	78.80	80.90
Different address 1 year ago	21.20	19.10
Same address 5 years ago	47.03	51.17
Different address 5 years ago	52.97	48.83

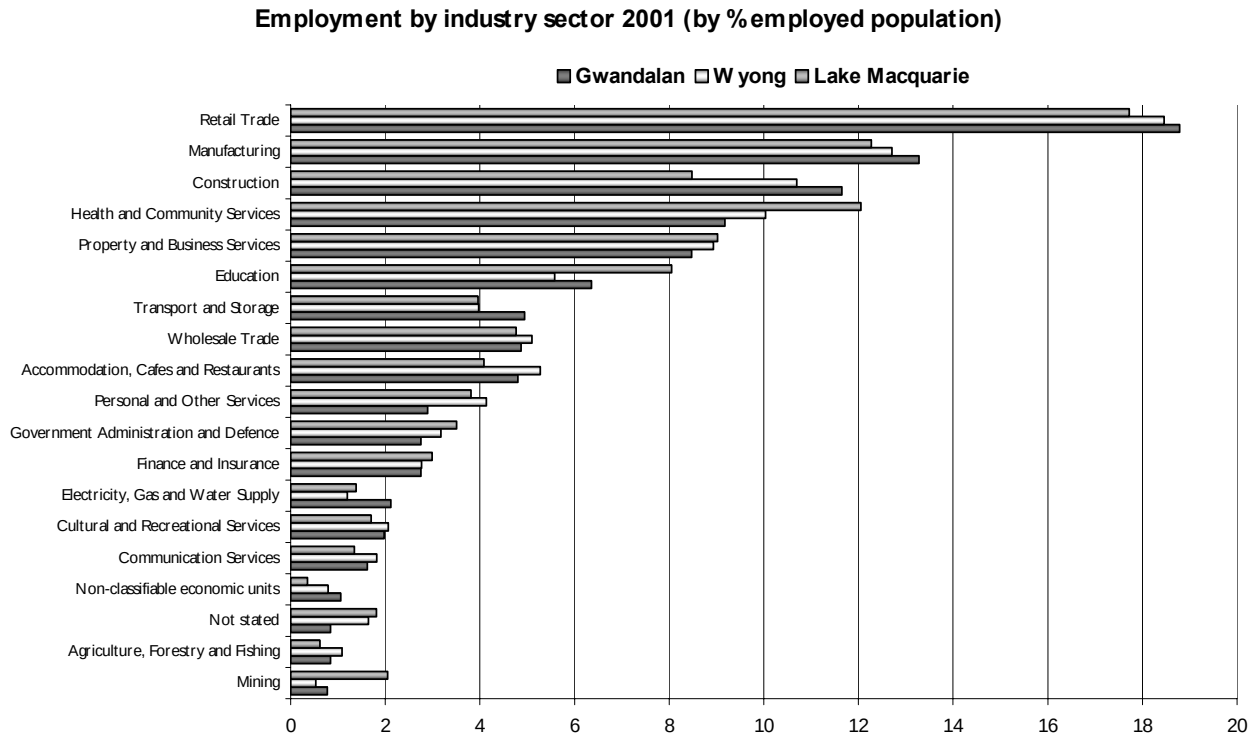
Year	Estimated Population
1996	3726
1997	3814
1998	3901
1999	3986
2000	4070
2001	4153
2002	4236
2003	4319
2004	4402
2005	4486
2006	4571
2007	4577
2008	4625
2009	4708
2010	4822
2011	4960

The above table is sourced from '*Table 5.1: Population Growth Projection for the Gwandalan District*' in Wyong Council's Gwandalan District Contributions Plan No 12. However, the original source for the figures is not included with the table.

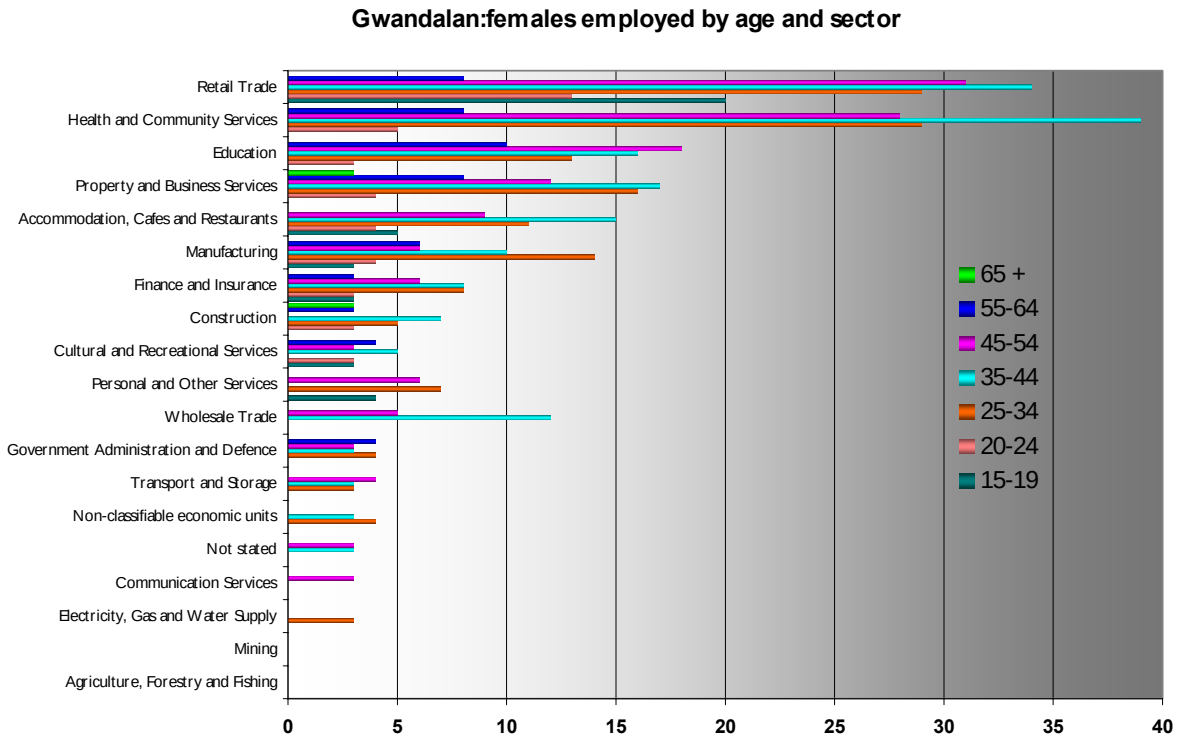
Comparisions with 2001 Census figures suggest either a disparity in population figures between various sources, or a greater than anticipated rate of population growth than predicted by Council. This suggestion is based on the difference between the 2001 census population figure of 4,538 compared to the Council 2001 prediction of 4,153 (ie. a difference of 385 people).

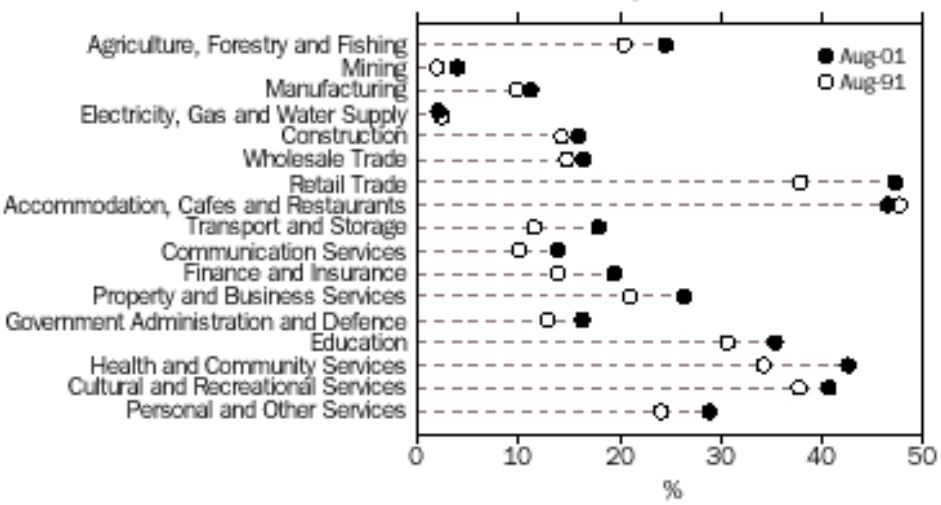
4.2 Employment





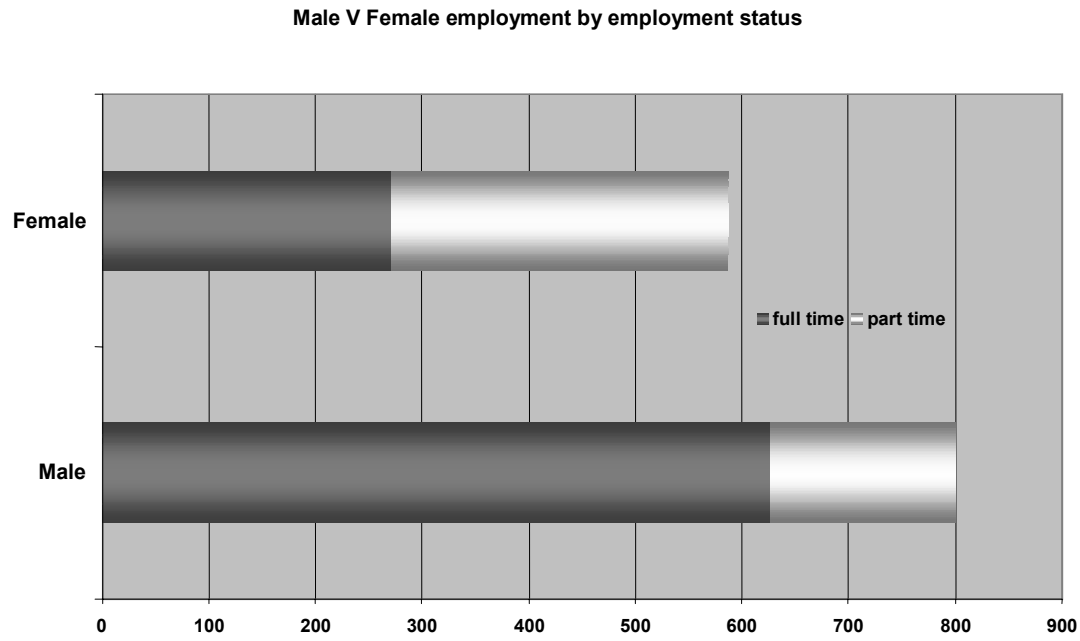
The principal sector of employment for Gwandalan residents is retail trade, as it is across Australia. Manufacturing, which was Australia's largest sector of employment for many years, remains the second most important sector for Gwandalan residents. The construction sector also employs significant numbers, a higher proportion than in Wyong generally or Lake Macquarie. It is likely that most of those employed in retail trade and manufacturing have to commute to work. Given the amount of construction being undertaken there would be some opportunities for tradespeople and construction workers to work locally.





*SOURCE: ABS **Labour Force, Australia** (Cat. No. 6203.0), October 2001*

This chart shows part-time employment as a percentage of all employment in different industry sectors, comparing the 1991 and 2001 Censuses to indicate growth.



The female employment chart above indicates a very low number of females aged 15 to 19 employed (fewer than 40, in fact). More than half of those are employed part-time.

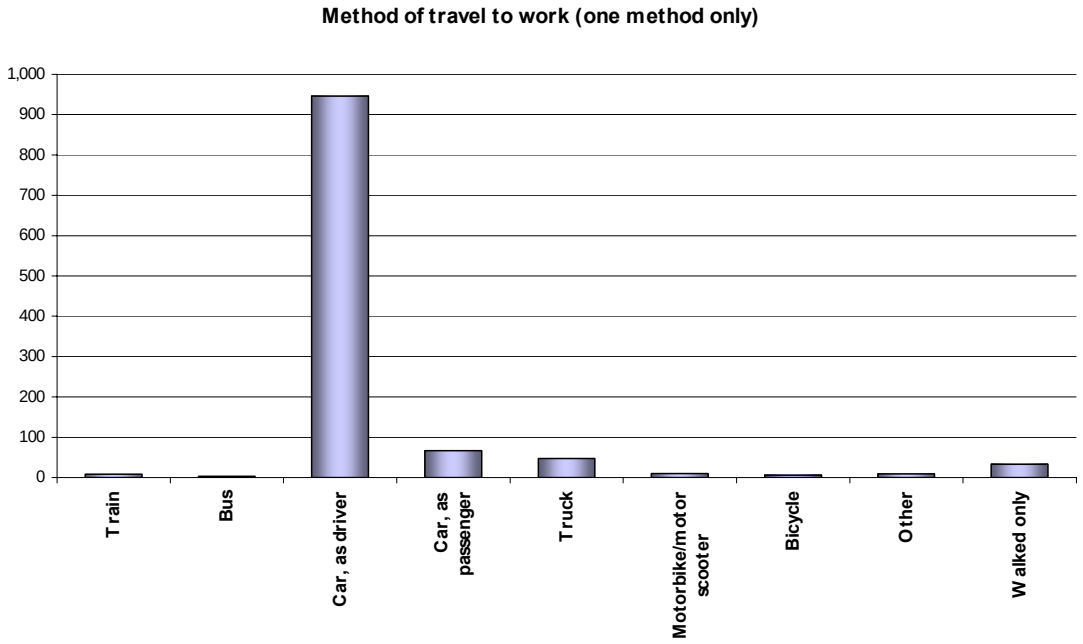
Many residents in this age group, female and male, are still attending school or another form of education.

The actual unemployment rate among people aged 15 to 24 is difficult to assess. Across Australia the number of people 15 to 19 seeking work is small, and in any given community the sample is so small as to be highly volatile. Using the Census 2001 figures, however, an apparent youth unemployment rate can be derived.

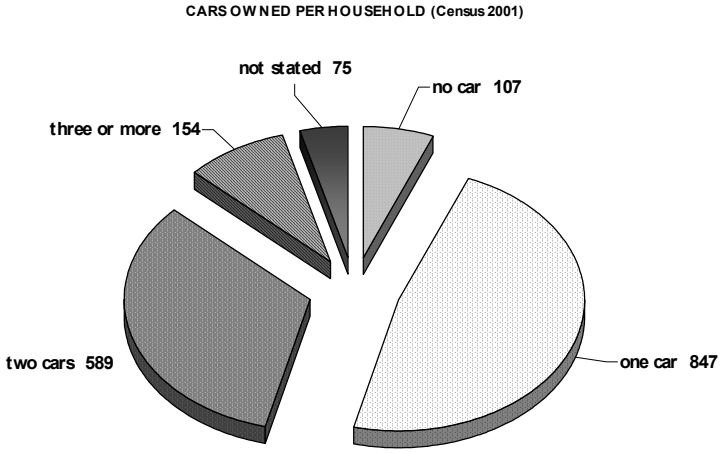
There were 13 males and 10 females aged 15 to 19 looking for work at the time of the total *labour force* in the age group of 106 – an apparent unemployment rate of 21.7%.

In the older age group (20-24years), where more people have left school or even post-school education, the apparent unemployment rate was 23.48%. This represented 27 residents seeking work of a labour force of 115.

4.3 Transport



With no railway in the town, travel to work is predominantly by motor car, either as driver or passenger.



Gwandalan has a high level of vehicle ownership and this trend is likely to continue unless the provision of public transport is matched with a cultural shift away from private vehicle use.

4.4 Urban Settlement

Gwandalan is experiencing urban growth with small subdivisions selling well. The town centre is not immediately obvious and community members report feeling disconnected from new residents. This indicates a trend of the community being re-made without reference to existing established networks.

While there are strong networks and evidence of social capital, there are also signs of dislocation – concerns about young people having a future in the area, concerns about integration of the old and new communities and a diminishing sense of safety. What is required is a proactive approach to social sustainability.

5. Contribution to the Wyong Council Strategies

There are a number of relevant policy documents that cover the proposed development site. The salient key points are listed here together with comments regarding their relevance to the proposed development.

5.1 Wyong Local Environment Plan 1991. Wyong Shire Council (Last amended August 22, 2003)

The overall aims of this plan are to promote the management, development, conservation and economic use of Wyong Shire resources and protect the amenity of its environment.

Objectives

The objectives of the plan relate to:

a) Population and housing, regarding
   - Development of a wide range of housing stock commensurate with changing characteristics of Shire,
   - Residential development achieving efficient use of existing physical and social infrastructure,
   - Provision of new urban development in areas that can be economically serviced are environmentally suitable;

b) Employment and economic development, regarding
   - Employment generation, contributing to Shire's economic and social growth,
   - Opportunities for appropriate home-based employment;

c) Retailing and commerce, regarding maintaining and reinforcing function and viability of commercial centres;

d) Leisure and tourism, regarding open spaces, leisure activities and recreation opportunities;

e) Community Services, regarding provision of a variety of community facilities appropriate to local needs;

f) Transport, regarding arterial roads, the free-flow of traffic, road additions and realignments and the provision of regional aerodrome facilities;

g) Rural and Environmental areas, regarding protection of sensitive areas and minimisation of adverse impacts of urban development on natural environment;

h) Conservation, regarding protection and enhancement of items of environmental heritage;

i) Administration, regarding facilitation of development through enunciation of Council's environmental planning objectives;

j) Tree Preservation, regarding minimising land degradation, conserving native vegetation and protecting water catchments and ecosystems.

Comment: **The key social issues concern the limited current range of housing stock available in Gwandalan, the efficient use of existing social infrastructure, and the current capacity for the area to economically and socially service new development in the immediate to mid term.**

Transport is a significant social issue because it concerns public safety, noise and air pollution, postal communications, and the accessibility of social and economic facilities and services.

A summary of the opportunities and constraints arising from the above objectives in regards to the proposed development from this document are outlined in the table below:

Opportunities	Constraints
• Job creation in both the construction and operational phases. The construction industry is a key employer within Gwandalan and Gwandalan's primary occupational group is tradespeople. **Key Insights recommends prioritising tenders for construction and other services locally.**	
• Opportunity to incorporate adaptable use housing and telecommunication facilities into the design to encourage home businesses. This contributes to the current trend, supported by local government, towards the promotion of home offices or small offices near people's homes as a means to sustainability. Existing and prospective Gwandalan residents have access to high speed broadband internet connections as well as Gwandalan's location near three major markets, Sydney, Central Coast and Newcastle, means it is an excellent site for such development.	• Commercial focus is currently constrained by lack of a defined town centre. • Commercial benefits of new development constrained by reported trend of new residents to shop at bigger urban centres.[21]
• There is an opportunity to increase the efficiency of the local commercial centre as the development does not propose to offer competitive services on–site. Council's current concern that Gwandalan is an isolated community might be mitigated by an increase in residents and diversification of the community which in turn increases the self-sufficiency of the township, and stimulates follow on effects in the local	• Focus group members report that teenagers have few recreational opportunities in Gwandalan, as well as inadequate public transport to nearby towns in after school hours. This might deter families that might otherwise choose to reside in Gwandalan.

[21] This anecdotal information was sourced at the focus group meeting. It has not been verified and perhaps should be when a full Social Impact Assessment is completed.

commercial centre through an increase in residential consumption patterns. • Opportunity to enhance Gwandalan's recreational capacity by providing facilities catering to local families. • Opportunity to incorporate open space and recreational facilities into the development. • There are opportunities to integrate community services if gaps are identified, or further promote and utilise existing community services to new residents. • Opportunities for proponent to contribute to improved public or community transport options, eg, donation of minibus, sponsorship of transport brokerage. • The opportunity exists to develop the land maintaining maximum natural and visual integrity of the land, via the preservation of existing native vegetation and trees, and the planting of native vegetation to complement the current landscape. • There is an opportunity to balance conservation with development and set a new benchmark for the local area. There is also an opportunity to respect community perceptions and values regarding the natural environment, including scenic integrity.	• New development is constrained by existing transport infrastructure, and also the requirements of Council for developers to contribute to the upgrading of transport facilities. However, these contributions can also be regarded as an opportunity. • New development constrained by environmental regulations and fire safety hazards. (Subject of separate expert reports)

5.2 Wyong Shire Community Plan: Main Report. Strategic Planning Department. Prepared by Kerrie Forrest, Social Planner. July 2002.

The key aim of the Community Plan is to set the strategic direction for Council's role in the planning and provision of human services in Wyong Shire. It aims to translate Council's corporate objectives into concrete action plans, focusing on direct and facilitated service provision, community development, advocacy for services needed to be provided by other agencies, and the development of human and social capital. The emphasis is on a collaborative approach to planning and integrated service delivery.

The plan is broad based and encompasses key social issues focusing on people's quality of life in the community, including: education, employment, health, housing, community safety, transport, recreation and open space.

The Community Plan identifies Wyong Council as best placed to take on a *leadership* role in ensuring community needs are recognised and addressed. However, as its resource and skill bases are limited, Council seeks to establish *partnerships* with other levels of government, NGOs, the local community and the private sector.

Key points particularly relevant to Gwandalan are:

New Release Areas:
The Plan acknowledges the difficulties in achieving community cohesion in new urban release areas, where residents have relocated from their pre-existing social networks and initially focus on establishing home and garden. The plan points to the need and opportunity to enhance social cohesion and support networks (social capital) in growing these new communities, as well as integrating them into existing networks.

Established Areas/Community Renewal:
The Plan notes problems in social capital in existing communities. It points to the provision of central and resourced community facilities for meetings, education, support, referral and activities for the community. It suggests that vacant buildings or space can be transformed from community 'liabilities' into community 'assets'.

Public Transport:
The plan identifies Gwandalan as one of several areas in need of better public transport, but recognises profitability as a threat to sustainability of such services.

Employment:
The plan identified small business as a key player in the local economy, with almost all business in Wyong Shire being small. Recent research has revealed the need to focus on new business creation, especially amongst women and young people, as an important avenue for creating jobs. The plan also highlights the potential of linking education initiatives to employment sector gaps.

5.3 Shaping the Central Coast Action Plan Version II – A work in Progress November 2002. Planning NSW, Gosford City Council and Wyong Shire Council.

This regional plan is part of the renewed emphasis on a regional approach to coordinating local development. The plan is the result of major and widespread consultation across the region. Its starting point was the identification of desired regional outcomes for the Central Coast in the year 2021. It identifies the key issues confronting the region and presents actions to achieve outcomes.

The desired outcomes of the Action Plan relate to:

- Diversity of employment and business;
- Educated community and skilled workforce;

- Access and efficient transport;
- Protection of natural environment;
- Appropriate infrastructure and sustainable resource use;
- Connected, safe and trusting communities;
- Healthy communities;
- Regional identity and diverse recreational and cultural opportunities;
- Logical settlement patterns and housing;
- Integrated regional governance.

The guiding principles of the action plan are:

- Competitiveness is fundamental;
- People are at the centre of the Action Plan, therefore sustainable communities and social inclusion are vital;
- Environmental investment and prudent resource management;
- The tying together of opportunity and need, i.e., allowing economic activity to benefit deprived communities;
- **Creation of a life-long learning culture in the region;**
- Better use of resources;
- Working in partnerships;
- Capitalising on Information Communication and Technology opportunities.

The plan moves on to detail broad strategic goals and specific action points to take to achieve goals. The goals and actions are grouped in the following four key areas:

Goal 1: Competitive and Adaptable Economy

Goal 2: Healthy and Sustainable Environment

Goal 3: Vibrant and Liveable Communities

Goal 4: Regional Governance.

Comment: The Rosecorp development has the opportunity to contribute to the above goals, particularly the achievement of vibrant and liveable communities and a healthy and sustainable environment. The benefits derived from a partnership approach are relevant to opportunities arising from the development. Potential partnerships with the school and community could assist in the fostering of a life-long learning culture in the local area, as well as the region. Strategies to achieve social inclusion both internally and within the existing community are also relevant. Careful and skilled management of, and investment in, the site's natural resources, such as water and bushland, allows the opportunity to contribute to the preservation of the local environment. A key point of relevance refers to the criteria for logical settlement and housing. The proposed site has already been earmarked for residential subdivision, and therefore fits into the logic of the Wyong settlement strategy.

5.4 Wyong Development Control Plan No 18 - Gwandalan & Summerland Point, 2005, Wyong Shire Council.[22]

Gwandalan's Development Control Plan aims to identify developer contributions applicable for the upgrading of bushfire brigade facilities, roads and intersections, as well as the method of apportioning costs.

1. Roads

The Gwandalan DCP identifies Kanangra Road as requiring upgrading between Summerland Road and Parraweena Road (to a 7.0 metre rural road) and between Parraweena and Orana Road (to a 13 m urban road standard).There are also requirements regarding improvements to minor roads in Gwandalan. Under the former Gwandalan DCP, an upgrade to include traffic lights in the Kanangra Drive intersection with the Pacific Highway has been completed.

These requirements will interact with transport and access issues concerning the potential development. The relevant social impacts concern accessibility, physical isolation, road safety, noise and traffic (particularly for construction vehicles) and public transport.

2. Developer Contributions

The plan outlines the Section 94 contributions that apply when development occurs, and their method of calculation. The components that are relevant to the social constraints and opportunities aspect of master planning are point c), d) and e), namely:

a) Contributions to public reserves and community facilities, which accords to Council's *Policy No D2 – Development Contributions to Community Facilities and Service;*
b) Contributions to the upgrading of bushfire brigade facilities, which will contribute to actual and perceived public safety; and
c) Contribution towards the upgrading of roads and intersections, which impacts upon community accessibility, safety, noise, and issues concerning perceived physical or social isolation.

5.5 Contributions Plan No 12. Gwandalan District. December 2001.

The purpose of this document is to determine the contribution rates and means of providing public services and amenities that are necessary as a consequence of proposed development in the Gwandalan area.

The plan is premised on an anticipated population increase of 890 people by 2011[23]. Whilst 144 of these are included in remaining lots and future medium density development, the balance of 746 will be located on existing vacant and unoccupied properties. It is important to note that the proposed development site, and the potential population increases accompanying its subdivision, are not included in Gwandalan's urban release zone and therefore not accounted for by these figures.

The plan details contributions to:

[22] Accessed on web 21/10/06.
[23] According to 2001 census figures, population rates are increasing at a faster rate than anticipated in this document.

1) Local Roads and Drainage

Existing roads and intersections are adequate to cater for existing development and future low density development on existing residential lots. Certain roads, such as Kanangra Drive, would be required to cater for the proposed development;

2) Community Facilities

This section considers the human service requirements generated as a result of development. The measurement criteria for assessing needs are a) Land for Community Facilities, and b) Community Facilities Floor Space. The general assessment is that there is sufficient community *land* within Gwandalan District; there is not sufficient *capacity* (facilities/services) to meet population growth:

> *"Assessment of existing land holdings shows that there is an excess of community land for the existing population and there is not significant shortfall due to the requirements generated by the future development.*
>
> *However, while there is sufficient community land within the district, assessment of existing services indicates there is no spare capacity in these facilities to meet the need generated by the future development considered in the Plan. Therefore, additional facilities will need to be provided to cater for the proposed population increases in both the urban release areas and in the existing areas."*[24]

Council figures indicate that with an expected additional population of 144 (45DU x 3.2), a total of 52 square meters of floor space is required. Council proposes to construct a district level multi-purpose community centre to cater for the populations of Mannering Park, Gwandalan, Summerland Point, Chain Valley, Lake Munmorah, Budgewoi and Buff Point. Construction is proposed for 2005. **(This may present an opportunity for a Rosecorp contribution, although focus group members were saying: Projects are more important than buildings).**

3) *Public Open Space*

Assessment shows that there is an excess of open space land for the existing population and no predicted shortfalls. Further there is no concentrated location of future development planned, and therefore no specific open space sites required to be provided.

5.6 Warnervale District Planning Strategy, Woods Bagot. Final Draft June 2002.

Wyong Council's current proposal to create a sustainable urban development within Warnervale District is relevant to the Gwandalan proposal. The Warnervale District Planning Strategy sets out the vision and principles for this development. The plan responds to the demands being placed upon the area by the growing population.

The overarching guiding principle of the Warnervale District Planning Strategy is that of 'sustainable community development' and aims to simultaneously benefit the area's economy, environment, social equity, community life and personal quality of life. The plan

[24] Wyong Council Contributions Plan No 12. Gwandalan District, December 2001, p, 10

aims to avoid the 'potential disaster' posed by the sprawling Sydney mega city by adopting instead **"urban forms built on liveable human-scale communities in balance with nature"** p3.

The Warnervale strategy takes a whole-of government and community collaboration approach, with partnerships between Wyong Shire Council, the local community, NSW government (eg. Planning NSW, Transport NSW), Landcom, and professional consultants informing the planning process. These partnerships have fostered several major initiatives being proposed by Wyong Council and NSW Government for the District.

The vision for Warnervale integrates the building of infrastructure with social and human capital. Key components of planning include the establishment of a new town centre, the provision of services and facilities, and employment within the new town. Proposed community facilities include an Aquatic and Leisure Centre, an Arts and Culture Centre, a library, district sports ground, aged person centre, central park, and a Youth Precinct. There are proposals to build two new state primary schools in the District. New transport facilities are proposed, including a $19 million railway station, bus interchange and car park, as well as a $10 million upgrade to Spark Road and a link road from the Pacific Highway.

There is an opportunity for Rosecorp to draw upon, and add to, Wyong Council's innovation, vision and commitment to creating sustainable communities and social capital as demonstrated in the Warnervale planning strategy.

The proximity of Gwandalan (and Catherine Hill Bay) to the proposed Warnervale community (24km) is also relevant and provides opportunities to integrate planning for services such as public transport, education and youth activities.

The major differences between the projects revolve about the scale and proposed uses of the actual development sites. It is proposed that Rosecorp's land at Gwandalan be used solely for residential purposes, whilst the Warnervale project incorporates the development of a complete mixed-use town centre, residential infrastructure (housing 40,000 new people over 15 years), employment lands, and a complete mixed-use town centre, including major infrastructure construction such as a railway interchange and multipurpose buildings. However, by taking a whole-of-town approach to the Gwandalan development, opportunities to match and link with Warnervale arise.

Strategies being developed that are relevant to Gwandalan

The vision for the Warnervale District adheres closely to the vision that Rosecorp has for its Gwandalan site, and has shared with residents at the Focus Group meeting. Both proposals value the emergence of vibrant, vital and active communities that incorporate strategies to balance development with a healthy natural environment. There is the opportunity for Rosecorp and the Gwandalan community to look toward the Warnervale for working examples of sustainable community design.

Possible links between the two proposed developments

Gwandalan's development as a 'learning community' has the potential to link in with the educational components of the Warnervale Development. The Warnervale development has the potential to foster the emergence of a new learning culture, arising from and contributing

to the processes of community development. The challenge is to harness the energies, skills, and innovations stimulated in the local area, as well as in burgeoning regional and national networks, that are potential products of the planning and creation of a new town.

Strategic links in services such as public transport, youth facilities, and educational programs such as adult education or specialised youth training, can be incorporated into both designs to optimise future capacities. Gwandalan's natural amenity and recreational facilities such as Point Wollstonecraft have the potential to service Warnervale residents. Conversely, Warnervale's development as an attractive urban centre could provide employment options to Gwandalan residents that are closer to home than current major centres, as well as opportunities for larger scale sports and culture. This is especially relevant to Gwandalan's young people, providing that accessible public transport exists.

6. Gwandalan as a Learning Community/Village

"Learning Communities are clearly an important dimension of community capacity building" – Sharon Zivkovic[25], p6

At the community focus group (see next section, Qualitative research results) it was clear that Gwandalan is an excellent place to live and there are strong networks and connections. Social planners would describe Gwandalan as having "social capital". At the same time there are emerging social and economic issues that need to be addressed, particularly the integration of new residents with the existing community, the ongoing vitality and sense of community that includes activities for all age groups and access to employment and education.

Education, in its broadest sense, is central to many of Gwandalan's aspirations. Many communities around the globe are turning to education, and more specifically the notion of "learning communities" as a community development tool. Given that Rosecorp is a company with a demonstrated commitment to community development and is looking to invest in the local community, then there presents a unique opportunity for Gwandalan to become a learning community and reap the subsequent benefits.

6.1 What is a 'Learning Community'?

The Learning Community Catalyst online network has distilled four core functions of learning in a community:

- to develop skills,
- to grow business,
- to foster collaboration, and
- to strengthen community.

Learning communities are neighbourhoods, villages, towns, cities and regions that use **lifelong learning** as an organising principle and social goal of the community. Collaboration of civic, economic, public, volunteer, and education sectors is promoted to enhance social, economic and environmental conditions. Development is sustainable and inclusive.

[25] Zivkovic, Sharon "Building Community Capacity'. Senior Community Development Coordinator, Department of Human Services, Government of South Australia.

6.2 Learning Communities

The Learning Community initiative is a concept that is part of a growing international and Australian movement towards the practical integration of life-long learning values and practices into the everyday life of communities. The movement includes initiatives in Canada, the US, Europe, the UK and Australia, and has been labelled variously as learning communities, learning cities, learning regions and learning towns.

According to the Centre for Lifelong Learning and Development, Learning Communities have two common concerns:

1. The need to respond at a local level to the changing economic circumstances at a global level which are exerting a significant impact on nations, and therefore on regions, cities and towns.
2. The potential for learning communities to promote and support social inclusion, social cohesion, and the personal development and fulfilment of individual community members.

There are various definitions of learning communities. The key themes emphasise a focus on the needs of the learners, the importance of partnerships or networks, and the potential for a learning community to stimulate economic development, revitalisation of communities and promote social cohesion. Definitions include:

> *"A Learning community is a city, town or region which goes beyond its statutory duty to provide education and training for those who require it and instead creates a vibrant, participative, culturally aware and economically buoyant human environment through the provision, justification and active promotion of learning opportunities to enhance the potential of all citizens".* ELLI (Longworth, 1999, p112)[26]

> *"The Learning Community is one that strives to understand how it is changing in order to shape its future. The creation of learning resources that allow for, or create, a community of skilled and flexible learners who work toward the common goals of Lifelong Learning, and ultimately the creation of a Learning Society that is all inclusive." ALA (2000, p5)*[27]

> *"A Learning Community is any group of people, whether linked by geography or some other shared interest, which addresses the learning needs of its members through pro-active partnerships. It explicitly uses learning as a way of promoting social cohesion, regeneration and economic development"*. Kearns, McDonald, Candy, Knights and Papadopoulus (1999, p61-2)[28].

6.3 Australian Learning Towns Networks

"Learning Towns Networks" exist in several states, and are growing around Australia. Collaborations between state education departments, universities, schools and adult

[26] Longworth, N. (1999). Making lifelong learning work: Learning cities for a learning century. London: Kogan Page.
[27] ALA (2000). Learning Around Town: Learning Communities in Australia.
[28] Kearns, P., McDonald, R., Candy, P., Knights, S., & Papadopoulus, G. (1999). VET in the learning age: The challenge of lifelong learning for all. Vol 1.NCVER

education organisations form the networks. The Victorian Learning Towns Network and the Learning Communities Catalyst are examples of some initiatives. The goal of all Learning Towns is the development of sustainable lifelong community learning.

The Learning Towns aim to achieve integrated social and economic development within an 'action learning paradigm'. They focus on achieving measurable outcomes via collaborative and strategic learning partnerships. These partnerships are between education providers, businesses, local government, and other community bodies.

Learning Towns mentor other communities aiming to achieve Learning Town outcomes. Mt Evelyn has developed a Township Development Toolkit resource. A performance measurement framework, which measures the impact Learning Towns are having on their community, has also been developed.

6.4 Community Learning as Social Capital

> *"Community learning is about people combining their knowledge and skills to achieve a mutually beneficial outcome. Learning is a complex process that goes beyond simple acquisition or creation of new knowledge and skills…Managing change is a learning process….*
>
> *The CRLRA (Centre for Research and Learning in Regional Australia) has found that social capital [the networks, norms and/or values preset in a community that facilitate cooperation for mutual benefit] facilitates change in communities by 'oiling' the process of learning through accessing, sharing and creating knowledge, skills and values. Strong and abundant social capital means you can get more from your physical, financial and human capital. Sue Kilpatrick[29], p2"*

Sue Kilpatrick identifies the promoters of learning communities, that is, factors that enhance the outcomes of learning:

- Opportunities and structures for interaction: opportunities for both formal and informal meetings facilitate networking and collaboration.
- Human infrastructure: Human resources in the form of local coordinators and training brokers effective in smooth operation of ongoing relationships. 'Enabling leadership', or leadership that allowed others to take responsibility to get things done, is the most effective.
- Shared visions, values and trust: the purpose of the collaboration must be relevant to partners needs and consistent with their visions and values. Structures that encourage inclusiveness and sharing develop shared visions and trust between members;
- External networks: a range of contacts advantageous for accessing advice, resources and specialist providers. Communities with a mix of internal and external networks have stronger social capital.

Conversely, the inhibitors of learning communities, that is, factors that reduce the effectiveness of outcomes of learning are:

[29] Kilpatrick, Sue Dr. "Community Learning & Rural Sustainability". Director, Centre for Research and Learning in Regional Australia, University of Tasmania.

- Small size of community: small, remote communities often have insufficient groups and individuals with time and skills to plan and negotiate to meet local training needs;
- Tension between collaboration and competition: competitive tendering for training sometimes means large outside providers win bids, who then often fail to account for specific local needs, eg cultural appropriate training for indigenous or some NESB groups.
- Continuity: a degree of continuity in collaborators, coordinators and brokers is important for effective planning and training (taken from Kilpatrick).

6.5 Mawson Lakes

Mawson Lakes is a new urban estate 12kms north of Adelaide that is currently being developed into a learning community. The Mawson Lakes project is an $850 million joint venture urban development between the South Australian Government and the Delfin Lend Lease Consortium, supported by Telstra, the University of South Australia and the City of Salisbury. It is on a 620 hectare site, incorporating a campus of the University of South Australia and the Technology Park business precinct. Ultimately, it will have 3700 dwellings, a 10,000 population, 5000 university students and employment for around 6000. **Obviously the scale of the Mawson Lakes development is far greater than the Rosecorp proposal for Gwandalan; however the Mawson Lakes project provides some excellent ideas that could be modelled on a smaller scale and applied jointly to Gwandalan and Catherine Hill Bay.**

Mawson Lakes' two most unique characteristics are that every home, workplace and institution will be connected with wide-band optic fibre cabling and educational services provided within the context of lifelong learning. The vision is to create a lifelong learning community with educational services which make optimal use of advanced information technologies and telecommunications (IT&T). These educational services will be delivered to institutions, businesses and the community, both on and off the site. In this way, learning will be available to anybody, anywhere, all of the time.

The Mawson Lakes School has been designed to offer a wide range of educational services to learners of all ages from the local community and beyond. It will not be a school in the traditional term of a school. Instead of catering for just one sector of education, the school will provide an integrated range of care and education services covering child care, pre-school, junior primary, primary, middle and senior schooling, as well as adult community education.

Mawson Lakes School will serve as an advisory, information and brokerage service for all learners. Beyond 'schooling', it will operate as an "education/training/learning business" generating an income stream that can be used to enhance the school's facilities, programs and services. It will develop and run short-term training courses on areas specific to Mawson Lakes specialities. Many of these programs will be developed in partnership with other organisations and involve the adoption of new funding models between private and public bodies.

The local primary school is already central to the Gwandalan community and has relationships with both long-term and new community members. It has expressed a desire to see its former teacher's house transformed into an Adult Learning Centre. It is from this kernel of an idea that the "learning community" has sprung. If Gwandalan choose to

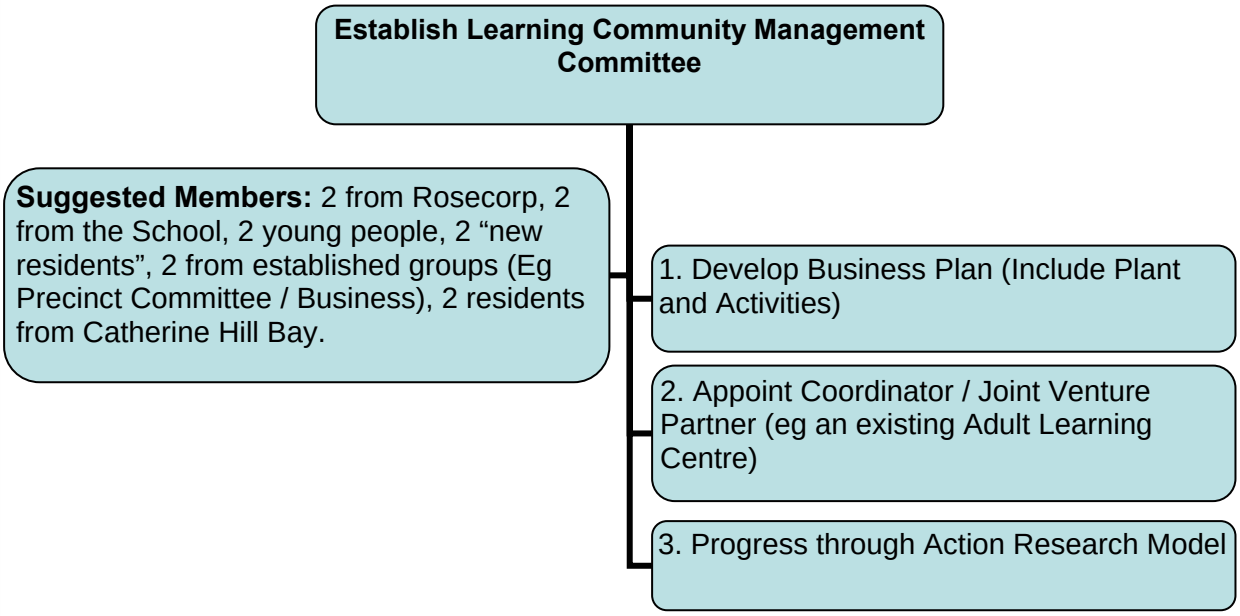
embrace the idea then the community will shape the project to its own unique needs, drawing on the best examples from other Learning Towns such as Mawson Lakes.

6.6 A Possible Learning Community Strategy for Gwandalan & Rosecorp

This Social Impact Assessment is recommending that as a community building exercise to complement Rosecorp's proposed residential development the company support the Learning Community Concept and fund a Learning Centre managed by the local community in conjunction with the local public school. This would involve the following commitment from the developer:

- Establishment of a Learning Centre (possibly rebuilding the former teacher's house)
- 3 year funding of a part-time "Learning Community Coordinator" ($25,000 p.a.)
- Appropriate Learning Community support infrastructure as the budget provides (eg a small community bus)

Implementation Plan:



An Ideal Learning Centre:

As a result of an interview with Ben Grushka, CEO of WEA Hunter, the following suggestions regarding an ideal learning centre for Gwandalan emerged;

- it should provide a diverse range of learning opportunities including accredited and non accredited;
- the physical space should include classrooms (breakout rooms), some catering capacity, and outdoor spaces.
- the space could be multipurpose with the ability to close off spaces to make smaller breakout rooms.
- it should have the ability to provide childcare
- broadband access and computers

- there should be a mix of target groups, particularly age groups
- it should have a vision and needs someone to drive it. No point having a building without human resources to implement the vision. It is important that the learning needs be identified by the local community rather than being imposed from outside.
- should be opened beyond business hours
- The Mindaribba Centre[30] is a good model venue.
- Some office space may be appropriate.

Subject to the business plan developed by the community, some ideas about what activities may occur in the Learning Centre include:

- Pre-vocational training for young people
- U3A courses
- Government funded Numeracy and Literacy programs
- Vocational courses (accredited)
- Enterprise education (business development)
- Playgroups and Parenting workshops
- Environmental Study/Action Groups
- General Adult Education Courses

The concept of Gwandalan as a learning community was put to the second focus group meeting of local people. There was unanimous support for the proposal and the focus recommended that:

1. That the Learning Community concept be promoted in the broader community and input from a variety of people be obtained.
2. That if this subdivision is to be approved, then Rosecorp pursue the detail involved in establishing a Learning Centre and the necessary support infrastructure.

6.7 Other Influencing Issues

Other factors that contribute to an analysis of the site include:

- National decreasing housing affordability – increasing need for affordability mechanisms.
- Rising interest rates – affects homebuyer's decisions/perceptions.
- Telecommunications – speed and ranges of internet and mobile phones will influence home business, education, etc.

[30] Indigenous Centre in the Maitland LGA

7. Qualitative Research Results

Qualitative research identifies issues and major themes as articulated by key parties consulted during the course of the investigation. Central to this process was the active engagement of community leaders or representatives within Gwandalan via the formation of a community liaison focus group. Interviews were also conducted with local or regional transport and youth services specialists. These interviews commenced in 2004 and have been updated in 2006.

7.1 Focus Group

Key Insights invited key representatives and leaders from Gwandalan's business, community and government sectors to participate in a focus group meeting to work with Rosecorp towards preliminary plans. Rosecorp also sought suggestions as to how the company could make meaningful and appropriate contributions to the community.

The initial focus group meeting was held on September 1, 2004 at Gwandalan Primary School. Eight Gwandalan community members met with Rosecorp and Key Insights to begin the dialogue. Participants included representatives from the local schools, business, service clubs and the Progress Association and Precinct Committee.

Discussions focused on what was good about living in Gwandalan and some of the issues facing Gwandalan now and in the future, especially relating to population growth. Rosecorp then discussed their preliminary proposal for the site, and responded to issues arising from the discussion.

Summary of Discussion:

What is it that is good about living in Gwandalan?

Key responses were:

Amenity

Gwandalan's 'nice and quiet" atmosphere was cited as a major driver of residents' initial attraction to the area, and is still a major value. It is like "living in the country".

Natural environment

Residents value the bushland and lakeside surroundings. One participant described Gwandalan as "the most unspoilt area of the Lake". The drive into the Gwandalan area provides a desirable separation between "the outside world" and "the community".

Access to lake and ocean

The ability to walk around the foreshore is highly valued. Access to boating is seen as a key asset for the area.

Kids' freedom and safety

Gwandalan is regarded as a great place to raise young children due to its peaceful lakeside amenity and informal system of community surveillance. This is regarded as a major motivation for new residents settling in Gwandalan. Perceptions of personal safety however are gradually decreasing, and children's freedoms lessening.

Convenience and accessibility
Gwandalan is regarded as being easily accessible to both Newcastle and Sydney, while out of the way enough to feel separate from city life. The "one road in, one road out" is generally regarded as an easy, convenient, pleasant drive (albeit the road requires upgrading). However, it is noted that the limited access to Gwandalan increases its physical isolation to the detriment to some facilities such as Lakes Grammar School, which would like to be able to attract more students from outside the peninsular to their institution.

Community spirit
Participants regard Gwandalan as having a strong sense of community, especially relative to the surrounding area. Gwandalan has a strong historical culture of volunteerism. However, from the perspective of focus group members, it is noted that new residents are not generally engaging with community groups, facilities or activities.

This challenge of integrating new residents into the existing community is a major concern to focus group members. Established community-minded residents are concerned about the lack of engagement that new residents have with existing community groups such as service clubs, precinct committees and other voluntary organisations. They are concerned that new residents will not contribute to the existing community culture of citizenship and participation. Subsequently there is concern about the quality of community that will be experienced by new residents.

Business is good
Business representatives report general satisfaction with current trends, although they think increases in business activity are not proportional to population growth. It was noted that weekend holiday-makers spend more locally (in Gwandalan) than new residents do.

Issues facing Gwandalan

The issues identified by the focus group fall into three major categories:

Infrastructure Issues
The Focus group identified a general issue about feeling overlooked by Council. This means that Gwandalan is perceived as not having the critical mass to attract Council projects or attention. Key infrastructure issues included:

Public transport
The inadequacy of public transport was identified as a major issue for Gwandalan. However, there was not a consistent view on this as some participants had family members who, for example, made use of the bus service to Wyong. Points raised include:

- Lack of night transport;
- Bus timetables are indecipherable and unreliable;
- Transport to Newcastle is 'useless' (too many inter-changes);
- Bus services are deteriorating;
- There is no bus to the railway line.

Water quality
Gwandalan residents value the quality of their lake and waterways. Water shortages and chemical run-off from gardens is a problem.

Road Maintenance

Kanangra Drive is in need of repair and upgrading and residents are dissatisfied with Council's response to this issue.

The intersection of Kanangra Drive and the Pacific Highway has recently been upgraded with traffic lights now a feature. Kanangra Drive is at the top of the list of 'rolling works' of Wyong Shire Council with various sections of Kanangra Drive to be rehabilitated in the 2007/08 period[31].

Urban Design – "No Town Centre"

Gwandalan's layout is considered too dispersed to efficiently cater for the community. The quality of the urban design associated with the development of the area, particularly the commercial areas, is questionable. The unplanned nature of business development and duplication at Summerland Point are identified as issues. Participants felt that the Town Centre should be where the Bowling Club is. They do not want to see the creation of other commercial areas, but rather the enhancement of the existing commercial area.

Capacity Issues

Capacity relates to the social capital and economic activity generated in a community, and the ability of the community to initiate and sustain such activity. Key capacity issues included:

Employment

Youth employment in Gwandalan is a particular concern for focus group participants. Small business owners present pointed to systemic problems associated with bureaucratic requirements and "overheads" that make it very difficult for small business to grow its number of employees.

Education Facilities

The Gwandalan Primary School will need more permanent buildings over time to efficiently cater for its present and future school population. Gwandalan presently has a limited adult learning capacity, although it was noted that there are appropriate underutilised physical facilities within the community that could assist in filling this gap.

Wyong Council (support/attention)

Participants expressed frustration with Wyong Council. They felt "at the end of the line" and largely ignored by Wyong Council. Participants felt they were overlooked because Gwandalan does not have the critical mass to "make enough noise" or to secure representation on Council.

Community Issues

Community Issues were a major theme of focus group discussion and included:

Lack of Opportunities for Young People

Issues concerning young people were identified as major concerns, and cut across other areas such as employment, community safety, public transport and vandalism.

There is a lack of adequate recreational activities (such as sport) catering to Gwandalan youth. Facilities that have been provided (skate ramp/hall) are underutilised due to personal

[31]The full list of Wyong Shire Council's rolling works may be viewed at www.wyongsc.nsw.gov.au/services/roads_and_drainage_2007_2008.html

safety fears arsing from their location away from current areas of activity, therefore limiting informal community surveillance. Lack of out-of-school hours bus services to the beach, the railway station or other town centres is a problem.

It is noted that Gwandalan young people "must leave Gwandalan" after leaving school to pursue future opportunities.

Participants identify the need for separate consultation with Gwandalan's young people.

Isolation

The issue of isolation is two-sided: on one hand, Gwandalan's perceived isolation is regarded as a positive and the issue relates more to managing potential compromises to this status; on the other hand, Gwandalan's physical isolation is a negative by placing limits on its capacity to support services that rely on external inputs.

The general response of the focus group was that Gwandalan has an isolated atmosphere (a positive attribute), but is actually convenient and easily accessible to major urban centres such as Sydney and Newcastle (also a positive attribute). Gwandalan's perceived remoteness, and distinct demarcation from city life, is the key attraction for residents to the area (according to focus group participants).

Integration: Division Between Old and New Residents

The lack of integration of new subdivisions into the existing Gwandalan community is regarded as a major issue, especially pertinent to the proposed development. Key points regarding this issue include:

- *"the "them and us" mentality – this perspective on both sides of old community and new estates";*
- *"new people are not community minded and do not support Gwandalan's volunteer culture;"*
- *"in the past developers have not been open or have not consulted the community, and therefore people are 'alarmed' by or suspicious about what they might not know";*

Impacts of Population Growth

Impact on Gwandalan Primary School

Gwandalan Primary School is currently at capacity. The school was built for 250 students in 1991, and now caters for 400 students. The buildings are inadequate and the school relies primarily on demountables to house classes (currently there are 6 permanent classrooms and 8 demountables). The permanent classrooms are inappropriately designed. The school is very keen to maintain the integrity of its designated 'environmental area'.

Gwandalan Primary is classified as a disadvantaged school. This means it has access to a higher level of resources than schools that are not classified as "disadvantaged". Its socio-economic school profile is a mix of affluent and low-income groups, with the large proportion being low-income.

Adequate parking and access for the school are identified as issues to be addressed as the school community grows.

2006 Update
Enrolments in Gwandalan Primary are growing. New enrolments are coming in across the grades, the 2006 enrolment numbers total 430 children. It will be necessary to closely liaise with this school as well keep the Department of Education informed on the progress of this proposal to allow adequate time for planning.

Business Impacts
Businesses report recent increases in business, but not proportionate to the rate or extent of population growth. Key points include:

- *"Population growth could help sustain business/facilities if new residents shop locally";*
- *"There is more business from Sydney weekenders than new residents";*
- *"New residents (i.e. "city people") shop at big supermarkets in nearby urban centres";*
- *"There is a need to rezone for good urban planning, especially in regard to concentrating commercial and community facilities around a town centre. Council are aware of this issue, but have not included it in recent agendas".*

Political Impacts
It was suggested that increased population growth could facilitate the 'critical mass' necessary for recognition and representation at Council.

Response to Preliminary Development Plans
Stuart and Bob Rose from Rosecorp outlined their preliminary ideas for the development of the site. Discussion focused on the community and ecological philosophy of the company, and their previous and potential performance as "community builders". The focus group welcomed being invited to participate in planning for this project at such an early stage and welcomed further dialogue.

The key concerns raised regarding the proposal mainly revolved about themes of public access to natural resources, the effects of new 'community-building' on the existing community, water management, and integration between old and new residents and cultures.

Community Building and Integration
The explicit "community mindedness" of the developers was well received, but concerns regarding the potential creation of another distinct and disconnected community of new residents on the development site were expressed. The concern regarding the usurping of the old community via the creation of a new one was noted.

The key discussion involved how to include the old community with the fostering of the new developing community. The main points included:

- *"The avoidance of gated communities and the removal of the surrounding fence";*

- *"The orientation of all houses to the road";*
- *"Only residential use for development site, so as to not compete with existing commercial facilities";*
- *"Concerns re Community versus Torrens title, and the need for the existing community to be aware of requirements underlying chosen titling";*
- *"The potential for an "Adult Learning Centre" as a key tool of integration".*
- *"The need for workers and projects rather than bricks and mortar facilities".*

Public Access to Resources

The potential of the development to continue to constrain waterfront walking was raised by participants. However, proactive suggestions as to provision of alternative shared walking tracks traversing the development site were discussed. The proponents indicated their plans to remove the fence that currently isolates the site. This was welcomed by participants.

Water quality

Participants expressed concern about the potential pollution of the lake by run off from the proposed development. They are also concerned about inadequate drainage. Rosecorp is also very interested in this issue, and has proactively engaged a water consultant (beyond the requirements of Council) to explore innovative solutions for the issue. One of Rosecorp's aims is to utilise wetlands and holding ponds to enable a natural filter system for water cleansing.

Water Supply

Residents are concerned about general water shortages in the area, and how the new subdivision will contribute to the problem or what strategies will be put in place to limit demands on water.

Wish List

The proponent, Rosecorp initiated discussion regarding a Gwandalan "wish list" encouraging the community to identify its needs and present them to Rosecorp for consideration. Initial suggestions by the group included built facilities, but also went beyond "bricks and mortar" to include social programs and community development facilitators. The emphasis on programs and workers over buildings was regarded as a desirable direction because of:

- *"the current availability of existing infrastructure in Gwandalan which is underutilised";*
- *"the easier integration of changes into the community if undertaken in existing neutral buildings, such as the school residence";*
- *"the belief that social capital outcomes are best delivered by resourcing people and programs rather than buildings and facilities";.*

Suggestions included:

- *Shared Walkway* –funded by developer and State, connecting subdivision to existing community and beyond;
- *Youth facilities* – provision of young people's recreational activities in a central location;
- *Adult education program* – use of existing school residence for training purposes;
- *Community Hall* – construction of new centre in town;

- *Town Centre* – emphasis on services and facilities in centralised location;
- *Seats/rest areas in new subdivision* – enables old residents space to appreciate area;
- *Social facilitation* – locally based social planners, social workers, program coordinators, training programs, youth activities etc. possibly linked to the school.
- *Local news and dialogue* – existing newspaper considered inadequate in discussing community issues.

This list represented the very early musings of the group. Participants were asked to give some more thought to "the wish list" for future dialogue. Rosecorp emphasised that it would not be able to provide for all requests and that it would consider proposals in the context of its budget for the project.

7.2 Follow-up Focus Group Meeting

The second Focus Group Meeting was held on Monday October 20th 2004. Ten Gwandalan community members and Rosecorp attended with Key Insights facilitating. The main objective of the second meeting was to present for discussion a possible strategic response to issues identified by the group in the first meeting. Key amongst these issues was the lack of "community cohesiveness" in Gwandalan, particularly in relation to the insufficient integration of new subdivision residents into the existing community and the lack of a town centre. Other key issues articulated at the first meeting concerned public transport, youth issues, and the impact of population growth on the capacity of local educational facilities.

The strategic response presented by Key Insights to the second meeting was the potential development of Gwandalan as a Learning Community. Identification of avenues for Rosecorp's contribution to the strategy, if the Gwandalan community decided to further explore it, was also discussed.

Firstly the notes from the first meeting were checked to make sure that participants were happy with their inclusion in the final report. At the group's suggestion the local GP had been included in this second meeting so the focus group began with an overview of local health care issues. Key discussion points regarding health included:

- There are insufficient numbers of G.Ps in Gwandalan, and on the Central Coast in general.
- Gwandalan currently has a G.P ratio of 1:3000, while 1:1500 is the recommended ratio.
- There is an immediate need for 1 or 2 more G.Ps to work in the Gwandalan area. Current G.Ps find maintaining the general health of the current population 'hard enough', highlighting concerns regarding adequate health services for an increasing Gwandalan population.
- The local GP has difficulty in finding locums.
- Lack of GPs is due more to the supply side rather than demand, including
  - Problems with medical training;
  - Tendency for graduates to specialise rather than go into General Practice;
  - Doctors unwilling to uproot families into country areas after establishing themselves in cities during training.
- Gwandalan's development as a learning community would make Gwandalan a more attractive option for G.Ps.

- Granting medical scholarships for local students might mitigate the lack of GPs in the long term. Previous experience shows that scholarships to local young people are one way of increasing local medical services over time.
- Access to hospitals is via private vehicle or ambulance. Services at the closest hospital (Wyong) are often considered unsatisfactory by some patients and they would prefer to attend Belmont Hospital.
- Wyong Council is investing in health facilities at Warnervale.
- A functioning clinic is an excellent strategy for attracting GPs to an area.

It was recognised by the group and the social researchers that the GP shortage was an issue across NSW and that the solutions to health care issues were systemic and needed to be addressed with policy changes at State and Federal levels.

The Development of Gwandalan as a Learning Community

The 'fragmentation of Gwandalan' is a major issue, and the need for community building, better integration between 'old' and 'new' residents, and a focused town centre were identified in the first focus group meeting. In response to these issues, Key Insights developed the concept of Gwandalan becoming *a Learning Community/Village* as a community development strategy. The Learning Community concept was presented to the group and a paper outlining the suggested model distributed. Discussion points responding to the suggestion included:

- School important in both a physical School has existing underutilised facilities;
- The concept of 'clustering' – find what Gwandalan can specialise in, possibly water skills, bushcraft and sailing;
- Suggestions that course content target retired males and young mothers (there was a perception that these were the highest need groups);
- It would be desirable to build on existing movements such as local CTC initiative (technology);
- Inter-generational aspects of learning should be emphasised;
- Utilise current providers such as local ACE providers and the University of the 3rd age (U3A);
- Key Insights highlighted the possibility of external assistance in developing the Gwandalan community – i.e. The Hunter Life Long Learning Network, Australian Learning Towns Network, mentoring from other Learning Towns; TAFE and the University of Newcastle. Key Insights has already informally sounded out some of these organisations and received a positive response;
- Possibility to network with University of Newcastle, Hunter Institute of TAFE and other smaller institutions.

Participant feedback regarding the Learning Community strategy was very positive. Rosecorp were also enthusiastic about supporting such a concept. Comments include:

- *"AAA rating – potential to make community far more active and proactive"*
- *"Lots of work, but worth it"*
- *"Progress is going to happen. We can make it as easy on the community as we can – we can soften it"*
- *"We need to take this to the broader community, make sure everyone thinks it's a good idea."*

- *"We need to promote this – a brochure outlining everything – get input from new residents, young mums – get people involved."*

Other Issues

- Residents would like a local supermarket. The current population is insufficient to attract a major supermarket. However, if all the land marked for residential release (including proponent's property) was developed then sufficient numbers might be reached for an IGA or similar.
- There will be no commercial facilities on site, as the proponent does not wish to further fragment Gwandalan's town centre
- The Morisset Bus service from Swansea – Wyee won't stop for Gwandalan, due to commercial competition issues.
- The Central Coast Community Council Transport brochure was distributed.
- Follow-up: Rosecorp will come back to the community with the Master plan and consult widely.

The input of the community group and the generous donation of their time are much appreciated by the researchers and Rosecorp.

Wyong Council held a public on the redevelopment subsequent to the community focus group meetings. Council decided in 2005 not to consider the rezoning and Rosecorp has therefore undertaken no further work in developing the Learning Community proposal.

7.3 Interview with Trevor Jennings, Busways

Trevor Jennings is the Planning and Infrastructure Manager with Busways, a bus service which serves the Gwandalan community. Key points arising from a telephone interview with Mr Jennings are:

- Bus services through Gwandalan are under supported by Gwandalan residents, despite the perceptions of residents that there is inadequate public transport;
- The Gwandalan component of the Busways' service is not paying its own way;
- Gwandalan's population would have to grow "significantly" to make putting on extra services viable;
- School kids and shoppers at Lake Haven (mainly retirees) are the main users;
- The circuitous nature of the route is unattractive to most people, but unavoidable due to the geographical way the region's villages and towns are located;
- No Busways services from Gwandalan go to Wyee as it is only a minor station, and Wyong station has about twice the frequency of trains to Sydney. Therefore, Wyong station is the focal point for all Busways services from Gwandalan;
- Gwandalan commuters may get to Wyong bus station by transferring at Lake Haven. All Busways' services are timed to be congruent with Wyong railway timetable;
- It is important to provide the right infrastructure to support bus services, including:
    - Appropriate road system – free of speed humps and with good surfaces.
    - Footpaths alongside bus routes
    - Wheelchair accessibility at bus stops
    - Bus shelters
- Gwandalan fares 'fairly ordinarily" in the infrastructure regard. The roads system is "OK" for a small town, but there are limited bus shelters and limited disability access points.

Data forwarded by Mr Jennings to Key Insights regarding an analysis of passenger data for the month of May 2004 has revealed that, on average, about 80 passengers are transported out of Gwandalan every week day. Most of these passengers (about 90%) are school children travelling on government subsidised bus passes. The main destinations for passengers are Lake Haven (75%) and Charlestown (13%). Trips within Gwandalan account for 7% and, surprisingly, only 1% of trips are made to Wyong Station and township.

7.4 Interview with John Roberts, Central Coast Community Council.

John Roberts is the Transport Development Officer with the Central Coast Community Council. His role is to represent and advocate on behalf of the community for the development of better transport options. He also facilitates the **Central Coast Transport Forum**, which is a quarterly meeting of government, service providers, and the community.

John focuses on community solutions to transport issues, rather than major infrastructure issues such as upgrading freeways or building new railway stations. He works on about 13 transport projects in his position with the Council. One of his projects, **"The 4 C's Central Coast Transport Brokerage"**, is particularly relevant to this report as it provides an alternative opportunity for Rosecorp's contribution to addressing Gwandalan's transport and accessibility issues.

The 4 C's Central Coast Transport Brokerage[32]

John has recently received funding from the NSW Premiers Department for a 2 year trial scheme promoting the use of existing underutilised resources within the Central Coast community. The brokerage aims to source underutilised vehicles, like school minibuses, and match them with identified needs within the community. John points to the numbers of minibuses sitting largely unused in the region's bowling clubs or schools, and then to the well recognised Central Coast public transport problem.

John offered the recent example of Lake Haven School, where school children risked missing out on an important vocationally based event in South Newcastle, because of transport challenges. The brokerage found a bus, volunteer drivers, and top-up funds from the Premiers department to pay driver and vehicle costs. The bus was used to transport students to and from Lake Haven for the week. John regards the problem such as the one faced by Lake Haven School as being an issue of 'transport disadvantage' that can be targeted with a transport based solution.

John regards the brokerage as expanding over the years to include various services as dictated by the needs of the community. One suggestion has been the provision of community feeder buses to a commercial express service on the Pacific Highway. He says local bus providers are hesitant as they do not see the service as filling a gap, but providing undesirable competition.

[32] www.thecccc.org.au

John recommends developers "stop funding mini buses" and instead make an equivalent contribution to innovative alternatives, such as the brokerage. He regards the cost of buying a minibus for a school, without supplying a driver or maintenance provisions, as being less of a solution than directly funding the brokerage. The visibility of a company name on the side of a bus could be matched by being seen as a sponsor of the brokerage project. John believes this has potential to be incorporated into a developer's marketing strategy. No developer has contributed to the project as yet. The project was launched in 2003.

2006 Update: The 4C's was successfully launched in September of 2003. The 2005 report identified several that 42 organisations on the Central Coast had utilised the service and that a further 10 organisations had requested services. The 4C's had since launch made 3174 passenger trips more than two thirds of those being made in the nine months preceding the 2005 report. The service is working well at 'filling the gap' in Central Coast public transport.

7.5 Interview with Jillian Hogan, San Remo Neighbourhood Centre

Jillian Hogan is the Services Manager at San Remo Neighbourhood Centre. San Remo Neighbourhood Centre runs Links Youth Services which comprises six youth outreach centres in the surrounding region. Links currently runs a Youth group in Summerland Point. Links previously ran a Youth Centre in Gwandalan, but closed it down 3-4 years ago due to difficulties relating to surveillance and facility size.

Summerland Point Youth Centre

The current Youth outreach service at Summerland Point runs three afternoons a week catering for young people aged 11-18. Gillian reports a wide level of attendance at the centre, ranging from 3 – 26 young people daily. Significantly, Gillian reports that few Gwandalan young people use the centre. The main reason for this is inadequate night-time access due to a lack of good walking tracks and the security problems posed by the bushland setting.

Gwandalan's Previous Youth Centre

Jillian reports that Gwandalan's Youth Centre closed 3-4 years ago, primarily due to the venue, Tunkuwillin Hall, as being "too big". The facility included basketball courts which rendered surveillance and control as 'high maintenance'. She also noted that the venue was located at a site that might have been originally intended to keep young people 'out of sight, out of mind', and which added to surveillance problems.

Recommendations re services for Gwandalan's Young People

Jillian regards adequate personnel and programs as being the key components of a successful youth service. She believes **youth services in Gwandalan need to focus on people – good youth workers and *"adults in there to support*" - rather than new buildings.**

Update 2006
San Remo Neighbourhood Centre has since moved from Summerland Point back to Gwandalan as the Centre at Summerland Point was no longer viable. Young people were not attending due to changes in; youth group culture, the very young age group and it was difficult to sustain the staff. Gwandalan is a successful venue and its size now compliments the area's growth. The centre reports as having good community and parent input.

2006 New Qualitative Data

7.6 Interview with Christine Graham, Ray White, Gwandalan

Ms Graham works in sales for this Gwandalan real estate agent. Ms Graham deals with the Gwandalan township itself as well as Summerland Point. Key points to arise from this discussion were;

- The current market demand is for old houses, particularly those which fell into the lower pricing bracket. Ms Graham thought that the recent residential release from Crighton created an interest in the area. She attributed the rise in demand for pre-existing dwellings in the Gwandalan /Summerland point area to the selling out of house and land packages in the Crighton release.
- The lower and higher ends of the market appear to more active than the mid range which she termed to be around $400,000. It was also her experience that people tended to purchase house and land packages in preference to buying and building themselves.
- Ms Graham saw a potential drawback of the area for older residents may be the lack of medium density housing in the area in addition to there being no aged care facilities locally at the present time.
- The location of Gwandalan in relation to the F3 Freeway was seen as desirable as it allowed for existing and potential residents to commute easily to both Sydney and Newcastle. Ms Graham also thought that the recent upgrades in telecommunications in the area would be of great benefit to Gwandalan as it would allow residents and businesses to have broadband internet access which was previously unavailable.
- Ms Graham indicated that she believed that young families , Sydney retirees and 'sea-changers' could be expected to be the most interested groups if the proposal were to proceed. Ms Graham believed this to be the case as previously mentioned the proximity of the development to the F3 Freeway is convenient for working commuters in addition to the picturesque location of Gwandalan being a motivating factor.

7.7 Interview with Timothy Tully, Raine and Horne, Gwandalan

Mr Tully works in Sales and Property Management. He made the following points during the interview;

- The demand for blocks of land had diminished recently with buyers preferring instead to seek out ready built dwellings.

- Mr Tully also said that the greatest demand for property fell both within the lower first buyers end of the market, as well as at the top end of the price range.
- There was very little available land for sale at the present time.
- Mr Tully would expect that retirees from Sydney as well as other owner-occupiers would be most likely to be interested in the proposed development.

7.8 Interview with Jan Macmillan, Lakeside Surgery, Gwandalan

Ms Macmillan is the full time receptionist at the Lakeside Surgery.

She indicated that the surgery currently has two Doctor's and one Nurse employed full time within the Surgery.

This service presently reports as being busy but able to take on new patients provided they are local residents.

7.9 Interview with John Holmes, Gwandalan Pre-School

Mr Holmes is the owner operator of this pre-school facility. The pre-school falls under the category of 'long day care' meaning children from 0-6years are eligible to attend the service times that extend past normal school hours. Mr Holmes made the following comments during the phone interview;

- The centre was opened nine months ago.
- It provides extended hours care for children of parents who are working, studying or have other time commitments.
- There is no waiting list in order for a child to gain a place at the centre as the service is currently running at 50% of total capacity.
- Mr Holmes indicated that even if the existing capacity was to be met, he is able to expand his services past this point should sufficient demand exist.
- Mr Holmes made the comment that an increase in population in the area as a result of the development would not place any stress on the pre-school services.

8. Analysis of Opportunities and Constraints for Gwandalan

8.1 Overview Table of Opportunities and Constraints

Opportunities	Constraints
Mitigation of social isolation by increasing self sufficiency	
Increasing integration between old and new residents	Community perceptions of development in general
Building of an active community culture of citizenship and participation	Physical isolation
Modelling sustainable development – environment, community building, community participation, Masterplanning.	Inadequate Public transport
Diversification of Gwandalan community	Limited educational facilities/services
Stimulation of local economy	Limited opportunities for young people, especially employment
Development of a Learning Community	Need to maintain community identity

Fostering of innovative community and public transport alternatives	Need to preserve valued bushland environment
Increasing of social equity	Need to maintain public access to natural resources, especially the Lake.
Increased opportunity for young people	
Opportunity to move ahead an earmarked process within an active community consultation context.	
Opportunity to link in with Warnervale development	
Increasing range and availability of housing options	
Opportunity to facilitate desirable outcomes previously identified by the community, such as shared walkways	
Opportunity to increase resource capacity of school via funding, facilities, and integrated access design.	
Opportunity to contribute to upgrading of, and access to, Kanangra Drive adjacent to development.	
Opportunity to foster home business via incorporating home office designs at DA stage	

8.1.1 Social Constraints

In general many of the constraints lead to opportunities and the proponent has demonstrated a commitment to work with the community to address constraints throughout this social research process.

Community perceptions (of this development and development generally)

- Resistance to change.
- Concern re visual impacts
- Concern re environmental impact
- Concerns about the future culture of the community
- Concerns about community capacity

Isolation

Gwandalan is sometimes described as an 'isolated community'. However, the extent and nature of this isolation is largely determined by one's definition of isolation and the values accorded to it. Gwandalan is in some ways physically isolated from the broader Central Coast. It has 'one road in, one road out' and is poorly serviced by public transport. It is also located at the edge of the Wyong Shire border. However, this physical isolation and the accompanying 'country atmosphere' are the key characteristics of Gwandalan that make it attractive to its residents. At the same time, residents report Gwandalan as being conveniently located within easy access to Sydney and Newcastle, as well as smaller urban centres around the Central Coast. Central to this accessibility is Gwandalan's high level of car use and ownership. Businesses report 'good' business within the town centre, a trend that could be increased if new residents patronised local business more. In short,

Gwandalan residents enjoy an isolated *atmosphere*, but a convenient and accessible *actuality.*

Gwandalan's 'isolation', when recognised as a diverse and complex feature of the community, presents both opportunities and constraints for the proposed development. Wyong Council's concern regarding isolation is a constraint in the immediate term. However, Council's concern, and the developer's willingness to engage in strategic community building, may be viewed as an opportunity for a collaborative partnership towards conceptualising the 'isolation' issue as a first step toward devising community development strategies and actions.

The challenge is to increase Gwandalan's internal self sufficiency, thereby alleviating its social isolation, without compromising its physical 'isolation' which is a key factor contributing to its identity, culture and sense of place, and which underlays the social and environmental value accorded to it by current and aspiring residents.

The Wyong Community Plan has identified isolation as a problem facing families living in new release areas, (p22):

> *"The settlement pattern of Wyong Shire has been influenced by the topography and other natural features of the area. This has resulted in the concentration of a large proportion of the population in a few centres and many smaller population pockets, including Gwandalan, spread throughout the shire. Whether these smaller centres are 'isolated' is a key issue addressed in this paper.*
>
> *"Wyong Shire's population is spread along the coastal fringe and along the lakes. Current facilities tend to serve their local communities as geography and distance between individual townships make access by the whole community difficult. This is reflected by the "circuitous" nature of current local bus services which remain unattractive to potential commuters".*

Public Transport

Gwandalan is generally regarded as being poorly serviced by public transport. Focus group participants identify inadequacies in public transport as a one of the primary constraints on Gwandalan's community development. Lack of bus services, particularly after-school and at night, cross over into issues concerning opportunities for young people and elderly or disabled residents.

Gwandalan's public transport problems link with issues concerning its physical isolation. Interviews with transport providers and investigations undertaken in the Wyong community plan point to the nature and topography of the Central Coast settlement as being the key factor contributing to unsatisfactory public transport. Routes are currently long and circuitous as the area consists generally of small hamlets on peninsulas off the Pacific Highway, and not connected to one another by direct routes.

Current bus services through Gwandalan are underutilised and are not economically self-sustaining. An analysis of Busways' passenger data for the month of May 2004 has revealed that, on average, about 80 passengers are transported out of Gwandalan every week day. Most of these passengers (about 90%) are school children travelling on government subsidised bus passes. The main destinations for passengers are Lake Haven (75%) and

Charlestown (13%). Trips within Gwandalan account for 7% and, surprisingly, only 1% of trips are made to Wyong Station and township.

Gwandalan residents are low users of public transport and high users of private cars. Consultation with the current commercial bus provider indicates that the potential population increase provided by the proposed development would be insufficient for the company to provide additional services. The current perception of poor public transport services is a constraint to the proposed development as it increases the sense of Gwandalan's isolation and threatens the potential diversity of the development if some groups, say those with teenage children, are deterred from purchasing within the community.

However, the immediate constraint of a poor transport system also provides the opportunity for the proponent to contribute to innovative and community based strategies to tackle public transport issues. Local projects, such as the Central Coast Transport Brokerage and the Central Coast Transport Forum have proven to be very successful in delivering community transport systems. A partnership between the proponent and community transport projects provides an opportunity to make concrete change to public transport, as well as build linkages with regional organisational bodies.

Limited Educational Facilities

At present, Gwandalan's educational infrastructure and building capacity does not adequately match the anticipated demand for public school services within the area as the population grows. As present, the local primary school is at capacity level, and is under resourced for a growing student population. It is currently highly dependent upon demountables to house students. The school's environmental area is in danger of being utilised to house classrooms if alternatives are not found. The issues facing the school as the population grows have the potential to be a constraint on development. However, out of this constraint arises the opportunity for the proponent to respond to the school's changing needs and incorporate a partnership and educational strategy accordingly. The proximity of the development site adjacent to the school allows a number of actions to be taken, ranging from building construction (Adult Learning Centre to be available to the school), to the funding of programs to enhance the capacity of existing school infrastructure.

The general pattern is that communities without a High school tend not to attract families, so there is the opportunity to provide alternative educational or recreational attractions to families with adolescent children.

The proposed development offers the opportunity for building upon linkages with the school and wider community and developing Gwandalan as a learning village – a centre of lifelong learning (one of the Central Coast Action Plan key strategies)

Limited facilities/opportunities for adolescents as a deterrent to families settling in area Gwandalan has limited facilities/opportunities for adolescents which may act as a deterrent to families settling in area:

- limited secondary educational facilities
- limited recreational facilities
- limited public transport to nearby recreational towns

One of the key features of a vibrant and diverse community is a wide spectrum of ages amongst residents. Gwandalan's age distribution is currently concentrated at the early to primary aged child age group, followed by the retirement age bracket. This distribution of ages is significant in two ways: as a present constraint and a future opportunity.

Firstly, Gwandalan's limited adolescent population means that Gwandalan's young people have not built up sufficient critical mass to push the provision of better youth opportunities and services. This in turn acts a deterrent to some families with young people, therefore contributing to the cycle. It also means that young people must leave Gwandalan to pursue future opportunities, making them a group less likely to seem as wise economic investments in the present, and contributing also to the cycle of limited opportunities and attraction.

Secondly, Gwandalan's current high level of preschool and primary school aged children means that within the decade, Gwandalan's adolescent population will significantly rise. Identification of this pattern provides the opportunity for current community development to cater for the changing needs of the population, and increase its capacity to cater for young peoples' needs, including the provision of opportunities such as traineeships, public transport, and recreational programs.

8.1.2 Social Opportunities

Diversify community without compromising identity of Gwandalan.
Gwandalan is a fairly homogenous community, carefully planned and marketed development could increase the range of cultures and household types.

Mitigation against social isolation via increasing self-sufficiency.
There is the opportunity to approach the issue of isolation from the inside via facilitating immediate residential development to support Gwandalan's underutilised facilities and services and stimulate internal economics. This could only be successful within the context of good urban design, careful attention to environmental sustainability and sound social and economic planning. Sensitive population growth in key areas identified by Council would serve to extend and diversify the consumer base available to access Gwandalan's local retail and service sector. It could also provide opportunities for home business and telecommuting outcomes if these goals are addressed in the urban planning stage.

The social and economic planning strategy that is central to this report is the development of a Learning Community. This strategy has been demonstrated to increase the sense of community and place amongst residents (both old and new) via a holistic approach to education and economic development. This strategy is strongly supported by key locals consulted to date.

Model of Good Planning
Wyong and Central Coast strategic documents emphasise collaboration and partnerships in local and regional planning. There is the opportunity to set the benchmark of successful pro-active partnerships between developer, community and Council. The methodology used in preliminary planning as part of the Master planning process is an indication of the developer's strengths in this regard, and the potential to build upon this process.

Opportunity to Move Ahead an Earmarked Process
Wyong Shire is one of the fastest growing areas in Australia. Gwandalan is a desirable residential destination, as evidenced by recent growth in the area and increasing demand for property. The proposed development site is land that is earmarked for development in the medium term. The strategy defines medium term as 2003-2015 and so there is now the opportunity to move the process forward to fill an immediate gap in the needs of current home purchasers.

Stimulate Gwandalan's Local Business/Economy for Increased Self-Sufficiency
People generate economic activity. The Central Coast is booming. The challenge is to make sure that the infrastructure meets the demands and that there aren't groups of people who miss out. Sound economic planning that would be a core component of the Learning Community will assist Gwandalan in meeting the challenges. Planning at the micro level within the Learning Community can identify skill gaps, identify and support new businesses around appropriate "clusters", build links with training providers and other learning communities and programs, and promote and support existing businesses.

Build Upon Sense of Community
Gwandalan residents value the sense of community and active volunteerism within their community culture. However, they are concerned that this historical sense of community is threatened by the inward movement of new residents into the area, especially the concentration of these new residents in new subdivisions with little linkages to existing community and who are perceived as having social and economic loyalties elsewhere. At the same time, Gwandalan has a more than sufficient supply of community land, open space and community infrastructure. There is the opportunity to build up the local population at the same time as building up community links to expand and enhance existing community facilities, services and structures.

Social Equity
Wyong Shire has a greater percentage of socio-economically disadvantaged groups than the state average. It has more unemployed people and higher numbers of low income groups, including a high proportion of families/people requiring support. The proposed development has the opportunity to increase opportunities for those wishing to settle on Central Coast by increasing housing stock and providing a range of affordable options to groups such as first home buyers, low-income earners and retirees. It also has the opportunity to provide safe physical and social spaces for families and retirees to reside.

Increase housing type options available in the locality.

There is a strong demand for vacant standard lots in Wyong Shire. Gwandalan is predominantly composed of separate houses. The proposed subdivision would keep with the general character of Gwandalan, but it has the potential to extend the housing options to integrated home offices and adaptable housing. Because of the predominance of existing separate residential housing any variations offered by the proposed development would not impact significantly upon the general aesthetic or separate housing culture of Gwandalan.

Shared Pathway
The Gwandalan / Summerland Point Community Precinct Committee is committed to the concept of a shared pathway on the waterfront reserve from Diamond Drill Point to the southern end of Gamban Rd. The walkway is supported by Council and was included in the

2003 revision. However, due to other project priorities and funding limits, no firm time can be given by Council, and it is unlikely to be commenced prior to 2005/6. The shared pathway was raised at the community focus group with the proponents indicating that they were willing and keen to: 1) build a walk way through the school grounds and then across the subdivision that would give the community a direct link to the State Recreational Area, and 2) remove the fence along Kanangra Drive. An existing pathway/bushwalk currently extends from Gwandalan to Summerland Point.

8.2 Council's Key Tests

Wyong Council's key tests for rezoning are:

1. Whether rezoning can improve the viability of services (such as public transport, general community service and local convenience services), without requiring the extension of services if not justified by the population threshold.
2. Whether rezoning can provided local employment opportunities and support existing shops, services.

This report has found that if the developer is prepared to take a community building approach and support strategies that enhance social capital then the first test of viability can be met. Many services are demand driven, particularly transport. Two hospitals are within a half hour trip from Gwandalan although finding another locally based GP will be a challenge. Rosecorp has indicated that it would like to assist the local school with its capacity and this was welcomed by the Principal.

Shopping locally will be a bonus – it will grow out of community development and the spread of a community culture centred on citizenship and participation. The Learning Community approach will foster local employment readiness and generation. However, this development of itself does not attract significant new business to the area other than contributing to the building and construction industries.

The challenge is to increase Gwandalan's internal self sufficiency, thereby alleviating its social isolation, without compromising its physical 'isolation' which is a key factor contributing to its identity, culture and sense of place, and which underlies the social and environmental value accorded to it by current and aspiring residents.

Recommendations
Concrete ways to enhance community development and community capacity are recommended:

- Emphasise coordination, implementation, and capacity building ahead of infrastructure. People and projects first, with bricks and mortar to support the projects if necessary.
- Development of Gwandalan as a Learning Community
- Establish and constitute a "Learning Community" Management Team, made up of a cross section of interested people and organisations from Gwandalan[33].
- Attract local training brokers
- Fund coordination and implementation

[33] Include new community members, the school, Rosecorp and the Precinct Committee.

- Revitalise existing networks and buildings
- Establish a multi-purpose facility to be used by the school and also as an adult learning centre by altering and adding to an existing school building.
- Sponsorship of innovative community transport alternatives, such as brokerage (Central Coast Community Council)
- Explore sponsorship possibilities for local medical students through the Rosecorp scholarship fund
- Contribute towards the funding of shared walkway.
- Continue the community consultation process initiated in this research project and encourage Wyong Council to engage with the process.

Conclusions

Social sustainability research that considers existing social infrastructure, access, population projections and capacity to meet demand has been undertaken over a two year period in relation to the Catherine Hill Bay and the Gwandalan sites. Demographic analysis and population projections, document reviews and qualitative research with local people and organisations are the major methods supporting the social sustainability research.

Each community is unique, but they share in common features such as being small coastal villages clearly geographically defined, located beside significant natural water areas in the beach and lake, beautifully scenic with strong histories, older populations than the state average, a high level of unoccupied (holiday) houses, limited employment and a geographic area of influence for services and facilities that extends from Newcastle to the Central Coast.

Gwandalan is larger and has more services and facilities than Catherine Hill Bay. The later was once a thriving mining town but is now in decline and small miner's cottages are purchased by the wealthy. Gwandalan has a more modest profile. Real estate agents report that both the top end and the lower first home owner end (Gwandalan only) of the market age going well. The middle of the market is quiet with a recent drop in demand for land. There is an opportunity to set affordable housing targets, particularly in Gwandalan.

Catherine Hill Bay has some strong and vocal opposition to development of the former mining site, particularly if large areas of bush were to be lost. It is anticipated that the proponent's decision to allocate 314 hectares of the 374 hectare site for conservation purposes may go some way to addressing these concerns. The concern about loss of heritage and amenity was also raised. There is also resistance to the State government making a decision on this land. However, some residents, particularly older residents, would like to return to a more vibrant village with post office, store and other services operating that disappeared with the closure of the mine. The land in Gwandalan is already marked for future residential development and many locals are supportive of development if it is matched by appropriate infrastructure.

Both Catherine Hill Bay and Gwandalan are geographically close, each township is located less than fifteen minutes drive from the other. Both locations are relatively well serviced while **over time there will need to be improvements in access to public transport (and a shift in community usage patterns), local accessible medical services and expansion of education facilities.** There is an opportunity to creatively address education needs through the development of a "Learning Community", centred on Gwandalan, but including the Catherine Hill Bay site.

The development of these sites must be seen in the wider context of social infrastructure challenges for the lower Hunter arising from the Lower Hunter Regional Strategy.

If the developments are to proceed the growth in population would be:

	Catherine Hill Bay: At full development (600 dwellings)	*Gwandalan: At full development (312 dwellings)*	*Total: Combined Populations*
Children under 5	71	52	123
Children under 15	227	165	392
Attending Primary School	91	81	172
Attending High School	104	43	147
Residents over 65 years	218	114	332
Total Population	**1102**	**698**	

The Social Impact Assessments for both Gwandalan and Catherine Hill predict a net positive impact for the communities if the developments were to go ahead. Community development planning and a social strategy will be essential to the success of these developments. With attention to education, transport and medical services the wider area has the capacity to meet the demand created by the increase in population. The wider area will also benefit from related economic growth associated with construction and increased consumer demand.

Ω

Appendix 1: Records of Previous Consultation

A1.1 Wallarah Community Alliance Meeting, 8th August 2003

Background
Coastal Hamlets (Rosecorp) had been in regular contact with Catherine Hill Bay resident and local activist Brian Cogan for some time and had sent representatives to relevant meetings of the Catherine Hill Bay Progress Association at their request.

To pre-empt with the lodgement of a Conservation Management Plan, Coastal Hamlets organised a community information evening, to outline the contents of the Plan and to answer questions from the local residents.

A fact sheet was provided to every person who attended the meeting and the balance of fact sheets were distributed to homes in Catherine Hill Bay and neighbouring areas by letterbox drop.

In addition, a project website was established, containing general information, a downloadable copy of the fact sheet, electronic feedback form and a Free-call 1800 number for enquiries.

Meeting
Bob Rose introduced Rosecorp, provided a brief background to the proposal and then introduced Barney Collins from EJE architecture to make a formal presentation. On conclusion of this presentation, Mr Rose and Mr Collins answered questions from the residents in attendance.

The questions covered a wide range of topics including the following:

- The anticipated timeframe for development
- Whether the proposed development will be a gated community
- Whether there is any chance of retaining Catherine Hill Bay as it is
- Aboriginal heritage in the area
- The affordable housing scheme
- Effects of the development on visual amenity
- The Moonee wetland area
- The future of the land on the lake-side of the Pacific Highway
- How the developer would continue to maintain community awareness
-

A1.2 Catherine Hill Bay Bowling Club Members – 31/8/04 Meeting Minutes

1. Andrew Patroni:
The amalgamation has not gone through yet. Waiting for:

- Signatures from Catherine Hill Bay Club.
- Judge happy to consider it once the documentation comes through.
- Swansea RSL has 2 weeks to get the info through and then it is a “rubber stamp”.

- There are no plans from Lake Macquarie Council to say that the club is here. (Originally it was approved by Joint Coal Board).
- AGM – not necessary at this point in time.
- Board needed to continue bowls in club.

- Want to stick with "Catherine Hill Bay Sporting and Social Club" as a name.
- Ladies happy with the proposed situation.

2. Bob Rose:

- Detailed background of the company including partnership with C-Bus (superfund for CMFEL).
- CHB – proposing to develop the land that has been despoiled by mining activities on the site.
- The benefits will be enormous for CHB Bowling Club and CHB.

Questions:

- Water and sewerage; this development will make water and sewerage available to the CHB town. Rosecorp is exploring water desalination opportunities for the site. Another option is to build an eco – sewer.
- Access to Monee beach and headland – will provide safe pedestrian access and regenerate bush where possible. Handing back beach and foreshore to public.

"We really need more people in the Bay – its nothing like it was when I was a little girl" (Bowler / permanent resident).

3. Stuart Rose:

Outlined the proposal:

- The proposed retention of the Heritage jetty with commercial use to provide cash flow for continued maintenance
- The Bin building – reconstructing a mine
  - Scuba diving with controlled access
  - Day spa in tunnels
  - Climbing wall over 9 storeys
  - Small theatre/boutique/conference room
- Apartments – 96 in total 25 nominated as serviced apartments, the balance for residential use. One bedders up to 3- bedders
- The club would maintain the rented apartments

Comment: *"We want permanent residents"*

Rosecorp typically focuses on owner-occupiers. Breakfast Point is 75-80% owner occupied.

We need to get the bigger residential development in Wyong or the proposal does not stack up.

- Emphasised the importance of mining to the history of the place – don't want to lose that.
- The surf club - owned by Council – needs rebuilding, but this is not part of the current proposal.
- Progress Association – will object to everything. They have been upfront and honest about this from the start.
- Number of bowling greens – **the ladies want 2.** *(This is a matter from Andrew Patroni)*

- No of greens/lockers etc: Andrew Patroni's decision. Once the DA is approved, fine tuning and consultation will occur.

Part 2:

Wyong LGA – Moonee Beach.

- Provide environmentally sensitive boardwalk to the beach
- No caravan spots
- Provision of usable parks and open space open to the greater community
- Huge range of houses: small to large and huge price range
- The second road in CHB (Southern) is private, but the insurance implications are huge.
- Traffic flows: Traffic studies have been done.
- The pub – its future will depend on development happening in the town.
- Every new home will have a requirement to have tank water.
- Plan to bring back Wallarah house and 2 cottages to their original state and a B&B.

Key Insights comment:
Participants were pleased with the information provided as it seemed to dispel a number of rumours present in the town. There is a strong desire to breathe life into the town and the club, and therefore there was a level of excitement about the proposal. People appreciated the care that was being taken with the development and the fact that the visual impact from the foreshore was minimal.

Ellen Davis-Meehan

A1.3 Community Survey Results

Key Insights is conducting a community survey for the relocation of the Catherine Hill Bay Bowling Club to a new building on the current mine site (Bin Building and surrounds). The DA also includes a proposal to develop 96 apartments at the rear (south) of the club, 25 of which would be serviced apartments. We have been contracted by Rosecorp, the proponent, and our report will be submitted to Lake Macquarie City Council as part of the development approval process. We are seeking the comments of Catherine Hill Bay residents for our research. Our main aim is to assess the local community view of the development of a new Club and related facilities, including apartments, on the site.

23 residents from the following street were interviewed. Lindsey Clarke Flowers

How long have you been a resident of Catherine Hill Bay?

<12 months	*1 to 10 years*	*10 to 40 years*	*40 + life*
1	3	8	11

What is import to you about Catherine Hill Bay?

Community	*Location*	*Heritage*	*Environment*	*Isolation*	*Ocean/Beach*
7	6	9	6	4	2

Comments from above question:
- A nice place to live
- The bowling club

- Quiet, away from the bustle
- Nice township
- Quiet
- Love the place , I was born here
- As it is – and the preservation of it
- Having some amenities, there are no services
- Won't want to see it change, happy the way it is, depending on the rain for our water and using septic
- Keeping it the same way, a quiet coastal town
- The way it is, the lifestyle, the peaces quiet and tranquillity. The history and the village atmosphere
- Quietness and the low population
- Maintains integrity of historical village, remains small scale
- Uniqueness, sense of community, unspoilt nature, surrounding bushland.
- Keeping it the same
- Stay as it is
- Maintain its integrity, my home
- Uniqueness of area
- Uniqueness
- Beach and fishing.

The uniqueness of the location and the preservation of the community is important to the residents of Catherine Hill Bay.

What are the biggest issues facing Catherine Hill Bay in the next 5-10 years?

- Issues with properties used as holiday lettings and rentals. (not community orientated population) Lost services, nothing left in town, no police shops etc.
- Development is a bad issue. Disturbs town life.
- Rosecorp development.
- Not happy with proposed development and changing landscape. Future change of lifestyle.
- Resisting development successfully.
- Having no services to town, Police, Post office, shops.
- Preserving the character of the Bay as it stands now, and preserving the environment.
- Don't know.
- Development. Rosecorp upsetting things.
- Developers and traffic increasing.
- Traffic, pressure on place, this is a great spot and there is pressure to develop it. Pressure form overdevelopment.
- Mr Rosecorp!
- Development. I am not for it.
- Over development, loss of open space and the green buffer as populations increase to the north and the south. I wish to see a national park surrounding the village, adjoining with the existing national parks to the north and the south.
- Encroachment on all things that is important to me about CHB-uniqueness, sense of community, bushland, unspoilt nature. Development.
- Rosecorp- the development if it gets approved will change Catherine Hill Bay.
- Development.
- Population explosion.
- Overdevelopment.

- This development!! Rosecorp.
- Population and traffic increase.
- Absentee residents who don't care. Development of this type (Rosecorp) on the coastal fringe.
- Don't know.

The proposed Rosecorp development and future development was the major issue facing Catherine Hill Bay and the preservation of the current lifestyle and environment enjoyed by the residents of Catherine Hill Bay.

What is your view of the level of services available to residents in the area?

	Fantastic	Good	OK	Under serviced	Don't use/know
Schools	2	3	5	6	7
Transport	1	8	7	3	4
Recreation	3	8	5	4	3
Medical services	1	6	3	11	3
Shopping	2	6	5	13	1
Other: police				2	
Total	9	31	25	39	18

Medical services and shopping were regarded as under-serviced in Catherine Hill Bay.

Some residents utilise the services of the district nurse and Dr who make house calls.

Shopping is carried out in Swansea .One resident commented there is no real need for a school. 3 residents made the comment they are happy with rainwater and septic. There is a bus service to the town from Swansea.

4. What are your thoughts regarding the development of a new Club and apartments?

(a) Club:

Fantastic	Good	Don't like it	Don't care
0	4	18	1

(b) Apartments:

Fantastic	Good	Don't like it
0	3	20

18 of the 23 residents don't like the idea of a new club for Catherine Hill Bay. 20 of the 23 residents surveyed don't like the idea of apartment development in Catherine Hill Bay.

5. Do you think this development is appropriate for Catherine Hill Bay?

Yes	No
4	19

Comments:

- No. Disgraceful and opposing it to the best of my ability! Not in keeping with the character of the Bay. Totally inappropriate, the Bay has a special character of its own.

Community is alive and well and does not need the addition of a Rosecorp development.
- No. It won't help the place.
- No. Opposed to club development and totally opposed to the apartments which are illegal. Against the zoning and will destroy the heritage cultural landscape.
- No. I want to see the club stay were it is and the apartments are not a good idea. Want the town to remain as is a sleepy quiet place.
- No, it will change the profile of the Bay to become a suburb of Sydney which we are trying to escape from! The apartments are not appropriate for this area. Apartments remind me of Woolloomooloo (in the negative)
- No. Won't fit in.
- No. Emphasis will change from a community venue, from existing community bowling club with community facilities to a conference/ visitor centre and will not be in the interest of the town. (The visitors to this development will not have a community spirit and be interested in the town). Only one bowling green in new development!
- No. Ruin Catherine Hill Bay.
- Definitely not appropriate. Out of character with town, spoil whole ambience of existing residents who are here to enjoy beach bush and peace. The existing club provides access to both halves of town. Money would be better spent on existing club which would still benefit the community, the apartments will be only for the rich and they won't have any feeling for the existing community.
- No. Don't want the apartments. Don't like the apartments and definitely against moving the club! The club was built with voluntary labour by locals 50 years ago. Approval of this development will snowball and allow further development in the area.
- Definitely not! Like using the existing club. Definitely don't like the apartments. Will change the lifestyle of the area with increased traffic and people.
- No. It is overdevelopment on the coastline. We should maintain coastal integrity. This will open door to more development. Don't mind idea of moving the club as long as kept inline with town and does not overshadow town. Not over fussed about the apartments but glad it is on the other side of hill.
- No. Totally out of character of whole town.
- No. Not heritage and will turn area into overdeveloped place like The Entrance.
- No. Should return to bushland.
- No. Not on scale proposed and the development only has one bowling green (a negative). Don't want to move the club and the apartments are too high and don't blend in.
- No. Too large and will take character away from town.
- No. Gold Coast maybe but NOT Catherine Hill Bay! Against club and against apartments.
- No. Not at all. Infringement on the rights of all the people, including visitors who come to enjoy the special nature of this place. Definitely do not like the development of the new club and apartments.
- Yes. But prefer to see club stay were it is and like to see existing houses fixed up in the area, in a heritage way.
- Yes, This is not a community town
- Yes need something in the Bay, and anything to help Catherine Hill Bay go ahead.

19 of the 23 residents felt that this development was not appropriate for Catherine Hill Bay.

They are totally opposed to the development in view of the change to the cultural and heritage landscape.

6. Can you see any problems arising from the proposed development?

- Yes destruction of character of Bay, increase in housing tenfold, destroy natural beauty of environment and destroy heritage of Catherine Hill Bay
- Still no services, nothing to help us
- Many problems!
- Traffic problems and don't want to see us become a suburb of Sydney and crime increase.
- Traffic issues, the access is close to my house. Don't like solutions proposed by developer. There will be crowding from increased population, noise into the night with late leavers from the club. Will snowball with antisocial behaviour and bad lifestyle choices being made in the area. i.e. gambling
- It will change the bay
- No
- Yes. Increased traffic, change in the nature of what Catherine Hill Bay has to offer. A change in the community nature of Catherine Hill Bay. Will swing to a high level of tourism. Club will signal more population in increasing number of hamlets, which is what Rosecorp wants to do via further development in the area.
- Don't know
- Yes, Water run off, traffic issues, access to beach, parking is limited at the beach at present.
- Yes, increased traffic will ruin nature and ton of this place. No buffer zone between Central Coast and Newcastle
- Yes increased problems with conventions, lack of peace and quiet and privacy. Possible further development in area if this goes through. Loss of lifestyle in area.
- If they keep it clean.
- Yes, Concern with next step – more development.
- Heaps of problems, traffic increased, population increased, environmental damage, change to the coastline with buildings. The height of the proposal.
- Yes, Traffic increase, native wildlife threatened. Stupid people speeding along the roads. And people killing themselves while try to fish off the rocks. (Washed away)
- Yes, Amount of people coming, town does not have facilities to cope. Visitors come here and do what they like and leave their mess behind. (leave shit everywhere)
- Yes, The water supply; where will it come from? And where will the sewerage go?
- Yes, Rates increase with no extra services provided.
- Yes, Sewerage and water? Where is the water coming from?
- Yes, a negative impact on town and current population. Increased traffic, damage to native bush. Increased level of litter, loss of native habitat. Residents will be forced to pay for water and sewerage which they have got already.
- No problems
- Don't think so.

Majority of respondent believe that there would be problems arising from the proposed development. Traffic issues, the loss of lifestyle enjoyed by the residents and the prospect of further unwanted development.

7. Any benefits?

- No benefits

- No benefits
- No benefits
- No benefits
- Cant see any benefits, bowling club is fine were it is.
- No benefits
- No benefits
- No benefits, Only for the pockets of Rosecorp
- Maybe jobs
- No benefits
- May provide services for older people
- No benefits, None
- No benefits
- Yes, the bowling club will be new and may come to having shops
- Might get a shop
- Not as far as I am concerned
- None at all
- None
- Jobs maybe, but probable not for locals
- No benefit for us
- Might bring some people into town
- Not really
- Can't see any benefits for anyone except developer.

17 residents believe there will be no benefit with the approval of this development.

2 residents thought there might be the possibility of employment arising from the development.

If the development does go ahead what suggestions, if any, would you make?

- Hoping it won't go ahead.
- Don't have any.
- Scale it down and address the traffic and noise issues more comprehensively.
- No suggestions.
- Pray that it does not go ahead, Hail Street not to be used as an access or entry is most important. Use Montefiores as only access to development. Avoid traffic thru town.
- Don't want to see it happen.
- None.
- I am completely against it. I feel passionate about not allowing this to happen.
- Only the Bowling Club being relocated, but that is it. Community would need to benefit in some way. i.e. sewer, water, kerbing, new surf club.
- None, because we don't want to see it happen!
- See some shops for residents to use.
- None.
- Like to see another shop.
- Keep it as low visibility as possible, do not overshadow town.
- Close it down.
- Don't want to add anything, don't like the development.
- Don't have any suggestions.
- Hate to see the development go ahead. Out of character with the area.
- Please consider existing residents, reduce the size of development to at least half.

- Against it! Go to somewhere else!
- Don't want it to happen.

10 residents responded by saying they really opposed the development go ahead at all.
3 residents suggested a reduction in the size of the development and traffic issues be addressed.

9. Further comments?

- Does nothing to enhance community and environment. Will destroy heritage of Bay. Not in keeping with the area. We do not need the addition of 1000 new homes!
- No further comments.
- This survey is a bit late as application is already with Council.
- Would like to see a shop and the Police return.
- Proposed road usage and changes will dramatically affect my lifestyle!
- Developer will get water and facilities residents have gone without.
- Should be handled by the State Government in a total strategy of increasing population along the coast. This is our last chance to get and keep a significant green buffer between the Hunter and the Central Coast.
- Don't want to see it happen!
- I am completely against the development. Feel passionate about not allowing this to happen. I don't want sewer and water. I have access to excellent community services.
- Native flora and fauna are just returning to area. No economic benefits to town with apartments. Change of culture at the new bowling club- it will be too flash for the locals. I am happy to see the survival of the bowling club by being relocated but not with added development of units, convention centre etc.
- This development is illegal 7 (1) Conservation Primary Zone does not permit units!
- Inconsistent with conservation and sustainability objectives of Lake Macquarie Coastline Management Strategy.
- Rosecorp Conservation Management Plan is not included in the DA and is not endorsed by the Heritage Office.
- Coal and allied promised in 1987 to revert area to open space when mining ceased.
- Don't ruin a place that is unique. Residents abide by heritage rules but Rosecorp can build 3 storey units.
- Strongly opposed to development and will fight it for the sake of my children and future generations!
- Coastal fringe is being developed!!! What, will we see development in National Parks next?!
- The old club has sentimental value attached to it and is in a good area.
- Rosecorp has been lying about what was on the site years ago. Loss of green belt along the beach/coast should be 500 metres wide. Would not like to see it occur. Lies and deception of Rosecorp's information.
- Don't want to see it approved. People buy in Catherine Hill Bay because of the current way it is.
- Should not be allowed to happen. Residents abiding by conservation and heritage rules and Rosecorp can do what they like. No consultation with community before application lodged. Carr government was not supposed to allow anymore coastal development. How is this being allowed??
- Don't want to see it occur. Residents are against it, even ex- residents. Everyone is writing letters to council protesting this development.
- We have had our lives, happy to see it for the future.

- No further comments.
- It is a good idea, would like to see it go ahead.

Only two residents were happy to see the development go ahead. The majority of responses were strongly opposed to this development and any further development. Residents are protective of their lifestyle.

10. Do you have enough information about this proposal?

Yes	No
17	6

11. Where do you get your information about this proposal from?

- Paper
- DA at the club and Progress Association
- Progress Association
- Progress Association
- Paper and Progress Association
- Progress Association
- Meetings, Community group and Progress Association
- Council, Emails and Progress Association
- Radio and TV
- Progress Association
- Progress Association
- Progress Association
- Progress Association
- Progress Association
- Rosecorp, Council and Progress Association
- Bowling Club
- Progress Association, Newspaper and TV media
- Progress Association and Council
- Progress Association
- Progress Association
- Rosecorp , DA State Government Strategies Progress Association
- Mail
- Progress Association and own inquiries

12. Age and Gender Demographics

18-25	26-31	31-40	41-50	51-65	Over 65
1	3	2	3	7	8

Male	Female
14	10

A1.4 Catherine Hill Bay Surf Lifesaving Club Meeting

Sunday 10 October 2004

1. ATTENDANCE: 30 - 40 people plus Rosecorp representatives

2. MEETING OPENS.
Meeting opened at 12.45pm. Meeting opened by Surf Life Saving President and community and Rosecorp welcomed.

3. PRESENTATION BY ROSECORP
Bob and Stuart Rose presented Rosecorp's values and visions for their Catherine Hill Bay site, focusing on the DA proposal currently before Lake Macquarie Council.

During the presentation, Rosecorp made the following comments:

Values and intentions

- Rosecorp has strong community values, including a commitment to social and environmental responsibility and a reputation as a high quality residential developer.
- Rosecorp does not want to spoil Catherine Hill Bay.

DA proposal

- Washing Plant and Jetty are the only part of the site with a current DA before Lake Macquarie Council.
- Rosecorp's principles for the Catherine Hill Bay development are:
  1) Develop only despoiled areas,
  2) ensure that Catherine Hill Bay does not change visually (from beach, town, etc).
- Rosecorp's proposal for the Jetty includes adopting the responsibilities for the jetty from Lake Coal. Rosecorp will spend $1 million plus upgrading it for public use, and $100,000 p/a for maintenance. Rosecorp proposes that the Jetty be heritage listed by the Heritage Council for adaptable re-use. The retention of the jetty is vital for Catherine Hill Bay in terms of its history and future.
- There is no suggestion of developing the headland; visual amenity is very important.
- There will be a lot less use of site than has existed in the past.
- Revitalisation of heritage elements is a key component of proposal, e.g., social history and industrial history village walks.
- Swansea RSL will be offered a 99 year lease for the social club.
- Catherine Hill Bay Bowling club will have a new on-site building and green.
- A reflective pond will be included as a recreational activity for children and builds upon historical past.
- The residential component will be 2-5 stories, but all will remain below the tree line and not be visible from the existing town. The eight story social club component will be developed underground.
- Coastal acquisition of land – Rosecorp will give land back to the community instead of selling it to the NSW government.

- There is the possibility of closing off the access road on the site if the DA is not approved. This is an issue of cost, i.e. insurance premiums, although it is preferable it becomes a dedicated road or the government buys from Rosecorp.

Whole site

- This development application is only one part of Rosecorp's overall vision for their Catherine Hill Bay site. Rosecorp briefly outlined the overall plan for residential development on land within Wyong Shire.
- The green buffer will remain, except despoiled areas will be developed. Reforestation of the despoiled areas eliminates the links with mining heritage for Catherine Hill Bay.
- Despoiled areas make up 30% of the entire site.
- Rosecorp is taking the "sensible approach" to development in the area.
- Rosecorp stressed Catherine Hill Bay's sustainability for the future is dependent upon population growth

Benefits to the Catherine Hill Bay Community.

- Heritage – retention, restoration, adaptive re use of items of cultural significance
- Environmental benefits – rehabilitation of degraded land
- Public access to heritage items
- Retention of community and public space
- Change private to public road with permanent public access
- Ensuring viability of Catherine Hill Bay
- New public parks and playgrounds
- Provision of social club – tourism income
- Sustainable population for local business
- No cost to government re "land acquisition"
- Provision of water and sewage
- Upgraded road network for permanent public access
- Provision, upgrade and maintenance of fire trails
- Community ownership of coastal land

Surf Club

- Rosecorp regards Surf Club as the "heart of Catherine Hill Bay"
- Rosecorp's development provides potential to upgrade surf club. There is the potential to assist the Surf Club to renovate the Clubhouse.
- Renovation proposal is not merely magnanimous; it is also an issue of Club quality. Amenity of club will affect the profile of people moving into Catherine Hill Bay.

4. PRESENTATION BY MILTON ORKOPOLOUS (State Member for Swansea)

- Rosecorp has a reputation as good developers.
- However, their good ideas and intentions are not borne out by documents presently before Council
- Sustainability of the coastal Club will be dependent upon a lot more people in the area. The DA application needs to be viewed in the context of plans for the larger 300+ hectares of Rosecorp land.

- There needs to be a public commission of inquiry (section 119 Environmental Assessment Act) as the fairest option for both Rosecorp and the catchment/coastline. This is necessary for a number of reasons:

    - The site is split over two Council areas (Lake Macquarie and Wyong LGAs)
    - The land makes up some of the last coastal areas in state.
    - There is a potential for Rosecorp's development to set a precedent for future large scale development in area.
    - Struggling clubs are vulnerable to developers.
    - Need "big picture planning" to avoid "piecemeal" development process.
    - The inquiry would provide "big picture planning and avoid having a development process that is "piecemeal".

Rosecorp's Response

- Rosecorp would also like bigger picture planning, but Council has not been receptive to such an idea. Rosecorp wanted to submit Masterplan, but Lake Macquarie Council was not interested.
- Rosecorp is currently arranging a meeting with both Councils (Lake Macquarie and Wyong), Department of Planning , Mr Orkopoulos and other stakeholders for bigger picture approach (10th November)
- Rosecorp agrees with Milton's comments regarding clubs in general but asserts that in this instance they have been welcomed by the Bowling Club and are working cooperatively with them.

5. COMMUNITY CONCERNS AND ROSECORP'S RESPONSE

- **Local Parking:** There was a concern about the availability of parking, particularly for the purpose of shopping. It was not clear whether the concern related to Catherine Hill Bay (which currently has no shopping) or Swansea. Rosecorp responded by highlighting that they will provide a general store with parking to ease concerns.
- **Traffic:** a community member suggested that road connecting site to Catherine Hill Bay should be closed and new traffic should be directed away from Catherine Hill Bay via a new exit on Rosecorp's land. Rosecorp responded indicating that was a valid idea and should be submitted by the community member to Council accordingly.
- **Mine's responsibilities**: a community member asked; *"shouldn't the mine itself have to rehabilitate the site making it unnecessary to rely on Rosecorp's proposal to rehabilitate the site?"* Bob responded the Mine Company will have to remediate but not revegetate and that this option would be inferior to Rosecorp's proposal.
- **Water and Sewage**: a community member asked what is being done about water and sewage. Bob and Stuart spoke of Rosecorp's intentions to be environmentally responsible, outlined the potential for provision of a desalination plant as well as the potential to provide sewer and water onsite, i.e. "sewer farming".
- **Community identity and wellbeing**: a community member (Gary O'Reilly) was concerned that Rosecorp will "overwhelm" Catherine Hill Bay. Concern was expressed that Rosecorp has not got a clear idea of what the community wants,

in contrast to the Progress Association, which has undertaken many surveys of what residents want.

- **Support for Commission of Inquiry** – several community members expressed support for a Commission of Inquiry as outlined by Mr Orkopoulos, arguing that the State significance of the area (acknowledged by Rosecorp) justifies an investigation with wider scope. Rosecorp responded by saying that they would accept the conditions of a Commission of Inquiry if it was called. Community members who had raised the issue also agreed to accept terms of inquiry if it was undertaken and resolved.

6. MEETING CLOSES.

Meeting closed at 2.20pm

Appendix 2: Focus Group Participants

Name	Business/Organisation
Neville Latta	Gwandalan Precinct Committee (President) Lions Club Zone (Chairperson)
Gwen Bates	Gwandalan Progress Association (Secretary) Neighbourhood Watch Gwandalan Bushcare Precinct Committee
Patricia Martin	Gwandalan Quality Meats
John Mayne	Precinct Committee (Secretary) Tidy Towns Committee
David Harris	Gwandalan Primary School (Principal)
Garth Holmes	Gwandalan Primary School P&C committee
Boyd Findlay	Gwandalan Post Office
David Sarich	Lakes Anglican Grammar School (Principal)
Bob Rose	Rosecorp
Stuart Rose	Rosecorp
Ellen Davis-Meehan	Key Insights
Melissa Kilkelly	Key Insights

Appendix 3: Gwandalan Facilities and Services

Sports and Recreational Clubs
Gwandalan has a number of sports clubs, catering to those interested in Tennis, Bowling, Minibike, Fishing, Bowling, Darts, Swimming, Euchre and Horse Sports. Other recreational clubs cater for Gardening, Tae Kwan Do, Pistols and Yoga.

Bangree Aboriginal Association
Gwandalan indigenous community is serviced by Bangree Aboriginal Association which offers Housing, Transport, Respite, Educational, Community Options, and Aged and Home Care programs. Bangree is located in Toukley, about a half-hours drive away. Bus commuters must transfer services at Lake Haven. Several Gwandalan residents currently access Bangree's services.

Youth Facilities, Groups and Services
There is currently no organised Youth Centre in Gwandalan township. Links Youth Services, facilitated by San Remo Neighbourhood Centre, run an outreach centre in Summerland Point which is available to Gwandalan youth. However, discussions with Links reveal that presently no Gwandalan youth access the service.

Community Groups and Service Clubs
Gwandalan is represented to Wyong Council by Gwandalan/Summerland Point Precinct Committee. It is made up of people who live, work or own property in the precinct area and who meet to discuss matters referred by Council, and items of local importance and interest. The Precinct Committee distributes a

Gwandalan also has a Progress Association which also liaises with Wyong Council on behalf of Gwandalan residents, as well as Neighbourhood Watch, Meals on Wheels, a playgroup, V.I.E.W club and a Senior Citizens/Combined Pensioners/Superannuants Association.

Environmental Organisations
Gwandalan has a Bushcare group and Tidy Towns/Landcare group. There is also a Landcare group that focuses on Crangan Bay.

Community Groups
Lions Club
Lioness Club
Gwandalan/Summerland Point Precinct Committee
Progress Association, Gwandalan,
Neighbourhood Watch
Tidy Towns/Landcare
Meals on Wheels
V.I.E.W Club
Bushcare Group
Lancare Group, Crangan Bay
Senior Citizens/Combined Pensioners
Links Youth Group
Playgroup, Gwandalan
Playgroup, Summerland Point

Sports and Recreational Clubs
Garden Club
Bowling Club

Ladies Bowling Club
Bowling Fishing Club
Bowling Pool Club
Bowling Darts Club
Bowling Euchre Club
Tennis and Sports Club
Scouts and Cubs
Arts and Crafts Club
Tunkuwallin Fishing Club
Swimming Club
Sporting Horse Club
Pistol Club
Junior Minibike Club
Tae Kwan Do Club
Yoga Club

Koori Organisations
Bungree Aboriginal Association

Churches
Anglican Church
Community Baptist Church

Appendix 4: Communication Strategy

In order for the population increase to be satisfactorily planned for and catered to in terms of social infrastructure it is vital that the relevant bodies be kept informed of the progress of this application.

The cumulative affect of other proposals in the region must also been taken into account when planning for adequate social infrastructure changes. Developments such as the Coal & Allied proposal for 300 lots at Middle Camp and the recent Crighton Release at Gwandalan are likely to contribute significant numbers to any population increase anticipated from the Rosecorp proposal.

Education
Key Insights is of the view that, in the initial stages of the development, the proposal at both Catherine Hill Bay and Gwandalan will not place excessive strain on education facilities. However, at the completion of all stages and in conjunction with other current/proposed developments, there will need to be consideration given to an additional school or expansion of current education facilities.

To facilitate the anticipated demand on educational services, liaison with the Department of Education in addition to direct contact with the relevant local schools is recommended.

Community
The community consultation within the Catherine Hill Bay site revealed quite a lot of negative sentiment. The Catherine Hill Bay Progress Association raised concerns that were not based on potential negative social impacts. They identified concerns about inconsistency with Council zoning, inconsistency with state and regional planning objectives, heritage concerns and overdevelopment concerns. Since this consultation, the proponent has allocated 314ha of the total 374ha site for conservation and secondary wildlife corridor use.

After extensive community consultation when the original social opportunities and constraints research was undertaken in 2004, significant social opportunities were identified in partnership with the Gwandalan Primary School, including creating a “Learning Community” and pursuing community development opportunities within the new sub-division. It also emerged that community members wanted to consolidate the existing town centre rather than create a fragmented dispersal of commercial facilities. Therefore, the proponent has not included any plans for retail or commercial development at Gwandalan.

Community consultation has allowed Rosecorp to identify the key issues that the community have in relation to the proposal. Key Insights recommends that Rosecorp continue to communicate with members of both the Catherine Hill Bay and Gwandalan local communities to allow the existing residents to remain informed of the progress of the development. This continuous contact will enable Rosecorp to be sensitive to the concerns of the existing residents, helping to build a community that all residents, old and new alike value.

In addition to briefing the community and education providers it is recommended that regular (every 6 months) written updates that include timelines and number of projected dwellings be provided to the following organisations and agencies:

- Premiers Department Regional Infrastructure Planning Group (inter-agency group, working from the Newcastle Office)
- NSW Ambulance Service
- Rural Fire Service
- Local Area Commands of the NSW Police (Swansea and Central Coast)
- Local GP providers and the Hunter Urban Division of General Practice
- Hunter New England Health and Central Coast Area Health (strategic planning divisions)
- Lake Macquarie City Council and Wyong City Council
- Primary Schools and High Schools within the area of influence

Ω

Appendix L

STORMWATER, DRAINAGE AND WATER QUALITY REPORT - CATHERINE HILL BAY AND MOONEE

Stormwater Management Strategy

Residential Subdivision, Catherine Hill Bay

July 2007

Coastal Hamlets Pty Ltd

Parsons Brinckerhoff Australia Pty Limited ABN 80 078 004 798

Suite 1, Level 3,
55 Bolton Street
Newcastle NSW 2300
PO Box 1162
Newcastle NSW 2300
Australia
Telephone +61 2 4929 3900
Facsimile +61 2 4929 7299
Email newcastle@pb.com.au

NCSI Certified Quality System ISO 9001

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Author: Joshua Wukowic .....

Signed: .....

Reviewer: Stuart Holle .....

Signed: .....

Approved by: Stuart Holle .....

Signed: .....

Date: .....

Distribution: .....

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Sub-catchment Data

Executive Summary

The Catherine Hill Bay development involves the subdivision of approximately 600 residential lots on a decommissioned coal mine, location shown in Figure 1. A study was undertaken to quantify existing and developed stormwater flow using the XP-SWMM computer modelling software package. The existing flows at the catchment outlets were calculated using the Probabilistic Rational Method (PRM) as described in Australian Rainfall and Runoff (1987), and used as a base line for comparison to ensure post development flows do not impact on the environment.

A stormwater management strategy has been composed to mitigate developed flows and recommend suitable water quality devices. Each precinct of the development is to include a centralised roof area stormwater harvesting system. This system will include the conveyance of harvested rainwater to strategically placed treatment reservoirs filled with a sand filter medium where a pump system will be used to pressurise the treated rainwater and reticulate it throughout the respective precinct. Runoff originating from the roads, pervious (vegetated) areas and surface hardstand areas of lots will be drained through a separate drainage system via swales located within the road alignments.

A stormwater management strategy has been composed to mitigate developed flows and recommend suitable water quality devices. The mitigation devices proposed within the strategy include a temporary water storage pond, rock-lined swales and centralised rainwater reservoirs. Water quality devices include the use of a landscaped swale drainage system, gross pollutant traps upstream of each reservoir and sand filter media in storage reservoirs. The proposed mitigation structures were included within the XP-SWMM model. The model predicted that the provision of these structures would be suitable to mitigate developed flows back to or below existing levels.

1. Introduction

1.1 General

Parsons Brinckerhoff Australia Pty Ltd (PB) was engaged by Coastal Hamlets Pty Ltd to prepare a stormwater management strategy for a proposed residential development located at Catherine Hill Bay.

The Catherine Hill Bay site was formerly an underground coal mine on the eastern shores of Lake Macquarie, approximately 6km south of Swansea. At this site, coal was transported from underground to the surface before being washed, graded and loaded on ships for export. The development site has since been decommissioned and undergone rehabilitation.

It is proposed to recover the site from its former coal production use and convert it to residential development. The location of the proposed development is shown in Figure 1. The development area is bounded by a SEPP-14 protected wetland to the south and future proposed conservation area dedication to the north.

1.2 Purpose

At the request of Coastal Hamlets Pty Ltd, PB has carried out stormwater modelling to assess the impact of a proposed residential subdivision in Catherine Hill Bay, on existing catchment hydrology. The modelling will be used as an important part of the stormwater strategy which will support the Concept Plan and Project Applications.

This study's objectives were to:

- Determine existing flow rates from the local drainage catchments,
- Estimate developed flow rates from the local developed drainage catchments following the construction of dwellings and roads on the development site,
- Estimate mitigated flow rates from the local drainage catchments following the inclusion of stormwater detention structures, and
- Recommend appropriate structures or devices for the treatment of runoff from the development.

1.3 Site Description

The study area lies within the Lake Macquarie local government area, to the east of the Pacific Highway, as indicated in Figure 1. The proposed development consists of approximately 600 residential allotments of standard density. The development has an assumed average lot size of 400m^2.

The site consists of a mix of flat (former stockpile) and sloping vegetated land. The current topography ranges between 5m AHD to 40m AHD and has been significantly disturbed throughout the operation of mining activities, hence extensive earthworks will be required to enable the site to be developed. Parsons Brinckerhoff Pty Ltd has also conducted civil engineering design for the site and produced proposed surface levels, which have been used in this analysis to determine sub catchment boundaries. There is an existing water

storage pond in the southern corner of the site. It is proposed to utilise this pond as a final stormwater flow mitigation structure.

1.4 Available Data

Information used in the preparation of this stormwater strategy includes:

- Proposed development layout provided by Conybeare Morrison International Pty Ltd,
- Civil engineering surface design and catchment delineation,
- Contour map of the proposed development,
- Evapotranspiration rates, and
- Site specific rainfall information provided through Australian Rainfall and Runoff guide.

2. Modelling Methodology

The methodology comprises quantitative analysis of available data to estimate exiting and future flow behaviour from the development site. The analysis involved examination of surface hydrology to assess runoff characteristics from the site and sizing of stormwater mitigation devices to control the impact of site development on existing flows.

2.1 Hydrology

Rainfall originating from the site will be conveyed through two separate drainage systems. As part of the proposed stormwater management strategy, runoff originating from the roads, pervious (vegetated) areas and surface hardstand areas of lots will be drained via swales within the road alignments. Swales will be used to convey peak flows from the system whereby water will infiltrate back into the natural water table, there it will be used by plantings within the swales via evapotranspiration.

A separate drainage network, also located in the road reserve, will be used to convey up to 1 year ARI flows originating from the roof areas of lots to a series of reservoirs strategically located within the site as shown in Figure 3. The harvested rainwater will then be reticulated throughout the lots using separate pump systems to pressurise mains, which deliver water for gardens and other suitable non-potable uses. This centralised system has the logistical benefit of improved maintenance capabilities, with a group of owners able to share the responsibility as opposed to individual management of water tanks on each allotment. This stormwater management option enables a level of sustainability of the water supply due to significantly reducing the draw on the potable water source, and will partially satisfy the BASIX requirements for water efficiency of residential dwellings.

The catchments contributing to runoff within the study area have been identified from preliminary design information. The impervious area for each sub-catchment has been estimated from the proposed lot layout, assuming an average roof area of 200m^2 per lot. For the Precinct 1 catchment, average lot configurations were extended to account for 50m^2 of surface hardstand and 150m^2 of garden area.

The SEPP14 wetland, located to the south of the development, will not be affected by flows originating from the development as they are directed through an existing channel to the ocean.

2.2 Hydraulics

The hydraulics mode of XP-SWMM was used to route estimated flows through proposed stormwater drainage and mitigation devices for the 1, 10 and 100 year ARI storm events.

3. Existing Hydrology

In order to determine the relative impact of site development on existing catchment hydrology, it is necessary to establish existing flow conditions. Provided below are estimates of existing flow rates from each catchment outlet

3.1 Parameters

A catchment plan of the site is shown in Figure 2. The catchments align with the 'precinct' or hamlet boundaries as nominated in the Concept Plan. However, the topography at Hamlet 1 (village centre) requires the delineation of two separate sub-catchments noted as 1A and 1B on Figure 2.

A summary of loss and roughness parameters for pervious land is provided in Table 3-1.

Table 3-1 – Adopted Loss and Roughness Parameters for Existing Conditions

Parameter	Pervious
Initial Loss (mm)	15
Continuing Loss Rate (mm/hr)	2.5
Roughness	0.07

3.2 Existing Flow Rates

A summary of existing flow rates at each catchment outlet is provided in Table 2 for the 1, 10 and 100 year ARI storm events. The probabilistic rational method (PRM) calculations for the 1, 10 and 100 year ARI storm events are provided in Appendix A.

Table 3-2 – Existing Probabilistic Rational Method (PRM) Peak Flow Rates at Catchment Outlets

Precinct (Catchment Area)	ARI	PRM Estimate Flow Rates (m^3/s)
1A (2.26ha)	1 Year	0.12
	10 Year	0.35
	100 Year	0.71
1B (2.21ha)	1 Year	0.12
	10 Year	0.34
	100 Year	0.69
2 (4.73ha)	1 Year	0.32
	10 Year	0.96
	100 Year	1.94
3 (7.57ha)	1 Year	0.34
	10 Year	1.00
	100 Year	2.03
4 (13.47ha)	1 Year	0.53
	10 Year	1.58
	100 Year	3.21
5 (8.19ha)	1 Year	0.32
	10 Year	0.95
	100 Year	1.93

4. Developed Hydrology

4.1 Stormwater Strategy

The stormwater management strategy for the proposed development is required to manage both water quality and quantity. A plan showing an indicative layout of proposed stormwater management structures is shown in Figure 3.

Water treatment reservoirs will be used as both a qualitative and quantitative mitigation structure for rainfall harvested from roof areas within each precinct.

4.2 Parameters

The catchment plan for the developed site is shown in Figure 2. Sub-catchment boundaries are defined by the lot and drainage layouts and separated into five separate precincts.

The percentage of impervious for each sub-catchment was calculated from the relative proportion of lot and road area. Additionally, a further roof area (200m^2) was used in a separate model to simulate the harvesting of rainfall for 1 year ARI storm event and sizing of the storage reservoirs. A water balance to analyse of the effectiveness of each reservoir was then undertaken using rainfall and estimated lot usages.

A summary of loss and roughness parameters for pervious and impervious land is provided in Table 4-1.

Table 4-1 – Adopted Loss and Roughness Parameters for Developed Conditions

Parameter	Pervious	Impervious
Initial Loss (mm)	15	1.5
Continuing Loss Rate (mm/hr)	2.5	0
Roughness	0.07	0.014

4.3 Developed Flow Rates

The developed peak flows expected from the outlet of each precinct (catchment) during a 1, 10 and 100 year ARI storm event is provided in Table4-2.

Table 4-2 – Developed Peak Flow Rates at Catchment Outlets

Precinct	ARI	Existing Flow Rates (m^3/s)	Developed [Mitigated] Flow Rates (m^3/s)	Change
1A	1 Year	0.12	0.08	- 33 %
	10 Year	0.35	0.25	- 28 %
	100 Year	0.71	0.39	- 45 %
1B	1 Year	0.12	0.12	0 %
	10 Year	0.34	0.33	- 3 %
	100 Year	0.69	0.57	- 17 %
2	1 Year	0.32	0.30	- 6 %
	10 Year	0.96	0.88	- 8 %
	100 Year	1.94	1.29	- 33 %
3	1 Year	0.34	0.29	- 14 %
	10 Year	1.00	0.65	- 35 %
	100 Year	2.03	1.01	- 50 %
Combined Precinct 4 and 5*	1 Year	0.64	0.83 [0.20]	+ 30 % [- 68 %]
	10 Year	1.92	2.28 [0.89]	+ 19 % [- 54 %]
	100 Year	3.89	3.62 [1.85]	- 7 % [- 52 %]

* Note that the peaks flows from precincts 4 and 5 occur at separate times, hence the resultant combined outflow is lower than the sum of the two respective peak flows. Values in brackets represent results obtained after the introduction of the mitigation works described below.

An existing pond of approximately 1,500m^3 capacity (located to the south of the site) has been modelled as a temporary storage for end of pipe peak flow mitigation for precincts 4 and 5. Rock lined swales will be provided for road drainage through precinct 1B to attenuate flows from the catchment.

4.4 Reservoir Sizing

Reservoirs for each precinct were sized using the XP-SWMM stormwater modelling package. The resulting reservoirs were then tested through a water balance model simulating rainfall, losses and general usage requirements of the harvested rainwater supplies. Garden watering was assumed to occur when daily rainfall < 5mm at a rate of 25 mm per week.

The effect of reusing harvested rainwater is a significant reduction in potable water usage a partial requirement of BASIX. During periods when reservoirs are dry, water will need to be supplemented from potable water mains, available as a backup when required.

Table 4-3 – Water Balance Modelling Of Each Precinct Reservoir

Precinct No. (lots contributing)	Reservoir Capacity (m^3)	Annual Average Days Where Reservoir Empty	Annual Average No. of Reservoir Overflows
1A (33)	1020	47.1	5.9
1B (34)	1140	43.5	5.0
2 (108)	3600	44.2	5.0
3 (85)	2850	44.7	5.0
4 (116)	3900	44.7	5.0
5 (79)	2650	43.5	5.0

4.5 Water Quality

The reservoirs for each precinct are to be filled with a sand filter medium to allow for sediment and nutrient removal. Gross pollutant traps will be placed at the inlet of each reservoir to improve the treatment capacity of the reservoirs.

Water quality modelling for each reservoir was undertaken using MUSIC modelling software. The modelling results, shown in Table 4-4, indicated that the developed reservoirs will mitigate stormwater quality in-excess of the current best practice, that is a percentage reduction in outflow concentrations of;

- Suspended solids – 80%
- Total Phosphorus – 40%
- Total Nitrogen – 40%

(Source – *Australian Runoff Quality*, Institute of Engineers Australia)

Table 4-4 – Pollutant Removal Efficiencies

Precinct	Capacity (m^3)	Suspended Solids removal (%)	Total Phosphorus removal (%)	Total Nitrogen removal (%)
1A	1020	98	93	90
1B	1140	97	92	89
2	3600	97	94	88
3	2850	85	78	65
4	3900	95	94	92
5	2650	80	74	62

5. Conclusions and Recommendations

The proposed stormwater management strategy for the development will comprise;

- A drainage network of vegetated roadside swales to convey flows from the roads, open areas and lots to existing watercourse to the south of the development,
- An existing pond structure located to the south of the development will allow for significant attenuation of flows from precincts 4 and 5,
- Rock-lined swales will be used to convey flows from the roads, open areas and lots through precinct 1B,
- A separate piped drainage system, located within the road reserve, to convey rainfall harvested from roof areas,
- Strategically placed reservoirs will be used to store and treat harvested rainwater,
- Pump stations to be used to pressurise the harvested rainwater throughout each precinct of the development,

This sustainable option of water re-use will significantly reduce the draw on potable water of the development as required under BASIX.

Mathematical modelling using XP-SWMM has demonstrated that the proposed storage structures will attenuate developed flows to, or below existing flows. Storage structures utilised across the site are to consist of;

- Several storage reservoirs filled with sand filter media,
- Rainwater tanks on selected lots within precinct 1,
- An existing pond located within the southern natural watercourse.

Harvested rainwater stored in the reservoirs and on-site tanks should be used for garden watering and other suitable, non-potable uses. A first flush bypass device should be provided on each rainwater tank to intercept the first lot of roof runoff. Water captured in this device should drain to landscaped areas. Potable supplement will be required during extended dry periods where respective reservoir/tank is emptied. Gross pollutant traps will be placed at the inlet of each reservoir to improve the treatment capacity of the reservoirs.

The local swale drainage network in each precinct catchment will be required to capture and convey flows up to and including the 5 year ARI storm event, with enough capacity within the road reserve to convey the 100 year ARI storm event.

Figures

Figure 1: Site Locality Plan
Figure 2: Proposed Development Layout and Catchment Plan
Figure 3: Stormwater Management Plan

Client: Rosecorp
Project: Stormwater Servicing Strategy
Location: Residential Subdivision
Catherine Hill Bay

PB PARSONS BRINCKERHOFF

0 500 1000 Metres

SCALE 1: 20,000

Locality Plan

Figure 1

Plot Date: 17/07/07 - 09:44 Cad File: \\auncif\ncldata\A502-NCL\PROJ\212274\3A_Catherine_Hill\09_CADD\DRAWINGS\PR_0559\pr-0559-Fig 1.dwg

Client: Rosecorp
Project: Stormwater Strategy - Catherine Hill Bay
Location: Catherine Hill Bay
New South Wales

20 0 20 40 60 80 100 Metres

Scale 1 : 2000

PARSONS BRINCKERHOFF

BEACH

1B

1A

2

3

4

5

EXISTING POND

BEACH

LEGEND

CATCHMENT BOUNDARY

ROOF WATER PIPE

5 CATCHMENT (PRECINCT)

Proposed Development Layout and Catchment Boundaries

Figure 2

Plot Date: 23/07/07 - 12:02 Cad File: J:\A502-NCL\PROJ\21227A3A_Catherine_Hill\09_CADD\DRAWINGS\PR_0559\pr-0559-sw-fig 2.dwg

Client: ROSECORP
Project: Stormwater Strategy - Catherine Hill Bay
Location: Catherine Hill Bay
NEW SOUTH WALES

20 0 20 40 60 80 100 Metres

Scale 1 : 2000

PARSONS BRINCKERHOFF

BEACH

1B

1A

2

3

4

5

LEGEND

- ROOF WATER PIPE
- ROOF WATER RESERVOIR
- RECYCLED WATER MAIN
- SWALE DRAIN
- (5) CATCHMENT (PRECINCT)

EXISTING POND

BEACH

STORMWATER MANAGEMENT PLAN

Figure 3

Plot Date: 23/07/07 - 12:05 Cad File: J:\A502-NCL\PROJ\212274.3A_Catherine_Hill\09_CADD\DRAWINGS\PR_0559\pr-0559-sw-fig 3.dwg

Appendix A

PRM Flow Estimates

Catherine Hill Bay

RATIONAL METHOD HYDROLOGICAL CALCULATIONS

ARI	1	$^{10}I_1$ =	52.5 mm/h
C10	0.4	Min Tc	5
Rainfall Data for:		Catherine Hill Bay	

Minimum tc	5
Method for tc	1

1 = Bransby Williams

2 = Regional tc=0.76A$^{0.38}$

3 = Kinematic Wave

Frequency Factors:

	ARI	1	2	5	10	20	50	100
Rural:	FFy	0.62	0.74	0.88	1	1.12	1.24	1.36
Urban:	FFy	0.8	0.85	0.95	1	1.05	1.15	1.2

Node	CATCHMENT DATA								SUBCAT. t_c				MAIN CHANNEL			TIME OF CONC.		RAINFALL INTENSITY	CA	**FLOW**
	Area	%Imperv.	FFy	C	CA	L	S	n	Bransby.W	Regional	Kinematic	tc	L	v	t	u/s	this			
	ha	%	-	-	ha	m	m/m	-	Min.	Min.	Min.		m	m/s	Min.	Min.	Min.	mm/hr	ha	m^3/s
1a	2.26	0.0%	0.62	0.248	0.56	200	0.08	0.07	7.05	10.8	14.5	7.1	180	1.5	2.0	0	7.1	75.6	0.56	0.12
1b	2.21	0.0%	0.62	0.248	0.55	200	0.08	0.07	7.07	10.7	14.5	7.1	170	1.5	1.9	0	7.1	75.5	0.55	0.12
2	7.57	0.0%	0.62	0.248	1.88	350	0.06	0.07	11.59	17.1	24.6	11.6	370	1.5	4.1	0	11.6	61.6	1.88	0.32
3	8.8	0.0%	0.62	0.248	2.18	450	0.06	0.07	14.67	18.1	29.7	14.7	380	1.5	4.2	0	14.7	55.4	2.18	0.34
4	13.47	0.0%	0.62	0.248	3.34	450	0.07	0.07	13.64	21.3	28.0	13.6	400	1.5	4.4	0	13.6	57.3	3.34	0.53
5	8.19	0.0%	0.62	0.248	2.03	440	0.07	0.07	14.01	17.6	27.3	14.0	420	1.5	4.7	0	14.0	56.6	2.03	0.32
Combined 4+5	21.66	0.0%	0.62	0.248	5.37	850	0.070	0.07	24.56	25.5	28.0	24.6	550	1.5	6.1	0	24.6	43.1	5.37	0.64
																	FINAL PEAK FLOW:			**1.42**

Catherine Hill Bay

RATIONAL METHOD HYDROLOGICAL CALCULATIONS

ARI	**10**	$^{10}I_1$ =	52.5 mm/h
C10	**0.4**	Min Tc	**5**
Rainfall Data for:		**Catherine Hill Bay**	

Minimum tc	**5**
Method for tc	**1**

1 = Bransby Williams

2 = Regional tc=0.76A$^{0.38}$

3 = Kinematic Wave

Frequency Factors:

	ARI	1	2	5	10	20	50	100
Rural:	FFy	0.62	0.74	0.88	1	1.12	1.24	1.36
Urban:	FFy	0.8	0.85	0.95	1	1.05	1.15	1.2

Node	CATCHMENT DATA								SUBCAT. t_c				MAIN CHANNEL			TIME OF CONC.		RAINFALL INTENSITY	CA	**FLOW**
	Area	%Imperv.	FFy	C	CA	L	S	n	Bransby.W	Regional	Kinematic	tc	L	v	t	u/s	this			
	ha	%	-	-	ha	m	m/m	-	Min.	Min.	Min.		m	m/s	Min.	Min.	Min.	mm/hr	ha	m^3/s
1a	2.26	0.0%	1	0.400	0.90	200	0.08	0.07	7.05	10.8	10.8	7.1	180	1.5	2.0	0	7.1	139.0	0.90	0.35
1b	2.21	0.0%	1	0.400	0.88	200	0.08	0.07	7.07	10.7	10.8	7.1	170	1.5	1.9	0	7.1	138.9	0.88	0.34
2	7.57	0.0%	1	0.400	3.03	350	0.06	0.07	11.59	17.1	18.1	11.6	370	1.5	4.1	0	11.6	113.6	3.03	0.96
3	8.8	0.0%	1	0.400	3.52	450	0.06	0.07	14.67	18.1	21.8	14.7	380	1.5	4.2	0	14.7	102.2	3.52	1.00
4	13.47	0.0%	1	0.400	5.39	450	0.07	0.07	13.64	21.3	20.6	13.6	400	1.5	4.4	0	13.6	105.7	5.39	1.58
5	8.19	0.0%	1	0.400	3.28	440	0.07	0.07	14.01	17.6	20.1	14.0	420	1.5	4.7	0	14.0	104.4	3.28	0.95
Combined 4+5	21.66	0.0%	1	0.400	8.66	850	0.070	0.07	24.56	25.5	20.6	24.6	550	1.5	6.1	0	24.6	79.7	8.66	1.92
																	FINAL PEAK FLOW:			**4.23**

Catherine Hill Bay

RATIONAL METHOD HYDROLOGICAL CALCULATIONS

ARI	**100**	$^{10}I_1$ =	52.5 mm/h
C10	**0.4**	Min Tc	**5**
Rainfall Data for:		**Catherine Hill Bay**	

Minimum tc	**5**
Method for tc	**1**

1 = Bransby Williams

2 = Regional tc=0.76A$^{0.38}$

3 = Kinematic Wave

Frequency Factors:

	ARI	1	2	5	10	20	50	100
Rural:	FFy	0.62	0.74	0.88	1	1.12	1.24	1.36
Urban:	FFy	0.8	0.85	0.95	1	1.05	1.15	1.2

Node	CATCHMENT DATA								SUBCAT. t_c				MAIN CHANNEL			TIME OF CONC.		RAINFALL INTENSITY	CA	**FLOW**
	Area	%Imperv.	FFy	C	CA	L	S	n	Bransby.W	Regional	Kinematic	tc	L	v	t	u/s	this			
	ha	%	-	-	ha	m	m/m	-	Min.	Min.	Min.		m	m/s	Min.	Min.	Min.	mm/hr	ha	m^3/s
1a	2.26	0.0%	1.36	0.544	1.23	200	0.08	0.07	7.05	10.8	8.9	7.1	180	1.5	2.0	0	7.1	206.8	1.23	0.71
1b	2.21	0.0%	1.36	0.544	1.20	200	0.08	0.07	7.07	10.7	8.9	7.1	170	1.5	1.9	0	7.1	206.7	1.20	0.69
2	7.57	0.0%	1.36	0.544	4.12	350	0.06	0.07	11.59	17.1	14.9	11.6	370	1.5	4.1	0	11.6	169.2	4.12	1.94
3	8.8	0.0%	1.36	0.544	4.79	450	0.06	0.07	14.67	18.1	17.9	14.7	380	1.5	4.2	0	14.7	152.3	4.79	2.03
4	13.47	0.0%	1.36	0.544	7.33	450	0.07	0.07	13.64	21.3	16.9	13.6	400	1.5	4.4	0	13.6	157.5	7.33	3.21
5	8.19	0.0%	1.36	0.544	4.46	440	0.07	0.07	14.01	17.6	16.5	14.0	420	1.5	4.7	0	14.0	155.5	4.46	1.93
Combined 4+5	21.66	0.0%	1.36	0.544	11.78	850	0.070	0.07	24.56	25.5	16.9	24.6	550	1.5	6.1	0	24.6	119.0	11.78	3.90
																	FINAL PEAK FLOW:			**8.57**

Appendix B

Sub-catchment Data

The following sub-catchment data corresponds to XP-SWMM modelling undertaken whereby;

- Sub-catchment A – precinct 5
- Sub-catchment B – precinct 4
- Sub-catchment C – precinct 3
- Sub-catchment D – precinct 2
- Sub-catchment E – precinct 1A
- Sub-catchment F – precinct 1B

Node	Pervious (ha)	Slope (m/m)	Impervious (ha)	Slope (m/m)	Roof Area (ha)
A1			0.026	0.020	
A2	0.075	0.066	0.097	0.051	0.10
A3	0.090	0.069	0.108	0.046	0.12
A4					
A5	0.109	0.080			
A6					
A7					
A8					
A9			0.055	0.120	
A10					
A11	0.090	0.066	0.030	0.066	0.12
A12	0.105	0.066	0.035	0.066	0.14
A13	0.060	0.090	0.060	0.065	0.08
A14	0.075	0.087	0.107	0.062	0.10
A15	0.030	0.068	0.010	0.068	0.04
A16	0.045	0.068	0.015	0.068	0.06
A17	0.030	0.080	0.086	0.080	0.04
A18			0.047	0.080	
A19			0.071	0.076	
A20			0.031	0.070	
A21	0.120	0.045	0.092	0.035	
A22			0.100	0.059	
A23	0.060	0.058	0.084	0.029	0.08
A24	0.060	0.058	0.084	0.031	0.08
A25	0.208	0.064	0.059	0.015	
A26	0.075	0.075	0.075	0.063	0.10
A27	0.075	0.066	0.087	0.032	0.10
A28	0.060	0.066	0.091	0.033	0.08
A29	0.150	0.064			
A30	0.140	0.064			
A31	0.075	0.064	0.075	0.046	0.10
A32	0.075	0.064	0.095	0.050	0.10
A33	0.045	0.110	0.015	0.110	0.06
A34	0.045	0.100	0.015	0.100	0.06
A35	0.111	0.110			
A36					

Node	Pervious (ha)	Slope (m/m)	Impervious (ha)	Slope (m/m)	Roof Area (ha)
B1	0.060	0.058	0.180	0.015	0.08
B2	0.045	0.058	0.081	0.025	0.06
B3			0.089	0.075	
B4	0.095	0.070	0.073	0.070	
B5	0.076	0.071	0.056	0.068	
B6	0.068	0.066	0.048	0.066	
B7					
B8	0.040	0.041	0.049	0.030	
B9			0.139	0.030	
B10					
B11	0.060	0.091	0.090	0.053	0.08
B12					
B13					
B14	0.075	0.051	0.403	0.075	0.10
B15					
B16					
B17			0.030	0.070	
B18			0.026	0.055	
B19	0.060	0.068	0.062	0.043	0.08
B20	0.060	0.068	0.560	0.043	0.08
B21	0.060	0.075	0.061	0.044	0.08
B22	0.060	0.075	0.074	0.030	0.08
B23	0.060	0.075	0.093	0.048	0.08
B24					
B25	0.060	0.062	0.020	0.062	0.08
B26	0.350	0.040			
B27	0.230	0.040			
B28	0.168	0.055			
B29	0.227	0.064			
B30					
B31	0.075	0.045	0.080	0.039	0.10
B32	0.045	0.090	0.065	0.055	0.06
B33	0.060	0.060	0.020	0.060	0.08
B34	0.045	0.061	0.073	0.038	0.06
B35	0.030	0.090	0.010	0.090	0.04
B36					
B37	0.045	0.035	0.015	0.035	0.06
B38	0.030	0.058	0.048	0.033	0.04
B39	0.060	0.058	0.077	0.037	0.08
B40	0.060	0.058	0.077	0.045	0.08

Node	Pervious (ha)	Slope (m/m)	Impervious (ha)	Slope (m/m)	Roof Area (ha)
B41			0.055	0.062	
B42			0.049	0.075	
B43			0.059	0.075	
B44	0.075	0.062	0.080	0.046	0.10
B45	0.075	0.063	0.089	0.047	0.10
B46	0.090	0.040	0.030	0.040	0.12
B47	0.090	0.035	0.030	0.035	0.12
B48	0.045	0.067	0.057	0.054	0.06
B49	0.045	0.075	0.075	0.059	0.06
B50	0.045	0.075	0.015	0.075	0.06
B51	0.030	0.075	0.010	0.075	0.04
B52	0.045	0.043	0.053	0.034	0.06
B53	0.045	0.050	0.065	0.036	0.06
B54	0.015	0.080	0.005	0.080	0.02
B55	0.480	0.100			
B56	0.060	0.066	0.074	0.047	0.08
B57	0.150	0.066	0.187	0.046	0.20
B58	0.045	0.110	0.072	0.071	0.06
B59	0.060	0.110	0.099	0.073	0.08
B60	0.060	0.055	0.020	0.055	0.08
B61	0.060	0.055	0.020	0.055	0.08
B62					
B63	0.075	0.067	0.025	0.067	0.10
B64	0.075	0.062	0.025	0.062	0.10
B65	0.250	0.075			
B66	0.290	0.075			
B67					
B68	0.200	0.005			
B69					
B70	0.120	0.075	0.040	0.075	0.16
B71					
C1			0.038	0.050	
C2			0.020	0.055	
C3			0.090	0.055	
C4			0.028	0.050	
C5			0.050	0.050	
C6			0.030	0.046	
C7	0.210	0.050	0.120	0.051	
C8			0.035	0.046	
C9					

Node	Pervious (ha)	Slope (m/m)	Impervious (ha)	Slope (m/m)	Roof Area (ha)
C10					
C11			0.018	0.070	
C12	0.060	0.090	0.110	0.062	0.08
C13	0.060	0.100	0.079	0.064	0.08
C14					
C15	0.075	0.048	0.084	0.048	0.10
C16	0.030	0.055	0.030	0.048	0.04
C17	0.045	0.055	0.075	0.048	0.06
C18	0.030	0.050	0.010	0.050	0.04
C19	0.175	0.044	0.015	0.050	0.06
C20	0.030	0.055	0.035	0.055	0.04
C21	0.045	0.055	0.071	0.039	0.06
C22	0.045	0.035	0.015	0.035	0.06
C23	0.045	0.036	0.015	0.036	0.06
C24	0.045	0.053	0.043	0.030	0.06
C25	0.045	0.053	0.062	0.037	0.06
C26	0.045	0.037	0.101	0.032	0.06
C27	0.030	0.045	0.010	0.045	0.04
C28	0.045	0.045	0.103	0.043	0.06
C29	0.090	0.043	0.086	0.043	0.12
C30	0.045	0.050	0.015	0.050	0.06
C31	0.045	0.050	0.015	0.050	0.06
C32	0.075	0.055	0.115	0.033	0.10
C33	0.090	0.055	0.030	0.055	0.12
C34	0.090	0.066	0.097	0.052	0.12
C35			0.055	0.030	
C36	0.480	0.028	0.090	0.030	0.64
C37					
C38	0.170	0.075			
C39	0.220	0.050			
C40	0.170	0.050			
C41	0.024	0.053			
C42	0.350	0.045			
C43			0.079	0.020	
D1	0.045	0.050	0.040	0.043	0.06
D2	0.075	0.041	0.042	0.036	0.10
D3	0.045	0.015	0.041	0.030	0.06
D4	0.045	0.011	0.042	0.017	0.06
D5	0.075	0.055	0.025	0.055	0.10
D6	0.060	0.056	0.085	0.051	0.08

Node	Pervious (ha)	Slope (m/m)	Impervious (ha)	Slope (m/m)	Roof Area (ha)
D7			0.060	0.050	
D8					
D9			0.036	0.043	
D10			0.029	0.035	
D11	0.150	0.031	0.030	0.035	
D12					
D13			0.051	0.070	
D14	0.045	0.120	0.069	0.067	0.06
D15	0.060	0.116	0.093	0.062	0.08
D16					
D17	0.090	0.070	0.046	0.031	0.12
D18	0.120	0.075	0.040	0.075	0.16
D19	0.045	0.075	0.015	0.075	0.06
D20			0.050	0.051	
D21	0.060	0.055	0.050	0.053	
D22	0.108	0.055	0.078	0.052	
D23	0.045	0.059	0.063	0.043	0.06
D24	0.045	0.061	0.067	0.052	0.06
D25	0.045	0.050	0.015	0.050	0.06
D26	0.045	0.050	0.015	0.050	0.06
D27	0.045	0.060	0.053	0.048	0.06
D28	0.045	0.051	0.087	0.042	0.06
D29	0.045	0.050	0.058	0.040	0.06
D30	0.060	0.051	0.093	0.045	0.08
D31	0.045	0.056	0.015	0.056	0.06
D32	0.045	0.055	0.015	0.055	0.06
D33	0.045	0.055	0.054	0.055	0.06
D34	0.060	0.057	0.090	0.057	0.08
D35	0.045	0.049	0.074	0.041	0.06
D36	0.045	0.050	0.072	0.042	0.06
D37	0.060	0.055	0.020	0.055	0.08
D38	0.045	0.100	0.086	0.057	0.06
D39			0.260	0.090	
D40			0.027	0.030	
D41			0.056	0.045	
D42	0.045	0.071	0.044	0.053	0.06
D43	0.045	0.071	0.056	0.056	0.06
D44			0.073	0.051	
D45	0.045	0.051	0.015	0.051	0.06
D46	0.120	0.055	0.040	0.055	0.16

Node	Pervious (ha)	Slope (m/m)	Impervious (ha)	Slope (m/m)	Roof Area (ha)
E1	0.105	0.035	0.035	0.035	0.14
E2	0.120	0.037	0.040	0.037	0.16
E3	0.105	0.064	0.067	0.064	0.14
E4					
E5	0.075	0.075	0.107	0.025	0.10
E6	0.075	0.040	0.076	0.030	0.10
E7	0.075	0.031	0.081	0.031	0.10
E8	0.060	0.010	0.020	0.010	0.08
E9	0.030	0.075	0.010	0.075	0.04
F1			0.028	0.033	
F2			0.063	0.035	
F3			0.082	0.033	
F4			0.071	0.029	
F5			0.068	0.032	
F6	0.030	0.090	0.065	0.089	0.04
F7					
F8					
F9			0.063	0.035	
F10	0.060	0.091	0.088	0.028	0.08
F11	0.090	0.090	0.098	0.030	0.12
F12	0.045	0.102	0.084	0.031	0.06
F13			0.025	0.036	
F14	0.090	0.089	0.079	0.034	0.12
F15			0.063	0.034	
F16	0.120	0.087	0.040	0.087	0.16

Appendix M

CONTAMINATION REPORTS - CATHERINE HILL BAY AND MOONEE

Environmental Site Assessment
Moonee Colliery, Catherine Hill Bay NSW

25 October 2004

Prepared for:
LakeCoal Pty Limited
PO Box 7115
Mannering Park, NSW 2259

Report by:
HLA-Envirosciences Pty Limited
ABN: 34 060 204 702
18 Warabrook Boulevarde Warabrook NSW 2304
PO Box 73 Hunter Region MC NSW 2310 Australia
Ph: +61 2 4968 0044
Fax: +61 2 4968 0005

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DISTRIBUTION

Environmental Site Assessment
Moonee Colliery
25 October 2004

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1	**Kerry Heywood** **General Manager** LakeCoal Pty Limited PO Box 7115 Mannering Park, NSW 2259	**Original**	**HLA – Envirosciences** **Project File**
1	**Greg Summerhayes** **Principal Environmental Scientist** NSW Department of Mineral Resources PO Box 51 Singleton NSW 2330		

This document was prepared for the sole use of LakeCoal Pty Limited and the regulatory agencies that are directly involved in this project, the only intended beneficiaries of our work. No other party should rely on the information contained herein without the prior written consent of HLA-Envirosciences Pty Limited and LakeCoal Pty Limited.

By

HLA-Envirosciences Pty Limited
ABN: 34 060 204 702
18 Warabrook Boulevarde Warabrook NSW 2304
PO Box 73 Hunter Region MC NSW 2310 Australia

_____

David Rollings
Chemical Engineer

Peer Review: **Date:**

Tom Farrell **Principal Scientist, Mining**	

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APPENDICES

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EXECUTIVE SUMMARY

A Phase 1 Preliminary Site Investigation (PSI), undertaken by HLA-Envirosciences Pty Limited (HLA) (HLA, 2003a), identified historical activities that may have resulted in contamination of various locations at the Moonee Colliery (the Site). LakeCoal Pty Limited (LakeCoal) engaged HLA to conduct an Environmental Site Assessment (ESA) of these locations, located at Catherine Hill Bay, NSW.

This report has been prepared to detail the methodology used to collect and analyse samples from various locations and to assess the results of the analyses against assessment criteria.

The contaminants identified by this investigation were Total Petroleum Hydrocarbons TPH) and Polycyclic Aromatic Hydrocarbons (PAH). The extensive presence of coal waste across the Site makes clear assessment of the nature and source of this contamination difficult, as coal contains hydrocarbons and PAHs in a naturally occurring and immobilised form. The comparison of the relative profiles of these compounds in target samples and coal waste reference samples indicated that the majority of the detected compounds were associated with coal and hence do not warrant specific remediation. No significant heavy metal contamination was identified.

The majority of the areas where contamination was identified are covered by concrete hardstand. As such, the contaminants are generally isolated from human or environmental contact and have a reduced potential to leach or migrate. The need for remediation is determined largely by the proposed future land use and the form that land rehabilitation might take. However, in accordance with the Mine Closure Plan (HLA, 2003c), remediation is only required to enable the restoration of typical coastal vegetation. If this can be achieved by filling and vegetating over the concrete, the potential for disturbance of contaminated areas is minimised.

The following remediation actions are recommended in association with the implementation of the Mine Closure Plan:

- **Substation** – no action;
- **Bramble Maintenance Area and Sump** – no action unless hardstand is to be removed;
- **Stormwater Sump and Flammable Goods Storage Area** – excavate and treat hydrocarbon impacted soils in area of location MS8 (adjacent to the outlet to the stormwater sump);
- **Vehicle Maintenance Building** – no action unless hardstand is to be removed;
- **Above Ground Storage Tank** – no action;
- **Compressor House** – no action;
- **Main Drift Conveyor Housing** – no action;
- **Old Office and Bathhouse** – No action; and
- **Site Sediment Dams** – where practical, the coal fines and sediments should be excavated and recovered, as with other coal wastes on the site. The traces of hydrocarbons present in some of the sediments will not constrain the recovery and use of the coal materials. The cleared dams will then continue to function as sediment traps during the rehabilitation of the site. If the dams cannot be excavated then it is recommended that the dams are filled in and revegetated.

The hydrocarbon-affected soil is most cost effectively treated by land farming within a bunded area on the site. Treated soil can then be used to backfill the excavated areas or be incorporated into landscaping activities.

If the rehabilitation of the site involves the removal of concrete hardstands and result in exposure or excavation of identified contaminated areas, further screening investigations (eg. visual inspection, targeted sampling) should be undertaken at that time to confirm that there is no significant contamination present that could affect future development proposals.

1 INTRODUCTION

A Phase 1 Preliminary Site Investigation (PSI), undertaken by HLA-Envirosciences Pty Limited (HLA) (HLA, 2003a), identified historical activities that may have resulted in contamination of various locations at the Moonee Colliery (the Site). LakeCoal Pty Limited (LakeCoal) engaged HLA to conduct an Environmental Site Assessment (ESA) of these locations at Catherine Hill Bay, NSW. The location of the Site is shown in **Figure 1** and the layout is shown in **Figure 2**.

This report has been prepared to detail the methodology used to collect and analyse samples from various locations and to assess the results of the analysis with guidelines sourced from the NSW EPA.

2 SCOPE OF WORK

2.1 Investigation Objectives

The objectives of this ESA were to:

- Investigate areas at the Site identified in the PSI where contamination may be present;
- Evaluate, if possible, the nature of the contamination;
- Collect appropriate soil samples for analysis;
- Assess areas identified as contaminated to determine whether contaminants are present in concentrations exceeding the assessment criteria; and
- Present recommendations as appropriate.

This report is intended to evaluate potential issues at the Site that have the potential to influence the future management of the site as detailed in the Mine Rehabilitation and Closure Plan (HLA, 2003c). In particular, the investigation has been designed to identify major contamination issues that could require actions to allow the rehabilitation of the site, i.e. to "*encourage natural regeneration of a scrub-woodland formation which will ultimately blend back into the existing landscape*".

2.2 Guidelines

Investigative and reporting work was conducted with reference to the following guidelines:

NSW EPA (1995) – *Sampling Design Guidelines* considered when developing the sampling plan.

NSW EPA (1997) – *Guidelines for Consultants Reporting on Contaminated Sites:* provide guidance for an ESA.

NEPM (1999) - Assessment of Site Contamination: considered throughout the entire investigation.

NSW EPA (1997) - Guidelines for Consultants Reporting on Contaminated Sites: were considered throughout the investigations and during preparation of this report.

ANZECC (1996) - Guidelines for the Laboratory Analysis of Contaminated Soils: were used to ensure laboratory analysis of samples obtained from the site used appropriate methods to acceptable levels of accuracy and precision.

2.3 Scope of Investigation

The scope of work undertaken to prepare this ESA was:

1. Review historical and site background information contained in the HLA Phase 1 report (HLA, 2003a).

2. Collect and analyse samples from potentially contaminated areas on the Site identified in the PSI. These areas were:

    - Diesel Above Ground Storage Tank (AGST) adjacent to former maintenance facility;

- Oil contamination behind former compressor house located adjacent to AGST;
- Maintenance building where there was evidence of oil staining from maintenance activities;
- Stormwater and process water sump adjacent to the maintenance building;
- Wastewater sump and slab from former Brambles maintenance facility;
- Main drift conveyor housing located adjacent to main administration/bathhouse building;
- Substation adjacent to transformers; and
- Site sedimentation dams.

3. Prepare a report detailing the methodologies used, review of the results and comparison with assessment criteria.

3 SITE IDENTIFICATION

The following information describes the portion of land that is the subject of this investigation:

Table 1: Moonee Colliery Identification Details

Item	Details
Site Owner (as recorded by Council)	Coal Operations Australia Ltd listed on Section 149 certificate. Recently changed ownership to Rosecorp
Site Address	595 Pacific Highway, Crangan Bay NSW 2259
Lot and DP Number	Lot 2 DP 809795
County and Parish	Wallarah, Northumberland
Local Government Authority	Wyong Shire Council
Current Zoning	7E Coastal Lands Acquisition Zone
Distance from nearest CBD	8.5 km (Swansea)
Geographical Coordinates	372000E 6329625N
Site Area	90.82 Hectares
Site Elevation	30 mAHD
Locality Map	**Figure 1**
Site Layout	**Figure 2**

Notes:
Coordinates are approximate and relative to Australian Map Grid (AMG).
Elevation is approximate and relative to Australian Height Datum (AHD) based on a 1:25,000 topographic map of the area.
CBD – Central Business District.

4 SITE HISTORY AND LAND USE

Site history details are provided in HLA (2003a).

4.1 Existing Land Use

At the time of HLA's site investigations in May 2004, the Moonee colliery site was in the final stages of decommissioning following the cessation of mining operations in 2002. Only the administration and bathhouse buildings remained on the site with the conveyors, drift and maintenance facilities all removed down to the hardstand. The mine access drift and shafts had been sealed and the belt drive house removed down to the hardstand. The site infrastructure and buildings shown in **Figures 2** and **3** include the site bathhouse, maintenance building locations, conveyor buildings and associated infrastructure, the above ground fuel storage tank and the site sediment control dams.

4.2 Future Land Use

At the time of reporting, the future land use for the Site had not been finalised as the new landowner, Rosecorp, has requested that the majority of the site structures remain pending the submission of Development Applications for the area (as detailed in HLA 2003c).

In the Mine Rehabilitation and Closure Plan (the Plan) for the Site, prepared in November 2003 (HLA 2003c), LakeCoal committed to rehabilitating the Site to native woodland and heath land and also stated its intention to remove all buildings during the life of the Plan. Should approval be obtained from the appropriate authorities for adaptive re-use of the buildings, LakeCoal may seek amendment to the Plan.

On the basis of LakeCoal's current intention to clean and rehabilitate the site, the assessment criteria for this investigation have been based on a recreational and ecological land use.

5 SITE CONDITION AND SURROUNDING ENVIRONMENT

5.1 Topography and Drainage

Topography surrounding the Moonee Colliery is defined by a ridgeline running from the coastline along the northern and southern boundary of the site. The colliery is contained within a narrow basin draining to the southeast toward Deep Cave Bay at a slope of approximately 0.07 m/m (7% slope), referenced from the 1:25 000 topographic map of Catherine Hill Bay, 9231-IV-S (CMA, 1979). The colliery site has been extensively altered with the majority of the site having been levelled around the maintenance buildings and the former coal storage areas to the east of the maintenance facility.

Drainage from the colliery is controlled by means of a series of sedimentation ponds. Four large sedimentation ponds collect water from the northern boundary of the basin area. The water flows from the large dams further down gradient (to the south) through six additional sedimentation ponds. Following the sedimentation ponds, the water flows into Wallarah Creek. Site runoff is collected by various stormwater and process water sumps and is collected in a large separator sump which separates out any hydrocarbon material floating in the water before releasing the water into the sedimentation pond network.

5.2 GEOLOGY AND HYDROGEOLOGY

5.2.1 Regional Geology

Geology of the region around the Moonee Colliery is defined as being part of the following groups, as described in Murphy (1993).

- Narrabeen Group-Munmorah Conglomerate Formation: conglomerate, pebbly sandstone, grey green and grey siltstone and claystone; and
- Newcastle Coal Measures-Moon Island, Boolaroo and Adamstown Subgroups: conglomerate, sandstone, tuff, siltstone, claystone and black coal.

The regional soils are described as follows (Murphy, 1993):

'Soils - Shallow (<50 cm) Lithosols on steep slopes, shallow to moderately deep (50-150 cm) Soloths and Yellow Podzolic Soils on gentler slopes with Soloths along drainage lines. Occasionally deep (>150 cm) Yellow Podzolic Soils on fine grained substrates.'

'Limitations – step slopes (localised), very high erosion hazard, shallow soils (localised), hard setting soils, stoniness, occasionally shallow, strongly acid and with low fertility.'

Soils encounted during this assessment are shown in detail within the Bore Logs contained in **Appendix 1** and are generally described as follows:

- Moonee Colliery soils were sandy clays and sandy clay loams.
- Colours included browns, orangey browns, bright yellow / orange and greys.
- The areas also contained substantial amounts of coal chitter fill.

5.2.2 Hydrogeology

A search of the Department of Land and Water Conservation (DLWC) groundwater well database was performed. Three wells were found within a 3 km search radius centred between Wallarah and Moonee Collieries. One well is located at the Catherine Hill Bay Bowling Club about 1.5 km to the north of the Moonee Colliery, the second is along the Pacific Highway approximately 2 km to the southwest of Moonee Colliery and the third is in the Munmorah State Recreation Area approximately 2 km to the south of Moonee Colliery.

These wells are too far from the Site to enable extrapolation of groundwater characteristics.

It is inferred that shallow perched groundwater may accumulate at the base of the soil/weathered conglomerate or fill profiles.

5.3 Regional Meteorology

Data were obtained from the NSW Bureau of Meteorology (BOM) for the Nora Head Lighthouse (approximately 16 km to the south of Catherine Hill Bay).

Average monthly maximum temperatures range from 25.2 °C in February (summer) to 17.2 °C in winter months.

Annual average relative humidity levels at Nora Head are 78% and 71% at 9:00 am and 3:00 pm respectively.

Average annual rainfall between 1969 and 2001 was 1246 mm with rain generally falling on more than 137 days per year.

5.4 Condition of Buildings and Roads

All site buildings at the colliery were inspected as part of a hazardous materials survey (HLA 2003b). The survey identified buildings containing asbestos, synthetic mineral fibre and lead based paints. As noted in **Section 4**, many of the buildings on the Site have been removed.

The colliery access roads were all sealed, as were the main internal site roads leading to the administration building and maintenance building. The access road leading to the main shaft was sealed along with access roads to the former Brambles maintenance sheds located at the east of the administration building. The access road leading down to the site sedimentation dams was not sealed but was in generally good condition.

5.5 Proximity to Local Sensitive Environments

Receptors surrounding the site under investigation are:

- The nearest sensitive receptor to the Moonee colliery is the Catherine Hill Bay township to the north (approximately 500 m away from the mining activities);
- The forests, woodlands and heathlands to the south; and
- Environmental receptors also include Wallarah Creek, which feeds directly into the ocean.

6 POTENTIAL AREAS AND CONTAMINANTS OF CONCERN

Areas and contaminants of concern identified in the PSI (HLA 2003a) are listed in **Table 2**. This table shows areas reported as having visible contamination or that had the potential for contamination.

Table 2: Areas and Contaminants of Concern

Area of Concern	Contaminant(s) of Concern[1]
AGST adjacent to former maintenance facility	TPH, BTEX, PAH
Former compressor house adjacent to AGST	TPH, PAH
Vehicle maintenance building	TPH, BTEX, PAH, Heavy metals
Stormwater and process water sump	TPH, BTEX, PAH.
Flammable materials storage area	PAH, SVOCs, VOCs, Heavy Metals
Wastewater sump and slab former Brambles maintenance facility	TPH, BTEX, PAH, Heavy Metals
Main drift conveyor drive housing	TPH, BTEX, PAH
Site sedimentation dams	TPH, PAH, Heavy Metals
Old office and bathhouse	Heavy Metals, OCPs
Substation	PCBs

[1] Further details on these contaminants are provided below.

Specific details of the contaminants of concern are:

- *Petroleum Hydrocarbons* – Petroleum hydrocarbons are generally quantified by analytical laboratories as total petroleum hydrocarbons (TPH), and as four fractions of hydrocarbons grouped into ranges of volatility. Monocyclic aromatic hydrocarbons can also be found in petroleum fuels. The typical compounds include Benzene, Toluene, Ethyl Benzene and Xylene (BTEX).
- *Polycyclic Aromatic Hydrocarbons (PAHs)* **–** these are components of heavy oils, creosote, bitumen/tar, coal and ash.
- *Heavy Metals* – Heavy metals were targeted due the potential for these compounds to be present due to the maintenance activities occurring on the site. Targeted heavy metals were arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.
- *Polychlorinated Biphenyls (PCB).* – PCBs have been targeted due to the potential for these compounds to have been in the transformer oil used in the site substations.
- *Organochlorine pesticides* (OCPs) – These compounds are typically used to control pests around buildings and other structures.
- *Volatile and Semi-volatile Organic Compounds (VOCs & SVOCs)* – these are components of light hydrocarbon products such as degreasers, solvents, fuels etc.

7 BASIS FOR ASSESSMENT CRITERIA

7.1 Current Guidelines

The current assessment criteria used in NSW to evaluate soil analytical results are based on EPA (1994), EPA (1998) and NEPM (1999). These guidelines present a range of Health-Based Soil Investigation Levels (SILs), provisional Phytotoxicity-Based Investigation Levels (PBILs), Ecological Investigation Levels (EILs), sensitive land use thresholds and expected background concentration ranges for urban redevelopment sites in NSW. Application of these guidelines is briefly described below.

SILs

The SILs described in the NSW EPA (1998) and NEPM (1999) guidelines are based on the National Environmental Health Forum (NEHF) levels devised by Imray and Langley (1996). Guideline levels are provided for various substances for the protection of human health, based on four specific land use and exposure scenarios:

- SIL_1 Residential with gardens and accessible soil (home-grown produce contributing less than 10% fruit and vegetable intake; no poultry), including children's day care centres, preschools and primary schools, or town houses or villas.
- SIL_2 Residential with minimal access to soil including high-rise apartments and flats.
- SIL_3 Parks, recreational open space, playing fields including secondary schools.
- SIL_4 Commercial or industrial.

PBILs & EILs

The PBILs (EPA 1998) and EILs (NEPM 1999) have been devised for the protection of plants, and are designed to be applied as single number criteria indicative of environmental effect. Their use has significant limitations since phytotoxicity depends on the types of soil and species; therefore they are intended to be applied as a screening guide only. The NSW EPA decision process for assessing urban redevelopment sites stipulates that the PBILs need to be considered on sites used for either residential purposes or land uses including parks, recreational open space and secondary schools.

The NSW EPA assessment process also stipulates that aesthetic issues, impact of contaminants on ground and surface water, potential degradation of building structures and affects of chemical mixtures need to be considered.

7.2 Proposed Site Soil Quality Criteria

Based on the potential for recreational and ecological land use, as outlined in **Section 4.2**, the analytical results obtained during the investigation were compared to the NSW EPA (1994 and 1998) SIL_3 (Parks, Recreation and open space) guidelines. PBILs were also considered when assessing the results.

7.3 Sampling and Analysis Plan

A Sampling and Analysis Plan (SAP) was developed to assess the areas and potential contaminants of concern identified in HLA (2003a) and summarised in **Section 7** above.

7.3.1 Data Quality Objectives

Data Quality Objectives (DQOs) for this project were defined in terms of:

- Accuracy;
- Precision;
- Completeness;
- Representativeness;
- Comparability.

A detailed explanation and evaluation of the field and laboratory DQOs is included in **Appendix 2**.

7.3.2 Sample Collection and Analysis Plan

This assessment was based on a targeted, judgemental sampling grid over a number of small areas identified as having the potential for contamination (as outlined in **Section 7**).

Table 3 shows the methods used to obtain samples at the areas defined in **Section 7**. Details of the sample identification, depth and analysis for each sample collected are provided in **Table 4**.

Table 3: Moonee Colliery Sample Details

Location	Samples Analysed	Sample Method
Substation	1	Four surface samples (MS1 – MS4) collected and composited by analytical laboratory into one sample for analysis.
Wastewater sump & the Brambles maintenance area	6	Samples from two test pits (MS5 – MS6) dug by an excavator. Samples collected at surface and 0.5 m intervals and/or at changes in soil horizon. Sample locations on the northeastern corner of the slab, which was adjacent to the sump and a small bunded area.
Stormwater and process water sump & Flammable Materials storage area	6	Samples collected from three excavator test pits (two test pits (MS8 and MS9) on the down gradient side of the grit trap and one test pit on the flammable materials storage area side (MS7)). Samples collected at surface, 0.5 m intervals and/or at changes in soil horizon.
Vehicle Maintenance Building	19	Samples collected from six excavator test pits (MS10 – MS15) spaced over the maintenance building area. Samples were collected at the surface, 0.5 m intervals and/or at changes in soil horizon.
AGST (Adjacent to Maintenance Facility)	5	Samples collected from two test pits (MS16, MS17) on the southern and western sides of the bunded area. Samples collected at the surface, 0.5 m intervals and/or at changes in soil horizon, down to 2 m.
Compressor House Adjacent to AGST	2	Samples collected from two test pits (MS18, MS19) on the southern and western sides of the bunded area. Samples collected at the surface, 0.5 m intervals and/or at changes in soil horizon.
Main Drift Conveyor Drive Housing	2	Samples collected from one excavator test pit (MS20) adjacent to the slab that supported the drive housing. Samples collected at the surface, 0.5 m intervals and/or at changes in soil horizon.

Location	Samples Analysed	Sample Method
Site Sedimentation Dams	16	Two surface sediment samples were collected from each dam (sample identifiers M Dam 1-1, M Dam 1-2, M Dam 2-1, M Dam 2-2, M Dam 3-1, M Dam 3-2, M Dam 4-1, M Dam 4-2, M Dam 5-1, M Dam 5-2, M Dam 9-1, M Dam 9-2, M Dam 14-1, M Dam 14-2). Samples from dams that directly receive runoff from the site were analysed and samples from dams providing secondary settlement were placed on hold pending review of the other results.
Old Office and Bathhouse Buildings	6	Surface samples from the unsealed areas surrounding the bathhouse. Samples were composited into groups of two or three for analysis. For exampled, Comp 1 is the analysed composite samples and C1, C2 and C3 are the discrete samples that make up the composite.

Table 4: Moonee Colliery Sample Identification

Location	Sample ID		Sample Depth (m) (all depth samples were sampled over an approximate 100 mm sample interval)	Analysis						
				TPH	BTEX	Heavy Metals	PAH	SVOC & VOC	OCP	PCB
Substation	MS1	All Samples composited into one sample for analysis	Surface							✔
	MS2		Surface							
	MS3		Surface							
	MS4		Surface							
Wastewater sump and the former Brambles maintenance area	MS5-1		0.15	✔	✔	✔	✔			
	MS5-2		0.3	✔	✔	✔	✔			
	MS5-3		1.5	✔	✔	✔	✔			
	MS6-1		0.2	✔	✔	✔	✔			
	MS6-2		0.3	✔	✔	✔	✔			
	MS6-3		1.5	✔	✔	✔	✔			
Stormwater and process water sump and Flammable Materials storage area	MS7-1		0.1	✔		✔	✔	✔		
	MS7-2		0.4	✔		✔	✔	✔		
	MS7-3		2.0							
	MS8-1		0.1	✔			✔			
	MS8-2		0.3							
	MS8-3		0.3	✔			✔			
	MS8-4		1.5							
	MS9-1		0.5	✔			✔			
	MS9-2		1.0	✔			✔			
Vehicle Maintenance Building	MS10-1		0.1	✔	✔	✔	✔			
	MS10-2		0.2							
	MS10-3		0.4	✔	✔	✔	✔			
	MS10-4		0.5							
	MS10-5		1.0	✔	✔	✔	✔			
	MS11-1		0.1	✔	✔	✔	✔			
	MS11-2		0.2							
	MS11-3		0.4	✔	✔	✔	✔			
	MS11-4		0.5	✔	✔	✔	✔			
	MS11-5		1.0	✔	✔	✔	✔			

Location	Sample ID	Sample Depth (m) (all depth samples were sampled over an approximate 100 mm sample interval)	Analysis						
			TPH	BTEX	Heavy Metals	PAH	SVOC & VOC	OCP	PCB
	MS12-1	0.15	✔	✔	✔	✔			
	MS12-2	0.30	✔	✔	✔	✔			
	MS12-3	0.6	✔	✔	✔	✔			
	MS12-4	1.0							
	MS13-1	0.15	✔	✔	✔	✔			
	MS13-2	0.3							
	MS13-3	1.7	✔	✔	✔	✔			
	MS13-4	2.0	✔	✔	✔	✔			
	MS14-1	0.1	✔	✔	✔	✔			
	MS14-2	0.2	✔	✔	✔	✔			
	MS14-3	0.5							
	MS14-4	1.0	✔	✔	✔	✔			
	MS15-1	0.2							
	MS15-2	0.35	✔	✔	✔	✔			
	MS15-3	0.55							
	MS15-4	0.7	✔	✔	✔	✔			
	MS15-5	1.2	✔	✔	✔	✔			
AGST Adjacent To Former Maintenance Facility	MS16-1	0.05	✔	✔					
	MS16-2	0.1	✔	✔					
	MS16-3	0.3	✔	✔					
	MS16-4	1.50							
	MS17-1	0.1	✔	✔					
	MS17-2	0.2	✔	✔					
	MS17-3	0.5							
Former Compressor House Adjacent to AGST	MS18-1	0.01							
	MS18-2	0.2							
	MS18-3	0.15							
	MS18-4	0.3							
	MS18-5	0.4	✔			✔			
	MS18-6	0.5							
	MS18-7	1.5							

Location	Sample ID		Sample Depth (m) (all depth samples were sampled over an approximate 100 mm sample interval)	Analysis						
				TPH	BTEX	Heavy Metals	PAH	SVOC & VOC	OCP	PCB
	MS19-1		0.1	✔			✔			
	MS19-2		0.4							
	MS19-3		1.0							
Main Drift Conveyor Drive Housing	MS20-1		0.05							
	MS20-2		0.1	✔			✔			
	MS20-3		0.2	✔			✔			
	MS20-4		0.3							
	MS20-5		0.5							
Bathhouse Composite Samples	C1	Comp 1	Surface						✔	
	C2		Surface							
	C3		Surface							
	C4	Comp 2	Surface						✔	
	C5		Surface							
	C6		Surface							
	C7	Comp 3	Surface						✔	
	C8		Surface							
	C9		Surface							
	C10	Comp 4	Surface						✔	
	C11		Surface							
	C12	Comp 5	Surface						✔	
	C13		Surface							
	C14	Comp 6	Surface						✔	
	C15		Surface							
	C16		Surface							
Sedimentation Dam	**MCP Dam ID**	**Sample ID**	--	--	--	--	--	--	--	--
	26	MDam 1-1	Surface	✔		✔	✔		✔	
		MDam 1-2	Surface	✔		✔	✔		✔	
	Cleanwater Dam	MDam 2-1	Surface	✔		✔	✔		✔	
		MDam 2-2	Surface	✔		✔	✔		✔	
	27	MDam 3-1	Surface	✔		✔	✔		✔	
		MDam 3-2	Surface	✔		✔	✔		✔	

Location	Sample ID		Sample Depth (m) (all depth samples were sampled over an approximate 100 mm sample interval)	Analysis						
				TPH	BTEX	Heavy Metals	PAH	SVOC & VOC	OCP	PCB
	28	MDam 4-1	Surface	✔		✔	✔		✔	
		MDam 4-2	Surface	✔		✔	✔		✔	
	New Dam (not shown in MCP)	MDam 5-1	Surface	✔		✔	✔		✔	
		MDam 5-2	Surface	✔		✔	✔		✔	
	9a	MDam 9-1	Surface	✔		✔	✔		✔	
		MDam 9-2	Surface	✔		✔	✔		✔	
	7	MDam 14-1	Surface	✔		✔	✔		✔	
		MDam 14-2	Surface	✔		✔	✔			

7.4 Contaminant Profile Analysis

The most likely potential contaminants of concern at the Site are TPH and PAH arising from fuel and lubricant use. TPH and PAHs are present naturally within coal but are also immobilised by being bound up within the coal's carbonaceous matrix (DEC 1999). Because of this, coal is not considered a major contaminant of concern. There was a possibility during the sampling that all samples could contain coal (whether it be coal, coal fines or coal chitter) and some samples were collected from layers containing various forms of coal.

To assist in clarifying the source of PAH and TPH concentrations in the samples, profiles of the percentages of the PAH compounds were compared to those for coal fines collected from a nearby LakeCoal stockpile. TPH was not used as an indicator compound for coal fines as TPH references a wide group of hydrocarbons and does not provide the accuracy that PAH speciation allows. Comments on the results of this analysis are included in **Appendix 3**.

7.5 Quality Assurance

A QA/QC programme was developed for this investigation to assure the quality and therefore the reliability of the overall data used in this assessment, including whether sampling and laboratory analysis procedures are appropriate. Analysis of the quality assurance data was performed and the results summarised in **Appendix 2**.

Based on an assessment of field and laboratory QA/QC data, the field investigation procedures and reported analytical results are considered to have produced valid and representative concentrations of the analysed compounds at the sample locations tested. The full assessment of the QA/QC data has been included as **Appendix 2**.

8 RESULTS AND SITE CHARACTERISATION

The results of the soil analysis are shown in **Table 5** at the end of the report text. **Figure 2** shows the location of the soil samples at the colliery and **Figure 3** those collected from the site sedimentation dams. The laboratory certificates of analysis are included as **Appendix 4**. The following comments on the Site are based on these results.

The contaminants identified at concentrations exceeding the nominated assessment criteria at the Site were TPH and PAH. TPH is a broad measure of the hydrocarbon content in a soil sample and provides an indication of the relative concentrations of different hydrocarbon fractions (e.g. C_6-C_9 hydrocarbons). The TPH analysis can also detect the presence of aromatic compounds (e.g. PAH), which appear typically as heavier chain TPH fraction hydrocarbons. The PAH concentrations for the various samples discussed below have been used to infer whether the apparent hydrocarbon contamination may in fact be due to the presence of coal fines and/or chitter (see **Section 8.4**) (see **Appendix 3** for PAH profile discussion).

Substation

The composite sample collected adjacent to the concrete pads of the transformers was analysed for PCB, with the result being below laboratory detection limits.

Bramble Maintenance Area and Sump

Samples MS5-2, MS5-3 and MS6-3 exceeded the assessment criterion for TPH with sample MS5-3 also exceeding the criterion for total PAH. Field observations made on the day of sampling describe samples MS5-3 and MS6-3 to be primarily coal chitter, with sample MS5-3 also described as having a hydrocarbon odour.

Analysis of the PAH compound profiles suggests that the TPH found in sample MS6-3 is probably due to the presence of coal fines as its PAH profile is consistent with those for the coal fines. Samples MS5-2 and MS5-3 have PAH compound profiles that differ from those observed for coal fines and hence the TPH and PAH contamination is probably due to petroleum hydrocarbons.

Stormwater Sump (to the east of the vehicle maintenance building) and Flammable Goods Storage Area

Sample MS8-1 exceeded the assessment criterion for TPH, with all other results from this area falling below the assessment criteria. The field observations for sample MS8-1 describe the sample as containing coal chitter. The analysis of the PAH compound profiles was inconclusive.

Vehicle Maintenance Building

Total chromium results from samples MS10-1 and MS11-1 exceeded the criterion for chromium (VI) but were well below the total chromium criterion. The samples were subsequently reanalysed for chromium (VI) with the results for each sample being below the laboratory detection limit.

Samples MS14-1, MS14-4 and MS15-2 exceeded the assessment criteria for TPH and sample MS14-4 also exceeded the criterion for total PAH. Field observations describe sample MS14-1 as containing "*a dark grey sand with a strong hydrocarbon odour*" while samples MS14-4 and MS15-2 were described as being "*coal chitter*" and "*containing some coal chitter*" respectively.

Analysis of the PAH compound profiles suggests that the TPH found in samples MS14-4 and MS15-2 is probably due to the presence of coal fines, as their PAH analysis profiles are consistent with those for the coal fines. Sample MS14-1 had a PAH profile different to those for the coal fines and, hence, the TPH and PAH contamination is probably due to petroleum hydrocarbons.

Above Ground Storage Tank

The samples collected adjacent to the Above Ground Storage Tanks were analysed for TPH, BTEX and PAH (for one sample location). All results were below the site assessment criteria.

Compressor House

The samples collected adjacent to the Compressor House were analysed for TPH, BTEX and PAH. All results were below the site assessment criteria.

Main Drift Conveyor Drive Housing

The samples collected adjacent to the Main Drift Conveyor Drive Housing were analysed for TPH, BTEX and PAH (for one sample location). All results were below the site assessment criteria.

Old Office and Bathhouse

The composite samples collected adjacent to the old office and bathhouse building were analysed for OCP, Lead and Arsenic, with the results being below assessment criteria.

Site Sediment Dams

Moonee Colliery has an extensive series of sedimentation dams with the majority being on the northeastern and eastern sides of the site. All of the dams that were sampled exceeded the TPH criterion, with Dam 27, the New Dam and Dam 9a also exceeding the total PAH criteria. Field observations describe all samples except for that from the outlet of Dam 27as containing coal fines.

Analysis of the PAH compound profiles suggests that the TPH concentrations found in all dams with the exception of Dam 7 are probably due to the presence of coal fines, as the PAH profiles are consistent with those of the coal fines. The profile for Dam 7 differed from those for the coal fines and, hence, the TPH and PAH in this dam is probably due to petroleum hydrocarbons.

EXCEEDANCES OF PHYTOTOXICITY CRITERIA

There were some exceedences of the phytotoxicity assessment criteria (PBIL). The NSW EPA points out in its assessment guidelines that "*Phytotoxicity criteria have significant limitations because the phytotoxicity depends upon soil and species parameters that are not fully understood. They are intended for use as a screening guide and may be assumed to apply to sandy loam soils, or soils of a closely similar texture*".

The areas that exceed the phytotoxicity criteria are not widespread and were typically in areas that were heavily disturbed (eg. sediments for the site sedimentation ponds) or that are likely to require remediation to allow revegetation to occur. The contamination concentrations are unlikely to have any impact on the revegetation of the site.

9 CONCLUSIONS

The Phase 1 Investigation performed at the Moonee Colliery identified various areas with the potential to be affected by contamination arising from past industrial practices. These areas include: substation, Bramble maintenance area and sump, stormwater sump and flammable goods storage area, vehicle maintenance building, above ground storage tank, compressor house, main drift conveyor drive housing, office and bathhouse buildings and site sedimentation dams.

The contaminants identified by this investigation were Total Petroleum Hydrocarbons and Polycyclic Aromatic Hydrocarbons. The extensive presence of coal waste across the Site makes clear assessment of the nature and source of this contamination difficult, as coal contains hydrocarbons and PAHs in a naturally occurring and immobilised form. The comparison of the relative profiles of these compounds in target samples and coal waste reference samples indicated that the majority of the detected compounds were associated with coal and hence do not warrant specific remediation. No significant heavy metal contamination was identified.

The majority of the areas where contamination was identified are covered by concrete hardstand. As such, the contaminants are generally isolated from human or environmental contact and have a reduced potential to leach or migrate. The need for remediation is determined largely by the proposed future land use and the form that land rehabilitation might take. However, in accordance with the Mine Closure Plan (HLA, 2003c), remediation is only required to enable the restoration of typical coastal vegetation. If this can be achieved by filling and vegetating over the concrete, the potential for disturbance of contaminated areas is minimised.

10 RECOMMENDATIONS

The following remediation actions are recommended in association with the implementation of the Mine Closure Plan:

- **Substation** – no action;
- **Bramble Maintenance Area and Sump** – no action unless hardstand is to be removed;
- **Stormwater Sump and Flammable Goods Storage Area** - excavate and treat hydrocarbon impacted soils in area of location MS8 (adjacent to the outlet to the stormwater sump);
- **Vehicle Maintenance Building** – no action unless hardstand is to be removed;
- **Above Ground Storage Tank** – no action;
- **Compressor House** – no action;
- **Main Drift Conveyor Housing** – no action;
- **Old Office and Bathhouse** – No action;
- **Site Sediment Dams** – where practical, the coal fines and sediments should be excavated and recovered, as with other coal wastes on the site. The traces of hydrocarbons present in some of the sediments will not constrain the recovery and use of the coal materials. The cleared dams will then continue to function as sediment traps during the rehabilitation of the site. If the dams cannot be excavated then it is recommended that the dams are filled in and revegetated.

The hydrocarbon-affected soil is most cost effectively treated by land farming within a bunded area on site. Treated soil can then be used to backfill the excavated areas or be incorporated into landscaping activities.

If the rehabilitation of the site involves the removal of concrete hardstands and result in exposure or excavation of identified contaminated areas, further screening investigations (eg. visual inspection, targeted sampling) should be undertaken at that time to confirm that there is no significant contamination present that could affect future development proposals.

11 REFERENCES

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Table 5 - Soil Sample Analytical Results

Sample Location					Substation	Brambles Maintenance Area and Sump						Stormwater Sump and Flammable Goods Storage Area					
Sample Number		NSW EPA (1998) Guidelines			comp (MS1, MS2, MS3, MS4)	MS5-1	MS5-2	MS5-3	MS6-1	MS6-2	MS6-3	MS7-1	MS7-2	MS8-1	MS8-3	MS9-1	MS9-2
Sample Depth (mbgs)		NSW EPA (1994)			0-0.1	0.1-0.2	0.2-0.3	1.5-1.6	0.2-0.3	0.3-0.4	1.5-1.6	0.1-0.2	0.4-0.5	0.1-0.2	0.5-0.6	0.5-0.6	1.0-1.1
Sample Type					Hand Auger	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket
Date Sampled			SIL_3	PBIL	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04
Heavy Metals	As	NC	200	20	-	11	3	<1	2	2	<1	3	1	-	-	-	-
	Cd	NC	40	3	-	1	<1	<1	<1	1	<1	<1	<1	-	-	-	-
	Cr (total)	NC	120,000*	400*	-	7	8	4	4	13	5	8	9	-	-	-	-
	Cu	NC	2000	100	-	13	8	20	<1	11	15	16	9	-	-	-	-
	Ni	NC	600	60	-	16	4	3	<1	5	3	11	2	-	-	-	-
	Pb	NC	600	600	-	8	4	10	1	5	40	7	5	-	-	-	-
	Zn	NC	14000	200	-	36	15	21	<1	20	39	55	19	-	-	-	-
	Hg (inorganic)	NC	30	1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
TPH	C_6 - C_9	65	NC	NC	-	<2	<2	9	<2	<2	<2	<2	<2	7	<2	<2	<2
	C_{10} - C_{14}	NC	NC	NC	-	<50	1410	641	<50	<50	109	<50	<50	161	<50	<50	<50
	C_{15} - C_{28}	NC	NC	NC	-	370	4990	3640	<100	<100	686	<100	<100	1270	177	<100	<100
	C_{29} - C_{36}	NC	NC	NC	-	177	182	899	<100	<100	291	<100	<100	784	139	<100	<100
	C_{10} - C_{36}	1000	NC	NC		547	**6582**	**5180**	-	-	**1086**	-	-	**2215**	316	-	-
BTEX	Benzene	1	1.0	NC	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Toluene	1.4	1.4	NC	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	3.1	3.1	NC	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Xylene	14	14.0	NC	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2
PAH	Total PAH	NC[1]	40	NC	-	0.6	35.2	**88.3**	ND	ND	18.5	ND	0.6	23.5	1.5	ND	ND
	B(a)P	NC[1]	2	NC	-	ND	ND	1.1	ND	ND	0.6	ND	ND	ND	ND	ND	ND
OCP	Aldrin + Dieldrin	NC	20**	NC	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chlordane	NC	100***	NC	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDT + DDD + DDE	NC	400****	NC	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor	NC	20	NC	-	-	-	-	-	-	-	-	-	-	-	-	-
VOC	Various Species	NCC	NCC	NCC	-	-	-	-	-	-	-	ND	ND	-	-	-	-
SVOC	Various Species	NCC	NCC	NCC	-	-	-	-	-	-	-	ND	ND	-	-	-	-
PCB	Total PCB	NC	20	NC	<0.1	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

All values mg/kg: milligrams per kilogram

[1] Heavy metal and PAH criteria referenced in this document were not listed as they apply only to sensitive land uses

[2] Criteria exist for individual pesticides but are not shown here because the results were all "not detected"

mbgs: metres below ground surface

<: analyte not detected above laboratory practical quantitation limit (PQL)

NC: No Individual Criterion Listed

NCC: No Combined Criterion Listed

* = trivalent chromium criterion (sensitive landuse criteria referenced due to lack of suitable SIL_3 criterion for Chromium III)

** : combined criteria for aldrin+dieldrin

*** : combined criteria for cis+trans chlordane

**** : combined criteria for DDT+DDD+DDE

- : sample not analysed

ND: No species detected aboveindividual limits of detection

RPD: Relative Percent Difference

Box: concentration above PBIL criterion

Bold: concentrations above SIL_3

Table 5 - Soil Sample Analytical Results

Sample Location					Vehicle Maintenance Building																	
Sample Number		NSW EPA (1994)	NSW EPA (1998) Guidelines		MS10-1	MS10-3	MS10-5	MS11-1	MS11-3	MS11-4	MS11-5	MS12-1	MS12-2	MS12-3	MS13-1	MS13-3	MS13-4	MS14-1	MS14-2	MS14-4	MS15-2	MS15-4	MS15-5
Sample Depth (mbgs)					0.1-0.2	0.4-0.5	1.0-1.1	0.1-0.2	0.4-0.5	1.0-1.1		0.2-0.3	0.3-0.4	0.6-0.7	0.2-0.3	1.7-1.8	2.0-2.1	0.1-0.2	0.2-0.3	1.0-1.1	0.4-0.5	0.7-0.8	1.2-1.3
Sample Type					Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket
Date Sampled			SIL_3	PBIL	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04
Heavy Metals	As	NC	200	20	9	2	2	10	2	2	2	5	1	2	7	<1	2	3	1	<1	2	<1	2
	Cd	NC	40	3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Cr (total)	NC	120,000*	400*	311	12	10	412	5	8	7	6	6	9	8	4	15	17	6	2	7	7	12
	Cu	NC	2000	100	7	13	4	9	2	12	4	11	2	3	14	8	<1	8	8	5	5	<1	<1
	Ni	NC	600	60	10	10	2	9	2	9	1	6	1	2	6	1	3	2	2	<1	1	<1	<1
	Pb	NC	600	600	33	6	3	56	3	5	3	4	2	3	5	17	2	3	5	26	5	2	3
	Zn	NC	14000	200	23	35	11	23	19	35	9	27	9	12	31	17	<1	27	25	370	17	<1	<1
	Hg (inorganic)	NC	30	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TPH	C_6 - C_9	65	NC	NC	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	3	<2	2	<2	<2	<2
	C_{10} - C_{14}	NC	NC	NC	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	1910	<50	266	119	<50	<50
	C_{15} - C_{28}	NC	NC	NC	<100	<100	<100	134	<100	<100	124	110	<100	<100	439	134	<100	3240	276	1670	742	<100	<100
	C_{29} - C_{36}	NC	NC	NC	<100	<100	<100	124	<100	<100	<100	<100	<100	<100	500	<100	<100	2580	143	646	317	<100	<100
	C_{10} - C_{36}	1000	NC	NC	-	-	-	258	-	-	124	110	-	-	939	134	--	**7730**	419	**2582**	**1178**	-	-
BTEX	Benzene	1	1.0	NC	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Toluene	1.4	1.4	NC	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	3.1	3.1	NC	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Xylene	14	14.0	NC	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
PAH	Total PAH	NC[1]	40	NC	ND	ND	ND	1	ND	ND	2.7	1.1	0.5	ND	ND	2.9	ND	22.7	5.8	**50.7**	26.1	ND	ND
	B(a)P	NC[1]	2	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	0.7	ND	ND
OCP	Aldrin + Dieldrin	NC	20**	NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chlordane	NC	100***	NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	DDT + DDD + DDE	NC	400****	NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heptachlor	NC	20	NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VOC	Various Species	NCC	NCC	NCC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SVOC	Various Species	NCC	NCC	NCC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB	Total PCB	NC	20	NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

All values mg/kg: milligrams per kilogram

[1] Heavy metal and PAH criteria referenced in this document were not listed as they

[2] Criteria exist for individual pesticides but are not shown here because the results v

mbgs: metres below ground surface

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NC: No Individual Criterion Listed

NCC: No Combined Criterion Listed

* = trivalent chromium criterion (sensitive landuse criteria referenced due to lack of s

** : combined criteria for aldrin+dieldrin

*** : combined criteria for cis+trans chlordane

**** : combined criteria for DDT+DDD+DDE

- : sample not analysed

ND: No species detected aboveindividual limits of detection

RPD: Relative Percent Difference

Box: concentration above PBIL criterion

Bold: concentrations above SIL_3

Table 5 - Soil Sample Analytical Results

Sample Location					Above Ground Storage Tank					Compressor House		Main Drift Conveyor Housing		Old Office and Bathhouse					
Sample Number		NSW EPA (1994)	NSW EPA (1998) Guidelines		MS16-1	MS16-2	MS16-3	MS17-1	MS17-2	MS18-5	MS19-1	MS20-2	MS20-3	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6
Sample Depth (mbgs)					0-0.1	0.1-0.2	0.3-0.4	0.1-0.2	0.2-0.3	0.4-0.5	0.1-0.2	0.1-0.2	0.2-0.3	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1
Sample Type					Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Exc. Bucket	Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger
Date Sampled			SIL_3	PBIL	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	30-03-04	7-05-04	7-05-04	7-05-04	7-05-04	7-05-04	7-05-04
Heavy Metals	As	NC	200	20	-	-	-	-	-	-	-	-	-	2	2	2	4	<1	3
	Cd	NC	40	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cr (total)	NC	120,000*	400*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cu	NC	2000	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ni	NC	600	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Pb	NC	600	600	-	-	-	-	-	-	-	-	-	9	11	6	388	44	98
	Zn	NC	14000	200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hg (inorganic)	NC	30	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH	C_6 - C_9	65	NC	NC	51	<2	<2	4	<2	<2	10	<2	<2	-	-	-	-	-	-
	C_{10} - C_{14}	NC	NC	NC	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	-	-	-	-	-
	C_{15} - C_{28}	NC	NC	NC	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	-	-	-	-	-
	C_{29} - C_{36}	NC	NC	NC	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	-	-	-	-	-
	C_{10} - C_{36}	1000	NC	NC	-	-	-	-	-	-	-	-	-						
BTEX	Benzene	1	1.0	NC	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	-	-	-
	Toluene	1.4	1.4	NC	0.6	<0.2	<0.2	0.4	<0.2	<0.2	0.6	<0.2	<0.2	-	-	-	-	-	-
	Ethylbenzene	3.1	3.1	NC	0.7	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	-	-	-
	Xylene	14	14.0	NC	8.7	<0.2	<0.2	2	0	<0.2	1	<0.2	<0.2	-	-	-	-	-	-
PAH	Total PAH	NC[1]	40	NC	12.3	-	-	-	-	16	2.3	-	ND	-	-	-	-	-	-
	B(a)P	NC[1]	2	NC	ND	-	-	-	-	ND	ND	-	ND	-	-	-	-	-	-
OCP	Aldrin + Dieldrin	NC	20**	NC	-	-	-	-	-	-	-	-	-	ND	ND	ND	0.08	ND	ND
	Chlordane	NC	100***	NC	-	-	-	-	-	-	-	-	-	ND	ND	0.6	0.37	ND	ND
	DDT + DDD + DDE	NC	400****	NC	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND
	Heptachlor	NC	20	NC	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND
VOC	Various Species	NCC	NCC	NCC	-	-	-	-	-	-	-	-	-	-	-				
SVOC	Various Species	NCC	NCC	NCC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB	Total PCB	NC	20	NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

All values mg/kg: milligrams per kilogram

[1] Heavy metal and PAH criteria referenced in this document were not listed as they

[2] Criteria exist for individual pesticides but are not shown here because the results v

mbgs: metres below ground surface

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*** : combined criteria for cis+trans chlordane

**** : combined criteria for DDT+DDD+DDE

- : sample not analysed

ND: No species detected aboveindividual limits of detection

RPD: Relative Percent Difference

Box: concentration above PBIL criterion

Bold: concentrations above SIL_3

Table 5 - Soil Sample Analytical Results

Sample Location					Dam 26		Cleanwater Dam		Dam 27		Dam 28		New Dam		Dam 9a		Dam 7	
Sample Number		NSW EPA (1998) Guidelines			MDam 1-1	MDam 1-2	MDam 2-1	MDam 2-2	MDam 3-1	MDam 3-2	MDam 4-1	MDam 4-2	MDam 5-1	MDam 5-2	MDam 9-1	MDam 9-2	MDam 14-1	MDam 14-2
Sample Depth (mbgs)		NSW EPA (1994)			0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1	0-0.1
Sample Type					Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger	Hand Auger
Date Sampled			SIL_3	PBIL	13-04-04	13-04-04	13-04-04	13-04-04	13-04-04	13-04-04	13-04-04	13-04-04	13-04-04	13-04-04	13-04-04	13-04-04	13-04-04	13-04-04
Heavy Metals	As	NC	200	20	5	3	2	2	8	6	3	2	4	4	3	3	3	4
	Cd	NC	40	3	<1	<1	<1	<1	6	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Cr (total)	NC	120,000*	400*	15	11	8	10	17	7	11	6	190	45	11	14	33	17
	Cu	NC	2000	100	24	15	10	17	72	19	31	10	102	26	13	14	75	71
	Ni	NC	600	60	6	6	4	4	4	10	3	4	2	8	6	7	14	13
	Pb	NC	600	600	24	19	10	18	597	13	17	17	14	27	21	24	35	34
	Zn	NC	14000	200	144	51	32	44	2420	608	20	36	122	215	521	319	484	366
	Hg (inorganic)	NC	30	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TPH	C_6 - C_9	65	NC	NC	19	13	7	10	22	<2	17	19	34	24	9	15	48	19
	C_{10} - C_{14}	NC	NC	NC	177	169	54	84	244	<50	81	115	70	200	200	299	65	71
	C_{15} - C_{28}	NC	NC	NC	1580	1440	588	1130	2430	<100	1040	1440	833	2360	1800	2510	761	549
	C_{29} - C_{36}	NC	NC	NC	950	835	363	860	1750	<100	619	916	820	2240	974	1450	1190	713
	C_{10} - C_{36}	1000	NC	NC	**2707**	**2444**	**1005**	**2074**	**4424**	--	**1740**	**2471**	**1723**	**4800**	**2974**	**4259**	**2016**	**1333**
BTEX	Benzene	1	1.0	NC	-	-	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2
	Toluene	1.4	1.4	NC	-	-	-	-	-	-	-	-	-	-	-	-	**3.3**	**1.6**
	Ethylbenzene	3.1	3.1	NC	-	-	-	-	-	-	-	-	-	-	-	-	0.3	<0.2
	Xylene	14	14.0	NC	-	-	-	-	-	-	-	-	-	-	-	-	2	0.6
PAH	Total PAH	NC[1]	40	NC	35.1	32	14.6	27.1	**50.6**	ND	23.7	37	19.3	**45**	**44**	39	25.8	13.4
	B(a)P	NC[1]	2	NC	0.8	0.8	<0.5	0.7	1	ND	0.6	0.8	<0.5	<0.5	1	1	0.6	<0.5
OCP	Aldrin + Dieldrin	NC	20**	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Chlordane	NC	100***	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DDT + DDD + DDE	NC	400****	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Heptachlor	NC	20	NC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
VOC	Various Species	NCC	NCC	NCC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SVOC	Various Species	NCC	NCC	NCC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB	Total PCB	NC	20	NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

All values mg/kg: milligrams per kilogram

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- : sample not analysed

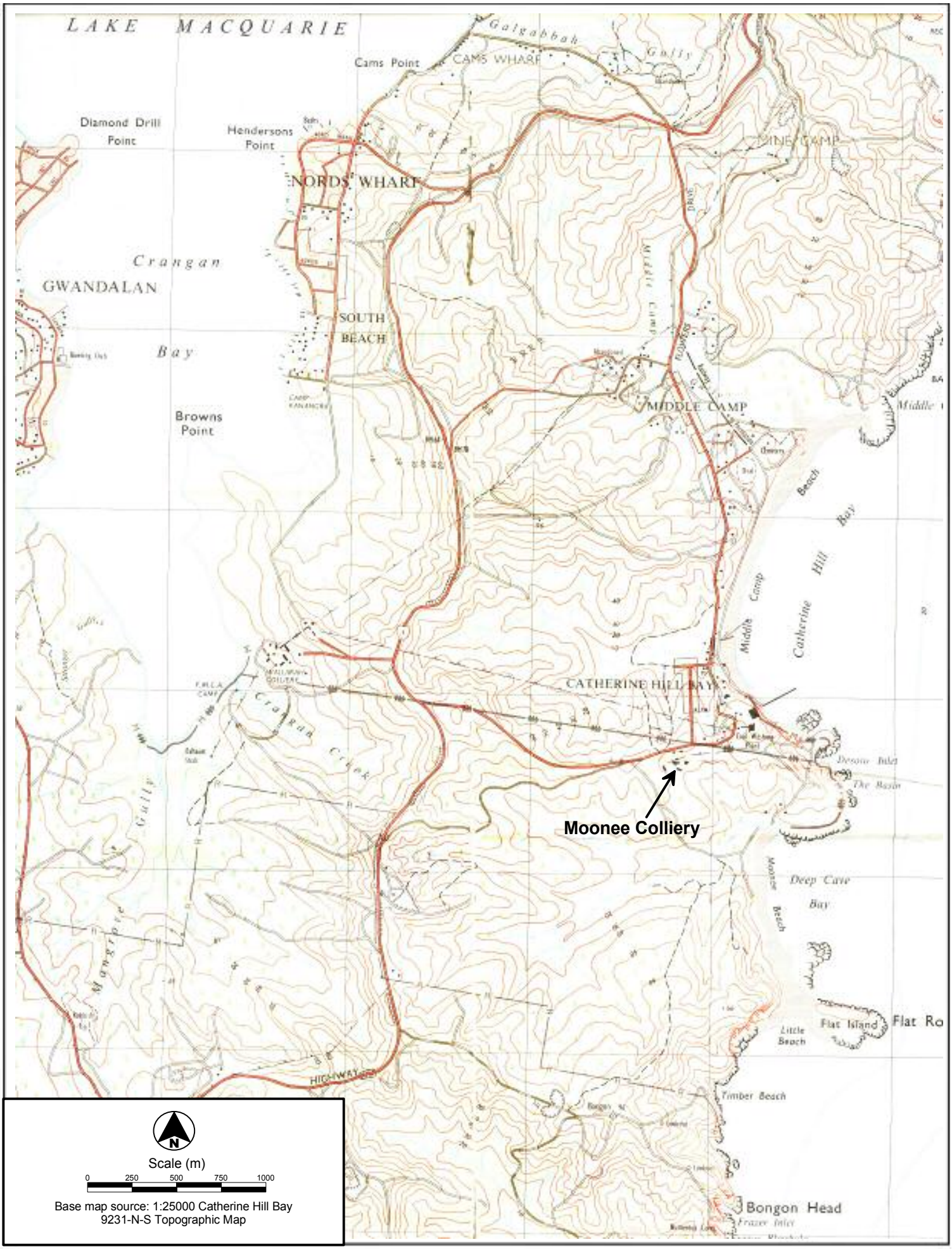
ND: No species detected aboveindividual limits of detection

RPD: Relative Percent Difference

Box: concentration above PBIL criterion

Bold: concentrations above SIL_3

Figures



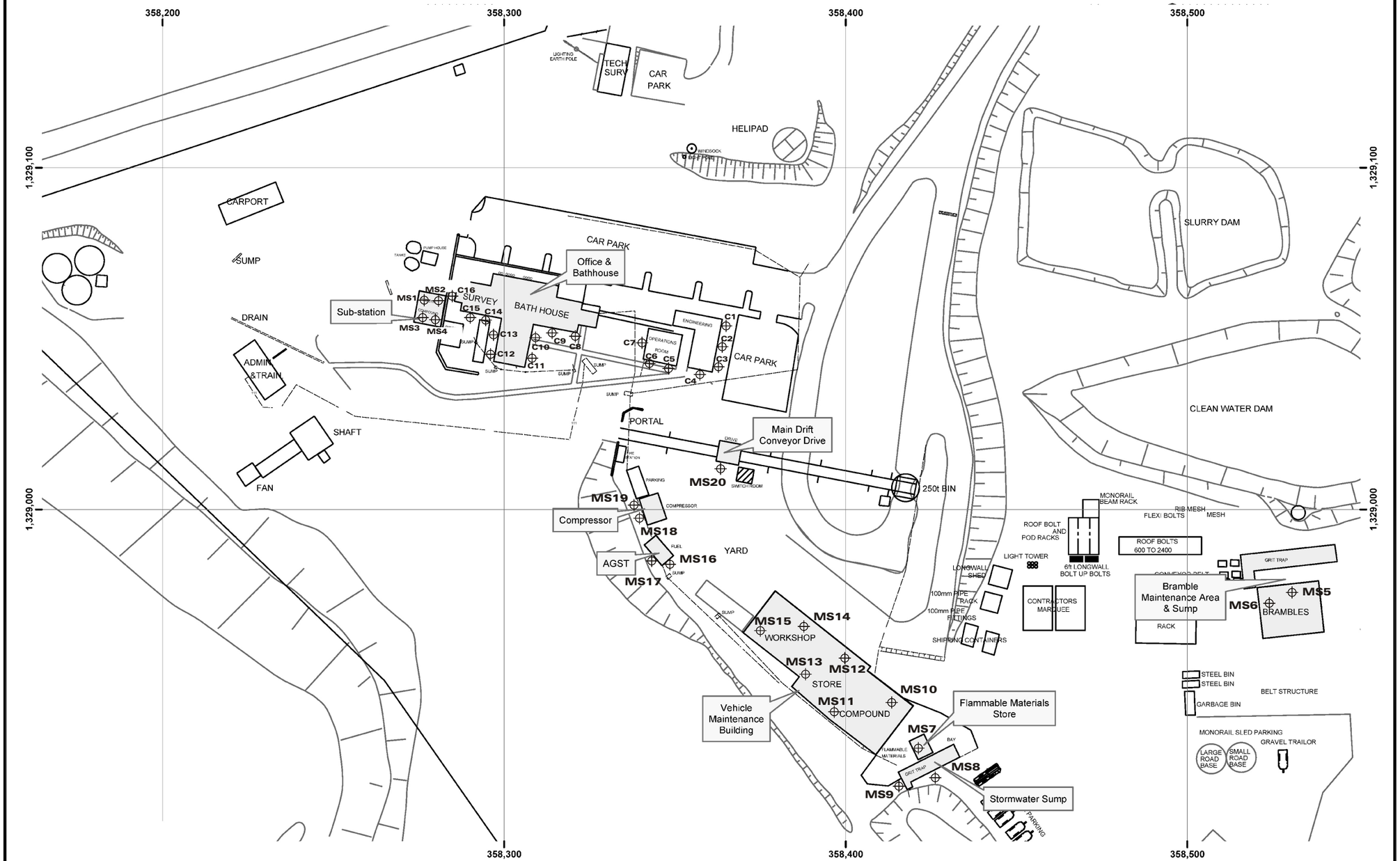
HLA

Locality Map
Environmental Site Assessment
Moonee Colliery
LakeCoal Pty Limited

FIGURE
1

PROJECT-FILE NAME N5014201 DATE 29/9/04 DRAWN DR APPROVED

A3



PROJECT-FILE NAME	**N5014201**
DATE	**September 2004**
DRAWN	**DR**
APPROVED	

LEGEND:

⌖ Sampling point

0 15 30 45 50
metres

N

SAMPLING LOCATION PLAN
MOONEE COLLIERY

HLA

FIGURE
2

PROJECT-FILE NAME	N5014201
DATE	Oct2004
DRAWN	amt
APPROVED	

SAMPLING LOCATION PLAN
Moonee Colliery Sediment Dams

HLA

FIGURE
3

Appendices

Appendix 1: Borelogs

HLA - Envirosciences
55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS10

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
			MS10-1	✳			Dark grey, black compacted gravel and chitter.	
			MS10-2				Coal Chitter.	0.2
			MS10-3	✳			Greenish grey course sand.	0.4
			MS10-4		0.5		Compacted coal chitter.	0.5
							Brown sandy clay, moderate plasticity.	0.6
			MS10-5	✳	1.0			
					1.5			
					2.0		Total Depth: 2.00 m	2.0

GENERAL LOG N1014201MO.GPJ HLA_SYD.GDT 10/8/04

HLA - Envirosciences
55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS11

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
			MS11-1	✳			Dark grey, black compacted gravel and chitter.	
			MS11-2					0.2
							Coal chitter	
			MS11-3	✳				0.4
							Orange medium grained sand.	0.5
					0.5		Greenish grey course sand.	0.6
							Brown sandy clay, moderate plasticity.	
			MS11-5	✳	1.0			
					1.5			
					2.0			
					2.5		Total Depth: 2.50 m	2.5

GENERAL LOG N1014201MO.GPJ HLA_SYD.GDT 10/8/04

HLA - Envirosciences
55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS12

PROJECT NUMBER N5014201 **DATE** 30/3/2004
PROJECT NAME Lake Coal **SURFACE ELEVATION**
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
							Concrete	0.2
			MS12-1	✳			Light brown, grey and brown sand, very moist.	0.3
			MS12-2	✳			Brown sandy clay.	
					0.5			0.6
			MS12-3	✳			Brown, red, grey and orange clay with some sand (brown and orange seams).	0.9
							Brown sandy clay with some seams of orange and grey coffe rock.	
			MS12-4		1.0			
					1.5			
					2.0			
					2.5		Total Depth: 2.50 m	2.5

GENERAL LOG N1014201MO.GPJ HLA_SYD.GDT 10/8/04

HLA - Envirosciences
55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS13

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
							Concrete	
			MS13-1	✳				0.2
							Grey and orange sand.	
			MS13-2					0.3
							Brown-dark grey sandy clay, very moist with slight hydrocarbon odours at 1.8m.	
					0.5			
					1.0			
					1.5			
			MS13-3	✳				
								1.8
							Orangy brown sandy clay, moist, no odour.	
			MS13-4	✳	2.0			
								2.3
							Total Depth: 2.30 m	

GENERAL LOG N1D14201MO.GPJ HLA_SYD.GDT 10/8/04

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55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS14

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
							Asphalt.	0.1
							Coarse gravel (to 30mm).	0.1
			MS14-1	✳			Dark grey sand some gravel, strong hydrocarbon odour.	
			MS14-2	✳				0.2
							Dark brown sandy clay, some orange and light brown seams, hydrocarbon odour in the top 100mm.	
			MS14-3		0.5			
								0.9
							Coal chitter.	
			MS14-4	✳	1.0			
					1.5			
								1.8
							Total Depth: 1.80 m	

GENERAL LOG N1014201MO.GPJ HLA_SYD.GDT 10/8/04

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Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS15

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
							Concrete	
			MS15-1				Brown beach sand.	0.2
			MS15-2	✳			Dark brown / black fine sand / silt, moderate plasticity, some coal chitter.	0.4
					0.5			
			MS15-3				Dark brown fine sand with some clay.	0.6
			MS15-4	✳			Light brown sandy clay (increasing clay content with depth).	0.7
					1.0			
			MS15-5	✳			Red, orange and mottled clay	1.2
					1.5			
					2.0		Total Depth: 2.00 m	2.0

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55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS16

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
			MS16-1	✳			Dark grey / black silt, some chitter, moderate hydrocarbon odour.	
			MS16-2	✳				0.1
							Brown moist sand, strong hydrocarbon odour.	
			MS16-3	✳				0.3
							Dark brown sandy clay, slight hydrocarbon in the top 300mm.	
					0.5			
					1.0			
			MS16-4		1.5			1.5
							Orange, white and red clayey sand, moist.	
					2.0			2.0
							Total Depth: 2.00 m	

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55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS17

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
			MS17-1	✳			Dark grey / black silt, some chitter, old hydrocarbon odour.	
			MS17-2	✳				0.2
							Brown sandy clay, slight hydrocarbon odour.	0.3
							Orange, white and red clayey sand, moist.	
			MS17-3		0.5			
					1.0			
					1.5			
					2.0		Total Depth: 2.00 m	2.0

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55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS18

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
			MS18-1				Black oil stained crust.	0.0
			MS18-2				Brown clayey sand with some gravel.	
			MS18-3				Dark brown claey sand with some gravel.	0.2
			MS18-4				Beach sand, slight hydrocarbon odour.	0.3
			MS18-5	✳			Black clayey sand, stong hydrocarbon odour.	0.4
			MS18-6		0.5		Brown sand with some clay, slight hydrocarbon odour.	0.5
							Orange, white and red clayey sand.	0.6
			MS18-7		1.0			
					1.5			
					2.0		Total Depth: 2.00 m	2.0

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55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS19

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
			MS19-1	✳			Coal chitter and some black silt.	
			MS19-2					0.4
							Grey clayey sand.	0.5
					0.5		White sand with some orange and brown seams. Also a pipe at 1.8mbgs.	
			MS19-3		1.0			
					1.5			
					2.0		Total Depth: 2.00 m	2.0

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55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS20

PROJECT NUMBER N5014201 **DATE** 30/3/2004
PROJECT NAME Lake Coal **SURFACE ELEVATION**
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
			MS20-1				Oil effected topsoil, heavily stained black.	0.1
			MS20-2	✳				
			MS20-3	✳				0.2
							Brown, red and orange clayey sand.	
			MS20-4					0.3
							Thin layer of coal fines.	0.4
							Orange and red (with some grey) sandy clay. Increasing clay content with depth.	
			MS20-5		0.5		Greenish grey course sand.	
					1.0			
					1.5			
					2.0			
					2.5		Total Depth: 2.50 m	2.5

GENERAL LOG N10142O1MO.GPJ HLA_SYD.GDT 10/8/04

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55-65 Grandview Street
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Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS5

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
							Concrete	0.2
			MS5-1	✳			Orange and brown coarse sand fill	0.3
			MS5-2	✳			Orangy brown gravelly clay (some sand) some black layering, slight hydrocarbon odour	0.4
							Coal chitter, slight hydrocarbon odour.	
					0.5			
					1.0			
			MS5-3	✳	1.5			
					2.0		Total Depth: 2.00 m	2.0

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55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS6

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
							Concrete	
			MS6-1	✳				
							Orange medium grained sand	0.2
			MS6-2	✳				
							Orangy brown gravelly clay.	0.3
					0.5			0.5
							Coal chitter.	0.6
							Orangy brown gravelly clay.	0.7
							Coal chitter.	
					1.0			
			MS6-3	✳	1.5			
					2.0		Total Depth: 2.00 m	2.0

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55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS7

PROJECT NUMBER N5014201 **DATE** 30/3/2004
PROJECT NAME Lake Coal **SURFACE ELEVATION**
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
			MS7-1	✳			Concrete	0.1
							Orangy brown gravelly clay (some sand).	
			MS7-2	✳				0.4
					0.5		Brown clay with some gravel, moderate plasticity.	
								0.7
							Coal chitter.	
					1.0			
					1.5			
			MS7-3		2.0			
					2.5			
					3.0		Total Depth: 3.00 m	3.0

GENERAL LOG N1014201MO.GPJ HLA_SYD.GDT 10/8/04

HLA - Envirosciences
55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS8

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
			MS8-1	✳			Brown sandy silt some humic material and some coal chitter.	
								0.2
			MS8-2				Fill on top of a buried pipe (400mm in diameter), orangy brown and red clay with some coal chitter.	
								0.4
			MS8-3	✳	0.5		Fill around and underneath pipe, orange and brown sands with some clays and coal chitter.	
								0.8
							Coal chitter.	
					1.0			
			MS8-4		1.5			
					2.0		Total Depth: 2.00 m	2.0

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55-65 Grandview Street
Pymble, NSW 2073
Telephone: 02 9988 4422
Fax: 02 9988 4441

BOREHOLE LOG MS9

PROJECT NUMBER N5014201
PROJECT NAME Lake Coal
LOCATION Moonee Colliery
DRILLING METHOD Excavator
SAMPLING METHOD Grab
LOGGED BY S.Everingham
STABILISED WATER LEVEL
GROUND WATER ELEVATION
COMMENTS

DATE 30/3/2004
SURFACE ELEVATION

PID (ppm)	BLOW COUNTS	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
							Topsoil, heavily vegetated (prior to excavation).	0.1
							White, brown and orange clayey sand, moderate plasticity, some coal chitter.	
			MS9-1	✳	0.5			
							slightly cemented fine grained brown sand.	0.9
			MS9-2	✳	1.0			
					1.5			
							Total Depth: 1.60 m	1.6

GENERAL LOG N1014201MO.GPJ HLA_SYD.GDT 10/8/04

Appendix 2: QA/QC Assessment

INTRODUCTION

The following sections describe components of the Sampling and Analysis Plan and the Quality Assurance and Control Plan for the Environmental Site Assessment conducted at the Moonee Colliery. This Appendix complements the measures described in the report. An evaluation of the conformance of the results of the investigation against predetermined data quality objectives (DQOs) is also included.

OBJECTIVES

SAMPLING OBJECTIVES

The objectives of the sampling program were to:

- Evaluate the levels of contamination around areas that were identified in the preliminary site assessment to be potentially contaminated;
- Establish acceptable reporting limits for all analytes so that appropriate recommendations can be made in regard to further investigation or remediation of the contamination; and
- Confirm that laboratory analytical procedures are in accordance with relevant guidelines.

The data collected during the investigation was to be used to:

- Evaluate the extent of soil contamination; and
- Make recommendations concerning the need for remediation due to identified contamination or requirements for further detailed investigation (if any).

FIELD DATA QUALITY OBJECTIVES

The following field methods and DQOs were defined for the investigation to achieve results of sufficient quality to be used in an assessment of the environmental condition of the investigation area:

Sample Collection, Handling and Preservation – Sampling activities were undertaken by an experienced Environmental Engineer to ensure that all samples collected were representative of the investigation area. Soil samples were collected using clean disposable latex gloves and/or decontaminated tools and placed in laboratory supplied, acid washed and solvent rinsed glass jars with screw top Teflon-lined lids. The jars were stored on ice in a chilled, insulated container until being received by the analysing laboratory. Sample numbers, depths, preservation and analytical requirements were recorded on Chain of Custody (COC) documentation, which was delivered to the analytical laboratory.

Field Duplicate Samples – Duplicate (intra-laboratory duplicate) soil samples were collected in the field at a rate of one in ten primary samples. The duplicate samples were obtained from similar soils of an identical depth and close proximity to the primary sample. Approximately equal portions of the primary sample were placed in the duplicate sample jars. Duplicated samples were labelled so as to conceal their relationship from the laboratory.

Duplicates are used to measure the precision of the sampling and analysis process (sampling, sample preparation and analysis). Significant variation in field duplicate results is often observed (particularly for solid matrix samples) due to sample heterogeneity.

The overall precision of field duplicates, laboratory split samples and laboratory duplicates is generally assessed by their Relative Percent Difference (RPD), given by:

$$RPD = \frac{|D1-D2|}{(D1+D2)/2} \times 100\%$$

where D1 is the primary sample measurement
D2 is the duplicate sample measurement

RPDs of field and laboratory duplicates have been compared to criteria detailed below in laboratory DQOs.

Decontamination – *The following decontamination procures were followed:*

- Latex gloves were worn during the collection of all soil samples. Following the collection of each sample the gloves were changed and a new set used for the following sample.

LABORATORY DATA QUALITY OBJECTIVES

LABORATORY METHODS, HOLDING TIMES AND QUANTITATION LIMITS

The following general laboratory DQOs applied:

- All sample analyses were conducted using National Association of Testing Authorities (NATA) registered methods;
- Maximum acceptable sample holding time is 14 days for organic analyses and 6 months for metal analyses (28 days for mercury);
- Samples to be appropriately preserved and handled.
- All practical quantitation limits (PQLs) must be less than the assessment criteria;

LABORATORY BLANKS

Laboratory or control blanks consist of reagents specific to each individual analytical method and are prepared and analysed by laboratories in the same manner as regular samples. The preparation and analysis of laboratory blanks enables the measurement of contamination within the laboratory. Laboratory blanks are typically analysed at a frequency of 1 in 20, with a minimum of one analysed per batch. Ideally, no contamination should be present in blanks, however in the event that contamination is detected, the following actions are taken:

- The organic test results are not to be corrected by subtracting any blank value;
- If an analyte is found in a blank but not a sample, no action is taken;
- No absolute results are reported unless the analyte concentration within a sample exceeds 10 times the amount in any blank for common contaminants (dichloromethane, acetone, phthalates, and 2-butanone), or five times the amount for any other analyte; and
- Professional judgement is used where little or no contamination is present in the associated blanks, but contamination is suspected in actual samples.

LABORATORY DUPLICATES

Laboratory duplicate samples are prepared in the laboratory by splitting a field sample and analysing it as two independent samples. The analysis of laboratory duplicate samples provides an indication of analytical precision and may be influenced by sample heterogeneity. Laboratory duplicates are typically analysed at a frequency of 1 in 10, with a minimum of one analysed per batch.

The RPDs will be determined and compared to the following criteria for acceptability. The acceptance criteria are based on both HLA's experience and the criteria listed in AS 4482.1 of 1997:

- Less than 50 percent for field duplicate samples;
- Less than 30 percent for laboratory duplicates where the detection is less than 10 times the PQL; and
- Less than 20 percent for laboratory duplicates where the detection is greater than 10 times the PQL.

In HLA's experience, since samples to be analysed for volatiles cannot be homogenised, the RPD results obtained for duplicate samples and repeat analyses will typically not provide an assessment of laboratory precision but rather an indication of homogeneity of the distribution of the analyte within the sample. Any exceedances of the above acceptable limits were professionally assessed in terms of the site and sample properties to determine the affect, if any on the overall usability or validity of the field sample data.

LABORATORY CONTROL SAMPLES

Laboratory control samples (LCS) or quality control check samples are prepared within the laboratory by spiking an aliquot of an appropriate clean matrix reagent with known concentrations of specific analytes. The check sample is then analysed and the results are used to assess the laboratory performance on sample preparation and analysis procedure. Certified reference material may also be used to assess analytical accuracy independent of the investigations.

Accuracy is assessed by calculation of percent recovery (PR):

$$PR = X / T \times 100\%$$

Where: X is the measured analyte concentration
T is the "true" value

To evaluate percent recovery, HLA use the quality control limits that the laboratories have calculated following the procedures required by the US EPA. Ideally, all calculated recovery values should be within acceptance limits, which for the case of metals consisted of historical analyte recoveries as experienced by the laboratory. However, in the event that control limit outliers are reported, professional judgement is used to assess the extent to which such results may affect the overall useability of the data. LCS are typically analysed at a frequency of 1 in 20, with a minimum of one analysed per analytical batch.

MATRIX SPIKES

Matrix spikes are samples prepared within the laboratory by dividing a field sample into two aliquots, then spiking each with identical concentrations of the analytes. The matrix spike and

matrix spike duplicate, are then analysed separately and the results compared to determine the effects of the sample matrix on the accuracy and precision of the analytes. Accuracy is assessed by the calculation of the percent recovery (PR) for matrix spikes:

$$PR = \frac{(SSR - SR)}{SA} \times 100\%$$

Where: SSR is the spiked sample result
SR is the sample result
SA is the spike added

Percent recoveries of matrix spikes were compared to an acceptable range of 70–130 %. Where this range was exceeded, reference to the laboratories internal DQO limits was made. In addition, percentage recoveries of surrogates were also compared to the USEPA surrogate recovery limits. Note that when the sample concentration is less than the instrument detection level, then a value of SR = 0 is recommended.

SURROGATES

Surrogates are compounds which are similar to the organic analytes of interest in chemical composition, extraction, and chromatography, but which are not normally found in field samples. Surrogates are generally spiked into all sample aliquots prior to preparation and analysis. Percent recoveries are calculated for each surrogate, providing an indication of analytical accuracy. US EPA methodology (SW–846) requires that surrogate testing be performed whenever analysing by Gas Chromatography or HPLC. In order to compare analytical accuracy, it is usually necessary to spike a range of surrogate compounds of different chemical properties into each sample aliquot.

USEPA Method 8000 provides that the laboratory may calculate its own surrogate recovery limit should the EPA not specify a limit. In the absence of specified PR criteria for individual surrogates or laboratory calculated control limit, the general acceptance criteria for quality control measurements employed were taken from USEPA guidelines which are summarised below:

< 10%	Unacceptable low recovery which may result in negative detections.
10% to 25%	Recoveries are sufficiently low that results provide only an estimate of analyte concentration.
25% to 130%	Acceptable recovery.
> 130%	Unacceptable high recovery which may result in false high detections.

Ideally, all calculated surrogate recovery values should be within acceptable limits. In the event that some recoveries lie outside the control limits, the USEPA guidance documents provide criteria for surrogate recovery results to assign a level of confidence in the results of actual sample analyses. USEPA protocols identify the need to test a minimum of three surrogates for each analytical group.

HLA generally compares percent recoveries of control spikes and matrix spikes to an acceptable range of 70–130 %. Where this range was exceeded, reference to the laboratories internal DQO limits was made and percentage recoveries of surrogates were then compared to the USEPA surrogate recovery limits.

CHEMICAL ANALYSIS

Individual laboratory methods utilised by the laboratories are listed below in **Table A2-1**.

Table A2-1
ALS Analysis Methods

Analyte	Matrix	Laboratory Method No.	Reference Method
TPH (C_6-C_9)	Soil	EP080/EP071	USEPA 5030/8260, USEPA 3510/8015
TPH (C_{10}-C_{36})	Soil	EP071	USEPA 3510/8015
BTEX	Soil	EP080	USEPA 5030/8260
As, Cd, Cr, Cu, Ni, Pb, Zn	Soil	EG-005T	USEPA 200.2 (mod), USEPA 6010
Hg	Soil	EG035T	USEPA 200.2 (mod), APHA 3112
Cr (VI)	Soil	EG050	APHA 3500 – Cr B
PAH (16 USEPA PAHs)	Soil	EP075B (SIM)	GC-MS (SIM)
PCB (total)	Soil	EP066	USEPA 3510/8270 GC/ECD/MS
OCP	Soil	EP068A	USEPA 3510/8270 GC/ECD/MS

DATA VALIDATION

QA/QC samples obtained and the analyses performed are provided in the analytical reports (Appendix 4). The overall assessment of the quality of the laboratory data produced is discussed below in terms of the data quality objectives.

The quality control samples collected are summarised in Table A2-2.

Table A2-2
List of QA/QC Samples Collected During Phase II ESA

Sample Type	Sample ID	Analysis Conducted	Laboratory	Comments
Field Duplicate	D003	TPH, BTEX, Heavy Metals, PAH	ALS	Field duplicate of MS14-1
Field Duplicate	D004	TPH, BTEX, PAH	ALS	Field duplicate of MS16-1

PRECISION

As part of HLA's QA/QC program, HLA collected field duplicate samples (approximately 10% of all samples were duplicates). The relative percentage differences (RPDs) between the primary and duplicate samples were calculated to evaluate the precision of analytical results and assess the homogeneity of soil and contaminant distribution at the site.

RPDs for positive results were generally less than 50%, except for the following samples shown in **Table A2-3** (this table also provides an assessment of the RPDs).

Table A2-3
RPD Assessment

Primary Sample ID	Duplicate Sample ID	Analyte	RPD	Elevated RPD possibly attributed to:
MS14-1	D003	Cd	140	Heterogeneity of the sampled material and analysis results close to the PQL
MS16-1	D004	Ethyl Benzene	80	Analysis results close to the PQL
MS16-1	D004	Xylene	88	Heterogeneity of the sampled material and analysis results close to the PQL

PQL Practical Quantitation Limit
RPD Relative percentage Difference

The exceedances of the DQOs (listed above) are likely to be attributed to the Heterogeneity of the sampled material and the results being low with respect to the laboratory PQL, and does not necessarily indicate poor analytical or sampling precision.

ACCURACY

Laboratory QA/QC results were included with the laboratory certificates in **Appendix 4**. The laboratory QA/QC results indicated:

- All method blank samples were reported at less than laboratory LORs;
- Laboratory LORs were less than the assessment criteria;
- Samples were extracted and analysed within acceptable holding times;
- Surrogate compound concentrations were similar to sample result concentrations;
- All percent recoveries of spikes and reference materials were reported within the DQOs; and
- Laboratory duplicate RPDs were within acceptable limits for all samples.

The laboratory QA/QC results indicated that the accuracy of the laboratory data is considered to be sufficient for the purposes of the investigation.

REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of parameter variations at sampling points or environmental conditions. Sample representativeness is controlled through selecting sampling locations that exemplify site conditions and obtaining suitable samples from these sites.

Samples were collected from natural soils at the site where possible and were analysed as described in this report. Samples were collected from a targeted sampling pattern designed to evaluate the potential areas of concern and contaminants of concern identified for the site. All of the samples were appropriately stored for analysis.

The overall assessment of field QA/QC data indicates that reported analytical results are considered to be acceptable and are representative of concentrations of the compounds at this site.

COMPARABILITY

Comparability expresses the confidence with which one data set can be compared with another. In order to assess comparability, field sampling procedures, laboratory sample preparation procedures, analytical procedures, and reporting units must be known and similar to established protocols, as was the case during this investigation and validation. Qualitatively, data subjected to strict QA/QC procedures will be deemed more reliable, and therefore more comparable, than other data.

An appropriately qualified Environmental Engineer conducted the sampling. Each analyte was analysed by the laboratories using USEPA and NATA approved methods for the analysis undertaken and laboratory PQLs were consistent over each laboratory batch. Analysis of a rinsate blank and blank has shown that the decontamination process was adequate. The data obtained throughout the investigation is considered to be suitably comparable.

COMPLETENESS

The completeness of data is defined as the percentage of analytical results that are considered valid. Valid chemical data are values that have been identified as acceptable or acceptable as qualified during the data validation process. The completeness is a comparison of the total number of samples accepted against the total number of samples, calculated as a percentage. The project goal for completeness is 90%. Completeness also includes checking that all entries in the database are correct, properly entered, and that any typographical errors in the database are corrected and the data re-entered properly. Completeness is defined as:

$$\text{Completeness} = \frac{\text{number of acceptable items}}{\text{total number of items}} \times 100$$

All samples collected and analysed complied with the predetermined DQOs, with the exception of the few (justified) deviations from the predetermined DQOs discussed in the above sections. Therefore, HLA considers that the data obtained is greater than 90% quantitative and complete, and meets the project goal for completeness.

CONCLUSION

Based on an assessment of field and laboratory QA/QC data, the reported analytical results are considered to be valid and representative of concentrations of the analysed compounds at the sample locations tested.

Appendix 3: PAH Profile Analysis

INTRODUCTION

Coal mines have the potential to be contaminated with total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAHs). The potential contamination is due to the extensive use of oils (primarily transmission oil) in mining equipment and also the use of diesel fuel to run the coal haulage trucks and equipment.

However, TPH and PAH are present naturally within coal and it is commonly accepted that the TPH and PAH are bound up within the matrix of the coal. Thus coal is not considered a major contaminant of concern. In this study the need arose to differentiate between TPH and PAH occurring naturally in coal (whether it be coal, coal fines or coal chitter) and that indicating oil and diesel contamination.

To assist in this, the percentages of the PAH compounds in the samples were compared to those in coal fines collected from a nearby LakeCoal stockpile. TPH was not used as an indicator compound for coal fines as TPH references a wide group of hydrocarbons and does not provide the accuracy that PAH speciation allows.

METHODOLOGY

Three samples of coal fines were collected from the Snake and Possum Gully emplacements where coal fines from the Moonee and Wallarah collieries have been stockpiled.

The percentages of the 16 USEPA PAH compounds shown below were calculated for each sample. The PAH compounds used were:

1. Napthalene
2. Acenaphthylene
3. Acenaphthene
4. Fluorene
5. Phenanthrene
6. Anthracene
7. Fluroanthene
8. Pyrene
9. Benzo (a) anthracene
10. Chrysene
11. Benzo (b) fluoranthene
12. Benzo (k) fluoranthene
13. Benzo (a) pyrene
14. Indeno (1.2.3.cd) pyrene
15. Dibenzo (a.h) anthracene
16. Benzo (g.h.I) perylene.

RESULTS

All samples that had either TPH or PAH concentrations that exceeded the assessment criteria were subjected to this comparison. The PAH compound profiles have been presented graphically and are shown in the following figures:

- **Figure A3-1**: PAH Profiles - Soil Samples; and
- **Figure A3-2**: PAH Profiles – Dam Samples.

DISCUSSION

The results of the analysis are as follows:

- Samples MS6-3, MS14-2, MS14-4, MS15-2, MS16-1 and MS18-5 profiles were similar to those for the coal fine samples and therefore the elevated TPH and PAH concentrations are probably due to the presence of the coal fines rather than petroleum hydrocarbon contamination;

- The profiles for samples MS5-2 and MS5-3 vary from those for the coal samples and therefore these two samples are probably contaminated with petroleum hydrocarbons;

- The profile for sample MS8-1 is variable and the comparison with those for the coal fines is inconclusive;

- The profile for sample MS14-1 differs from those of the coal fines samples and therefore the elevated TPH and PAH concentrations are probably due to petroleum hydrocarbon contamination,

- The profiles for samples from all sediment dams except Dam 7 are similar to those for the coal fines, suggesting the apparent contamination in these samples is due to the presence of the coal fines; and

- The profiles for the samples from Dam 7 (samples MDam14-1 and 14-2) differ sufficiently from those for the coal fine samples to suggest that the TPH and PAH concentrations in these samples are the result of petroleum hydrocarbon contamination.

CONCLUSION

The analysis of the PAH compound profiles has shown that there are similarities between the PAH profiles of soil samples and the coal samples in the majority of samples where elevated PAH concentrations were recorded. The samples whose profiles differ to those of the coal samples correspond to those identified in the field to contain either odorous hydrocarbons or which were collected from locations considered to have a high risk for contamination (adjacent to workshops, AGST etc).

Figure A3-1: PAH Profiles - Soil Samples

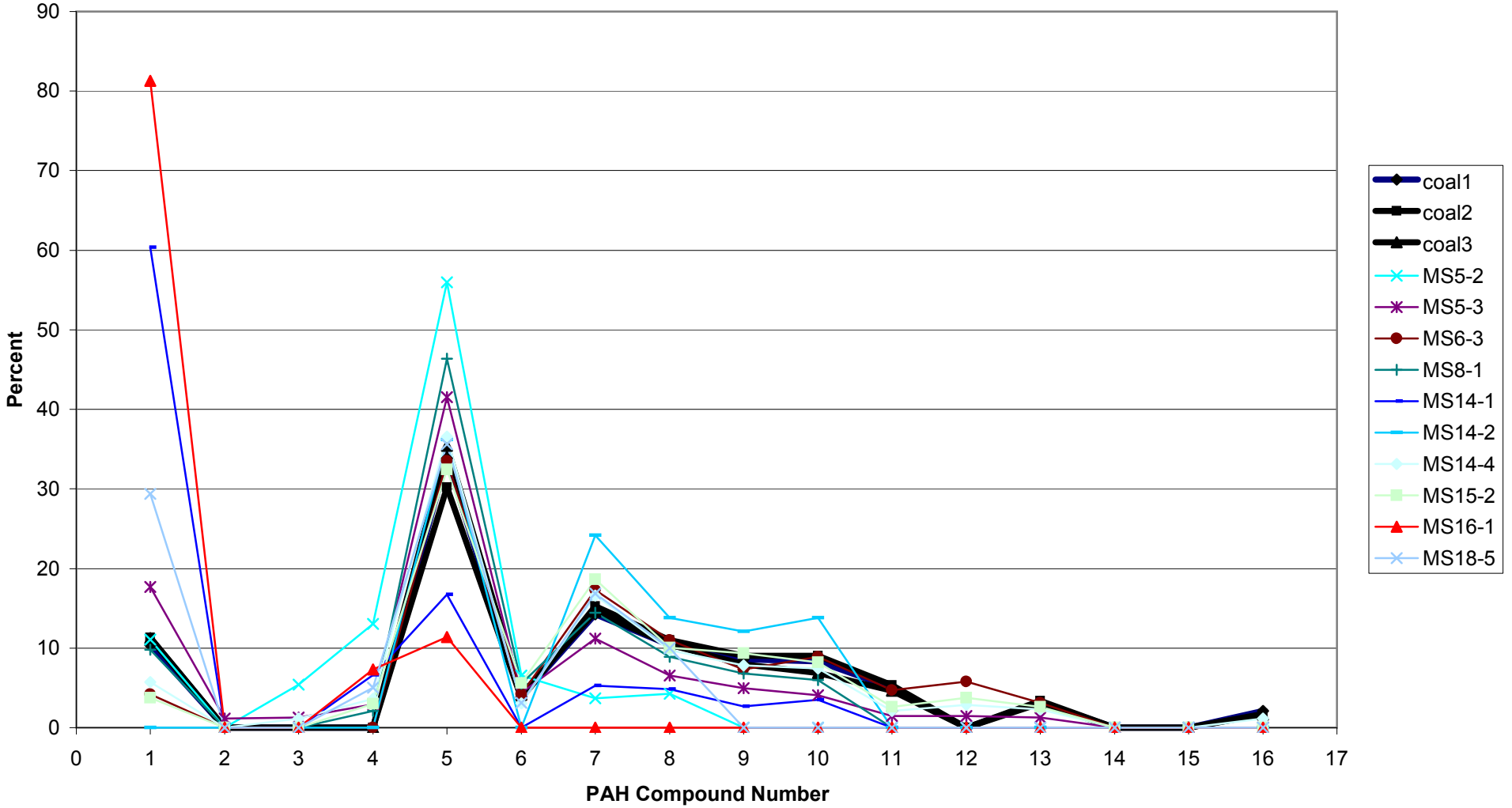
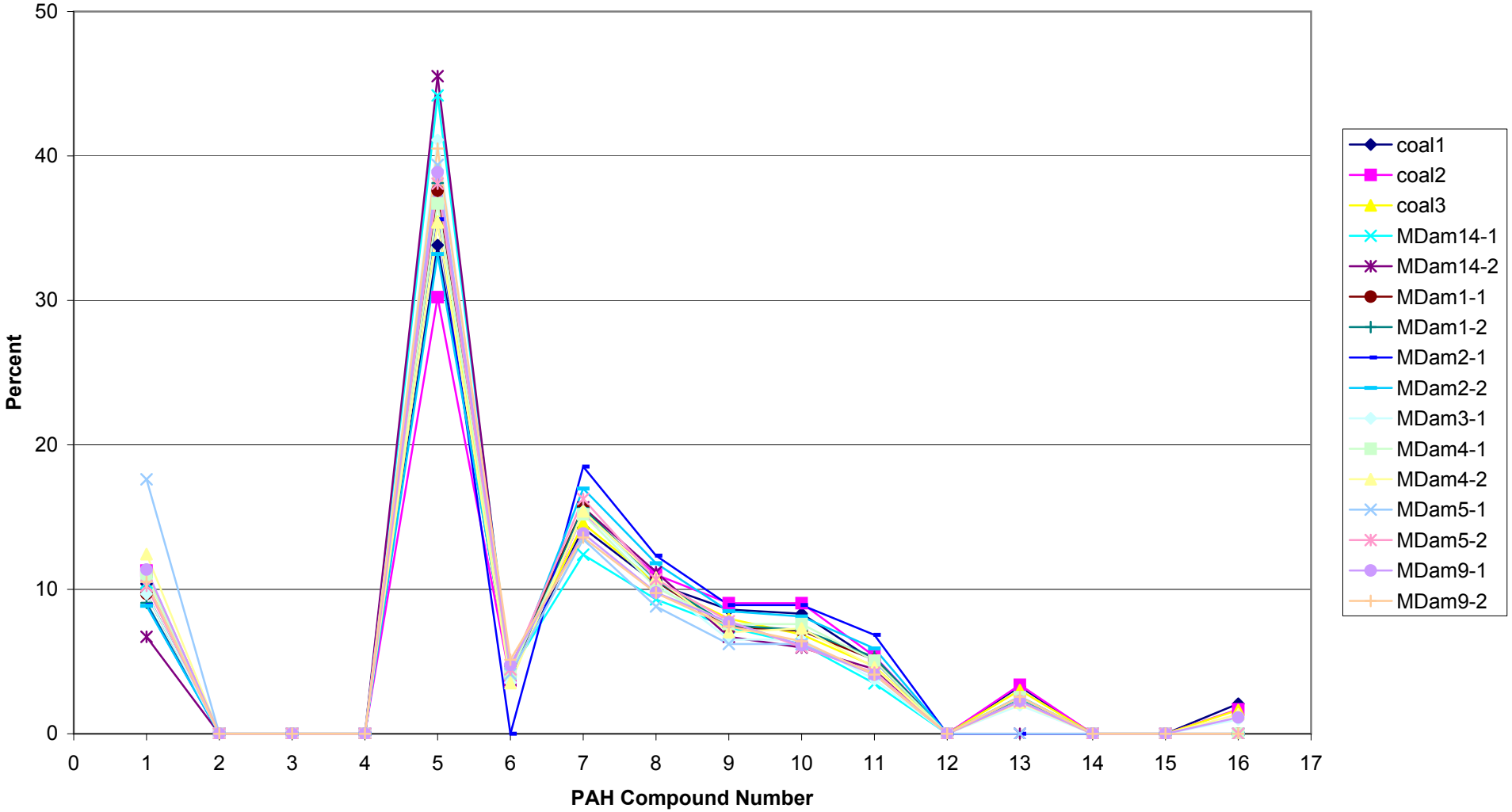


Figure A3-2: PAH Profiles - Dam Samples



Appendix 4: Laboratory Analysis Reports

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129431
PROJECT:	N5014201

Batch:	NE14162
Sub Batch:	0
LABORATORY:	NEWCASTLE
DATE RECEIVED:	07/05/2004
DATE COMPLETED:	19/05/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	15

COMMENTS

Samples as received digested by USEPA method 200.2 (modified) prior to the determination of metals. Results reported on a dry weight basis.

All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

Address
5 Rosegum Close
Warabrook NSW 2304
Australia

Phone: 61-2-4968 9433
Fax: 61-2-6363 1189
Email: ken.reid@alsenviro.com

Signatory

NATA Accredited Laboratory Number 825
Site:NEWCASTLE

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

Batch: NE14162
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5	6	7	8	9	10
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S1-1	S1-2	S1-3	S2-1	S2-2	S2-3	S3-1	S3-2	S3-3	S4-1
EA-055	Moisture Content (dried @ 103'C)	%	0.1	8.2	2.9	2.4	6.2	3.4	6.3	3.8	2.5	3.5	2.9
EG-005T	Arsenic - Total	mg/kg	1	8	<1	<1	7	<1	<1	1	<1	3	1
EG-005T	Cadmium - Total	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
EG-005T	Chromium - Total	mg/kg	1	7	<1	<1	9	<1	<1	4	<1	5	5
EG-005T	Copper - Total	mg/kg	1	18	<1	<1	17	<1	1	17	<1	8	13
EG-005T	Nickel - Total	mg/kg	1	5	<1	<1	6	<1	<1	6	<1	4	9
EG-005T	Lead - Total	mg/kg	1	7	5	<1	7	10	4	5	2	5	6
EG-005T	Zinc - Total	mg/kg	1	23	1	<1	30	3	10	31	2	39	35
EG-035T	Mercury - Total	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Batch: NE14162
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		11	12	13	14	15					
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S4-2	S5-1	S5-2	S5-3	S5-4					
EA-055	Moisture Content (dried @ 103'C)	%	0.1	5.2	4.3	3.7	2.7	2.9					
EG-005T	Arsenic - Total	mg/kg	1	2	<1	14	<1	<1					
EG-005T	Cadmium - Total	mg/kg	1	<1	<1	<1	<1	<1					
EG-005T	Chromium - Total	mg/kg	1	3	5	9	<1	<1					
EG-005T	Copper - Total	mg/kg	1	8	11	15	2	<1					
EG-005T	Nickel - Total	mg/kg	1	4	7	10	<1	<1					
EG-005T	Lead - Total	mg/kg	1	6	5	7	4	<1					
EG-005T	Zinc - Total	mg/kg	1	25	31	33	8	<1					
EG-035T	Mercury - Total	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1					

Batch: NE14162
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	1	11	200	201	202				
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004				
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S1-1 MS	S1-1 CHK	S4-2 CHK	METHOD BLANK	LCS	MS				
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	7.6	4.1	----	----	----				
EG-005T	Arsenic - Total	mg/kg	1	90.0%	7	2	<1	101%	90.0%				
EG-005T	Cadmium - Total	mg/kg	1	92.0%	<1	<1	<1	96.0%	92.0%				
EG-005T	Chromium - Total	mg/kg	1	92.0%	7	3	<1	97.0%	92.0%				
EG-005T	Copper - Total	mg/kg	1	94.0%	20	8	<1	91.0%	94.0%				
EG-005T	Nickel - Total	mg/kg	1	91.0%	5	3	<1	96.0%	91.0%				
EG-005T	Lead - Total	mg/kg	1	88.0%	8	5	<1	91.0%	88.0%				
EG-005T	Zinc - Total	mg/kg	1	87.0%	22	21	<1	90.0%	87.0%				
EG-035T	Mercury - Total	mg/kg	0.1	104%	<0.1	<0.1	<0.1	103%	104%				

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129431
PROJECT:	N5014201

Batch:	NE14162
Sub Batch:	1
LABORATORY:	NEWCASTLE
DATE RECEIVED:	07/05/2004
DATE COMPLETED:	19/05/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	6

COMMENTS

Analysis conducted on samples composited by ALS. Samples digested by USEPA method 200.2 (mod) prior to the determination of metals.
Results reported on a dry weight basis. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999).
Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

Address
5 Rosegum Close
Warabrook NSW 2304
Australia

Phone: 61-2-4968 9433
Fax: 61-2-6363 1189
Email: ken.reid@alsenviro.com

Signatory

NATA Accredited Laboratory Number 825
Site:NEWCASTLE

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

Batch: NE14162
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		16	17	18	19	20	21				
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004				
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	COMP1	COMP2	COMP3	COMP4	COMP5	COMP6				
EA-055	Moisture Content (dried @ 103'C)	%	0.1	1.9	4.6	6.6	4.1	3.2	4.6				
EG-005T	Arsenic - Total	mg/kg	1	2	2	2	4	<1	3				
EG-005T	Lead - Total	mg/kg	1	9	11	6	388	44	98				

Batch: NE14162
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		200	201	202	21	21					
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	LCS	MS	COMP6 MS	COMP6 CHK					
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	5.2					
EG-005T	Arsenic - Total	mg/kg	1	<1	101%	90.0%	99.0%	2					
EG-005T	Lead - Total	mg/kg	1	<1	91.0%	88.0%	100%	83					

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129431
PROJECT:	N5014201

Batch:	NE14162
Sub Batch:	2
LABORATORY:	NEWCASTLE
DATE RECEIVED:	07/05/2004
DATE COMPLETED:	19/05/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	6

COMMENTS

Samples analysed on an as received basis. Results reported on a dry weight basis. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999).

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

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Address
5 Rosegum Close
Warabrook NSW 2304
Australia

Phone: 61-2-4968 9433
Fax: 61-2-6363 1189
Email: ken.reid@alsenviro.com

Signatory

Batch: NE14162
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		16	17	18	19	20	21				
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004				
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	COMP1	COMP2	COMP3	COMP4	COMP5	COMP6				
EA-055	Moisture Content (dried @ 103'C)	%	0.1	1.9	4.6	6.6	4.1	3.2	4.6				
EP-068A-SS	**ORGANOCHLORINE PESTICIDES**												
EP-068A-SS	alpha-BHC	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	HCB	mg/kg	0.05	<0.05	0.60	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	beta-BHC & gamma-BHC	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				
EP-068A-SS	delta-BHC	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	Heptachlor	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	Aldrin	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	Heptachlor epoxide	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	Chlordane - trans	mg/kg	0.05	<0.05	<0.05	0.38	0.24	<0.05	<0.05				
EP-068A-SS	Endosulfan 1	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	Chlordane - cis	mg/kg	0.05	<0.05	<0.05	0.22	0.13	<0.05	<0.05				
EP-068A-SS	Dieldrin	mg/kg	0.05	<0.05	<0.05	<0.05	0.08	<0.05	<0.05				
EP-068A-SS	DDE	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	Endrin	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	Endosulfan 2	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	DDD	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	Endrin aldehyde	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	Endosulfan sulfate	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	DDT	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
EP-068A-SS	Endrin ketone	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				
EP-068A-SS	Methoxychlor	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
EP-068S-SS	**ORGANOCHLORINE PESTICIDE SURROGATE**												
EP-068S-SS	Dibromo-DDE	%	1	82	63	71	73	102	87				

Batch: NE14162
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		100	101	102	103	104					
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	NOCOPS1680 SCS	NOCOPS1680 DCS	NOCOPS1680 MS	NOCOPS1680 MSD					
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----					
EP-068A-SS	**ORGANOCHLORINE PESTICIDES**												
EP-068A-SS	alpha-BHC	mg/kg	0.05	<0.05	93.3%	106%	----	----					
EP-068A-SS	HCB	mg/kg	0.05	<0.05	111%	95.4%	----	----					
EP-068A-SS	beta-BHC & gamma-BHC	mg/kg	0.1	<0.1	88.2%	100%	86.8%	99.2%					
EP-068A-SS	delta-BHC	mg/kg	0.05	<0.05	88.2%	103%	----	----					
EP-068A-SS	Heptachlor	mg/kg	0.05	<0.05	85.1%	102%	94.5%	101%					
EP-068A-SS	Aldrin	mg/kg	0.05	<0.05	90.9%	97.6%	106%	102%					
EP-068A-SS	Heptachlor epoxide	mg/kg	0.05	<0.05	85.8%	100%	----	----					
EP-068A-SS	Chlordane - trans	mg/kg	0.05	<0.05	86.2%	98.2%	----	----					
EP-068A-SS	Endosulfan 1	mg/kg	0.05	<0.05	89.0%	107%	----	----					
EP-068A-SS	Chlordane - cis	mg/kg	0.05	<0.05	82.7%	98.2%	----	----					
EP-068A-SS	Dieldrin	mg/kg	0.05	<0.05	94.4%	109%	91.9%	104%					
EP-068A-SS	DDE	mg/kg	0.05	<0.05	90.0%	102%	----	----					
EP-068A-SS	Endrin	mg/kg	0.05	<0.05	86.0%	103%	94.4%	96.9%					
EP-068A-SS	Endosulfan 2	mg/kg	0.05	<0.05	89.5%	106%	----	----					
EP-068A-SS	DDD	mg/kg	0.05	<0.05	87.4%	105%	----	----					
EP-068A-SS	Endrin aldehyde	mg/kg	0.05	<0.05	81.6%	99.0%	----	----					
EP-068A-SS	Endosulfan sulfate	mg/kg	0.05	<0.05	84.8%	102%	----	----					
EP-068A-SS	DDT	mg/kg	0.2	<0.2	89.4%	108%	87.4%	102%					
EP-068A-SS	Endrin ketone	mg/kg	0.05	<0.05	89.1%	99.1%	----	----					
EP-068A-SS	Methoxychlor	mg/kg	0.2	<0.2	82.9%	99.7%	----	----					
EP-068S-SS	**ORGANOCHLORINE PESTICIDE SURROGATE**												
EP-068S-SS	Dibromo-DDE	%	1	100	83	86	108	118					

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129431
PROJECT:	N5014201

Batch:	NE14162
Sub Batch:	3
LABORATORY:	NEWCASTLE
DATE RECEIVED:	07/05/2004
DATE COMPLETED:	19/05/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	15

COMMENTS

Samples analysed on an as received basis. Results reported on a dry weight basis. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

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All pages of this report have been checked and approved for release.

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Signatory

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Batch: NE14162
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5	6	7	8	9	10
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S1-1	S1-2	S1-3	S2-1	S2-2	S2-3	S3-1	S3-2	S3-3	S4-1
EA-055	Moisture Content (dried @ 103'C)	%	0.1	8.2	2.9	2.4	6.2	3.4	6.3	3.8	2.5	3.5	2.9
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
EP-071-SS	C15 - C28 Fraction	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
EP-071-SS	C29 - C36 Fraction	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	81	85	83	81	81	84	81	85	82	84
EP-080S-SS	Toluene-D8	%	1	85	80	81	85	84	82	78	85	83	79
EP-080S-SS	4-Bromofluorobenzene	%	1	79	82	77	77	77	75	77	77	74	74

Batch: NE14162
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		11	12	13	14	15					
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S4-2	S5-1	S5-2	S5-3	S5-4					
EA-055	Moisture Content (dried @ 103'C)	%	0.1	5.2	4.3	3.7	2.7	2.9					
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	<2	<2	<2	<2	<2					
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	<50	<50	<50	<50					
EP-071-SS	C15 - C28 Fraction	mg/kg	100	<100	<100	<100	<100	<100					
EP-071-SS	C29 - C36 Fraction	mg/kg	100	<100	<100	<100	<100	<100					
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2					
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2					
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2					
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2					
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2					
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2					
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	83	80	85	87	87					
EP-080S-SS	Toluene-D8	%	1	81	80	84	85	85					
EP-080S-SS	4-Bromofluorobenzene	%	1	78	78	81	80	79					

Batch: NE14162
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		200	201	202	7	7	7	11			
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004			
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	NTPHT5039 SCS	NTPHT5039 DCS	S3-1 MS	S3-1 MSD	S3-1 CHK	S4-2 CHK			
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----	3.8	5.2			
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	<2	94.3%	95.1%	98.4%	102%	<2	<2			
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	92.9%	93.1%	91.4%	78.3%	<50	<50			
EP-071-SS	C15 - C28 Fraction	mg/kg	100	<100	97.9%	98.6%	91.9%	80.9%	<100	<100			
EP-071-SS	C29 - C36 Fraction	mg/kg	100	<100	101%	103%	116%	104%	<100	<100			
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	100%	94.7%	103%	98.5%	<0.2	<0.2			
EP-080-SS	Toluene	mg/kg	0.2	<0.2	100%	99.7%	93.8%	91.0%	<0.2	<0.2			
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	101%	96.6%	98.1%	97.8%	<0.2	<0.2			
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	102%	97.8%	99.0%	106%	<0.2	<0.2			
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	101%	94.9%	107%	105%	<0.2	<0.2			
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	104%	98.2%	98.3%	97.8%	<0.2	<0.2			
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	90	99	99	107	100	84	81			
EP-080S-SS	Toluene-D8	%	1	91	98	101	96	95	81	85			
EP-080S-SS	4-Bromofluorobenzene	%	1	91	99	99	100	95	75	75			

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129431
PROJECT:	N5014201

Batch:	NE14162
Sub Batch:	4
LABORATORY:	NEWCASTLE
DATE RECEIVED:	07/05/2004
DATE COMPLETED:	19/05/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	15

COMMENTS

Samples analysed on an as received basis. Results reported on a dry weight basis. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

Address
5 Rosegum Close
Warabrook NSW 2304
Australia

Phone: 61-2-4968 9433
Fax: 61-2-6363 1189
Email: ken.reid@alsenviro.com

Signatory

Batch: NE14162
Sub Batch: 4
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5	6	7	8	9	10
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S1-1	S1-2	S1-3	S2-1	S2-2	S2-3	S3-1	S3-2	S3-3	S4-1
EA-055	Moisture Content (dried @ 103'C)	%	0.1	8.2	2.9	2.4	6.2	3.4	6.3	3.8	2.5	3.5	2.9
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluorene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Phenanthrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5
EP-075B-SA	Anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Chrysene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	82	93	90	107	110	104	87	107	108	110
EP-075T-AS	Anthracene-d10	%	1	95	104	98	92	93	91	104	93	91	97
EP-075T-AS	4-Terphenyl-d14	%	1	147	106	110	94	92	90	95	89	89	93

Batch: NE14162
Sub Batch: 4
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		11	12	13	14	15					
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S4-2	S5-1	S5-2	S5-3	S5-4					
EA-055	Moisture Content (dried @ 103'C)	%	0.1	5.2	4.3	3.7	2.7	2.9					
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Fluorene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Phenanthrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Chrysene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5					
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	106	107	109	109	101					
EP-075T-AS	Anthracene-d10	%	1	89	91	96	96	98					
EP-075T-AS	4-Terphenyl-d14	%	1	85	88	89	91	95					

Batch: NE14162
Sub Batch: 4
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		7	8	8	8	100	101	102			
		Date Sampled		07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004	07/05/2004			
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S3-1 CHK	S3-2 MS	S3-2 MSD	S3-2 CHK	METHOD BLANK	NEP075S375 SCS	NEP075S375 DCS			
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	3.8	----	----	2.5	----	----	----			
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	93.3%	93.7%			
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	92.5%	90.3%			
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	96.7%	92.7%	<0.5	<0.5	93.7%	91.8%			
EP-075B-SA	Fluorene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	90.1%	88.1%			
EP-075B-SA	Phenanthrene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	80.3%	79.4%			
EP-075B-SA	Anthracene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	97.0%	93.3%			
EP-075B-SA	Fluoranthene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	93.4%	90.8%			
EP-075B-SA	Pyrene	mg/kg	0.5	<0.5	108%	112%	<0.5	<0.5	92.4%	90.1%			
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	92.2%	90.0%			
EP-075B-SA	Chrysene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	101%	99.1%			
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	85.4%	81.7%			
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	96.0%	93.2%			
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	92.9%	91.5%			
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	92.5%	90.3%			
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	91.7%	89.3%			
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	----	----	<0.5	<0.5	90.0%	87.6%			
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	104	102	110	105	77	81	76			
EP-075T-AS	Anthracene-d10	%	1	92	86	97	94	88	85	80			
EP-075T-AS	4-Terphenyl-d14	%	1	88	91	92	89	78	78	73			

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129530
PROJECT:	N5014201

Batch:	NE14078
Sub Batch:	0
LABORATORY:	NEWCASTLE
DATE RECEIVED:	03/05/2004
DATE COMPLETED:	14/05/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	6

COMMENTS

Samples as received digested by USEPA method 200.2 (modified) prior to the determination of metals. Results reported on a dry weight basis.

All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

Address
5 Rosegum Close
Warabrook NSW 2304
Australia

Phone: 61-2-4968 9433
Fax: 61-2-6363 1189
Email: ken.reid@alsenviro.com

Signatory

NATA Accredited Laboratory Number 825
Site:NEWCASTLE

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

Batch: NE14078
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		2	3	4	5	6	7				
		Date Sampled		27/04/2004	27/04/2004	27/04/2004	27/04/2004	27/04/2004	27/04/2004				
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	CS_DAMA-1	CS_DAMA-2	CS_DAMB-1	CS_DAMB-2	CS_DAMC-1	CS_DAMC-2				
EA-055	Moisture Content (dried @ 103'C)	%	0.1	20.6	24.6	9.6	28.1	3.3	13.1				
EG-005T	Arsenic - Total	mg/kg	1	3	2	3	3	2	3				
EG-005T	Cadmium - Total	mg/kg	1	<1	<1	<1	<1	<1	<1				
EG-005T	Chromium - Total	mg/kg	1	17	17	11	16	4	14				
EG-005T	Copper - Total	mg/kg	1	16	17	18	20	10	23				
EG-005T	Nickel - Total	mg/kg	1	4	4	5	6	2	7				
EG-005T	Lead - Total	mg/kg	1	22	22	15	17	9	24				
EG-005T	Zinc - Total	mg/kg	1	93	91	151	148	87	249				
EG-035T	Mercury - Total	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				

Batch: NE14078
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		200	201	202							
		Date Sampled		03/05/2004	03/05/2004	03/05/2004							
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	LCS	MS							
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----							
EG-005T	Arsenic - Total	mg/kg	1	<1	91.0%	97.0%							
EG-005T	Cadmium - Total	mg/kg	1	<1	95.0%	93.0%							
EG-005T	Chromium - Total	mg/kg	1	<1	100%	94.0%							
EG-005T	Copper - Total	mg/kg	1	<1	103%	100%							
EG-005T	Nickel - Total	mg/kg	1	<1	101%	93.0%							
EG-005T	Lead - Total	mg/kg	1	<1	96.0%	91.0%							
EG-005T	Zinc - Total	mg/kg	1	<1	95.0%	102%							
EG-035T	Mercury - Total	mg/kg	0.1	<0.1	96.0%	100%							

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129530
PROJECT:	N5014201

Batch:	NE14078
Sub Batch:	1
LABORATORY:	NEWCASTLE
DATE RECEIVED:	03/05/2004
DATE COMPLETED:	14/05/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	1

COMMENTS

Samples analysed on an as received basis. Results reported on a dry weight basis. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

Address
5 Rosegum Close
Warabrook NSW 2304
Australia

Phone: 61-2-4968 9433
Fax: 61-2-6363 1189
Email: ken.reid@alsenviro.com

Signatory

Batch: NE14078
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1									
		Date Sampled		27/04/2004									
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	COMP(CS5, CS7,CS8)									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	3.1									
EP-066-SS	Total Polychlorinated biphenyls	mg/kg	0.1	<0.1									
EP-066S-SS	**POLYCHLORINATED BIPHENYL SURROGATE**												
EP-066S-SS	Decachlorobiphenyl	%	1	75									

Batch: NE14078
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		100	101	102	103	104					
		Date Sampled		03/05/2004	03/05/2004	03/05/2004	03/05/2004	03/05/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	NPCBS779 SCS	NPCBS779 DCS	NPCBS779 MS	NPCBS779 MSD					
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----					
EP-066-SS	Total Polychlorinated biphenyls	mg/kg	0.1	<0.1	71.0%	69.0%	106%	108%					
EP-066S-SS	**POLYCHLORINATED BIPHENYL SURROGATE**												
EP-066S-SS	Decachlorobiphenyl	%	1	89	86	80	85	86					

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129530
PROJECT:	N5014201

Batch:	NE14078
Sub Batch:	2
LABORATORY:	NEWCASTLE
DATE RECEIVED:	03/05/2004
DATE COMPLETED:	14/05/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	3

COMMENTS

Samples analysed on an as received basis. Results reported on a dry weight basis. Samples required dilution prior to analysis due to matrix interferneces. LOR values have been adjusted accordingly. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Surrogates were diluted outside of the analytical range and were not determined. Anlaysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

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Address
5 Rosegum Close
Warabrook NSW 2304
Australia

Phone: 61-2-4968 9433
Fax: 61-2-6363 1189
Email: ken.reid@alsenviro.com

Signatory

Batch: NE14078
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		2	4	7							
		Date Sampled		27/04/2004	27/04/2004	27/04/2004							
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	CS_DAMA-1	CS_DAMB-1	CS_DAMC-2							
EA-055	Moisture Content (dried @ 103'C)	%	0.1	20.6	9.6	13.1							
EP-068A-SS	**ORGANOCHLORINE PESTICIDES**												
EP-068A-SS	alpha-BHC	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	HCB	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	beta-BHC & gamma-BHC	mg/kg	0.1	<0.8	<0.8	<0.8							
EP-068A-SS	delta-BHC	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Heptachlor	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Aldrin	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Heptachlor epoxide	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Chlordane - trans	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Endosulfan 1	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Chlordane - cis	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Dieldrin	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	DDE	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Endrin	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Endosulfan 2	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	DDD	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Endrin aldehyde	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Endosulfan sulfate	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	DDT	mg/kg	0.2	<1.6	<1.6	<1.6							
EP-068A-SS	Endrin ketone	mg/kg	0.05	<0.40	<0.40	<0.40							
EP-068A-SS	Methoxychlor	mg/kg	0.2	<1.6	<1.6	<1.6							
EP-068S-SS	**ORGANOCHLORINE PESTICIDE SURROGATE**												
EP-068S-SS	Dibromo-DDE	%	1	Not Det'd	Not Det'd	Not Det'd							

Batch: NE14078
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		100	101	102	103	104					
		Date Sampled		03/05/2004	03/05/2004	03/05/2004	03/05/2004	03/05/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	NOCOPS1671 SCS	NOCOPS1671 DCS	NOCOPS1671 MS	NOCOPS1671 MSD					
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----					
EP-068A-SS	**ORGANOCHLORINE PESTICIDES**												
EP-068A-SS	alpha-BHC	mg/kg	0.05	<0.05	82.9%	90.2%	----	----					
EP-068A-SS	HCB	mg/kg	0.05	<0.05	86.5%	81.2%	----	----					
EP-068A-SS	beta-BHC & gamma-BHC	mg/kg	0.1	<0.1	87.6%	80.2%	117%	107%					
EP-068A-SS	delta-BHC	mg/kg	0.05	<0.05	81.0%	88.4%	----	----					
EP-068A-SS	Heptachlor	mg/kg	0.05	<0.05	86.9%	84.3%	110%	92.0%					
EP-068A-SS	Aldrin	mg/kg	0.05	<0.05	89.4%	85.7%	107%	97.8%					
EP-068A-SS	Heptachlor epoxide	mg/kg	0.05	<0.05	88.1%	85.0%	----	----					
EP-068A-SS	Chlordane - trans	mg/kg	0.05	<0.05	88.2%	85.1%	----	----					
EP-068A-SS	Endosulfan 1	mg/kg	0.05	<0.05	88.3%	84.4%	----	----					
EP-068A-SS	Chlordane - cis	mg/kg	0.05	<0.05	89.4%	85.9%	----	----					
EP-068A-SS	Dieldrin	mg/kg	0.05	<0.05	87.8%	85.0%	97.8%	86.7%					
EP-068A-SS	DDE	mg/kg	0.05	<0.05	87.1%	83.3%	----	----					
EP-068A-SS	Endrin	mg/kg	0.05	<0.05	92.0%	89.9%	122%	109%					
EP-068A-SS	Endosulfan 2	mg/kg	0.05	<0.05	88.4%	89.0%	----	----					
EP-068A-SS	DDD	mg/kg	0.05	<0.05	88.2%	84.9%	----	----					
EP-068A-SS	Endrin aldehyde	mg/kg	0.05	<0.05	88.6%	83.9%	----	----					
EP-068A-SS	Endosulfan sulfate	mg/kg	0.05	<0.05	93.9%	92.0%	----	----					
EP-068A-SS	DDT	mg/kg	0.2	<0.2	88.4%	85.7%	82.7%	76.1%					
EP-068A-SS	Endrin ketone	mg/kg	0.05	<0.05	86.8%	82.8%	----	----					
EP-068A-SS	Methoxychlor	mg/kg	0.2	<0.2	97.3%	86.3%	----	----					
EP-068S-SS	**ORGANOCHLORINE PESTICIDE SURROGATE**												
EP-068S-SS	Dibromo-DDE	%	1	85	86	77	108	97					

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129530
PROJECT:	N5014201

Batch:	NE14078
Sub Batch:	3
LABORATORY:	NEWCASTLE
DATE RECEIVED:	03/05/2004
DATE COMPLETED:	14/05/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	6

COMMENTS

Samples analysed on an as received basis. Results reported on a dry weight basis. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

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All pages of this report have been checked and approved for release.

ISSUING LABORATORY: NEWCASTLE

Address
5 Rosegum Close
Warabrook NSW 2304
Australia

Phone: 61-2-4968 9433
Fax: 61-2-6363 1189
Email: ken.reid@alsenviro.com

Signatory

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

Batch: NE14078
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		2	3	4	5	6	7				
		Date Sampled		27/04/2004	27/04/2004	27/04/2004	27/04/2004	27/04/2004	27/04/2004				
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	CS_DAMA-1	CS_DAMA-2	CS_DAMB-1	CS_DAMB-2	CS_DAMC-1	CS_DAMC-2				
EA-055	Moisture Content (dried @ 103'C)	%	0.1	20.6	24.6	9.6	28.1	3.3	13.1				
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	26	33	23	17	9	27				
EP-071-SS	C10 - C14 Fraction	mg/kg	50	151	337	86	<50	<50	92				
EP-071-SS	C15 - C28 Fraction	mg/kg	100	2240	5040	1190	696	211	1410				
EP-071-SS	C29 - C36 Fraction	mg/kg	100	1240	2500	716	320	176	759				
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
EP-080-SS	Toluene	mg/kg	0.2	0.3	0.3	<0.2	<0.2	<0.2	<0.2				
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	0.9	0.9	<0.2	<0.2	<0.2	0.4				
EP-080-SS	ortho-Xylene	mg/kg	0.2	0.5	0.5	<0.2	<0.2	<0.2	0.3				
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	87	99	114	94	86	94				
EP-080S-SS	Toluene-D8	%	1	86	91	103	87	87	95				
EP-080S-SS	4-Bromofluorobenzene	%	1	89	108	103	109	86	111				

Batch: NE14078
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		200	201	202	4	4	4	6			
		Date Sampled		03/05/2004	03/05/2004	03/05/2004	27/04/2004	27/04/2004	27/04/2004	27/04/2004			
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	NTPHT4996 SCS	NTPHT4996 DCS	CS_DAMB-1 MS	CS_DAMB-1 MSD	CS_DAMB-1 CHK	CS_DAMC-1 CHK			
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----	9.6	3.3			
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	<2	97.8%	95.5%	101%	101%	23	7			
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	93.3%	96.6%	84.8%	92.7%	71	<50			
EP-071-SS	C15 - C28 Fraction	mg/kg	100	<100	85.7%	87.9%	84.7%	100%	946	<100			
EP-071-SS	C29 - C36 Fraction	mg/kg	100	<100	98.3%	96.4%	102%	134%	469	<100			
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	91.7%	97.3%	100%	103%	<0.2	<0.2			
EP-080-SS	Toluene	mg/kg	0.2	<0.2	93.7%	95.9%	101%	104%	<0.2	<0.2			
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	98.1%	99.4%	99.9%	98.5%	<0.2	<0.2			
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	93.7%	98.5%	102%	100%	<0.2	<0.2			
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	98.0%	95.5%	99.2%	98.1%	<0.2	<0.2			
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	98.9%	99.6%	99.6%	98.6%	<0.2	<0.2			
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	100	103	105	94	115	109	102			
EP-080S-SS	Toluene-D8	%	1	95	93	95	96	103	104	112			
EP-080S-SS	4-Bromofluorobenzene	%	1	91	97	101	109	102	105	107			

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129530
PROJECT:	N5014201

Batch:	NE14078
Sub Batch:	4
LABORATORY:	NEWCASTLE
DATE RECEIVED:	03/05/2004
DATE COMPLETED:	14/05/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	6

COMMENTS

Samples analysed on an as received basis. Results reported on a dry weight basis. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Analysis conducted by ALS Sydney, NATA Site No. 10911.

NOTES

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All pages of this report have been checked and approved for release.

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Australia

Phone: 61-2-4968 9433
Fax: 61-2-6363 1189
Email: ken.reid@alsenviro.com

Signatory

Batch: NE14078
Sub Batch: 4
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		2	3	4	5	6	7				
		Date Sampled		27/04/2004	27/04/2004	27/04/2004	27/04/2004	27/04/2004	27/04/2004				
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	CS_DAMA-1	CS_DAMA-2	CS_DAMB-1	CS_DAMB-2	CS_DAMC-1	CS_DAMC-2				
EA-055	Moisture Content (dried @ 103'C)	%	0.1	20.6	24.6	9.6	28.1	3.3	13.1				
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	4.5	4.1	1.4	1.0	<0.5	1.9				
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				
EP-075B-SA	Fluorene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				
EP-075B-SA	Phenanthrene	mg/kg	0.5	21.0	16.2	6.5	5.1	1.5	9.7				
EP-075B-SA	Anthracene	mg/kg	0.5	1.7	1.6	0.9	<0.5	<0.5	1.1				
EP-075B-SA	Fluoranthene	mg/kg	0.5	4.8	4.4	3.2	2.3	0.8	3.2				
EP-075B-SA	Pyrene	mg/kg	0.5	4.0	3.9	2.1	1.6	0.5	2.2				
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	2.8	2.7	1.5	1.4	<0.5	2.0				
EP-075B-SA	Chrysene	mg/kg	0.5	2.4	2.3	1.6	1.2	<0.5	1.8				
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	1.4	1.3	0.9	0.8	<0.5	1.2				
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	0.9	0.8	<0.5	<0.5	<0.5	0.6				
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	93	94	90	92	91	90				
EP-075T-AS	Anthracene-d10	%	1	78	81	79	88	87	62				
EP-075T-AS	4-Terphenyl-d14	%	1	92	92	91	96	93	90				

Batch: NE14078
Sub Batch: 4
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		100	101	102	103	104					
		Date Sampled		03/05/2004	03/05/2004	03/05/2004	03/05/2004	03/05/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	NEP075S350 SCS	NEP075S350 DCS	NEP075S350 MS	NEP075S350 MSD					
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----					
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	<0.5	98.4%	101%	----	----					
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	99.1%	98.8%	----	----					
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	96.5%	95.0%	89.7%	90.9%					
EP-075B-SA	Fluorene	mg/kg	0.5	<0.5	96.2%	97.3%	----	----					
EP-075B-SA	Phenanthrene	mg/kg	0.5	<0.5	98.5%	97.6%	----	----					
EP-075B-SA	Anthracene	mg/kg	0.5	<0.5	94.6%	98.6%	----	----					
EP-075B-SA	Fluoranthene	mg/kg	0.5	<0.5	96.3%	95.9%	----	----					
EP-075B-SA	Pyrene	mg/kg	0.5	<0.5	99.3%	99.6%	92.4%	94.2%					
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	<0.5	100%	94.7%	----	----					
EP-075B-SA	Chrysene	mg/kg	0.5	<0.5	97.3%	98.3%	----	----					
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	93.1%	91.9%	----	----					
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	98.2%	99.0%	----	----					
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	<0.5	91.9%	95.7%	----	----					
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	96.4%	95.6%	----	----					
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	98.3%	96.8%	----	----					
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	97.3%	100%	----	----					
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	105	101	101	90	88					
EP-075T-AS	Anthracene-d10	%	1	92	101	101	89	87					
EP-075T-AS	4-Terphenyl-d14	%	1	109	105	103	93	92					

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129401
PROJECT:	N5014201

Batch:	EM23205
Sub Batch:	0
LABORATORY:	MELBOURNE
DATE RECEIVED:	02/04/2004
DATE COMPLETED:	23/04/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	62

COMMENTS

Results apply to sample(s) as submitted. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Samples as received digested by USEPA method 200.2 (modified) prior to the determination of metals. Results reported on a dry weight basis.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: MELBOURNE

Address
Unit 6 / Adamco Business Park
2 Sarton Road
Clayton VIC 3168

Phone: 61-3-9538 4444
Fax: 61-3-9538 4400
Email: tim.kilmister@alsenviro.com

Signatory

Valda Chen
Senior Inorganic Chemist

Dr. Aaron Stott
Senior Organic Chemist

Phillip Hill
Senior Microbiologist

NATA Accredited Laboratory Number 825
Site:MELBOURNE

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

Batch: EM23205
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		10	11	12	13	14	15	16	17	18	19
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S13-1	S13-2	S14-1	S14-2	S14-3	S15-1	S15-2	S15-3	S16-1	S16-2
EA-055	Moisture Content (dried @ 103'C)	%	0.1	11.7	18.7	9.1	20.1	21.9	9.3	13.0	16.4	9.5	19.9
EG-005T	Arsenic - Total	mg/kg	1	<1	<1	1	<1	<1	<1	<1	<1	<1	3
EG-005T	Cadmium - Total	mg/kg	1	<1	<1	<1	<1	1	<1	<1	<1	<1	1
EG-005T	Chromium - Total	mg/kg	1	2	3	2	9	21	<1	6	5	2	10
EG-005T	Copper - Total	mg/kg	1	<1	<1	1	5	<1	<1	6	1	2	47
EG-005T	Nickel - Total	mg/kg	1	<1	<1	<1	3	2	<1	4	<1	<1	7
EG-005T	Lead - Total	mg/kg	1	3	3	<1	6	6	<1	5	3	2	16
EG-005T	Zinc - Total	mg/kg	1	8	<1	1	12	2	<1	12	1	33	81
EG-035T	Mercury - Total	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Batch: EM23205
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		20	21	22	23	24	25	26	27	28	29
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S16-3	S17-1	S17-3	S17-4	S18-1	S18-4	S18-5	S19-1	S19-5	S19-3
EA-055	Moisture Content (dried @ 103'C)	%	0.1	19.8	8.6	17.7	17.9	11.6	6.4	12.2	3.8	14.0	10.9
EG-005T	Arsenic - Total	mg/kg	1	<1	1	<1	<1	<1	<1	<1	1	<1	<1
EG-005T	Cadmium - Total	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
EG-005T	Chromium - Total	mg/kg	1	6	<1	2	6	<1	8	2	<1	2	6
EG-005T	Copper - Total	mg/kg	1	<1	<1	2	<1	<1	16	<1	<1	2	<1
EG-005T	Nickel - Total	mg/kg	1	1	<1	2	2	<1	14	1	<1	1	2
EG-005T	Lead - Total	mg/kg	1	2	<1	5	5	<1	7	5	<1	5	7
EG-005T	Zinc - Total	mg/kg	1	<1	3	4	2	3	42	1	4	5	2
EG-035T	Mercury - Total	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Batch: EM23205
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		34	35	36	37	38	39	40	41	42	43
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S22-1	S22-2	S23-1	S23-2	S23-3	S24-1	S24-3	S24-4	S25-1	S25-2
EA-055	Moisture Content (dried @ 103'C)	%	0.1	4.5	15.2	3.0	7.0	14.6	3.1	7.9	19.5	2.3	23.8
EG-005T	Arsenic - Total	mg/kg	1	17	<1	<1	<1	<1	2	<1	<1	<1	<1
EG-005T	Cadmium - Total	mg/kg	1	<1	<1	<1	<1	<1	2	<1	<1	<1	<1
EG-005T	Chromium - Total	mg/kg	1	5	1	5	5	2	239	3	4	3	12
EG-005T	Copper - Total	mg/kg	1	8	<1	4	12	<1	4	16	4	5	2
EG-005T	Nickel - Total	mg/kg	1	3	<1	5	11	<1	3	2	1	<1	2
EG-005T	Lead - Total	mg/kg	1	15	12	3	5	5	8	11	6	10	7
EG-005T	Zinc - Total	mg/kg	1	518	6	24	38	<1	24	66	9	27	8
EG-035T	Mercury - Total	mg/kg	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	<0.1	<0.1

Batch: EM23205
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		44	45	46	47	51	52	53	54	55	56
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S26-1	S26-2	S27-1	S27-2	MS5-1	MS5-2	MS5-3	MS6-1	MS6-2	MS6-3
EA-055	Moisture Content (dried @ 103'C)	%	0.1	6.9	18.3	4.4	10.4	6.0	8.6	10.2	9.6	16.7	6.4
EG-005T	Arsenic - Total	mg/kg	1	<1	<1	<1	<1	11	3	<1	2	2	<1
EG-005T	Cadmium - Total	mg/kg	1	<1	<1	<1	<1	1	<1	<1	<1	1	<1
EG-005T	Chromium - Total	mg/kg	1	1	4	1	4	7	8	4	4	13	5
EG-005T	Copper - Total	mg/kg	1	12	8	7	4	13	8	20	<1	11	15
EG-005T	Nickel - Total	mg/kg	1	1	1	<1	2	16	4	3	<1	5	3
EG-005T	Lead - Total	mg/kg	1	7	4	3	5	8	4	10	1	5	40
EG-005T	Zinc - Total	mg/kg	1	9	8	2	8	36	15	21	<1	20	39
EG-035T	Mercury - Total	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Batch: EM23205
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		57	58	63	64	65	66	67	68	69	70
		Date Sampled		30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS7-1	MS7-2	MS10-1	MS10-3	MS10-5	MS11-1	MS11-3	MS11-4	MS11-5	MS12-1
EA-055	Moisture Content (dried @ 103'C)	%	0.1	6.8	8.8	3.3	8.2	8.9	7.7	9.5	7.8	8.0	11.0
EG-005T	Arsenic - Total	mg/kg	1	3	1	9	2	2	10	2	2	2	5
EG-005T	Cadmium - Total	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
EG-005T	Chromium - Total	mg/kg	1	8	9	311	12	10	412	5	8	7	6
EG-005T	Copper - Total	mg/kg	1	16	9	7	13	4	9	2	12	4	11
EG-005T	Nickel - Total	mg/kg	1	11	2	10	10	2	9	2	9	1	6
EG-005T	Lead - Total	mg/kg	1	7	5	33	6	3	56	3	5	3	4
EG-005T	Zinc - Total	mg/kg	1	55	19	23	35	11	23	19	35	9	27
EG-035T	Mercury - Total	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Batch: EM23205
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		71	72	73	74	75	76	77	78	79	80
		Date Sampled		30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS12-2	MS12-3	MS13-1	MS13-3	MS13-4	MS14-1	MS14-2	MS14-4	MS15-2	MS15-4
EA-055	Moisture Content (dried @ 103'C)	%	0.1	9.6	9.7	7.2	13.6	12.1	9.1	10.7	7.4	11.1	10.8
EG-005T	Arsenic - Total	mg/kg	1	1	2	7	<1	2	3	1	<1	2	<1
EG-005T	Cadmium - Total	mg/kg	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
EG-005T	Chromium - Total	mg/kg	1	6	9	8	4	15	17	6	2	7	7
EG-005T	Copper - Total	mg/kg	1	2	3	14	8	<1	8	8	5	5	<1
EG-005T	Nickel - Total	mg/kg	1	1	2	6	1	3	2	2	<1	1	<1
EG-005T	Lead - Total	mg/kg	1	2	3	5	17	2	3	5	26	5	2
EG-005T	Zinc - Total	mg/kg	1	9	12	31	17	<1	27	25	370	17	<1
EG-035T	Mercury - Total	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Batch: EM23205
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		81	91								
		Date Sampled		30/03/2004	30/03/2004								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS15-5	D003								
EA-055	Moisture Content (dried @ 103'C)	%	0.1	10.6	8.1								
EG-005T	Arsenic - Total	mg/kg	1	2	<1								
EG-005T	Cadmium - Total	mg/kg	1	<1	<1								
EG-005T	Chromium - Total	mg/kg	1	12	3								
EG-005T	Copper - Total	mg/kg	1	<1	6								
EG-005T	Nickel - Total	mg/kg	1	<1	2								
EG-005T	Lead - Total	mg/kg	1	3	3								
EG-005T	Zinc - Total	mg/kg	1	<1	23								
EG-035T	Mercury - Total	mg/kg	0.1	<0.1	<0.1								

Batch: EM23205
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		10	11	20	21	40	41	51	70	71	80
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S13-1 CHK	S13-2 MS	S16-3 CHK	S17-1 MS	S24-3 CHK	S24-4 MS	MS5-1 MS	MS12-1 CHK	MS12-2 MS	MS15-4 CHK
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	12.3	----	18.7	----	7.9	----	----	11.2	----	10.1
EG-005T	Arsenic - Total	mg/kg	1	<1	104%	<1	110%	<1	87.0%	96.0%	5	96.0%	<1
EG-005T	Cadmium - Total	mg/kg	1	<1	109%	<1	107%	<1	101%	89.0%	<1	102%	<1
EG-005T	Chromium - Total	mg/kg	1	2	109%	6	107%	3	101%	89.0%	6	106%	7
EG-005T	Copper - Total	mg/kg	1	1	114%	<1	106%	16	100%	89.0%	10	106%	<1
EG-005T	Nickel - Total	mg/kg	1	<1	108%	1	105%	2	97.0%	84.0%	6	100%	<1
EG-005T	Lead - Total	mg/kg	1	<1	107%	2	103%	11	100%	86.0%	4	100%	1
EG-005T	Zinc - Total	mg/kg	1	8	109%	<1	105%	66	99.0%	86.0%	27	114%	<1
EG-035T	Mercury - Total	mg/kg	0.1	<0.1	91.0%	<0.1	90.0%	0.4	94.0%	101%	<0.1	85.0%	<0.1

Batch: EM23205
Sub Batch: 0
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		81	91	200	201	202	210	211	220	221	
		Date Sampled		30/03/2004	30/03/2004	02/04/2004	02/04/2004	02/04/2004	02/04/2004	02/04/2004	02/04/2004	02/04/2004	
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS15-5 MS	D003 MS	METHOD BLANK 1	LCS 1	MS 1	METHOD BLANK 2	LCS 2	METHOD BLANK 3	LCS 3	
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----	----	----	----	----	
EG-005T	Arsenic - Total	mg/kg	1	84.0%	112%	<1	99.0%	----	<1	103%	<1	100%	
EG-005T	Cadmium - Total	mg/kg	1	103%	101%	<1	112%	----	<1	112%	<1	89.0%	
EG-005T	Chromium - Total	mg/kg	1	96.0%	104%	<1	100%	----	<1	101%	<1	97.0%	
EG-005T	Copper - Total	mg/kg	1	104%	107%	<1	104%	----	<1	104%	<1	99.0%	
EG-005T	Nickel - Total	mg/kg	1	98.0%	99.0%	<1	99.0%	----	<1	100%	<1	98.0%	
EG-005T	Lead - Total	mg/kg	1	97.0%	97.0%	<1	101%	----	<1	102%	<1	98.0%	
EG-005T	Zinc - Total	mg/kg	1	102%	104%	<1	99.0%	----	<1	100%	<1	96.0%	
EG-035T	Mercury - Total	mg/kg	0.1	95.0%	110%	<0.1	100%	90.0%	<0.1	98.0%	<0.1	95.0%	

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129401
PROJECT:	N5014201

Batch:	EM23205
Sub Batch:	1
LABORATORY:	MELBOURNE
DATE RECEIVED:	02/04/2004
DATE COMPLETED:	23/04/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	87

COMMENTS

Results apply to sample(s) as submitted. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Samples analysed on an as received basis. Results reported on a dry weight basis. Sample #87(MS18_5) required dilution prior to analysis due to matrix interferences. LOR values have been adjusted accordingly.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: MELBOURNE

Address
Unit 6 / Adamco Business Park
2 Sarton Road
Clayton VIC 3168

Phone: 61-3-9538 4444
Fax: 61-3-9538 4400
Email: tim.kilmister@alsenviro.com

Signatory

Vaida Chen
Senior Inorganic Chemist

Dr. Aaron Stott
Senior Organic Chemist

Phillip Hill
Senior Microbiologist

NATA Accredited Laboratory Number 825
Site:MELBOURNE

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		2	3	4	5	6	7	8	9	10	11
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S5	S6	S7	S8	S9	S10	S11	S12	S13-1	S13-2
EA-055	Moisture Content (dried @ 103'C)	%	0.1	3.8	2.1	3.8	8.2	4.2	3.5	7.1	18.4	11.7	18.7
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	<0.5	0.9	<0.5	4.3	<0.5	1.9	0.5	0.6	<0.5	<0.5
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluorene	mg/kg	0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Phenanthrene	mg/kg	0.5	<0.5	2.7	<0.5	16.7	<0.5	8.3	1.9	1.8	<0.5	<0.5
EP-075B-SA	Anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	2.0	<0.5	1.2	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluoranthene	mg/kg	0.5	<0.5	1.3	<0.5	7.0	<0.5	4.1	1.2	1.0	<0.5	<0.5
EP-075B-SA	Pyrene	mg/kg	0.5	<0.5	0.8	<0.5	4.0	<0.5	2.3	0.7	0.6	<0.5	<0.5
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	<0.5	0.6	<0.5	3.1	<0.5	1.8	0.6	0.6	<0.5	<0.5
EP-075B-SA	Chrysene	mg/kg	0.5	<0.5	0.7	<0.5	2.8	<0.5	1.9	0.6	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	0.7	<0.5	0.6	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	0.8	<0.5	0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	112	111	108	100	108	102	105	119	115	116
EP-075T-AS	Anthracene-d10	%	1	92	85	96	70	93	77	84	93	102	100
EP-075T-AS	4-Terphenyl-d14	%	1	97	98	97	93	91	98	95	97	98	94

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		12	13	14	15	16	17	18	19	20	21
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S14-1	S14-2	S14-3	S15-1	S15-2	S15-3	S16-1	S16-2	S16-3	S17-1
EA-055	Moisture Content (dried @ 103'C)	%	0.1	9.1	20.1	21.9	9.3	13.0	16.4	9.5	19.9	19.8	8.6
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluorene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Phenanthrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Chrysene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	117	115	117	112	106	96	109	106	109	100
EP-075T-AS	Anthracene-d10	%	1	102	89	106	92	97	96	93	96	107	92
EP-075T-AS	4-Terphenyl-d14	%	1	97	110	105	90	91	90	91	92	97	83

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		22	23	24	25	26	27	28	29	34	35
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S17-3	S17-4	S18-1	S18-4	S18-5	S19-1	S19-5	S19-3	S22-1	S22-2
EA-055	Moisture Content (dried @ 103'C)	%	0.1	17.7	17.9	11.6	6.4	12.2	3.8	14.0	10.9	4.5	15.2
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluorene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Phenanthrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Chrysene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	102	103	102	103	93	107	98	98	92	105
EP-075T-AS	Anthracene-d10	%	1	96	94	90	99	90	94	84	91	89	106
EP-075T-AS	4-Terphenyl-d14	%	1	90	88	82	88	91	90	80	88	86	96

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		36	37	38	39	40	41	42	43	44	45
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S23-1	S23-2	S23-3	S24-1	S24-3	S24-4	S25-1	S25-2	S26-1	S26-2
EA-055	Moisture Content (dried @ 103'C)	%	0.1	3.0	7.0	14.6	3.1	7.9	19.5	2.3	23.8	6.9	18.3
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	1.0	<0.5	1.1	<0.5	0.9	<0.5
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluorene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Phenanthrene	mg/kg	0.5	<0.5	<0.5	<0.5	0.9	16.2	<0.5	14.6	<0.5	13.5	<0.5
EP-075B-SA	Anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	1.8	<0.5	1.3	<0.5	1.2	<0.5
EP-075B-SA	Fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	8.3	<0.5	5.5	<0.5	5.0	<0.5
EP-075B-SA	Pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	4.7	<0.5	2.8	<0.5	2.5	<0.5
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	3.7	<0.5	2.4	<0.5	2.1	<0.5
EP-075B-SA	Chrysene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	3.3	<0.5	2.2	<0.5	1.6	<0.5
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	0.7	<0.5	0.6	<0.5
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	1.0	<0.5	0.7	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	93	92	96	88	88	90	104	103	97	98
EP-075T-AS	Anthracene-d10	%	1	110	101	105	89	71	90	81	111	78	112
EP-075T-AS	4-Terphenyl-d14	%	1	97	84	101	92	82	107	100	107	95	110

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		46	47	51	52	53	54	55	56	57	58
		Date Sampled		29/03/2004	29/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S27-1	S27-2	MS5-1	MS5-2	MS5-3	MS6-1	MS6-2	MS6-3	MS7-1	MS7-2
EA-055	Moisture Content (dried @ 103'C)	%	0.1	4.4	10.4	6.0	8.6	10.2	9.6	16.7	6.4	6.8	6.2
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	2.9	2.7	<0.5	3.9	15.6	<0.5	<0.5	0.8	<0.5	<0.5
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	1.0	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	1.9	1.1	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluorene	mg/kg	0.5	0.9	0.8	<0.5	4.6	2.6	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Phenanthrene	mg/kg	0.5	17.1	14.3	0.6	19.7	36.7	<0.5	<0.5	6.4	<0.5	0.6
EP-075B-SA	Anthracene	mg/kg	0.5	1.4	1.3	<0.5	2.3	3.9	<0.5	<0.5	0.8	<0.5	<0.5
EP-075B-SA	Fluoranthene	mg/kg	0.5	5.8	5.4	<0.5	1.3	9.9	<0.5	<0.5	3.3	<0.5	<0.5
EP-075B-SA	Pyrene	mg/kg	0.5	3.1	2.9	<0.5	1.5	5.8	<0.5	<0.5	2.1	<0.5	<0.5
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	2.8	2.7	<0.5	<0.5	4.4	<0.5	<0.5	1.4	<0.5	<0.5
EP-075B-SA	Chrysene	mg/kg	0.5	2.2	2.1	<0.5	<0.5	3.6	<0.5	<0.5	1.7	<0.5	<0.5
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	0.7	0.9	<0.5	<0.5	1.3	<0.5	<0.5	0.9	<0.5	<0.5
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	0.7	0.7	<0.5	<0.5	1.3	<0.5	<0.5	1.1	<0.5	<0.5
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	0.6	0.6	<0.5	<0.5	1.1	<0.5	<0.5	0.6	<0.5	<0.5
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	100	88	80	101	119	105	106	98	102	99
EP-075T-AS	Anthracene-d10	%	1	83	74	83	93	85	103	109	82	114	97
EP-075T-AS	4-Terphenyl-d14	%	1	98	86	86	94	106	102	100	98	100	100

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		59	60	61	62	63	64	65	66	67	68
		Date Sampled		30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS8-1	MS8-3	MS9-1	MS9-2	MS10-1	MS10-3	MS10-5	MS11-1	MS11-3	MS11-4
EA-055	Moisture Content (dried @ 103'C)	%	0.1	10.0	6.2	3.3	8.2	8.9	7.7	9.5	7.8	8.0	11.0
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluorene	mg/kg	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Phenanthrene	mg/kg	0.5	10.9	1.0	<0.5	<0.5	<0.5	<0.5	<0.5	1.0	<0.5	<0.5
EP-075B-SA	Anthracene	mg/kg	0.5	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluoranthene	mg/kg	0.5	3.4	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Pyrene	mg/kg	0.5	2.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	1.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Chrysene	mg/kg	0.5	1.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	91	91	104	93	91	107	95	111	94	96
EP-075T-AS	Anthracene-d10	%	1	77	95	91	110	93	98	89	94	87	90
EP-075T-AS	4-Terphenyl-d14	%	1	89	96	90	101	96	92	95	101	97	107

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		69	70	71	72	73	74	75	76	77	78
		Date Sampled		30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS11-5	MS12-1	MS12-2	MS12-3	MS13-1	MS13-3	MS13-4	MS14-1	MS14-2	MS14-4
EA-055	Moisture Content (dried @ 103'C)	%	0.1	9.6	9.7	7.2	13.6	12.1	9.1	10.7	7.4	11.1	10.8
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	13.7	<0.5	3.0
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6
EP-075B-SA	Fluorene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.5	<0.5	1.9
EP-075B-SA	Phenanthrene	mg/kg	0.5	2.0	0.5	0.5	<0.5	<0.5	1.6	<0.5	3.8	2.1	19.2
EP-075B-SA	Anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.6
EP-075B-SA	Fluoranthene	mg/kg	0.5	0.7	0.6	<0.5	<0.5	<0.5	0.7	<0.5	1.2	1.4	8.7
EP-075B-SA	Pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	0.8	5.1
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.7	4.1
EP-075B-SA	Chrysene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	0.8	3.9
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.1
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.5
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	91	94	87	82	97	96	89	101	96	91
EP-075T-AS	Anthracene-d10	%	1	87	91	82	76	96	89	84	95	92	73
EP-075T-AS	4-Terphenyl-d14	%	1	98	103	92	89	104	96	104	109	103	89

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		79	80	81	82	87	88	90	91	93	94
		Date Sampled		30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	31/03/2004	31/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS15-2	MS15-4	MS15-5	MS16_1	MS18-5	MS19-1	MS20-3	D003	CS1-1	CS1-2
EA-055	Moisture Content (dried @ 103'C)	%	0.1	10.6	14.3	3.1	15.1	8.0	11.0	12.4	6.4	8.3	16.1
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	1.0	<0.5	<0.5	10.0	4.7	0.7	<0.5	13.3	<0.5	1.1
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	0.8	<0.5	<0.5
EP-075B-SA	Fluorene	mg/kg	0.5	0.8	<0.5	<0.5	0.9	0.8	<0.5	<0.5	1.9	<0.5	<0.5
EP-075B-SA	Phenanthrene	mg/kg	0.5	8.7	<0.5	<0.5	1.4	5.7	1.1	0.6	3.0	1.0	12.4
EP-075B-SA	Anthracene	mg/kg	0.5	1.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	1.5
EP-075B-SA	Fluoranthene	mg/kg	0.5	5.0	<0.5	<0.5	<0.5	2.7	0.5	<0.5	0.8	0.5	7.2
EP-075B-SA	Pyrene	mg/kg	0.5	2.7	<0.5	<0.5	<0.5	1.6	<0.5	<0.5	1.0	<0.5	4.0
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	2.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	2.9
EP-075B-SA	Chrysene	mg/kg	0.5	2.2	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	0.7	<0.5	2.8
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	0.7	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	0.9
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	1.0	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	0.9
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	0.7	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	0.7
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	101	94	98	98	121	98	96	113	105	94
EP-075T-AS	Anthracene-d10	%	1	87	85	91	98	101	86	94	108	95	74
EP-075T-AS	4-Terphenyl-d14	%	1	103	105	116	107	91	101	113	124	105	96

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		95	96	97	98	99	100	101			
		Date Sampled		31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004			
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	CS2-1	CS2-2	CS2-3	CS3-3	CS3-4	CS4-3	CS4-4			
EA-055	Moisture Content (dried @ 103'C)	%	0.1	10.8	7.6	11.2	13.3	12.6	13.3	12.6			
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	9.2	<0.5	1.9	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Acenaphthene	mg/kg	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Fluorene	mg/kg	0.5	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Phenanthrene	mg/kg	0.5	18.7	1.7	12.9	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Anthracene	mg/kg	0.5	2.0	<0.5	0.8	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Fluoranthene	mg/kg	0.5	7.6	0.9	5.7	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Pyrene	mg/kg	0.5	4.6	0.5	3.1	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	3.6	<0.5	2.6	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Chrysene	mg/kg	0.5	3.8	<0.5	2.3	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	2.3	<0.5	1.6	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	2.3	<0.5	1.6	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	1.1	<0.5	0.6	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	100	102	98	85	86	94	93			
EP-075T-AS	Anthracene-d10	%	1	83	105	85	84	83	87	106			
EP-075T-AS	4-Terphenyl-d14	%	1	113	121	113	87	87	89	112			

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		10	20	29	40	51	60	72	80	100	105
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	31/03/2004	31/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S13-1 29/3/04CHK	S16-3 29/3/04CHK	S19-3 29/3/04CHK	S24-3 29/3/04CHK	MS5-1 30/3/04CHK	MS8-3 30/3/04CHK	MS12-3 30/3/04CHK	MS15_4 30/3/04CHK	CS4_3 31/3/04CHK	METHOD BLANK 1
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	11.7	19.8	10.9	7.9	6.0	6.2	13.6	14.3	13.3	----
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluorene	mg/kg	0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Phenanthrene	mg/kg	0.5	<0.5	<0.5	<0.5	16.3	1.0	0.7	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	1.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	5.6	<0.5	0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	3.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	2.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Chrysene	mg/kg	0.5	<0.5	<0.5	<0.5	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	101	96	101	89	111	90	98	96	113	99
EP-075T-AS	Anthracene-d10	%	1	99	106	97	72	85	81	91	92	104	96
EP-075T-AS	4-Terphenyl-d14	%	1	93	99	100	86	97	90	114	113	111	111

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		106	107	108	109	110	111	112	113	114	115
		Date Sampled		31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	VEP075S096 SCS	VEP075S096 DCS	S5 29/3/04 MS	S5 29/3/04 MSD	METHOD BLANK 2	VEP075S097 SCS	VEP075S097 DCS	S17_3 29/3/04 MS	S17_3 29/3/04MSD	METHOD BLANK 3
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----	----	----	----	----	----
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	98.2%	104%	----	----	<0.5	87.5%	93.0%	----	----	<0.5
EP-075B-SA	Acenaphthylene	mg/kg	0.5	100%	107%	----	----	<0.5	88.6%	94.0%	----	----	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	101%	107%	102%	92.3%	<0.5	91.7%	95.6%	95.8%	104%	<0.5
EP-075B-SA	Fluorene	mg/kg	0.5	104%	106%	----	----	<0.5	93.5%	97.5%	----	----	<0.5
EP-075B-SA	Phenanthrene	mg/kg	0.5	96.6%	99.2%	----	----	<0.5	84.9%	89.1%	----	----	<0.5
EP-075B-SA	Anthracene	mg/kg	0.5	89.6%	92.0%	----	----	<0.5	78.7%	82.6%	----	----	<0.5
EP-075B-SA	Fluoranthene	mg/kg	0.5	99.6%	104%	----	----	<0.5	89.2%	95.4%	----	----	<0.5
EP-075B-SA	Pyrene	mg/kg	0.5	94.3%	97.1%	69.6%	63.6%	<0.5	84.9%	89.7%	61.5%	67.1%	<0.5
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	93.2%	87.8%	----	----	<0.5	83.5%	91.2%	----	----	<0.5
EP-075B-SA	Chrysene	mg/kg	0.5	99.9%	110%	----	----	<0.5	88.7%	94.2%	----	----	<0.5
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	87.3%	94.5%	----	----	<0.5	74.0%	82.5%	----	----	<0.5
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	112%	116%	----	----	<0.5	102%	102%	----	----	<0.5
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	99.8%	106%	----	----	<0.5	88.6%	93.3%	----	----	<0.5
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	96.9%	102%	----	----	<0.5	84.5%	90.8%	----	----	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	96.7%	101%	----	----	<0.5	84.1%	90.3%	----	----	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	97.1%	102%	----	----	<0.5	85.0%	89.5%	----	----	<0.5
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	109	112	107	107	94	95	101	110	108	93
EP-075T-AS	Anthracene-d10	%	1	103	101	103	91	109	90	93	95	94	108
EP-075T-AS	4-Terphenyl-d14	%	1	105	103	99	88	109	94	99	90	95	111

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		116	117	118	119	120	121	122	123	124	125
		Date Sampled		31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	VEP075S098 SCS	VEP075S098 DCS	S27-1 29/3/04 MS	S27-1 29/3/04MSD	METHOD BLANK 4	VEP075S099 SCS	VEP075S099 DCS	MS11-5 30/3/03 MS	MS11-5 30/3/03MSD	METHOD BLANK 5
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----	----	----	----	----	----
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	95.9%	107%	----	----	<0.5	93.0%	94.4%	----	----	<0.5
EP-075B-SA	Acenaphthylene	mg/kg	0.5	99.4%	110%	----	----	<0.5	97.9%	98.8%	----	----	<0.5
EP-075B-SA	Acenaphthene	mg/kg	0.5	96.9%	109%	86.3%	90.3%	<0.5	95.4%	95.6%	83.0%	83.2%	<0.5
EP-075B-SA	Fluorene	mg/kg	0.5	90.6%	102%	----	----	<0.5	89.2%	89.2%	----	----	<0.5
EP-075B-SA	Phenanthrene	mg/kg	0.5	94.3%	106%	----	----	<0.5	94.3%	94.0%	----	----	<0.5
EP-075B-SA	Anthracene	mg/kg	0.5	96.6%	107%	----	----	<0.5	96.8%	95.9%	----	----	<0.5
EP-075B-SA	Fluoranthene	mg/kg	0.5	93.0%	104%	----	----	<0.5	91.5%	91.3%	----	----	<0.5
EP-075B-SA	Pyrene	mg/kg	0.5	86.9%	97.3%	64.0%	53.2%	<0.5	86.3%	86.2%	43.5%	39.1%	<0.5
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	110%	116%	----	----	<0.5	104%	104%	----	----	<0.5
EP-075B-SA	Chrysene	mg/kg	0.5	99.0%	117%	----	----	<0.5	107%	107%	----	----	<0.5
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	84.2%	95.1%	----	----	<0.5	84.1%	82.3%	----	----	<0.5
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	88.9%	97.1%	----	----	<0.5	84.6%	86.5%	----	----	<0.5
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	88.3%	98.0%	----	----	<0.5	86.2%	85.9%	----	----	<0.5
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	96.5%	108%	----	----	<0.5	93.6%	94.3%	----	----	<0.5
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	97.2%	108%	----	----	<0.5	93.9%	94.7%	----	----	<0.5
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	93.3%	104%	----	----	<0.5	89.7%	91.1%	----	----	<0.5
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	102	110	107	110	108	98	97	90	93	104
EP-075T-AS	Anthracene-d10	%	1	97	104	64	85	81	94	92	81	78	108
EP-075T-AS	4-Terphenyl-d14	%	1	97	104	73	93	100	95	92	83	87	110

Batch: EM23205
Sub Batch: 1
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		126	127	128	129						
		Date Sampled		31/03/2004	31/03/2004	31/03/2004	31/03/2004						
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	VEP075S095 SCS	VEP075S095 DCS	VEP075S095 MS	VEP075S095 MSD						
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----						
EP-075B-SA	**POLYNUCLEAR AROMATIC HYDROCARBONS (SIM)**												
EP-075B-SA	Naphthalene	mg/kg	0.5	91.5%	89.1%	----	----						
EP-075B-SA	Acenaphthylene	mg/kg	0.5	95.6%	93.2%	----	----						
EP-075B-SA	Acenaphthene	mg/kg	0.5	92.7%	92.0%	104%	109%						
EP-075B-SA	Fluorene	mg/kg	0.5	95.7%	93.7%	----	----						
EP-075B-SA	Phenanthrene	mg/kg	0.5	93.0%	88.6%	----	----						
EP-075B-SA	Anthracene	mg/kg	0.5	96.1%	82.1%	----	----						
EP-075B-SA	Fluoranthene	mg/kg	0.5	93.5%	91.3%	----	----						
EP-075B-SA	Pyrene	mg/kg	0.5	87.7%	86.9%	80.2%	80.7%						
EP-075B-SA	Benzo(a)anthracene	mg/kg	0.5	85.8%	84.3%	----	----						
EP-075B-SA	Chrysene	mg/kg	0.5	90.6%	89.8%	----	----						
EP-075B-SA	Benzo(b)fluoranthene	mg/kg	0.5	80.4%	77.8%	----	----						
EP-075B-SA	Benzo(k)fluoranthene	mg/kg	0.5	104%	103%	----	----						
EP-075B-SA	Benzo(a)pyrene	mg/kg	0.5	92.5%	91.5%	----	----						
EP-075B-SA	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	90.3%	87.1%	----	----						
EP-075B-SA	Dibenzo(a.h)anthracene	mg/kg	0.5	89.5%	86.9%	----	----						
EP-075B-SA	Benzo(g.h.I)perylene	mg/kg	0.5	91.1%	88.1%	----	----						
EP-075T-AS	**PAH SURROGATES (SIM)**												
EP-075T-AS	2-Fluorobiphenyl	%	1	98	101	115	104						
EP-075T-AS	Anthracene-d10	%	1	91	92	102	107						
EP-075T-AS	4-Terphenyl-d14	%	1	90	94	111	114						

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129401
PROJECT:	N5014201

Batch:	EM23205
Sub Batch:	2
LABORATORY:	MELBOURNE
DATE RECEIVED:	02/04/2004
DATE COMPLETED:	23/04/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	2

COMMENTS

Results apply to sample(s) as submitted. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Samples analysed on an as received basis. Results reported on a dry weight basis.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: MELBOURNE

Address
Unit 6 / Adamco Business Park
2 Sarton Road
Clayton VIC 3168

Phone: 61-3-9538 4444
Fax: 61-3-9538 4400
Email: tim.kilmister@alsenviro.com

Signatory

Valda Chen
Senior Inorganic Chemist

Dr. Aaron Stott
Senior Organic Chemist

Phillip Hill
Senior Microbiologist

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

Batch: EM23205
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		57	58								
		Date Sampled		30/03/2004	30/03/2004								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS7-1	MS7-2								
EA-055	Moisture Content (dried @ 103'C)	%	0.1	6.8	8.8								
EP-075A-SS	**PHENOLS**												
EP-075A-SS	Phenol	mg/kg	0.5	<0.5	<0.5								
EP-075A-SS	2-Chlorophenol	mg/kg	0.5	<0.5	<0.5								
EP-075A-SS	2-Methylphenol	mg/kg	0.5	<0.5	<0.5								
EP-075A-SS	3- & 4-Methylphenol	mg/kg	0.5	<0.5	<0.5								
EP-075A-SS	2-Nitrophenol	mg/kg	0.5	<0.5	<0.5								
EP-075A-SS	2.4-Dimethylphenol	mg/kg	0.5	<0.5	<0.5								
EP-075A-SS	2.4-Dichlorophenol	mg/kg	0.5	<0.5	<0.5								
EP-075A-SS	2.6-Dichlorophenol	mg/kg	0.5	<0.5	<0.5								
EP-075A-SS	4-Chloro-3-methylphenol	mg/kg	0.5	<0.5	<0.5								
EP-075A-SS	2.4.6-Trichlorophenol	mg/kg	0.5	<0.5	<0.5								
EP-075A-SS	2.4.5-Trichlorophenol	mg/kg	0.5	<0.5	<0.5								
EP-075A-SS	Pentachlorophenol	mg/kg	1	<1	<1								
EP-075B-SS	**POLYNUCLEAR AROMATICS**												
EP-075B-SS	Naphthalene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	2-Methylnaphthalene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	2-Chloronaphthalene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Acenaphthylene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Acenaphthene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Fluorene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Phenanthrene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Anthracene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Fluoranthene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Pyrene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	N-2-Fluorenylacetamide	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Chrysene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Benzo(b) & (k)fluoranthene	mg/kg	1	<1	<1								
EP-075B-SS	7.12-Dimethylbenz(a)anthracene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	3-Methylcholanthrene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Indeno(1.2.3-cd)pyrene	mg/kg	0.5	<0.5	<0.5								
EP-075B-SS	Dibenz(a.h)anthracene	mg/kg	0.5	<0.5	<0.5								

Batch: EM23205
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		57	58								
		Date Sampled		30/03/2004	30/03/2004								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS7-1	MS7-2								
EP-075B-SS	Benzo(g.h.i)perylene	mg/kg	0.5	<0.5	<0.5								
EP-075C-SS	**PHTHALATE ESTERS**												
EP-075C-SS	Dimethyl phthalate	mg/kg	0.5	<0.5	<0.5								
EP-075C-SS	Diethyl phthalate	mg/kg	0.5	<0.5	<0.5								
EP-075C-SS	Di-n-butyl phthalate	mg/kg	0.5	<0.5	<0.5								
EP-075C-SS	Butyl benzyl phthalate	mg/kg	0.5	<0.5	<0.5								
EP-075C-SS	Bis(2-ethylhexyl) phthalate	mg/kg	5	<5	<5								
EP-075C-SS	Di-n-octylphthalate	mg/kg	0.5	<0.5	<0.5								
EP-075D-SS	**NITROSAMINES**												
EP-075D-SS	N-Nitrosomethylethylamine	mg/kg	0.5	<0.5	<0.5								
EP-075D-SS	N-Nitrosodiethylamine	mg/kg	0.5	<0.5	<0.5								
EP-075D-SS	N-Nitrosopyrrolidine	mg/kg	1	<1	<1								
EP-075D-SS	N-Nitrosomorpholine	mg/kg	0.5	<0.5	<0.5								
EP-075D-SS	N-Nitrosodi-n-propylamine	mg/kg	0.5	<0.5	<0.5								
EP-075D-SS	N-Nitrosopiperidine	mg/kg	0.5	<0.5	<0.5								
EP-075D-SS	N-Nitrosodibutylamine	mg/kg	0.5	<0.5	<0.5								
EP-075D-SS	N-Nitrosodiphenyl & Diphenylamine	mg/kg	1	<1	<1								
EP-075D-SS	Methapyrilene	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	**NITROAROMATICS AND CYCLIC KETONES**												
EP-075E-SS	2-Picoline	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	Acetophenone	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	Nitrobenzene	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	Isophorone	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	2.6-Dinitrotoluene	mg/kg	1	<1	<1								
EP-075E-SS	2.4-Dinitrotoluene	mg/kg	1	<1	<1								
EP-075E-SS	1-Naphthylamine	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	4-Nitroquinoline-N-oxide	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	5-Nitro-o-toluidine	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	Azobenzene	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	1.3.5-Trinitrobenzene	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	Phenacetin	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	4-Aminobiphenyl	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	Pentachloronitrobenzene	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	Pronamide	mg/kg	0.5	<0.5	<0.5								

Batch: EM23205
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		57	58								
		Date Sampled		30/03/2004	30/03/2004								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS7-1	MS7-2								
EP-075E-SS	Dimethylaminoazobenzene	mg/kg	0.5	<0.5	<0.5								
EP-075E-SS	Chlorobenzilate	mg/kg	0.5	<0.5	<0.5								
EP-075F-SS	**HALOETHERS**												
EP-075F-SS	Bis(2-chloroethyl) ether	mg/kg	0.5	<0.5	<0.5								
EP-075F-SS	Bis(2-chloroethoxy) methane	mg/kg	0.5	<0.5	<0.5								
EP-075F-SS	4-Chlorophenyl phenyl ether	mg/kg	0.5	<0.5	<0.5								
EP-075F-SS	4-Bromophenyl phenyl ether	mg/kg	0.5	<0.5	<0.5								
EP-075G-SS	**CHLORINATED HYDROCARBONS**												
EP-075G-SS	1.3-Dichlorobenzene	mg/kg	0.5	<0.5	<0.5								
EP-075G-SS	1.4-Dichlorobenzene	mg/kg	0.5	<0.5	<0.5								
EP-075G-SS	1.2-Dichlorobenzene	mg/kg	0.5	<0.5	<0.5								
EP-075G-SS	Hexachloroethane	mg/kg	0.5	<0.5	<0.5								
EP-075G-SS	1.2.4-Trichlorobenzene	mg/kg	0.5	<0.5	<0.5								
EP-075G-SS	Hexachloropropylene	mg/kg	0.5	<0.5	<0.5								
EP-075G-SS	Hexachlorobutadiene	mg/kg	0.5	<0.5	<0.5								
EP-075G-SS	Hexachlorocyclopentadiene	mg/kg	3	<3	<3								
EP-075G-SS	Pentachlorobenzene	mg/kg	0.5	<0.5	<0.5								
EP-075G-SS	Hexachlorobenzene	mg/kg	1	<1	<1								
EP-075H-SS	**ANILINES AND BENZIDINES**												
EP-075H-SS	Aniline	mg/kg	0.5	<0.5	<0.5								
EP-075H-SS	4-Chloroaniline	mg/kg	0.5	<0.5	<0.5								
EP-075H-SS	2-Nitroaniline	mg/kg	1	<1	<1								
EP-075H-SS	3-Nitroaniline	mg/kg	1	<1	<1								
EP-075H-SS	Dibenzofuran	mg/kg	0.5	<0.5	<0.5								
EP-075H-SS	4-Nitroaniline	mg/kg	0.5	<0.5	<0.5								
EP-075H-SS	Carbazole	mg/kg	0.5	<0.5	<0.5								
EP-075H-SS	3.3'-Dichlorobenzidine	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	**ORGANOCHLORINE PESTICIDES**												
EP-075I-SS	alpha-BHC	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	beta-BHC & gamma-BHC	mg/kg	1	<1	<1								
EP-075I-SS	delta-BHC	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	Heptachlor	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	Aldrin	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	Heptachlor epoxide	mg/kg	0.5	<0.5	<0.5								

Batch: EM23205
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		57	58								
		Date Sampled		30/03/2004	30/03/2004								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS7-1	MS7-2								
EP-075I-SS	Endosulfan 1	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	4.4'-DDE	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	Dieldrin	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	Endrin	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	Endosulfan 2	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	4.4'-DDD	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	Endosulfan sulfate	mg/kg	0.5	<0.5	<0.5								
EP-075I-SS	4.4'-DDT	mg/kg	1	<1	<1								
EP-075J-SS	**ORGANOPHOSPHORUS PESTICIDES**												
EP-075J-SS	Dichlorvos	mg/kg	0.5	<0.5	<0.5								
EP-075J-SS	Dimethoate	mg/kg	0.5	<0.5	<0.5								
EP-075J-SS	Diazinon	mg/kg	0.5	<0.5	<0.5								
EP-075J-SS	Chlorpyrifos methyl	mg/kg	0.5	<0.5	<0.5								
EP-075J-SS	Malathion	mg/kg	0.5	<0.5	<0.5								
EP-075J-SS	Fenthion	mg/kg	0.5	<0.5	<0.5								
EP-075J-SS	Chlorpyrifos	mg/kg	0.5	<0.5	<0.5								
EP-075J-SS	Pirimiphos ethyl	mg/kg	0.5	<0.5	<0.5								
EP-075J-SS	Chlorfenvinphos-E	mg/kg	0.5	<0.5	<0.5								
EP-075J-SS	Chlorfenvinphos-Z	mg/kg	0.5	<0.5	<0.5								
EP-075J-SS	Prothiofos	mg/kg	0.5	<0.5	<0.5								
EP-075J-SS	Ethion	mg/kg	0.5	<0.5	<0.5								
EP-075S-SS	**ACID EXTRACTABLE SURROGATES**												
EP-075S-SS	2-Fluorophenol	%	1	86	84								
EP-075S-SS	Phenol-D6	%	1	57	58								
EP-075S-SS	2-Chlorophenol-D4	%	1	63	65								
EP-075S-SS	2.4.6-Tribromophenol	%	1	53	76								
EP-075T-SS	**BASE/NEUTRAL EXTRACTABLE SURROGATES**												
EP-075T-SS	Nitrobenzene-D5	%	1	85	91								
EP-075T-SS	1.2-Dichlorobenzene-D4	%	1	73	74								
EP-075T-SS	2-Fluorobiphenyl	%	1	74	73								
EP-075T-SS	Anthracene-d10	%	1	77	80								
EP-075T-SS	p-Terphenyl-D14	%	1	113	118								

Batch: EM23205
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		58	100	101	102	103	104				
		Date Sampled		30/03/2004	02/04/2004	02/04/2004	02/04/2004	30/03/2004	30/03/2004				
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MW7/2 CHK	METHOD BLANK	VSVOCS753 SCS	VSVOCS753 DCS	MS7-1 MS	MS7-1 MSD				
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	8.8	----	----	----	----	----				
EP-075A-SS	**PHENOLS**												
EP-075A-SS	Phenol	mg/kg	0.5	<0.5	<0.5	89.1%	95.1%	73.6%	69.3%				
EP-075A-SS	2-Chlorophenol	mg/kg	0.5	<0.5	<0.5	86.2%	92.7%	76.6%	71.4%				
EP-075A-SS	2-Methylphenol	mg/kg	0.5	<0.5	<0.5	78.7%	84.0%	----	----				
EP-075A-SS	3- & 4-Methylphenol	mg/kg	0.5	<0.5	<0.5	84.0%	91.0%	----	----				
EP-075A-SS	2-Nitrophenol	mg/kg	0.5	<0.5	<0.5	85.2%	95.4%	114%	112%				
EP-075A-SS	2.4-Dimethylphenol	mg/kg	0.5	<0.5	<0.5	26.8%	23.2%	----	----				
EP-075A-SS	2.4-Dichlorophenol	mg/kg	0.5	<0.5	<0.5	83.2%	91.4%	----	----				
EP-075A-SS	2.6-Dichlorophenol	mg/kg	0.5	<0.5	<0.5	81.2%	88.3%	----	----				
EP-075A-SS	4-Chloro-3-methylphenol	mg/kg	0.5	<0.5	<0.5	85.4%	92.8%	91.1%	85.8%				
EP-075A-SS	2.4.6-Trichlorophenol	mg/kg	0.5	<0.5	<0.5	65.1%	69.4%	----	----				
EP-075A-SS	2.4.5-Trichlorophenol	mg/kg	0.5	<0.5	<0.5	77.2%	81.1%	----	----				
EP-075A-SS	Pentachlorophenol	mg/kg	1	<1	<1	33.3%	39.2%	111%	101%				
EP-075B-SS	**POLYNUCLEAR AROMATICS**												
EP-075B-SS	Naphthalene	mg/kg	0.5	<0.5	<0.5	88.4%	96.4%	----	----				
EP-075B-SS	2-Methylnaphthalene	mg/kg	0.5	<0.5	<0.5	89.9%	98.8%	----	----				
EP-075B-SS	2-Chloronaphthalene	mg/kg	0.5	<0.5	<0.5	87.9%	95.0%	----	----				
EP-075B-SS	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	85.7%	92.7%	----	----				
EP-075B-SS	Acenaphthene	mg/kg	0.5	<0.5	<0.5	89.9%	96.0%	90.5%	88.1%				
EP-075B-SS	Fluorene	mg/kg	0.5	<0.5	<0.5	88.4%	94.8%	----	----				
EP-075B-SS	Phenanthrene	mg/kg	0.5	<0.5	<0.5	87.5%	95.9%	----	----				
EP-075B-SS	Anthracene	mg/kg	0.5	<0.5	<0.5	86.2%	93.8%	----	----				
EP-075B-SS	Fluoranthene	mg/kg	0.5	<0.5	<0.5	85.7%	95.9%	----	----				
EP-075B-SS	Pyrene	mg/kg	0.5	<0.5	<0.5	86.5%	95.7%	98.9%	96.0%				
EP-075B-SS	N-2-Fluorenylacetamide	mg/kg	0.5	<0.5	<0.5	85.7%	98.9%	----	----				
EP-075B-SS	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5	85.1%	96.5%	----	----				
EP-075B-SS	Chrysene	mg/kg	0.5	<0.5	<0.5	86.7%	98.2%	----	----				
EP-075B-SS	Benzo(b) & (k)fluoranthene	mg/kg	1	<1	<1	87.2%	99.6%	----	----				
EP-075B-SS	7.12-Dimethylbenz(a)anthracene	mg/kg	0.5	<0.5	<0.5	88.8%	103%	----	----				
EP-075B-SS	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	85.5%	97.0%	----	----				
EP-075B-SS	3-Methylcholanthrene	mg/kg	0.5	<0.5	<0.5	84.3%	97.3%	----	----				

Batch: EM23205
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		58	100	101	102	103	104				
		Date Sampled		30/03/2004	02/04/2004	02/04/2004	02/04/2004	30/03/2004	30/03/2004				
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MW7/2 CHK	METHOD BLANK	VSVOCS753 SCS	VSVOCS753 DCS	MS7-1 MS	MS7-1 MSD				
				CHECKS AND SPIKES									
EP-075B-SS	Indeno(1.2.3-cd)pyrene	mg/kg	0.5	<0.5	<0.5	80.0%	94.1%	----	----				
EP-075B-SS	Dibenz(a.h)anthracene	mg/kg	0.5	<0.5	<0.5	79.2%	93.2%	----	----				
EP-075B-SS	Benzo(g.h.i)perylene	mg/kg	0.5	<0.5	<0.5	80.5%	93.6%	----	----				
EP-075C-SS	**PHTHALATE ESTERS**												
EP-075C-SS	Dimethyl phthalate	mg/kg	0.5	<0.5	<0.5	87.7%	93.9%	----	----				
EP-075C-SS	Diethyl phthalate	mg/kg	0.5	<0.5	<0.5	89.5%	98.1%	----	----				
EP-075C-SS	Di-n-butyl phthalate	mg/kg	0.5	<0.5	<0.5	87.7%	98.8%	----	----				
EP-075C-SS	Butyl benzyl phthalate	mg/kg	0.5	<0.5	<0.5	87.5%	98.2%	----	----				
EP-075C-SS	Bis(2-ethylhexyl) phthalate	mg/kg	5	<5	<5	90.1%	101%	----	----				
EP-075C-SS	Di-n-octylphthalate	mg/kg	0.5	<0.5	<0.5	87.2%	99.0%	----	----				
EP-075D-SS	**NITROSAMINES**												
EP-075D-SS	N-Nitrosomethylethylamine	mg/kg	0.5	<0.5	<0.5	89.0%	101%	----	----				
EP-075D-SS	N-Nitrosodiethylamine	mg/kg	0.5	<0.5	<0.5	94.9%	105%	----	----				
EP-075D-SS	N-Nitrosopyrrolidine	mg/kg	1	<1	<1	82.2%	94.4%	----	----				
EP-075D-SS	N-Nitrosomorpholine	mg/kg	0.5	<0.5	<0.5	88.6%	97.8%	----	----				
EP-075D-SS	N-Nitrosodi-n-propylamine	mg/kg	0.5	<0.5	<0.5	87.4%	96.6%	88.5%	86.1%				
EP-075D-SS	N-Nitrosopiperidine	mg/kg	0.5	<0.5	<0.5	88.0%	96.9%	----	----				
EP-075D-SS	N-Nitrosodibutylamine	mg/kg	0.5	<0.5	<0.5	92.0%	98.8%	----	----				
EP-075D-SS	N-Nitrosodiphenyl & Diphenylamine	mg/kg	1	<1	<1	86.4%	92.7%	----	----				
EP-075D-SS	Methapyrilene	mg/kg	0.5	<0.5	<0.5	89.9%	100%	----	----				
EP-075E-SS	**NITROAROMATICS AND CYCLIC KETONES**												
EP-075E-SS	2-Picoline	mg/kg	0.5	<0.5	<0.5	84.2%	22.1%	----	----				
EP-075E-SS	Acetophenone	mg/kg	0.5	<0.5	<0.5	91.4%	101%	----	----				
EP-075E-SS	Nitrobenzene	mg/kg	0.5	<0.5	<0.5	88.8%	97.4%	----	----				
EP-075E-SS	Isophorone	mg/kg	0.5	<0.5	<0.5	88.2%	96.9%	----	----				
EP-075E-SS	2.6-Dinitrotoluene	mg/kg	1	<1	<1	85.9%	93.2%	----	----				
EP-075E-SS	2.4-Dinitrotoluene	mg/kg	1	<1	<1	85.2%	94.6%	90.8%	88.5%				
EP-075E-SS	1-Naphthylamine	mg/kg	0.5	<0.5	<0.5	60.6%	59.8%	----	----				
EP-075E-SS	4-Nitroquinoline-N-oxide	mg/kg	0.5	<0.5	<0.5	82.0%	88.6%	----	----				
EP-075E-SS	5-Nitro-o-toluidine	mg/kg	0.5	<0.5	<0.5	86.4%	96.9%	----	----				
EP-075E-SS	Azobenzene	mg/kg	0.5	<0.5	<0.5	89.7%	95.8%	----	----				
EP-075E-SS	1.3.5-Trinitrobenzene	mg/kg	0.5	<0.5	<0.5	59.4%	71.1%	----	----				

Batch: EM23205
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		58	100	101	102	103	104				
		Date Sampled		30/03/2004	02/04/2004	02/04/2004	02/04/2004	30/03/2004	30/03/2004				
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MW7/2 CHK	METHOD BLANK	VSVOCS753 SCS	VSVOCS753 DCS	MS7-1 MS	MS7-1 MSD				
				CHECKS AND SPIKES									
EP-075E-SS	Phenacetin	mg/kg	0.5	<0.5	<0.5	89.9%	100%	----	----				
EP-075E-SS	4-Aminobiphenyl	mg/kg	0.5	<0.5	<0.5	88.5%	94.9%	----	----				
EP-075E-SS	Pentachloronitrobenzene	mg/kg	0.5	<0.5	<0.5	89.6%	97.1%	----	----				
EP-075E-SS	Pronamide	mg/kg	0.5	<0.5	<0.5	87.5%	96.5%	----	----				
EP-075E-SS	Dimethylaminoazobenzene	mg/kg	0.5	<0.5	<0.5	80.2%	90.5%	----	----				
EP-075E-SS	Chlorobenzilate	mg/kg	0.5	<0.5	<0.5	87.7%	100%	----	----				
EP-075F-SS	**HALOETHERS**												
EP-075F-SS	Bis(2-chloroethyl) ether	mg/kg	0.5	<0.5	<0.5	88.3%	97.0%	----	----				
EP-075F-SS	Bis(2-chloroethoxy) methane	mg/kg	0.5	<0.5	<0.5	87.5%	97.9%	----	----				
EP-075F-SS	4-Chlorophenyl phenyl ether	mg/kg	0.5	<0.5	<0.5	88.5%	94.2%	----	----				
EP-075F-SS	4-Bromophenyl phenyl ether	mg/kg	0.5	<0.5	<0.5	88.2%	95.2%	----	----				
EP-075G-SS	**CHLORINATED HYDROCARBONS**												
EP-075G-SS	1.3-Dichlorobenzene	mg/kg	0.5	<0.5	<0.5	85.1%	91.9%	----	----				
EP-075G-SS	1.4-Dichlorobenzene	mg/kg	0.5	<0.5	<0.5	84.8%	92.1%	85.8%	81.0%				
EP-075G-SS	1.2-Dichlorobenzene	mg/kg	0.5	<0.5	<0.5	86.1%	92.8%	----	----				
EP-075G-SS	Hexachloroethane	mg/kg	0.5	<0.5	<0.5	82.2%	90.7%	----	----				
EP-075G-SS	1.2.4-Trichlorobenzene	mg/kg	0.5	<0.5	<0.5	88.5%	96.2%	102%	101%				
EP-075G-SS	Hexachloropropylene	mg/kg	0.5	<0.5	<0.5	82.5%	91.6%	----	----				
EP-075G-SS	Hexachlorobutadiene	mg/kg	0.5	<0.5	<0.5	85.7%	93.7%	----	----				
EP-075G-SS	Hexachlorocyclopentadiene	mg/kg	3	<3	<3	36.3%	55.5%	----	----				
EP-075G-SS	Pentachlorobenzene	mg/kg	0.5	<0.5	<0.5	89.1%	97.0%	----	----				
EP-075G-SS	Hexachlorobenzene	mg/kg	1	<1	<1	90.6%	95.7%	----	----				
EP-075H-SS	**ANILINES AND BENZIDINES**												
EP-075H-SS	Aniline	mg/kg	0.5	<0.5	<0.5	70.8%	76.9%	----	----				
EP-075H-SS	4-Chloroaniline	mg/kg	0.5	<0.5	<0.5	69.6%	73.2%	----	----				
EP-075H-SS	2-Nitroaniline	mg/kg	1	<1	<1	87.5%	95.2%	----	----				
EP-075H-SS	3-Nitroaniline	mg/kg	1	<1	<1	83.2%	88.6%	----	----				
EP-075H-SS	Dibenzofuran	mg/kg	0.5	<0.5	<0.5	88.2%	95.1%	----	----				
EP-075H-SS	4-Nitroaniline	mg/kg	0.5	<0.5	<0.5	79.7%	87.9%	----	----				
EP-075H-SS	Carbazole	mg/kg	0.5	<0.5	<0.5	86.1%	96.5%	----	----				
EP-075H-SS	3.3'-Dichlorobenzidine	mg/kg	0.5	<0.5	<0.5	87.8%	95.9%	----	----				
EP-075I-SS	**ORGANOCHLORINE PESTICIDES**												

Batch: EM23205
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		58	100	101	102	103	104				
		Date Sampled		30/03/2004	02/04/2004	02/04/2004	02/04/2004	30/03/2004	30/03/2004				
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MW7/2 CHK	METHOD BLANK	VSVOCS753 SCS	VSVOCS753 DCS	MS7-1 MS	MS7-1 MSD				
				CHECKS AND SPIKES									
EP-075I-SS	alpha-BHC	mg/kg	0.5	<0.5	<0.5	84.4%	92.8%	----	----				
EP-075I-SS	beta-BHC & gamma-BHC	mg/kg	1	<1	<1	86.8%	95.1%	----	----				
EP-075I-SS	delta-BHC	mg/kg	0.5	<0.5	<0.5	85.5%	94.2%	----	----				
EP-075I-SS	Heptachlor	mg/kg	0.5	<0.5	<0.5	84.9%	93.5%	----	----				
EP-075I-SS	Aldrin	mg/kg	0.5	<0.5	<0.5	85.7%	94.1%	----	----				
EP-075I-SS	Heptachlor epoxide	mg/kg	0.5	<0.5	<0.5	86.6%	95.8%	----	----				
EP-075I-SS	Endosulfan 1	mg/kg	0.5	<0.5	<0.5	90.3%	92.3%	----	----				
EP-075I-SS	4.4'-DDE	mg/kg	0.5	<0.5	<0.5	88.6%	98.7%	----	----				
EP-075I-SS	Dieldrin	mg/kg	0.5	<0.5	<0.5	86.6%	98.7%	----	----				
EP-075I-SS	Endrin	mg/kg	0.5	<0.5	<0.5	86.6%	98.7%	----	----				
EP-075I-SS	Endosulfan 2	mg/kg	0.5	<0.5	<0.5	86.6%	96.4%	----	----				
EP-075I-SS	4.4'-DDD	mg/kg	0.5	<0.5	<0.5	86.5%	96.0%	----	----				
EP-075I-SS	Endosulfan sulfate	mg/kg	0.5	<0.5	<0.5	68.6%	85.8%	----	----				
EP-075I-SS	4.4'-DDT	mg/kg	1	<1	<1	81.7%	95.1%	----	----				
EP-075J-SS	**ORGANOPHOSPHORUS PESTICIDES**												
EP-075J-SS	Dichlorvos	mg/kg	0.5	<0.5	<0.5	84.5%	91.8%	----	----				
EP-075J-SS	Dimethoate	mg/kg	0.5	<0.5	<0.5	76.8%	86.8%	----	----				
EP-075J-SS	Diazinon	mg/kg	0.5	<0.5	<0.5	86.3%	95.9%	----	----				
EP-075J-SS	Chlorpyrifos methyl	mg/kg	0.5	<0.5	<0.5	79.7%	89.0%	----	----				
EP-075J-SS	Malathion	mg/kg	0.5	<0.5	<0.5	82.1%	91.2%	----	----				
EP-075J-SS	Fenthion	mg/kg	0.5	<0.5	<0.5	83.8%	93.6%	----	----				
EP-075J-SS	Chlorpyrifos	mg/kg	0.5	<0.5	<0.5	87.2%	97.9%	----	----				
EP-075J-SS	Pirimiphos ethyl	mg/kg	0.5	<0.5	<0.5	86.0%	96.5%	----	----				
EP-075J-SS	Chlorfenvinphos-E	mg/kg	0.5	<0.5	<0.5	----	----	----	----				
EP-075J-SS	Chlorfenvinphos-Z	mg/kg	0.5	<0.5	<0.5	87.0%	98.1%	----	----				
EP-075J-SS	Prothiofos	mg/kg	0.5	<0.5	<0.5	86.3%	98.9%	----	----				
EP-075J-SS	Ethion	mg/kg	0.5	<0.5	<0.5	85.0%	97.0%	----	----				
EP-075S-SS	**ACID EXTRACTABLE SURROGATES**												
EP-075S-SS	2-Fluorophenol	%	1	75	62	92	102	77	65				
EP-075S-SS	Phenol-D6	%	1	76	77	91	102	62	58				
EP-075S-SS	2-Chlorophenol-D4	%	1	75	74	89	99	69	62				
EP-075S-SS	2.4.6-Tribromophenol	%	1	75	55	87	94	66	64				
EP-075T-SS	**BASE/NEUTRAL EXTRACTABLE SURROGATES**												

Batch: EM23205
Sub Batch: 2
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

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		Laboratory I.D.		58	100	101	102	103	104				
		Date Sampled		30/03/2004	02/04/2004	02/04/2004	02/04/2004	30/03/2004	30/03/2004				
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MW7/2 CHK	METHOD BLANK	VSVOCS753 SCS	VSVOCS753 DCS	MS7-1 MS	MS7-1 MSD				
				CHECKS AND SPIKES									
EP-075T-SS	Nitrobenzene-D5	%	1	77	80	90	101	87	83				
EP-075T-SS	1.2-Dichlorobenzene-D4	%	1	77	77	85	94	78	71				
EP-075T-SS	2-Fluorobiphenyl	%	1	74	78	90	99	74	71				
EP-075T-SS	Anthracene-d10	%	1	78	81	89	98	79	76				
EP-075T-SS	p-Terphenyl-D14	%	1	113	82	87	99	114	112				

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129401
PROJECT:	N5014201

Batch:	EM23205
Sub Batch:	3
LABORATORY:	MELBOURNE
DATE RECEIVED:	02/04/2004
DATE COMPLETED:	23/04/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	99

COMMENTS

Results apply to sample(s) as submitted. Samples analysed on an as received basis. Results reported on a dry weight basis. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999).

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: MELBOURNE

Address
Unit 6 / Adamco Business Park
2 Sarton Road
Clayton VIC 3168

Phone: 61-3-9538 4444
Fax: 61-3-9538 4400
Email: tim.kilmister@alsenviro.com

Signatory

Valda Chen
Senior Inorganic Chemist

Dr. Aaron Stott
Senior Organic Chemist

Phillip Hill
Senior Microbiologist

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

Batch: EM23205
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		2	3	4	5	6	7	8	9	10	11
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S5	S6	S7	S8	S9	S10	S11	S12	S13-1	S13-2
EA-055	Moisture Content (dried @ 103'C)	%	0.1	3.8	2.1	3.8	8.2	4.2	3.5	7.1	18.4	11.7	18.7
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	<2	4	<2	7	<2	23	<2	<2	<2	<2
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	55	<50	314	<50	102	99	<50	<50	<50
EP-071-SS	C15 - C28 Fraction	mg/kg	100	<100	321	108	3500	<100	1700	2500	274	344	831
EP-071-SS	C29 - C36 Fraction	mg/kg	100	118	204	108	2120	<100	504	3770	125	1030	2930
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	0.2	<0.2	<0.2	<0.2	<0.2	0.5	<0.2	<0.2	<0.2	<0.2
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.2	<0.2	<0.2
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	96	103	113	90	102	104	109	97	105	106
EP-080S-SS	Toluene-D8	%	1	89	92	102	74	93	99	100	85	98	89
EP-080S-SS	4-Bromofluorobenzene	%	1	77	75	86	71	80	80	84	71	86	81

Batch: EM23205
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		12	13	14	15	16	17	18	19	20	21
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S14-1	S14-2	S14-3	S15-1	S15-2	S15-3	S16-1	S16-2	S16-3	S17-1
EA-055	Moisture Content (dried @ 103'C)	%	0.1	9.1	20.1	21.9	9.3	13.0	16.4	9.5	19.9	19.8	8.6
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
EP-071-SS	C15 - C28 Fraction	mg/kg	100	429	108	<100	410	170	101	343	185	<100	407
EP-071-SS	C29 - C36 Fraction	mg/kg	100	750	253	192	693	331	220	1190	949	<100	943
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	111	96	103	110	110	110	118	104	97	115
EP-080S-SS	Toluene-D8	%	1	92	85	90	92	94	87	96	86	81	94
EP-080S-SS	4-Bromofluorobenzene	%	1	85	72	96	83	86	80	84	79	75	83

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CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		22	23	24	25	26	27	28	29	30	31
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S17-3	S17-4	S18-1	S18-4	S18-5	S19-1	S19-5	S19-3	S20-2	S20-3
EA-055	Moisture Content (dried @ 103'C)	%	0.1	17.7	17.9	11.6	6.4	12.2	3.8	14.0	10.9	15.7	11.7
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	<2	<2	<2	<2	<2	<2	<2	<2	5	<2
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	<50	<50	75	<50	<50	<50	<50	567	122
EP-071-SS	C15 - C28 Fraction	mg/kg	100	<100	<100	<100	139	<100	185	<100	<100	2820	392
EP-071-SS	C29 - C36 Fraction	mg/kg	100	<100	202	156	150	<100	212	<100	<100	216	<100
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	<0.2
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	110	113	109	101	104	102	114	110	118	100
EP-080S-SS	Toluene-D8	%	1	83	88	87	90	81	96	84	87	83	95
EP-080S-SS	4-Bromofluorobenzene	%	1	79	89	77	79	74	80	81	77	79	83

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Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		32	33	34	35	36	37	38	39	40	41
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S21-1	S21-2	S22-1	S22-2	S23-1	S23-2	S23-3	S24-1	S24-3	S24-4
EA-055	Moisture Content (dried @ 103'C)	%	0.1	11.5	14.0	4.5	15.2	3.0	7.0	14.6	3.1	7.9	19.5
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	31	<2	<2	<2	<2	<2	<2	<2	9	<2
EP-071-SS	C10 - C14 Fraction	mg/kg	50	3200	102	<50	<50	<50	<50	<50	<50	265	<50
EP-071-SS	C15 - C28 Fraction	mg/kg	100	13.9g/kg	361	220	<100	<100	<100	<100	118	1900	<100
EP-071-SS	C29 - C36 Fraction	mg/kg	100	601	<100	574	<100	<100	<100	<100	105	719	<100
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	105	96	117	109	117	110	119	109	70	100
EP-080S-SS	Toluene-D8	%	1	86	84	96	88	97	92	84	95	69	81
EP-080S-SS	4-Bromofluorobenzene	%	1	78	79	83	78	87	82	82	79	55	71

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CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		42	43	44	45	46	47	48	49	51	52
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	29/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S25-1	S25-2	S26-1	S26-2	S27-1	S27-2	D001	D002	MS5-1	MS5-2
EA-055	Moisture Content (dried @ 103'C)	%	0.1	2.3	23.8	6.9	18.3	4.4	10.4	13.8	10.7	6.0	8.6
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	15	<2	29	2	12	<2	2	28	<2	<2
EP-071-SS	C10 - C14 Fraction	mg/kg	50	215	<50	251	<50	142	<50	562	5080	<50	1410
EP-071-SS	C15 - C28 Fraction	mg/kg	100	1300	<100	1520	<100	843	<100	1890	14.0g/kg	370	4990
EP-071-SS	C29 - C36 Fraction	mg/kg	100	586	<100	567	<100	312	<100	176	647	177	182
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	<0.2	1.5	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	102	98	90	103	108	106	111	110	100	103
EP-080S-SS	Toluene-D8	%	1	76	80	71	83	83	86	87	84	96	101
EP-080S-SS	4-Bromofluorobenzene	%	1	70	73	54	83	76	76	75	76	84	84

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CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		53	54	55	56	57	58	59	60	61	62
		Date Sampled		30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS5-3	MS6-1	MS6-2	MS6-3	MS7-1	MS7-2	MS8-1	MS8-3	MS9-1	MS9-2
EA-055	Moisture Content (dried @ 103'C)	%	0.1	10.2	9.6	16.7	6.4	6.8	8.8	5.4	6.2	7.1	10.0
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	9	<2	<2	<2	<2	<2	7	<2	<2	<2
EP-071-SS	C10 - C14 Fraction	mg/kg	50	641	<50	<50	109	<50	<50	161	<50	<50	<50
EP-071-SS	C15 - C28 Fraction	mg/kg	100	3640	<100	<100	686	<100	<100	1270	177	<100	<100
EP-071-SS	C29 - C36 Fraction	mg/kg	100	899	<100	<100	291	<100	<100	784	139	<100	<100
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2
EP-080-SS	ortho-Xylene	mg/kg	0.2	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	84	93	100	94	102	97	99	94	103	111
EP-080S-SS	Toluene-D8	%	1	75	87	92	82	95	87	92	84	97	99
EP-080S-SS	4-Bromofluorobenzene	%	1	74	73	75	70	76	79	76	76	76	79

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CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		63	64	65	66	67	68	69	70	71	72
		Date Sampled		30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS10-1	MS10-3	MS10-5	MS11-1	MS11-3	MS11-4	MS11-5	MS12-1	MS12-2	MS12-3
EA-055	Moisture Content (dried @ 103'C)	%	0.1	3.3	8.2	8.9	7.7	9.5	7.8	8.0	11.0	9.6	9.7
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
EP-071-SS	C15 - C28 Fraction	mg/kg	100	<100	<100	<100	134	<100	<100	124	110	<100	<100
EP-071-SS	C29 - C36 Fraction	mg/kg	100	<100	<100	<100	124	<100	<100	<100	<100	<100	<100
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	98	93	90	110	107	109	109	104	112	100
EP-080S-SS	Toluene-D8	%	1	91	93	83	92	87	97	95	95	89	92
EP-080S-SS	4-Bromofluorobenzene	%	1	75	70	74	74	81	74	73	73	70	70

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CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		73	74	75	76	77	78	79	80	81	82
		Date Sampled		30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS13-1	MS13-3	MS13-4	MS14-1	MS14-2	MS14-4	MS15-2	MS15-4	MS15-5	MS16-1
EA-055	Moisture Content (dried @ 103'C)	%	0.1	7.2	13.6	12.1	9.1	10.7	7.4	11.1	10.8	10.6	15.1
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	<2	<2	<2	3	<2	2	<2	<2	<2	51
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	<50	<50	1910	<50	266	119	<50	<50	<50
EP-071-SS	C15 - C28 Fraction	mg/kg	100	439	134	<100	3240	276	1670	742	<100	<100	<100
EP-071-SS	C29 - C36 Fraction	mg/kg	100	500	<100	<100	2580	143	646	317	<100	<100	<100
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.6
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.7
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	6.6
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	2.1
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	108	97	107	118	95	96	96	110	102	108
EP-080S-SS	Toluene-D8	%	1	92	82	91	94	85	90	81	90	89	76
EP-080S-SS	4-Bromofluorobenzene	%	1	72	72	72	85	80	78	70	73	81	78

Batch: EM23205
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		83	84	85	86	87	88	89	90	91	92
		Date Sampled		30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS16-2	MS16-3	MS17-1	MS17-2	MS18-5	MS19-1	MS20-2	MS20-3	D003	D004
EA-055	Moisture Content (dried @ 103'C)	%	0.1	9.8	14.3	7.3	7.0	14.3	3.1	8.0	11.0	8.1	13.4
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	<2	<2	4	<2	<2	10	<2	<2	3	31
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
EP-071-SS	C15 - C28 Fraction	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
EP-071-SS	C29 - C36 Fraction	mg/kg	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	0.4	<0.2	<0.2	0.6	<0.2	<0.2	<0.2	0.4
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.3
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	<0.2	1.6	0.4	<0.2	0.9	<0.2	<0.2	<0.2	2.5
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	0.4	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	0.9
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	109	90	89	107	81	100	111	93	111	85
EP-080S-SS	Toluene-D8	%	1	92	85	82	91	65	85	95	96	91	77
EP-080S-SS	4-Bromofluorobenzene	%	1	84	72	65	77	55	80	79	76	83	70

Batch: EM23205
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		93	94	95	96	97	98	99	100	101	
		Date Sampled		31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	31/03/2004	
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	CS1-1	CS1-2	CS2-1	CS2-2	CS2-3	CS3-3	CS3-4	CS4-3	CS4-4	
EA-055	Moisture Content (dried @ 103'C)	%	0.1	12.4	6.4	8.3	16.1	10.8	7.6	11.2	13.3	12.6	
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	3	21	26	<2	<2	<2	<2	<2	<2	
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	<50	<50	<50	157	<50	<50	<50	<50	
EP-071-SS	C15 - C28 Fraction	mg/kg	100	<100	<100	<100	<100	942	<100	<100	<100	<100	
EP-071-SS	C29 - C36 Fraction	mg/kg	100	<100	<100	<100	<100	372	<100	<100	<100	<100	
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	95	105	92	86	90	92	85	93	78	
EP-080S-SS	Toluene-D8	%	1	80	93	82	86	90	92	84	89	71	
EP-080S-SS	4-Bromofluorobenzene	%	1	80	83	77	75	82	85	77	82	78	

Batch: EM23205
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		10	20	29	40	51	60	72	80	90	200
		Date Sampled		29/03/2004	29/03/2004	29/03/2004	29/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	30/03/2004	02/04/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	S13-1 CHK	S16-3 CHK	S19-3 CHK	S24-3 CHK	MS5-1 CHK	M28-3 CHK	MS12-3 CHK	MS15-4 CHK	MW20-3 CHK	METHOD BLANK 1
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	11.7	19.8	10.9	7.9	6.0	6.2	9.7	10.8	11.0	----
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	<2	<2	<2	12	<2	<2	<2	<2	<2	<2
EP-071-SS	C10 - C14 Fraction	mg/kg	50	<50	<50	<50	200	70	<50	<50	<50	<50	<50
EP-071-SS	C15 - C28 Fraction	mg/kg	100	432	<100	<100	1340	779	217	<100	<100	<100	<100
EP-071-SS	C29 - C36 Fraction	mg/kg	100	1430	219	<100	582	272	107	<100	<100	101	<100
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080-SS	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	115	104	111	84	118	90	110	119	91	96
EP-080S-SS	Toluene-D8	%	1	95	85	85	70	95	81	86	79	91	92
EP-080S-SS	4-Bromofluorobenzene	%	1	86	76	75	53	83	76	79	75	78	84

Batch: EM23205
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		201	202	203	204	210	105	106	107	108	220
		Date Sampled		02/04/2004	02/04/2004	29/03/2004	29/03/2004	02/04/2004	02/04/2004	02/04/2004	29/03/2004	29/03/2004	02/04/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	VTPHT1981 SCS	VTPHT1981 DCS	S5 29/3/04 MS	S5 29/3/04MSD	METHOD BLANK 2	VTPHT1982 SCS	VTPHT1982 DCS	S17-3 MS	S17-3 MSD	METHOD BLANK 3
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----	----	----	----	----	----
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	90.0%	90.0%	86.0%	90.0%	<2	92.0%	91.0%	84.0%	90.0%	<2
EP-071-SS	C10 - C14 Fraction	mg/kg	50	95.0%	93.0%	97.0%	94.0%	<50	98.0%	99.0%	91.0%	100%	<50
EP-071-SS	C15 - C28 Fraction	mg/kg	100	83.0%	82.0%	79.0%	79.0%	<100	85.0%	86.0%	81.0%	90.0%	<100
EP-071-SS	C29 - C36 Fraction	mg/kg	100	66.0%	70.0%	Not Det'd	Not Det'd	<100	72.0%	78.0%	90.0%	108%	<100
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	100%	97.0%	91.0%	89.1%	<0.2	98.0%	97.0%	90.2%	96.3%	<0.2
EP-080-SS	Toluene	mg/kg	0.2	96.0%	95.5%	94.2%	115%	<0.2	96.8%	95.5%	89.3%	96.0%	<0.2
EP-080-SS	Chlorobenzene	mg/kg	0.2	95.8%	95.1%	77.8%	72.4%	<0.2	94.8%	95.7%	78.6%	83.8%	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	94.3%	92.4%	----	----	<0.2	93.4%	92.2%	----	----	<0.2
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	92.2%	89.5%	----	----	<0.2	92.2%	89.8%	----	----	<0.2
EP-080-SS	ortho-Xylene	mg/kg	0.2	95.8%	91.7%	----	----	<0.2	93.0%	91.8%	----	----	<0.2
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	109	105	109	107	108	98	102	118	116	111
EP-080S-SS	Toluene-D8	%	1	96	97	97	97	100	96	97	94	94	101
EP-080S-SS	4-Bromofluorobenzene	%	1	96	93	85	84	88	92	93	83	83	86

Batch: EM23205
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		109	110	111	112	230	113	114	115	116	240
		Date Sampled		02/04/2004	02/04/2004	29/03/2004	29/03/2004	02/04/2004	02/04/2004	02/04/2004	30/03/2004	30/03/2004	02/04/2004
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	VTPHT1983 SCS	VTPHT1983 DCS	S27-1 MS	S27-1 MSD	METHOD BLANK 4	VTPHT1984 SCS	VTPHT1984 DCS	MS11-5 MS	MS11-5 MSD	METHOD BLANK
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----	----	----	----	----	----
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	94.0%	93.0%	85.0%	82.0%	<2	99.0%	105%	92.0%	95.0%	<2
EP-071-SS	C10 - C14 Fraction	mg/kg	50	99.0%	87.0%	86.0%	88.0%	<50	99.0%	96.0%	78.0%	83.0%	<50
EP-071-SS	C15 - C28 Fraction	mg/kg	100	86.0%	79.0%	80.0%	77.0%	<100	86.0%	83.0%	65.0%	73.0%	<100
EP-071-SS	C29 - C36 Fraction	mg/kg	100	70.0%	58.0%	84.0%	86.0%	<100	80.0%	74.0%	Not Det'd	Not Det'd	<100
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	98.0%	97.0%	78.6%	77.3%	<0.2	103%	106%	99.1%	102%	<0.2
EP-080-SS	Toluene	mg/kg	0.2	98.2%	97.2%	72.7%	71.6%	<0.2	104%	99.3%	99.1%	99.8%	<0.2
EP-080-SS	Chlorobenzene	mg/kg	0.2	96.7%	96.7%	60.0%	59.0%	<0.2	104%	99.7%	84.1%	85.5%	<0.2
EP-080-SS	Ethylbenzene	mg/kg	0.2	94.3%	92.8%	----	----	<0.2	102%	103%	----	----	<0.2
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	89.9%	89.1%	----	----	<0.2	100%	102%	----	----	<0.2
EP-080-SS	ortho-Xylene	mg/kg	0.2	94.5%	93.4%	----	----	<0.2	103%	102%	----	----	<0.2
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	101	97	94	88	108	103	106	100	102	100
EP-080S-SS	Toluene-D8	%	1	96	95	66	62	101	102	96	88	90	98
EP-080S-SS	4-Bromofluorobenzene	%	1	91	91	51	49	86	104	95	73	74	86

Batch: EM23205
Sub Batch: 3
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		117	118	119	120						
		Date Sampled		02/04/2004	02/04/2004	30/03/2004	30/03/2004						
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	VTPHT1985 SCS	VTPHT1985 DCS	MS16-3 MS	MS16-3 MSD						
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----						
EP-071-SS	**TOTAL PETROLEUM HYDROCARBONS**												
EP-071-SS	C6 - C9 Fraction	mg/kg	2	100%	93.0%	76.0%	77.0%						
EP-071-SS	C10 - C14 Fraction	mg/kg	50	95.0%	95.0%	91.0%	98.0%						
EP-071-SS	C15 - C28 Fraction	mg/kg	100	82.0%	83.0%	71.0%	80.0%						
EP-071-SS	C29 - C36 Fraction	mg/kg	100	76.0%	68.0%	Not Det'd	Not Det'd						
EP-080-SS	**BTEX**												
EP-080-SS	Benzene	mg/kg	0.2	103%	96.0%	94.7%	92.8%						
EP-080-SS	Toluene	mg/kg	0.2	102%	98.0%	98.8%	90.7%						
EP-080-SS	Chlorobenzene	mg/kg	0.2	99.7%	101%	79.8%	78.2%						
EP-080-SS	Ethylbenzene	mg/kg	0.2	98.3%	96.5%	----	----						
EP-080-SS	meta- & para-Xylene	mg/kg	0.2	96.8%	94.6%	----	----						
EP-080-SS	ortho-Xylene	mg/kg	0.2	97.8%	95.3%	----	----						
EP-080S-SS	**VOLATILE TPH/BTEX COMPOUND SURROGATES**												
EP-080S-SS	1.2-Dichloroethane-D4	%	1	103	103	106	100						
EP-080S-SS	Toluene-D8	%	1	94	105	80	79						
EP-080S-SS	4-Bromofluorobenzene	%	1	93	105	72	71						

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129401
PROJECT:	N5014201

Batch:	EM23205
Sub Batch:	4
LABORATORY:	MELBOURNE
DATE RECEIVED:	02/04/2004
DATE COMPLETED:	23/04/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	2

COMMENTS

Results apply to sample(s) as submitted. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999). Samples analysed on an as received basis. Results reported on a dry weight basis.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: MELBOURNE

Address
Unit 6 / Adamco Business Park
2 Sarton Road
Clayton VIC 3168

Phone: 61-3-9538 4444
Fax: 61-3-9538 4400
Email: tim.kilmister@alsenviro.com

Signatory

Valda Chen
Senior Inorganic Chemist

Dr. Aaron Stott
Senior Organic Chemist

Phillip Hill
Senior Microbiologist

NATA Accredited Laboratory Number 825
Site:MELBOURNE

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

Batch: EM23205
Sub Batch: 4
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		57	58								
		Date Sampled		30/03/2004	30/03/2004								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS7-1	MS7-2								
EA-055	Moisture Content (dried @ 103'C)	%	0.1	6.8	8.8								
EP-074A-SS	**MONOCYCLIC AROMATIC HYDROCARBONS**												
EP-074A-SS	Benzene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	Toluene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	Ethylbenzene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	meta- & para-Xylene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	Styrene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	ortho-Xylene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	Isopropylbenzene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	n-Propylbenzene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	1.3.5-Trimethylbenzene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	sec-Butylbenzene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	1.2.4-Trimethylbenzene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	tert-Butylbenzene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	p-Isopropyltoluene	mg/kg	0.5	<0.5	<0.5								
EP-074A-SS	n-Butylbenzene	mg/kg	0.5	<0.5	<0.5								
EP-074B-SS	**OXYGENATED HYDROCARBONS**												
EP-074B-SS	Vinyl Acetate	mg/kg	5	<5	<5								
EP-074B-SS	2-Butanone (MEK)	mg/kg	5	<5	<5								
EP-074B-SS	4-Methyl-2-pentanone (MIBK)	mg/kg	5	<5	<5								
EP-074B-SS	2-Hexanone (MBK)	mg/kg	5	<5	<5								
EP-074C-SS	**SULFONATED COMPOUNDS**												
EP-074C-SS	Carbon disulfide	mg/kg	0.5	<0.5	<0.5								
EP-074D-SS	**FUMIGANTS**												
EP-074D-SS	2.2-Dichloropropane	mg/kg	0.5	<0.5	<0.5								
EP-074D-SS	1.2-Dichloropropane	mg/kg	0.5	<0.5	<0.5								
EP-074D-SS	cis-1.3-Dichloropropylene	mg/kg	1	<1	<1								
EP-074D-SS	trans-1.3-Dichloropropylene	mg/kg	1	<1	<1								
EP-074D-SS	1.2-Dibromoethane (EDB)	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	**HALOGENATED ALIPHATIC HYDROCARBONS (VOL)**												
EP-074E-SS	Dichlorodifluoromethane	mg/kg	5	<5	<5								
EP-074E-SS	Chloromethane	mg/kg	5	<5	<5								
EP-074E-SS	Vinyl chloride	mg/kg	5	<5	<5								
EP-074E-SS	Bromomethane	mg/kg	5	<5	<5								

Batch: EM23205
Sub Batch: 4
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		57	58								
		Date Sampled		30/03/2004	30/03/2004								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS7-1	MS7-2								
EP-074E-SS	Chloroethane	mg/kg	5	<5	<5								
EP-074E-SS	Trichlorofluoromethane	mg/kg	5	<5	<5								
EP-074E-SS	1.1-Dichloroethene	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	Iodomethane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	trans-1.2-Dichloroethene	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	1.1-Dichloroethane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	cis-1.2-Dichloroethene	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	1.1.1-Trichloroethane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	1.1-Dichloropropylene	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	Carbon tetrachloride	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	1.2-Dichloroethane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	Trichloroethene	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	Dibromomethane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	1.1.2-Trichloroethane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	1.3-Dichloropropane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	Tetrachloroethene	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	1.1.1.2-Tetrachloroethane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	trans-1.4-Dichloro-2-butene	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	cis-1.4-Dichloro-2-butene	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	1.1.2.2-Tetrachloroethane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	1.2.3-Trichloropropane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	Pentachloroethane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	1.2-Dibromo-3-chloropropane	mg/kg	0.5	<0.5	<0.5								
EP-074E-SS	Hexachlorobutadiene	mg/kg	0.5	<0.5	<0.5								
EP-074F-SS	**HALOGENATED AROMATIC HYDROCARBONS**												
EP-074F-SS	Chlorobenzene	mg/kg	0.5	<0.5	<0.5								
EP-074F-SS	Bromobenzene	mg/kg	0.5	<0.5	<0.5								
EP-074F-SS	2-Chlorotoluene	mg/kg	0.5	<0.5	<0.5								
EP-074F-SS	4-Chlorotoluene	mg/kg	0.5	<0.5	<0.5								
EP-074F-SS	1.3-Dichlorobenzene	mg/kg	0.5	<0.5	<0.5								
EP-074F-SS	1.4-Dichlorobenzene	mg/kg	0.5	<0.5	<0.5								
EP-074F-SS	1.2-Dichlorobenzene	mg/kg	0.5	<0.5	<0.5								
EP-074F-SS	1.2.4-Trichlorobenzene	mg/kg	0.5	<0.5	<0.5								
EP-074F-SS	1.2.3-Trichlorobenzene	mg/kg	0.5	<0.5	<0.5								
EP-074G-SS	**TRIHALOMETHANES (VOLATILES)**												

Batch: EM23205
Sub Batch: 4
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		57	58								
		Date Sampled		30/03/2004	30/03/2004								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	MS7-1	MS7-2								
EP-074G-SS	Chloroform	mg/kg	0.5	<0.5	<0.5								
EP-074G-SS	Bromodichloromethane	mg/kg	0.5	<0.5	<0.5								
EP-074G-SS	Dibromochloromethane	mg/kg	0.5	<0.5	<0.5								
EP-074G-SS	Bromoform	mg/kg	0.5	<0.5	<0.5								
EP-074H-SS	**NAPHTHALENE**												
EP-074H-SS	Naphthalene	mg/kg	5	<5	<5								
EP-074S-SS	**VOLATILE COMPOUND SURROGATES**												
EP-074S-SS	1.2-Dichloroethane-D4	%	1	100	95								
EP-074S-SS	Toluene-D8	%	1	95	88								
EP-074S-SS	4-Bromofluorobenzene	%	1	75	78								

Batch: EM23205
Sub Batch: 4
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		100	101	102	103	104					
		Date Sampled		02/04/2004	02/04/2004	02/04/2004	02/04/2004	02/04/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	VVSCS327 SCS	VVSCS327 DCS	VVSCS327 MS	VVSCS327 MSD					
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----					
EP-074A-SS	**MONOCYCLIC AROMATIC HYDROCARBONS**												
EP-074A-SS	Benzene	mg/kg	0.5	<0.5	106%	90.5%	97.2%	99.6%					
EP-074A-SS	Toluene	mg/kg	0.5	<0.5	91.1%	110%	95.0%	96.6%					
EP-074A-SS	Ethylbenzene	mg/kg	0.5	<0.5	103%	97.5%	----	----					
EP-074A-SS	meta- & para-Xylene	mg/kg	0.5	<0.5	103%	97.6%	----	----					
EP-074A-SS	Styrene	mg/kg	0.5	<0.5	92.3%	108%	----	----					
EP-074A-SS	ortho-Xylene	mg/kg	0.5	<0.5	106%	94.8%	----	----					
EP-074A-SS	Isopropylbenzene	mg/kg	0.5	<0.5	107%	94.8%	----	----					
EP-074A-SS	n-Propylbenzene	mg/kg	0.5	<0.5	102%	93.6%	----	----					
EP-074A-SS	1.3.5-Trimethylbenzene	mg/kg	0.5	<0.5	106%	98.5%	----	----					
EP-074A-SS	sec-Butylbenzene	mg/kg	0.5	<0.5	102%	94.7%	----	----					
EP-074A-SS	1.2.4-Trimethylbenzene	mg/kg	0.5	<0.5	103%	97.7%	----	----					
EP-074A-SS	tert-Butylbenzene	mg/kg	0.5	<0.5	104%	97.0%	----	----					
EP-074A-SS	p-Isopropyltoluene	mg/kg	0.5	<0.5	107%	96.1%	----	----					
EP-074A-SS	n-Butylbenzene	mg/kg	0.5	<0.5	100%	93.4%	----	----					
EP-074B-SS	**OXYGENATED HYDROCARBONS**												
EP-074B-SS	Vinyl Acetate	mg/kg	5	<5	92.3%	94.1%	----	----					
EP-074B-SS	2-Butanone (MEK)	mg/kg	5	<5	103%	96.7%	----	----					
EP-074B-SS	4-Methyl-2-pentanone (MIBK)	mg/kg	5	<5	106%	94.7%	----	----					
EP-074B-SS	2-Hexanone (MBK)	mg/kg	5	<5	98.4%	102%	----	----					
EP-074C-SS	**SULFONATED COMPOUNDS**												
EP-074C-SS	Carbon disulfide	mg/kg	0.5	<0.5	99.5%	101%	----	----					
EP-074D-SS	**FUMIGANTS**												
EP-074D-SS	2.2-Dichloropropane	mg/kg	0.5	<0.5	85.9%	116%	----	----					
EP-074D-SS	1.2-Dichloropropane	mg/kg	0.5	<0.5	108%	93.0%	----	----					
EP-074D-SS	cis-1.3-Dichloropropylene	mg/kg	1	<1	102%	97.8%	----	----					
EP-074D-SS	trans-1.3-Dichloropropylene	mg/kg	1	<1	98.1%	102%	----	----					
EP-074D-SS	1.2-Dibromoethane (EDB)	mg/kg	0.5	<0.5	107%	93.8%	----	----					
EP-074E-SS	**HALOGENATED ALIPHATIC HYDROCARBONS (VOL)**												
EP-074E-SS	Dichlorodifluoromethane	mg/kg	5	<5	109%	91.7%	----	----					
EP-074E-SS	Chloromethane	mg/kg	5	<5	101%	99.3%	----	----					

Batch: EM23205
Sub Batch: 4
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		100	101	102	103	104					
		Date Sampled		02/04/2004	02/04/2004	02/04/2004	02/04/2004	02/04/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	VVSCS327 SCS	VVSCS327 DCS	VVSCS327 MS	VVSCS327 MSD					
				CHECKS AND SPIKES									
EP-074E-SS	Vinyl chloride	mg/kg	5	<5	102%	97.8%	----	----					
EP-074E-SS	Bromomethane	mg/kg	5	<5	93.7%	107%	----	----					
EP-074E-SS	Chloroethane	mg/kg	5	<5	101%	99.3%	----	----					
EP-074E-SS	Trichlorofluoromethane	mg/kg	5	<5	106%	94.5%	----	----					
EP-074E-SS	1.1-Dichloroethene	mg/kg	0.5	<0.5	101%	99.0%	101%	105%					
EP-074E-SS	Iodomethane	mg/kg	0.5	<0.5	93.9%	107%	----	----					
EP-074E-SS	trans-1.2-Dichloroethene	mg/kg	0.5	<0.5	107%	93.9%	----	----					
EP-074E-SS	1.1-Dichloroethane	mg/kg	0.5	<0.5	95.7%	105%	----	----					
EP-074E-SS	cis-1.2-Dichloroethene	mg/kg	0.5	<0.5	107%	93.1%	----	----					
EP-074E-SS	1.1.1-Trichloroethane	mg/kg	0.5	<0.5	109%	91.7%	----	----					
EP-074E-SS	1.1-Dichloropropylene	mg/kg	0.5	<0.5	102%	98.4%	----	----					
EP-074E-SS	Carbon tetrachloride	mg/kg	0.5	<0.5	102%	98.3%	----	----					
EP-074E-SS	1.2-Dichloroethane	mg/kg	0.5	<0.5	109%	92.0%	----	----					
EP-074E-SS	Trichloroethene	mg/kg	0.5	<0.5	103%	97.1%	95.2%	98.3%					
EP-074E-SS	Dibromomethane	mg/kg	0.5	<0.5	104%	96.1%	----	----					
EP-074E-SS	1.1.2-Trichloroethane	mg/kg	0.5	<0.5	97.8%	102%	----	----					
EP-074E-SS	1.3-Dichloropropane	mg/kg	0.5	<0.5	106%	94.0%	----	----					
EP-074E-SS	Tetrachloroethene	mg/kg	0.5	<0.5	105%	95.3%	----	----					
EP-074E-SS	1.1.1.2-Tetrachloroethane	mg/kg	0.5	<0.5	101%	98.7%	----	----					
EP-074E-SS	trans-1.4-Dichloro-2-butene	mg/kg	0.5	<0.5	101%	99.5%	----	----					
EP-074E-SS	cis-1.4-Dichloro-2-butene	mg/kg	0.5	<0.5	86.6%	115%	----	----					
EP-074E-SS	1.1.2.2-Tetrachloroethane	mg/kg	0.5	<0.5	105%	95.5%	----	----					
EP-074E-SS	1.2.3-Trichloropropane	mg/kg	0.5	<0.5	102%	98.2%	----	----					
EP-074E-SS	Pentachloroethane	mg/kg	0.5	<0.5	110%	91.2%	----	----					
EP-074E-SS	1.2-Dibromo-3-chloropropane	mg/kg	0.5	<0.5	106%	94.4%	----	----					
EP-074E-SS	Hexachlorobutadiene	mg/kg	0.5	<0.5	110%	90.6%	----	----					
EP-074F-SS	**HALOGENATED AROMATIC HYDROCARBONS**												
EP-074F-SS	Chlorobenzene	mg/kg	0.5	<0.5	105%	95.6%	92.6%	94.9%					
EP-074F-SS	Bromobenzene	mg/kg	0.5	<0.5	106%	94.0%	----	----					
EP-074F-SS	2-Chlorotoluene	mg/kg	0.5	<0.5	102%	97.5%	----	----					
EP-074F-SS	4-Chlorotoluene	mg/kg	0.5	<0.5	108%	92.3%	----	----					
EP-074F-SS	1.3-Dichlorobenzene	mg/kg	0.5	<0.5	104%	96.6%	----	----					

Batch: EM23205
Sub Batch: 4
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		100	101	102	103	104					
		Date Sampled		02/04/2004	02/04/2004	02/04/2004	02/04/2004	02/04/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	VVSCS327 SCS	VVSCS327 DCS	VVSCS327 MS	VVSCS327 MSD					
				CHECKS AND SPIKES									
EP-074F-SS	1.4-Dichlorobenzene	mg/kg	0.5	<0.5	104%	95.8%	----	----					
EP-074F-SS	1.2-Dichlorobenzene	mg/kg	0.5	<0.5	106%	94.0%	----	----					
EP-074F-SS	1.2.4-Trichlorobenzene	mg/kg	0.5	<0.5	110%	90.6%	----	----					
EP-074F-SS	1.2.3-Trichlorobenzene	mg/kg	0.5	<0.5	106%	93.7%	----	----					
EP-074G-SS	**TRIHALOMETHANES (VOLATILES)**												
EP-074G-SS	Chloroform	mg/kg	0.5	<0.5	106%	94.8%	----	----					
EP-074G-SS	Bromodichloromethane	mg/kg	0.5	<0.5	107%	93.3%	----	----					
EP-074G-SS	Dibromochloromethane	mg/kg	0.5	<0.5	106%	94.1%	----	----					
EP-074G-SS	Bromoform	mg/kg	0.5	<0.5	107%	93.2%	----	----					
EP-074H-SS	**NAPHTHALENE**												
EP-074H-SS	Naphthalene	mg/kg	5	<5	105%	95.6%	----	----					
EP-074S-SS	**VOLATILE COMPOUND SURROGATES**												
EP-074S-SS	1.2-Dichloroethane-D4	%	1	105	105	96	76	78					
EP-074S-SS	Toluene-D8	%	1	99	99	101	86	85					
EP-074S-SS	4-Bromofluorobenzene	%	1	98	102	98	87	88					

CERTIFICATE OF ANALYSIS

ALS Environmental

CONTACT:	MR STEFAN EVERINGHAM
CLIENT:	HLA-ENVIROSCIENCES PTY LTD
ADDRESS:	PO BOX 73 HUNTER REGION MC NSW 2310
ORDER No.:	129401
PROJECT:	N5014201

Batch:	EM23205
Sub Batch:	5
LABORATORY:	MELBOURNE
DATE RECEIVED:	02/04/2004
DATE COMPLETED:	23/04/2004
SAMPLE TYPE:	SOIL
No. of SAMPLES:	2

COMMENTS

Results apply to sample(s) as submitted. Samples analysed on an as received basis. Results reported on a dry weight basis. All analysis and Laboratory QC conducted in accordance with Schedule B(3) NEPM Guideline on Laboratory Analysis of Potentially Contaminated Soil (December 1999).

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: MELBOURNE

Address
Unit 6 / Adamco Business Park
2 Sarton Road
Clayton VIC 3168

Phone: 61-3-9538 4444
Fax: 61-3-9538 4400
Email: tim.kilmister@alsenviro.com

Signatory

Valda Chen
Senior Inorganic Chemist

Dr. Aaron Stott
Senior Organic Chemist

Phillip Hill
Senior Microbiologist

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its scope of accreditation. This document shall not be reproduced, except in full.

Batch: EM23205
Sub Batch: 5
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	50								
		Date Sampled		29/03/2004	30/03/2004								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	COMP(S1,S2,S3,S4)	COMP MS3,MS4,MS2,MS1								
EA-055	Moisture Content (dried @ 103'C)	%	0.1	2.5	5.1								
EP-066-SS	Total Polychlorinated biphenyls	mg/kg	0.1	<0.1	<0.1								
EP-066S-SS	**POLYCHLORINATED BIPHENYL SURROGATE**												
EP-066S-SS	Decachlorobiphenyl	%	1	94	104								

Batch: EM23205
Sub Batch: 5
Date of Issue: 11/08/2004
Client: HLA-ENVIROSCIENCES PTY LTD
Client Reference: N5014201

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		100	101	102	103	104					
		Date Sampled		02/04/2004	02/04/2004	02/04/2004	02/04/2004	02/04/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	METHOD BLANK	VPCBS205 SCS	VPCBS205 DCS	VPCBS205 MS	VPCBS205 MSD					
				CHECKS AND SPIKES									
EA-055	Moisture Content (dried @ 103'C)	%	0.1	----	----	----	----	----					
EP-066-SS	Total Polychlorinated biphenyls	mg/kg	0.1	<0.1	99.6%	110%	71.7%	71.4%					
EP-066S-SS	**POLYCHLORINATED BIPHENYL SURROGATE**												
EP-066S-SS	Decachlorobiphenyl	%	1	80	80	86	93	102					

Appendix N

MINE STABILITY REPORT - CATHERINE HILL BAY AND MOONEE

ATT: Ian McNicol. 4943 5955

In reply please send to: Head Office

Our reference: FN05-00116W5 MJC:JR

Your reference:

Contact: Tom Hole 4352 1646

EJE Architecture
412 King Street
NEWCASTLE NSW 2300

28th April 2005

ATTENTION: BARNEY COLLINS

Dear Sirs

BUILDING APPLICATION NO TBA05-01156W5
LOT 2 DP 809795 MONTEGIORE STREET CATHERINE HILL BAY
COASTAL HAMLETS PTY LTD

The Members of the Mine Subsidence Board have granted their conditional approval of this building application on the following conditions:

1. The final drawings to be submitted prior to commencement of construction, are to contain a certification by a qualified structural engineer, to the effect that any improvement constructed to meet the specifications of such final drawings will be safe, serviceable and repairable taking into account the geotechnical conditions at the site.

2. Removal of any risk of mine subsidence by a suitable means, such as grouting. Alternatively, satisfy the Board by confirming through geotechnical investigations that the workings are long term stable and there is no risk of mine subsidence affecting the site.

3. The geotechnical investigation may require a sufficient number of boreholes to the floor of the seam and numerical modelling/sensitivity analysis to demonstrate the appropriateness of the strata to support the development given the mine workings. The investigation is to contain confirmation of the depth of coal seam, height of workings, floor conditions and thickness of competent rock, as well as providing details of the pillar dimensions used in any analysis. ISG co-ordinates and the measured deviation from vertical are required for any boreholes. The report must be to the satisfaction of the Mine Subsidence Board.

HEAD OFFICE:
PO Box 488G
Newcastle 2300
Telephone: (02) 4908 4395
Facsimile: (02) 4929 1032

NEWCASTLE:
NSW Government Offices
117 Bull Street
Newcastle West 2302
PO Box 488G
Newcastle 2300
Telephone: (02) 4908 4300
Facsimile: (02) 4929 1032
DX 4322 Newcastle West

SPEERS POINT
143 Main Road
Speers Point 2284
PO Box 9 Boolaroo 2284
Telephone: (02) 4950 8088
Facsimile: (02) 4950 8101
DX 7820 Newcastle

WYONG:
Suite 3 Feldwin Court
30 Hely Street
Wyong 2259
PO Box 157 Wyong 2259
Telephone: (02) 4352 1646
Facsimile: (02) 4352 1757
DX 7317 Wyong

SINGLETON:
Coal Services Building
1 Civic Avenue
Singleton 2330
PO Box 524 Singleton 2330
Telephone: (02) 6572 4144
Facsimile: (02) 6572 4504

PICTON:
100 Argyle Street
Picton 2571
PO Box 40 Picton 2571
Telephone: (02) 4677 1967
Facsimile: (02) 4677 2040
DX 26053 Picton

EMAIL:
mail@minesub.nsw.gov.au

WEBSITE:
www.minesub.nsw.gov.au

Quality Endorsed Company
ISO 9001:2000
Cert 12771
Standards Australia

28th April 2005

FN05-00116W5

This approval is current for two years.

Yours faithfully

M J Clarke
Secretary

MINE STABILITY ASSESSMENT

CATHERINE HILL BAY

Prepared for

ASQUITH & deWITT PTY LTD

On behalf of

COASTAL HAMLETS PTY LTD

Prepared by

RCA AUSTRALIA

RCA Ref: 4670-002/1

MAY 2005

RCA AUSTRALIA

ABN 53 063 515 711

Sydney Office
34/15 Valediction Road, KINGS PARK NSW 2148

Telephone: +61 2 9421 1900
Facsimile: +61 2 9421 1999
Email: sydney@rca.com.au
Internet: www.rca.com.au

Newcastle Office
92 Hill Street, CARRINGTON NSW 2294

Telephone: +61 2 4902 9200
Facsimile: +61 2 4902 9299
Email: newcastle@rca.com.au
Internet: www.rca.com.au

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DOCUMENT STATUS						
Rev No.	Comment	Author	Reviewer	Approved for Issue (Project Manager)		
				Name	Signature	Date
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RCA ref: 4670-002/1

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GEOTECHNICAL • ENVIRONMENTAL

Geotechnical Engineering
Engineering Geology
Hydrogeology
Environmental Audits
Contamination Assessment
Earthworks Testing
Materials Evaluation
Construction Quality Control

23 May 2005

Coastal Hamlets Pty Ltd
c/- Asquith & deWitt
PO Box 179
CHARLESTOWN NSW 2290

Attention: Mr Ian McNichol

MINE STABILITY ASSESSMENT
CATHERINE HILL BAY

1 INTRODUCTION

This report describes geotechnical studies carried out for Coastal Hamlets Pty Ltd on the proposed project located at Catherine Hill Bay.

This work was commissioned by Mr Stuart Rose of Coastal Hamlets Pty Ltd on 27 January 2005.

Based on plans provided by Asquith and de Witt Pty Ltd and discussions with Mr Ian McNichol it is understood that the proposed development comprises:

- Retention of the existing coal bunker building with refurbishment as a recreational area.
- Construction of a new three level club building to the north of the existing coal bunker.
- Construction of residential buildings to the south of the existing coal bunker building.

Drawing 1 shows the principal elements of the development on an ortho photo map.

Part of the site is underlain by relic coal workings and it is understood that the NSW Mine Subsidence Board (MSB) require an assessment of the stability of the workings to provide assurance of long term stability.

Data provided in relation to the project comprised:

- Plan drawing of the area showing the proposed development (Asquith & deWitt, Ref 11688).

This report presents an assessment of the stability of mine workings beneath the proposed development. The factual data on which this report is based is presented in the attached appendices.

2 SITE DESCRIPTION

2.1 GEOLOGY

The site is situated in the upper part of the Newcastle Coal Measures in the Moon Island Beach Formation. The geological sequence exposed in the cliff at the site from younger (highest) to older (lower) is shown in Table 1.

Table 1 *Site Geology*

Member	Location	Rock types
Teralba Conglomerate	Extends from the base of the cliff to the coal washery plant and above. Forms the cliff lines and steep slopes above.	Conglomerate rock with sandstone layers. Competent rock material with widely spaced joints.
Great Northern Seam	Top of the seam exposed at water level to the south of the jetty with the overall seam (up to 3m thick) exposed at the base of the cliff about 90m south of the jetty.	Coal comprising a competent rock material that extends out into the surf as a rock shelf. Erosion contact between coal and overlying conglomerate (no tuff noted to be present)
Awaba Tuff	Exposed at the base of the cliff about 90m south of the jetty.	Tuffaceous claystone that breaks down on exposure to a highly plastic clay.

Data for three nearby bores was obtained from the NSW Department of Primary Industries (DPI) as shown in Table 2.

Table 2 *Bore Data*

Bore	Date	Collar	Depth to Seam	Seam Thickness
Wallarah Shaft D	1910	45.5′ ASL	91.5′	6′
Wallarah Prospecting Shaft	1916	54.5′ ASL	87′	12′ 1′′
Wallarah DDH	1910	44.5′ ASL	72.5′	-

Analysis of the bore data indicates that the seam dips at approximately 1.2° to the north west. At the jetty the coal seam is exposed below the level of the existing sand cover with the depth of the seam below the base of the cliff increasing to the north.

The Teralba Conglomerate forms the cliff lines and is characterised by competent conglomerate rock with very widely spaced (>2m) sub vertical joints. The cliff face is predominantly aligned on a north-west orientation, which coincides with a major joint set that strikes north-west. As such, much of the cliff face has formed along existing north-west striking joint surfaces. A second major joint set striking north-east typically intersects the cliff face at right angles and locally forms large blocks where intersections with the north-west striking joint set are exposed in the cliff face.

3 DISCUSSION AND COMMENTS

3.1 MINE HISTORY

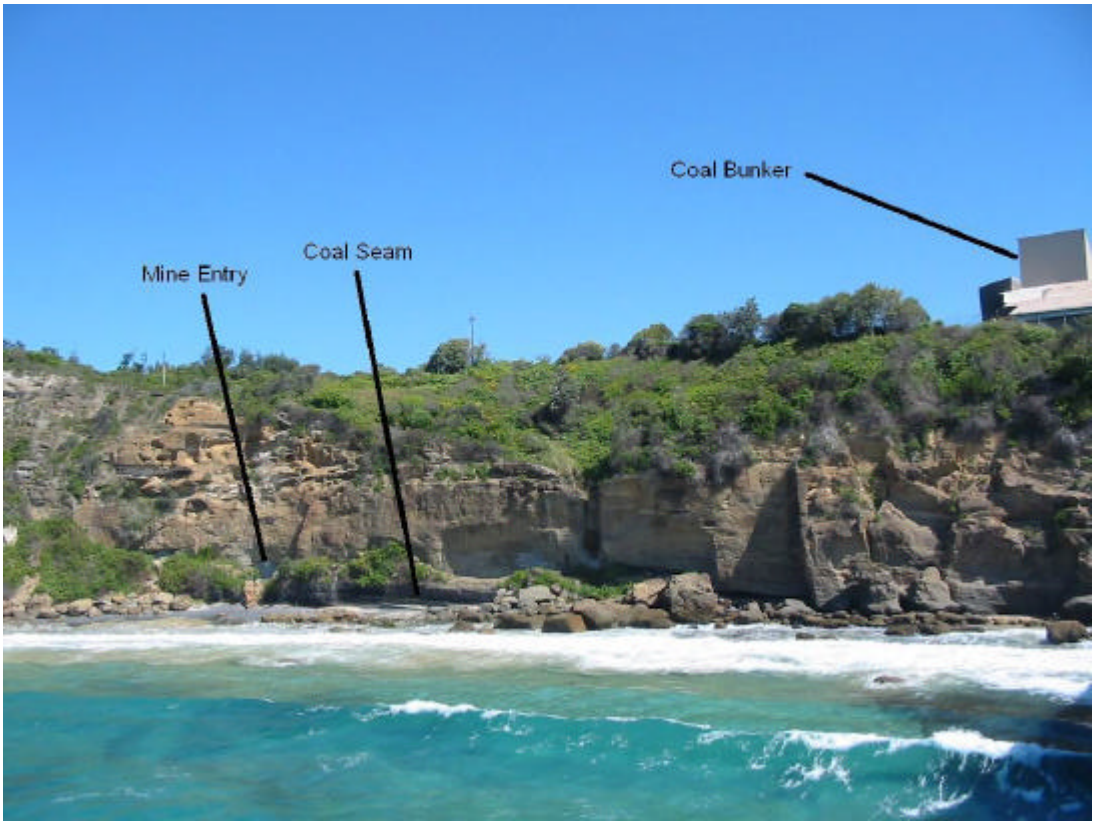
Historical sources indicate that The New Wallsend Company began coal mining operations at Catherine Hill Bay from a tunnel just above the beach near the jetty during 1873 and the first shipment was made from the newly constructed jetty in 1873. The mine employed some 70 men in 1874, but was closed for economic reasons in 1877.

3.2 DETAILS OF WORKINGS

Record Tracing (RT) 536 was obtained from the NSW DPI and it is reproduced in Drawing 2. The RT is dated 22 August 1874 and indicates bord and pillar workings accessed from the beach cliff face near the original jetty. The RT shows irregular workings of limited scale. The closed up mine access is identified in Photograph 1 along with the exposed Great Northern Seam. The Great Northern Seam can also be seen near water level near the current jetty as indicated in Photograph 2.

Drawing 3 presents a site plan showing the proposed development with the mine workings laid over them.

On the basis that the seam dips at 1.2° to the north west, as assessed in Section 2.1, the RL of the top of the seam is considered to be in the range 0m to 5m AHD beneath the development area. Drawing 1 indicates that the RL of the surface over the development area is a minimum of 35m AHD indicating that the cover to the workings over the development area is in the range 30m-35m.



Photograph 1 *Cliff Face Showing Mine Access and Coal Seam*

Photograph 2 *Coal Seam Exposed at Water Level at Jetty*

Typical dimensions of the workings scaled off the RT are shown in Table 3 and pillar geometry is defined in Figure 1. The pillar dimensions have been measured for the smallest pillar within the area of influence defined in Drawing 3. The area of influence is approximately 15m from the building boundaries to account for the angle of draw in the event of a pillar collapse. The angle of draw has been assumed to be 26.5°.

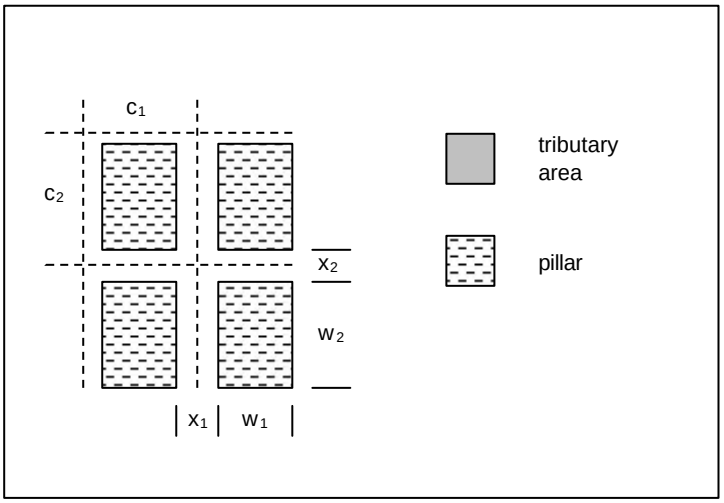


Figure 1 *Pillar Geometry*

Table 3 *Mine Dimensions*

Variable	Value	Comments
Cover to Seam, H (m)	30-35	Inferred from RL of seam in cliff line. Will vary slightly across the site with the dip of the seams.
Pillar Height or Thickness of Workings, h (m)	2.0-3.0	The outcropping seam thickness is up to 3m.
Average Unit Weight of Rock, γ (kN/m^3)	24.8827	As assumed by Galvin et al (1998)
Pillar Width, w_1(m)	~7.0	Measured off tracings.
Pillar Length, w_2(m)	~44.0	Measured off tracings.
R, $\frac{w_1}{h}$	2.3-3.5	
Effective Pillar Width, w_e(m)	7.0-7.7	Calculated in accordance with Galvin et al (1998)
Heading Width, x_1(m)	5.5	Measured off tracings.
Cut-through Width, x_2(m)	4.0	Measured off tracings.
Tributary Area Width , c_1(m)	12.5	Measured off tracings.
Tributary Area Length , c_2(m)	48.0	Measured off tracings.
Angle between adjacent pillars, ϕ	90	Measured off tracings.
Extraction Rate, $\frac{w_1 w_2}{c_1 c_2}$ (%)	~50	

3.3 MINE STABILITY ASSESSMENT

There are three possible modes of failure of abandoned bord and pillar workings which could result in surface subsidence:

1) Roof collapse.

2) Pillar failure.

3) Floor failure.

These modes of failure are discussed in the following sections.

3.3.1 OVERBURDEN & FLOOR CONDITION

The Great Northern Seam has been widely exploited and there is a great deal of literature relating to the roof and floor conditions.

The overburden comprises 30m of competent Teralba conglomerate rock with very widely spaced (ie, >2m) sub vertical joints. The literature refers to cases in long wall mining where safety issues have arisen through the ability of the Teralba Conglomerate to stand without immediate caving as the long wall face is advanced, resulting in windblast when it finally collapses (eg, Mooney Colliery). Roof collapse is not considered to be a credible risk.

The exposed seam in the cliff at the site indicates that the seam is underlain by claystone. This is considered to be Awaba Tuff which is known to be prone to softening upon exposure. Ref 1 indicates that four mechanisms can develop with pillars on soft floors:

1) Plastic failure of the floor (eg, bearing capacity failure of the floor under pillar load).

2) Consolidation of the floor under pillar load.

3) Swelling or heaving of the floor.

4) Creep settlement of the floor.

As a result of the relatively shallow depth of the workings (~30-35m), the corresponding pillar loads are relatively low. Assuming full development of tributary load for 50% extraction, the maximum pillar load is of the order of 1.7MPa. Data presented in Ref 3 indicates unconfined compressive strengths for fresh Awaba Tuff in the range 20-254 MPa. Bearing capacity calculations indicate that the tuff would need to soften over a significant depth (several metres) to a cohesionless plastic clay to produce a factor of safety for bearing capacity failure approaching 1. This is not considered to be a credible scenario. It is not considered that pillar failure caused by bearing capacity failure of the floor is a credible risk.

3.3.2 PILLAR STABILITY

An assessment of pillar stability has been made using the procedure presented by Galvin et al (1998). The calculation was undertaken for the smallest pillar within the area of influence identified in Drawing 3. The dimensions used are shown in Table 3.

For a range of mined heights from 2-3m and depth of cover from 30-35m, the stability analysis indicates a factor of safety (FOS) against collapse by pillar failure of between 4.9 and 8.2. Results are summarised in Table 4.

Table 4 *Summary Results of Stability Analysis*

Cover to Seam (m)	Thickness of Workings (m)	Factor of Safety
30	2.0	8.2
30	2.5	6.7
30	3.0	5.7
35	2.0	7.0
35	2.5	5.7
35	3.0	4.9

It is noted that the calculated factors of safety are based upon the geometry indicated in RT536. It is useful to carry out a sensitivity assessment to determine whether inaccuracy or undocumented activities (eg, pillar robbing) have a significant effect on the stability. The percentage extraction would have to be increased from approximately 50% as indicated in RT536 to in the order of 70% before the factor of safety for pillar stability went below 3. This would require over 1m being taken off each side of the assumed pillar dimensions.

3.3.3 PROBABILITY OF PILLAR FAILURE

On the basis of the probabilistic analysis of pillar performance data in NSW and Queensland presented by Galvin et al (1998), a relationship between Factor of Safety and Probability of Failure has been defined. The relationship for the Power Law formula is listed in Table 5.

Table 5 *Relationship Between FOS and Probability of Failure (Galvin et al, 1998)*

Probability of Failure	Factor of Safety (Power Law)
8 in 10	0.87
5 in 10	1.00
1 in 10	1.22
5 in 100	1.30
2 in 100	1.38
1 in 100	1.44
1 in 1000	1.63
1 in 10000	1.79
1 in 100000	1.95
1 in 1000000	2.11

With reference to the factors of safety calculated in Section 3.3.2, it can be seen that the probability of pillar failure using this framework is substantially greater than 1 in 1000000 for the workings in the Great Northern Seam.

3.3.4 LEVEL OF RISK TO PROPOSED DEVELOPMENT

The incidence, extent and frequency of mining subsidence are, in general, not amenable to accurate prediction, so the assessment of stability inevitably needs to be made within a risk framework as in many other engineering fields.

The risk is the product of the probability and the consequences of a subsidence event. The probability of a pillar collapse has been defined above using the analysis of Galvin et al (1998) which is based upon historical analysis of pillar performance. The outcomes of the pillar stability analysis are that the probability of pillar failure in the Great Northern Seam workings is substantially greater than 1 in 1000000.

It is noted that in this assessment of pillar stability of the Greta Northern Seam workings no account has been directly made of the following stabilising influences on pillar stability at this site:

- The presence of a 30m thickness of high strength spanning strata over the workings.
- The limited extent of the workings and the likelihood that tributary loads are reduced through spanning across the workings.

Based on the calculated probabilities of pillar failure, it is expected that the pillars will remain stable in the long term. It is noted that the above probabilities of failure are typical of those with an acceptable risk level for development.

4 CONCLUSION

A desktop investigation of the abandoned workings underlying the site of the proposed Catherine Hill Bay development has been undertaken.

On the basis of the investigation undertaken RCA Australia considers that the abandoned workings of the Great Northern Seam satisfy criteria to be considered to be long term stable.

Yours faithfully
RCA AUSTRALIA

Dr Mark Allman

REFERENCES

[1] ACARP Report C4026 (1999) "Engineered Mine Design in Soft Strata Environments – Geomechanical Behaviour of Soft Floor Strata in Underground Coal Mines"

[2] Galvin, JM, Hebblewhite, BK, Salamon, MDG and Lin, BB (1998) "Establishing the Strength of Rectangular and Irregular Pillars" ACARP Research Project No. C5024.

[3] Ives MJ (1995) "Stratigraphy and Engineering Properties of the Newcastle and Tomago Coal Measures", Engineering Geology of the Newcastle-Gosford Region pp. 223-240.

Appendix A

Drawings

NOTE: Drawing adapted from plan supplied by Asquith & deWitt Pty Ltd
Ref No 11688, Dated 31/5/05

RCA AUSTRALIA
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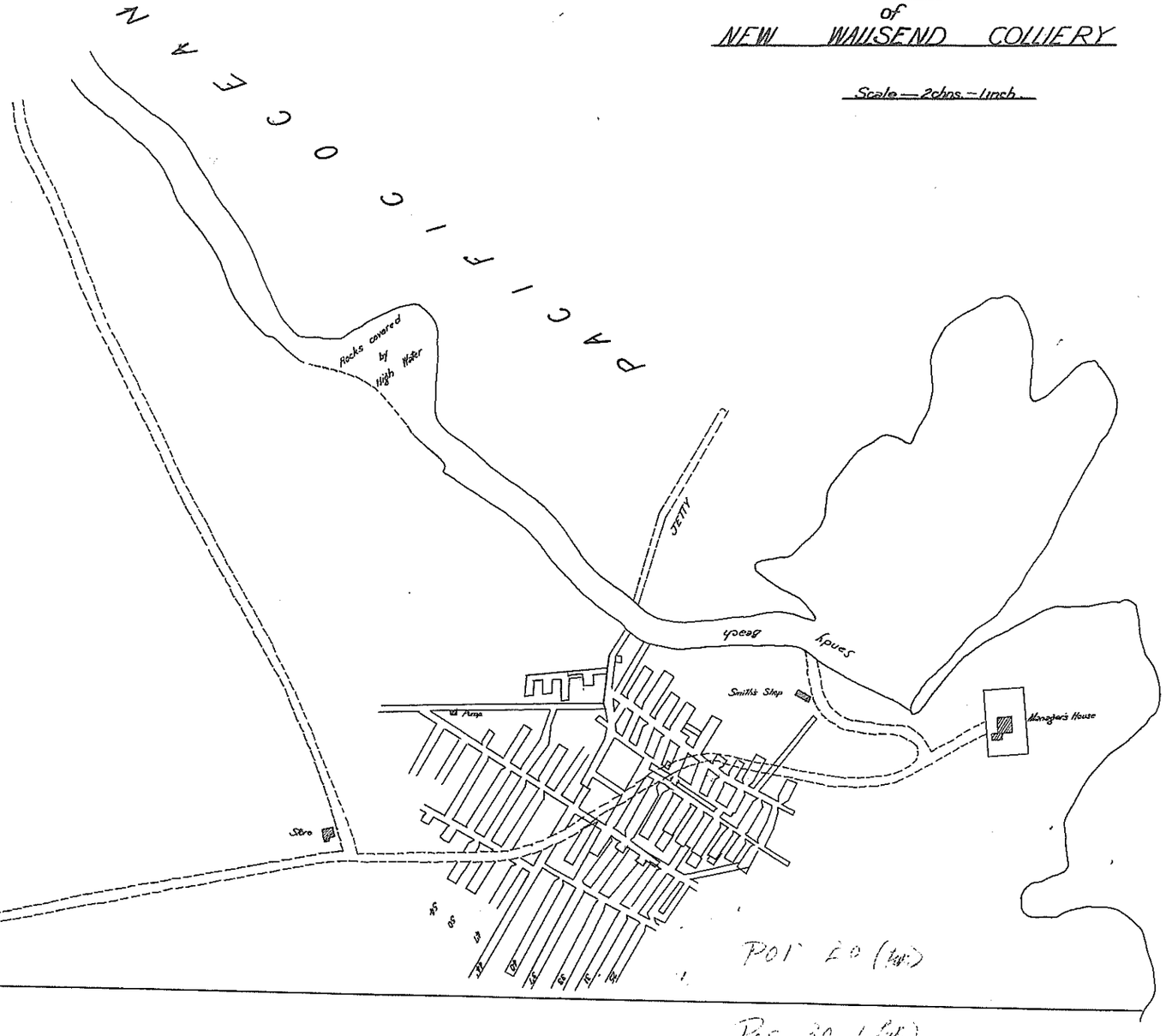
PROPOSED DEVELOPMENT
PACIFIC HIGHWAY
CATHERINE HILL BAY

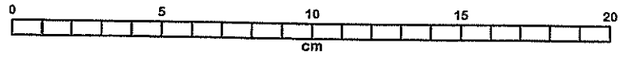
CLIENT Asquith & deWitt Pty Ltd		PROJECT No 4670	
DRAWN BY MA	SCALE 1 : 1000	DRAWING No 1	REV 0
APPROVED BY MA	DATE 21/9/05	OFFICE NEWCASTLE	

CDT-DWG-A3H-001/1

PLAN
of
NEW WALLSEND COLLIERY

Scale — 2chns. – 1inch.





J B Winship
Newcastle
August 22nd. 1874

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

RT 536

CLIENT	Asquith & deWitt Pty Ltd			PROJECT No	4760
DRAWN BY	MA	SCALE	N.T.S.	DRAWING No 2	REV 0
APPROVED BY	MM	DATE	21/8/05	OFFICE	NEWCASTLE

CDT-DWG-A3H-001/1

Area of workings that could influence structures

SITE PLAN SHOWING
APPROXIMATE LOCATION OF WORKINGS

RCA AUSTRALIA

CLIENT Asquith & deWitt Pty Ltd		PROJECT No 4670	
DRAWN BY MA	SCALE 1 : 2000	DRAWING No 3	REV 0
APPROVED BY MAA	DATE 21/4/05	OFFICE NEWCASTLE	

CDT-DWG-A3H-001/1

Appendix O

BUSHFIRE ASSESSMENT - CATHERINE HILL BAY

BUSHFIRE HAZARD ASSESSMENT

FOR

CATHERINE HILL BAY & GWANDALAN

AT

MONTEFIORE STREET, CATHERINE HILL BAY AND KANANGARA DRIVE, GWANDALAN

FOR

ROSECORP PTY LTD

19 July 2007
Version A

Prepared by:

Barry Eadie Consulting Pty Ltd

50 Central Avenue Como West NSW 2226 • Ph: 02) 9528 7904 • Fax: 02) 9575 7756 • Mobile: 0432 739 443
email: barryeadie@optusnet.com.au • ABN: 61 111 815 215

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PREFACE

Readers of this report must be aware that the bushfire mitigation recommendations described in this report will not completely remove the risk of bushfire impacting the development site. Recommendations contained herein are designed to improve the bushfire related issues for the existing development. With regard to the application the implementation of recommendations in their entirety, together with the diligent maintenance of Asset Protection Zones, will provide for a reduction of the bushfire threat and the associated risk.

This report caters specifically for the requirements of this project and the Client. No warranty is intended or implied, or responsibility undertaken by Barry Eadie Consulting Pty Ltd for its use on any other project or by any third party.

This report does not include an environmental assessment, Aboriginal heritage assessment or identify endangered species in the area.

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1 EXECUTIVE SUMMARY

The requirements under ***'Planning for Bushfire Protection' (2006)*** are addressed under Bush Fire Protection Measures, which include:

- Asset Protection Zones (APZ).
- Access and Egress; Public Roads, Property Access and Fire Trails.
- Services; Water, electricity and gas.
- Construction requirements for Dwellings.

The bushfire measures proposed comply with the requirements of ***'Planning for Bushfire Protection' (2006)*** in all respects and in particular the Bush Fire Protection Measures. The available Asset Protection Zones will require a minimum Level 1 construction in accordance with AS 3959-1999 for all residential dwellings within 100 metres of unmanaged vegetation.

The landscape areas and the Managed Bush Corridors of the proposed development will comply with the requirements for landscaping and Asset Protection Zones and therefore not contribute to any bushfire hazard.

2 INTRODUCTION

2.1 Report Purpose

This report assesses the capability of the existing sites to be developed for residential purposes in accordance with the legislative requirements of ***'Planning for Bushfire Protection' (2006)***. The sites comprise 374 ha at Catherine Hill Bay owned and controlled by Coastal Hamlets Pty Ltd and 18 ha at Gwandalan controlled by Lakeside Living Pty Ltd. The report will form part of the supporting documentation for a Concept Plan and Major Project Applications to be submitted to the Minister. A Bushfire Hazard Assessment has been undertaken to determine the necessary requirements for the development in accordance with:

- NSW Rural Fire Service, Planning NSW, ***'Planning for Bushfire Protection' (2006)***; and
- AS 3959-1999: ***Construction of Buildings in Bush Fire Prone Areas.***

Barry Eadie Consulting Pty Ltd has been engaged by Rosecorp Pty Ltd to prepare the Bushfire Hazard Assessment report, to be used in support of the application.

3 BUSHFIRE LEGISLATION IN NSW

The ***Environmental Planning and Assessment Act 1979*** and the ***Rural Fires Act 1997*** were amended via the ***Rural Fires and Environmental Assessment*** Legislation ***Amendment Act 2002.***

The amendments to the legislation are not retrospective and consequently will not usually apply to development applications which were made, but not necessarily finally determined, before 1 August 2002.

With regard to the ***Environmental Planning and Assessment Act 1979***, the amendments:

a) Require local government councils to record on maps land identified by the Commissioner of the NSW Rural Fire Service as bushfire prone land; and

b) Prevent development consent being granted for the carrying out of development for certain purposes on bushfire prone land unless the consent authority is satisfied that the development conforms to certain documented bushfire protection specifications and requirements **(*'Planning for Bushfire Protection' (2006)*** and ***AS 3959 – Construction of Buildings in Bushfire-Prone Areas*)** or has consulted with the Commissioner;

'Planning for Bushfire Protection' (2006), defines bushfire prone areas as an area that can support a bushfire or is likely to be subject to bushfire attack. In general, a bushfire prone area is an area containing a high, medium or low bushfire hazard, or any area within 100 m of a high or medium bushfire hazard, or within 30 m of a low bushfire hazard. Bushfire hazard areas do not include existing urban areas or water bodies (other than wetland vegetation), and are identified by bushfire hazard mapping produced under an approved Bushfire Risk Management Plan, or other such map certified by the Commissioner of the NSW Rural Fire Service for this purpose.

4 SITE ASSESSMENT – CATHERINE HILL BAY

NAME: Rosecorp Pty Ltd

ADDRESS:

SITE ADDRESS: Lot 5 DP 774923, Lot 6 DP 774923, Lot 7 DP 774923
Pt Lot 2031 DP 84 1175, Lot 2 DP 809795,
Lot 201 DP 702 669, Lot 2, 4 & 6 Section F DP 163,
Lots A and B DP 384745, Lot 3 DP 129431, Lot 4 DP129431
Montefiore Street Catherine Hill Bay NSW 2259

COUNCIL: Lake Macquarie City and Wyong Shire Councils'

TYPE of AREA:

TYPE of DEVELOPMENT: Community Title Subdivision.

Barry Eadie conducted inspections of the site at Catherine Hill Bay and the surrounding area on 8 June 2007. The following assessment has been undertaken in accordance with the requirements of ***'Planning for Bushfire Protection' (2006)***. The proposal is for approval of the Community Title at Catherine Hill Bay and residential subdivision at Gwandalan.

4.1 Location

The site comprises approximately 374 ha on both sides of the Pacific Highway at Catherine Hill Bay. The land stretches from the Ocean in the East to Lake Macquarie in the West and straddles the Lake Macquarie and Wyong LGA boundary.

The area that is proposed for development is the eastern portion, which straddles Montefiore St.

4.2 Vegetation

The vegetation has been assessed over a distance of 140 m from the existing bush vegetation both on and off site in all directions in accordance with Figure A2.1 of ***'Planning for Bushfire Protection' (2006)***.

Hamlet 1:

The vegetation that impacts upon Hamlet 1 to the East is the narrow strip of Coastal Heath along the coastal area between the Hamlet and the cliff top. There will be a "Coastal Walk", which also runs along the cliff top and through the vegetation. The area from the Hamlet to the cliff top is likely to be managed. With the absence of any significant area of vegetation and the low potential hazard there will be no bushfire APZ requirements for Hamlet 1 to the East.

To the South, South-west is vegetation comprising Tall Heath and proposed managed landscape. The slope under this vegetation is 7^0 down-slope. This area of vegetation separates Hamlets 1 and 2 and the coastal walk links these two Hamlets in the South-west. The coastal walk will provide access for fire services and will comply with the requirements for a Fire Trail. The area between Hamlets 1 and 2 will be managed as an APZ from the Hamlets to the Fire Trail/Coastal Walk.

Access will be provided by a network of roads capable of supporting a fully loaded fire appliance.

Services, water supplies for fire fighting will be provided by hydrants, which will be provided in the roads and at the end of each Carcourt in such locations that each dwelling is within 70 metres of a hydrant.

Electricity and Gas services will be provided underground

Hamlet 2:

The vegetation that impacts upon Hamlet 2 comprises

The area between Hamlets 1 and 2 (see Hamlet 1 above).

To the South of Hamlet 2 the vegetation is tall heath and the slope is 7^0 Down-slope, which requires a minimum APZ of 20 metres. The Coastal Walkway travels across the southern portion of Hamlet 2-5 this walkway will also comply with the requirements for a Fire Trail. The area between Hamlet 2 and the Fire Trail/Coastal Walkway will be managed as an APZ.

Hamlets 3-5.

The vegetation from Hamlet 3 to Hamlet 5 is Tall Heath; this vegetation runs across the southern area of the Hamlets, South-west of Hamlet 5 to Montefiore Street.

The vegetation on the northern side of Montefiore Street is Open Forest.

Hamlets 6-7

The vegetation around Hamlets is Tall Heath with a section of Open Forest between the two Hamlets.

4.3 Slope

Based on the site inspection, the slope of the land over a distance of 100 m from the indicative building lines in all directions has been assessed. In accordance with ***'Planning for Bushfire Protection' (2006)***, the slope has been assessed based on the gradient that will most significantly influence the fire behaviour of the site.

The slope that most significantly influences fire behaviour is as follows:

HAMLET	ASPECT	VEGETATION	SLOPE
1	East	Managed coastal walk, Short Heath	N/A
	South, South East & South West	Tall Heath	6^0 Downslope
2	East	Tall Heath	6^0 Downslope
	South & South West	Tall Heath	6-9^0 Downslope
3	South	Tall Heath/Woodland	7^0 Downslope
4 & 5	South-west	Tall Heath	3^0 Downslope
6	North	Open Forest	5^0 Downslope
	South	Tall Heath & Road	4^0 Upslope
	East	Open Forest	4^0 Downslope
	West	Tall Heath & Open Forest	4^0 Downslope
7	North	Open Forest	5^0 Downslope
	South	Tall Heath/Open Forest	9^0 Upslope
	East	Tall Heath & Open Forest	4^0 Downslope
	West	Open Forest	7^0 Upslope

4.4 Asset Protection Zone

The Asset Protection Zone (APZ) acts as a buffer zone between the development and the hazard. The primary purpose of an APZ is to ensure that a progressive reduction of bushfire fuels occurs between the bushfire hazard and any habitable structures. The APZ consists of an Inner Protection Area (IPA) and an Outer Protection Area (OPA).

The following table shows the minimum required Asset Protection Zones which attracts Level 3 construction for residential dwellings, the table also shows the proposed Asset Protection Zone which will comply with the requirements for Level 1 construction for all dwellings within 100 metres of unmanaged vegetation.

HAMLET	ASPECT	VEGETATION	SLOPE	Minimum APZ required	APZ Reqd for Level 3	APZ Reqd for Level 2	APZ Reqd for Level 1
1	East	Managed Coastal Walk	N/A	N/A	N/A	N/A	N/A
	South	Tall Heath (area between Hamlets 1 and 2 will be managed as an APZ)	6^0 Downslope	20m	17m	24m	35m
2	East	Tall Heath	6^0 Downslope	20m	17m	24m	
	South	Tall Heath	$6\text{-}9^0$ Downslope	20m	17m	24m	35m
3	South	Tall Heath\ Woodland	7^0 Downslope	20m	17m	24m	35m
4 & 5	South-west	Tall Heath	3^0 Downslope	15m	15m	22m	31m
6	North	Open Forest	5^0 Downslope	25m	25m	36m	49m
	South	Tall Heath & Road	4^0 Upslope	15m	13m	19m	27m
	East	Open Forest	4^0 Downslope	25m	25m	36m	49m
	West	Tall Heath & Open Forest	4^0 Downslope	25m	25m	36m	49m
7	North	Open Forest	5^0 Downslope	25m	25m	36m	49m
	South	Tall Heath & Open Forest	9^0 Upslope	20m	20m	29m	40m
	East	Tall Heath & Open Forest	4^0 Downslope	25m	25m	36m	49m
	West	Open Forest	7^0 Upslope	20m	20m	29m	40m

4.5 Level of Construction

Table A3.3 of ***'Planning for Bushfire Protection' (2006)*** allow the determination of the relevant level of construction in accordance with AS 3959-1999: ***Construction of Buildings in Bushfire-Prone Areas.***

All residential dwellings within 100 metres of unmanaged vegetation will be required to be constructed to a Level of construction in accordance with the Table in section 4.4 above subject to the available Asset Protection Zone.

4.6 Fire Fighting Personnel Access

4.6.1 Public Road Access

Access is provided to each Hamlet directly from Montefiore Street, which is capable of supporting fully loaded fire fighting vehicles.

4.6.2 Property Access

Property Access is available from Montefiore Street, the Hamlets are served by access roads and Carcourts all of which are capable of supporting a fully loaded fire fighting vehicle.

Access to any vegetation related to Hamlet 1 will be accessed from the Hamlet road network and hydrants will be available for structure or vegetation fires.

It is proposed to provide a fire trail around the southern area of Hamlets 2 to 5. This fire trail will form part of the walkway and link into the Hamlets at suitable locations via the Carcourts and / or the access roadways.

Fire trails will also be provided around Hamlets 6 and 7 and linked into the Hamlet road network at suitable locations to provide alternate access and egress from both Hamlets.

In the event that the development is staged, access would be provided by means of the provision of the fire trail for each individual Hamlet as developed. The design of the fire trail lends itself to staged development by means of the interconnection into each Hamlet whilst not having to be altered for completion of the whole development in particular Hamlets 1 to 5.

4.7 Electricity Supply

It is proposed that transmission lines providing power to the proposed development should be installed underground.

4.8 Gas

Reticulated or bottled gas shall be installed and maintained in accordance with AS/NZS 1596-2002: ***Storage and Handling of LP Gas*** and the requirements of the relevant authorities. If gas cylinders are to be kept close to buildings, the release valve must be directed away from the building and away from any hazardous materials such as firewood, so that it does not act as a catalyst to combustion.

4.9 Water Supply

Town reticulated water supply will available to the development. Hydrants will be located throughout the development and in particular where Carcourts interconnect with the fire trail. This will ensure that there are hydrants available for fire fighting at the interface between the APZ's and the unmanaged vegetation.

4.10 Recommendations

Based on Barry Eadie's site inspection and assessment, the following recommendations would be required for future development of dwellings on the lots:

(a) APZ's be provided in accordance with section 5.4 of this report;

(b) If any trees are to be located within the envisaged APZs, this is considered acceptable, providing the following conditions are met:

  (i) Canopies are a minimum of 2-5 metres apart;

  (ii) Canopies should not overhang buildings Vegetation is not to touch or overhang dwellings (canopy vegetation must not be within 5 metres of any building / dwelling);

  (iii) Vegetation is not species that retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period; and

  (iv) Vegetation is located far enough away from dwellings so that it will not ignite the dwelling by direct flame contact or radiant heat emission.

(c) Bushfire Risk Management Plan be prepared, to the Satisfaction of the Director General and be compatible with the existing Bushfire Risk Management Plan for the whole site.

(d) Woodpiles, combustible material storage sheds, large areas / quantities of garden mulch and stacked flammable building materials should not be located within IPA of dwellings;

(e) Reticulated or bottled gas shall be installed and maintained in accordance with AS/NZS 1596-2002: ***Storage and Handling of LP Gas*** and the requirements of the relevant authorities.

5 SITE ASSESSMENT - GWANDALAN

NAME: Rosecorp Pty Ltd

ADDRESS:

SITE ADDRESS: Lot 3 DP 588206
Kanangra Drive,
Gwandalan NSW 2259

COUNCIL: Wyong Shire Council

TYPE of AREA:

TYPE of DEVELOPMENT: Subdivision.

Barry Eadie conducted inspections of the site at Gwandalan and the surrounding area on 8 June 2007. The following assessment has been undertaken in accordance with the requirements of ***'Planning for Bushfire Protection' (2006)***. The proposal is for approval of the Community Title at Catherine Hill Bay and residential subdivision at Gwandalan.

5.1 Location

The site is 18 ha on the eastern side of Kanangra Drive, Gwandalan. Gwandalan Primary School is to the South, a reserve to the North, Lake Macquarie to the East and Kanangra Drive to the West.

5.2 Vegetation

The vegetation has been assessed over a distance of 140 m from the existing bush vegetation both on and off site in all directions in accordance with Figure A2.1 of ***'Planning for Bushfire Protection' (2006)***.

The vegetation that impacts upon the site is:

North:	Open Forest
North-west:	Tall heath
South:	Gwandalan Primary School
East:	Existing residential development and Lake Macquarie.
West:	Kanangra Drive then Low Forest beyond the roads reserve.

5.3 Slope

Based on the site inspection, the slope of the land over a distance of 100 m from the indicative building lines in all directions has been assessed. In accordance with ***'Planning for Bushfire Protection' (2006)***, the slope has been assessed based on the gradient that will most significantly influence the fire behaviour of the site.

The only vegetation that impacts upon the site is to the North and West, the slopes are as follows:

North: Open Forest 5^0 Upslope

North-west: Tall Heath 5^0 Downslope

West: Low Forest 5^0 Downslope beyond Kanangra Drive road reserve.

5.4 Asset Protection Zone

The Asset Protection Zone (APZ) acts as a buffer zone between the development and the hazard. The primary purpose of an APZ is to ensure that a progressive reduction of bushfire fuels occurs between the bushfire hazard and any habitable structures. The APZ consists of an Inner Protection Area (IPA) and an Outer Protection Area (OPA).

North:	Open Forest 5^0 Upslope	APZ 20m
North-west:	Tall Heath 5^0 Downslope	APZ 15m
West:	Low Forest 5^0 Downslope beyond Kanangra Drive road reserve.	APZ 25m

ASPECT	VEGETATION	SLOPE	Minimum APZ required	Available APZ
North	Open Forest	5^0 Upslope	20m	20m
North-west Lota 1-9	Tall Heath	5^0 Downslope	15m	15m
West	Road reserve then Low Forest	5^0 Downslope	25m	>25m Road reserve

5.5 Level of Construction

Table A3.3 of ***'Planning for Bushfire Protection' (2006)*** allow the determination of the relevant level of construction in accordance with AS 3959-1999: ***Construction of Buildings in Bushfire-Prone Areas.***

Proposed dwellings within 100 metres of the unmanaged vegetation will be required to comply with the requirements of Table A3.3 of ***Planning for Bush Fire Protection 2006***, based upon the minimum APZ requirement the level of construction would be Level 3.

5.6 Fire Fighting Personnel Access

5.6.1 Public Road Access

Access is provided from Kanangara Drive in three separate locations, Kanangara Drive is capable of supporting fully loaded fire fighting vehicles.

5.6.2 Property Access

Property Access is available from Kanangara Drive and all roads within the subdivision will be capable of supporting a fully loaded fire fighting vehicle.

5.7 Electricity Supply

It is proposed that transmission lines providing power to the proposed development should be installed underground.

5.8 Gas

Reticulated or bottled gas shall be installed and maintained in accordance with AS/NZS 1596-2002: ***Storage and Handling of LP Gas*** and the requirements of the relevant authorities. If gas cylinders are to be kept close to buildings, the release valve must be directed away from the building and away from any hazardous materials such as firewood, so that it does not act as a catalyst to combustion.

5.9 Water Supply

Town reticulated water supply will available to the development. Hydrants will be located throughout the development.

5.10 Recommendations

Based on Barry Eadie's site inspection and assessment, the following recommendations would be required for future development of dwellings on the lots:

(a) The APZ's be provided in accordance with section 6.4 of this report:

(b) If any trees are to be located within the envisaged APZs, this is considered acceptable, providing the following conditions are met:

(i) Canopies are a minimum of 2-5 metres apart and from buildings.

(ii) Canopies should not overhang buildings Vegetation is not to touch or overhang dwellings (canopy vegetation must not be within 5 metres of any building / dwelling);

(iii) Vegetation is not species that retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period; and

(iv) Vegetation is located far enough away from dwellings so that it will not ignite the dwelling by direct flame contact or radiant heat emission.

(c) Bushfire Risk Management Plan be prepared, to the Satisfaction of the Director General and be compatible with the existing Bushfire Risk Management Plan for the whole site.

(d) Woodpiles, combustible material storage sheds, large areas/quantities of garden mulch and stacked flammable building materials should not be located within IPA of dwellings;

(e) Reticulated or bottled gas shall be installed and maintained in accordance with AS/NZS 1596-2002: ***Storage and Handling of LP Gas*** and the requirements of the relevant authorities.

6 CONCLUSIONS

Barry Eadie has conducted a site inspection and assessment of the existing site. The assessment has been undertaken in accordance with ***'Planning for Bushfire Protection' (2006)*** and AS 3959-1999: ***Construction of Buildings in Bush Fire Prone Areas.***

Provided the recommendations stated above are implemented in full, Barry Eadie Consulting Pty Ltd is of the opinion that the proposed development achieves the intent of the relevant legislation and in particular the requirements as set out in ***'Planning for Bushfire Protection' (2006).***

7 REPORT BASIS INFORMATION

The report is based on the following:

(i) Site inspections carried out on 8 June 2007 by Barry Eadie;

(ii) Site Plan

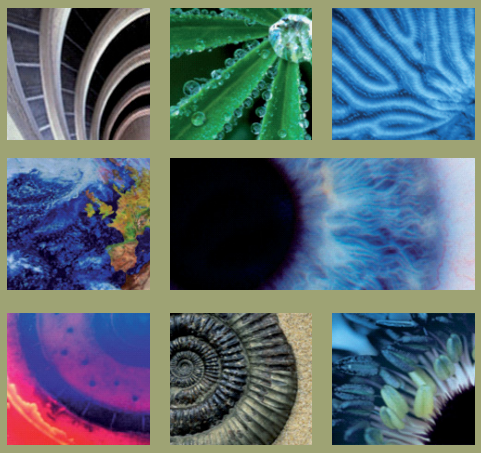
8 REFERENCES

- NSW Rural Fire Service, Planning NSW, ***'Planning for Bushfire Protection' (2006).***
- AS 3959-1999: ***Construction of Buildings in Bush Fire Prone Areas.***

APPENDIX A – PROPOSED DEVELOPMENT PLAN

Appendix P

ECOLOGICAL CONSTRAINTS REPORT - GWANDALAN



EPBC Addendum Report

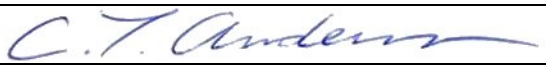
For Proposed Subdivision
Lot 3 DP 588206
Kanangra Drive
Gwandalan

Prepared for
Rosecorp Pty Ltd

Job Reference 24619 - August 2007

HARPER SOMERS O'SULLIVAN
PLANNING · SURVEYING · ECOLOGY
A member of RPS Group Plc

Prepared By:
Harper Somers O'Sullivan Pty Ltd
PO Box 428
Hamilton NSW 2303
Tel: (02) 4961 6500
Fax: (02) 4961 6794
Web: www.hso.com.au

PROJECT: EPBC ADDENDUM REPORT – LOT 3 DP588206 KANANGRA DRIVE, GWANDALAN	
CLIENT:	ROSECORP PTY LTD
OUR REF	24619
DATE:	14TH AUGUST 2007
APPROVED BY:	D. LANDENBERGER
SIGNATURE:	
CHECKED BY:	C. ANDERSON
SIGNATURE:	

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1 INTRODUCTION

This EPBC Addendum Report has been prepared to update and supplement previous surveys which have been undertaken within Lot 3 DP588206 Kanangra Drive, Gwandalan NSW, hereafter referred to as 'the site'. In particular the survey and assessment has targeted key seasonal/cryptic threatened flora species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

1.1 Site Description

The site is approximately 26ha in size and adjoins the southern boundary of the Point Wolstoncroft Sports and Recreation Area on the south western shores of Lake Macquarie. To the west the site is bound by Kanangra Drive, to the east with Lake Macquarie and to the south by existing residential development and Gwandalan Primary School.

There are several existing buildings present within the site and these include a caretaker's residence and associated gardens located in the south western corner near the main entrance. The main house, swimming pool, playground equipment, tennis court and boat ramp are located on the shores of Lake Macquarie in the eastern portion of the site. Along the south eastern boundary is a number of machine sheds and chicken coop. A bunk house and Chapel are located in the north eastern section of the site. Six constructed dams to retain runoff are located throughout the property.

A disused gravel pit is located within the north western corner of the property. Approximately 15ha of the property is vegetated with native vegetation which is in various states of condition.

The soils within the site are composed of the erosional landscape of Doyalson which is described as gently undulating rises on Munmorah Conglomerate. The alluvial landscape of Wyong is present within the eastern and south eastern portions of the site. This soil landscape is underlain by Quaternary sediments.

1.2 Previous Surveys

Wildthing Environmental Consultants prepared an Ecological Constraints Report (2003a). This report included flora survey of the site according to the procedures set out in Wyong Shire Council's Flora and Fauna Survey Guidelines. Targeted threatened flora searches were also undertaken in August 2003 for *Diuris praecox* (Double-tailed Orchid), *Caladenia tessellata* (Thick-lipped Spider-orchid), *Tetratheca juncea* (Black-eyed Susan) and *Cryptostylis hunteriana* (Leafless Tongue-orchid).

Four vegetation communities were delineated which include, Established Native Garden, Disturbed Open Woodland, Narrabeen Snappy Gum Forest and Narrabeen Coastal Sheltered Peppermint-Apple Forest. Two threatened flora species were identified within the site, *Tetratheca juncea* (Black-eyed Susan) and *Syzygium paniculatum* (Magenta Lillypilly). Both of these species are listed as vulnerable under the *Threatened Species Conservation Act 1995* and the federal *Environmental Protection and Biodiversity Conservation Act 1999.* It was considered that the three specimens of *Syzygium paniculatum* (Lillypilly) were planted within the Established Native Garden vegetation community as they were amongst other *Syzygium* species. 178 plants of *Tetratheca juncea* were located throughout both the Narrabeen Coastal

Sheltered Peppermint-Apple Forest and the Narrabeen Snappy Gum Forest during the targeted threatened flora surveys.

Fauna surveys also followed the Wyong Shire Council's guidelines and these included extensive trapping for mammals (including arboreal), reptile, amphibian, bird and bat surveys.

Three threatened fauna species were recorded within the site and these include *Tyto novaehollandiae* (Masked Owl), *Miniopterus australis* (Little Bent-wing Bat) and *Miniopterus schreibersii* (Large Bentwing Bat).

1.3 Memorandum of Understanding (MOU)

A MOU has been signed between the Minister for Environment, the Minister for Planning, Coastal Hamlets Pty Ltd and Lakeside Living Pty Ltd in which 86 ha has been set aside for development and the remaining 310 ha is proposed to be an environmental offset. The development lands are located at both Catherine Hill Bay and Gwandalan (this site). The offsets include lands at Catherine Hill Bay and Wallarah Pennisula adjoining Lake Macquarie.

1.4 Brief of Current Survey

This report has been prepared to update and supplement the previous report by Wildthing Environmental Consultants. The main focus was to perform targeted seasonal surveys for threatened EPBC flora species that may occur within the site. These species include, *Diuris praecox* (Double-tailed Orchid), *Caladenia tessellata* (Thick-lipped Spider-orchid), *Tetratheca juncea* (Black-eyed Susan), *Microtis angusii*, and *Cryptostylis hunteriana* (Leafless Tongue-orchid). *Syzygium paniculatum* (Magenta Lillypilly) was also searched for as this species was previously noted by Wildthing (2003), and is EPBC listed.

The second objective of this report was to review existing literature in relation to key threatened EPBC species that could occur within the site, to ensure that all matters/species of relevance to the *Environmental Protection and Biodiversity Conservation Act 1999* are adequately addressed.

Thirdly, the findings of above were related to the known ecological characteristics of the proposed offset areas, to assess their adequacy and suitability in this regard.

2 METHODS

2.1 Field Methods

A variety of field survey techniques were employed over the course of fieldwork for this assessment to target threatened flora species across the site. Where possible survey methods followed "Flora and Fauna Guidelines for Development" (Wyong Shire Council, 1999). The document Wyong Ground Orchid Survey (Gunninah Environmental Consultants 2003) was also consulted to obtain further information on the habitat of the targeted threatened orchids.

Whilst the Wyong Shire Council's guidelines suggest that some of the orchids mentioned above are best searched whilst performing Transects and Quadrat surveys of the site, all searches were undertaken using the Random Meander Technique. This involves walking in a random manner throughout the site, visiting the full range of potential habitats and recording any threatened flora species (Cropper, 1993).

All vegetated areas were searched utilising the above technique by two ecologists on the 13th August 2007. Where particular habitat was noted (eg *Diruris praecox* is known to prefer Grassy areas of *Themeda australis*), parallel transects were utilised to maximise the chances of finding a species.

2.2 Limitations of Methodology

A limitation of this survey is that it was performed outside the flowering period for both *Cryptostylis hunteriana* (Leafless Tongue-orchid) and *Caladenia tessellata* (Thick-lipped Spider-orchid). Table 2-1 is a list of the threatened flora species targeted and their optimum flower periods in which survey should ideally take place.

Table 2-1 Flowering Periods of Threatened Flora

Threatened Flora Species	TSC listed	EPBC listed	Survey Notes	Flowering Period (Best time to Survey) in Months of the Year											
				J	F	M	A	M	J	J	A	S	O	N	D
Caladenia tessellata	V	V										■	■	■	
Cryptostylis hunteriana	V	V												■	■
Diuris praecox	V	V									■	■			
Microtis angusii	E	E								■	■	■	■	■	
Syzygium paniculatum	V	V	Survey anytime											■	■
Tetratheca juncea	V	V		■								■	■	■	■

3 RESULTS

3.1 Caladenia tessellata

A small terrestrial orchid, which regrows its single leaf on an annual basis. It is known to occur in grassy woodland and locally it has potential to occur within Coastal Plains Scribbly Gum Woodland. It has been recorded within Munmorah State Recreation Area to the south east of the site. Gunninah Environmental Consultants (2003) report that this species favours low open forest with heathy or sometimes grassy understorey and Coastal Heathland.

No individuals of this species were located within the site. However it is noted that this species was not in flower at the time of the survey (See Table 2-1). Potential habitat is present within the Narrabeen Snappy Gum Forest vegetation community within the site.

3.2 Cryptostylis hunteriana

A cryptic Saprophytic orchid species that flowers between December and February. Distribution limits N-Gibraltar Range S- south of Eden. Grows in a variety of habitats from tall open forests to swamp heath on sandy soils. Local records exist from the Wallarah peninsula to the north of the site (NPWS Database Atlas).

No individuals of this species were detected however this species can occur anywhere that *Cryptostylis subulata* or *C. erecta* occur (Gunnindah Environmental Consultants, 2003). Both of the aforementioned species were recorded throughout both the Narrabeen Snappy Gum Forest and the Narrabeen Coastal Sheltered Peppermint-Apple Forest (Plate 3-1) within the site. These two species both flower at the same time as *Cryptostylis hunteriana* however they both have an aboveground leaf for the majority of the year, whereas *C. hunteriana* has no above ground leaf and exists as an underground tuber, except when flowering. Whilst no individuals of this species were detected, the survey was performed outside the flowering period (Table 2-1). Given the recorded presence of *C. subulata* and *C. erecta*, it is considered that there is potential habitat for *C. hunteriana* throughout the site.

Plate 3-1 *Cryptostylis erecta* leaves in Narrabeen Snappy Gum Forest

3.3 Diuris praecox

This species is found predominantly in coastal Eucalypt forests on hilltops or slopes. and has been recorded at a number of dry woodland locations to the south east of Lake Macquarie.

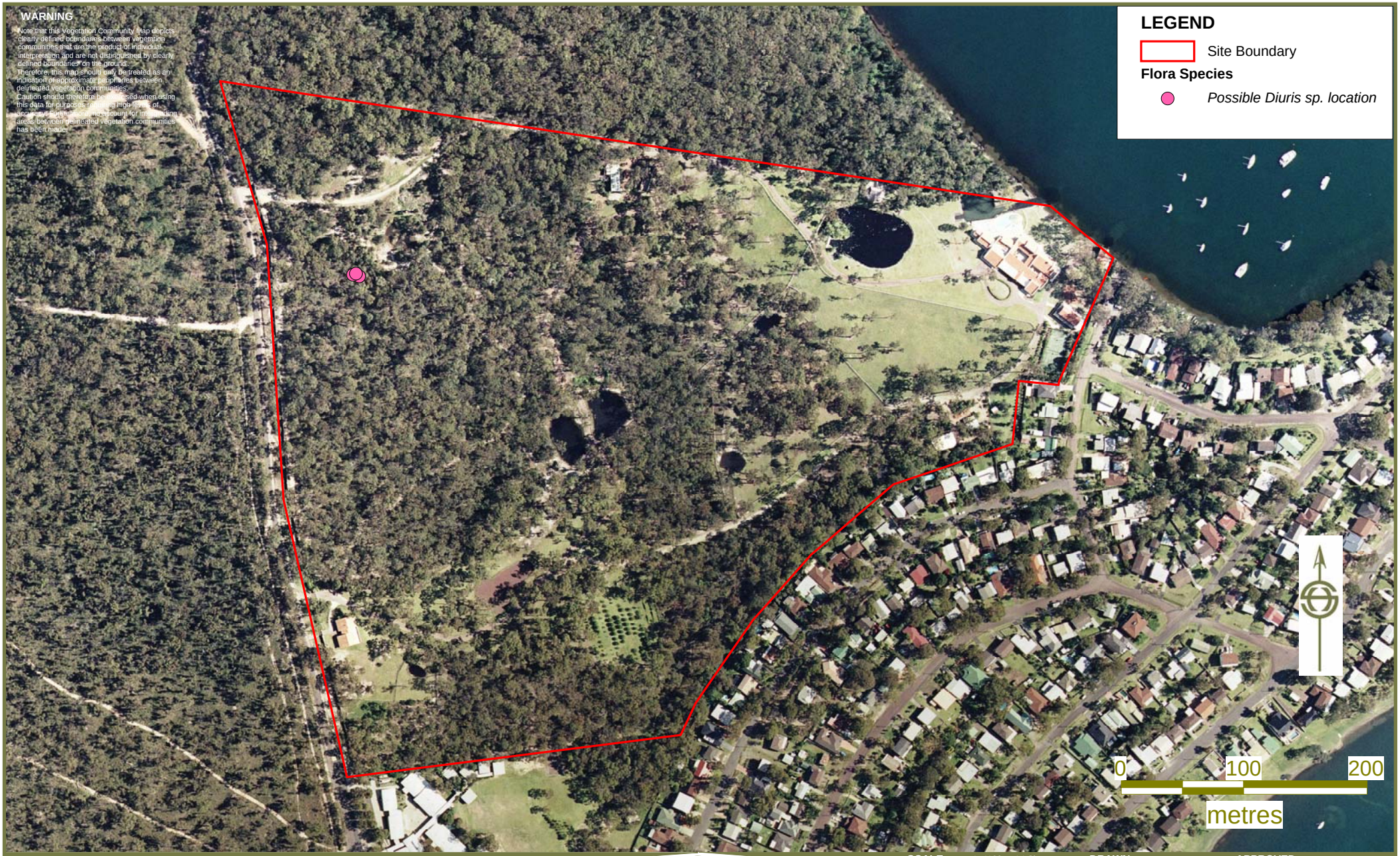
Seven individuals that could possibly be *Diuris praecox* were located within the north western portion of the site within the Narrabeen Snappy Gum Woodland. The flower heads have not yet opened and it is difficult to determine from vegetative characters alone if this is *Diuris praecox* or if it is another *Diuris sp.* or a different genus. The soils of Doyalson group and the Narrabeen Snappy Gum Forest provides habitat for *Diuris praecox.* In addition, the specimens were found in grassy habitats with *Themeda australis* which this species has been previously associated with (Gunnindah Environmental Consultants, 2003). Confirmation of identification would be required and it is expected that the flowers should open within the next 2 – 3 weeks. Plate 3-2 illustrates the orchid and Figure 3-1 shows the location within the site.

Plate 3-2 Possible *Diuris praecox*

3.4 Microtis angusii

Recorded from the Terry Hill's district of Sydney occurs upon disturbed soil horizons that were originally ridgetop lateritic soils supporting a distinctive open to low open forest community, Duffy's Forest Vegetation Community, which is listed as an EEC. Suspected occurrences in the southern Lake Macquarie hinterland are derived from a tentative record by Bell (1998) cited in NPWS (2005) in the Lake Macquarie State Recreation area, which occurs to the south of Gwandalan.

No specimens of this species was recorded during the current survey, however the ecotone between the Narrabeen Snappy Gum Forest and the Narrabeen Coastal Sheltered Peppermint Forest located in the south east of the site, provides potential habitat for this species.



TITLE: POSSIBLE DIURIS SP. LOCATION

CLIENT: ROSECORP PTY LTD

SCALE: 1: 4100 at A4 Size **DRAWN:** D. Landenberger **APPROVED:** C. Anderson

DATUM: MGA Zone 56 (GDA 94) **DATE:** 14/8/2007

LAYOUT REF: J:\JOBS\24k\24619 - Gwandalan\Drafting\Mapinfo\24619_Diuris_Location_A-A4

CONTOUR INTERVAL: N/A

JOB REF: 24619

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Figure 3-1
Page 6

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

3.5 Syzygium paniculatum

A shrub to small tree, found in sub-tropical and littoral rainforest on sandy soils or sheltered gullies mostly near water courses. Distribution is mainly between Bulahdelah and Jervis Bay. Hunter Region records confined to the Lake Macquarie hinterland (Atlas of NSW Wildlife data).

This species was located by Wildthing (2003) in the Native Garden in the south east of the site and these species are planted as they occur with other Syzygium species which are not locally occurring. In addition, there is no rainforest present within the site and it is considered that no potential habitat for this species is present within the site.

3.6 Tetratheca juncea

Occurs in a variety of forested and heathy habitats. Locally found in Open Forests and Woodlands with dense, undisturbed understorey, often in association with *Angophora costata* / *Corymbia gummifera* on slopes with south-easterly aspects. A number of records exist from the local area including the Gwandalan peninsula (Atlas of NSW Wildlife data).

Wildthing (2003) conducted intensive targeted searches for this species and located 175 specimens throughout the native vegetation areas of the site. The current survey confirmed the extent of the population and the species was budding up with a few flowers present on some specimens. The main population was observed to be within the Narrabeen Snappy Gum Forest within the north west of the site, however the species occurred throughout the site (as mapped by Wildthing 2003a).

4 CONCLUSIONS

The following EPBC listed species were identified within the site:-

- *Tetratheca juncea* was confirmed as occurring within the site.
- Seven individuals that could **possibly be** *Diuris praecox* were identified.
- Three specimens of *Syzygium paniculatum* were identified within the Established Native Garden vegetation community and are probably planted.

The following EPBC listed species have potential habitat within the site but were not identified during the current survey:-

- *Caladenia tessellata;*
- *Cryptostylis hunteriana;*
- *Microtis angusii.*

4.1 Vegetation Communities in Offset Lands

As part of the MOU (Section 1.3) 310 ha of land of which the majority is native vegetation will be set aside for environmental offsets. Wildthing (2003b & 2003c) have performed intensive surveys over part of the environmental offsets and the proposed development area at Catherine Hill Bay. The vegetation communities that were delineated include:-

1. Estuarine Swamp Oak Forest (EEC – under TSC Act 1995);
2. Estuarine Mangrove – Saltmarsh Complex (EEC – under TSC Act 1995);
3. Coastal Sand Mahogany – Paperbark Swamp Forest (EEC – under TSC Act 1995);
4. Narrabeen Wallarah Sheltered Grassy Forest;
5. Munmorah Palm – Apple Drainage Line Forest; and
6. Coastal Headland Complex (Shrubland Variant).

A parcel of land to the north of the Part Lot 6 DP774923 has not to date been subject to any ecological investigations, so aerial photograph interpretation and use of the Bell (2002) mapping was undertaken to predict possible vegetation communities in this offset area, as follows:-

1. Estuarine Swamp Oak Forest (EEC – under TSC Act 1995);
2. Estuarine Mangrove – Saltmarsh Complex (EEC – under TSC Act 1995);
3. Coastal Sand Mahogany – Paperbark Swamp Forest (EEC – under TSC Act 1995);
4. Narrabeen Wallarah Sheltered Grassy Forest;
5. Narrabeen Foreshore Redgum Ironbark Forest; and
6. Munmorah Palm – Apple Drainage Line Forest.

4.2 Habitat for Threatened Flora

Table 4-1 is a summary of the potential habitats which exists in the offset areas for the threatened flora species which have potential habitat within the site. The dominant vegetation community within the offset lands is Narrabeen Wallarah Sheltered Grassy Woodland and this vegetation community provides potential habitat for all of the EPBC listed threatened flora species which have been identified within the site or have potential habitat within the site.

Table 4-1 Potential Habitat for Threatened Flora Species in the Offset lands

Potential Habitat	Threatened Flora					
	Caladenia tessellata	*Cryptostylis hunteriana*	*Diruris praecox*	*Microtis anugusii*	*Syzygium paniculatum*	*Tetratheca juncea*
Estuarine Swamp Oak Forest						
Estuarine Mangrove – Saltmarsh Complex						
Coastal Sand Mahogany – Paperbark Swamp Forest					✓	
Narrabeen Wallarah Sheltered Grassy Forest	✓	✓	✓	✓		✓
Munmorah Palm – Apple Drainage Line Forest					✓	
Narrabeen Foreshore Redgum Ironbark Forest	✓	✓	✓			✓
Coastal Headland Complex (Shrubland Variant).	✓		✓			✓

During the surveys within the offset lands potential habitat for *Cryptostylis hunteriana* was observed within the Narrabeen Wallarah Sheltered Grassy Forest, with the presence of the associated *Cryptostylis subulata* observed throughout this vegetation community.

4.3 Threatened Flora Species Recorded in the Offset Lands

Wildthing (2003b) performed targeted *Tetratheca juncea* searches and recorded 55 individuals within the Narrabeen Wallarah Sheltered Grassy Woodland and eight individuals were recorded within the same community at the Catherine Hill Bay land holdings. A review of the NPWS Atlas revealed that several sightings for *Tetratheca juncea* have been recorded within the site.

4.4 Concluding Statement

The habitat for the threatened flora species which have been recorded within the site or have potential habitat within the Gwandalan site have potential habitat within proposed conservation offset lands which is far greater in area (at least 5 fold) than that which is proposed to be removed for the development. In addition, *Tetratheca juncea* has been recorded throughout the offset areas and it is not considered that this species will be adversely impacted upon by the proposal.

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Wyong Shire Council (1999) *Flora and Fauna Guidelines for Development.*

APPENDIX A CV'S OF PERSONNEL INVOLVED IN PROJECT

Curriculum Vitae

Name:	CRAIG ANDERSON
Office:	RPS HARPER SOMERS O'SULLIVAN
Position in Company:	Director - Environment
Qualifications / Memberships:	Bachelor Applied Science (Environmental Assessment & Management) University of Newcastle, NSW (1994) Currently undertaking Graduate Diploma in Archaeological Heritage through University of New England Ecological Consultants Association of NSW (ECA) Planning Institute of Australia (PIA) Frog and Tadpole Study Group (FATS) Hunter Birds Observers Club (HBOC) Bird Observers Club of Australia (BOCA) Australasian Bat Society (ABS) Hunter Heritage Network (HHN) Waterways Authority Boating Licence NSW Driver's Licence (Class C) OH&S Induction Training (Green Card) NPWS Scientific Investigation Licence NSW Animal Ethics Research Authority

Areas of Expertise:

- Production of complex ecological impact assessment documents
- Detailed understanding of environmental legislation
- Conflict resolution and environmental impact mediation
- Land and Environment Court hearings
- Flora, habitat, and fauna surveys including threatened species
- Bushfire Threat Assessment & Management reporting
- Project Management (including areas outside environmental concern)

Experience Includes:

2001 – current	Director - Environment RPS Harper Somers O'Sullivan, Newcastle.
2000 – 2001	Senior Ecologist & NSW Projects Manager Wildthing Environmental Consultants, Salt Ash.
1996 – 1999	Ecologist Wildthing Environmental Consultants, Salt Ash.
1995 – 1996	Ecologist / Environmental Officer Pulver Cooper & Blackley, Newcastle.

Curriculum Vitae

Name:	ALLAN RICHARDSON
Office:	RPS HARPER SOMERS O'SULLIVAN
Position in Company:	Ecologist
Qualifications / Memberships:	B.Env.Sc. (Environmental Management) B.Env.Sc. (Hons) (Biology) 2002 Hunter Environmental Institute Scholarship Hunter Bird Observers Club Waterways Authority Boating Licence NSW Driver's Licence (Class C) OH&S Induction Training (Green Card) NPWS Scientific Investigation Licence NSW Animal Ethics Research Authority

Areas of Expertise:

- Ornithological Surveys and Research
- Terrestrial flora and fauna surveys
- Flora & Fauna Assessment and Reporting
- GPS Survey and GIS Mapping Projects
- Site and Logistics Management
- Tertiary Tutoring and Demonstrating

Experience Includes:

Jan 2005 – Current	Ecologist RPS Harper Somers O'Sullivan
Jul 2003 – May 2004	Casual Tutor/Demonstrator The University of Newcastle
Jul – Nov 2003	Casual Tutor/Demonstrator The University of Newcastle
Jan 2002	Ornithological Surveyor Wetland Care Australia, Ballina
Nov 1998 – Sep 2000	Manager, Caretaker, Ecologist Yarrahapinni Youth, School and Ecology Centre
Nov 1997	Ornithological Surveyor State Forests
1979 – 1998	Metal Fabrication Trade and Sub-contract Carpentry

Curriculum Vitae

Name: DEBORAH LANDENBERGER

Office: RPS HARPER SOMERS O'SULLIVAN

Position in Company: Ecologist/ Botanist

Qualifications / Memberships: B. Sc (Hons)

Australian Plant Society
Australian Ecological Society
Australasian Native Orchid Society
NSW Driver's Licence (Class C)
OH&S Induction Training (Green Card)
NPWS Scientific Investigation Licence
NSW Animal Ethics Research Authority

Key Clients: HEZ Nominees P/L
Hardie Holdings P/L
Hunter Land P/L

Areas of Expertise:

- Expert Botanist
  - Flora identification and habitat assessment
  - Targeted threatened flora surveys
  - Delineation and mapping of vegetation communities
  - Endangered Ecological Community (EEC) assessment
- Project Management and quote preparation
- Fauna habitat identification
- Experience with GPS/GIS for project design and mapping
- Environmental reporting and assessment
- Detailed understanding of environmental legislation

Experience Includes:

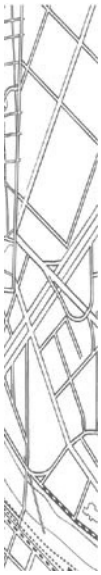
June 2006 – Current Ecologist/ Botanist
RPS Harper Somers O'Sullivan, Broadmeadow, NSW

Mar 2005 – Jun 2006 Botanist
Conacher Travers, Gosford, NSW

Dec 2004 – Mar 2005 Research Assistant/Casual Demonstrator
University of Newcastle, Newcastle, NSW

Appendix Q

TRAFFIC ASSESSMENT - GWANDALAN



Traffic Report

Kanangra Drive Gwandalan Subdivision

6 August 2007

Prepared for

Rose Property Group

Suite 20/809 Pacific Highway
Chatswood NSW 2067
(t) 02 9410 4100 **(f)** 02 9410 4199
(e) info@mwttraffic.com.au
(w) www.mwttraffic.com.au

MASSON | WILSON | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS

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1. Introduction

This report has been prepared on behalf of Rose Property Group to present the findings of an investigation of the transport implications of a proposed residential subdivision of Lot 3 DP588206 at Gwandalan.

This report has examined the existing traffic conditions in the vicinity of the site, estimated the likely generation of the proposed development, and assessed the impacts of the additional traffic on local conditions. The layout of the subdivision has been reviewed.

The remainder of the report is set out as follows:

- Chapter 2 reviews the existing traffic conditions, including the road network, traffic volumes, operation of intersections and public transport accessibility.
- Chapter 3 describes the proposed subdivision.
- Chapter 4 assesses the likely peak hour traffic generation of the subdivision, and its impacts on traffic conditions. The layout of the subdivision is also reviewed.
- Chapter 5 presents a summary of the investigation and its conclusions.

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2. Existing Situation

An appreciation of the existing traffic conditions can be gained by examining the road network, traffic volumes, and the operation of key intersections in the vicinity of the site. These aspects are discussed in this section.

2.1 Site Location

The subject site is located on the eastern side of Kanangra Drive at Gwandalan, as shown in **Figure 1**. It is bounded to the north by Point Wolstoncroft Sport and Recreation Centre, and to the south by Gwandalan Public School, and to the southeast by existing residences which front Billbabourie Road and Garema Road. The site has a small frontage to Lake Macquarie at its eastern end.

2.2 Existing Road Network

The existing road network in the vicinity of the subject site is briefly described below.

Kanangra Drive extends northwards from Pacific Highway, and provides the only vehicular access for Gwandalan, Summerland Point, and Point Wolstoncroft, connecting to Pacific Highway at a signalised intersection. It intersects with Summerland Road at a roundabout, and with Parraweena Road and Orana Road at priority controlled intersections. Parraweena Road and Orana Road form part of a loop road around Gwandalan, and they provide access to other local residential streets.

2.3 Existing Traffic Volumes

In order to quantify the existing traffic conditions in the vicinity of the site, surveys of vehicle movements were undertaken at the following locations:

- Kanangra Drive, Pacific Highway and Blue Wren Drive
- Kanangra Drive and Summerland Road
- Kanangra Drive and Parraweena Road
- Kanangra Drive and Orana Road
- Orana Road and Billbabourie Road.

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The surveys were undertaken during the morning period on Thursday 2 November 2006, and during the evening peak period on Wednesday 1 November 2006. The morning peak hour occurred between 8:00am and 9:00am, and the evening peak hour between 3:30pm and 4:30pm.

It is noted that during the morning survey, road works were underway on Kanangra Drive which resulted in some delays to traffic entering and exiting Gwandalan during the survey period. This resulted in some fluctuations in the volume of traffic exiting Kanangra Drive measured on a 15 minute basis. The survey results have been adjusted to smooth out the fluctuations which would not be typical. As this is the only route available for traffic travelling into and out of Gwandalan, it is expected that the overall surveyed volumes would be similar to those on a "typical" weekday.

Also during the morning survey, it is noted that an orientation day was conducted at Gwandalan Public School, which started at 9am. This is likely to have attracted some additional trips in the vicinity of the school. In the context of this study, this additional traffic is not considered significant, as the overall numbers would be relatively low, and a proportion of the families would have been attending the school anyway.

The peak hour turning movements are presented in **Figure 2**, and are summarised in the following table. The survey results are presented in Appendix A.

Table 2.1 – Existing Peak Hour Two Way Traffic Volumes (veh/hr)

Road	Location	8:00-9:00am	3:30-4:30pm
Billbabourie Road	North of Orana Road	35	37
Blue Wren Drive	South of Pacific Highway	14	27
Kanangra Drive	North of Pacific Highway	600	597
	North of Summerland Road	524	555
	North of Parraweena Road	285	205
	North of Orana Road	262	56
Orana Road	East of Kanangra Drive	208	151
	East of Billbabourie Road	162	135
Pacific Highway	West of Kanangra Road	1,604	1,744
	East of Kanangra Drive	1,238	1,372
Parraweena Road	East of Kanangra Drive	334	381
Summerland Road	West of Kanangra Drive	391	442

The results show the dominance of Pacific Highway, and that the Gwandalan and Summerland Point areas generate some 600 vehicle trips per hour in and out of the local area during the peak hours. It is noted that the surveyed volume on Kanangra Drive north of Orana Road was significantly higher during the morning peak than the evening peak. This may be due to activity associated with the school, which was conducting an orientation session on the surveyed day.

2.4 Existing Operation of Intersections

The key intersections have been analysed using SIDRA Intersection analysis program. SIDRA Intersection determines the average delay that vehicles encounter, the degree

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of saturation of the intersection, and the level of service. The degree of saturation, known as the x-value, is the ratio of the arrival rate of vehicles to the capacity of the approach. SIDRA Intersection provides analysis of the operating conditions which can be compared to the performance criteria set out in Table 2.2.

Table 2.2 – Level of Service Criteria

Level of Service	Average Delay per Vehicle (secs/veh)	Signals & Roundabouts	Give Way & Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & Spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Extra capacity required	Extreme delay, traffic signals or other major treatment required

Adapted from RTA Guide to Traffic Generating Developments, 2002.

The results of the analysis are presented in Table 2.3.

Table 2.3 – Existing Intersection Operating Conditions

Intersection	Control	X-Value		Average Delay (sec/veh)		Level of Service	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Kanangra/Pacific	signals	0.64	0.54	18.4	14.5	B	B
Kanangra/Summerland	roundabout	0.27	0.32	12.0	12.4	A	A
Kanangra/Parraweena	priority	0.23	0.22	7.8	7.7	A	A
Kanangra/Orana	priority	0.16	0.06	5.9	5.1	A	A
Orana/Billbabourie	priority	0.05	0.04	5.8	5.6	A	A

Avg Delay is over all movements at signals, and for the worst movement at priority and roundabouts

The results demonstrate that the intersections currently operate at good levels of service, with spare capacity and short delays. Detailed results for each intersection are presented in Appendix B, showing 95th percentile queues and delays to each movement.

2.5 Public Transport

Gwandalan is served by Busways Wyong Route 99. This service commences at Lake Haven Shopping Centre and travels along the Pacific Highway through Charmhaven and Blue Haven, diverting into Blue Haven on Roper Road. It continues along the Pacific Highway to Doyalson North and diverts into Lake Munmorah on Boronia Road and Elizabeth Bay Drive. The route travels along Kanangra Drive and operates a circuit around Summerland Point and Gwandalan before returning back to the Pacific

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Highway and continuing to Catherine Hill Bay, Nords Wharf, Swansea and Charlestown.

At Gwandalan, the bus travels in a clockwise loop along Kanangra Drive, Orana Road, Winbin Crescent, Gamban Road, and Parraweena Road to Kanangra Drive.

Route 99 operates six services each way on weekdays, five services each way on Saturdays, and two services each way on Sundays. The weekday timetable varies between school days and school holidays, and a school bus route links Summerland Point and Gwandalan with Gwandalan Public School.

2.6 Holiday Period Traffic and Background Growth

Traffic volumes are expected to continue to increase along the Pacific Highway as the population continues to grow between the Central Coast and Newcastle. For analysis purposes, a 2 percent per annum growth rate was assumed for a 10 year analysis period.

Pacific Highway is subject to variations in traffic volumes during holiday periods, which may influence the operation of the intersection of Pacific Highway and Kanangra Drive. Holiday traffic influences are unlikely to significantly affect the intersections within Summerland Point and Gwandalan.

In order to assess the implications of the development on the intersection during holiday periods, a review has been undertaken of the seasonal variation in traffic flows on Pacific Highway, with reference to the RTA's permanent count station on Pacific Highway 2km south of Swansea Bridge. It is usual to consider the 85th percentile traffic demands, and the review has found that 2001 daily flows in the first week of November are slightly above the 85th percentile planning level.

The busiest period of the year is December-January, and the highest weekly flow was around 3% above the flow during the first week of November. As a "worst case" the operation of the intersection has been reviewed for the holiday period assuming that the peak hour through volumes on Pacific Highway would be increased by 3% above the surveyed volumes, and then assuming ten years of growth as well. The resulting two way traffic volumes are summarised in Table 2.4.

Table 2.4 – Traffic Volumes on Pacific Highway (veh/hr)

Location	AM Peak			PM Peak		
	Surveyed	Holiday	Holiday + 10yr Growth	Surveyed	Holiday	Holiday + 10yr Growth
West of Kanangra Drive	1,604	1,638	1,869	1,744	1,781	2,039
East of Kanangra Drive	1,238	1,271	1,503	1,372	1,409	1,667

The results of the intersection analysis are summarised in Table 2.5, and detailed results for each movement are provided in Appendix B.

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Table 2.5 – Pacific Hwy/Kanangra Dr Operating Conditions

Scenario	X-Value		Average Delay (sec/veh)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Surveyed	0.64	0.54	18.4	14.5	B	B
Holiday	0.65	0.55	18.4	14.5	B	B
Holiday plus 10 Years' Growth	0.64	0.60	19.0	14.5	B	B

Avg Delay is over all movements at signals

The results indicate that the intersection would still operate satisfactorily with ten years of growth in traffic along the highway during the busiest week of the year.

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3. Proposed Subdivision

It is proposed to subdivide the subject site to contain 215 residential lots. Vehicular access is proposed to be provided via three new tee intersections on Kanangra Drive.

The proposed layout of the subdivision is presented in **Figure 3**.

The road layout allows for extension of the existing Route 99 bus service through the subdivision.

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4. Impacts of the Subdivision

4.1 Traffic Generation

The peak period traffic generation of the proposed subdivision has been estimated using the results of surveys of residential developments conducted by the NSW Roads and Traffic Authority. The RTA guidelines[1] suggest that dwelling houses generate an average of 0.85 vehicle trips per dwelling during morning and evening peak hours. This rate is based on surveys of new residential subdivisions with limited public transport facilities, and is considered appropriate for the Gwandalan subdivision.

On this basis, the proposed 215 lots would be expected to generate 183 vehicle trips per hour during the weekday morning and evening peak hours.

4.2 Traffic Distribution

The RTA guide notes that typically, around 25% of trips are generated internal to residential subdivisions, involving local shopping, schools and local social visits. In this case, it would be expected that these "internal" trips would be within the local Gwandalan and Summerland Point area, while the "external" trips would involve trips along Kanangra Drive to/from Pacific Highway.

The surveys of existing conditions indicate that during the morning peak, around 70% of total traffic in and out of Gwandalan/Summerland Point is outbound, and in the evening peak, around 65% is inbound. These proportions are likely to be reflected by the additional traffic generated by the subdivision, and therefore have been applied to the externally generated trips.

Internal trips are likely to be spread throughout the local area, with key generators being the Public School, Bowling Club, shops, and the residential areas within Gwandalan and Summerland Point.

4.3 Future Traffic Volumes

The additional traffic has been added to the road system according to the distribution discussed above. The resulting turning movements at key intersections are presented

[1] "Guide to Traffic Generating Developments" Roads and Traffic Authority of New South Wales, October 2002

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in **Figure 4**, and the two way volumes are summarised in Table 4.1. The future volumes include ten years of background growth on Pacific Highway, as discussed in Section 2.6.

Table 4.1 – Existing and 10 Year Future Peak Hour Two Way Traffic Volumes (veh/hr)

Road	Location	AM Peak		PM Peak	
		Surveyed	Future[A]	Surveyed	Future[A]
Billbabourie Road	North of Orana Road	35	35	37	37
Blue Wren Drive	South of Pacific Highway	14	15	27	29
Kanangra Drive	North of Pacific Highway	600	737	597	734
	North of Summerland Road	524	673	555	704
	North of Parraweena Road	285	448	205	368
	North of Orana Road	262	445	56	239
Orana Road	East of Kanangra Drive	208	228	151	171
	East of Billbabourie Road	162	172	135	145
Pacific Highway	West of Kanangra Road	1,604	1,938	1,744	2,106
	East of Kanangra Drive	1,238	1,488	1,372	1,647
Parraweena Road	East of Kanangra Drive	334	348	381	395
Summerland Road	West of Kanangra Drive	391	403	442	454

[A] Future includes 10 years of background growth and development traffic

The results demonstrate that the greatest increases in traffic would be expected to occur along Kanangra Drive, as this is the only route for traffic in and out of Gwandalan. Increases on other local roads would be minor.

4.4 Future Operation of Intersections

The key intersections have been reanalysed using SIDRA Intersection, to determine what impact the additional traffic can be expected to have on their operating conditions. The results are presented in Table 4.2. As a worst case assessment, the subdivision traffic has been assigned to a single access intersection off Kanangra Drive, which will tend to overestimate the delays experienced at any one of the three access intersections. Detailed results are provided for each movement in Appendix C.

Table 4.2 – Existing and 10 Year Future Intersection Operating Conditions

Intersection		X-Value		Average Delay (sec/veh)		Level of Service	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Kanangra/Pacific	Existing	0.64	0.54	18.4	14.5	B	B
	Future	0.75	0.58	21.1	15.6	B	B
Kanangra/Summerland	Existing	0.27	0.32	12.0	12.4	A	A
	Future	0.35	0.40	12.1	12.9	A	A
Kanangra/Parraweena	Existing	0.23	0.22	7.8	7.7	A	A
	Future	0.28	0.28	8.9	8.2	A	A
Kanangra/Orana	Existing	0.16	0.06	5.9	5.1	A	A
	Future	0.21	0.13	7.2	5.7	A	A
Orana/Billbabourie	Existing	0.05	0.04	5.8	5.6	A	A
	Future	0.06	0.05	5.8	5.6	A	A
Kanangra/Subdivision	Future	0.14	0.10	5.6	5.1	A	A

Avg Delay is over all movements at signals, and for the worst movement at priority and roundabouts

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The results demonstrate that the intersections would continue to operate at satisfactory levels of service, with only short delays to traffic and spare capacity with the additional traffic generated by the proposed subdivision.

4.5 Future Holiday Traffic

As discussed in Section 2.6, the operation of the intersection of Pacific Highway with Kanangra Drive has been reviewed with regard to traffic conditions during the busiest week of the year. The operation of the intersection has been reassessed for this busiest week with the additional traffic generated by the proposed subdivision, and the results are summarised below. Detailed results for each movement are presented in Appendix C.

Table 4.3 – Holiday Pacific Hwy/Kanangra Dr Operating Conditions

Scenario	X-Value		Average Delay (sec/veh)		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Holiday	0.65	0.55	18.4	14.5	B	B
Holiday + 10yrs Growth	0.64	0.59	19.0	14.5	B	B
Holiday + 10yrs Growth + Subdivision	0.73	0.58	21.6	15.6	B	B

Avg Delay is over all movements at signals

The results indicate that the intersection can be expected to operate at satisfactory levels of service with holiday background traffic on Pacific Highway, background growth and the additional traffic generated by the proposed subdivision.

4.6 Public Transport

The proposed layout of the roads within the subdivision allows for the extension of the existing Route 99 bus service through the site without needing to amend any part of the existing route through Gwandalan.

The timing of the extension of the service would be determined by the operator, however it is recommended that it be undertaken as early as possible once the subdivision becomes populated. The Wyong Shire Community Plan 2002 identifies that new release areas tend to be poorly serviced by public transport as the bus companies need sufficient volumes of people to run viable services, and contracts are not awarded until population thresholds are reached. Delays in providing the services mean that residents become used to using their own vehicles and it is then difficult to encourage use of public transport.

It is anticipated that bus service levels would increase with the additional population to be served. This would be of benefit to existing residents as well as to those in the proposed subdivision.

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4.7 Road Layout

The proposed layout of the subdivision has been reviewed with respect to the requirements of Council's DCP66 Subdivision (2000). The DCP sets out "default standards" for acceptable characteristics of residential streets.

The internal road system is shown in **Figure 3** of this report, and is made up of the following:

- Road 1 – forms a loop around the outside of the subdivision, and intersects with Kanangra Drive at both its ends.
- Road 5 which extends east-west between Kanangra Drive and Road 1
- Road 2, which forms an L-shaped link between Road 1 near Kanangra Drive at the northern end of the site and Road 1 at the eastern side of the site
- Road 3 which extends east-west between Road 2 and Road 1
- Road 4 which forms a loop to and from Road 1 in the southern portion of the site.

The internal road which could accommodate the extension of the bus service (Road 1) is proposed to have a road reserve width of 22.0m, which is slightly less than the DCP's requirement for a 23.0m road reserve width for bus route streets. It is understood that this slight deviation from the DCP has been discussed with Council officers, and is considered to be satisfactory as along most of this route, there are only properties on one side of the road, and it is likely that buses would only travel in one direction around the subdivision. Parking would be permitted along the carriageway, and 1.2m wide footpaths would be provided on one side of the road. It is noted that the DCP requires footpaths on both sides of bus route roads, however this deviation from the DCP is satisfactory because along most of this route, there are only residential properties on one side of the road, so there would not be a demand for footpaths on both sides.

Road 5 is proposed to have a road reserve width which tapers from approximately 33m at its western end, to 17m at its eastern end. The road is proposed to be constructed as two one way carriageways, each 5.5m wide, with a landscaped median. A u-turn bay is proposed midway along Road 5 to allow eastbound traffic to u-turn to travel west. This carriageway width would allow parking along the kerb, and 1.2m wide footpaths are proposed on either side, within the 4.5m wide verges.

The other internal roads are proposed to have 16.5m road reserve, with a 7.5m carriageway, and verges which vary between 3.0 and 6.0m, and a 1.2m paved footpath on one side of the road. This reserve width complies with the requirements of the DCP for access streets. The layout of the road system encourages drivers to use the collector/bus route street to travel between Kanangra Drive and the access streets, and the access streets would not tend to be used as through routes due to their connectivity. This will ensure that traffic volumes on the access streets remain below 1,000 vehicles per day as indicated in the DCP.

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In order to limit vehicle speeds to the maximum street speeds set out in the DCP, it is recommended that appropriate measures to control speed be included on those lengths of road where speeds would otherwise exceed 40kph on access streets and 50kph on collector/bus route streets. Based on the design elements set out in the AMCORD guidelines[2] (to which the DCP refers) the length of street between slow points/bends will vary according to the design speed at the slow point or bend, and the carriageway width. Assuming 20kph slow points, the maximum length of roadway between slow points should be 100-160m to achieve a design speed of 40kph, and 120-155m to achieve a design speed of 50kph. These should be included on road design plans when they are prepared.

A pedestrian path is proposed to extend north-south through the subdivision. The 2.5m wide path is proposed to be within a 10m wide reservation, and traffic calming devices are proposed where this path crosses roads.

The overall layout of the road system is considered to be satisfactory, providing for the movement of vehicles (including buses), bicycles and pedestrians.

[2] *AMCORD (Australian Model Code for Residential Development) – A National Resource Document for Residential Development,* Commonwealth Department of Housing and Regional Development, 1995.

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5. Summary and Conclusions

5.1 Summary

Existing Situation

- The subject site is located on the eastern side of Kanangra Drive at Gwandalan, to the north of Gwandalan Public School.
- Kanangra Drive provides the only vehicle link between Gwandalan/Summerland Point and Pacific Highway.
- Surveys of peak period vehicle movements show that Kanangra Drive carries some 260 and 60 vehicles per hour north of Orana Road during the morning and afternoon periods respectively.
- The intersections in the vicinity of the site operate at satisfactory levels of service during the peak hours.
- Gwandalan is served by Busways Route 99, which operates a limited number of services connecting Gwandalan and Summerland Point with Lake Haven, Charmhaven, Blue Haven. Doyalson North, Lake Munmorah, Catherine Hill Bay, Nords Wharf, Swansea and Charlestown.
- During the busiest week of the year, traffic flows on Pacific Highway would be some 3% higher than those surveyed. Analysis indicates that the intersection of Pacific Highway and Kanangra Drive would continue to operate at satisfactory levels of service with the additional holiday period traffic.

Proposed Subdivision

- It is proposed to subdivide the site to contain 215 residential lots.
- Vehicular access is proposed via three new tee intersections on Kanangra Drive.

Impacts of the Subdivision

- The subdivision would be expected to generate some 183 vehicle trips per hour during the weekday morning and evening peak hours.
- Around 25% of generated trips would be internal to Gwandalan and Summerland Point, being local shopping and school trips and the like.
- The greatest increases in traffic resulting from the subdivision would occur on Kanangra Drive, as it is the only route into and out of Gwandalan.
- The intersections would continue to operate at satisfactory levels of service with the additional traffic generated by the subdivision.

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- The intersection of Pacific Highway and Kanangra Drive would operate at a satisfactory level of service during the busiest week of the year with the additional traffic generated by the subdivision.
- The layout of the subdivision allows for the future extension of Busways Route 99, and generally complies with the requirements of Council's DCP, subject to the provision of speed control measures to limit vehicle speeds in the road design plans.

5.2 Conclusions

The proposed residential subdivision at Gwandalan would have satisfactory impacts on the surrounding road system. The internal layout of the proposed road system is satisfactory subject to the provision of speed control measures to limit vehicle speeds to the design speeds set out in Council's Subdivision DCP.

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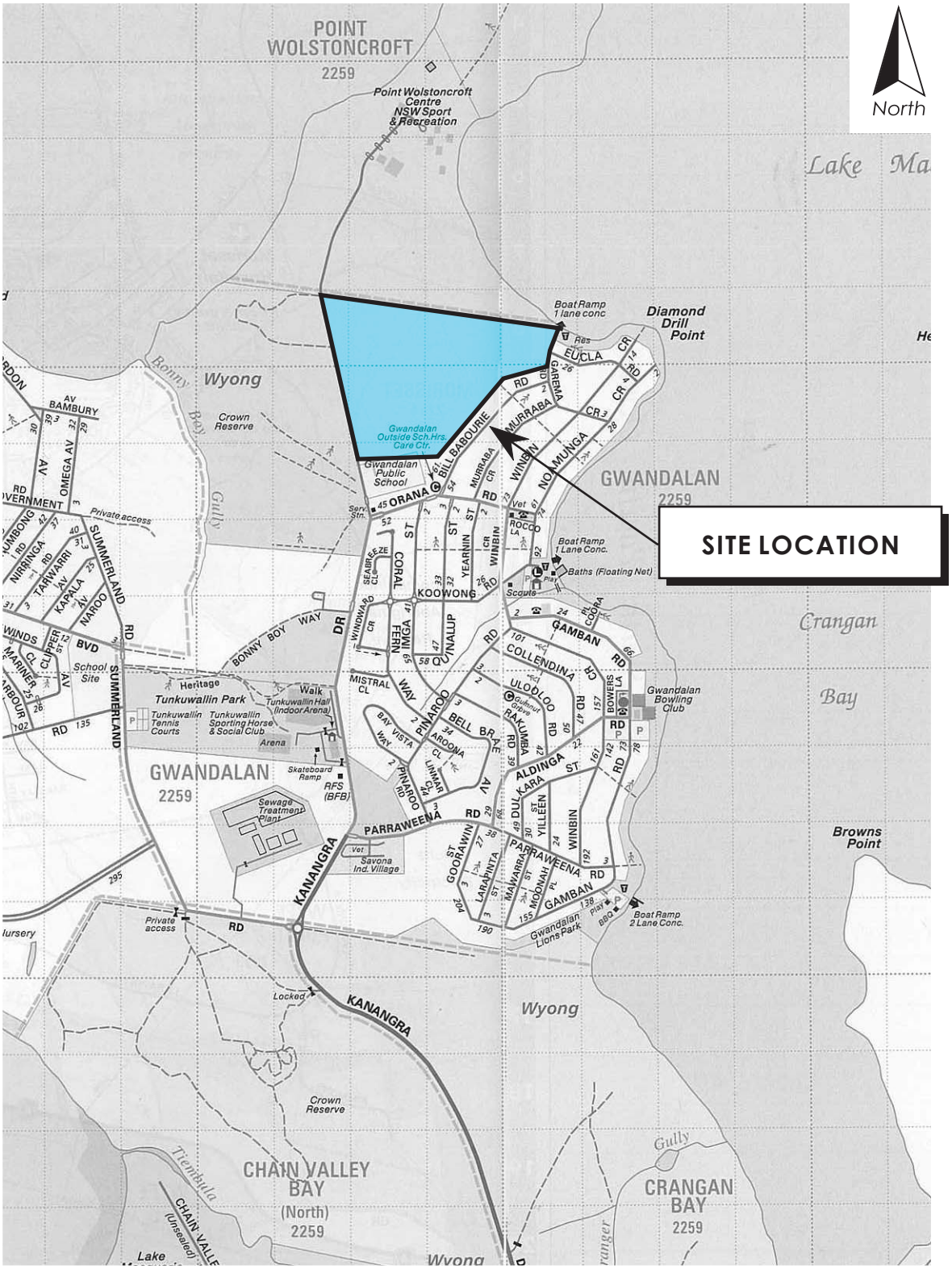
SITE LOCATION

KANANGRA DRIVE, GWANDALAN



MASSON | WILSON | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS

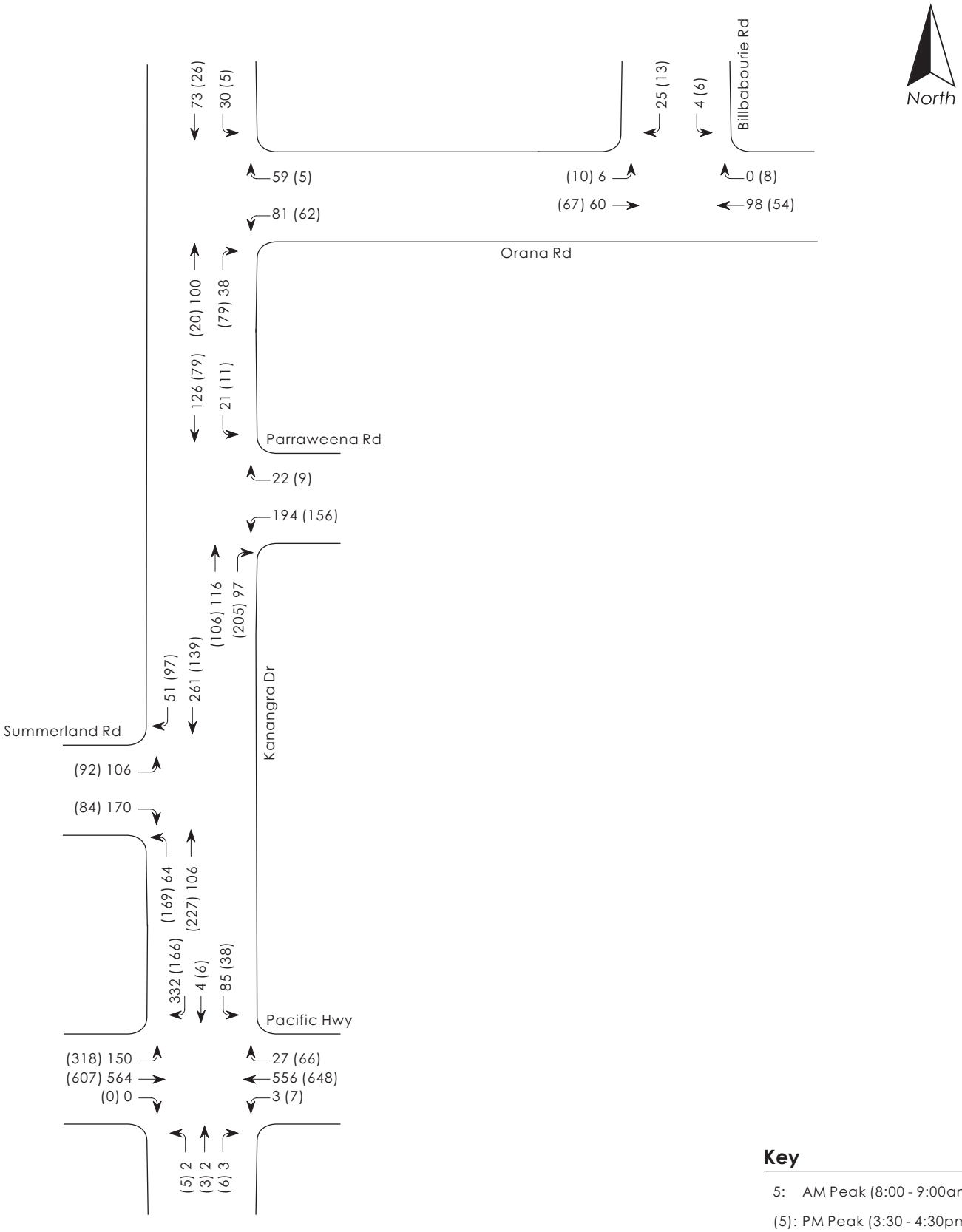
Figure 1

Filename: 063217di01.ai

Date: 3 November 2006

SURVEYED PEAK HOUR TRAFFIC VOLUMES

KANANGRA DRIVE, GWANDALAN



Key

5: AM Peak (8:00 - 9:00am)

(5): PM Peak (3:30 - 4:30pm)

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TRAFFIC AND TRANSPORT CONSULTANTS

Figure 2

Filename: 063217di02.ai

Date: 3 November 2006

PROPOSED SUBDIVISION LAYOUT

KANANGRA DRIVE, GWANDALAN

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TRAFFIC AND TRANSPORT CONSULTANTS

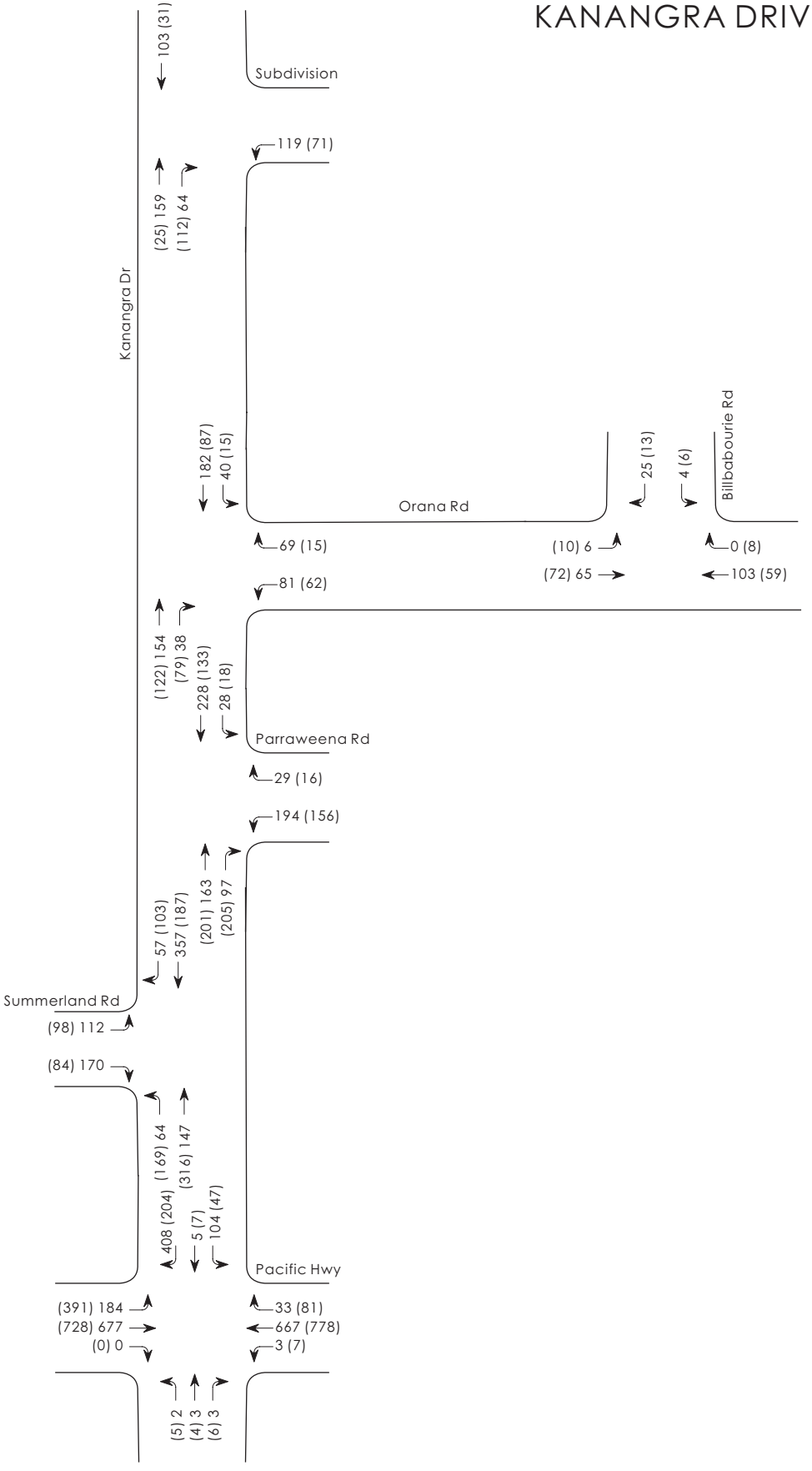
Figure 3

Filename: 063217di06.ai

Date: 17 July 2007

10 YEAR FUTURE PEAK HOUR TRAFFIC VOLUMES

KANANGRA DRIVE, GWANDALAN



Key

5: AM Peak (8:00 - 9:00am)

(5): PM Peak (3:30 - 4:30pm)

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TRAFFIC AND TRANSPORT CONSULTANTS

Figure 4

Filename: 063217di05.ai

Date: 13 July 2007

Appendix A - Traffic Surveys

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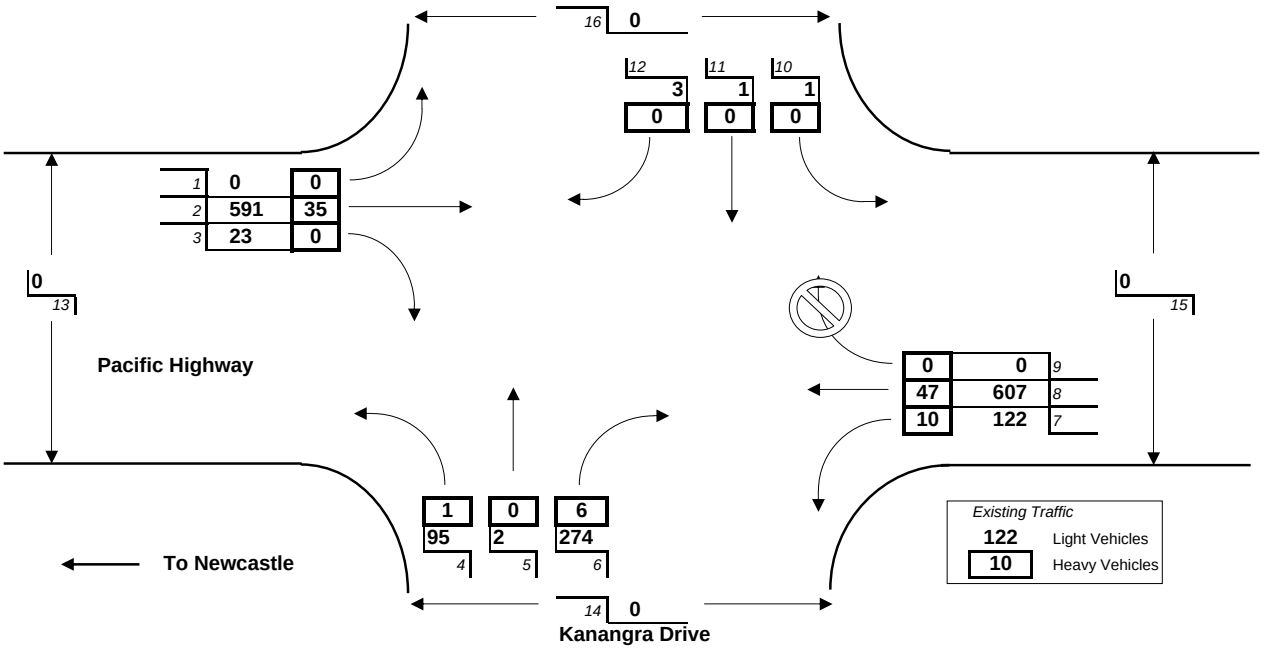
2/11/2006 - Pacific Highway / Kanangra Drive, Gwandalan

8:30 <<< HOUR ENDING **Thursday**

Summary: Pacific Highway / Kanangra Drive	
1719	Total Light Vehicles
99	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



Light Vehicles

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total Vehicles 15 MIN	HOUR
07:45	0	140	7	33	0	73	19	140	0	0	0	0	0	0	0	0	412	
08:00	0	159	3	16	0	44	26	165	0	0	0	2	0	0	0	0	415	
08:15	0	137	9	21	1	74	27	169	0	1	1	1	0	0	0	0	441	
08:30	0	155 <	4	25 <	1	83	50	133 <	0	0	0	0 <	0	0	0	0	451	1719 <
08:45	1	134	7	25	0	83	32	115	0	0	0	0 <	0	0	0	0	397	1704
09:00	1	88	7 <	13	2	84	31	117	0	1 <	1 <	2 <	0	0	0	0	317	1606
09:15	0	92	4	12	2 <	83 <	28 <	114	0	1 <	0	0	0	0	0	0	366	1531
09:30	1 <	103	7	9	0	66	27	76	0	0 <	0	0	0	0	0	0	289	1369

Heavy Vehicles

	1	2	3	4	5	6	7	8	9	10	11	12	Total Vehicles 15 MIN	HOUR
07:45	0	11	0	0	0	2	1	17	0	0	0	0	31	
08:00	0	6	0	0	0	0	3	14	0	0	0	0	23	
08:15	0	9	0	0	0	3	4	6	0	0	0	0	22	
08:30	0	9	0	1 <	0	1	2	10 <	0	0	0	0	23	99 <
08:45	0	12	0	0 <	0	3	3 <	4	0	0	0	0	22	90
09:00	1 <	12	0	0 <	0	1 <	1	10	0	0	0	0	25	92
09:15	0 <	9	0	0 <	0	1	4	7	0	1 <	0	0	22	92
09:30	0 <	10 <	1 <	1 <	0	1	3	11	0	0 <	0	0	27	96

All Vehicles

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total Vehicles 15 MIN	HOUR
07:45	0	151	7	33	0	75	20	157	0	0	0	0	0	0	0	0	443	
08:00	0	165	3	16	0	44	29	179	0	0	0	2	0	0	0	0	438	
08:15	0	146	9	21	1	77	31	175	0	1	1	1	0	0	0	0	463	
08:30	0	164 <	4	26 <	1	84	52	143 <	0	0	0	0 <	0	0	0	0	474	1818 <
08:45	1	146	7	25	0	86	35	119	0	0	0	0 <	0	0	0	0	419	1794
09:00	2	100	7 <	6	1	63	32	127	0	1	1 <	2 <	0	0	0	0	342	1698
09:15	0	101	4	19	3 <	106 <	32 <	121	0	2 <	0	0	0	0	0	0	388	1623
09:30	1 <	113	8	10	0	67	30	87	0	0 <	0	0	0	0	0	0	316	1465

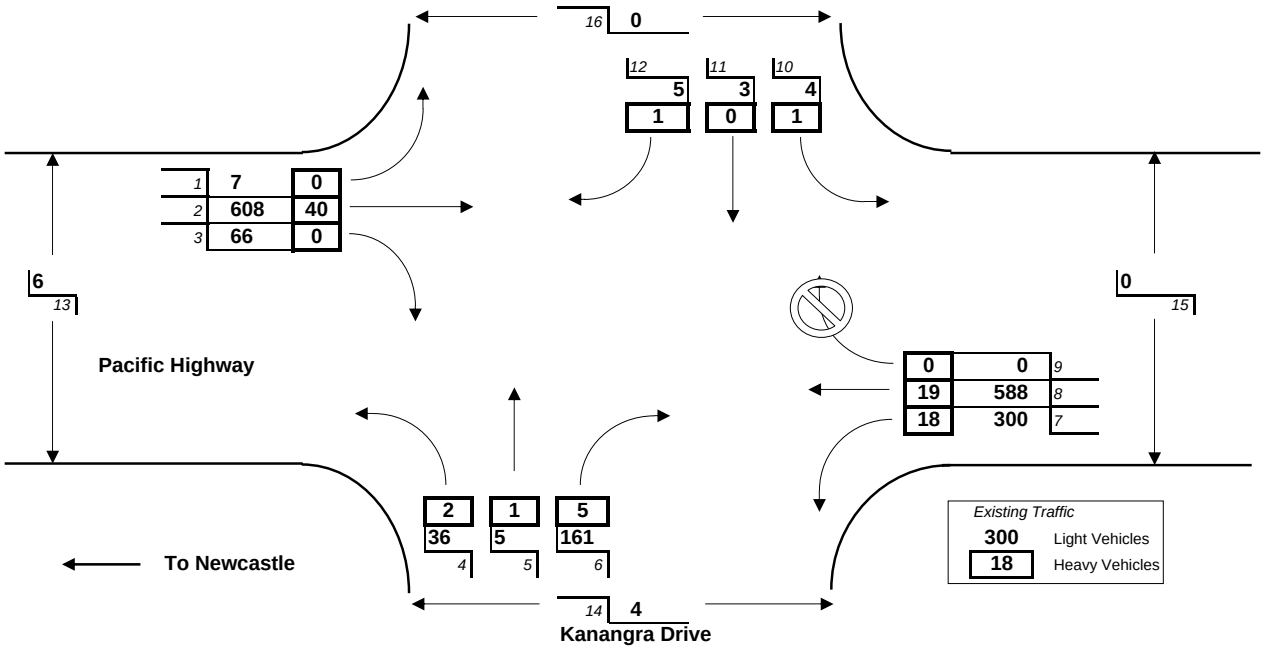
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

1/11/2006 - Pacific Highway / Kanangra Drive, Gwandalan

16:30 <<< HOUR ENDING **Wednesday**

Summary: Pacific Highway / Kanangra Drive	
1783	Total Light Vehicles
87	Total Heavy Vehicles
10	Total Pedestrians

Quality Surveys



Light Vehicles

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total Vehicles 15 MIN	HOUR
15:15	1	96	18	10	1	37	71	116	0	2	3	0	0	0	0	0	355	
15:30	0	104	13	8	1	50	80	138	0	2	2	0	0	0	0	0	398	
15:45	3	138	17	12	0	40	78	189	0	3	2	1	0	0	0	0	483	
16:00	0	135	14	7	2	34 <	73	141	0	0 <	0	2	6 <	4 <	0	0	408	1644
16:15	2	168	22	12 <	0	32	71	138 <	0	1	1	0	0 <	0 <	0	0	447	1736
16:30	2 <	167 <	13	5	3	55 <	78	120	0	0	0	2 <	0 <	0 <	0	0	445	1783 <
16:45	3 <	126	21	7	1 <	36	84	141	0	2	0	0	0 <	0 <	0	0	421	1721
17:00	0 <	111	23	7	1	29	82	130	0	0	2	1	0	0	0	0	386	1699
17:15	0	139	18	10	1 <	32	67	165	0	3	1	1	0	0	0	0	437	1689
17:30	1	153	30 <	5	3 <	31	89 <	165	0	0	2	1	0	0	0	0	480	1724
17:45	1	147	21 <	10	0	27	83	141	0	1	4 <	1	0	0	0	0	436	1739
18:00	2	160	22	9	1	34	80	107	0	3 <	0	1	0	0	0	0	419	1772

Heavy Vehicles

	1	2	3	4	5	6	7	8	9	10	11	12	Total Vehicles 15 MIN	HOUR
15:15	1	5	0	0	0	2	0	9	0	0	0	0	17	
15:30	0	10	0	0	0	0	0	7	0	0	0	0	17	
15:45	0	13	0	1	0	1	6	7	0	0	0	0	28	
16:00	0 <	9	0	0	0	2	3	7 <	0	0	0	1 <	22	84
16:15	0	10 <	0	0	1 <	1	6	4	0	1 <	0	0 <	23	90 <
16:30	0	8	0	1 <	0 <	1	3 <	1	0	0 <	0	0 <	14	87
16:45	0	4	0	0	0 <	2 <	1	1	0	0 <	0	0 <	8	67
17:00	0	2	0	0	0 <	1	3	4	0	0 <	0	0	10	55
17:15	0	6	0	0	0	1	2	6	0	0	0	0	15	47
17:30	0	6	0	0	0	1	2	3	0	0	0	0	12	45
17:45	0	4	1 <	0	0	1	1	2	0	0	0	0	9	46
18:00	0	2	0 <	0	0	0	1	2	0	0	0	0	5	41

All Vehicles

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total Vehicles 15 MIN	HOUR
15:15	2	101	18	10	1	39	71	125	0	2	3	0	0	0	0	0	372	
15:30	0	114	13	8	1	50	80	145	0	2	2	0	0	0	0	0	415	
15:45	3	151	17	13	0	41	84	196	0	3	2	1	0	0	0	0	511	
16:00	0	144	14	7	2	36 <	76	148	0	0 <	0	3	6 <	4 <	0	0	430	1728
16:15	2	178	22	12 <	1	33	77	142 <	0	2 <	1	0	0 <	0 <	0	0	470	1826
16:30	2 <	175 <	13	6	3	56 <	81	121	0	0	0	2 <	0 <	0 <	0	0	459	1870 <
16:45	3 <	130	21	7	1 <	38	85	142	0	2	0	0	0 <	0 <	0	0	429	1788
17:00	0 <	113	23	7	1	30	85	134	0	0	2	1	0	0	0	0	396	1754
17:15	0	145	18	10	1	33	69	171	0	3	1	1	0	0	0	0	452	1736
17:30	1	159	30	5	3	32	91 <	168	0	0	2	1	0	0	0	0	492	1769
17:45	1	151	22 <	10	0	28	84	143	0	1	4 <	1	0	0	0	0	445	1785
18:00	2	162	22	9	1	34	81	109	0	3 <	0	1	0	0	0	0	424	1813

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

2/11/2006 - Kanangra Drive / Summerland Road, Gwandalan

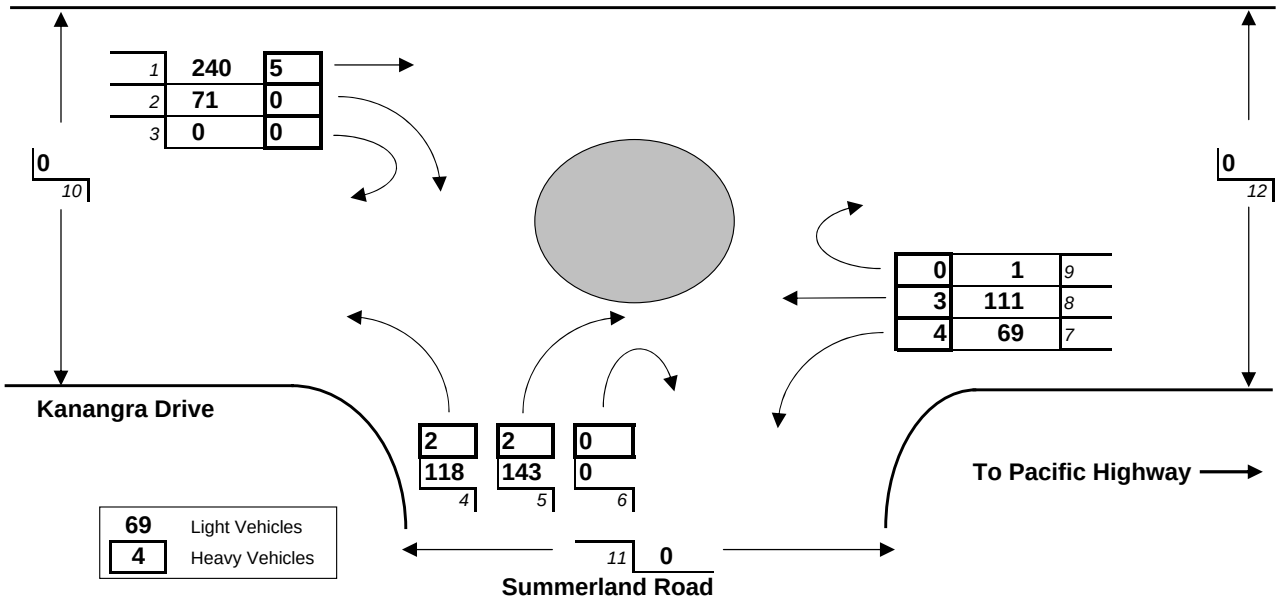
9:15 <<< HOUR ENDING **Thursday**

Summary:

Kanangra Drive / Summerland Road

753	Total Light Vehicles
16	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



2/11/2006 - Kanangra Drive / Summerland Road, Gwandalan

Light Vehicles

	1	2	3	4	5	6	7	8	9	10	11	12	Total Vehicles 15 MIN	HOUR
07:45	56	2	0	8	29	0	6	15	0	0	0	0	116	
08:00	54	9	0	6	33	0	12	18	0	0	0	0	132	
08:15	75	6	0	8	53	0	9	18	0	0	0	0	169	
08:30	64	6	0	17	40	0	13	29	1 <	0	0	0	170	587
08:45	60	13	0	26	45 <	0	18	26	0 <	0	0	0	179	650
09:00	57 <	26	0	54	30	0	19	27	0 <	0	0	0	222	740
09:15	59	26	0	21 <	28	0	19	29 <	0 <	0	0	0	182	753 <
09:30	47	14 <	0	17 <	23	0	18 <	22	0	0	0	0	141	724

Heavy Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
07:45	0	0	0	1	1	0	0	1	0	3	
08:00	3	0	0	0	0	0	0	3	0	6	
08:15	1	0	0	0	0	0	2	3	0	6	
08:30	2 <	0	0	0	1 <	0	2	1	0	6	21 <
08:45	0 <	0	0	1	0	0	0	2 <	0	3	21 <
09:00	2	0	0	0	1 <	0	1 <	0	0	4	19
09:15	1	0	0	1 <	0 <	0	1	0	0	3	16
09:30	1	0	0	0 <	0	0	3 <	0	0	4	14

All Vehicles

	1	2	3	4	5	6	7	8	9	10	11	12	Total Vehicles 15 MIN	HOUR
07:45	56	2	0	9	30	0	6	16	0	0	0	0	119	
08:00	57	9	0	6	33	0	12	21	0	0	0	0	138	
08:15	76	6	0	8	53	0	11	21	0	0	0	0	175	
08:30	66	6	0	17	41	0	15	30	1 <	0	0	0	176	608
08:45	60	13	0	27	45 <	0	14	23	0 <	0	0	0	182	671
09:00	59 <	26	0	54	31	0	24	32	0 <	0	0	0	226	759
09:15	60	26	0	22 <	28	0	20	29 <	0 <	0	0	0	185	769 <
09:30	48	14 <	0	17 <	23	0	21 <	22	0	0	0	0	145	738

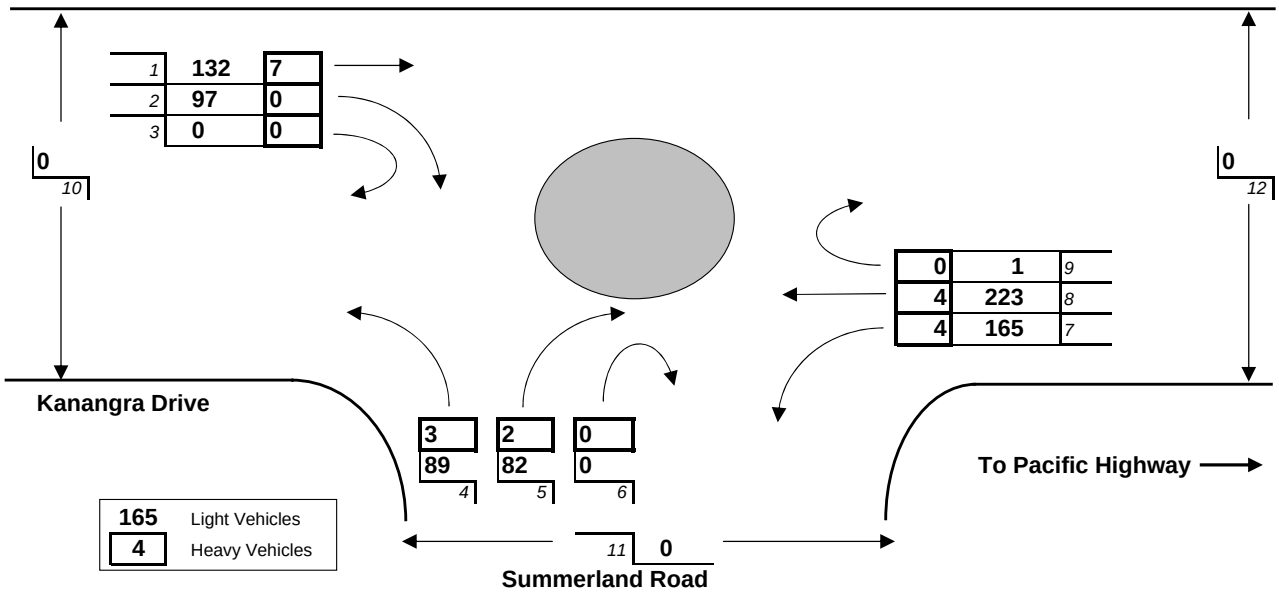
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

1/11/2006 - Kanangra Drive / Summerland Road, Gwandalan

16:30 <<< HOUR ENDING **Wednesday**

Quality Surveys

Summary: Kanangra Drive / Summerland Road	
789	Total Light Vehicles
20	Total Heavy Vehicles
0	Total Pedestrians



1/11/2006 - Kanangra Drive / Summerland Road, Gwandalan

Light Vehicles

	1	2	3	4	5	6	7	8	9	10	11	12	Total Vehicles 15 MIN	HOUR
15:15	43	30	0	15	17	0	54	36	0	0	0	0	195	
15:30	41	17	0	14	16	0	47	58	0	0	0	0	193	
15:45	35	26	0	19	27	0	51	57	0	0	0	0	215	
16:00	32 <	21	0	25	17	0	33 <	56	1 <	0	0	0	185	788
16:15	26	27	0	25	13	0	45	53	0 <	0	0	0	189	782
16:30	39	23 <	0	20	25 <	0	36	57	0 <	0	0	0	200	789 <
16:45	29	22	0	20 <	17	0	40	70	0 <	0	0	0	198	772
17:00	27	19	0	11	7	0	51	73	0	0	0	0	188	775
17:15	25	18	0	14	23	0	37	47	0	0	0	0	164	750
17:30	32	24	0	17	14	0	44	69 <	0	0	0	0	200	750
17:45	28	19	0	19	18	0	51	67	0	0	0	0	202	754
18:00	32	28	0	17	14	0	34	68	0	0	0	0	193	759

Heavy Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
15:15	0	1	0	1	1	0	0	0	0	3	
15:30	0	1	0	1	1	0	1	0	0	4	
15:45	2	0	0	0	0	0	1	2	0	5	
16:00	3	0 <	0	0	1	0	0	0	0	4	16
16:15	1	0	0	2 <	0	0	2 <	0	0	5	18
16:30	1 <	0	0	1 <	1	0	1 <	2	0	6	20 <
16:45	0	0	0	0 <	1	0	0	0	0	1	16
17:00	0	0	0	0 <	1	0	1 <	2	0	4	16
17:15	0	0	0	0	1 <	0	0	3 <	0	4	15
17:30	1	0	0	0	0	0	0	1	0	2	11
17:45	0	0	0	0	0	0	2	1 <	0	3	13
18:00	0	0	0	0	0	0	1	0	0	1	10

All Vehicles

	1	2	3	4	5	6	7	8	9	10	11	12	Total Vehicles 15 MIN	HOUR
15:15	43	31	0	16	18	0	54	36	0	0	0	0	198	
15:30	41	18	0	15	17	0	48	58	0	0	0	0	197	
15:45	37	26	0	19	27	0	52	59	0	0	0	0	220	
16:00	35 <	21	0	25	18	0	33 <	56	1 <	0	0	0	189	804
16:15	27	27	0	27	13	0	47	53	0 <	0	0	0	194	800
16:30	40	23 <	0	21	26 <	0	37	59	0 <	0	0	0	206	809 <
16:45	29	22	0	20 <	18	0	40	70	0 <	0	0	0	199	788
17:00	27	19	0	11	8	0	52	75	0	0	0	0	192	791
17:15	25	18	0	14	24	0	37	50	0	0	0	0	168	765
17:30	33	24	0	17	14	0	44	70 <	0	0	0	0	202	761
17:45	28	19	0	19	18	0	53	68	0	0	0	0	205	767
18:00	32	28	0	17	14	0	35	68	0	0	0	0	194	769

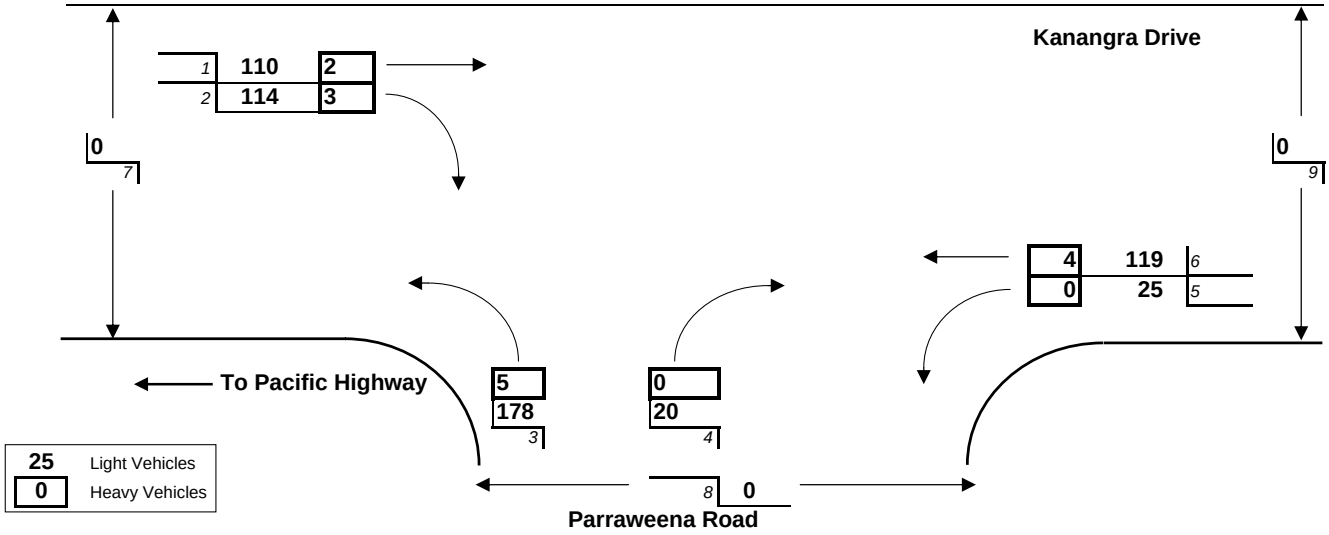
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

2/11/2006 - Kanangra Drive / Parraweena Road, Gwandalan

9:30 <<< HOUR ENDING **Thursday**

Quality Surveys

Summary: Kanangra Drive / Parraweena Road	
566	Total Light Vehicles
14	Total Heavy Vehicles
0	Total Pedestrians



2/11/2006 - Kanangra Drive / Parraweena Road, Gwandalan

Light Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
07:45	7	13	48	2	0	18	0	1	0	88	
08:00	8	19	32	3	0	15	0	0	0	77	
08:15	16	14	50	4	2	30	0	0	0	116	
08:30	22	26	50	1	4	26	0	0 <	0	129	410
08:45	26	32	46	6	4	27	0	0	0	141	463
09:00	48 <	22	41 <	11 <	11	42	0	0	0	175	561
09:15	12	20	38	2	6 <	37 <	0	0	0	115	560
09:30	24	40 <	53	1	4 <	13	0	0	0	135	566 <

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
07:45	2	2	0	0	0	0	4	
08:00	2	1	0	0	0	1	4	
08:15	3	0	1	0	0	0	4	
08:30	0 <	1 <	3	0	0	0	4	16 <
08:45	1	1	1	0	0	0	3	15
09:00	0	1	2	0	0	1	4	15
09:15	0	1 <	2 <	0	0	2	5	16 <
09:30	1	0	0	0	0	1 <	2	14

All Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
07:45	9	15	48	2	0	18	0	1	0	92	
08:00	10	20	32	3	0	16	0	0	0	81	
08:15	19	14	51	4	2	30	0	0	0	120	
08:30	22	27	53	1	4	26	0	0 <	0	133	426
08:45	27	33	47	6	4	27	0	0	0	144	478
09:00	48 <	23	43 <	11 <	11	43	0	0	0	179	576
09:15	12	21	40	2	6 <	39 <	0	0	0	120	576
09:30	25	40 <	53	1	4 <	14	0	0	0	137	580 <

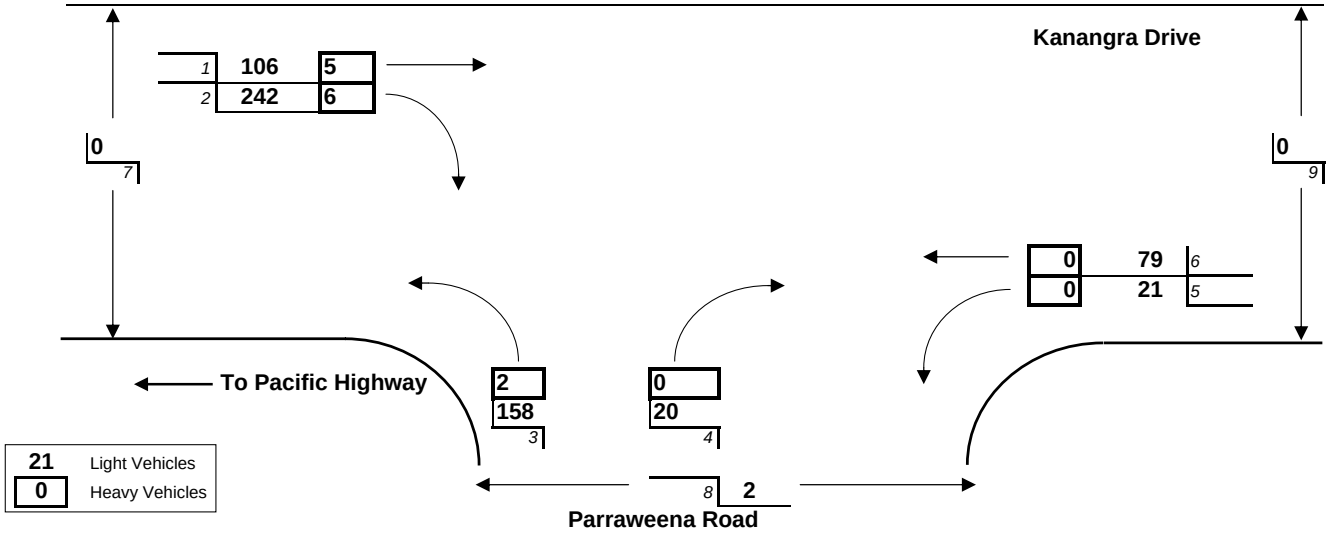
Note : Arrows "<" indicate the end time for the peak hour for each turning movement

1/11/2006 - Kanangra Drive / Parraweena Road, Gwandalan

17:00 <<< HOUR ENDING **Wednesday**

Summary: Kanangra Drive / Parraweena Road	
626	Total Light Vehicles
13	Total Heavy Vehicles
2	Total Pedestrians

Quality Surveys



1/11/2006 - Kanangra Drive / Parraweena Road, Gwandalan

Light Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
15:15	21	34	30	1	12	47	0	0	0	145	
15:30	19	49	42	0	4	16	0	0	0	130	
15:45	25	49	39	1	2	14	0	0	0	130	
16:00	19	48	42	2	1	18 <	0	0	0	130	535
16:15	27	49	35 <	5	4	22	0	2 <	0	142	532
16:30	28	54	37	0	4	24	0	0 <	0	147	549
16:45	34 <	67	36	4	7	21	0	0 <	0	169	588
17:00	17	72	50 <	11	6	12	0	0 <	0	168	626 <
17:15	17	27	21	0	3	14	0	0	0	82	566
17:30	31	78 <	43	6	7	19	1	1	0	184	603
17:45	19	45	25	10 <	9 <	31	0	0	0	139	573
18:00	24	77	49	3	3	10	1 <	0	0	166	571

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
15:15	1	0	0	1	0	1	3	
15:30	0	0	1	0	0	0	1	
15:45	1	1	0	0	0	0	2	
16:00	2	0	2	1 <	0	1	6	12
16:15	2	2	0	0	0	0	4	13
16:30	2 <	2	1	0	0	0	5	17 <
16:45	0	0	1 <	0	0	0	1	16
17:00	1	2 <	0	0	0	0	3	13
17:15	0	1	0	0	0	1	2	11
17:30	2	2	2	0	0	1	7	13
17:45	0	1 <	0	0	0	1	2	14
18:00	0	1	0	0	0	1 <	2	13

All Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
15:15	22	34	30	2	12	48	0	0	0	148	
15:30	19	49	43	0	4	16	0	0	0	131	
15:45	26	50	39	1	2	14	0	0	0	132	
16:00	21	48	44	3	1	19 <	0	0	0	136	547
16:15	29	51	35 <	5	4	22	0	2 <	0	146	545
16:30	30	56	38	0	4	24	0	0 <	0	152	566
16:45	34 <	67	37	4	7	21	0	0 <	0	170	604
17:00	18	74	50	11	6	12	0	0 <	0	171	639 <
17:15	17	28	21	0	3	15	0	0	0	84	577
17:30	33	80 <	45	6	7	20	1	1	0	191	616
17:45	19	46	25	10 <	9 <	32	0	0	0	141	587
18:00	24	78	49	3	3	11	1 <	0	0	168	584

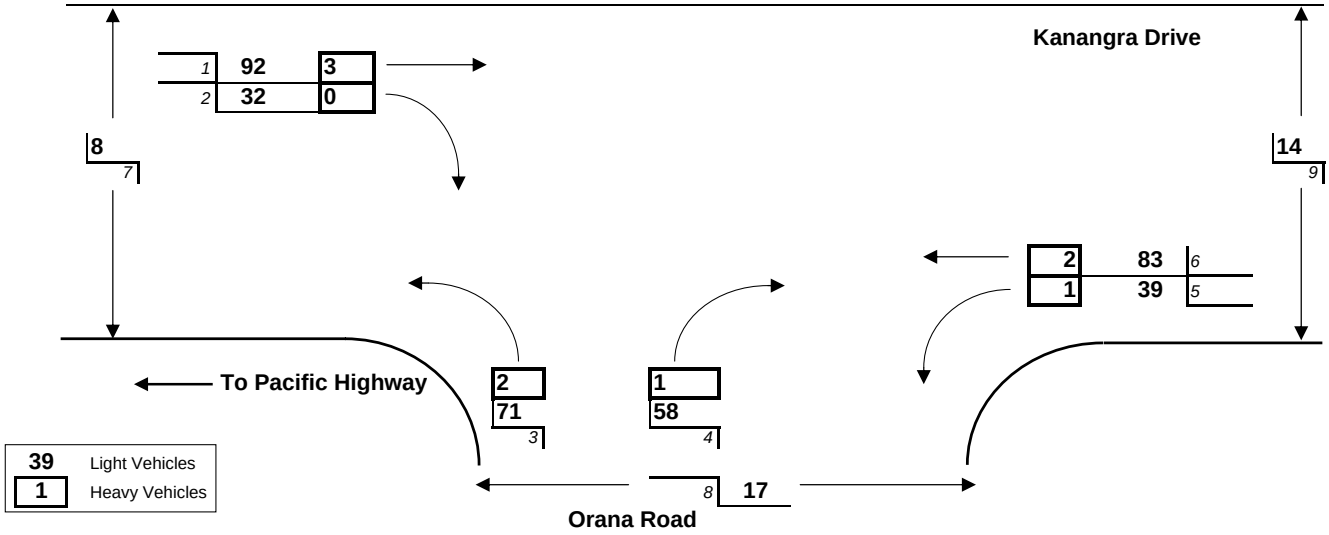
Note : Arrows "<" indicate the end time for the peak hour for each turning movement

2/11/2006 - Kanangra Drive / Orana Road, Gwandalan

9:15 <<< HOUR ENDING **Thursday**

Summary:	Kanangra Drive / Orana Road
375	Total Light Vehicles
9	Total Heavy Vehicles
39	Total Pedestrians

Quality Surveys



2/11/2006 - Kanangra Drive / Orana Road, Gwandalan

Light Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
07:45	8	3	18	4	2	3	0	1	0	38	
08:00	7	3	16	3	2	5	0	0	0	36	
08:15	14	7	21	8	3	6	0	3	0	59	
08:30	16	10	16	7	4	17	0	1	5	70	203
08:45	23	8	22	20	10	13	2	6	3	96	261
09:00	44 <	11 <	21 <	23 <	12	36	4	7	6 <	147	372
09:15	9	3	12	8 <	13 <	17 <	2 <	3	0 <	62	375 <
09:30	4	10	11	4	4 <	6	0 <	3 <	0	39	344

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
07:45	2	1	0	0	0	1	4	
08:00	2	0	0	0	0	1	3	
08:15	1	2	0	1	0	0	4	
08:30	0 <	0 <	0	0 <	0	0	0	11
08:45	2 <	0	1	0 <	1 <	1	5	12 <
09:00	0	0	0	0 <	0 <	0	0	9
09:15	1	0	1 <	1 <	0 <	1	4	9
09:30	0	0	0 <	0 <	0 <	1 <	1	10

All Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
07:45	10	4	18	4	2	4	0	1	0	42	
08:00	9	3	16	3	2	6	0	0	0	39	
08:15	15	9	21	9	3	6	0	3	0	63	
08:30	16	10	16	7	4	17	0	1	5	70	214
08:45	25	8	23	20	11	14	2	6	3	101	273
09:00	44 <	11 <	21 <	23 <	12	36	4	7	6 <	147	381
09:15	10	3	13	9 <	13 <	18 <	2 <	3	0 <	66	384 <
09:30	4	10	11	4	4 <	7	0 <	3 <	0	40	354

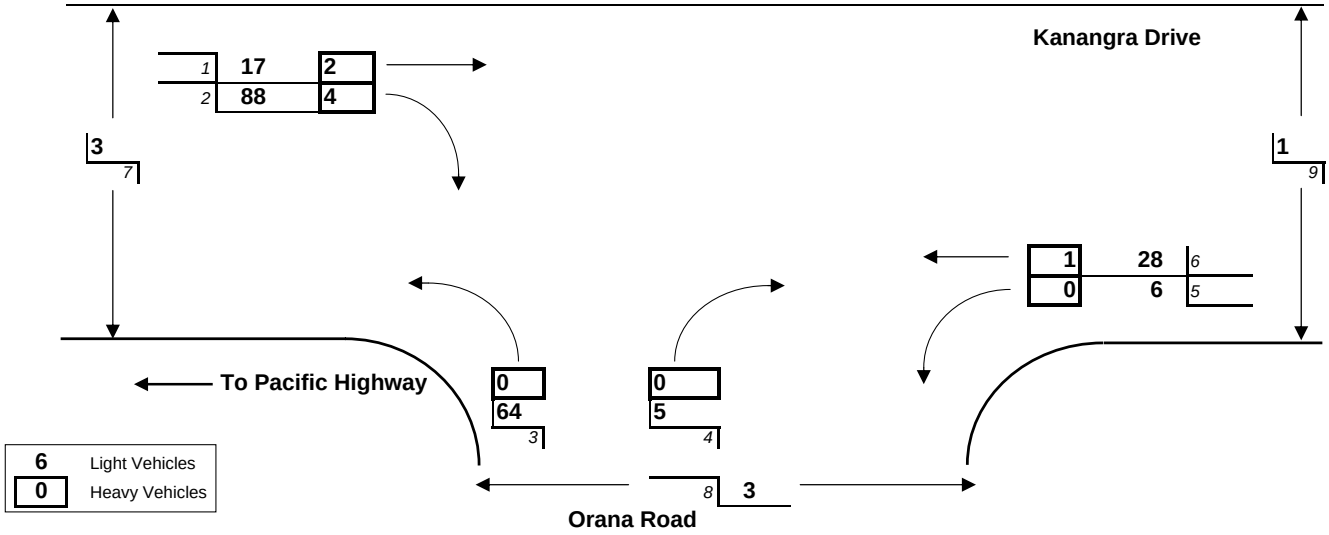
Note : Arrows "<" indicate the end time for the peak hour for each turning movement

1/11/2006 - Kanangra Drive / Orana Road, Gwandalan

16:45 <<< HOUR ENDING **Wednesday**

Summary: Kanangra Drive / Orana Road	
208	Total Light Vehicles
7	Total Heavy Vehicles
7	Total Pedestrians

Quality Surveys



1/11/2006 - Kanangra Drive / Orana Road, Gwandalan

Light Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
15:15	6	9	15	6	12	10	0	0	0	58	
15:30	5	14	12	4	8	4	2	0	0	47	
15:45	6	12	11	1	2	4	1	1	0	36	
16:00	4 <	17	10	0 <	0 <	4	2	0	0	35	176
16:15	6 <	22	24	2	1	7	1 <	1	1 <	62	180
16:30	2	23	17	2	2	10	0	0	0 <	56	189
16:45	5	26	13 <	1	3	7	0	2	0 <	55	208 <
17:00	2	15	8	0	2	6 <	0	2 <	0 <	33	206
17:15	1	22	11	0	3	6	0	1 <	0	43	187
17:30	0	29	13	1	2	4	0	0 <	0	49	180
17:45	2	27	23	1	2	2	0	0	0	57	182
18:00	3	22 <	14	1	3	4	0	0	0	47	196

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
15:15	0	0	0	0	1	1	2	
15:30	0	0	0	0	0	0	0	
15:45	0	1	0	0	0	0	1	
16:00	1	1	0	0	0 <	1 <	3	6
16:15	1 <	1	0	0	0	0	2	6
16:30	0 <	2 <	0	0	0	0	2	8 <
16:45	0 <	0	0	0	0	0	0	7
17:00	0	0	0	0	0	1	1	5
17:15	0	0	0	0	0	0	0	3
17:30	0	1	2 <	0	0	0	3	4
17:45	1	1	0 <	0	0	0	2	6
18:00	0	0	0 <	0	0	0	0	5

All Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
15:15	6	9	15	6	13	11	0	0	0	60	
15:30	5	14	12	4	8	4	2	0	0	47	
15:45	6	13	11	1	2	4	1	1	0	37	
16:00	5	18	10	0 <	0 <	5	2	0	0	38	182
16:15	7 <	23	24	2	1	7	1 <	1	1 <	64	186
16:30	2	25	17	2	2	10	0	0	0 <	58	197
16:45	5	26	13 <	1	3	7	0	2	0 <	55	215 <
17:00	2	15	8	0	2	7 <	0	2 <	0 <	34	211
17:15	1	22	11	0	3	6	0	1 <	0	43	190
17:30	0	30	15	1	2	4	0	0 <	0	52	184
17:45	3	28	23	1	2	2	0	0	0	59	188
18:00	3	22 <	14	1	3	4	0	0	0	47	201

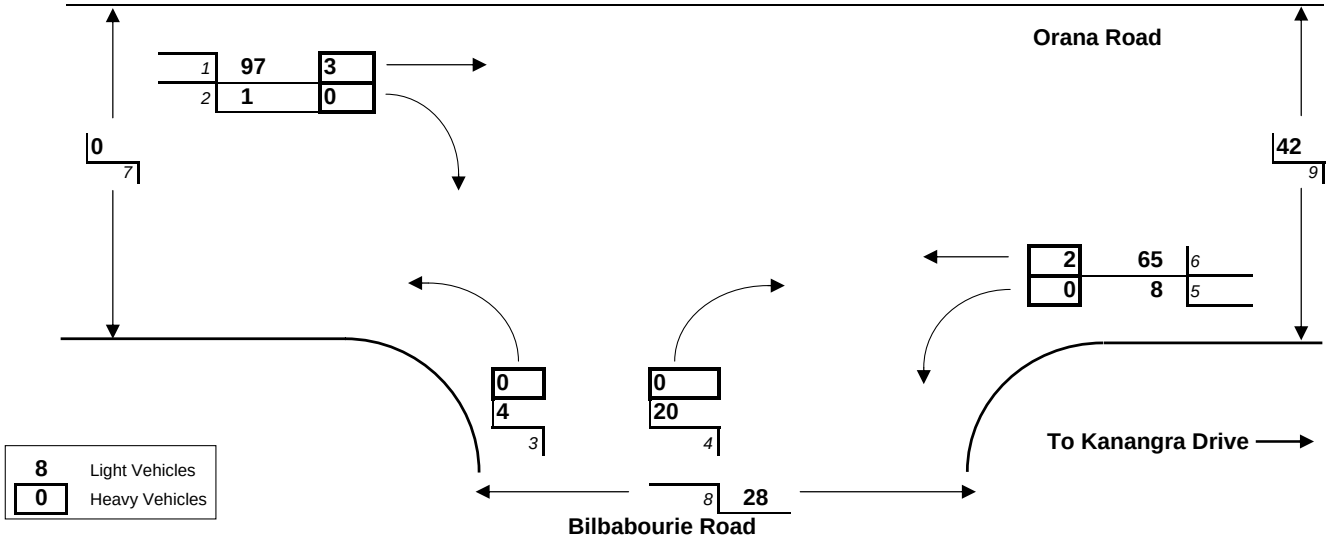
Note : Arrows "<" indicate the end time for the peak hour for each turning movement

2/11/2006 - Orana Road / Bilbabourie Road, Gwandalan

9:15 <<< HOUR ENDING **Thursday**

Summary: Orana Road / Bilbabourie Road	
195	Total Light Vehicles
5	Total Heavy Vehicles
70	Total Pedestrians

Quality Surveys



2/11/2006 - Orana Road / Bilbabourie Road, Gwandalan

Light Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
07:45	15	0	0	7	0	4	0	0	0	26	
08:00	14	0	0	7	0	3	0	2	0	24	
08:15	18	0	0	6	0	9	0	3	0	33	
08:30	19	0	0	3	2	11	0	4	0	35	118
08:45	24	0	1	10 <	3	14	0	3	19	52	144
09:00	36 <	0	3	6	1	22	0	15	18	68	188
09:15	18 <	1 <	0	1	2 <	18	0	6 <	5	40	195 <
09:30	14	0 <	1 <	3	2 <	12 <	0	0	1 <	32	192

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
07:45	0	0	0	0	0	1	1	
08:00	0	0	0	0	0	1	1	
08:15	0	0	0	0	0	2	2	
08:30	0	0	0	0	0	1 <	1	5
08:45	1	0	0	0	0	1 <	2	6 <
09:00	0	0	0	0	0	0	0	5
09:15	2 <	0	0	0	0	0	2	5
09:30	0 <	0	0	0	0	0	0	4

All Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
07:45	15	0	0	7	0	5	0	0	0	27	
08:00	14	0	0	7	0	4	0	2	0	25	
08:15	18	0	0	6	0	11	0	3	0	35	
08:30	19	0	0	3	2	12	0	4	0	36	123
08:45	25	0	1	10 <	3	15	0	3	19	54	150
09:00	36	0	3	6	1	22	0	15	18	68	193
09:15	20 <	1 <	0	1	2 <	18 <	0	6 <	5	42	200 <
09:30	14	0 <	1 <	3	2 <	12 <	0	0	1 <	32	196

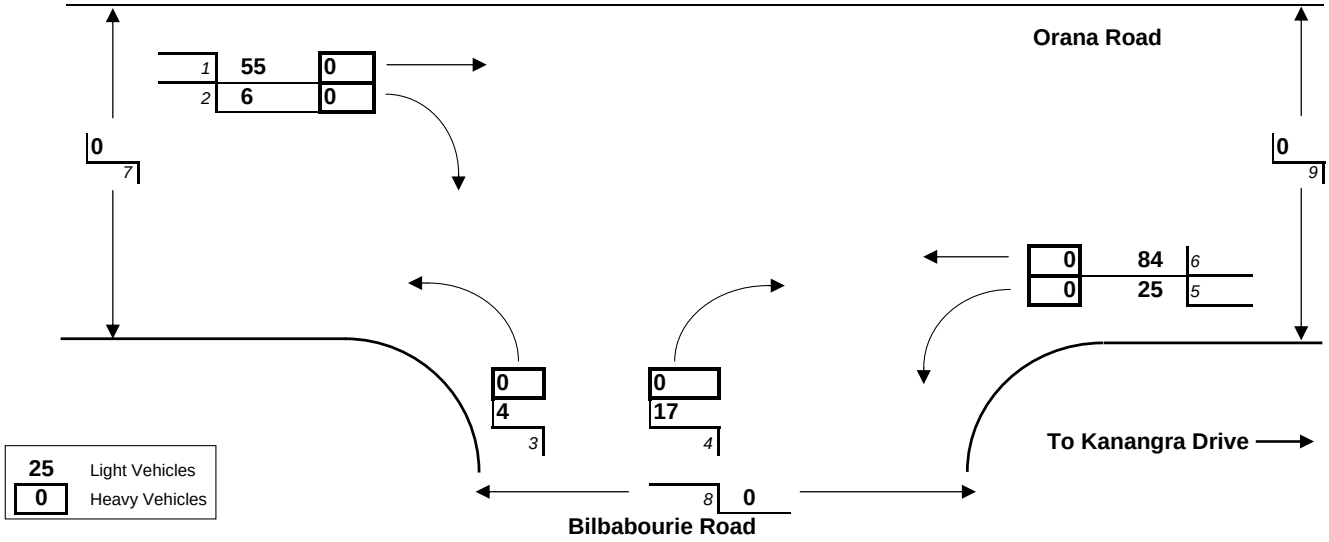
Note : Arrows "<" indicate the end time for the peak hour for each turning movement

1/11/2006 - Orana Road / Bilbabourie Road, Gwandalan

18:00 <<< HOUR ENDING **Wednesday**

Summary: Orana Road / Bilbabourie Road	
191	Total Light Vehicles
0	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



1/11/2006 - Orana Road / Bilbabourie Road, Gwandalan

Light Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
15:15	15	0	0	6	0	21	0	0	0	42	
15:30	15	2	1	2	0	18	0	0	0	38	
15:45	15	4	3	2	2	11	0	0	0	37	
16:00	12	1	1	1	0	17	4 <	0	2 <	32	149
16:15	16 <	2 <	1 <	5	3	14	0 <	0	0 <	41	148
16:30	8	1	0	5	4	22	0 <	0	0 <	40	150
16:45	10	0	1	1	6	20	0 <	0	0 <	38	151
17:00	9	3	0	3	8	15	0	0	0	38	157
17:15	11	2	0	4	4	24	0	0	0	45	161
17:30	19	1	2	8	3	23	0	0	0	56	177
17:45	14	0	0	1	11 <	20	0	0	0	46	185
18:00	11	3	2	4 <	7	17 <	0	0	0	44	191 <

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
15:15	0	0	0	0	0	1	1	
15:30	0	0	0	0	0	0	0	
15:45	1	0	0	0	0	1	2	
16:00	2 <	0	0	0	0	1 <	3	6
16:15	0 <	0	0	0	1 <	0	1	6
16:30	0 <	0	1 <	0	0 <	1 <	2	8 <
16:45	0	1 <	0 <	0	0 <	1 <	2	8 <
17:00	0	0 <	0 <	0	0 <	0	0	5
17:15	0	0 <	0 <	0	0	0	0	4
17:30	0	0 <	0	0	0	0	0	2
17:45	0	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0

All Vehicles

	1	2	3	4	5	6	7	8	9	Total Vehicles 15 MIN	HOUR
15:15	15	0	0	6	0	22	0	0	0	43	
15:30	15	2	1	2	0	18	0	0	0	38	
15:45	16	4	3	2	2	12	0	0	0	39	
16:00	14	1	1	1	0	18	4 <	0	2 <	35	155
16:15	16 <	2 <	1 <	5	4	14	0 <	0	0 <	42	154
16:30	8	1	1 <	5	4	23	0 <	0	0 <	42	158
16:45	10	1	1	1	6	21	0 <	0	0 <	40	159
17:00	9	3	0	3	8	15	0	0	0	38	162
17:15	11	2	0	4	4	24	0	0	0	45	165
17:30	19	1	2	8	3	23	0	0	0	56	179
17:45	14	0	0	1	11 <	20	0	0	0	46	185
18:00	11	3	2	4 <	7	17 <	0	0	0	44	191 <

Note : Arrows "<" indicate the end time for the peak hour for each turning movement

Appendix B - Sidra Intersection Results No Subdivision

SIDRA INTERSECTION

Movement Summary

Pacific Hwy and Kanangra Dr

Existing AM Peak

Signalised - Actuated isolated **Cycle Time = 59 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Blue Wren Dr										
1	L	2	0.0	0.012	22.7	LOS B	1	0.65	0.68	41.5
2	T	2	0.0	0.012	13.6	LOS A	1	0.65	0.44	43.7
3	R	3	0.0	0.012	22.7	LOS B	1	0.65	0.67	41.6
Approach		**7**	**0.0**	**0.012**	**20.1**	**LOS B**	**1**	**0.65**	**0.61**	**42.1**
Pacific Hwy										
4	L	3	33.3	0.008	29.5	LOS C	1	0.72	0.67	41.3
5	T	585	7.5	0.332	10.9	LOS A	48	0.65	0.55	65.9
6	R	28	0.0	0.148	39.7	LOS C	7	0.92	0.72	33.8
Approach		**616**	**7.3**	**0.332**	**12.3**	**LOS A**	**48**	**0.66**	**0.56**	**63.5**
Kanangra Dr										
7	L	89	1.1	0.251	16.4	LOS B	11	0.49	0.73	46.2
8	T	4	0.0	0.624	18.3	LOS B	74	0.87	0.75	39.9
9	R	349	2.3	0.635	27.6	LOS B	74	0.87	0.84	38.6
Approach		**442**	**2.0**	**0.635**	**25.2**	**LOS B**	**74**	**0.79**	**0.82**	**40.0**
Pacific Hwy										
10	L	158	7.0	0.143	14.6	LOS B	13	0.40	0.77	55.6
11	T	594	5.2	0.546	20.5	LOS B	66	0.87	0.74	53.4
Approach		**751**	**5.6**	**0.546**	**19.2**	**LOS B**	**66**	**0.77**	**0.74**	**53.8**
All Vehicles		**1816**	**5.3**	**0.635**	**18.4**	**LOS B**	**74**	**0.74**	**0.70**	**52.1**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA INTERSECTION

Movement Summary

Pacific Hwy and Kanangra Dr

Existing PM Peak

Signalised - Actuated isolated **Cycle Time = 48 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Blue Wren Dr										
1	L	5	20.0	0.037	25.7	LOS B	3	0.76	0.70	40.3
2	T	3	0.0	0.037	15.6	LOS B	3	0.76	0.54	42.0
3	R	6	16.7	0.037	25.4	LOS B	3	0.76	0.69	40.4
Approach		**14**	**14.3**	**0.037**	**23.4**	**LOS B**	**3**	**0.76**	**0.66**	**40.6**
Pacific Hwy										
4	L	7	0.0	0.012	23.9	LOS B	1	0.69	0.69	44.7
5	T	682	6.2	0.336	7.0	LOS A	41	0.58	0.50	72.9
6	R	69	0.0	0.297	34.0	LOS C	14	0.92	0.75	37.0
Approach		**758**	**5.5**	**0.336**	**9.6**	**LOS A**	**41**	**0.61**	**0.52**	**67.7**
Kanangra Dr										
7	L	40	5.0	0.110	16.8	LOS B	5	0.54	0.72	46.1
8	T	6	16.7	0.429	17.8	LOS B	33	0.86	0.70	40.3
9	R	175	2.9	0.428	27.0	LOS B	33	0.86	0.80	39.0
Approach		**220**	**3.6**	**0.428**	**24.9**	**LOS B**	**33**	**0.80**	**0.78**	**40.1**
Pacific Hwy										
10	L	335	5.7	0.328	15.7	LOS B	31	0.55	0.79	53.9
11	T	639	3.1	0.535	15.8	LOS B	56	0.85	0.72	58.8
Approach		**974**	**4.0**	**0.535**	**15.8**	**LOS B**	**56**	**0.75**	**0.75**	**57.2**
All Vehicles		**1966**	**4.6**	**0.535**	**14.5**	**LOS A**	**56**	**0.70**	**0.66**	**57.8**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA INTERSECTION

Movement Summary

Kanangra Dr and Summerland Dr

Existing AM Peak

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
1	L	67	7.5	0.136	7.5	LOS A	7	0.20	0.55	49.3
2	T	112	5.4	0.136	6.1	LOS A	7	0.20	0.47	50.6
Approach		**178**	**6.2**	**0.136**	**6.6**	**LOS A**	**7**	**0.20**	**0.50**	**50.1**
Kanangra Dr										
8	T	275	1.8	0.268	6.4	LOS A	14	0.40	0.53	49.5
9	R	54	0.0	0.267	12.0	LOS A	14	0.40	0.68	44.9
Approach		**328**	**1.5**	**0.268**	**7.3**	**LOS A**	**14**	**0.40**	**0.55**	**48.7**
Summerland Dr										
10	L	112	0.9	0.220	6.8	LOS A	11	0.29	0.53	49.4
12	R	179	1.1	0.220	11.7	LOS A	11	0.29	0.65	45.3
Approach		**291**	**1.0**	**0.220**	**9.8**	**LOS A**	**11**	**0.29**	**0.61**	**46.8**
All Vehicles		**797**	**2.4**	**0.268**	**8.1**	**LOS A**	**14**	**0.31**	**0.56**	**48.2**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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SIDRA INTERSECTION

Movement Summary

Kanangra Dr and Summerland Dr

Existing PM Peak

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
1	L	178	2.2	0.324	7.6	LOS A	19	0.32	0.57	48.6
2	T	239	1.7	0.324	6.3	LOS A	19	0.32	0.50	49.8
Approach		**417**	**1.9**	**0.324**	**6.9**	**LOS A**	**19**	**0.32**	**0.53**	**49.3**
Kanangra Dr										
8	T	146	4.8	0.184	5.9	LOS A	10	0.26	0.47	50.4
9	R	102	0.0	0.184	11.5	LOS A	10	0.26	0.65	45.4
Approach		**248**	**2.8**	**0.184**	**8.2**	**LOS A**	**10**	**0.26**	**0.54**	**48.2**
Summerland Dr										
10	L	97	3.1	0.162	7.6	LOS A	8	0.42	0.58	48.6
12	R	88	2.3	0.163	12.4	LOS A	8	0.42	0.68	44.8
Approach		**185**	**2.7**	**0.163**	**9.8**	**LOS A**	**8**	**0.42**	**0.63**	**46.7**
All Vehicles		**850**	**2.4**	**0.324**	**7.9**	**LOS A**	**19**	**0.33**	**0.56**	**48.4**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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SIDRA INTERSECTION

Movement Summary

Kanangra Dr and Parraweena Rd

Existing AM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
2	T	122	3.3	0.144	0.5	LOS A	6	0.25	0.00	47.8
3	R	102	2.9	0.144	7.4	LOS A	6	0.25	0.63	42.2
Approach		**224**	**3.1**	**0.144**	**3.7**	**LOS A**	**6**	**0.25**	**0.29**	**45.0**
Parraweena Rd										
4	L	204	0.0	0.232	7.5	LOS A	9	0.30	0.61	42.2
6	R	23	0.0	0.232	7.8	LOS A	9	0.30	0.73	42.0
Approach		**227**	**0.0**	**0.232**	**7.5**	**LOS A**	**9**	**0.30**	**0.62**	**42.2**
Kanangra Dr										
7	L	22	0.0	0.080	6.4	LOS A	0	0.00	0.61	43.3
8	T	133	0.8	0.080	0.0	LOS A	0	0.00	0.00	50.0
Approach		**155**	**0.6**	**0.080**	**0.9**	**LOS A**		**0.00**	**0.09**	**48.9**
All Vehicles		**606**	**1.3**	**0.232**	**4.4**	**Not Applicable**	**9**	**0.21**	**0.36**	**44.8**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

Kanangra Dr and Parraweena Rd

Existing PM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
2	T	112	6.3	0.221	0.4	LOS A	9	0.20	0.00	48.2
3	R	216	2.3	0.221	7.2	LOS A	9	0.20	0.62	42.3
Approach		**327**	**3.7**	**0.221**	**4.9**	**LOS A**	**9**	**0.20**	**0.41**	**44.2**
Parraweena Rd										
4	L	164	1.8	0.165	7.1	LOS A	6	0.21	0.59	42.5
6	R	9	11.1	0.167	7.7	LOS A	6	0.21	0.71	42.3
Approach		**173**	**2.3**	**0.165**	**7.1**	**LOS A**	**6**	**0.21**	**0.59**	**42.5**
Kanangra Dr										
7	L	12	0.0	0.049	6.4	LOS A	0	0.00	0.61	43.3
8	T	83	1.2	0.049	0.0	LOS A	0	0.00	0.00	50.0
Approach		**95**	**1.1**	**0.049**	**0.8**	**LOS A**		**0.00**	**0.08**	**49.0**
All Vehicles		**595**	**2.9**	**0.221**	**4.9**	**Not Applicable**	**9**	**0.17**	**0.41**	**44.4**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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SIDRA INTERSECTION

Movement Summary

Kanangra Dr and Orana Rd

Existing AM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
2	T	105	2.9	0.085	0.3	LOS A	4	0.20	0.00	38.9
3	R	40	5.0	0.085	5.4	LOS A	4	0.20	0.55	35.9
Approach		**145**	**3.4**	**0.085**	**1.7**	**LOS A**	**4**	**0.20**	**0.15**	**38.1**
Orana Rd										
4	L	85	1.2	0.157	5.5	LOS A	5	0.24	0.52	36.0
6	R	62	1.6	0.157	5.9	LOS A	5	0.24	0.62	35.7
Approach		**147**	**1.4**	**0.156**	**5.7**	**LOS A**	**5**	**0.24**	**0.56**	**35.9**
Kanangra Dr										
7	L	32	3.1	0.057	4.5	LOS A	0	0.00	0.52	36.7
8	T	77	1.3	0.057	0.0	LOS A	0	0.00	0.00	40.0
Approach		**109**	**1.8**	**0.057**	**1.3**	**LOS A**		**0.00**	**0.15**	**39.0**
All Vehicles		**401**	**2.2**	**0.157**	**3.1**	**Not Applicable**	**5**	**0.16**	**0.30**	**37.5**

Symbols which may appear in this table:

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x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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SIDRA INTERSECTION

Movement Summary

Kanangra Dr and Orana Rd

Existing PM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
2	T	21	9.5	0.071	0.1	LOS A	2	0.09	0.00	39.5
3	R	83	6.0	0.071	5.1	LOS A	2	0.09	0.55	36.2
Approach		**104**	**6.7**	**0.071**	**4.1**	**LOS A**	**2**	**0.09**	**0.44**	**36.8**
Orana Rd										
4	L	65	0.0	0.061	4.7	LOS A	2	0.10	0.50	36.4
6	R	5	0.0	0.062	5.1	LOS A	2	0.10	0.57	36.1
Approach		**70**	**0.0**	**0.061**	**4.7**	**LOS A**	**2**	**0.10**	**0.51**	**36.4**
Kanangra Dr										
7	L	5	0.0	0.017	4.5	LOS A	0	0.00	0.52	36.7
8	T	27	3.7	0.017	0.0	LOS A	0	0.00	0.00	40.0
Approach		**32**	**3.1**	**0.017**	**0.7**	**LOS A**		**0.00**	**0.08**	**39.4**
All Vehicles		**206**	**3.9**	**0.071**	**3.8**	**Not Applicable**	**2**	**0.08**	**0.41**	**37.0**

Symbols which may appear in this table:

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x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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SIDRA INTERSECTION

Movement Summary

Orana Rd and Billbabourie Rd

Existing AM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Orana Rd										
2	T	103	1.0	0.054	0.2	LOS A	2	0.16	0.00	39.2
3	R	1	0.0	0.053	5.1	LOS A	2	0.16	0.54	36.0
Approach		**104**	**1.0**	**0.054**	**0.2**	**LOS A**	**2**	**0.16**	**0.01**	**39.1**
Billbabourie Rd										
4	L	4	0.0	0.034	5.3	LOS A	1	0.24	0.49	36.0
6	R	26	0.0	0.034	5.8	LOS A	1	0.24	0.57	35.8
Approach		**30**	**0.0**	**0.034**	**5.7**	**LOS A**	**1**	**0.24**	**0.56**	**35.8**
Orana Rd										
7	L	6	0.0	0.037	4.5	LOS A	0	0.00	0.52	36.7
8	T	63	6.3	0.037	0.0	LOS A	0	0.00	0.00	40.0
Approach		**69**	**5.8**	**0.037**	**0.4**	**LOS A**		**0.00**	**0.05**	**39.7**
All Vehicles		**203**	**2.5**	**0.054**	**1.1**	**Not Applicable**	**2**	**0.12**	**0.10**	**38.8**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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SIDRA INTERSECTION

Movement Summary

Orana Rd and Billbabourie Rd

Existing PM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Orana Rd										
2	T	57	5.3	0.036	0.2	LOS A	2	0.16	0.00	39.1
3	R	8	0.0	0.036	5.1	LOS A	2	0.16	0.54	36.0
Approach		**65**	**4.6**	**0.036**	**0.8**	**LOS A**	**2**	**0.16**	**0.07**	**38.7**
Billbabourie Rd										
4	L	6	16.7	0.022	5.4	LOS A	1	0.21	0.49	36.1
6	R	14	0.0	0.022	5.6	LOS A	1	0.21	0.56	35.9
Approach		**20**	**5.0**	**0.022**	**5.5**	**LOS A**	**1**	**0.21**	**0.54**	**35.9**
Orana Rd										
7	L	11	10.0	0.043	4.6	LOS A	0	0.00	0.52	36.7
8	T	71	4.3	0.043	0.0	LOS A	0	0.00	0.00	40.0
Approach		**80**	**5.0**	**0.043**	**0.6**	**LOS A**		**0.00**	**0.07**	**39.6**
All Vehicles		**165**	**4.8**	**0.043**	**1.3**	**Not Applicable**	**2**	**0.09**	**0.12**	**38.7**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

Pacific Hwy and Kanangra Dr

Holiday AM Peak

Signalised - Actuated isolated **Cycle Time = 60 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Blue Wren Dr										
1	L	2	0.0	0.012	23.2	LOS B	1	0.66	0.68	41.2
2	T	2	0.0	0.012	14.1	LOS A	1	0.66	0.45	43.3
3	R	3	0.0	0.012	23.1	LOS B	1	0.66	0.67	41.3
Approach		**7**	**0.0**	**0.012**	**20.6**	**LOS B**	**1**	**0.66**	**0.61**	**41.7**
Pacific Hwy										
4	L	3	33.3	0.008	29.2	LOS C	1	0.70	0.67	41.6
5	T	603	7.6	0.336	10.8	LOS A	50	0.64	0.54	66.1
6	R	28	0.0	0.151	40.3	LOS C	7	0.92	0.72	33.5
Approach		**634**	**7.4**	**0.336**	**12.2**	**LOS A**	**50**	**0.65**	**0.55**	**63.7**
Kanangra Dr										
7	L	89	1.1	0.258	16.8	LOS B	11	0.50	0.73	45.9
8	T	4	0.0	0.635	19.0	LOS B	76	0.87	0.75	39.4
9	R	349	2.3	0.646	28.2	LOS B	76	0.87	0.84	38.3
Approach		**442**	**2.0**	**0.646**	**25.9**	**LOS B**	**76**	**0.80**	**0.82**	**39.6**
Pacific Hwy										
10	L	158	7.0	0.141	14.5	LOS B	13	0.40	0.77	55.7
11	T	612	5.2	0.540	20.2	LOS B	68	0.86	0.73	53.7
Approach		**769**	**5.6**	**0.540**	**19.0**	**LOS B**	**68**	**0.77**	**0.74**	**54.0**
All Vehicles		**1852**	**5.3**	**0.646**	**18.3**	**LOS B**	**76**	**0.74**	**0.69**	**52.2**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA INTERSECTION

Movement Summary

Pacific Hwy and Kanangra Dr

Holiday PM Peak

Signalised - Actuated isolated **Cycle Time = 48 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Blue Wren Dr										
1	L	5	20.0	0.037	25.7	LOS B	3	0.76	0.70	40.3
2	T	3	0.0	0.037	15.6	LOS B	3	0.76	0.54	42.0
3	R	6	16.7	0.037	25.4	LOS B	3	0.76	0.69	40.4
Approach		**14**	**14.3**	**0.037**	**23.4**	**LOS B**	**3**	**0.76**	**0.66**	**40.6**
Pacific Hwy										
4	L	7	0.0	0.012	23.9	LOS B	1	0.69	0.69	44.7
5	T	702	6.3	0.346	7.0	LOS A	43	0.59	0.50	72.8
6	R	69	0.0	0.297	34.0	LOS C	14	0.92	0.75	37.0
Approach		**779**	**5.6**	**0.346**	**9.6**	**LOS A**	**43**	**0.62**	**0.53**	**67.7**
Kanangra Dr										
7	L	40	5.0	0.110	16.8	LOS B	5	0.54	0.72	46.1
8	T	6	16.7	0.429	17.8	LOS B	33	0.86	0.70	40.3
9	R	175	2.9	0.428	27.0	LOS B	33	0.86	0.80	39.0
Approach		**220**	**3.6**	**0.428**	**24.9**	**LOS B**	**33**	**0.80**	**0.78**	**40.1**
Pacific Hwy										
10	L	335	5.7	0.328	15.7	LOS B	31	0.55	0.79	53.9
11	T	658	3.0	0.551	15.9	LOS B	58	0.86	0.73	58.7
Approach		**993**	**3.9**	**0.551**	**15.9**	**LOS B**	**58**	**0.76**	**0.75**	**57.2**
All Vehicles		**2006**	**4.6**	**0.551**	**14.5**	**LOS A**	**58**	**0.71**	**0.67**	**57.9**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA INTERSECTION

Movement Summary

Pacific Hwy and Kanangra Dr

Holiday AM Peak with 10yr Growth

Signalised - Actuated isolated **Cycle Time = 64 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Blue Wren Dr										
1	L	2	0.0	0.012	23.7	LOS B	1	0.65	0.68	40.9
2	T	2	0.0	0.012	14.5	LOS B	1	0.65	0.44	42.9
3	R	3	0.0	0.012	23.6	LOS B	1	0.65	0.67	41.0
Approach		**7**	**0.0**	**0.012**	**21.0**	**LOS B**	**1**	**0.65**	**0.61**	**41.4**
Pacific Hwy										
4	L	3	33.3	0.008	29.6	LOS C	1	0.69	0.67	41.3
5	T	724	7.6	0.402	11.9	LOS A	66	0.67	0.57	64.3
6	R	28	0.0	0.161	42.6	LOS D	8	0.93	0.72	32.3
Approach		**755**	**7.4**	**0.402**	**13.1**	**LOS A**	**66**	**0.68**	**0.58**	**62.3**
Kanangra Dr										
7	L	89	1.1	0.273	17.4	LOS B	12	0.50	0.73	45.5
8	T	4	0.0	0.618	19.7	LOS B	80	0.87	0.75	39.0
9	R	349	2.3	0.636	28.9	LOS C	80	0.87	0.84	37.9
Approach		**442**	**2.0**	**0.636**	**26.5**	**LOS B**	**80**	**0.79**	**0.82**	**39.2**
Pacific Hwy										
10	L	158	7.0	0.138	14.3	LOS A	13	0.37	0.77	55.9
11	T	734	5.3	0.623	21.6	LOS B	87	0.89	0.76	52.2
Approach		**892**	**5.6**	**0.623**	**20.3**	**LOS B**	**87**	**0.80**	**0.76**	**52.7**
All Vehicles		**2096**	**5.5**	**0.636**	**19.0**	**LOS B**	**87**	**0.75**	**0.71**	**51.9**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

SIDRA INTERSECTION

Movement Summary

Pacific Hwy and Kanangra Dr

Holiday PM Peak with 10yr Growth

Signalised - Actuated isolated **Cycle Time = 52 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Blue Wren Dr										
1	L	5	20.0	0.037	27.0	LOS B	3	0.76	0.70	39.5
2	T	3	0.0	0.037	16.8	LOS B	3	0.76	0.54	41.0
3	R	6	16.7	0.037	26.6	LOS B	3	0.76	0.69	39.6
Approach		**14**	**14.3**	**0.037**	**24.7**	**LOS B**	**3**	**0.76**	**0.66**	**39.8**
Pacific Hwy										
4	L	7	0.0	0.012	23.6	LOS B	1	0.66	0.69	45.0
5	T	842	6.2	0.403	7.4	LOS A	55	0.60	0.52	72.1
6	R	69	0.0	0.322	36.4	LOS C	15	0.93	0.75	35.6
Approach		**918**	**5.7**	**0.403**	**9.7**	**LOS A**	**55**	**0.62**	**0.54**	**67.5**
Kanangra Dr										
7	L	40	5.0	0.120	18.0	LOS B	5	0.56	0.72	45.1
8	T	6	16.7	0.436	19.2	LOS B	36	0.86	0.71	39.3
9	R	175	2.9	0.433	28.5	LOS B	36	0.86	0.80	38.1
Approach		**220**	**3.6**	**0.433**	**26.3**	**LOS B**	**36**	**0.81**	**0.78**	**39.3**
Pacific Hwy										
10	L	335	5.7	0.312	15.4	LOS B	31	0.51	0.79	54.3
11	T	789	3.0	0.596	16.2	LOS B	73	0.86	0.73	58.4
Approach		**1124**	**3.8**	**0.596**	**15.9**	**LOS B**	**73**	**0.75**	**0.75**	**57.3**
All Vehicles		**2276**	**4.6**	**0.596**	**14.5**	**LOS A**	**73**	**0.71**	**0.67**	**58.2**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

Appendix C - Sidra Intersection Results With Subdivision

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SIDRA INTERSECTION

Movement Summary

Pacific Hwy and Kanangra Dr

Future AM Peak - subdivision plus growth

Signalised - Actuated isolated **Cycle Time = 71 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Blue Wren Dr										
1	L	2	0.0	0.011	23.5	LOS B	1	0.61	0.69	41.1
2	T	2	0.0	0.011	14.3	LOS A	1	0.61	0.42	43.0
3	R	3	0.0	0.011	23.4	LOS B	1	0.61	0.67	41.1
Approach		**7**	**0.0**	**0.011**	**20.8**	**LOS B**	**1**	**0.61**	**0.60**	**41.6**
Pacific Hwy										
4	L	3	33.3	0.009	31.5	LOS C	1	0.69	0.67	39.8
5	T	702	7.5	0.406	14.1	LOS A	72	0.69	0.59	61.1
6	R	35	0.0	0.223	47.0	LOS D	11	0.94	0.73	30.3
Approach		**740**	**7.3**	**0.406**	**15.7**	**LOS B**	**72**	**0.70**	**0.60**	**58.7**
Kanangra Dr										
7	L	109	0.9	0.351	17.7	LOS B	16	0.49	0.74	45.2
8	T	5	0.0	0.746	21.0	LOS B	108	0.89	0.78	38.1
9	R	429	2.3	0.726	30.2	LOS C	108	0.89	0.86	37.2
Approach		**543**	**2.0**	**0.725**	**27.6**	**LOS B**	**108**	**0.81**	**0.83**	**38.6**
Pacific Hwy										
10	L	194	6.7	0.163	14.1	LOS A	16	0.35	0.77	56.3
11	T	713	5.3	0.611	23.9	LOS B	92	0.88	0.76	50.0
Approach		**907**	**5.6**	**0.610**	**21.8**	**LOS B**	**92**	**0.77**	**0.76**	**51.0**
All Vehicles		**2197**	**5.3**	**0.746**	**21.2**	**LOS B**	**108**	**0.75**	**0.72**	**49.3**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

SIDRA INTERSECTION

Movement Summary

Pacific Hwy and Kanangra Dr

Future PM Peak- subdivision plus growth

Signalised - Actuated isolated **Cycle Time = 55 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Blue Wren Dr										
1	L	5	20.0	0.037	26.8	LOS B	3	0.74	0.71	39.6
2	T	4	0.0	0.037	16.6	LOS B	3	0.74	0.52	41.2
3	R	6	16.7	0.037	26.5	LOS B	3	0.74	0.69	39.7
Approach		**15**	**13.3**	**0.037**	**24.0**	**LOS B**	**3**	**0.74**	**0.65**	**40.0**
Pacific Hwy										
4	L	7	0.0	0.013	24.3	LOS B	1	0.66	0.69	44.3
5	T	819	6.2	0.401	8.2	LOS A	58	0.61	0.53	70.6
6	R	85	0.0	0.420	38.6	LOS C	20	0.95	0.76	34.3
Approach		**911**	**5.6**	**0.420**	**11.2**	**LOS A**	**58**	**0.64**	**0.55**	**65.0**
Kanangra Dr										
7	L	49	6.0	0.156	18.2	LOS B	7	0.55	0.72	45.0
8	T	7	14.3	0.503	19.7	LOS B	46	0.87	0.72	38.9
9	R	215	2.8	0.499	29.0	LOS C	46	0.87	0.81	37.9
Approach		**271**	**3.7**	**0.499**	**26.7**	**LOS B**	**46**	**0.81**	**0.79**	**39.0**
Pacific Hwy										
10	L	412	5.6	0.373	15.4	LOS B	40	0.52	0.80	54.3
11	T	766	3.1	0.581	17.0	LOS B	74	0.85	0.73	57.4
Approach		**1178**	**4.0**	**0.581**	**16.4**	**LOS B**	**74**	**0.73**	**0.75**	**56.4**
All Vehicles		**2375**	**4.6**	**0.581**	**15.6**	**LOS B**	**74**	**0.71**	**0.68**	**56.3**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA INTERSECTION

Movement Summary

Kanangra Dr and Summerland Dr

Future AM Peak

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
1	L	67	7.5	0.168	7.5	LOS A	9	0.22	0.55	49.2
2	T	155	3.9	0.168	6.1	LOS A	9	0.22	0.47	50.4
Approach		**221**	**5.0**	**0.168**	**6.5**	**LOS A**	**9**	**0.22**	**0.50**	**50.0**
Kanangra Dr										
8	T	376	1.3	0.351	6.4	LOS A	21	0.43	0.54	49.3
9	R	60	0.0	0.351	12.1	LOS A	21	0.43	0.68	44.8
Approach		**436**	**1.1**	**0.351**	**7.2**	**LOS A**	**21**	**0.43**	**0.56**	**48.6**
Summerland Dr										
10	L	118	0.8	0.236	7.1	LOS A	12	0.35	0.55	49.0
12	R	179	1.1	0.236	11.9	LOS A	12	0.35	0.66	45.1
Approach		**297**	**1.0**	**0.236**	**10.0**	**LOS A**	**12**	**0.35**	**0.62**	**46.5**
All Vehicles		**954**	**2.0**	**0.351**	**7.9**	**LOS A**	**21**	**0.36**	**0.56**	**48.2**

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Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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Movement Summary

Kanangra Dr and Summerland Dr

Future PM Peak

Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
1	L	178	2.2	0.395	7.7	LOS A	24	0.36	0.57	48.4
2	T	333	1.2	0.395	6.4	LOS A	24	0.36	0.51	49.5
Approach		**510**	**1.6**	**0.395**	**6.9**	**LOS A**	**24**	**0.36**	**0.53**	**49.1**
Kanangra Dr										
8	T	197	3.6	0.223	5.9	LOS A	12	0.28	0.47	50.3
9	R	108	0.0	0.224	11.5	LOS A	12	0.28	0.65	45.4
Approach		**304**	**2.3**	**0.224**	**7.9**	**LOS A**	**12**	**0.28**	**0.53**	**48.4**
Summerland Dr										
10	L	103	2.9	0.181	8.1	LOS A	9	0.51	0.63	48.1
12	R	88	2.3	0.181	12.9	LOS A	9	0.51	0.71	44.5
Approach		**191**	**2.6**	**0.181**	**10.3**	**LOS A**	**9**	**0.51**	**0.67**	**46.3**
All Vehicles		**1005**	**2.0**	**0.395**	**7.8**	**LOS A**	**24**	**0.36**	**0.56**	**48.4**

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Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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SIDRA INTERSECTION

Movement Summary

Kanangra Dr and Parraweena Rd

Future AM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
2	T	172	2.3	0.178	1.1	LOS A	8	0.36	0.00	46.8
3	R	102	2.9	0.178	7.9	LOS A	8	0.36	0.67	41.8
Approach		**273**	**2.6**	**0.178**	**3.6**	**LOS A**	**8**	**0.36**	**0.25**	**44.8**
Parraweena Rd										
4	L	204	0.0	0.281	8.5	LOS A	10	0.43	0.68	41.5
6	R	31	0.0	0.282	8.9	LOS A	10	0.43	0.80	41.1
Approach		**235**	**0.0**	**0.281**	**8.6**	**LOS A**	**10**	**0.43**	**0.70**	**41.4**
Kanangra Dr										
7	L	29	0.0	0.139	6.4	LOS A	0	0.00	0.61	43.3
8	T	240	0.4	0.139	0.0	LOS A	0	0.00	0.00	50.0
Approach		**269**	**0.4**	**0.139**	**0.7**	**LOS A**		**0.00**	**0.07**	**49.2**
All Vehicles		**777**	**1.0**	**0.282**	**4.1**	**Not Applicable**	**10**	**0.26**	**0.32**	**45.1**

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Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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Movement Summary

Kanangra Dr and Parraweena Rd

Future PM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
2	T	212	3.3	0.281	0.7	LOS A	13	0.30	0.00	47.4
3	R	216	2.3	0.281	7.5	LOS A	13	0.30	0.64	42.0
Approach		**427**	**2.8**	**0.281**	**4.1**	**LOS A**	**13**	**0.30**	**0.32**	**44.5**
Parraweena Rd										
4	L	164	1.8	0.194	7.7	LOS A	7	0.30	0.61	42.2
6	R	17	5.9	0.193	8.2	LOS A	7	0.30	0.76	41.8
Approach		**181**	**2.2**	**0.194**	**7.8**	**LOS A**	**7**	**0.30**	**0.62**	**42.1**
Kanangra Dr										
7	L	19	0.0	0.082	6.4	LOS A	0	0.00	0.61	43.3
8	T	140	0.7	0.082	0.0	LOS A	0	0.00	0.00	50.0
Approach		**159**	**0.6**	**0.082**	**0.8**	**LOS A**		**0.00**	**0.07**	**49.1**
All Vehicles		**767**	**2.2**	**0.281**	**4.3**	**Not Applicable**	**13**	**0.23**	**0.34**	**44.8**

Symbols which may appear in this table:

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x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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Movement Summary

Kanangra Dr and Orana Rd

Future AM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
2	T	162	1.9	0.118	0.8	LOS A	6	0.32	0.00	38.3
3	R	40	5.0	0.118	5.9	LOS A	6	0.32	0.60	35.6
Approach		**202**	**2.5**	**0.118**	**1.8**	**LOS A**	**6**	**0.32**	**0.12**	**37.7**
Orana Rd										
4	L	85	1.2	0.205	6.7	LOS A	7	0.40	0.60	35.2
6	R	73	1.4	0.204	7.2	LOS A	7	0.40	0.72	35.0
Approach		**158**	**1.3**	**0.205**	**6.9**	**LOS A**	**7**	**0.40**	**0.65**	**35.1**
Kanangra Dr										
7	L	42	2.4	0.122	4.5	LOS A	0	0.00	0.52	36.7
8	T	192	0.5	0.122	0.0	LOS A	0	0.00	0.00	40.0
Approach		**234**	**0.9**	**0.122**	**0.8**	**LOS A**		**0.00**	**0.09**	**39.4**
All Vehicles		**594**	**1.5**	**0.205**	**2.8**	**Not Applicable**	**7**	**0.22**	**0.25**	**37.6**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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Movement Summary

Kanangra Dr and Orana Rd

Future PM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
2	T	128	1.6	0.130	0.4	LOS A	6	0.20	0.00	38.9
3	R	83	6.0	0.130	5.4	LOS A	6	0.20	0.56	35.9
Approach		**211**	**3.3**	**0.130**	**2.4**	**LOS A**	**6**	**0.20**	**0.22**	**37.7**
Orana Rd										
4	L	65	0.0	0.082	5.3	LOS A	3	0.22	0.51	36.1
6	R	16	0.0	0.082	5.7	LOS A	3	0.22	0.62	35.9
Approach		**81**	**0.0**	**0.082**	**5.4**	**LOS A**	**3**	**0.22**	**0.53**	**36.1**
Kanangra Dr										
7	L	16	0.0	0.056	4.5	LOS A	0	0.00	0.52	36.7
8	T	92	1.1	0.056	0.0	LOS A	0	0.00	0.00	40.0
Approach		**108**	**0.9**	**0.056**	**0.7**	**LOS A**		**0.00**	**0.08**	**39.5**
All Vehicles		**400**	**2.0**	**0.130**	**2.5**	**Not Applicable**	**6**	**0.15**	**0.24**	**37.8**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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SIDRA INTERSECTION

Movement Summary

Orana Rd and Billbabourie Rd

Future AM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Orana Rd										
2	T	108	0.9	0.056	0.2	LOS A	2	0.16	0.00	39.1
3	R	1	0.0	0.056	5.1	LOS A	2	0.16	0.54	36.0
Approach		**109**	**0.9**	**0.056**	**0.3**	**LOS A**	**2**	**0.16**	**0.00**	**39.1**
Billbabourie Rd										
4	L	4	0.0	0.034	5.4	LOS A	1	0.25	0.49	36.0
6	R	26	0.0	0.034	5.8	LOS A	1	0.25	0.58	35.8
Approach		**30**	**0.0**	**0.034**	**5.8**	**LOS A**	**1**	**0.25**	**0.56**	**35.8**
Orana Rd										
7	L	6	0.0	0.039	4.5	LOS A	0	0.00	0.52	36.7
8	T	68	5.9	0.039	0.0	LOS A	0	0.00	0.00	40.0
Approach		**74**	**5.4**	**0.039**	**0.4**	**LOS A**		**0.00**	**0.04**	**39.7**
All Vehicles		**213**	**2.3**	**0.056**	**1.1**	**Not Applicable**	**2**	**0.12**	**0.10**	**38.8**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

Site: OranaBillbabourieFut AM
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SIDRA INTERSECTION

Movement Summary

Orana Rd and Billbabourie Rd

Future PM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Orana Rd										
2	T	62	4.8	0.039	0.2	LOS A	2	0.17	0.00	39.1
3	R	8	0.0	0.039	5.2	LOS A	2	0.17	0.55	36.0
Approach		**70**	**4.3**	**0.039**	**0.8**	**LOS A**	**2**	**0.17**	**0.06**	**38.7**
Billbabourie Rd										
4	L	6	16.7	0.022	5.5	LOS A	1	0.22	0.49	36.1
6	R	14	0.0	0.022	5.6	LOS A	1	0.22	0.56	35.8
Approach		**20**	**5.0**	**0.022**	**5.6**	**LOS A**	**1**	**0.22**	**0.54**	**35.9**
Orana Rd										
7	L	11	10.0	0.046	4.6	LOS A	0	0.00	0.52	36.7
8	T	76	3.9	0.046	0.0	LOS A	0	0.00	0.00	40.0
Approach		**86**	**4.7**	**0.046**	**0.5**	**LOS A**		**0.00**	**0.06**	**39.6**
All Vehicles		**176**	**4.5**	**0.046**	**1.2**	**Not Applicable**	**2**	**0.09**	**0.12**	**38.8**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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SIDRA INTERSECTION

Movement Summary

Kanangra Dr and Subdivision

Future PM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
2	T	26	3.7	0.099	0.1	LOS A	3	0.10	0.00	39.5
3	R	118	1.7	0.098	5.1	LOS A	3	0.10	0.55	36.1
Approach		**145**	**2.1**	**0.098**	**4.1**	**LOS A**	**3**	**0.10**	**0.45**	**36.7**
Subdivision										
4	L	75	1.4	0.068	4.7	LOS A	2	0.11	0.50	36.4
6	R	1	50.0	0.067	5.1	LOS A	2	0.11	0.59	36.1
Approach		**76**	**2.6**	**0.068**	**4.7**	**LOS A**	**2**	**0.11**	**0.50**	**36.4**
Kanangra Dr										
7	L	1	50.0	0.019	4.5	LOS A	0	0.00	0.52	36.7
8	T	33	3.0	0.019	0.0	LOS A	0	0.00	0.00	40.0
Approach		**35**	**5.7**	**0.019**	**0.3**	**LOS A**		**0.00**	**0.03**	**39.8**
All Vehicles		**256**	**2.7**	**0.099**	**3.8**	**Not Applicable**	**3**	**0.09**	**0.41**	**37.0**

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Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA SOLUTIONS

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SIDRA INTERSECTION

Movement Summary

Kanangra Dr and Subdivision

Future AM Peak

Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Kanangra Dr										
2	T	167	1.8	0.137	0.4	LOS A	6	0.21	0.00	38.9
3	R	67	1.5	0.138	5.3	LOS A	6	0.21	0.56	35.9
Approach		**234**	**1.7**	**0.137**	**1.8**	**LOS A**	**6**	**0.21**	**0.16**	**38.0**
Subdivision										
4	L	125	2.4	0.122	5.1	LOS A	4	0.23	0.52	36.1
6	R	1	50.0	0.125	5.6	LOS A	4	0.23	0.65	35.8
Approach		**128**	**3.1**	**0.122**	**5.2**	**LOS A**	**4**	**0.23**	**0.52**	**36.1**
Kanangra Dr										
7	L	1	50.0	0.057	4.5	LOS A	0	0.00	0.52	36.7
8	T	108	1.9	0.058	0.0	LOS A	0	0.00	0.00	40.0
Approach		**110**	**2.7**	**0.058**	**0.1**	**LOS A**		**0.00**	**0.01**	**39.9**
All Vehicles		**472**	**2.3**	**0.138**	**2.3**	**Not Applicable**	**6**	**0.17**	**0.22**	**37.9**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

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SIDRA INTERSECTION

Movement Summary

Pacific Hwy and Kanangra Dr

Holiday AM Peak with 10yr Growth and Subdivision

Signalised - Actuated isolated **Cycle Time = 72 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Blue Wren Dr										
1	L	2	0.0	0.011	23.2	LOS B	1	0.60	0.69	41.2
2	T	2	0.0	0.011	14.1	LOS A	1	0.60	0.41	43.2
3	R	3	0.0	0.011	23.2	LOS B	1	0.60	0.67	41.3
Approach		**7**	**0.0**	**0.011**	**20.6**	**LOS B**	**1**	**0.60**	**0.60**	**41.7**
Pacific Hwy										
4	L	3	33.3	0.009	32.0	LOS C	1	0.70	0.67	39.5
5	T	724	7.6	0.425	14.8	LOS B	77	0.70	0.60	60.2
6	R	35	0.0	0.226	47.6	LOS D	11	0.94	0.73	30.1
Approach		**762**	**7.3**	**0.425**	**16.3**	**LOS B**	**77**	**0.71**	**0.61**	**57.9**
Kanangra Dr										
7	L	109	0.9	0.351	17.5	LOS B	16	0.48	0.74	45.3
8	T	5	0.0	0.730	20.7	LOS B	108	0.88	0.77	38.3
9	R	429	2.3	0.712	29.9	LOS C	108	0.88	0.85	37.3
Approach		**543**	**2.0**	**0.712**	**27.3**	**LOS B**	**108**	**0.80**	**0.83**	**38.7**
Pacific Hwy										
10	L	194	6.7	0.162	14.1	LOS A	16	0.34	0.77	56.3
11	T	734	5.3	0.637	24.7	LOS B	97	0.90	0.77	49.3
Approach		**928**	**5.6**	**0.637**	**22.5**	**LOS B**	**97**	**0.78**	**0.77**	**50.4**
All Vehicles		**2240**	**5.3**	**0.730**	**21.6**	**LOS B**	**108**	**0.76**	**0.73**	**49.0**

Symbols which may appear in this table:

Following Degree of Saturation
x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

SIDRA INTERSECTION

Movement Summary

Pacific Hwy and Kanangra Dr

Holiday PM Peak with 10yr Growth

Signalised - Actuated isolated **Cycle Time = 56 seconds**

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Blue Wren Dr										
1	L	5	20.0	0.037	27.3	LOS B	3	0.75	0.71	39.3
2	T	4	0.0	0.037	17.2	LOS B	3	0.75	0.53	40.8
3	R	6	16.7	0.037	27.0	LOS B	3	0.74	0.70	39.4
Approach		**15**	**13.3**	**0.037**	**24.5**	**LOS B**	**3**	**0.75**	**0.65**	**39.7**
Pacific Hwy										
4	L	7	0.0	0.013	24.0	LOS B	1	0.65	0.69	44.6
5	T	842	6.2	0.406	8.1	LOS A	60	0.60	0.52	70.7
6	R	85	0.0	0.427	39.2	LOS C	21	0.95	0.76	34.0
Approach		**934**	**5.6**	**0.427**	**11.1**	**LOS A**	**60**	**0.63**	**0.55**	**65.2**
Kanangra Dr										
7	L	49	6.0	0.160	18.6	LOS B	7	0.56	0.72	44.7
8	T	7	14.3	0.512	20.3	LOS B	47	0.87	0.73	38.5
9	R	215	2.8	0.509	29.6	LOS C	47	0.87	0.81	37.5
Approach		**271**	**3.7**	**0.509**	**27.3**	**LOS B**	**47**	**0.82**	**0.79**	**38.7**
Pacific Hwy										
10	L	412	5.6	0.369	15.3	LOS B	40	0.51	0.80	54.4
11	T	789	3.0	0.578	16.8	LOS B	77	0.84	0.72	57.6
Approach		**1200**	**3.9**	**0.578**	**16.3**	**LOS B**	**77**	**0.73**	**0.75**	**56.6**
All Vehicles		**2420**	**4.6**	**0.578**	**15.6**	**LOS B**	**77**	**0.70**	**0.67**	**56.5**

Symbols which may appear in this table:

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x = 1.00 for Short Lane with resulting Excess Flow
* x = 1.00 due to minimum capacity

Following LOS
- Based on density for continuous movements

Following Queue
- Density for continuous movement

Appendix R

WATER QUALITY AND DRAINAGE - GWANDALAN

ASQUITH & deWITT PTY LTD

Engineering Report for Residential Development - Stormwater Management, Concept Civil Design & Services

Property:

Lot 3 DP 588206
Kanangra Drive,
Gwandalan

Owner:

Rose Property Group Pty Limited

August, 2007

Unit 7/335 Hillsborough Road,
Warners Bay NSW 2290
Ph: (02) 4978 5100 Fax: (02) 4978 5199
www.asquithdewitt.com.au

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APPENDIX B - MUSIC MODEL DETAILS

APPENDIX C - SOIL & WATER MANAGEMENT CALCULATIONS

This report has been prepared using the most up to date available survey information and current flooding analysis methods. No responsibility for loss occasioned to any person acting or refraining from action as a result of any material in this publication will be accepted by Asquith & deWitt.

Prepared by:

Scott Day B.E. (Env.), Hons. MIEAust CPEng NPER
Member No. 1465150 Civil and Environmental Colleges
Senior Environmental Engineer

Section 1.0 Introduction

Asquith & deWitt Pty Limited has been commissioned by Rose Property Group Pty Limited to complete the engineering report for stormwater management, concept civil design and services for the residential development of Lot 3 DP 588206, Kanangra Drive, Gwandalan.

The NSW Department of Planning issued Director General's Requirements (DGRs) on 2 August 2007. This report will address the following DGRs for the development of the Gwandalan site:

Utilities and Infrastructure

(1) Prepare a utility and infrastructure servicing report and plan for the Site that includes (but is not limited to):

(a) identifying and assessing the capacity of existing utility and infrastructure servicing the site,

(b) identifying that adequate water supply is available for bushfire suppression operations,

(c) identifying all necessary augmentation works to service the site and whether these works can sustain this and other development foreshadowed for the Wallarah Peninsula shown in the Lower Hunter Regional Strategy, and

(d) demonstrate compliance with the requirements of any public authorities in regard to the connection to, relocation and/or adjustment of services affected by the development proposal.

(2) Provide appropriate detailed information on the drainage, sewerage and stormwater management measures to be incorporated on Site, including (but not limited to):

(a) sustainable water measures (such as on site stormwater detention, water sensitive urban design measures, and water recycling);

(b) sediment and erosion control measures; and

(c) the quality and quantity impacts on surface water, groundwater, the sea or any nearby beach, or an estuary, a coastal lake, a coastal creek or other similar body of water, or a rock platform.

Site preparation works

Provide a report that includes (but is not limited to):

- *(a) a detailed survey showing existing and proposed levels and quantities of fill necessary for site preparation works;*
- *(b) details on the source of fill including types of materials and their source; and*
- *(c) details of the quantity and quality of any excess material and arrangements for its disposal.*

A Rezoning report on stormwater management was previously submitted to Wyong Shire Council. The report was prepared by Umwelt (Australia) Pty Limited "Stormwater Management Plan for the Residential Rezoning of Lot 3 DP 588206, Kanangra Drive, Gwandalan", Report No. 1803/R02/V2, dated May 2004. The Umwelt report was used as a basis for the stormwater management design and was amended to reflect the changes to the development layout. Remodelling of the peak flows and water quality has been undertaken in this report.

The subject land parcel has frontage to Lake Macquarie as shown in **Figure 1**. The aim of this report is to provide a stormwater management design for the proposed development, generally in accordance with Wyong Shire Council requirements. The stormwater controls have been designed in accordance with current best management practices and Water Sensitive Urban Design (WSUD) principles.

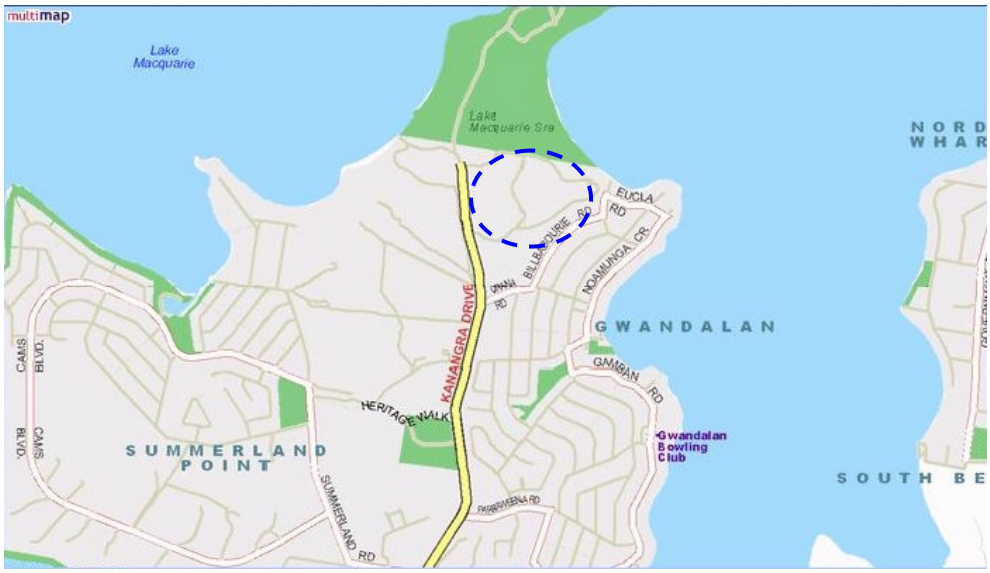


Figure 1 – Site Locality (Plan from Multimaps)

Whilst this report has been prepared for the Department of Planning, considerable effort has been made to meet all development standards for roads, drainage and infrastructure required by Wyong Shire Council (Council).

Section 2.0 Site Description

The site has common boundaries with Gwandalan Public School and existing residential development to the south, Lake Macquarie to the east, Point Wolstoncroft Sport & Recreation Centre (PWS&RC) to the north and Kanangra Drive to the west. The total area of the site is 26 hectares.

The general site topography consists of variable slopes from very flat at the base of the site adjacent to the lake, transitioning to gentle 3-5% slopes through the middle of the site, gradually increasing up to a maximum of 18% in the northwest corner of the site. Approximately half the site has been underscrubbed or cleared. There are six (6) existing dams on site. It is understood from the Rezoning report that these dams were constructed approximately 20 years ago. Refer to **Sheet 001** in **Appendix A**.

2.1 EXISTING DRAINAGE

Catchment boundary definition has been adopted from the Rezoning report with adjustments reflecting the reduction in the area of the site to be developed. The catchment includes small areas of the immediate surrounds, external to the site. The external catchments that directly affect the part of the site to be developed include:

- Public School Area – 2.50 hectares;
- PWS&RC – 0.03 hectares; and
- Kanangra Drive – 0.728 hectares.

The Rezoning report states that stormwater from the Public School buildings is controlled by a pipe constructed within the site conveying stormwater to the uppermost dam. There is no easement over this stormwater discharge into the site. The catchment from the PWS&RC is a natural catchment. Runoff from this catchment enters the site uncontrolled. The catchment area of Kanangra Drive is half road only, extending upslope across the school frontage to the intersection of Kanangra Drive with Orana Road. The existing low point of this catchment is at the site frontage adjacent to the existing site access. Refer to **Sheet 102 & 501** in **Appendix A**.

There are no formal stormwater controls for the runoff from the existing residential development of Billbabourie Road. The majority of this runoff enters the site downslope of the proposed development. There is no easement over this stormwater discharge into the site.

In summary, the external catchments described above have a total area of 3.258 hectares contributing to the developed catchment.

There are two (2) areas of the site which discharge runoff during storm events to the PWS&RC. The first area is an existing catchment area of 1.54 hectares in the north western corner of the site. This area is within the proposed development area. Most of this area is highly disturbed due to its former use as a small quarry. The second area is approximately 0.04 hectares, at the base of the site, close to the lake. This is an area of disturbed Melaleuca forest that continues into the PWS&RC. This area is outside of the proposed development area. Refer to **Sheet 001** in **Appendix A**.

Section 3.0 Proposed Development

The proposed development seeks to create 214 standard residential lots, generally varying in size from 480m^2 to 550m^2, up to a maximum of 1500m^2. These lots are proposed in the upper portion of the site, over an area of approximately 7.88 hectares. Refer to **Sheets 101-103** of **Appendix A**.

The layout has modified the catchment in the north western corner of the site discharging to the PWS&RC. The catchment of all developable area with potential for hardstand will now be contained within the site. Piped drainage is proposed along the rear of Lots 1 to 9. This will also collect street drainage stormwater from the low point in Road 1. The remaining catchment area of the site discharging runoff during storm events to the PWS&RC has been reduced from 1.54 hectares to 0.27 hectares. This contributing area is Asset Protection Zone that cannot be built on due to bushfire regulations. Overflows greater than the piped drainage capacity, suggested to have capacity for 1:5 year ARI storm event, will continue to flow to the PWS&RC. Refer to Sheets **101 & 501** of **Appendix A**.

The proposed development for this application will include the drainage and treatment of runoff from the Public School. The total contributing area of the development to drainage and stormwater controls is then as follows:

- Site Area – 17.612 hectares
- Kanangra Drive frontage – 0.728 hectares (external catchment)
- Gwandalan Public School – 2.50 hectares (external catchment)

Hence, the total contributing area across the site to be developed is 20.84 hectares.

Section 4.0 Background Information

The following documents have been used to complete the engineering design requirements:

- Asquith & deWitt development layout plan.
- Geotechnical Investigation, Lot 3 Kanangra Drive, Gwandalan by RCA Australia, Report No. 3438-003/0, August 2003
- "*Stormwater Management Plan for the Residential Rezoning of Lot 3 DP 588206, Kanangra Drive, Gwandalan*", Report No. 1803/R02/V2, dated May 2004, Umwelt (Australia) Pty Limited. (Rezoning report)
- Wyong Shire Subdivision – Development Control Plan No. 66.
- Wyong Shire Wetland - Development Control Plan No 30.
- Wyong Shire Engineering Requirements for Development - Development Control Plan No. 67.
- Wyong Shire Quality Housing - Development Control Plan No. 100.
- Wyong Shire Council's Stormwater Management Plan "Urban Stormwater Quality Management Plan for the Tuggerah Lakes and Coastal Catchments, Wyong Shire Council – July 1999."
- Wyong Council – WSUD DA Process Tools, Draft Prepared by Ecological Engineering, dated June 2007.
- Flood Levels for Lake Macquarie provided by Wyong Shire Council.
- "*Managing Urban Stormwater Soils and Construction*" 4th Edition, Volume 1, March 2004 produced by Landcom (Blue Book).
- Wyong Shire Council - Development Servicing Plan No. 12 Water Supply and Sewerage, The Gwandalan District.

The Australian Rainfall and Runoff (AR&R) Intensity Frequency Duration (IFD) Data used for this study was obtained from Wyong Shire Council's Engineering Requirements for Development – DCP No. 67. Appendix G contains Rainfall Intensity Table for Gwandalan. AR&R (1987) was referenced to generate the intensities for durations greater than one hour.

Section 5.0 Stormwater Requirements

Council's development control plans covering stormwater requirements for development have been reviewed. The stormwater requirements include peak flow attenuation, regional flooding and water quality, described in **Sections 5.1** to **5.3** respectively. The remaining stormwater requirements for wetlands and watercourses are covered in **Sections 5.4** and **5.5**.

5.1 PEAK FLOW ATTENUATION/FLOODING

Council requirements for peak flow attenuation are that the post development peak flows be less than the existing flows for all storm events up to and including the 1:100 year ARI storm event. DCP No. 67 requires the post development peak flows to be modelled with a minimum value of 50% impervious area for standard residential development and 70% for medium to high density residential development. To be conservative, the post development peak flows from the site post development have been remodelled with 70% impervious area with no allowance for rainwater tanks, refer to **Section 6.1**.

5.2 REGIONAL FLOODING

DCP No. 100 specifies an elevation of 2.7 mAHD to be the minimum floor level for residential development. In general, the floor level is required to have a minimum freeboard of 0.3 metres above the 1:100 year ARI flood level. If underground mine workings have taken place below or adjacent to the site, then additional freeboard may be necessary. Identification as to whether the site is affected by underground workings can be verified with the Mines Subsidence Board.

The Rezoning report states that Council has provided peak flood levels for Lake Macquarie. The flood levels are as follows:

- 1:20 year ARI – 0.97 mAHD;
- 1:50 year ARI – 1.24 mAHD;
- 1:100 year ARI – 1.38 mAHD; and
- PMF – 2.63 mAHD.

The highest observed flood level for Lake Macquarie is 1.2 mAHD in 1949.

From the flood level information provided, it appears that the minimum floor level from DCP No. 100 of 2.7 mAHD has been set to be above the Probable Maximum Flood (PMF) level for Lake Macquarie.

5.3 WATER QUALITY

Council has a range of water quality requirements for the improvement of runoff from proposed development prior to discharge from the site. This includes a requirement for control of water quality during construction, and also performance targets for the permanent controls to be installed for the ongoing improvement of stormwater runoff for the life of the development. This requirement is summarised in Section 7.16 of DCP No. 67, which reads as follows:

> *"All developments in the Shire shall ensure that stormwater discharge from the site satisfies environmental requirements by way of restricting increases in pollutants during and post construction."*

More specifically, the requirements for water quality control during construction are to be in accordance with the 'Blue Book', refer to **Section 6.3**. Requirements for the permanent controls for proposed development are contained in Wyong Shire Council's Stormwater Management Plan (SMP) "Urban Stormwater Quality Management Plan for the Tuggerah Lakes and Coastal Catchments, Wyong Shire Council – July 1999". Chapter 6.1.1 of the SMP outlines the stormwater performance objectives for new development. From Table 6.1.1a, the stormwater performance criteria for 'Subdivisions' are specified as follows:

- Suspended Solids - 90% retention of the annual load. *[Assume to be the Developed annual load with no controls].*
- Nutrients - 50% reduction in annual loads (Total Nitrogen and Total Phosphorus).
- Litter - retain material greater than 50 mm from 25% of the 1 year ARI flow.
- Coarse sediment – retain particles greater than 125µm in diameter from 25% of the 1 year ARI flow.
- Hydrocarbons – no visible oils and greases in discharge from 25% of the 1 year ARI flow.

On a development lot basis, each lot purchaser will be required to comply with DCP 100 for the construction of a dwelling. DCP 100 requires a rainwater tank with a minimum capacity of 5 KL is to be installed with each new dwelling. This exceeds the water reuse requirements for compliance with BASIX for new dwellings. The requirement is to increase water reuse potential by stormwater harvesting, reducing the mains water supply use. The additional benefit of a rainwater tank is the capture of roof water as an incidental 'at source' control for the improvement of water quality. The additional roof water runoff captured minimises the potential of pollutant entrainment and reduces the load on stormwater infrastructure downstream.

MUSIC (Model for Urban Stormwater Improvement Conceptualisation) is the most appropriate and current water quality model available to demonstrate that all requirements have been met. MUSIC was used in the water quality calculations for the Rezoning report. However, since that time, Council has new draft guidelines specifying the base parameters to be used. The guidelines are WSUD DA Process Tools. The modelling of the stormwater treatment train to meet these requirements, is described further in **Section 6.2**.

5.4 DCP NO. 30 - WETLANDS

As discussed in the Rezoning report, the site has been mapped by Council to contain a Wetlands Development Control Plan area at the base of the site. This area is predominantly pasture. It is not clear how the defined area in DCP No. 30 has been determined, since a large portion of the defined area has been pasture for approximately 20 years, and is the same as the adjacent surrounds. Refer to **Sheet 001** of **Appendix A**. From Table 1 of DCP No. 30, the identified area has the following treatment implications:

- **Level of Significance** – Local.
- **Role of Policy** – To ensure that wetland remnants, wetland buffers and lands of nutrient and sediment filtering value are properly protected.
- **Information to be submitted with Development Application** – Statement of Environmental Effects.
- **Consent Authority** – Department of Planning.

The proposed development area is generally clear of the wetland development control plan area mapped by Council. Dam 2, an existing farm dam, is within this area and will be modified and extended to be a constructed wetland.

In summary, the requirements from DCP No. 30 for this area of the site are as follows:

- make the wetland a feature for surrounding residents;
- provide wetland habitat and corridors for continuity;
- use indigenous species for revegetation; and
- maintain sediment and nutrient filtering value.

In accordance with the DCP requirements, Dam 2 will be extended and enhanced to become a feature of the site whilst maintaining sediment and nutrient filtering value in the form of a constructed wetland. Compliance with this requirement is described in **Section 7.3**.

5.5 WATERCOURSES

The management of existing watercourses is regulated by the Department of Water and Energy (DWE). The definition of a watercourse is generally characterised by defined bed and banks with associated riparian vegetation, conveying stormwater from a reasonable catchment area and maintaining continuity with an existing drainage area.

In the south eastern corner of the site area to be developed, a catchment of approximately 2 hectares of the school and existing residential development has discharged concentrated runoff to a gentle depression. The depression originally had no defined bed or banks. The concentration and increased runoff has scoured a small creek line into the depression. As a result there is no riparian vegetation associated with the creek line that has been created. From this sequence of events it is not considered that the scoured creek line be maintained, since at present there is little or no habitat value to preserve. Refer to **Sheet 001** of **Appendix A**.

As part of the proposed development, a water feature/swale will be reconstructed close to the alignment of the existing scoured creek line. The swale will be used for water quality improvement for runoff from the proposed development. Landscaping will be used to provide visual and ecological enhancement, also providing some habitat value. Refer to **Sheet 103** of **Appendix A**.

As described in **Section 2.0**, there are six (6) main existing dams on site. The dams have been influencing flows on the site for sufficient time to be part of the existing flow regime for the site. The Rezoning report describes these links as grassed, dry overland links between the upper dams. The dry overland flow links have no defined bed and banks or associated riparian vegetation. Refer to **Sheet 001** of **Appendix A**.

Section 6.0 Stormwater Management Strategy

The stormwater management strategy for the development of the site is a water sensitive urban design solution adopting current best management practices. In order to meet Council's stormwater requirements for the development of the site as a residential development, it will be necessary to address the issues raised in **Sections 5.1** to **5.4**. Watercourses have been addressed in **Section 5.5**.

The key considerations for the strategy are:

- conveyance of stormwater through the development of the site;
- water quality treatment of stormwater from the development of the site;
- peak flow attenuation of stormwater from the development of the site;
- conveyance of stormwater from the existing surrounds through the site;
- enhancement of the Wetlands Development Control Plan area;
- extent of the regional 1:100 year ARI flood level from Lake Macquarie;
- discharge of stormwater to the lake; and
- Erosion and Sediment Control during construction of the development.

Dam 2 will be retained within the treatment train for the stormwater management strategy. This dam will be reinstated as a constructed wetland at the base of the proposed development. The treatment train will be discussed further in **Sections 6.1** and **6.2**.

6.1 PEAK FLOW MODELLING

The peak flows and flood levels for the 1:100 year ARI rainfall event for the site and contributing catchments were modelled using XP-STORM in the Rezoning report. The post development peak flows have been remodelled, also using XP-STORM, to reflect the changes to the development layout. The peak flows have been modelled on the basis of the modelling parameters from the Rezoning report.

XP-STORM is a one-dimensional hydrodynamic model suitable for modelling peak flows. The XP-STORM model can be used to model stormwater flows in watercourses, culverts and conventional street drainage systems. The model is suitable to calculate overland runoff generated from large natural or developed catchments. The model also has the capacity to predict flood levels as a result of backwater effects. These capabilities indicate that the XP-STORM model is suitable to determine the peak flows and flood levels for the catchment.

The equation used in the XP-STORM model analysis was the Laurenson Equation, that is:

$$S = BQ^{n+1}$$

Where, S = volume of storage (m^3/s)

B = Storage Delay Parameter,

Q = instantaneous rate of runoff (m^3/s),

n = -0.285.

Table 7.2 of the Rezoning report shows that the modelled peak flow for the 1:100 year ARI rainfall event measured at the outlet of the site to Lake Macquarie is 8.25 m^3/s for a critical storm duration of two hours.

Since the extent of development will be less than stated in the Rezoning report, the location for comparison of sufficient peak flow attenuation has been amended. The new location is immediately downstream of the extent of development. The existing peak flow for the 1:100 year ARI rainfall event, measured to the extent of development, is 6.21m^3/s for a critical storm duration of two hours.

Post development peak flows from the overall development were modelled on the assumption of a 70% impervious component for each lot with no allowance for rainwater tanks on the future dwellings. The road reserves have been modelled as being 53% impervious. A 30% impervious component has been assumed over the school area, which also contains some existing residential catchment area.

A range of storm durations were simulated to determine the critical storm duration for the overall catchment producing the peak flow from the 1:100 year ARI rainfall event. This is consistent with the approach modelled for the Rezoning report. The simulated developed peak flows measured at the extent of development are presented in **Table 1**.

Table 1 - Storm Durations and Developed Flows for the 1:100 year ARI Rainfall Event

Storm Duration (hours)	0.5	0.75	1	1.5	2	3	6
Peak Flow (m^3/s)	9.13	8.53	9.07	9.21	9.17	6.50	4.21

Table 1 shows that the modelled peak flow for the 1:100 year ARI rainfall event for the developed catchment, with no controls, measured at the extent of development is 9.21 m^3/s for a critical storm duration of 1.5 hours. The results indicate that peak flow attenuation is required in order to comply with Council requirements.

Council requires demonstration by modelling that the post development peak flows will be less than the existing flows for all storm events up to and including the 1:100 year ARI storm event. In order to comply with these requirements, peak flows will be attenuated by detention storage, within Dam 2, the dam to be reinstated as a constructed wetland at the extent of development.

As before, a range of storm durations were simulated for peak flow attenuation to determine the critical storm duration for the main catchment producing the peak flow from the 1:100 year ARI rainfall event. The simulated developed peak flows with attenuation controls measured at the extent of development, outlet of Dam 2 are presented in **Table 2**.

Table 2 - Storm Durations and Developed Flows with Peak Flow Attenuation for the 1:100 year ARI Rainfall Event

Storm Duration (hours)	0.5	0.75	1	1.5	2	3	6
Peak Flow (m^3/s)	5.82	5.74	6.05	6.07	6.17	5.43	4.20

Table 2 shows that the modelled peak flow for the 1:100 year ARI rainfall event for the developed catchment, with attenuation controls and measured at the outlet of the site to Lake Macquarie is 6.17 m^3/s for the critical storm duration of two hours. Modelling indicates that the detention storage required is approximately 2800 m^3. The peak flow from the developed site with this storage is less than the existing peak flow of 6.21 m^3/s.

The detention storage required for peak flow attenuation is described above as approximately 2800 m^3. This is conservative, over estimated to define area requirements for the concept design of the constructed wetland. This is equivalent to a depth of approximately 0.9m over the surface area of the constructed wetland after enlargement of Dam 2. Commencement of storage capacity for detention is above the surcharge level for water quality control.

There will be opportunity to reduce the detention storage requirement from 2800m^3 by detailed design. In particular, piped drainage controls for detention control of runoff from minor storm events will enable this peak storage level to be reduced. Furthermore, there may be opportunity to consider a portion of the void space available in the rainwater tanks of the future dwellings. It is a requirement that the tanks are connected to indoor uses such as toilet flushing and laundry uses. This indoor connection provides a regular and reliable drawdown of the water stored in the tank. As a result, there is space available in each tank to reduce the level of storage required for detention in the constructed wetland. This will be subject to detailed design.

The modelling completed to date is conceptual only, and has been undertaken to demonstrate that peak flow attenuation requirements for the proposed development can be met within the development layout for the major design storm up to and including the 1:100 year ARI storm event. The 1:100 year ARI storm event typically has the largest runoff storage requirements for peak flow attenuation of all storm events. Design of the outlet controls will be required to evaluate the smaller storm events at the detailed design stage of the development, to refine the design and sizing of the constructed wetland to service the development.

6.2 WATER QUALITY MODELLING

As discussed in **Section 5.3**, MUSIC has been used to design and size the permanent water quality controls for the runoff from the proposed development and demonstrate compliance with Council's SMP water quality performance objectives. A treatment train of water quality controls was established and evaluated for effectiveness using MUSIC Version 3.

In addition to the water quality treatment for the runoff from the site post development, contributing runoff from external catchments of the Public School area and Kanangra Drive external to the site will also be treated. The total contributing catchment area modelled is approximately 20.84 hectares.

The first control of the treatment train will be the rainwater tanks for each dwelling within the site post development. Although the effect of these tanks has not been modelled, rainwater tanks reduce pollutant entrainment potential, as discussed in **Section 5.3**. The second stage will be perimeter swale drainage. The third stage will be a gross pollutant trap. Gross pollutant traps are for the capture of litter and heavy sediment. There are several proprietary products available that can be installed to meet the removal targets set in Council's SMP. The fourth stage of treatment is Dam 2, which will be reinstated as a constructed wetland. Constructed wetlands provide effective removal of Total Suspended Solids, Total Nitrogen and Total Phosphorus. A diagrammatic representation of the treatment train is shown in **Appendix B**.

The proposed development is now a separable parcel at the upslope end of the site. As such, the proposed development has been modelled to the discharge point from Dam 2, rather than the outlet of the site that was modelled in the Rezoning Report.

The following key parameters, generally in accordance with Council's WSUD DA Process Tools, were adopted:

- Rainfall – Since 6min rainfall data is not available for the site or a station within Council's region, Council's guidelines recommend that 6min rainfall data be used from Sydney Observatory Hill over a 20 year period. A parallel is drawn in the guidelines that on the basis of mean annual rainfall, the data from this station is close to the mean annual rainfall of 1184mm from Wyong Bowling Club. A simulation period of 30 years for the period 1931-1960 was used in this model from Sydney Observatory Hill, on the basis of 6min rainfall data. This period produced a mean annual rainfall of 1193mm which is closely equivalent to the mean annual rainfall from Wyong Bowling Club.

- Soil Characteristics – 'Lowland' characteristics described in Council's document were used in the model.

- Road catchments were separated, in the model, from urban areas, for application of the different pollution generation rates. Urban areas were modelled as 70% impervious and roads as 53% impervious. Note that no allowance has been made in this modelling for the effect of a 5KL rainwater tank on each lot, as required by Council. The school/existing residential area catchment was treated as 30% impervious.

- The length of swale modelled for treatment was taken as an average treatment length. For example, piped drainage from a subcatchment enters the swale at 50m, 100m and 150m treatment length before outlet to the wetland. Therefore the swale length was entered into the MUSIC model as the average length of treatment for the subcatchment. In the example above this is equivalent to 100m being entered into the model. Refer to **Sheets 101-103** of **Appendix A**.

- Treatment node parameters for the swale, gross pollutant trap and constructed wetland were adopted directly from Council's document.

- A detention time of 73hrs was used for the constructed wetland, marginally above Council's requirement of 72hrs. A seepage rate of 2.5mm/hr was adopted from the geotechnical report. This was a conservative estimate, lower than the rates anticipated.

The remodelling of the nutrients from the site post development, and the inclusion of the external catchments for treatment train effectiveness of the water quality controls are shown below in **Table 3**.

Table 3 – Water Quality Modelling Results from MUSIC

Pollutant	Development No Controls 'A'	Development with Controls 'B'	Treatment Train Effectiveness (%)
Total Suspended Solids (kg/year)	34,200	3,180	90.7
Total Phosphorus (kg/year)	62.9	15.8	74.8
Total Nitrogen (kg/year)	435	206	52.6

The modelling results in **Table 3** indicate compliance with the SMP performance objectives from **Section 5.3**. **Table 3** shows that the developed pollutant loads have been improved by 90.7%, 74.8% and 52.6% for TSS, TP and TN respectively with the water quality controls in place.

The outcomes of the water quality modelling indicate that a constructed wetland with a surface area of 3000m^2 and volume of 2200m^3 is required at the base of the proposed development. This will be accommodated within the site by extending Dam 2 to be reinstated as a constructed wetland. All treatment for the proposed development is contained to the swale, GPT and Dam 2 as a constructed wetland, with sufficient water quality and detention controls for the proposed development. Since there is significant area available for this wetland, only a concept sketch of the area requirements is provided. Final detailed design of the constructed wetland for the configuration of the shallow water and deep water zones will be undertaken for the Construction Certificate. Refer to **Sheet 502** of **Appendix A**.

6.3 SOIL AND WATER MANAGEMENT PLAN

Erosion and sediment control, described in a Soil and Water Management Plan is necessary during construction for the protection of receiving waters downstream. Erosion and sediment control measures are temporary, and are required until such time that building and construction areas are landscaped, revegetated and sealed. As described in the Rezoning report, Council generally requires sedimentation dams to be constructed for areas of disturbance greater than two (2) hectares. At this site there are five (5) main existing dams that could be used for erosion and sediment control during construction of each stage.

From the Geotechnical Investigation by RCA states that the soils are a mixture of Type F and Type C. As a result, the sediment basin has been designed for settlement of Type F soils. To be conservative, allowance has been made for disturbance of the overall development, however, the development will be constructed in a series of stages. An overall sediment basin, sized in accordance with "*Managing Urban Stormwater Soils and Construction*" (Blue Book) 4th Edition, Volume 1, March 2004 produced by Landcom, would be approximately 3854m^3. This sediment basin quantity however would be distributed between the existing dams allocating approximately 770m^3 per basin and to suit staging. Refer to **Appendix C** for calculation. Refer to **Sheet 601** of **Appendix A**.

Section 7.0 Additional Drainage Requirements

7.1 DRAINAGE FLOWPATHS

In addition to the peak flow attenuation and water quality requirements, stormwater management is required to manage peak flows to be passed safely through the development site. These flows will be conveyed by pathways and roads above piped drainage lines. Energy dissipation will be required at the end of the swales as an inlet structure to the constructed wetland. Refer to **Sheet 502** of **Appendix A.**

The drainage flowpaths, pipes and energy dissipation structure will be sized for the Construction Certificate at the detailed design stage.

In the north west corner of the proposed development, piped drainage will be used to contain runoff from hardstand areas entering the PWS&RC property. A low point in Road 1 at this location is unavoidable, however piped drainage can be constructed for control of runoff collected in the low point and returned to the piped street drainage for discharge to the treatment system. The piped drainage will be designed for capacity of runoff from the 1:5 year ARI storm event, in accordance with Council requirements. Flows in excess of this capacity from larger events, will continue to discharge from the site into the gully within PWS & RC. Refer to **Sheet 101** of **Appendix A.**

There is an existing low point in Kanangra Drive. The low point is on a localised topographical saddle with only half road draining through the site during rainfall events adjacent to the existing entry. As described in Section 2.1, the catchment does extend up to the intersection with Orana Road. This low point has been accommodated for within the design. Refer to **Sheet 102** of **Appendix A**.

The flowpath connection to Lake Macquarie should also be maintained. Dam 2, to be reinstated as a constructed wetland for the proposed development, overflows to Dam 1. Overflows from Dam 1 discharge to the existing harbour. Although Dam 1 is not required for water quality for the development, the existing harbour is the site discharge point and this is currently blocked and silted over. The existing 1:100 year ARI peak flow from the site is 8.25m^3/s. This peak flow should be controlled discharge to Lake Macquarie through the existing outlet. Detailed design for the reshaping of the harbour entrance to pass this peak flow safely should be undertaken. This will be to prevent potential inundation of major storm event flows toward the existing residence and/or uncontrolled discharge through the PWS&RC property. Refer to **Sheet 001** of **Appendix A.**

7.2 FILLING

Council's minimum floor level for development is 2.7 mAHD. The lowest existing ground elevation level within the proposed development area is a level of approximately 4mAHD, within proposed lots 95 and 113. Minor filling is required for the road at this location. This existing ground elevation is well above the 1:100 year ARI peak flood level for Lake Macquarie of 1.38 mAHD. Areas of regrade are described in **Section 8.0**. Refer to **Sheet 102** of **Appendix A.**

7.3 WETLAND DEVELOPMENT CONTROL PLAN AREA

The Wetlands Development Control Plan area in the lower section of the site, as described previously in **Section 5.4,** is predominantly pasture. In accordance with DCP No. 30, the defined area should be a feature for surrounding residents, and be designed to provide nutrient controls for the protection of Wetland Areas (7g) or SEPP 14 areas. At this site, the water quality/nutrient control is for the protection of Lake Macquarie. Dam 2, within the wetland development control plan area, will be reinstated as a constructed wetland. Dam 2 is an old farm dam, not providing any ecological function or feature or standardised nutrient control other than capacity. The reinstatement will involve landscaped enhancement of Dam 2 to be a feature wetland, meeting Council's requirements. The constructed wetland has been sized accordingly for water quality improvement prior to discharge to Lake Macquarie. Refer to Refer to **Sheets 001 & 502** of **Appendix A.**

Section 8.0 Concept Civil Design

The concept civil design for the proposed development has been completed to Council standards. This includes the standard for road widths and grades. The two (2) road reservation widths adopted within the proposed development are 22 metres wide for the bus route 'loop road' and 16.5 metres wide for the access streets. The 'loop road' provides for turning of the school bus. At present there is no provision for bus turning manoeuvres along Kanangra Drive or at the school. The overall road reservation width is in accordance with Council's standard, however, the streetscape of the carriageway, verge and concrete footpaving within the road reserve has been modified. Refer to **Sheet 701** in **Appendix A**.

Concrete footpaving 1.2 metres wide has been adopted for one side only of each road. The proposed development has a central, shared footpath 2.5 metres wide catering for increased levels of pedestrian movement to and from the school. It is considered unnecessary to duplicate concrete footpaving to both sides of the road for a number of reasons. A main thoroughfare has been provided as the centralised footpath. Footpaving on a single side of the road will adequately cater for the number of pedestrians likely to use it. The proposed development is also the last remaining residential development in the area and unlikely to need to convey further pedestrian movement in the future through the development. The duplicated concrete footpath would also be an increased area of hardstand impervious area, where generally, sustainability standards are attempting to reduce hardstand areas associated with development. Refer to **Sheets 101-103 & 701** in **Appendix A**.

The carriageway width proposed for the bus route will be 11 metres wide in accordance with Council's standard. The carriageway width for the access streets has been widened to 7.5 metres from Council's standard of 5.5 metres. The entry roads adjacent to the landscaped central median will be one-way, and have been designed with a carriageway width of 5.5 metres. The widened carriageways of both the access street and entry roads are to accommodate parking within the carriageway. Refer to **Sheet 701** in **Appendix A**.

The verge widths of the bus route and access streets have been modified from Council's standard. The verge of the bus route is to accommodate swale drainage at the base of the proposed development. The minimum verge width of the bus route is 4.5 metres, containing a 1.2 metre wide concrete footpath. The access streets have been further modified to alternate between 3 metre and 6 metre verge widths either side. This is to allow for the carriageway to be variable from the centreline of the road reserve, reducing the straight length appearance of these streets. The 1.2 metre wide concrete footpaving remains within the 6 metre wide verge, also alternating at this location. A traffic calming device is also proposed at each of these junctions. Refer to **Sheets 101-103 & 701** in **Appendix A**.

The maximum longitudinal grade of the bus route is along the northern boundary. After preliminary grading of the road alignments, the maximum grade by design is 9.8%. This is less than Council's maximum grade of 14% for a bus route. Road 3 contains the steepest section for an access street, which is 12%. The maximum permissible longitudinal grade of an access street is 15%. Refer to the longitudinal sections in the engineering plan set.

It is proposed to provide upright kerb and gutter and shoulder works of half road construction to Kanangra Drive. This is to provide an 11 metre wide carriageway for Kanangra Drive as a bus route loop. Half road drainage from Kanangra Drive will also be accommodated within the proposed development. Refer to **Sheets 501 & 701** in **Appendix A**.

A u-turn bay has been provided through the central median of the entry road. This is to facilitate access to residential lots fronting the entry road. The u-turn bay is designed in accordance with Council requirements. Refer to **Sheet 102** in **Appendix A**.

There are areas of the site requiring regrade. This includes the cut through the workings of the derelict quarry that has significantly modified the landform in this area. Adjacent to the northern boundary there is a relatively steep section which has been overcome with tiered retaining walls, each one (1) metre high. This is to improve driveway access to the lots on the southern side of the bus route and minimise site regrade. Generally site regrade has been shown where the top of batter encroached beyond the building setback. Regrade has been designed with a maximum elevation of one (1) metre above the boundary level. This is to accommodate future driveway access. Refer to **Sheets 101-103** in **Appendix A**.

It is unlikely that fill materials will be required to be imported to site, other than standard gravel materials of subbase and basecourse for road pavement construction. The regrade of the derelict quarry area will produce sandstone that can be reused on site for filling (dams, etc) and also subgrade replacement for road construction if unsuitable subgrade is found during construction. Conventionally this would be imported material for subgrade replacement however the development of this site will be self sufficient for this replacement material. The concept civil design indicates that at this preliminary stage, there will be some excess material generated however this will most likely be balanced during the process of detailed design.

Section 9.0 Services

Council has been contacted in relation to water and sewer servicing of the site. Development Servicing Plan No. 12 Water Supply and Sewerage – The Gwandalan District (DSP No. 12) was obtained from Council. This document covers water and sewer servicing for the area.

An existing sewer access chamber is located within the site. DSP No. 12 has provision for an additional 250 lots on our site. This is in excess of our development proposal to create 214 lots over the site. Correspondence with Council officers was obtained for the capacity of the system and to obtain work programs for upgrades. This has assisted with determining staging and costs to upgrade sewer infrastructure external to the site as 'works in kind' in accordance with DSP No. 12. Refer to **Sheet 702** of **Appendix A**.

In accordance with DSP No. 12, lead in water reticulation will be constructed to the site frontage along Cams Boulevarde as 'works in kind'. Provision has been made within DSP No. 12 for the lead in mains to cover bushfire requirements along Kanangra Drive. Refer to **Sheets 703 & 704** of **Appendix A**.

Energy Australia has been previously contacted for electrical servicing of the development. There is existing high voltage supply (11kV) at the site frontage and nearby adjoining existing residential development. The standard procedure of electrical feasibility design by Energy Australia will be required following acceptance of the proposed development layout.

Section 10.0 Compliance Checklist

The DGRs listed in **Section 1.0** have been addressed. From **Section 6.0**, the key considerations for the design of the stormwater management system have been addressed as follows:

- conveyance of stormwater through the development of the site (**Sections 6.1, 6.2 & 7.1**);
- water quality treatment of stormwater from the development of the site (**Section 6.2**);
- peak flow attenuation of stormwater from the development of the site (**Section 6.1**);
- conveyance of stormwater from the existing surrounds through the site (**Section 2.1, 3.0, 6.1, 6.2 & 7.2**);
- enhancement of the Wetlands Development Control Plan area (**Section 7.3**);
- extent of the regional 1:100 year ARI flood level from Lake Macquarie (**Section 7.2**);
- discharge of stormwater to the lake (**Section 6.1, 6.2 & 7.1**); and
- Erosion and Sediment Control during construction of the development (**Section 6.3**).

In addition to meeting Council's requirements, the stormwater management strategy is a water sensitive urban design. This is because there are key treatment train components targeting specific water harvesting and improvement of water quality. The added benefit to the community in terms of stormwater is that the development will provide treatment and control for runoff from Kanangra Drive and the public school, an area of approximately 3.23 hectares, that is presently untreated discharge to Lake Macquarie. This will be a positive impact on the water quality of discharge from the site. There is significant area available for the constructed wetland which will also be a wetland habitat area, providing water quality/nutrient control prior to discharge to Lake Macquarie.

Concept civil design has revealed that the site can be developed within acceptable grades for roads and lots.

Servicing of the development for water and sewer is available as part of proposed works within Council's servicing document DSP No. 12 for the Gwandalan District. Electrical reticulation is also available to the site frontage for servicing the development.

Appendix A – Selected Concept Engineering Plans

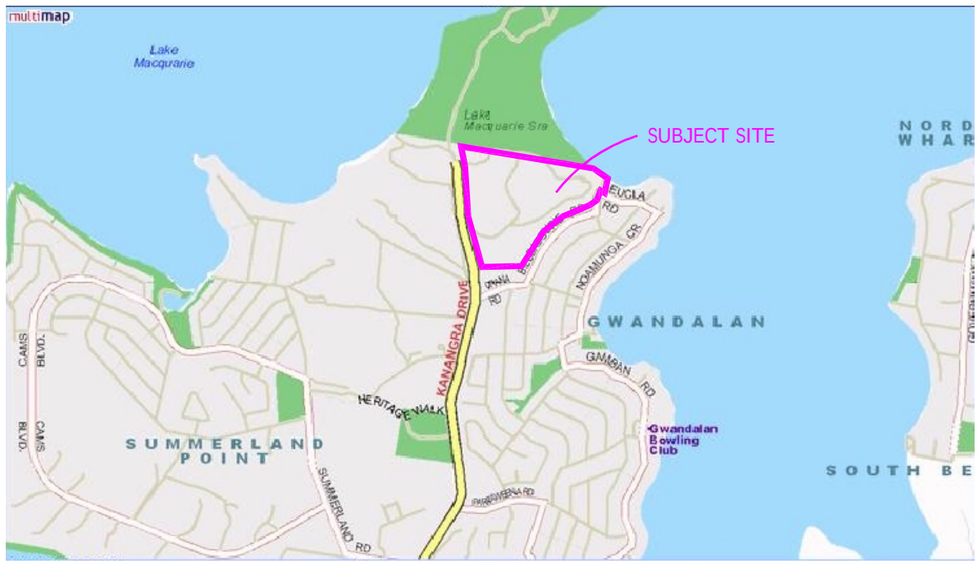
CONCEPT CIVIL ENGINEERING DESIGN PLANS FOR PROPOSED RESIDENTIAL SUBDIVISION

KANANGRA DRIVE, GWANDALAN
WYONG SHIRE COUNCIL

CLIENT: ROSE PROPERTY GROUP PTY. LTD.

ASQUITH & deWITT PTY LTD
SURVEYING, PLANNING, MAPPING
PROPERTY DEVELOPMENT MANAGERS

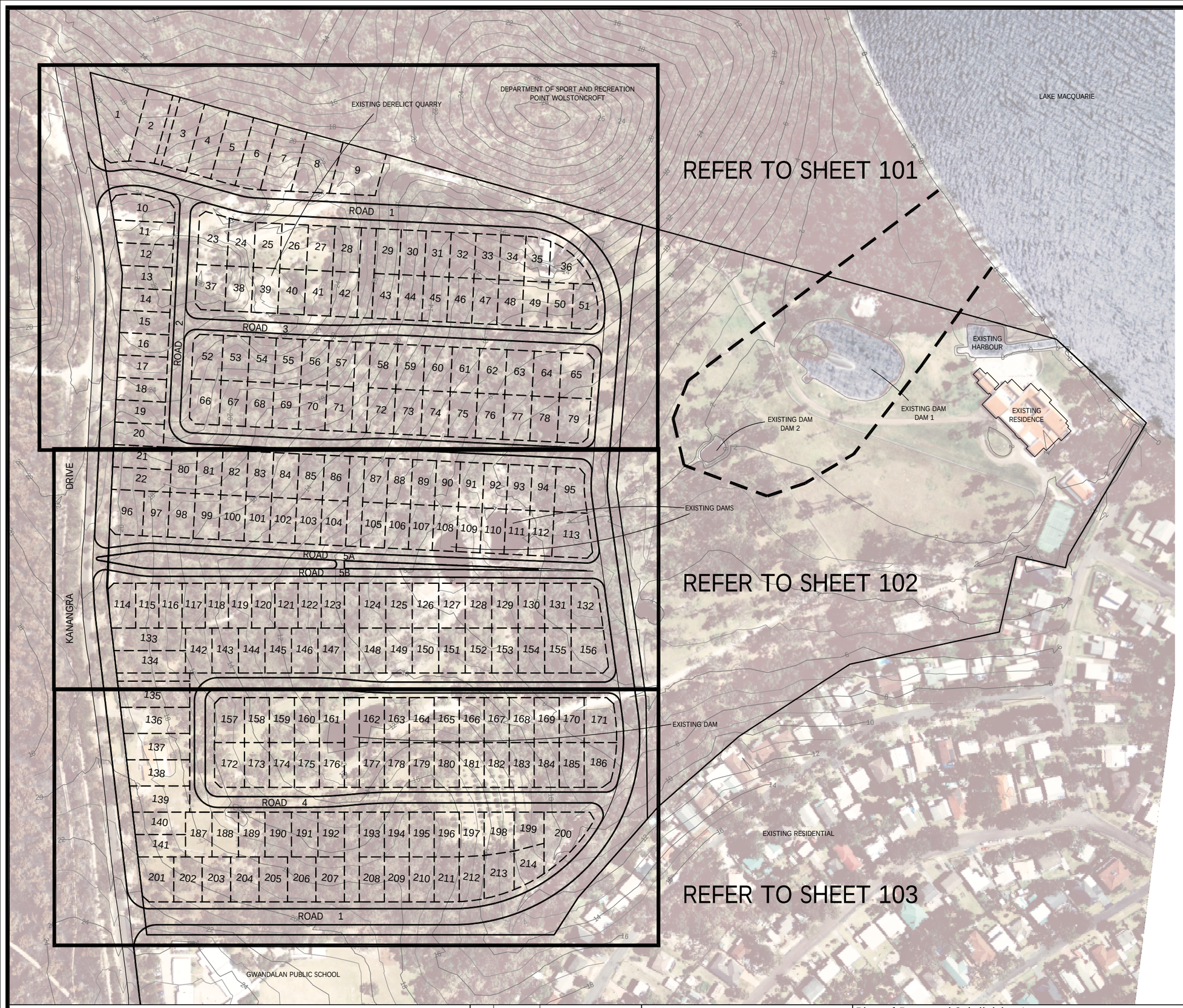
ROSE
Creating a quality way of living



LOCALITY PLAN
(FROM MULTIMAP)

AutoCAD File: N:\11778\Dwg\Eng\11778eng-3c

DWG No.	SHEET TITLE	VER.
000	TITLE SHEET, INDEX, LOCATION DIAGRAM & GENERAL NOTES	
001	PROPOSED SUBDIVISION LAYOUT	B
101	DETAIL PLAN 1	B
102	DETAIL PLAN 2	B
103	DETAIL PLAN 3	C
201	LONGITUDINAL SECTION - KANANGRA DRIVE	B
211	LONGITUDINAL SECTION - ROAD 1 (CH.0 - 330)	B
212	LONGITUDINAL SECTION - ROAD 1 (CH.330 - 660)	B
213	LONGITUDINAL SECTION - ROAD 1 (CH.660 - CH.1086.99)	B
221	LONGITUDINAL SECTION - ROAD 2 (CH.0 - CH.330)	B
222	LONGITUDINAL SECTION - ROAD 2 (CH.330 - CH.447.21)	B
231	LONGITUDINAL SECTION - ROAD 3	B
241	LONGITUDINAL SECTION - ROAD 4 (CH.0 - CH.330)	B
242	LONGITUDINAL SECTION - ROAD 4 (CH.330 - CH.630)	B
25a1	LONGITUDINAL SECTION - ROAD 5a (NORTH ARM)	B
25b1	LONGITUDINAL SECTION - ROAD 5b (SOUTH ARM)	B
501	STORMWATER CATCHMENTS	B
502	CONSTRUCTED WETLAND	B
601	SOIL AND WATER MANAGEMENT	B
701	TYPICAL SECTIONS	C
702	SEWER MAIN LAYOUT	B
703	WATER MAIN LAYOUT	B
704	LEAD-IN WATER MAIN	B



N

LEGEND

- SITE BOUNDARY
- PROPOSED BOUNDARY
- MAJOR NATURAL CONTOUR
- MINOR NATURAL CONTOUR
- WETLAND DEVELOPMENT CONTROL PLAN AREA

THIS SHEET IS NOT TO SCALE

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Ver.	Date	Comment
B	07/2007	Project Application
A	06/2007	Initial Release

LOCATION

KANANGRA DRIVE, GWANDALAN

Plan of Proposed Subdivision Layout

Council:	Wyong	Projection:	M.G.A.
Datum:	A.H.D.	North Direction:	Grid
Source:	ADW Survey	Plan By:	MJH
Contour Interval:	1.0m (Nat)	Checklist:	MJH

Version:	B (July 2007)
Client:	Rosecorp Pty. Ltd.
AutoCAD Ref:	N:\11778\Dwg\Eng\11778eng-3b
Job No:	11778

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Original Size A1

Sheet 001

NOTES:-
1. EACH DWELLING TO HAVE A MINIMUM 5KL RAINWATER TANK.

LEGEND
- REGRADE AREA
- NEW ROAD/FOOTPAVING
- EXISTING ROAD
- DESIGN CONTOURS
- BOUNDARY
- ROAD CENTRELINE
- EXISTING CONTOURS
- STORMWATER DRAINAGE (CONCEPT)

N

Bar Scale 1: 500 (A1), 1:1000 (A3)

KANANGRA DRIVE

OVERLAND FLOWPATH

BOLLARDS

LOW POINT

ROAD 1

ROAD 2

ROAD 3

RETAINING WALLS SEE SECTION "A"-"A" SHEET 701

"A"

REGRADE EXISTING QUARRY

TRAFFIC CALMING DEVICE

PATHWAY

HALF-ROAD CONSTRUCTION

EXISTING PAVEMENT

"C"

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Ver.	Date	Comment
B	07/2007	Project Application
A	06/2007	Initial Release

LOCATION

KANANGRA DRIVE, GWANDALAN

Plan of Detail 1

Council:	Wyong	Projection:	M.G.A.
Datum:	A.H.D.	North Direction:	Grid
Source:	ADW Survey	Plan By:	MJH
Contour Interval:	1.0m (Des & Nat)	Checklist:	MJH

Version:	B (July 2007)
Client:	Rosecorp Pty. Ltd.
AutoCAD Ref:	N:\11778\Dwg\Eng\11778eng-3b
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Sheet 101

LEGEND

- DESIGN CONTOURS
- BOUNDARY
- ROAD CENTRELINE
- EXISTING CONTOURS
- STORMWATER DRAINAGE (CONCEPT)
- REGRADE AREA
- NEW ROAD/FOOTPAVING
- EXISTING ROAD

NOTES:-

1. EACH DWELLING TO HAVE A MINIMUM 5KL RAINWATER TANK.

Bar Scale 1: 500 (A1), 1:1000 (A3)

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Ver.	Date	Comment
B	07/2007	Project Application
A	06/2007	Initial Release

LOCATION

KANANGRA DRIVE, GWANDALAN

Plan of Detail 2

Council:	Wyong	Projection:	M.G.A.
Datum:	A.H.D.	North Direction:	Grid
Source:	ADW Survey	Plan By:	MJH
Contour Interval:	1.0m (Des & Nat)	Checklist:	MJH

Version:	B (July 2007)
Client:	Rosecorp Pty. Ltd.
AutoCAD Ref:	N:\11778\Dwg\Eng\11778eng-3b
Job No:	11778

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Original Size A1

Sheet 102

LEGEND

- REGRADE AREA
- NEW ROAD/FOOTPAVING
- EXISTING ROAD
- DESIGN CONTOURS
- BOUNDARY
- ROAD CENTRELINE
- EXISTING CONTOURS
- STORMWATER DRAINAGE (CONCEPT)

NOTES:-

1. EACH DWELLING TO HAVE A MINIMUM 5KL RAINWATER TANK.

Bar Scale 1: 500 (A1), 1:1000 (A3)

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FAX: (02) 4978 5199

Ver.	Date	Comment
C	08/2007	Regrade Note
B	07/2007	Project Application
A	06/2007	Initial Release

LOCATION

KANANGRA DRIVE, GWANDALAN

Plan of Detail 3

Council:	Wyong	Projection:	M.G.A.
Datum:	A.H.D.	North Direction:	Grid
Source:	ADW Survey	Plan By:	MJH
Contour Interval:	1.0m (Des & Nat)	Checklist:	MJH

Version:	C (August 2007)
Client:	Rosecorp Pty. Ltd.
AutoCAD Ref:	N:\11778\Dwg\Eng\11778eng-3b
Job No:	11778

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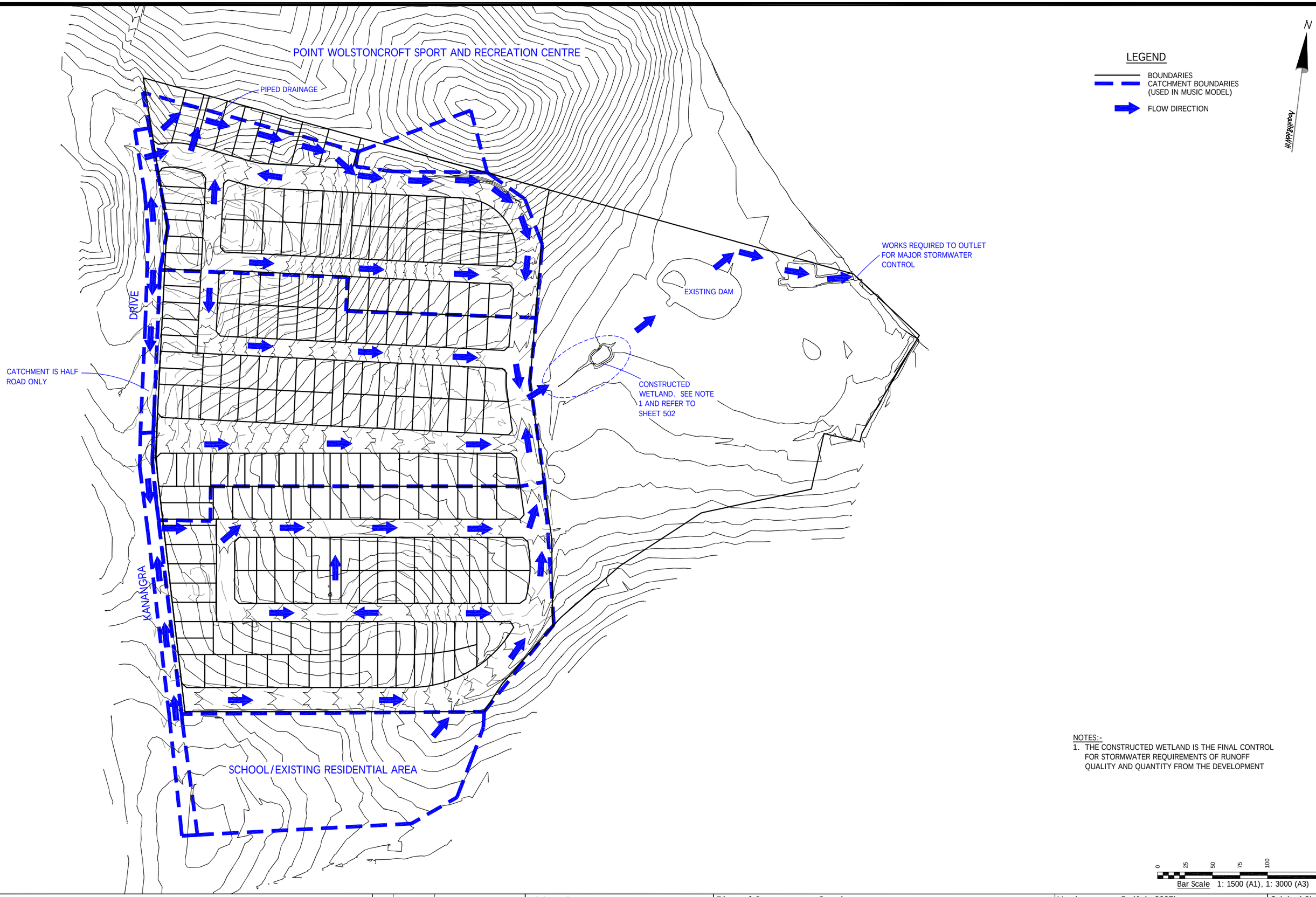
Original Size A1

Sheet 103



NOTES:-

1. THE CONSTRUCTED WETLAND IS THE FINAL CONTROL FOR STORMWATER REQUIREMENTS OF RUNOFF QUALITY AND QUANTITY FROM THE DEVELOPMENT

0 25 50 75 100 150

Bar Scale 1: 1500 (A1), 1: 3000 (A3)

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Ver.	Date	Comment
B	07/2007	Project Application
A	06/2007	Initial Release

LOCATION

KANANGRA DRIVE, GWANDALAN

Plan of Stormwater Catchments

Council:	Wyong	Projection:	M.G.A.
Datum:	A.H.D.	North Direction:	Grid
Source:	ADW Survey	Plan By:	MJH
Contour Interval:	1.0m (Des & Nat)	Checklist:	MJH

Version:	B (July 2007)
Client:	Rosecorp Pty. Ltd.
AutoCAD Ref:	N:\11778\Dwg\Eng\11778eng-3b
Job No:	11778

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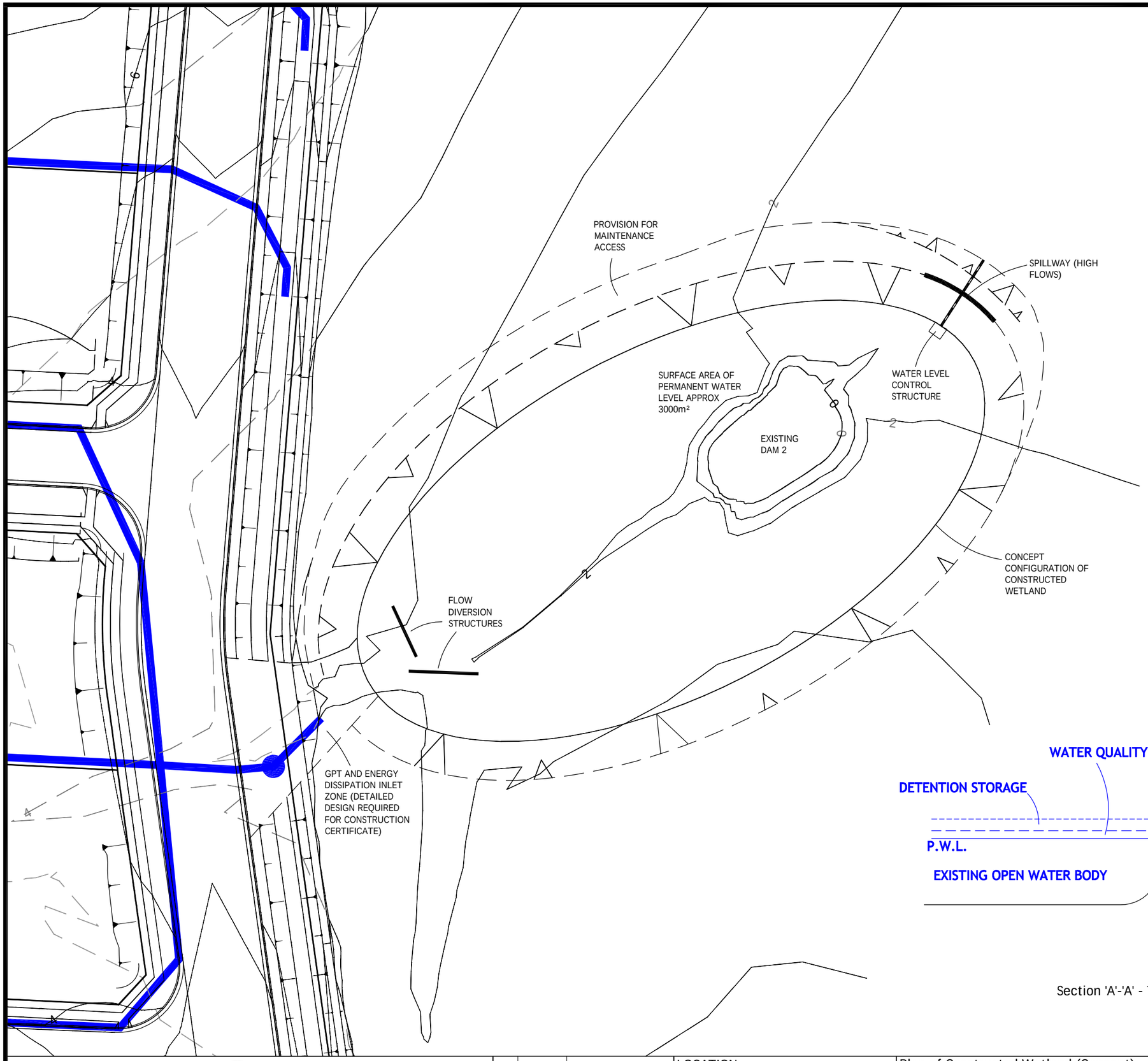
Original Size A1

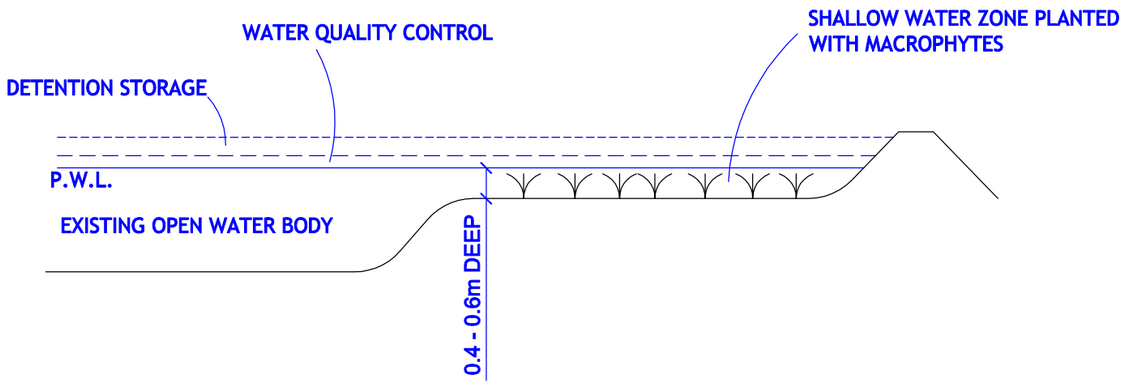
Sheet 501



N

NOTES:-

1. THIS IS A CONCEPT DESIGN ONLY. DETAILED DESIGN IS REQUIRED FOR ALL CONSTRUCTED WETLAND COMPONENTS FOR CONSTRUCTION CERTIFICATE.



Section 'A'-'A' - Typical Section Through Constructed Wetland

Not To Scale

0 1 2 3 4 5 10 15 20 30

Bar Scale 1: 250 (A1), 1:500 (A3)

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A	06/2007	Initial Release

LOCATION

KANANGRA DRIVE, GWANDALAN

Plan of Constructed Wetland (Concept)

Council:	Wyong	Projection:	M.G.A.
Datum:	A.H.D.	North Direction:	Grid
Source:	ADW Survey	Plan By:	MJH
Contour Interval:	1.0m (Des & Nat)	Checklist:	MJH

Version:	B (July 2007)
Client:	Rosecorp Pty. Ltd.
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Sheet 502

ESTABLISH SEDIMENT BASIN - TEMPORARY

INSTALL SEDIMENT FENCE. SEE DETAIL 'A'

DIVERT STORMWATER

STOCKPILE. SUGGESTED LOCATION ONLY

LIMIT OF DISTURBANCE. NO WORKS IN THIS AREA

DAM 1

DIVERSION BANK

REINSTATE DAM 2 AS SEDIMENT BASIN (SEE DETAIL 'C') SIZED TO 'BLUE BOOK' REQUIREMENTS

OVERFLOWS

REINSTATE DAM AS SEDIMENT BASIN. SEE DETAIL 'C'

SEDIMENT BASIN TO BE REINSTATED AS CONSTRUCTED WETLAND

DIVERSION BANK

SEE DETAIL 'D'

LIMIT OF DISTURBANCE. NO WORKS IN THIS AREA

SITE SHEDS. SUGGESTED LOCATION ONLY

DIVERSION BANK

REINSTATE DAM AS SEDIMENT BASIN. SEE DETAIL 'C'

TEMPORARY CONSTRUCTION ACCESS. SEE DETAIL 'B'

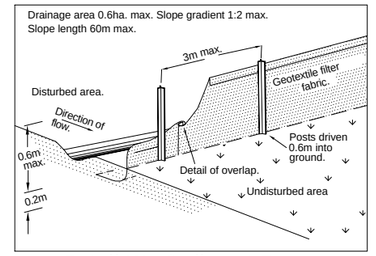
STOCKPILE. SUGGESTED LOCATION ONLY

INSTALL DRAINAGE OR DIVERSION OF STORMWATER FROM PUBLIC SCHOOL (CLEAN WATER) EARLY IN CONSTRUCTION PHASE

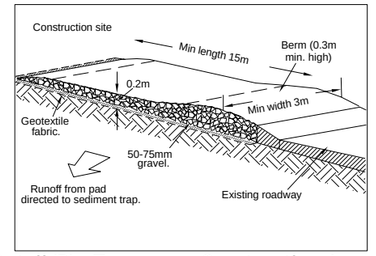
N

LEGEND

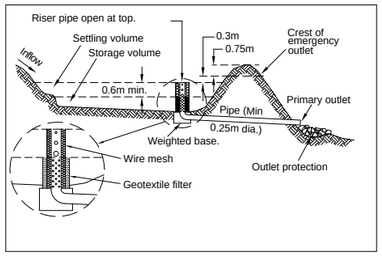
- SITE BOUNDARY
- PROPOSED BOUNDARY
- MAJOR NATURAL CONTOUR
- MINOR NATURAL CONTOUR



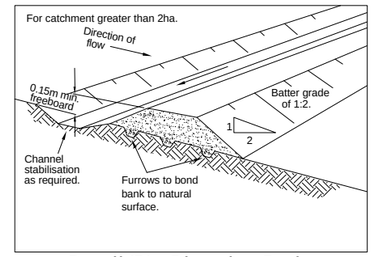
Detail 'A' - Sediment Fence



Detail 'B' - Temporary Construction Access



Detail 'C' - Typical Sediment Basin Section



Detail 'D' - Diversion Drain

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Ver.	Date	Comment
B	07/2007	Project Application
A	06/2007	Initial Release

LOCATION

KANANGRA DRIVE, GWANDALAN

Plan of Soil and Water Management

Council:	Wyong	Projection:	M.G.A.
Datum:	A.H.D.	North Direction:	Grid
Source:	ADW Survey	Plan By:	MJH
Contour Interval:	1.0m (Nat)	Checklist:	MJH

Version:	B (July 2007)
Client:	Rosecorp Pty. Ltd.
AutoCAD Ref:	N:\11778\Dwg\Eng\11778eng-3b
Job No:	11778

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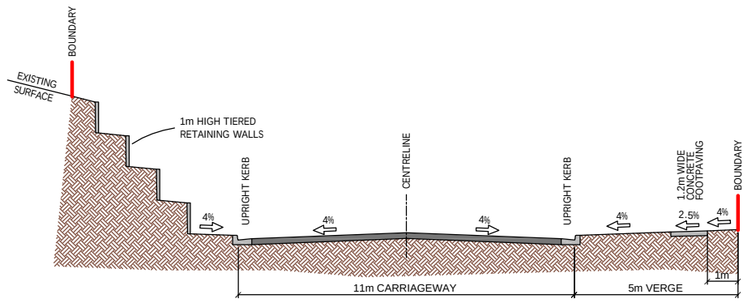
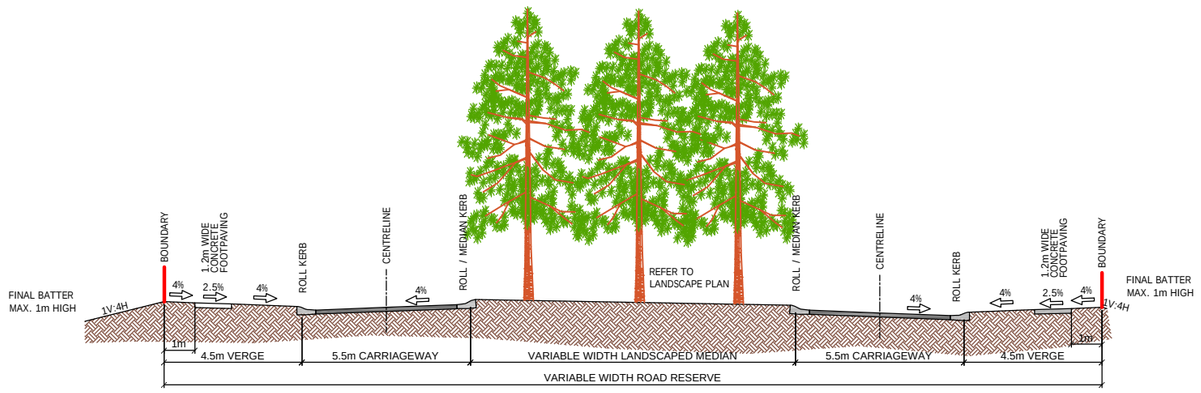
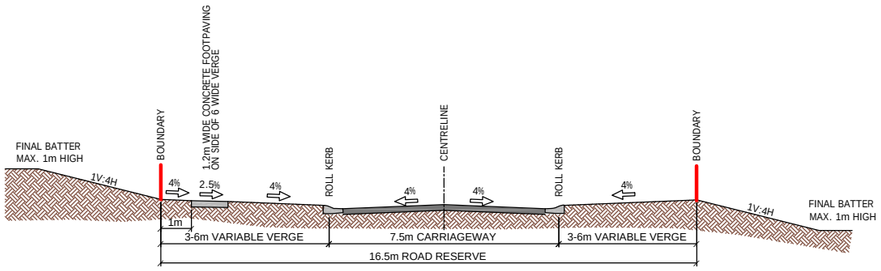
Sheet 601



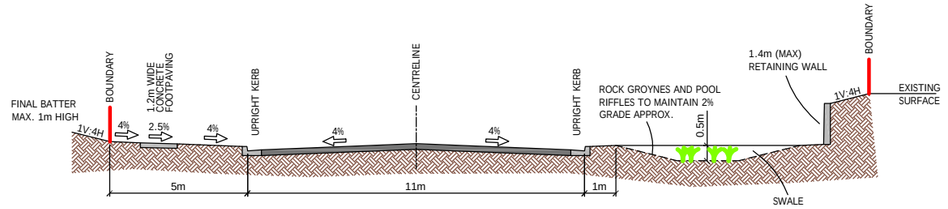
Section "A" - "A"
(Road 1)



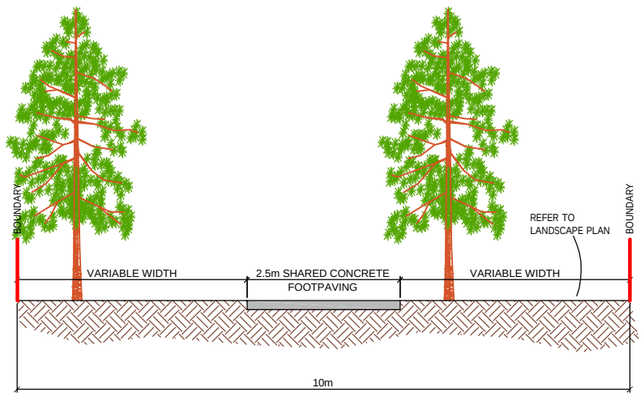
Section "B" - "B"
(Roads 5a and 5b)



Section "C"-"C"
(Roads 2, 3 and 4)

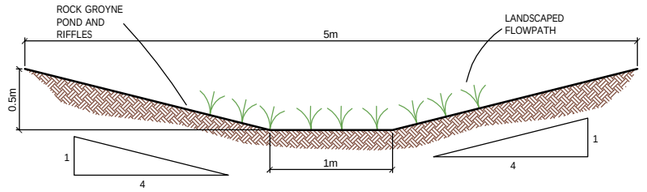


Section "D"-"D"
(Road 1)



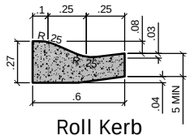
PATHWAY

Bar Scale 1: 50 (A1), 1:100 (A3)

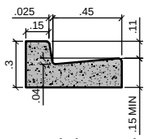


Water Feature / Swale

Bar Scale 1: 25 (A1), 1:50 (A3)



Roll Kerb
NTS



Upright Kerb
NTS

Bar Scale 1: 100 (A1), 1: 200 (A3)

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Ver.	Date	Comment
C	Aug. 2007	Amend Kerb Types
B	07/2007	Project Application
A	06/2007	Initial Release

LOCATION

KANANGRA DRIVE, GWANDALAN

Plan of Typical Sections

Council:	Wyong	Projection:	M.G.A.
Datum:	A.H.D.	North Direction:	Grid
Source:	ADW Survey	Plan By:	MJH
Contour Interval:	N/A	Checklist:	MJH

Version:	C (August 2007)
Client:	Rosecorp Pty. Ltd.
AutoCAD Ref:	N:\11778\Dwg\Eng\11778eng-3c
Job No:	11778

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Sheet 701

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Ver.	Date	Comment
B	07/2007	Project Application
A	06/2007	Initial Release

LOCATION

KANANGRA DRIVE, GWANDALAN

Plan of Proposed Sewer Main Layout

Council:	Wyong	Projection:	M.G.A.
Datum:	A.H.D.	North Direction:	Grid
Source:	ADW Survey	Plan By:	MJH
Contour Interval:	1.0m (Des & Nat)	Checklist:	MJH

Version:	B (July 2007)
Client:	Rosecorp Pty. Ltd.
AutoCAD Ref:	N:\11778\Dwg\Eng\11778eng-3b
Job No:	11778

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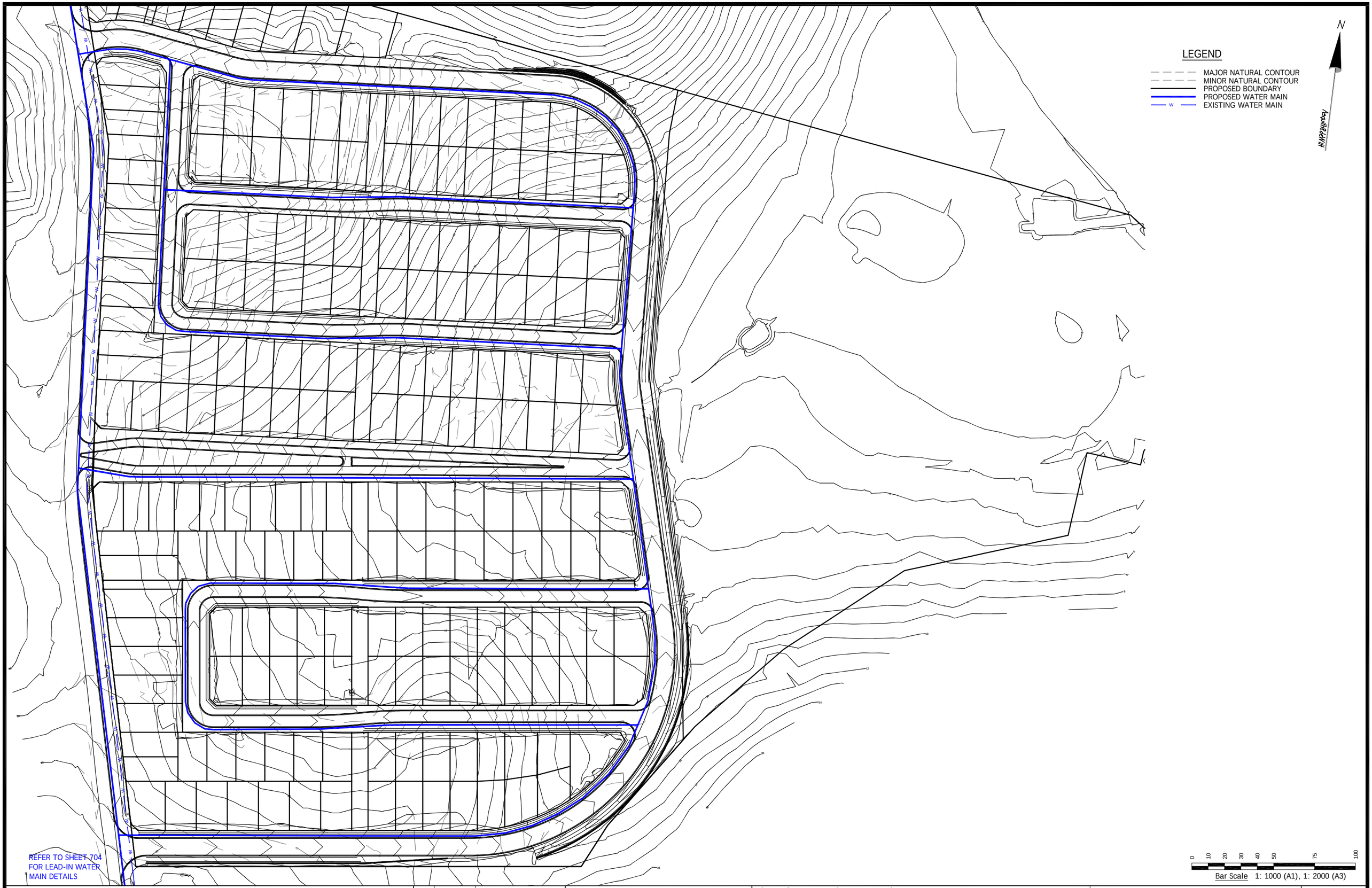
Sheet 702



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Ver.	Date	Comment
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LOCATION

KANANGRA DRIVE, GWANDALAN

Plan of Proposed Water Main Layout

Council:	Wyong	Projection:	M.G.A.
Datum:	A.H.D.	North Direction:	Grid
Source:	ADW Survey	Plan By:	MJH
Contour Interval:	1.0m (Des & Nat)	Checklist:	MJH

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AutoCAD Ref:	N:\11778\Dwg\Eng\11778eng-3b
Job No:	11778

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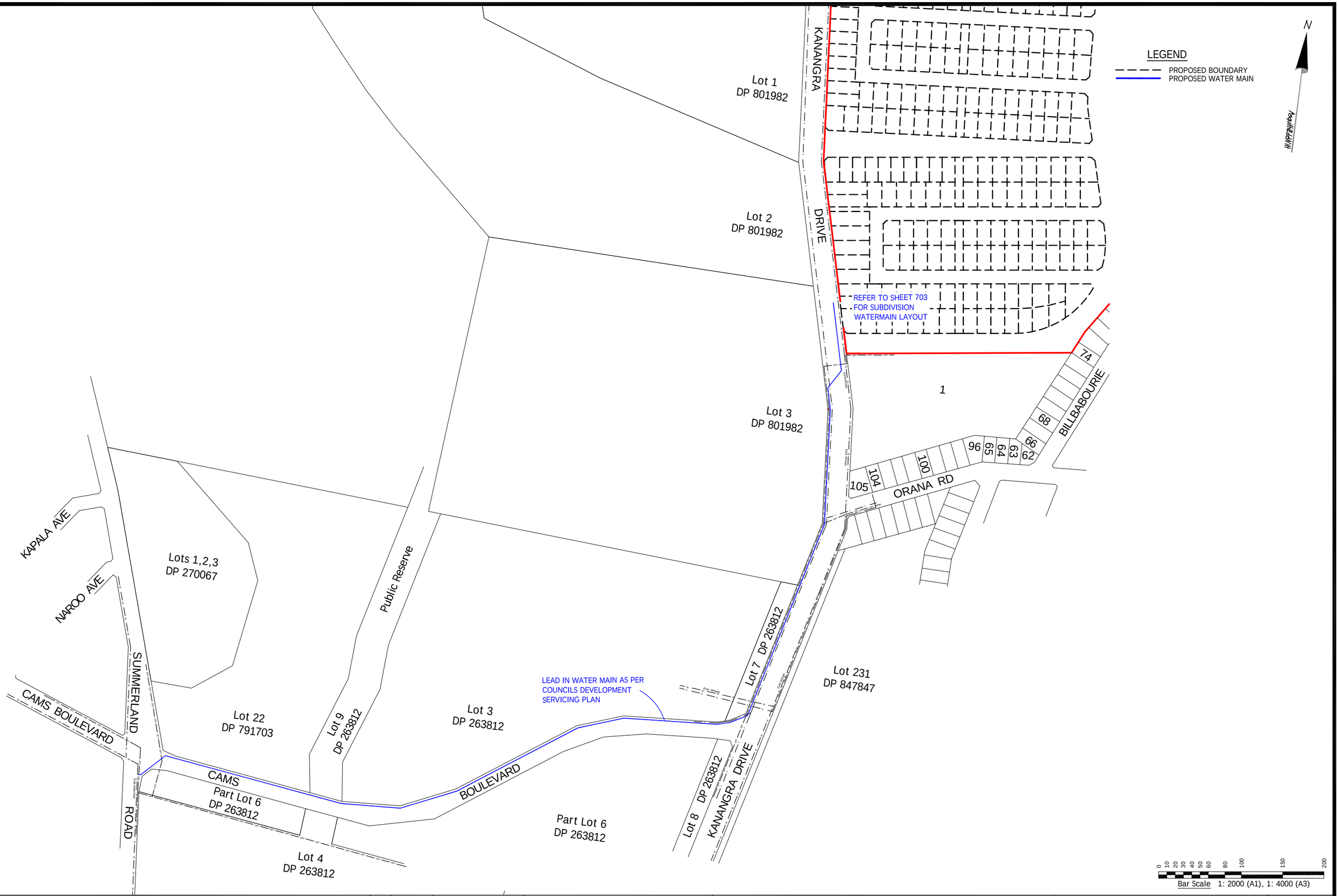
Original Size A1

Sheet 703



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Ver.	Date	Comment
B	07/2007	Project Application
A	06/2007	Initial Release

LOCATION

KANANGRA DRIVE, GWANDALAN

Plan of Proposed Lead-In Water Main

Council:	Wyong	Projection:	M.G.A.
Datum:	A.H.D.	North Direction:	Grid
Source:	ADW Survey	Plan By:	MJH
Contour Interval:	N/A	Checklist:	MJH

Version:	B (July 2007)
Client:	Rosecorp Pty. Ltd.
AutoCAD Ref:	N:\11778\Dwg\Eng\11778eng-3b
Job No:	11778

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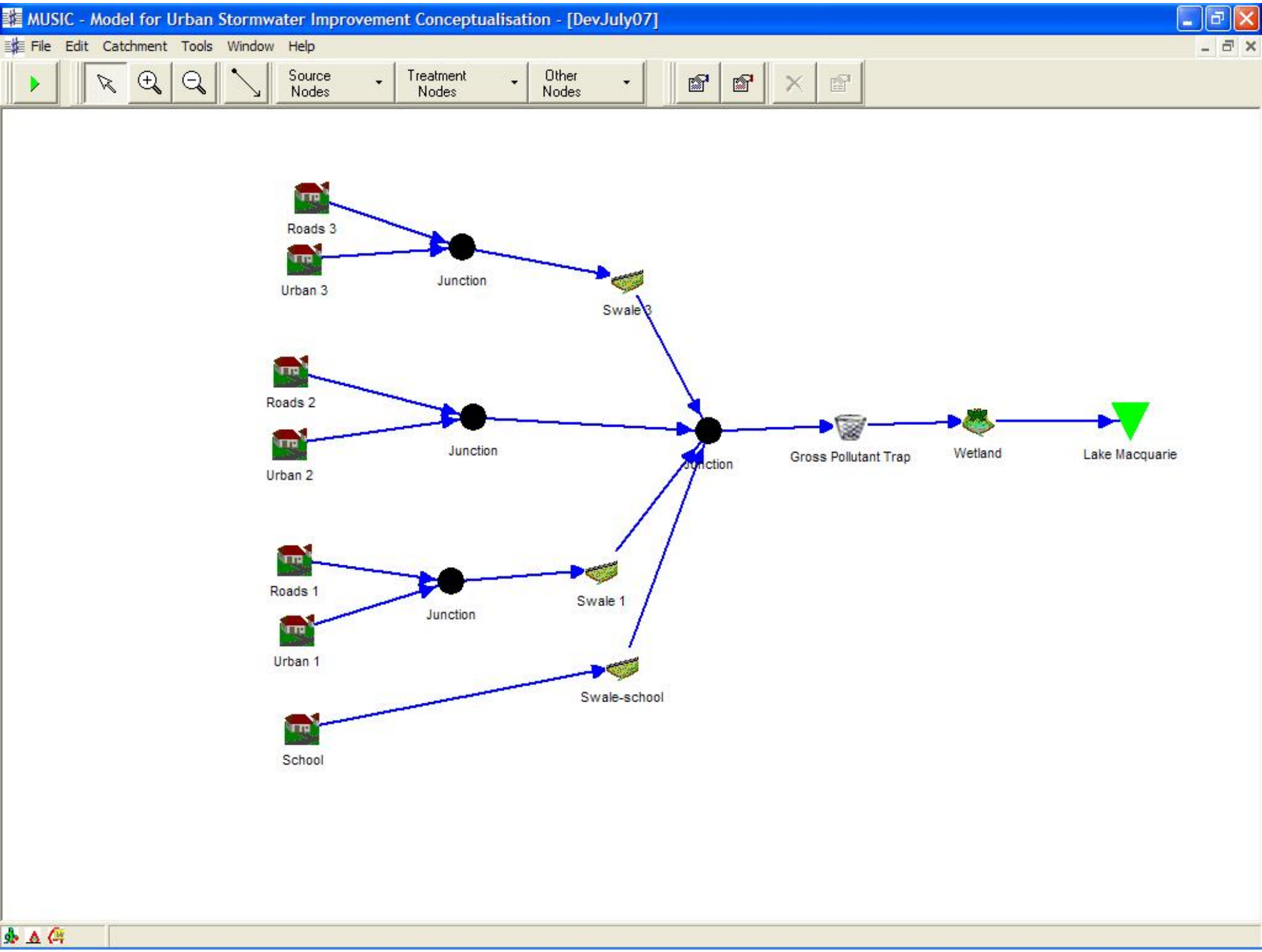
Sheet 704

Appendix B – MUSIC Model Details


MUSIC - Model for Urban Stormwater Improvement Conceptualisation - [DevJuly07]
File
Edit
Catchment
Tools
Window
Help
Source Nodes
Treatment Nodes
Other Nodes
Roads 3
Urban 3
Junction
Swale 3
Roads 2
Urban 2
Junction
Junction
Gross Pollutant Trap
Wetland
Lake Macquarie
Roads 1
Urban 1
Junction
Swale 1
Swale-school
School

MUSIC Model input parameters

Source nodes
Location,School,Urban 1,Roads 1,Roads 2,Roads 3,Urban 2,Urban 3
ID,1,2,3,4,5,6,7
Node
Type,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSource
Node,UrbanSourceNode,UrbanSourceNode
Total Area (ha),2.5,4.55,2.48,1.56,1.69,4.94,3.12
Area Impervious
(ha),0.751644736842105,3.18200657894737,1.31690175438596,0.621057894736842,0.897
404824561403,3.45475,2.18194736842106
Area Pervious
(ha),1.74835526315789,1.36799342105263,1.16309824561404,0.938942105263158,0.7925
95175438596,1.48525,0.938052631578945
Field Capacity (mm),100,100,100,100,100,100,100
Pervious Area Infiltration Capacity coefficient - a,200,200,200,200,200,200,200
Pervious Area Infiltration Capacity exponent - b,1,1,1,1,1,1,1
Impervious Area Rainfall Threshold (mm/day),1,1,1,1,1,1,1
Pervious Area Soil Storage Capacity (mm),250,250,250,250,250,250,250
Pervious Area Soil Initial Storage (% of Capacity),30,30,30,30,30,30,30
Groundwater Initial Depth (mm),10,10,10,10,10,10,10
Groundwater Daily Recharge Rate (%),4,4,4,4,4,4,4
Groundwater Daily Baseflow Rate (%),2,2,2,2,2,2,2
Groundwater Daily Deep Seepage Rate (%),0.4,0.4,0.4,0.4,0.4,0.4,0.4
Stormflow Total Suspended Solids Mean (log mg/L),2.2,2.2,2.38,2.38,2.38,2.2,2.2
Stormflow Total Suspended Solids Standard Deviation (log
mg/L),0.32,0.32,0.4,0.4,0.4,0.32,0.32
Stormflow Total Suspended Solids Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochas
tic
Stormflow Total Suspended Solids Serial Correlation,0,0,0,0,0,0,0
Stormflow Total Phosphorus Mean (log
mg/L),-0.45,-0.45,-0.6,-0.6,-0.6,-0.45,-0.45
Stormflow Total Phosphorus Standard Deviation (log
mg/L),0.25,0.25,0.5,0.5,0.5,0.25,0.25
Stormflow Total Phosphorus Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochas
tic
Stormflow Total Phosphorus Serial Correlation,0,0,0,0,0,0,0
Stormflow Total Nitrogen Mean (log mg/L),0.42,0.42,0.42,0.42,0.42,0.42,0.42
Stormflow Total Nitrogen Standard Deviation (log
mg/L),0.19,0.19,0.19,0.19,0.19,0.19,0.19
Stormflow Total Nitrogen Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochas
tic
Stormflow Total Nitrogen Serial Correlation,0,0,0,0,0,0,0
Baseflow Total Suspended Solids Mean (log mg/L),1.1,1.1,1.1,1.1,1.1,1.1,1.1
Baseflow Total Suspended Solids Standard Deviation (log
mg/L),0.17,0.17,0.17,0.17,0.17,0.17,0.17
Baseflow Total Suspended Solids Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochas
tic
Baseflow Total Suspended Solids Serial Correlation,0,0,0,0,0,0,0
Baseflow Total Phosphorus Mean (log
mg/L),-0.82,-0.82,-0.82,-0.82,-0.82,-0.82,-0.82
Baseflow Total Phosphorus Standard Deviation (log
mg/L),0.19,0.19,0.19,0.19,0.19,0.19,0.19
Baseflow Total Phosphorus Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochas
tic
Baseflow Total Phosphorus Serial Correlation,0,0,0,0,0,0,0
Baseflow Total Nitrogen Mean (log mg/L),0.32,0.32,0.32,0.32,0.32,0.32,0.32
Baseflow Total Nitrogen Standard Deviation (log
mg/L),0.12,0.12,0.12,0.12,0.12,0.12,0.12
Baseflow Total Nitrogen Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochas
tic

Baseflow Total Nitrogen Serial Correlation,0,0,0,0,0,0,0
OUT - Mean Annual Flow (ML/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - TSS Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - TP Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - TN Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - Gross Pollutant Mean Annual Load
(kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00

No Imported Data Source nodes

USTM treatment nodes
Location,Swale-school,Swale 1,Swale 3,Wetland
ID,8,9,10,11
Node Type,SwaleNode,SwaleNode,SwaleNode,WetlandNode
Lo-flow bypass rate (cum/sec),0,0,0,0
Hi-flow bypass rate (cum/sec), , , ,100
Inlet pond volume, , , ,0
Area (sqm), , , ,3000
Extended detention depth (m),0.5,0.5,0.5,1
Permanent pool volume (cum), , , ,2200
Proportion vegetated, , , ,0.5
Equivalent pipe diameter (mm), , , ,70
Overflow weir width (m), , , ,3
Notional Detention Time (hrs), , , ,73.0
Orifice discharge coefficient, , , ,0.6
Weir coefficient, , , ,1.7
Number of CSTR cells,10,10,10,5
Total Suspended Solids k (m/yr),15000,15000,15000,5000
Total Suspended Solids C* (mg/L),30,30,30,6
Total Suspended Solids C** (mg/L),13.6,13.6,13.6,6
Total Phosphorus k (m/yr),12000,12000,12000,2800
Total Phosphorus C* (mg/L),0.18,0.18,0.18,0.09
Total Phosphorus C** (mg/L),0.143,0.143,0.143,0.09
Total Nitrogen k (m/yr),1000,1000,1000,500
Total Nitrogen C* (mg/L),1.7,1.7,1.7,1.3
Total Nitrogen C** (mg/L),1.68,1.68,1.68,1.3
Threshold hydraulic loading for C** (m/yr),3500,3500,3500,3500
Extraction for Re-use,Off,Off,Off,Off
Annual Re-use Demand - scaled by daily PET (ML), , , ,
Constant Daily Re-use Demand (kL), , , ,
User-defined Annual Re-use Demand (ML), , , ,
Percentage of User-defined Annual Re-use Demand Jan, , , ,
Percentage of User-defined Annual Re-use Demand Feb, , , ,
Percentage of User-defined Annual Re-use Demand Mar, , , ,
Percentage of User-defined Annual Re-use Demand Apr, , , ,
Percentage of User-defined Annual Re-use Demand May, , , ,
Percentage of User-defined Annual Re-use Demand Jun, , , ,
Percentage of User-defined Annual Re-use Demand Jul, , , ,
Percentage of User-defined Annual Re-use Demand Aug, , , ,
Percentage of User-defined Annual Re-use Demand Sep, , , ,
Percentage of User-defined Annual Re-use Demand Oct, , , ,
Percentage of User-defined Annual Re-use Demand Nov, , , ,
Percentage of User-defined Annual Re-use Demand Dec, , , ,
Filter area (sqm), , , ,
Filter depth (m), , , ,
Filter median particle diameter (mm), , , ,
Saturated hydraulic conductivity (mm/hr), , , ,
Voids ratio, , , ,
Length (m),110,112.5,60,
Bed slope,0.02,0.02,0.02,
Base Width (m),2,2,2,
Top width (m),5,5,5,
Vegetation height (m),0.25,0.25,0.25,
Proportion of upstream impervious area treated, , , ,
Seepage Rate (mm/hr),0,0,0,2.5
Evap Loss as proportion of PET, , , ,1.25
Depth in metres below the drain pipe, , , ,
IN - Mean Annual Flow (ML/yr),0.00,0.00,0.00,0.00

```
IN - TSS Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00
IN - TP Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00
IN - TN Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00
IN - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00
OUT - Mean Annual Flow (ML/yr),0.00,0.00,0.00,0.00
OUT - TSS Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00
OUT - TP Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00
OUT - TN Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00

Generic treatment nodes
Location,Gross Pollutant Trap
ID,16
Node Type,GPTNode
Lo-flow bypass rate (cum/sec),0
Hi-flow bypass rate (cum/sec),100
Flow Transfer Function
Input (cum/sec),0
Output (cum/sec),0
Input (cum/sec),10
Output (cum/sec),10
Input (cum/sec),
Output (cum/sec),
Input (cum/sec),
Output (cum/sec),
Input (cum/sec),
Output (cum/sec),
Input (cum/sec),
Output (cum/sec),
Input (cum/sec),
Output (cum/sec),
Input (cum/sec),
Output (cum/sec),
Input (cum/sec),
Output (cum/sec),
Input (cum/sec),
Output (cum/sec),
Gross Pollutant Transfer Function
Input (kg/ML),0
Output (kg/ML),0
Input (kg/ML),15
Output (kg/ML),15
Input (kg/ML),
Output (kg/ML),
Input (kg/ML),
Output (kg/ML),
Input (kg/ML),
Output (kg/ML),
Input (kg/ML),
Output (kg/ML),
Input (kg/ML),
Output (kg/ML),
Input (kg/ML),
Output (kg/ML),
Input (kg/ML),
Output (kg/ML),
Input (kg/ML),
Output (kg/ML),
Total Nitrogen Transfer Function
Input (mg/L),0
Output (mg/L),0
Input (mg/L),50
Output (mg/L),50
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
```

Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Total Phosphorus Transfer Function
Input (mg/L),0
Output (mg/L),0
Input (mg/L),4.99921891476174
Output (mg/L),4.01144888916084
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Total Suspended Solids Transfer Function
Input (mg/L),0
Output (mg/L),0
Input (mg/L),999.827839994912
Output (mg/L),500.16367051885
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
Input (mg/L),
Output (mg/L),
IN - Mean Annual Flow (ML/yr),0.00
IN - TSS Mean Annual Load (kg/yr),0.00
IN - TP Mean Annual Load (kg/yr),0.00
IN - TN Mean Annual Load (kg/yr),0.00
IN - Gross Pollutant Mean Annual Load (kg/yr),0.00
OUT - Mean Annual Flow (ML/yr),0.00
OUT - TSS Mean Annual Load (kg/yr),0.00
OUT - TP Mean Annual Load (kg/yr),0.00
OUT - TN Mean Annual Load (kg/yr),0.00
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.00

Other nodes
Location,Junction,Junction,Junction,Junction,Lake Macquarie
ID,12,13,14,15,17
Node Type,JunctionNode,JunctionNode,JunctionNode,JunctionNode,ReceivingNode

IN - Mean Annual Flow (ML/yr),0.00,0.00,0.00,0.00,0.00
IN - TSS Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00
IN - TP Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00
IN - TN Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00
IN - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00
OUT - Mean Annual Flow (ML/yr),0.00,0.00,0.00,0.00,0.00
OUT - TSS Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00
OUT - TP Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00
OUT - TN Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00

Links
Location,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link
Source node ID,1,8,2,3,14,9,6,4,7,5,12,10,13,15,16,11
Target node ID,8,15,14,14,9,15,13,13,12,12,10,15,15,16,11,17
Muskingum-Cunge Routing,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed
Muskingum K, , , , , , , , , , , , , , ,
Muskingum theta, , , , , , , , , , , , , , ,
IN - Mean Annual Flow (ML/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00
IN - TSS Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00
IN - TP Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00
IN - TN Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00
IN - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - Mean Annual Flow (ML/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - TSS Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - TP Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - TN Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00,0.00

Appendix C – Sediment Basin Calculation

	Description		Typical Value/Source	
	Kanangra Drive, Gwandalan			
	Catchment Site Area (hectares)	18.34		
Type F/D	**Settling Zone**			
	Runoff Coefficient, Cv	0.5	0.5	
	75th %, 5 day Rainfall Event	26.8	Wyong	Table 6.3a, pg 6-24
	Settling Zone Volume	**2458**		m3
	Sediment Zone			
	Disturbed Site Area (hectares)	18.34		
	Rainfall Erosivity Factor, R	3000		Appendix B, Newcastle B-11
	Soil Erodibility Factor, K	0.059		Appendix A, Figure A3
	Slope Length Gradient Factor, LS	2.53	300m@5%	Table A1, pg A-9
	Erosion Control Practice Factor, P	1.3	1.3	Table A2, pg A-11
	Cover Factor, C	1	1	Figure A5, pg A-12
	Sediment Zone Volume	**1396**		m3
	Total Storage required (overall)			
	Settling + Sediment	3854		m3
	This is equivalent to	**770m3**	**per existing dam**	

Appendix S

CONSULTATIONS SUMMARY

Response to submissions from previous Catherine Hill Bay / Gwandalan Concept Plan

A Concept Plan for Catherine Hill Bay and Gwandalan was previously exhibited early in 2007. This Concept Plan received many comments and submissions from Agencies, community organisations and from individuals.

Along with comments from the expert panel appointed by the Minister, these submissions and the points they raised were used to inform the development of this new Concept Plan which addresses many of the concerns that were raised.

Although it is not practical to provide detailed responses to all submissions received, this document provides brief responses to issues raised by Government Agencies and Community Groups. The submissions from individuals were broadly consistent in the points raised with these submissions and as such the responses provided here will provide responses to the vast majority of submissions received. Key changes include:

- Separation of development from the existing heritage village by a community park
- Development of seven distinct hamlets, separated by bushland, including a village centre limited to 69 dwellings (reduced from 150 in the initial proposal
- Montefiore Parkway dedicated as a public road with significant bushland buffer from housing
- Reduction of development footprint overall by pulling back from Moonee Beach and Headland
- Provision of coastal and cliff walkways from Catherine Hill Bay to Moonee Beach
- Protection of ridgeline from development
- Inclusion of separate road access to Moonee Beach with parking
- Focus of development on areas despoiled by mining
- Location of new Village Centre away from Catherine Hill Bay Village
- Provision of a separate precinct includes Wallarah House and Jetty Master's Cottage
- Inclusion of strict controls over design and construction of all dwellings
- Reduction of dwellings at Gwandalan to 215
- Redesign of Gwandalan Subdivision

It is considered that the revised development has a significantly lower impact on both the surrounding environment and the existing village and as such addresses the vast majority of issues raised by submissions.

CATHERINE HILL CATHERINE HILL BAY AND GWANDALAN: SSS & CONCEPT PLAN - SUMMARY OF AGENCY SUBMISSIONS

No.	Agency	Nature	Comment	Issue Summary	Comment
1	Department of Environment and Conservation (DEC) **Att:** Brendan Diacono Manager, Planning and Aboriginal Heritage – North East Branch Environment Protection and Regulation Locked Bag 914 COFFS HARBOUR NSW 2450	Comments	*Environmental Planning Act 1979* • There appears to be several areas of inconsistencies between the proposed amendments and the Standard Instrument for inclusions of uses with/without consent and some appear to be incompatible with the zone in which they are proposed. These inconsistencies should be addressed. *Protection of the Environment Operations Act 1997* • The proposed development does not appear to be integrated under the POEO Act, thus Wyong Shire and Lake Macquarie Councils' will be the Appropriate Regulatory Authorities with respect to air, water, noise and waste. *Contaminated Land Management Act 1997* ▪ Contamination assessment appears adequate. Proposed remedial action appears appropriate. However, the removal of various concrete slabs across the site will need further targeted assessment of the areas. *National Parks and Wildlife Act 1974 – Aboriginal cultural heritage:* • A preliminary site inspection has been undertaken recently for both sites (Appendix S – Dec. 06).The report presents the preliminary results of background research and a short familiarisation inspection. • Reports appear to concentrate on archaeological issues. • Appendix S report does not meet the Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation developed by DEC and DoP specifically for Part 3A assessments. • Impacts on Aboriginal cultural heritage can not be assessed until adequate reports are submitted. *National Parks and Wildlife Act 1974 – DEC estate:* Catherine Hill Bay: • The CPs proposed development footprint excludes the coastal foreshore strip in front of CHB, the headland area and areas between the existing Munmorah State Conservation Area and the development area. • The excluded areas are indicated as being dedicated lands and may be areas to be dedicated to DEC. • Appendix G Ecological constraints provides APZs of 20-40m wide for Catherine Hill Bay/Moonee site. There is no indication of whether the RFS considers this distance adequate. • There is a strip of land between the two residential proposals	• Planning controls • Air, water, noise pollution • Soil contamination • Site remediation • Aboriginal cultural heritage • APZs • Dedication lands • Infrastructure • Water quality • Overland flow • Public foreshore access • Domestic animals • Views • Building Heights • Impacts on adjoining land • Flora and fauna • Offsets • MoU	• SSS report has been redrafted and is consistent with standard LEP • Contamination issues dealt with by SOC • Full aboriginal heritage assessment now included in EA • APZs are contained within the development area • Exact nature of dedication lands to be negotiated with DECC. • There will be no net overland flow increases as the stormwater management plan will match pre and post development flows • Buildings will be limited to 2 storeys with substantial plantings. • Visual impacts dealt with in new visual impact statement. Development has been redesigned to minimise impacts.

			on the north-western part of the site which appears to be narrow once the APZ allowance is deducted. • APZs should be designed so that there is no requirement for any part of an APZ (or ongoing maintenance) to be on future public lands. It is recommended that prior to dedication of lands to the State a wider buffer zone be established between the proposed residential lots and public lands. • This land should be maintained under Community Title and include APZs and any other local infrastructure. • Narrow strips of land are very difficult to manager as part of the DEC estate and it would be preferable for these to be included and managed as part of the residential development. • Infrastructure such as water, wastewater pipes, electricity supply, stormwater retention basins or car parks shall not be placed on public lands intended for DEC estate. • There should be no net increase in overland flow or degradation in water quality of the adjacent State Conservation Area as a result of the development. • Make sure that overland flow from the designed sewer reticulation system does not enter the DEC estate. • The POM for Munmorah State Conservation Area states that "it is proposed to continue to promote walking track access only to Moonee Beach, as opportunities for bushwalks in the park are limited as an alternative to the more highly developed areas to the south". Access to Munmorah State Conservation Area; discussions are required between DEC and the Proponent as to how best address impacts from any increase in the currently low usage of this section of the park. • Methods of ameliorating issues with domestic animals entering the DEC estate and having an impact on wildlife should be addressed. • Concerns regarding the building heights above any remaining tree line have been raised as they may have a detrimental impact on the views rom Moonee Beach. • Building heights maintained at 2 storeys and with substantial planting of trees such that their eventual canopy overtops the buildings, then eventually the buildings may be more sympathetic to its surroundings. *Gwandalan:* • Issues with unauthorised public access may occur as the site is directly adjacent to the Lake Macquarie State Conservation Area. The report also indicates that there may be some drainage into the adjoining park. • Discussions are required about how best to address impacts from the development on the adjoining NPWS/Sport and Recreation Land. • There should be no increase in overland flow or decrease in water quality into the adjoining park as a result of any urban		• There is no drainage into the park • Discussions will be held • APZ are fully contained in the development • There will be no stormwater impact on the park

			development. • Any APZs must be fully contained within the development footprint and if the area is to be cleared the development should remain securely fenced. • No additional stormwater should enter DEC estate and no degradation in water quality should occur as a result of the development. *Threatened Species Conservation Act 1995 – Flora and fauna* The flora and fauna report identified the following ecological constraints on the CHB site: ➢ Potential pygmy possum habitat; ➢ Three areas of Tetratheca juncea; ➢ 14.9ha of environmentally significant remnant vegetation. The flora and fauna report identified the following ecological constraints on the Gwandalan site: ➢ Large population of Tetratheca juncea over the western half of the lot; ➢ Two regionally significant vegetation communities; ➢ Three Syzygium paniculatum; ➢ Threatened species habitat. • The CP does not propose to retain these ecological values, instead it is proposed to transfer approximately 310ha of generally vegetated land into public ownership as on offset for development. Although it is stated that, inter alia the 310ha includes land with large areas of known *Tetratheca juncea* habitat, it does not specify where *Tetratheca juncea* has been recorded on that land. • Catherine Hill Bay and Gwandalan SSS are subject to a MoU between the State Government and Coastal Hamlets P/L and Lakeside Living P/L respectively. • The MoU sets out the parties intentions with respect to implementing the Government's Environmental Offset Scheme in relation to land owned by the above companies.		• Location is provided in EA • Agree
2	NSW Heritage Council **Att:** Mr Reece McDougall Executive Director Heritage Office Department of Planning Locked Bag 5020 PARRAMATTA NSW 2124	Comments	• Concerned that the proposed development does not comply with the CP objectives and in its present form will have a very significant impact of the potential State heritage values of the area. • The concept plan objectives (p13) are supported; however the current proposal does meet these objectives and explain • A number of further objectives are recommended: ➢ Be of a type an intensity which is sympathetic to the heritage values and character of the CHB precinct and comply with Lake Macquarie City Councils DCP. ➢ Aim to complement existing buildings and subdivision patterns. ➢ Be focussed in areas away from key views and vistas. ➢ Be restricted to simple one storey structures in the	• Objectives • Subdivision layout • Views (visual amenity) • Heritage • Commercial development • Development density	• Development has been reconfigured in order to take these comments into account. The village centre has been moved, the housing has been removed from the existing village and a lower impact approach has been adopted on the Moonee site.

			areas near the village and key views and vistas, ➢ Be restricted to simple one storey structures in the areas near the village and key view lines to reinforce compatibility with existing cottages, ➢ Elsewhere are no more that two storeys. • New development needs to be consistent with Councils DCP No. 1. • New development should not encroach further along headland to the east. • Development should be concentrated within Moonee Village rather than following original Town of Cowper layout. • Identified heritage area 6 should be included as open space to compliment heritage significance. • Concentric pattern of subdivision will adversely affect the character and heritage values of the existing village – should be amended to provide a more sympathetic design to the existing layout. • Commercial area should be relocated to a less visually prominent area. • Conditions should be included on any approval to address building height and materials, side and rear setbacks, fencing, landsaping and site coverage. • It is important that any future development respects and maintains key views. Key views are described as: *1. Impression of Catherine Hill Bat is gained from the south at the corner of Clarke St and Montefiore St where the dramatic landforms of the headland and beach dominate the rows of small houses,* *2. View north along Flowers Drive prior to the rows of small houses in Flowers Drive where the jetty and the headlands are sighted.* *3. View visible from Flowers Drive looking south to the original Cowper town plan defined by Clarke St and Lindsley St which provides an image of the developed character of Catherine Hill Bay. This group of buildings date back to 1888.* *4. Intersection of Clarke St and Lindsley St marks the beginning of Cowper Town which follows the boundaries of the original Plan of Cowper Town of 1879 and 1888. Only two of the proposed 8 streets have been developed but the street alignment remains as paddocks which act as a constant reminder of development proposed but never realised. While the landscape features provide a strong backdrop, the quality of the streets is derived from the low scale built form and highly consistent pattern of predominantly one storey weatherboard cottages. This reflects the historical association with the company.* • The proposed new residential development of Moonee Village should be screened from interrupting these view lines, by		

			retaining a buffer strip of vegetation along Montefiore St of 10m and that new housing is kept below the ridgeline of the street. • A number of brick buildings remain on the Moonee site which could be adaptively reused to provide for interpretation of the site. • Given the discrepancy on dwelling numbers as set out in the concept plan (p28 & 47) it is requested that the DoP clarify with the proponent the total number of dwellings and tourism beds and that this number is in accordance with the MoU.		
3	Hunter Water **Att:** Mr Brett Lewis Manager, Development Services PO Box 5171 HRMC NSW 2310	Comments	• The proponent is required to undertake an assessment of the options for wastewater treatment and the use of recycled water for the site, and undertake detailed water and sewer servicing strategies to the new development and existing properties of CHB. These studies are to be undertaken in consultation with both Hunter Water and Wyong Council.	• Wastewater treatment • Recycled water	• Stormwater will be reticulated through the site and will be used for suitable uses.
4	NSW Dept. of Education & Training **Att;** Paul Culshaw Director, Strategic Asset Planning and Procurement GPO Box 33 SYDNEY NSW 2001	Comments	• Support the proposal in principle subject to the development complying with all necessary legislative provisions, including any addressing of the requirements for the appropriate provision of educational infrastructure. • Given the scale of the CHB proposal relative to current development in the area it is anticipated that there will be government school infrastructure implications arising from the urban expansion. • There will be an additional demand for all levels of education generated by the proposal. • The Proponent makes no mention of schools in the concept plan nor how education will be addressed. • The proposal does not provide any level of contributions. It is estimated that the cost of infrastructure attributable to the anticipated level of students generated from Rosecorps proposed CHB development is estimated to be $5.38milliom (limited to provision of facilities only). • Gwandalan public school will require upgrading to 21-core standard to accommodate the anticipated growth attributable to both Rosecorp and Coal and Allied developments. • Lake Munmorah high school (where Gwandalan students are identified for secondary schooling) is almost at full capacity and may require supplementation to cater for enrolment increases. • The Dept. has assessed the cost of infrastructure attributable to Rosecorp groups Gwandalan proposal at $2.83 million. The contribution levy based on this amount would contribute towards the necessary capital works required to upgrade schools.	• Education • Developer contributions	• It is anticipated that existing schools will provide sufficient capacity given the expected demographic. Full SIA provided with the EA • Regional infrastructure contribution proposed in SOC
5	NSW Department of Natural Resources Att: Mark Mignanelli	Comments	<u>Groundwater</u> • The EA does not address the issue of groundwater interception, potential impacts on groundwater (including	• Impacts on groundwater and groundwater	• No groundwater impacts • Information provided in EAs

	Manager, Major Projects and Assessments Licensing and Policy Strategy Branch		groundwater dependent ecosystems) and approval requirements under water legislation. • Need to identify if any service infrastructure works (including existing and proposed stormwater storage reservoirs) involve excavations that intercept the groundwater during construction or require approval for bores or wells for dewatering purposes, which may require licensing under Part 5 of the *Water Act 1912*. • Storage reservoirs should be lined to ensure infiltration to groundwater does not occur. • At the proposed CHB/Moonee Colliery site, a long term groundwater monitoring program is required to protect the SEPP 14 wetland located to the south of the development. • Both sites are traversed by watercourses and the following issues need to be addressed: • Detailed description of the proposed development including all proposed construction, clearing, draining, excavation and filling; • An evaluation of the proposed methods of excavation, construction, material placement, • A detailed description of all potential environmental impacts of the proposed development in terms of vegetation, fauna, sediment movement, water quality and hydraulic regime, • A description of the design features to be incorporated into the proposed development to guard against long term actual and potential environmental disturbances, particularly maintaining natural hydrological regime and sediment movement patterns, • A description of the measures to be implemented to guard against actual and potential environmental disturbance during the construction of the proposal, particularly maintaining natural hydrological regime and sediment movement patterns,	dependent ecosystems • Water quality • Vegetation • Sediment management • Water quality • Hydraulic regime	
6	Lake Macquarie City Council **Att:** Mr Brian Bell General Manager Lake Macquarie City Council Box 1906 HRMC NSW 2310	Object and Comments	Due to the level of detail provided in Council's submission, the Department has summarised the broad issues and attaches a full copy of Council's submission. • Lifestyle 2020 Strategy for Lake Macquarie City. • Integrating Land Use and Transport SEPP • Draft SEPP No. 66 – Integration of Land Use and Transport • NSW Coastal Policy (Key action 2.3) • Offsets – current land use zoning • Structure planning – neighbourhood shopping facilities and related services, local school facilities, fire fighting facilities, recreation facilities) • Funding of infrastructure • SEPP 71 – Coastal Protection • SEPP 14 – Coastal Wetlands • Lake Macquarie LEP 2004 • Draft Statement of Commitments	•	• Many of Council's issues have been addressed in the complete redesign of the proposal. Impacts on the coast, the heritage precinct and the surrounding area are addressed fully. • A schedule of contributions is provided in the SOC which is benchmarked against the Lake Macquarie City wide S94 plan. • A full SIA is provided • A schedule demonstrating compliance with SEPP 71is provided in the EA • Public access to all coastal areas is secured and a cliff top walk way will be provided further enhancing access. • A new visual impact assessment is provided. Impacts have been significantly reduced in the new plan • A revised heritage impact assessment is provided

			• MoU • NSW Coastal Policy • Coastal Protection Zone • Lake Macquarie Coastaline Management Plan (1999) • Urban design and built form • Coastal foreshore and public access (particularly in vicinity of jetty below the cliff face) • NSW Coastal Design Guidelines • NSW Coastline cycleway • POM for Munmorah State Conservation Area • Visual impacts – particularly regarding curtilage of the CHB heritage conservation area. • Visual impact assessment • Heritage impact • Insufficient information • Future management and maintenance of the coal loading jetty • Known and potential non-indigenous archaeological relics • Conservation Management Plan • Lower Hunter Regional Strategy • Bushfire Threat and Protection • Impact on threatened species • Tetratheca juncea • Diuris praecox • Other threatened flora species • Eastern pygmy possum • EECs – themeda grassland • Wetland and wet heath vegetation communities • Impacts of servicing • Matters of national environmental significance • Social infrastructure • Landscape and Open Space • Access to Moonee Beach • Impacts on water quality and drainage • Heritage and urban design • Vegetation buffers • Location of development in areas that have not been previously despoiled • Cut and fill • Location of shopping centre • Height, scale and bulk • Interface between existing residential streets • House type • Subdivision design • Setbacks from coastline • Developer contributions – cross LGA issues, tourism, planning agreement		in the EA • The future of the Jetty is not impacted by this proposal • A revised bushfire management plan is provided in the EA • The location of the shopping centre has been moved and its scale reduced • Access to Moonee beach is secured • A full traffic assessment is provided in the EA • Additional detail is provided in PAs for the site's development

			• Subdivision/infrastructure – roads, stormwater. Sewer, STPs • Traffic/ infrastructure – traffic control signals, road upgrades, traffic management, car parking, bus routes • Pedestrian/cycle networks • Lands to be dedicated to Council • Employment • Proposed zoning provisions and planning controls		
7	NSW Department of Primary Industries **Att:** Mr Cameron Ricketts Chief Geoscientist Land Use Assessment DPI – Mineral Resources PO Box 344 HRMC NSW 2310	Object and Comments	<u>Coal Resources</u> • This Lakecoal lease is the residual surface lease covering the Moonee and Wallarah Collieries and the CHB Coal Handling and Preparation Plant (CHPP) operations which are undergoing mine closure activities. • Parts of the area of the CHB CP are underlain by remnant coal resources in the Fassifern seam. The Fassifern seam resource block (FAS24) is bounded by the coastline south of CHB and a line of seam deterioration approximately 5 kms southwest of the village. The seam in this area has a generally high ash content and occurs at a depth of 114m. It is considered unlikely that this resource block will be mined in the future as the Moonee Colliery has closed and access to the resource block would require extensive underground development from other collieries or the development of a new colliery. • At Gwandalan, much of the CP and proposed development site is covered by Consolidated Coal Lease (CCL) 707 also held by Lakecoal. The western two-thirds of the site is partly underlain by a resource block in the Fassifern seam (FAS 21b) which is partly covered by a Mining Control Zone surface constraint and lies within the Chain Valley Colliery Holding at a depth of 215m. It is likely that the part of this Resource Block located below the Gwandalan Concept Plan and proposed development area may be mined in the future. • The eastern one-third of the Gwandalan CP and proposed development site is underlain by another resource block in the Fassifern seam (FAS 23) which is largely affected by a Mining Control Zone surface constraint and falls inside the now closed, Wallarah Colliery Holding. It is unlikely that the part of this Resource Block located under the proposed development area will be mined in the future. <u>Petroleum Exploration</u> • The Catherine Hill Bay area is covered by a current Petroleum Exploration Licence (PEL) 446 held by Santelle Pty Ltd, and is considered to hold potential for coal seam methane and conventional gas resources. Proposed intensification of development on the land at CHB will have the effect of restricting access to the Moonee Colliery site for petroleum exploration. In order to minimize the potential for land use conflict, it is recommended that the proponent contact	• Coal resources • Mine closure • Rehabilitation plans • Petroleum exploration • Consultation • Heritage • Jetty • Contamination • Site remediation	• These issues are addressed in the revised EA

			Santelle Pty Ltd to negotiate access to the site during or prior to construction. • The areas identified for environmental protection must allow access for petroleum exploration and possible future development (eg State Conservation Area), as these areas comprise the majority of PEL 446, which largely remains unexplored to date. • The proposed development site at Gwandalan is covered by Petroleum Exploration Licence (PEL) 5, held by Sydney Gas Operations Pty Ltd (western half) and PEL 446, held by Santelle Pty Ltd (eastern half).The proposed residential development will severely restrict access for exploration in this vicinity. It is therefore recommended that the proponent contact the PEL holders and negotiate to allow access for exploration where required. <u>Colliery Closure Process</u> • Lakecoal is the holder of current mining lease Consolidated Coal Lease (CCL) 706, and holder of the adjoining current Mining Purpose Lease (MPL) 211, which occupies the coal loading jetty. CCL706 land is owned freehold by the proponent Coastal Hamlets Pty Ltd (a Rosecorp Group company) and MPL211 is Crown Land. • Coal mining commenced at CHB in 1873 and continued almost continuously until Lakecoal's coal production ceased in June 2003 at Wallarah and Mooney Collieries and the CHPP. Lakecoal is required to rehabilitate these mines and the plant infrastructure areas as a commitment of their current mining leases and for which security deposits are held. Site rehabilitation is proceeding according to a Mine Closure Plan approved by the Minister for Mineral Resources in December 2003. The Department of Primary Industries – Mineral Resources (DPI) chairs a Mine Closure Consultative Committee established for the Lakecoal closure operations which has met regularly since 2003 to facilitate ongoing consultation between Lakecoal, the local community, Lake Macquarie and Wyong Councils and the NSW Government on the mine closure plan preparation and its implementation. • Lakecoal's mine closure and completion on the proponent's land must be to the satisfaction of the DPI according to the Mine Closure Plan. The status of this process to date is summarized below; ➢ Design and construction sealing has been completed for all the entries to the mines' underground workings in accordance with DPI guidelines. Two coal handling tunnels at the CHPP are yet to be sealed - to be discussed further later in this submission. ➢ Rehabilitation of most of the disturbed mine land		

			has progressed by earthworks stabilization and revegetation, and is under maintenance. ➢ Mining infrastructure and mining purpose buildings at Catherine Hill Bay are owned and occupied by Lakecoal. The dismantling and removal of this mining infrastructure is ongoing, however activity on specific items has been pending assessment of heritage values and approval of their adaptive reuse. Two houses, the LEP heritage listed Wallarah House and the Jetty Master's Cottage are owned by the proponent and are occupied residences. ➢ Progress is documented in plans, reports and monitoring records held by DPI. <u>Environmental Assessment</u> • Particular rehabilitation liabilities currently remain at the CHB site which constrain the proposed residential development and the dedication of land to the NSW Government for conservation. The proponent has initiated no consultation with the DPI on the CP. The rehabilitation of mine disturbed land is to be satisfactorily concluded either by the mining lease holder in a timely manner through the Government's mining legislation or by the proponent land owner through transitional approval, with specific after care conditions, under the EP&A Act. Completion of mine closure at CHB is overdue. The DPI has identified particular constraints for assessment and resolution; <u>Dedication Areas</u> • Wallarah Colliery pit top site is located west of the Pacific Highway on land adjoining Lake Macquarie. This land is a component of the 310 ha dedicated by the proponent to the NSW Government for conservation. Rehabilitation of the site by Lakecoal is in an advanced state of completion which has involved sealing of mine entries, dismantling and removing all structures and buildings, and the stabilisation with native revegetation of the surface. The site is currently under maintenance surveillance by Lakecoal. The features remaining from mining at Wallarah Colliery are paved road access and various standard fencing. The future of these features or alternatively their adaptive reuse as part of conservation land management by the Government must be resolved at the time of coincident land transfer and mining lease relinquishment. • The coal reject emplacement named 'Possum Gully Emplacement' is located west of the CHB village and west of the Moonee village development proposal. This land is to be dedicated land for conservation. Rehabilitation of the site by Lakecoal is in an advanced state of completion. Coal washery reject has been removed for coal reprocessing and the		

			rehabilitated landform established according to the Mine Closure Plan. The site is currently under maintenance surveillance by Lakecoal. Aftercare maintenance will be required to confirm sustainable establishment of the native revegetation. The conservation land management of this must be resolved at the time of coincident land transfer and mining lease relinquishment. <u>Catherine Hill Bay Village Site</u> • Residential development is proposed on the CHPP site at the CHB headland. This site has had a history of mining purpose activity involving intensive and complex engineering construction which predates the SEPP 41 Coastal Protection planning. Infrastructure currently remains at the CHPP site which requires further rehabilitation. • The 'Bin Building' referred to in the CP is a 13,000 t coal storage bin` built in 1964 and constructed in an excavated gully of the headland. The bin, and feed-out tunnel connected to the jetty beneath are of reinforced concrete columns, beams and walls cast directly into the headland excavation. The steel structure and gantry above the bin has been dismantled and removed by Lakecoal. The structure is fenced but significant residual safety hazards remain. The CP proposes adaptive reuse of this structure to four (4) strata title residential apartments. The DPI is concerned that a specific building assessment be undertaken, supported by geotechnical studies, to verify that this structure is stable and safe to satisfy residential use requirements. • The CP's dedication of land for public access to the coastal headland is acknowledged and supported. However, the bin, tunnel and jetty form an integrated contiguous engineered structure set into the headland (see Figure 3.12.5). The proposed verge of public land along the headland at the location of the bin is inadequately defined and requires verification. • Concrete foundations, footings, pavement and concrete sumps remain at the CHPP site after decommissioning by Lakecoal. The proposed residential development areas and land dedication areas are inadequately identified to show where materials are to be removed and remediated to conclude mine closure responsibilities. • A 3,000t underground coal bunker and feeder tunnel constructed of reinforced concrete also remains at the CHPP site at the request of the proponent. The Mine Stability Assessment (Appendix M) states the bunker area is to be retained as 'recreational area'. This appears to have been prepared based on the development footprint of the proponent's previous development application to Lake Macquarie City Council. This report may not address issues		

			relevant to the current proposal Moonee Village site • The Lakecoal Mine Closure Plan activity has progressed to an advanced state of completion which has involved sealing of mine entries, dismantling and removing structures and buildings, drainage earthworks and the stabilisation with native revegetation of the surface. The site is currently under maintenance surveillance by Lakecoal. The features remaining from mining at Moonee Colliery are paved road access, retention dams for water runoff control, and buildings specified by the proponent in the Concept Plan for adaptive reuse. Heritage Impact Assessment • There are no items of heritage significance at CHB within Lakecoal's mine holdings currently listed on the State Heritage Register. The coal loading jetty is however a listed heritage item in the Lake Macquarie City Council LEP 2004. • The CP's HIS refers to the Wallarah and Moonee Collieries Conservation Management Plan 2004 as a basis for Heritage assessment and adaptive reuse of items including the bin building. The DPI is unaware of the standing of this Plan as it has not been given NSW Heritage Office endorsement despite exhibition and assessment since 2004. • The coal loading jetty extends on Crown Land from the high water mark at the coast. Lakecoal currently owns and occupies the jetty pursuant to MPL 211. It is under care and maintenance. The CP has no association or proposal for the jetty. The DPI is however concerned that the future of the jetty, to dismantle and remove or conserve for heritage, is determined at the same time and in context of the CP assessment. The DPI proposes to contact the Department of Planning separately for a pathway to resolve this matter. SEPP 55 Remediation • DPI confirms Lakecoal has completed site contamination studies (Stage 1 Assessment and Stage 2 Remediation) as part of the Mine Closure Plan. These are referred to in Environmental Assessment (Appendix L) of the Concept Plan. • The assessment criteria for these investigations by Lakecoal were for recreational and public space land use (Soil Investigation Level, SIL3) consistent with the agreed mine closure objectives. There is the likely risk of hydrocarbon contamination beneath concrete slabs and footings remaining at Moonee and CHPP at CHB. Removal of these slabs and footings for residential development would require further site contamination studies, using SIL1 and SIL2 investigation criteria, by the proponent. Conclusion • DPI objects to the current CP and proposed development		

			area for the Gwandalan site as it is likely that a future mineable resource exists beneath this area. • Any development undertaken in this area would need to comply with Mine Subsidence Board guidelines. • It is recommended that the proponent negotiate with Petroleum Exploration Licence holders covering the site to minimize impacts on their access for exploration. • The DPI does not object to the CHB CP and proposed development provided that the proponent negotiate with the Petroleum Exploration Licence holder covering the site to minimize impacts on their access for exploration activities. • The DPI has specific concerns regarding Lakecoal's mine closure and rehabilitation plans and the proposed adaptive re-use of certain buildings and facilities and the need for ongoing after-care maintenance by the proponent to fulfill mine closure requirements under the *Mining Act 1992*. The DPI is also concerned that the concept plan has not addressed the future of the CHB coal loading jetty and would like to see this site dealt with in association with the proposed development and mine closure		
8	Department of Lands **Att:** Craig Abbs Director, Coastal and Estuary Infrastructure PO Box 2185 DANGAR NSW 2309	Comments	• An unformed Crown Road bisects the Moonee development site. The Department of Lands is currently processing a road closure application lodged by Coastal Hamlets on 15 March 2005 to address an encroachment by one of the former mine buildings. This application cannot be determined until an objection to the closure by Wyong Council can be resolved with the proponent. The Department of Lands has issued a licence for the road encroachment until closure can be determined. The CP assumes that this road will be closed and should not be approved until this matter is resolved. • If all or parts of the Crown road need to remain, appropriate road works may be required to satisfy the access requirements of the development. If this is the case, transfer of the Crown Road should take place under Section 151 of the *Roads Act 1993* to the relevant road authority (local Council) prior to the commencement of any works. • The documentation is not clear on the details of proposed boundaries, ownership and management of each parcel of this land. Management arrangements at boundaries should be clarified where proposed dedications abut crown lands (such as at the high water mark). • Should any of the proposed dedication lands be intended to become part of the Crown estate managed by Department of Lands, the details should be agreed with this department prior to the issue of any approvals. • The CP does not include the jetty but makes specific reference to it in a number of locations. The CP should not be considered in isolation of the jetty. The jetty is located in	• Crown Roads • Land ownership • Jetty • Management of dedication lands	• No longer assuming closure of road • Issues dealt with in EA • No impact on Jetty, access will be maintained

			Crown land and forms part of a mining purpose lease held by LakeCoal with the DPI. As part of the mine closure process, it is understood that the lessee should remove any improvements on the site (including the jetty). If the jetty is not removed, it will impose significant operational and financial risk to the NSW Government. • The CP needs to consider physical linkages to the proposed development, how they will be managed and how risks will be dealt with, the impacts on proposed dedication lands such as interruption to foreshore access and the need to retain and maintain structures and assets, benefits of the jetty to the proposed development if it's not removed and any implications for management.		
9	Ministry of Transport **Att:** Mr Matthew James A/Director Transport Planning GPO Box 1620 SYDNEY NSW 2001	Comments	• The MoT view land use planning as a key issue in relation to provision of bus services. T • The MoT would like continued close consultation on issues affecting public transport operations, including road and intersection design, bus priority measures to maintain a bus travel speed of at least 25km/h and bus depot and bus stop infrastructure. <u>Gwandalan</u> ▪ Provision of an east west access road bisecting the site would enable extension of the existing bus service in an equitable manner equalising the likely walking distances for passengers. ▪ Desirable for a road to bisect part of stage 2 and link to the existing residential development to the east – this should be in place before development. ▪ The width of the east-west road should be in the order of 22m rather than 16.5metres to accommodate buses. ▪ There is an opportunity to consolidate the two bus loops (Busways Route 99) currently servicing the Gwandalan and Summerland Point locations would evolve in the long term if an improved east-west access road was provided in the proposed Gwandalan site. <u>Catherine Hill Bay</u> ▪ Progressive staging would make bus servicing of this site difficult and the projected road pattern may also inhibit improved bus services. ▪ Currently CHB receives 3 trips per week day by route 99. ▪ The development of urban form beyond 400-500m each side of main connector roads could restrict effectiveness of the service owing to the walking distance imposed on the catchment area. ▪ When fully developed some residents will be living in excess of 500m south of Montefiore Street and therefore an acceptable road system may be required to enable buses to travel through the development.	• Public Transport (buses) • Road layout	• Bus access provided • Regional contribution allows for contributions to bus services. • Issues addressed in EAs • Stage 2 Gwandalan removed

			▪ Further consideration will need to be given to appropriate road-side bus stop infrastructure as detailed planning progresses. Need to address compliance with the Commonwealth's Disability Standards for Accessible Public Transport 2002, in particular manoeuvring areas in accordance with AS1428.2 (1992) Clause 6.2, A boarding point comprising 3 metres of 150mm standard kerb, access paths and ramps, signage in accordance with AS1428.2 (1992) Clause 17, and Lighting (ideally 150-200lux).		
10	Ambulance Service of NSW Att: Allan Loundfoot Divisional Manager (Northern) PO Box 17 HAMILTON NSW 2303	Comments	• Would like to commence further discussion with the Department and developer in relation to the provision of ambulance services for the Swansea and Catherine Hill Bay areas.	• Infrastructure (Ambulance services)	
11	Northern Sydney Central Coast NSW Health **Att:** Dr Peter Lewis Area Director, Public Health Medical Officer of Health PO Box 361 GOSFORD NSW 2250	Comments	• Children who are overweight or obese has tripled over the last 20 years. • 46% of Central Coast residents do not get adequate physical activity to maintain good health. • Public health staff are actively interested and involved in healthy urban development projects. • Promote the NSW Police's *Safer by Design* (crime prevention through environmental design) and the National Heart Foundation's *Healthy by Design Guidelines.* • Safer communities encourage people to be outdoors and physically active and the built environment that promotes physical activity creates safer communities – one tends to perpetuate the other. • Strongly recommend that the concept plan have regard to *Safer by Design* and the *Healthy by Design Guidelines.* • Request that plans consider sustainable public transport, particularly the innovative and creative use of buses.	• Maintaining good human health • Public transport	• Walking and cycle facilities to be provided • On site health facilities include tennis courts and swimming pool
12	Wyong Shire Council **Att:** Gina Vereker Director, Shire Planning PO Box 20 WYONG NSW 2259	Object and Comments	Due to the level of detail provided in Council's submission, the Department has summariesed the broad issues and attaches a full copy of Council's submission. <u>Catherine Hill Bay</u> • No details on residential allotments are provided and differ from original DA application to Council in April 2005. • Council has previously received a DA for the land at CHB, which proposed 900 dwellings located predominantly on the old stockpile sites and a net density of 30 dwellings per hectare. Council note that the current proposal comprises 600 dwellings and net density of 10 dwellings per hectare. • There is insufficient information submitted to adequately assess bushfire assessment (APZs), threatened species, impacts on SEPP 14 wetland, detailed assessment of a number of species, downstream requirements of stormwater	•	• Application has been entirely remodelled to take into account issues raised. • Further detail is provided with Concurrent PAs for development of the site. • Visual impact assessment included in EA • S94 plans included based on Gwandalan plan for Gwandalan and Lake Macquarie Plan for Catherine Hill Bay. LMCC plan used because it is more expensive than the closest relevant Wyong Plan (for Munmorah) • Retail assessment included in EA and retail space reduced • Design of parks amended and all to be managed by community • Other issues dealt with in EAs

			management schemes, achievement of predevelopment flows, establishment of a coastal hazard line, details of traffic measures, public transport, pedestrian/cycleways and open space. • No visual assessment of the proposal was undertaken to assess its impact when viewed from both short and distance views. • There is no Section 94 plan for the area and no details have been provided of who will pay. Should be a developer agreement or similar signed and Council needs to have input into any agreement. • No detail on what role Council will play in the DA process once rezoning has been approved. • Limited detail has been provided on the upgrading of Montefiore Street. These details need to address Council's standards and be funded by the Proponent. • Montefiore Street should become a public road. • Pocket parks within the development are unacceptable. • No retail study has been submitted to assess the size and adequacy of the proposed retail floor space and no relationship to or impact with Council's draft Retail Strategy review has been undertaken. • There is very little information regarding proposed community facilities, services, programs and public transport for the new community. • It is unclear how the threatened species issues across the study area will be resolved, whether a process fo biocertifying the site will occur of these issues will be addressed when the site is listed in Schedule 3 of the MP SEPP. • There is insufficient information about contaminated land for Council to form the opinion that residential developments on that part of the development to be located on top of the coal chitter. This issue should be resolved at the rezoning stage. • Open Space(main access paths to the beach are in narrow bushland to the rear of properties, circular open space surrounded by major road intersection, circular open space has no offstreet adjacent parking, pocket parks fdon't satisy requirements of Open Space Principles plan in terms of size and shape, planting guidelines, visual character of CHB and Moonee Vilage) • Social and Population impact (housing market, ageing demographic, community recreation centre building, increased demands on government funded services, education, public infrastructure, security) • Traffic (options relating to intersection tratements, development contributions, traffic calming measures, public road, road layout, carparking "Commercial Premises", car parking facilities, footpath availability, provision of cycleway,		

			public transport) • Infrastructure and services (stormwater infrastructure, water supply approvals, electricity, pad sites) • Contaminated land (site investigation, environmental site auditor report) • Aboriginal issues (archaeological assessment completed by Indigenous Outcomes Pty Ltd) • European heritage issues (heritage values) • Mine subsidence (Mine subsidence authority, development contributions) • Bushfire assessment (Appendix G - ecological constraints, APZs, residential islands west of the existing village, local emergency services) • Threatened species (themeda grassland, SEPP 14 wetland, *Tetratheca juncea*, corridor, threatened species) • Water (flow regimes, stormwater management, MUSIC model, water quality analysis). • Coastal issues (beach assessment, beach safety, servicing requirements, NSW Coastal Policy 1997) • Planning controls (R1 General Residential Zone, subdivision consent, exempt and complying development, development for short term holiday or tourist rentals, SEPP 14 wetland, DA, SEPP71 – Coastal Protection) <u>Gwandalan</u> • The subdivision footprint is larger than the origincal rezoning application. Council has previously received a rezoning application and development masterplan for the Gwandalan site, which comprised 227 lots, 85 less than the current proposal which has a 312 lot yield. The previous application retained an important corridor in the North West region of the development site and demonstrated added open space within the footprint. • Council's residential Strategy identifies 270 dwellings for the site. • The Gwandalan District Section 94 plan will need to be amended to take account of both the Rosecorp and Coal and Allied proposals. • The proposal does not take into account the impacts on Point Wollstonecraft due to the opening up of the road. • There is no mention of public access and dedication of the foreshore. Council requires a link to be created between Point Wollstonecraft Sports and Rec Centre and the public open space corridor along the lake to the south. • Current infrastructure is not sufficient to cater for more than 150 dwellings in this area. A review of the Local Development Services Plan is needed urgently. Consideration needs to be given to the 700 dwellings proposed by Coal and Allied. • Bushfire Assessment fails to consider basic principles such as		• Footprint has been substantially reduced with the removal of stage 2 • 215 dwellings • There is no foreshore land in the area covered by the revised Concept Plan • Coal and Allied dwellings are not part of this application • Revised layout and bushfire plan provided • Updated flora and fauna study provided • Revised SSS plan provided • Other issues dealt with in EAs

			topography and vegetation and the importance of maintaining bushfire corridors. • Tetratheca juncea is a threatened species and the concept plan shows total removal of all plants. There is no identification of specific compensation for such a significant community. • The flora and fauna assessment was prepared in 2003 and has not been updated. Other species that need to be identified on this site include the threatened orchid species and the implications of habitat for species listed by the Commonwealth. Species from the surrounding area such as Koala and the Eastern Pygmy possum need to be addressed. • Councils role in relation to the SSS process should concept plan and rezoning be approved needs to be clarified. • Open Space(area to population requirements, local parks strategy, buffer zone, recreation areas) • Social and Population impact (social infrastructure, public space, education facilities, community consultation, development strategies) • Traffic (staging of development, Kanangra Drive, Buses, parent parking, intersections, access along Kanangra Dr, road widths, vehicle speeds, pedestrian pathways/cycleways, public transport) • Infrastructure and services (required infrastructure: drainage water and sewer, staging, amount) • Aboriginal issues (archaeological assessment) • Mine subsidence (Mine subsidence authority) • Bushfire assessment (Appendix O, RFS and APZs) • Threatened species (plant assessment - *Tetratheca juncea*, corridor issues, orchids, other threatened fauna) • Water (flow regimes, stormwater management, hydrological model, water quality). • Planning controls (Wyong DCP, NSW Coastal Policy (Access), S94 plans, DA)		
13	Hunter Regional Development Committee **Att:** Peta Waite C/- RTA Locked Bag 30 NEWCASTLE NSW 2300	Comments	• Considered the application under *SEPP 11 – Traffic Generating Developments*. <u>Catherine Hill Bay</u> • The committee supports the use of traffic control signal at the Montefiore Street/Pacific Highway and Flowers Drive/Pacific Highway intersections. These should be installed prior to construction of the development. • Road safety issues, including sight distance, should be addressed in the design of intersections, given the current speed limit and vertical/horizontal alignment through this area. • The design and construction of intersections should be in accordance with the RTAs Road Design Guide and relevant Austroads Guidelines and Australian Standards. • The RTA is the consent authority for traffic control	• Traffic • Road safety • Car Parking • PublicTransport	• Discussions with RTA re intersection upgrades ongoing • Issues dealt with in revised traffic study.

			signals/devices under the *Roads Act 1993* and may require alternative intersection treatments, possible restriction of movements and additional traffic control requirements on this section of the Pacific Highway. This may include traffic control at Nords Wharf Road intersection and relocation of intersections. Further assessment will be undertaken by RTA and Council at project application stage. • Flowers Dr should be upgraded to Council requirements with appropriate traffic calming devices to reduce/control speeds and to encourage traffic generated by the proposed development to use Montefiore Street. • Montefiore Street should be upgraded to Council requirements and dedicated as a public road to provide a direct link to/from the Pacific Highway to assist in reducing the traffic volumes on Flowers Dr. • Montefiore Street should function as the main access and collector road servicing the proposed new development. • Concerned about proposed traffic management around proposed commercial area. Detailed plans should be provided that take into account all accesses/intersections, service vehicles, public transport, pedestrians/cyclists and other traffic. • Carparking for commercial area should be integrated – not located on other side of the road. • Concerned that buses may not service the area because it is isolated. A bus route plan should be provided, in consultation with the bus authority and relevant bus company. • A revised CP Should be submitted to and discussed with the Council and RTA prior to lodging a development application. • All of the above should be to RTA/Council requirements. <u>Gwandalan</u> • Committee requests that traffic report be revised to the satisfaction of the RTA and Council in accordance with the RTAs G*uide to Traffic Generating Developments* for all relevant intersections/accesses, including the Pacific Highway/Kanangra Drive intersection and include; ➢ Current traffic counts and 10 year traffic growth projections, including development traffic; ➢ Use of SIDRA or similar traffic model; ➢ 95th percentile back of queue lengths on all legs; ➢ delays and level of service on all legs; ➢ road safety issues; ➢ input/output data files. • Pedestrian/cycle links connecting to the existing networks should be provided to the school. A shared foot/cycle path plan for the subdivision should be provided, with these facilities constructed as part of the proposed subdivision.		

			• All roads within the subdivision should be designed and constructed in accordance with Wyong Councils DCP. • Discussions need to be had with bus authority and relevant bus company about the bus routes in the area to improve the subdivision layout to facilitate bus movements. • Bus stops should be identified and shelters/seating provided where appropriate to bus authority requirements. • All of the above should be to RTA/Council requirements. • Wyong Council and RTA school safety officers have suggested that a roundabout be provided at the Kanangra Dr/ south access road to the proposed subdivision and that this road be located adjacent to the northern school boundary to allow parent pickup/drop off away from Kanangra Drive.		

13	Roads and Traffic Authority
	Att: Mr Dave Young
	Manager, Land Use Development
	Hunter Operations and Engineering Services
	Locked Bag 30
	NEWCASTLE NSW 2300
		Objects and Comments	<u>Catherine Hill Bay</u>
			• RTAs primary interests are in the road network, traffic and broader transport issues, particularly in relation to the efficiency and safety of classified road system, security of property assets and integration of land use and transport.
			• RTA has powers in accordance with *Roads Act 1993* in relation to road works, traffic control facilities, connections to roads and other works on the classified road network.
			• The Pacific Highway (H10) is a classified state road, RTA concurrence is required for connections to the road with Council consent, under section 138
			• RTA (as consent authority for traffic signals under *Roads Act 1993*) does not support the installation of traffic signals along this section of Pacific Highway.
			• Council is the roads authority for all public roads in the area.
			• The proposed access to the CHB area to/from the Pacific Highway, presented as options by the applicant, is considered inappropriate.
			• A revised traffic report shall be prepared in accordance with the RTAs *Guide to Traffic Generating Developments* to the RTAs satisfaction and include consideration of the following as a minimum:
			  • The road environment along the Pacifica Highway is essentially a high speed, rural road environment. Land use potential through the area, between Swansea and Kanangra Drive, Gwandalan is unlikely to change significantly in the future to the extent of creating an urban arterial road environment, where the speed limit may be reduced.
			  • The use of traffic control signals is considered inappropriate in current road environment. Submission mentions the recently constructed grade-seperated interchange immediately south of Swansea. The RTA requires that this standard of road corridor be retained through the CHB and Nords
				• Intersections – Pacific Highway/Flowers Drive and Pacific Highway/Montefiore Street.
				• Traffic
				• Road safety
					• Intersection works to be funded as part of regional infrastructure contribution
					• Updated traffic study provided

			Wharf area. • Existing intersection of PaciicHighway/Flowers Drive/Cams Wharf Road is subject to safety concerns, which would be heightened given the potential increase in traffic generated by proposed development at CHB. Uncontrolled cross traffic and right turn movements - not be acceptable. Uncontrolled or signal controlled treatments – not acceptable. Any treatment needs to consider accessibility and amenity for existing area at Nords Wharf as well as CHB. • Pacific Highway/Montefiore Street raises concern with the safety of right turn movements to/from highway and standard of treatment given potential traffic generation from proposed development. Not considered appropriate to allow right hand turns from Montefiore Street to the highway with the additional traffic generated by development – given length of right turn acceleration lane required and general safety concern of permitting increased right turn movements conflicting with the through movements in both directions. Right turn into Montefiore Street could be retained, but there could still be road safety issues of sight distance, appropriate storage/deceleration capacity and conflict with through movements. • Could restrict left in/left out only at the 2 main accesses at CHB to ensure compliance with RTAs philosophy of maintaining high speed, rural road environment. • Following treatments should be considered by applicant – 1. grade separated interchange could provide for all movements to/from CHB and 2. restrict to at-grade left in/left out movements, u-turn facilities would need to be considered at appropriate locations along Pacific Highway. • There are significant changes required to the intersection control philosophy adopted in the traffic report. It is recommended that these changes be carried out in consultation with RTA and both Councils prior to revising traffic report. <u>Gwandalan</u> • A revised traffic report shall be prepared in accordance with the RTAs *Guide to Traffic Generating Developments* to the satisfaction of the RTA and Council for all relevant intersections/accesses, including the Pacific Highway/ Kanangra Drive intersection and include: ➢ Current traffic counts and 10 year traffic		

			growth projections, including development traffic; ➢ Use of SIDRA or similar traffic model; ➢ 95th percentile back of queue lengths on all legs; ➢ delays and level of service on all legs; ➢ road safety issues; ➢ input/output data files. • All matters in relation to CHB and Gwandalan raised by the Hunter Regional Development Committee should also be addressed.		
14	Hunter New England Health **Att:** David Durrham Service Director Health Protection		• Support the concept of a healthy environment addressing both chronic disease and preventing communicable disease. • Assessment should include the following: ➢ Expected population demographics to inform essential services such as childcare facilities, schools and aged care facilities. ➢ Social Infrastructure to consider reviewing existing and potential employment opportunities. Employment is considered to be an important social determinant of health. ➢ Contaminated land and potential health impact both acute and cumulative. ➢ Impacts on Water Quality and Drainage and changes to the land use should consider the impact of creating mosquito breeding habitats either natural or constructed wetlands. • Recommend the key assessment requirements to include reference to two important urban planning documents, the NSW Police's Safer by Design located at www.police.nsw.gov.au and the National Heart Foundations Healthy by Design located at www.heartfoundation.com.au • We would appreciate if NSW Health was included as one of the consultation agencies.	• Demographics • Social infrastructure • Contaminated land • Water quality and drainage – mosquito breeding habitat	• Social impact assessment provided in EA • Facilities to encourage healthy lifestyle provided including footpaths and cycleways
15	NSW Rural Fire Service **Att:** Nika Fomin Development Control Co-ordinator		• APZ requirements for both Gwandalan and CHB developments are to be located outside the individual lot boundaries, on adjoining property, road reserves or land to be dedicated back to Council. • The RFS will support APZs on adjoining land where legal documentation is provided that ensures the maintenance of the APZ in perpetuity (i.e. Restriction as to Land use pursuant to S88B or a plan of management signed by an appropriately authorised person to give the document legal weight.) This applies to temporary APZs in staged developments. • Future residential development lodged for proposed lots within the subdivision, identified as bushfire prone land on the Councils Bushfire Prone Land Map may be subject to S79BA	• APZs • Future development. • RFS Act, 1997. • Planning for Bushfire Protection 2006. • Roads • Water	• Full bushfire report provided in EA

			of the Act and must meet the requirements of Planning for Bushfire Protection 2006. • Any future Special Fire Protection Purpose development application lodged for proposed lots within the subdivision, identified as bushfire prone land on Councils maps will be subject to S100B of the Rural Fires Act 1997 and must meet the requirements of Planning for Bushfire Protection 2006. • RFS suggests Council prepare a local policy/guideline in respect to bushfire protection measures that takes a strategic approach to the planning of residential areas. • Council take a strategic approach to bushfire protection by considering zoning land to reflect the hazard/risk posed to the proposed land use. Exclusion of certain areas is an option where the risk from bushfire is high and environmental and access constraints can not be easily overcome. • Public road access within the subdivision shall comply with Section 4.1.3(1) of Planning for Bushfire 2006. • Water, electricity and gas within the subdivision are to comply with Section 4.1.3 of Planning for Bushfire Protection 2006.		

CATHERINE HILL CATHERINE HILL BAY AND GWANDALAN: SSS & CONCEPT PLAN - SUMMARY OF NGO AND COMMUNITY GROUP SUBMISSIONS

No.	Date	Nature	Comment	Issue Summary	Response
1	26.02.2007	Object	• Inappropriate place for development to occur. The proposed development at CHB is totally inappropriate in terms of the cultural heritage. The existing village and its surrounding bush and heath land were in 2004 declared a Heritage Conservation Area. • The proposed town at CHB will engulf the town both physically, aesthetically and socially. • The dramatic coastal landscape of beach, bush and heath will be devastated by a six-fold increase in infrastructure and its associated pressures.. • The proposal's HIS acknowledges the high natural and cultural heritage significance yet does not allude to how the proposed zonings would impact on these heritage values. • The cumulative impact of the Rosecorp and middle camp proposal should be considered. • The town will become the largest on the Wallarah Peninsula. • Request that the site be placed on the State Heritage Register. • As part of the mining contract the site is to be rehabilitated, returning the site to natural coastal bushland, thus the loss of bushland is significant. • There is nothing in the documents that outlines the ecological benefits of the land to be provided as environmental offset and ignores the fact that the entirety of this land was due to be protected because of being in a Coastal Acquisition Zone. • Major biodiversity report is based on just 3 days study and does not attempt to show whether there is a net benefit from the offsets or not. • The Concept Plan does not adequately address traffic issues. The traffic report relates to an earlier proposal and is irrelevant to the subject proposal. • Traffic flow data was collected in June 2004 (winter) and thus does not accurately show peak traffic flows. • Traffic impacts during the construction phase are not addressed. • The flora and fauna assessment does not include the CHB extension proposal or the rehabilitated lands north of Montefiore Street or land west of Moonee Colliery. • The proposal suggests that the it will totally remove known tetratheca juncea stands and makes no attempt to detail other rare flora (including themeda grassland, an endangered ecological community, which is likely to exist on the headland proposed for development). • There is no analysis of the adequacy of the proposed buffer between the development and Munmorah State Conservation Area and its SEPP 14 wetlands. • Stormwater controls may be crucial to the integrity and survival of the rare wet heathland. • The environmental impacts of any proposed bushfire management hazard management are not dealt with. • Object to the site being redeveloped in the context of the Lower Hunter Regional Strategy. • This proposal contributes to urban sprawl in the Lower Hunter and weakens the public transport network. Placing a development in this location is not in the interests of a sustainable settlement pattern and contributes to greenhouse gas emissions, social dislocation and isolation. • The proposal undermines the integrity of SEPP 71 and other planning policies designed to protect the coast from inappropriate and overdevelopment. • Object because it sets a dangerous precedent in the treatment of Coastal Acquisition Zones. • CHB community has a clear preference for tank water and septic systems. A survey of residents indicated that only 11% thought that town water would improve their lifestyle and 14% in favour of mains sewer. • There is no information about providing gas, waste disposal or recycling facilities. • The proposal ignores the decisions of local authorities and the decision of the Land and Environment Court against the Rosecorp development plan. • The MoU provides for up to 600 dwellings but the proposal on display has a total of 694 (including 152 tourist beds). • No strategic justification is given other than a narrow reliance on the Lower Hunter Regional Strategy. However, the project's target market is for weekenders, tourism and short stay. • There appears to be no bushfire management plan for CHB in the concept plan documents. • There are no details about the ongoing management responsibility for the APZs around the development.	• Heritage • Aesthetic impacts • Social impacts • Cumulative impacts • Offset lands • Traffic • Flora and fauna • SEPP 14 wetlands • Bushfire Management • Stromwater • Urban sprawl • Public transport • Coastal planning policies • Infrastructure • MoUs • Management of dedicated lands.	• Concept Plan has been redesigned to incorporate many of these concerns most significantly all development in the vicinity of the existing village has been removed, the village centre has been moved and the nature of development is now carefully blended into a bush setting. • Infrastructure and visual impacts are dealt with in the revised EA • Revised Heritage impact statement provided in EA • Loss of bushland is minimal and significant offsets are to be provided as well as on site landscaping, park areas and other plantings. • Offsets have been agreed with DECC • Revised traffic report is included in EA • Development has been removed from headland areas • Stormwater management plans are included in the EA and ensure that there is no impact on SEPP 14 wetlands • APZs are contained within the site. Bushfire management plan provided in EA • The development will be constructed according to best practice sustainable development principles. It will enhance the sustainability and viability of existing community by providing access to reticulated sewer and water and through the provision of facilities and shops within walking distance of dwellings. • The revised proposal is compliant with SEPP 71 as detailed in the EA. • Waste management is dealt with in the EA • There have been no local government decisions that relate to this proposal, only to previous proposals which differ significantly in character and impact. • Land and environment court has not made any decisions relating to this proposal • Tourist beds have been removed • There will be a maximum of 600 dwellings, this is clearly stated in the Concept Plan • Bushfire management plan is provided. • Community will be responsible for management of APZs
2	28.02.2007	Object	• The proposal represents an inappropriate development of land and is contrary to the principles of ESD as enshrined in current local environmental planning provisions and zonings. • There is inadequate service infrastructure. • Important nationally significant heritage values of the area will be destroyed. • The proposal will have adverse effects on important biodiversity values and habitat corridors and no adequate scientific studies have been undertaken. • There has been no suitable site assessment to identify all the values and constraints of the land. • The proposal is contrary to the State Government Coastal Policy and to the Hunter REP 1989.	• ESD • Infrastructure • Heritage • Biodiversity • Policy	• Principles of ESD are adhered to • Service infrastructure is detailed in the EA • Development has been removed from the village • Only minimal biodiversity impacts all of which will be adequately offset • Full site capability assessment has been undertaken (see EA) • The proposal is consistent with the Coastal Policy (see EA)
3	2.02.2007	Object	• The two settlements at Catherine Hill Bay are within a National Trust Urban Conservation Area. • The proposed extension of the urban area will destroy the existing character of the villages, and the reason they were listed. • The proposal will change one of the few remaining examples of a coastal mining village into a tourist town. • The proposed 2-3 storey dwellings will alter the character of Catherine Hill Bay. • P.22 of the Catherine Hill Bay + Gwandalan Concept Plan Issue B – 4December 2006 Figure 3.10.12 is not a design that the Trust believes should be replicated across and beyond the entire village. The setback second storey extension dominates the original cottage, detrimentally changing the bulk and scale of the building. Altering existing buildings in this way would totally change the character of this unique coastal village.	• Conservation Area. • Protect character of the village. • Design proposed not consistent.	• Development has been removed from the village area and the ridgeline • Dwellings will be a maximum of 2 storeys and 1 storey in more sensitive areas this is consistent with the current village.

			• The Trust urges that the proposal be refused and that clear parameters for future development in the area be established to protect the existing character of Catherine Hill Bay.		
4	28.02.2007	Object	• There is a need for a full conservation and population strategy to be undertaken before any further development on the Central Coast occurs. • The region is fast losing fauna and flora species. • Water supply is at crisis point. • Objects to the two communities being linked. <u>Catherine Hill Bay</u> • The proposal will adversely affect the visual amenity from the NP walking tracks and negate the attractiveness of the area for eco-tourism activities which have been identified as an important economy for the Wyong Shire. • While the MoU provides for up to 600 dwellings, the proposal identifies a total of 694 (incl. 152 tourism beds). • Proposal does not adequately address ESD principles. • The major biodiversity report is based on only 3 days study. • The development will impact adversely on the many threatened and endangered species around the site. • The proposal suggests that it will totally remove known tetratheca juncea stands and makes no attempt to detail other rare flora (including themeda grassland, an endangered ecological community, which is likely to exist on the headland proposed for development). • There is no analysis of the adequacy of the proposed buffer between the development and Munmorah State Conservation Area and its SEPP 14 wetlands. • Stormwater controls may be crucial to the integrity and survival of the rare wet heathland. • The environmental impacts of any proposed bushfire management hazard management are not dealt with. • Concerned about the impact of domestic pets (dogs) on native fauna. • There appears to be no bushfire management plan for CHB in the concept plan documents. • There are no details about the ongoing management responsibility for the APZs around the development. • Proposal has no specific provision for access to or parking at Moonee Beach and proposes intensive development to the cliff edge on the headland which will restrict public access. • Proposal is inconsistent with the Lake Macquarie Coastline Management Plan and some parts appear to be within the Coastal Hazard Zone. • Proposal does not discuss the interface between the development and Munmorah State Conservation Area. • Proposal does not comply with Lake Macquarie City Council's Scenic Quality Guidelines and does not provide a detailed visual analysis. • Proposal's HIS acknowledges CHB as having high natural and cultural heritage significance but does not allude to how the proposed zoning will impact on these heritage values. • The proposed 3 storey buildings of 9.5 m max in pastel colours with 50% site coverage will severely impact on the small village life aesthetics of the existing community. • Proposal does not meet the overriding principles of the NSW Coastal Design Guidelines. • The proposal does not demonstrate the type, bulk ,scale size and design quality controls respond appropriately to the location. • The proposal does not adequately address traffic. The traffic report relates to an earlier proposal and is irrelevant to the subject proposal. • Traffic flow data was collected in June 2004 (winter) and thus does not accurately show peak traffic flows. • Traffic impacts during the construction phase are not addressed. • There are no road safety or intersection designs, no discussion about a public road to Moonee Beach and no public transport report. • CHB community has a clear preference for tank water and septic systems. A survey of residents indicated that only 11% thought that town water would improve their lifestyle and 14% in favour of mains sewer. • There is no information about providing gas, waste disposal or recycling facilities. • The proposal goes against the objectives of the Wyong Community Plan – it will create another isolated village away from social infrastructure, jobs, education, family support and transport. • Proposal contains no commitments to social infrastructure and economic matters and employment opportunities are not addressed. • Concerned that some major issues on stormwater management have been delayed until detailed design stage, particularly as it is located in close proximity to a SEPP 14 wetland. • Concerned that the Proponent has not fully addressed the extent of contaminated land on the site. <u>Gwandalan</u> • Proposal is contrary to Wyong Council's Residential Strategy which identifies 270 dwellings for the site. • The proposal does not deal with the entire portion of land (Stage 2) owned by Rosecorp. • When combined with the Coal and Allied proposal will place unacceptable pressure on all the services, amenity and the environment in this area and should be considered at the same time. • Insufficient detail regarding the dedication of foreshore land and the provision of public access, which is against principles of NSW Coastal Policy. • Buffer zones for the school and to the lake foreshore have not been addressed. • Proposal does not satisfy the open space principles plan – there are no small parks proposed and the nearest playground is 750m away from the majority of the proposed development. • There is no Species Impact Statement – the proposed area is known to contain Tetratheca juncea and the proposal shows a total removal of this species. A threatened orchid species is also known to be on the site and it is not expected to survive a development of this density. • Proponent has not undertaken a 7 part threatened species test including seasonal and repeat surveys for flora and fauna species – including the Pygmy possum and the koala. • Proposal will impact on wildlife corridor which has been recommended for the conservation of the masked owl. • There is no detail provided for tree removal. • Bushfire management and assessment has not been adequately addressed, in particular the importance of maintaining wildlife corridors and urban habitat to assist when fires affect the primary habitat of species.	• Fauna and flora • Water supply • Visual amenity • ESD • Water quality • Bushfire management • Public access • Heritage • Built form • Traffic • Public transport • Infrastructure • Social infrastructure • Contaminated land • Open space • Car dependency	• Development will provide 310ha of offsets • Water is to be supplied from the Hunter for the development at Catherine Hill Bay. Gwandalan to be supplied from the Central Coast • Visual impacts have been minimised by redesign see EA visual impact assessment • Tourism beds removed. Maximum of 600 dwellings will be provided • Revised proposal directly addresses ESD principles • There will be only limited impact on threatened species and these will be adequately offset. • Development has been removed from the headland • Stormwater management plans are included in the EA and ensure that there is no impact on SEPP 14 wetlands • APZs are contained within the site. Bushfire management plan provided in EA • Full public access to cliff top areas and all foreshore areas is provided by the revised development along with a public car park at Moonee Beach • Development is not taking place in the existing village a revised HIS is provided in the EA • Dwellings will be a maximum of 2 storeys • The revised proposal is compliant with SEPP 71 and the coastal design guidelines as detailed in the EA. • A revised traffic report is provided • The EA provides further road design details • Waste management is dealt with in the EA • A full SIA is provided in the EA • Contamination is addressed in EA • Development has been reduced to 215 dwellings • Stage 2 has been removed • There is now no foreshore land in the proposal • School buffer provided • Central Parkway included in revised layout • Undated threatened species report available. Offsets provided • Bushfire management plan provided in EA • Full SIA provided • Bus facilities provided • Regional contribution to assist augmentation of public transport

			• The adjoining public school is already overcrowded with 490 students – originally constructed to cater for 150-270 students. • The proposal will create unacceptable levels of traffic and parking needs, particularly in the vicinity of the public school at peak times. There are no reports that address this issue. • Inadequate public transport. • The social needs of a new community have to be properly catered for – good social infrastructure and activities for the youth. • Concerned that the proposal will create a high level of car dependency.		
5	02.03.2007	Object	• Concerned that the CHB and the Gwandalan site are being considered together as they are over 10km apart and have no functional connection to each other, are in different LGAs and have different social and environmental constraints. • Proposal does not contain an adequate threatened species assessment. • The Environmental Assessment does not contain a true assessment of the impact of the proposal because it is based upon consultant's reports that were prepared for a rezoning proposal that retained a vegetation corridor at Gwandalan. • The Ecological Constraints Analysis – Catherine Hill Bay and Moonee contains no meaningful threatened species analysis. • The EA does not contain any justification for giving absolute priority to offsets over on-site mitigation measures. Offsets should be seen as a last resort after avoidance and mitigation measures. • Offsets should be the subject of rigorous assessment to ensure that the proposed offset areas are suitable to compensate for ecological values being sacrificed – not just from comparing hectares. • Threatened species issues should not be deferred until project approval stage – threatened species impact assessment should occur prior to any concept plan application granted. • Proposal should be referred to the Commonwealth under the EPBC Act. The site is home to at least one federally-listed species (Tetratheca juncea) and contains suitable habitat for other federally listed species. <u>Provided an ecological review of the EA –</u> • Flora and fauna mapping is outdated and very broad. • Concept Plan does not appear to take into account any of the conservation recommendations as set out in the ecological constraints report. • EA argues that no further assessment or conservation measures apply to Gwandalan because 310 ha of land has been dedicated for conservation adjacent to the CHB site. • EA does not refer to any assessment of *Syzygium paniculatum* and *Tetratheca juncea* under the *EPBC Act* – national environment impact must be considered. • EA does not contain a seven part test – should be based on a recent survey that takes into account the latest listings on schedules of the TSCA Act. • No attempts have been made to mitigate the impacts associated with the development but instead recommend offsets in the first instance. • There has been no rigorous assessment of the offset area and therefore there is no way of ensuring ecological values will be similar to or better than those of the development area. • Proposal does not demonstrate a commitment to ESD principles with respect to maintaining biodiversity. • There are a number of limitations associated with Wildthing's 2003 report – it is outdated because it was prepared in 2003 and does not consider current threatened communities and species listings (WSC submission notes that 12 recent listings are relevant to the Wyong Shire), mapping is not detailed enough to discern remnant vegetation communities that occur on site. • The degree of disturbance does not negate EEC status. • Mapping does not enable easy comparison with vegetation communities described in the Comprehensive Regional Assessment (CRA) Forest Ecosystems of the Lower North East Region (NPWS 2000). • Wildthing relies on Draft Wyong Conservation Strategy – however this strategy was never adopted by Council. • The CP does not appear to take into account any of the recommendations as set out by Wildthing. For example, on the Gwandalan site a veg corridor has not been retained along the drainage channel to connect the site to adjacent vegetated areas or to provide habitat for threatened flora and fauna. • *Tetratheca juncea* are considered to be of very high conservation significance (Payne 2000). • EA does not address the loss of integrity of existing corridor between Point Wollstoncraft and Lake Macquarie State Conservation Area. • EA does not assess any indirect impacts associated with the proposed development on intact native veg to the north and the west –edge effects, rubbish and garden waste dumping, increase in cats and dogs, use of recreational vehicles, road kill, introduction of weeds, trampling, human disturbance, removal of bush rock and fire wood and altered fire regimes. • No specific sustainability actions are recommended in the EA. • Offset area should equal or better in ecological terms than the development area with respect to conservation values – no rigorous assessment of the offset lands has taken place and it is therefore unclear if it is a suitable offset for the Gwandalan site. For example, 178 *Tetratheca juncea* plants were found on the Gwandalan site and the offset area contains at least 100 ha of habitat for this species but there is no indication of the individual plants within the offset area. • EA does not refer to any assessment of the *Tetratheca juncea* under the *EPBC Act*. • There is no assessment of the impact of development on adjacent surrounding bushland and State Conservation areas. • The Glossy-Black Cockatoo, Masked Owl, Koala and *Diuris praecox* have been recorded within the immediate vicinity of the CHB site and can be assumed to occur there. • Wildthing recommended the retention of a corridor along the western side of the site, retention of hollow-bearing trees wherever possible and erection of wildlife warning and speed signs on local access roads. Authors also concluded that proposed development at CHB development had the potential to significantly effect the local population of *Tetratheca juncea* and recommended that all species be reassessed under *Section 5A* and that	• Threatened species • Vegetation corridors • Offsets • EPBC Act • Inadequacies of the flora and fauna assessment • ESD • Biodiversity • EECs • Impacts on surrounding bushland • Water quality • SEPP 14	• Updated Threatened species assessment for Gwandalan provided in EA • Offsets are agreed with DECC • EPBC nomination made

			Tetratheca juncea be reassessed under EPBC Act once development design finalised. • Surveys were undertaken for *Diuris praecox*, Thick-lipped spider-orchid (*Caladenia tessellate*), *Cryptostylis hunteriana*, *Microtus angusii* and *Tetratheca juncea* between October 2005 and February 2006 but did not locate any individual species. The flowering period for *Diuris praecox*, the orchid most likely to be found on site, is early June to early September and would therefore not have been detected in October 2006. This report also was not included as an appendix. • Raised concern about the scale of mapping which resulted in discrepancies in the location of *Tetratheca juncea* • Concerned that areas of known and potential habitat for threatened species correlate with undisturbed areas as highly disturbed EECs retain its EEC status and threatened fauna species are known to use highly disturbed areas. • Commonwealth legislation applies to the CHB site and national impact of the development must be assessed. • EA does not assess the loss of integrity of the existing corridor between Munmorah SRA and existing veg to the north in Lake Macquarie LGA. • EA does not assess any indirect impacts associated with the proposed development on intact native veg surrounding the site –edge effects, rubbish and garden waste dumping, increase in cats and dogs, use of recreational vehicles, road kill, introduction of weeds, trampling, human disturbance, removal of bush rock and fire wood and altered fire regimes. • Concerned about runoff impacts from the residential subdivision to the SEPP 14 wetland located less than 50m from the CHB site. • Proposal does not consider any alternative options eg. Lower density development. • Authors of the EA have have relied on the Lower Hunter Regional Strategy and the MoU in lieu of conducting a systematic and rigorous assessment of impacts. • There has been no attempt to avoid or mitigate impacts on Gwandalan or CHB prior to offsetting.		
6	28.02.2007	Object	• No strategic justification has been provided other than a narrow reliance on the Lower Hunter Regional Strategy's broad objectives to provide for population growth. However, CHB proposal will see the development of holiday houses and tourist accommodation. • No justification is given with regard to the quality of either the proposed green corridors of biodiversity on site. • No alternatives have been considered other than the developers own proposals. • There is no meaningful or detailed explanation of the proposed "tourism beds", the plans for the heritage precinct, or the sustainability of the commercial area. • Other details missing from the proposal are: how the village will be protected from through traffic, who will be responsible for infrastructure provision, accessibility to Moonee Beach, intention of the site excluded from the CP (which seems to be the same place formerly proposed by the developer for a licensed club). • Proposal sates over requirements of relevant SEPPS. • There is no relevant detail on contamination, no detail on coastal management issues, no detail as to why the headland can be developed within Coastal Policy and no detail on environmental safeguards n the site if adjoining conservation lands. • There are no detailed commitments on important public issues such as traffic management and safety, the timing and cost of infrastructure provision, mitigation of "adverse social impacts", contamination monitoring, access to Moonee and the Munmorah State Conservation Area. There is no clear identification of who is responsible for these measures. • Details on the contributions of the public benefits and how much the developer might pay towards these has not been provided. • It is outrageous that the proposed transfer of land for conservation purposes will relieve the developer of any further contributions.	• Strategic justification • Biodiversity corridors • Tourism • Heritage • Traffic • Infrastructure • Environment protection • Developer contributions	• Strategic justification provided in SSS report • Offsets prioritised in Lower Hunter Regional Conservation Plan • Completely revised development proposal • Tourism beds removed from revised proposal • Assessment of viability commercial precinct provided in EA • Traffic and infrastructure reports provided in EA • Access to Moonee beach to be provided • Excluded site is not the club site it is a lot under other ownership • Proposal consistent with relevant SEPPs • Contamination report provided in EA • Development removed from headland • Proposed contributions schedule provided in SOC
7	02.03.2007	Object	• The Gwandalan site has no strategic justification, as it is in direct conflict with Wyong Councils settlement strategy. • Previous DA for Moonee proposal had 11 objectives that would be best achieved if development did not go ahead. Current 3A application provides less detail of its objectives for this site and provides absolutely no strategic explanation why the objectives should be or have been changed. • CHB extension has been rejected by LMCC as being contrary to 13 planning strategies and against the public interest. Rosecorp appealed this matter in the L&EC and lost. • The application fails to consider alternatives for example, rehabilitating the site and leaving as a restored site rather than developing. • Proposal does not consider the option of following DECs recommendation for conservation of all lands from CHB to Crangan Bay. • Suggest that the current proposal is not consistent with the NSW Government's long term plans for the Wallarah Peninsula. • EA fails to adequately consider relevant state policies, in particular SEPP 71. • Contend that the proposal will significantly obliterate the natural and cultural values of the area, thus seriously and permanently compromising the recreational values. • The proposal will not benefit the broad community to the extent achievable by maximising the conservation and hence tourism values. • Development will impact economically on the broader community through the $11.5 mil cost to Lake Mac ratepayers in providing infrastructure and services. • The proposed development at Moonee and the headland are a travesty from a visual amenity point of view and would be visible from two beaches and from the two roads leading to CHB. • SEPP 71s requirements on beach environments and beach amenity would be compromised by this development. • The wetland which forms a significant part of Moonee Beach's environment will be impacted by water run-off from urban development. • EA identifies public access that is in the tidal zone and therefore not always accessible. • Concerned about the certainty of the provision of managed access and parking at Moonee Beach. • Proposal does not provide a strategic approach to coastal management.	• Strategic justification • Alternatives • SEPP 71 • Cultural, conservation and recreational values • Visual amenity • Coastal amenity • Water quality • Public foreshore access • Heritage • Carparking • Regional buffer • Offsets • Infrastructure • Developer contributions •	• Gwandalan proposal consistent with Wyong Settlement Strategy and Draft Central Coast Regional Strategy • Revised development proposed • Development removed from village and ridgeline • This proposal has never been considered by the Land and Environment Court • DECC support the principle of development (ref MOU) • Fully consistent with SEPP 71 (see EA) • Developer contributions schedule provided • Visual assessment ameliorated in new design, visual impact assessment provided in EA • There will be no impact on the SEPP 14 wetland • Full public access to the foreshore is provided • Habitat corridors provided • Parking provided • Development removed from village

			• Development will not conserve habitat corridors, particularly in the context of areas to the north of Montefiore Street. • Proposal fails to provide adequate parking for beach-goers. • Proposal would severely detract from the existing villages historical and heritage value by figuratively surrounding it and overshadowing it. • Proposal will impact on inter-regional buffer zone identified in the Lower Hunter REP. • EA identifies the primary objective of the NSW Coastal Policy to protect coast lines and beaches for the enjoyment of future generations and to ensure coastal development is balanced, well planned and environmentally sensitive. However, the EA disregards this objective. • If development is allowed at CHB, it will be allowed anywhere. • NSW Coastal Design Guidelines do not apply because No development should occur in CHB. • Proposal is not allowed under the Lake Macquarie LEP AND Wyong LEP, which means Councils' DCPs are irrelevant. • Coastal foreshore and public access has not been adequately addressed. The public access at CHB in the vicinity of the headland is in the tidal zone and is therefore inadequate. • EA refers to conservation of 310 ha without addressing the impacts on the 60ha identified for development and even states that the disturbed sites should be restored and conserved. • The EA does not acknowledge the disproportionate scale of the proposed development. • Proposal seeks to increase population at Gwandalan which will increase the problem of the provision of resources and will have a financial impost on Council and the ratepayer. • Proposal is against the public interest. • EA does not justify the project.		
8	22.02.2007	Object	• Object to the development at precinct 1A Gwandalan. • The current traffic situation is already critical and increased traffic flow past the school poses an unacceptable risk to our childres. • Parking situation would become worse and there is no provision for extra parking, turning bays for buses, traffic lights, and pedestrian crossings in the submission. • Traffic assessment is inadequate because it was done outside peak school time, which is 2.30 to 3.15pm. • Houses backing on to the school are a security risk and the proposed walkway covers a natural watercourse which runs through the area. • The current school was built in 1961 for approx. 250 students and now has 445 students. Library, hall, canteen and administration block have not been enlarged from their original size and are almost unusable for current school population. • The nature area at the northeast corner of the school site, connecting to the Rosecorp Property, currently acts as a wildlife corridor through to Point Wollstoncraft Recreation Area.Black Glossy Cockatoss have been observed sitting in the trees and there is evidence of echidnas, sugar gliders and squirrel gliders and a dead rose crowned fruit dove was found on the school grounds. The watercourse feeds a frog pond. • Concerned about the loss of the nature area. • The school has a vista of trees on the proposed development site. • Concerned that there is no provision for public open space in the subdivision plan. • There appears to be no provision for connecting the property to existing cycleways or walkways. • There are currently over 100 vacant sites in Gwandalan. Development should not go ahead until infrastructure is in place and environmental studies have been completed. • Gwandalan is heading for level 5 water restrictions and approving this development would be irresponsible. • Land offsets on the eastern side of Lake Macquarie and CHB (17kms away) do not compensate for the loss of vulnerable local habitat and the fragmentation that will occur in Gwandalan. The bushland setting should be protected. • Request that the determination of the future development be returned to Wyong Council.	• Traffic • Safety • School capacity • Wildlife Corridor • Public open space • Infrastructure • Water • Offsets	• Traffic study provided, dwelling numbers reduced • Bus route provided • Houses no longer back onto school • SIA provided in EA • Offsets provided • Trees will be retained where possible • Parkway forms part of the plan • Cycle and walkways provided throughout site • Offsets are judged within bioregion • House DAs on the site will be assessed under part 4
9	20.02.2007	Object	• The offsets proposed serve mainly to secure in part the current status of land for a variety of coastal protection, environmental and public open space uses). The proposal asserts that the offser of an area of bushland is more than sufficient to relieve the developer of virtually any responsibility to provide contributions for provision of community and public facilities beyond the site itself, road upgrades, sewerage augmentation, beach services, care of adjoining natural areas and ongoing environmental monitoring/care, all of which are normal for this type of development. • There is no scientific analysis of the condition of the offset lands and no assessment of the environmental or social value of the offset land. • No strategic context has been provided of the comparative value of the offset land against deleterious impact of the proposed development on the existing protected coastal environment. • There has been no detailed study or assessment made to justify 600 dwellings on the CHB site. • Appears to be no statutory foundation for this proposal. • CP seems to have been cobbled together from earlier Rosecorp proposals and is often misleading and does not provide an appropriate basis for assessment of a rezoning of a SSS. • CP does not achieve its stated objectives. • No strategic justification is given other than a reliance on the LHRS's broad objectives to provide for population growth even though the project's target market is weekenders, tourism and short stay. • No justifications are given to the quality of either the proposed green corridors or bio-diversity on site or in the green corridor. • No alternatives have been considered other than the developers own earlier proposals, which have been rejected or stalled for about a year. Land has been identified for conservation and public space for the last 25 years, which is not discussed as an option. • The proposal is misleading because it does not discuss the Mine Rehabilitation Closure Plan. • There is no meaningful or detailed explanation of the following: ➢ proposed "tourism beds" ;	• Coastal protection • Developer contributions • Infrastructure • Offsets • Strategic justification • Corridor • Inadequat eand inaccurate information • Contamination • Coastal Policy • Traffic • Urban design and built form • Heritage • Flora and fauna • Water quality • Social infrastructure • Lack of consultation	• Contributions schedule is provided in SOC. All water and sewer headworks to be fully funded. • Offsets agreed with DECC • Revised CP provided • SSS Report provided • Mine rehabilitation plan impact discussed in CP • SIA provided in EA • Tourism beds removed • Commercial viability assessment provided • Traffic assessment provided • Moonee Beach access provided • Excluded site is under different ownership • RFS station removed on advice Reference Panel • Contamination report provided in EA • Development removed from headland, consistency with Coastal Policy and SEPP 71 demonstrated in EA • The maximum dwelling number will be 600 • Full PA for first two hamlets provided • Maximum 2 storeys • Revised visual impact report provided • Bushfire management report provided in EA • There will be no impact on SEPP14 Wetlands • Stormwater report provided in EA • Bin building to be adaptively reused

			➢ what will happen in the so-called heritage precinct; ➢ how the commercial area will sustain itself; ➢ how the village is to be protected from through traffic; ➢ who pays the infrastructure provision (including life savers on Moonee Beach), ➢ how people will get access to Moonee Beach across NPWS sand dunes; ➢ what is actually intended for the central site "excluded" from the CP, ➢ whether the RFS station at corner of Montefiore St and Pacific Hwy is confirmed or could be later changed to a commercia operation. • No relevant detail is provided on contamination or mitigation – report was prepared on for the mine rehabilitation of the site for passive (recreation and conservation purposes) not residential. • Proposal skates over relevant SEPP requirements. • No detail is provided on coastal management issues, no explanation as to how and why the headland can be developed within Coastal Policy and no detail on environmental safeguards on the site or adjoining conservation lands. • There are no detailed commitments on public issues such as traffic management and safety, the timing and cost of infrastructure provision, mitigation of adverse social impacts, contamination monitoring, access to Moonee Beach and the Munmorah State Conservation Area. • Proposal implies that costs will be transferred to the community, councils and government but the costs and timing are not quantified. • Concerned that commitments are being deferred until after CP approval is obtained. • Concerned that the proposal to have no further statutory controls would be against the public interest. • Do not provide adequate justification for the project. • Makes a number of conflicting claims – for eg. Identifies proposal to be consistent with 1875 plan for Cowper but then puts 90 dwellings on 40 odd blocks with an inconsistent subdivision pattern. • Nowhere does the developer clearly identify its contributions or the public benefits provided or how much the or when the developer might pay towards provision of these. It is unacceptable that the proposed offset lands should relieve the developer of these obligations. • No certificate stating that the report is neither false nor misleading. • The MoU provides for 600 dwellings but the proposal on display has a total of 694 dwellings and 152 tourism beds. • The proposal does not adequately address urban design and built form – in particular type, bulk, scale, size and design controls. • The urban design for the Moonee Village is both grandly formal and bizarre in a coastal context. • Believe that it is inconsistent with no known contemporaneous planning instrument pr policy or with the Coastal Design Guidelines. • The historical justification of the urban design or not relevant to the site, the existing village or the coast or contemporary coastal living. • Text implies that 2 storey buildings or higher are somehow typical of the CHB village. Proposed 9.5m height max proposed by developer is inconsistent with CHB. • Proposals visual impact report is a "left over" from an earlier failed application and proposal contains no detailed analysis of visual impact. • Believe that the views from Munmorah State Conservation Area, Moonee Beach and the northern end of CHB Beach should be preserved. • Nsw Coastal Policy confirms that considerable attention needs to be given to visual impacts and the preservation of landscaped headlands. • Do not believe that proposal complies with Lake Macquarie Councils Scenic Quality Guidelines. • CHB has high natural and cultural significance (identified in HIS) yet proposal does not show how impacts on these values will be mitigated. • There is nothing in the proposal to say what the ecological benefits of the offset land are. The major biodiversity report is based on just three days of study and is inadequate to informed assessment. • Proposal does not adequately address traffic – it relates to a previous proposal. Submit that the explanation of the traffic report covering 900 dwellings being able to cover the current proposal and the Middle Camp Proposal as being not in the public interest. • Traffic flow data was collected in winter and does not accurately show peak traffic flows. • Flowers Drive is identified as a collector road –it's a collector road then would have to be 20m wide which would compromise the houses along this road and a heritage feature of the village. • Traffic impacts during the construction phase are not addressed and there are no road safety or intersection designs, no public transport report except for expressing a hope that an extra bus or two will run. • There appears to be no bushfire management plan for CHB in the documents and there is no specifics about who has the on-going management responsibility for the APZs. • The flora and fauna assessment does not include the CHB extension or the rehabilitated lands north of Montefiore Street or land west of Moonee Colliery. • CP suggests that all tetratheca juncea plant clumps will be removed and makes little or no attempt to detail other rare flora (incl. themeda grassland – an endangered ecological community which is likely to exist on the headland). • No detail on the adequacy of the buffer between the development and the SEPP 14 wetland is provided. Stormwater quality controls is crucial to the integrity and survival of the rare wet heathland. • Proposal has no specific provision for parking at Moonee Beach which will be heavily used once vehicle access is provided. • Proposal to have intensive development to the headland restricts public access. • No discussion of additional facilities at CHB Beach. • Proposal is not consistent with the Lake Macquarie Coastline Management Plan and some parts of the proposal appear to be in the Coastal Hazard Zone.		

			• CP does not discuss the interface between the development and park at its southern boundary. • CHB community has a clear preference for tank water and septic systems. A survey of residents indicated that only 11% thought that town water would improve their lifestyle and 14% in favour of mains sewer. • There is no information about providing gas, waste disposal or recycling facilities. • The section on Social infrastructure is inadequate. • Concerned that details about stormwater management have been put off until detailed design stage yet the development is adjacent to a SEPP 14 wetland, it feeds a drainage line whose contents end up on Moonee Beachand is an area of significant depth and variety in biodiversity and ecological significance. • The statement about the Mine Subsidence Board having given approval to development applications over both the coal washery and Moonee mine sites is questionable. • Consideration needs to be given to the long-term issues associated with retaining the bin building – such as the integrity of the structure, surrounding embankment and also responsibility for maintenance of the structure. • There has been no consultation between the developer and the community during the preparation of the environmental assessment. • The proposal does not adequately address the Director Generals Requirements, does not meet community expectations and should not be approved.		
10	02/03/2007	Object	• Support the submission made by Catherine Hill Bay Progress Association and Dune Care Inc (as detailed in the above submission #9). • The Lower Hunter Regional Strategy is a non-statutory strategic planning instrument. It indicates that new development areas will be defined by local planning. However, the development areas at CHB have been defined by a non-binding Memorandum of Understanding between the Minister and a developer. The MoU provides for 600 dwellings but the proposal on display has a total of 694 dwellings and 152 tourism beds. The proposal is not consistent over the two documents. • The proposal does not adequately address Urban Design and Built Form (type, bulk, scale, size and design quality controls). • The proposal's Visual Impact Report is a "left over" from an earlier, failed application and the proposal contains no detailed analysis of the visual impact of the subject development. • The development does not comply with Lake Macquarie City Council's Scenic Quality Guidelines, but clearly it does not, and there is no detailed visual analysis to justify the proposal's self-serving conclusions. • CHB is acknowledged by the proposal's Heritage Impact Statement as having high natural and cultural heritage significance yet it does not allude to how the proposed zonings would impact on these heritage values, nor how to mitigate such impacts. • The CP proposes three-storey buildings of 9.5m max. in pastel colours, with 50% site coverage, intruding into a village of small, single-storey miner's cottages generally on large blocks. • The proposal attempts to address ESD by stating that the proposed "offset" of 310ha of land given to the State and undefined "managed measures" are a "disproportionally positive" response to the effect of development at CHB. But there is nothing in the proposal to say what the ecological benefits of that land are. • the major biodiversity report is inadequate as it is based on just three days study. • The CP does not adequately address traffic. The traffic report, dated Jan 2005, relates to an earlier proposal and is irrelevant to the subject proposal. • Traffic flow data was collected in June 2004 (winter) and does not accurately show peak traffic flows. • The proposal's traffic over-view asserts that "the main road through the villages operates as a collector road". Concerned that this would mean a road width of 20 metres would have to be provided the main street and a heritage feature of the villages. • Traffic impacts during the construction phase are not addressed. There are no road safety or intersection designs, no discussion about a public road to Moonee Beach, no public transport report (except for expressing a fond hope that an extra bus or two will run). • There appears to be no Bushfire Management Plan for Catherine Hill Bay in the CP, and the documentation is completely non-specific about who has on-going management responsibility for the APZ around the development. • The Flora and Fauna Assessment does not include the CHB Extension proposal or the rehabilitated lands north of Montefiore St, or land west of Moonee Colliery. • The CP suggestS that it will totally remove known "*Tetratheca juncea*" plant clumps, and makes no attempt to detail other rare flora (including Themeda Grassland, an endangered ecological community, which is likely to exist on the headland proposed for development). • No analysis of the adequacy of the proposed buffer between the development and Munmorah State Conservation Area and its SEPP 14 Wetlands. • Storm-water controls could be crucial to the integrity and survival of the rare wet heathland. • The proposal has no specific provision for access to or parking at Moonee Beach, and proposes intensive development to the cliff-edge on the headland, which will restrict public access. • There is no discussion of additional facilities at Catherine Hill Bay Beach. • The proposal is not consistent with the Lake Macquarie Coastline Management Plan, and some parts of the proposal appear to be in the Coastal Hazard Zone. • The NPWS Plan of Management for Munmorah State Conservation Area (2005) prefers pedestrian access only to the SCA from the north, but the Concept proposal does not discuss this inter-face between the development and park area on its southern boundary. • The CHB community has a clear preference for tank water and septic system. A community survey conducted in January 2007 indicated that only 11% of respondents thought that town water would improve their life style, with 14% in favour of mains sewer. But 85% said they were not prepared to pay for sewer and 90% said "No" to paying for town water. There is no information in the proposal about providing gas, waste disposal or recycling facilities. The proposal is not specific nor does it provide any evidence of purported "in-principle agreements" with service agencies. • The section on social Infrastructure is inadequate. Other than providing an unspecified community facility amid commercial space somewhere in the development, the proposal gives no firm basis or undertaking of service provision, State Government infrastructure provision, and community amenity.	• Strategic justification • Urban design and built form • Visual impact • Heritage • ESD • Inadequate documentation • Traffic • APZs • Flora and fauna • SEPP 14 • Parking • Coastal and foreshore public access • Infrastructure	• Revised proposal lodged with more detail on built form including full plans for Hamlets 1 and 2 • Tourism beds removed • 600 Dwellings maximum • New visual impact statement provided in EA • Revised heritage impact statement in EA • 2 Storeys max throughout site • New traffic report provided • Bushfire management report provided in EA • Development removed from headland • Stormwater report provided in EA • Offer of Kiosk at beach as part of contributions schedule • Provision of reticulated water and sewer will enhance sustainability of community. • SIA provided

			• Economic matters and employment opportunities are not addressed; neither are the recreational needs of the prospective population. • It is of concern to the community that some major issues on storm water management have been put off until the detailed design stage. Particularly due to the proximity of the development to a State Conservation Area and SEPP 14 Wetland, and in an area of significant depth and variety in its biodiversity and State ecological significance. • Wallarah Peninsula should not be compromised by development and a funding mechanism for acquisition needs to be nominated. • The LEPs of Wyong and Lake Macquarie Council do not support this proposal. • The Gwandalan site is outside of Wyong Council's current settlement plans and could not be considered for development for some years yet. To bring it forward will only serve to create difficulties with Council's provision of infrastructure on this and other sites. The current plan is also lacking detail on how the Gwandalan foreshore will come into public ownership and be made accessible. • There is no justification for this project and that it should not proceed.		
11	01/03/2007	Object	• Astounded that the decision of Local Councils and Land and Environment Court would be overruled to allow hundreds of homes to be built on our beautiful coastline. • Proposal is contrary to state coastal policy and the wish of the local community. Homes should be built further inland. • The wishes of the local community should not be ignored. • The decision of Lake Macquarie Council should not be overturned. • The only benefit of the proposed development would be the financial gain of the developers and the wealthy who could afford to live there. • Support the protection of the north-south wildlife corridor. If proposal is rejected the area should be preserved as National park as it will link Wallarah National Park to Munmorah State Conservation Area.	• Coastal policy • Public interest	• This proposal has never been rejected by councils or Land and Environment Court • Revised proposal is consistent with coastal policy
12	06.02.2007	Object	• At a public meeting heLd on 29.02.2007 approximately 350 residents of Gwandalan and Summerland Point emphatically agreed to object to the inclusion of Lot 3, DP588206 Kanangra Drive, Gwandalan (known as Precinct 1A) in the MoU.	• MoU	•
13	06.02.2007	Object	• Media release by the Gwandalan/Summerland Point Action Group has been distributed throughout NSW detailing the proposed development at Gwandalan by Rosecorp. • Public meeting was held by Gwandalan/Summerland Point Action Group 29.01.07. Approximately 300 people were present. • Public meeting to address rezoning request of Precinct 1A (Rosecorp) and being a public meeting was open to all points of view, both for and against. • Public meeting was held by Gwandalan/Summerland Point Action Group 12.02.07. Approximately 150 people were present. • Public meeting to address 'fighting fund', distribute media press kit and the EDO had been approached for legal assistance. The DoP were present to give a brief summary of the role of the department in assessing proposals for rezoning.	• Public interest	•
Submissions inserted after copy of documentation provided to the Proponent.					
14	06/03/2007	Object	• Rosecorp claim that they had discussed rezoning from Environmental 7B to Residential with Wyong Shire Council prior to purchase but are unable to substantiate this claim. • Council did not plan to rezone the site until 2011. • There has been a lack of community consultation by Rosecorp. • The family is not involved in any community groups or activities. • Would like to see the rezoning proposal occur for the whole site and are concerned that foreshore won't be accessible to the public. • Concerned that the watercourses on the site are defined as uncontrolled drainage when they are marked on 1:25,000 topographic maps. Would like to see drainage line and associated vegetation retained. • Access to the school from the proposed development has at no time been requested by the school. • Would like to see Appendix R – Water quality and drainage , the document described as Appendices A Selected Concept Engineering Plans and B Sediment Basin Calculations are both devoid of any information. • Community feels disempowered.	• Consultation • Drainage • Access • Inadequate documentation	• Community reference group have been consulted • Foreshore is not included in the proposal • Drainage management assessed in EA

Appendix T

NSW COASTAL POLICY - CATHERINE HILL BAY

CATHERINE HILL BAY- GWANDALAN CONCEPT PLAN – RESPONSE TO NSW COASTAL POLICY Catherine Hill Bay and Moonee Sites	
Goal 1 Protect, Rehabilitate & Improve Natural Environment	
1.1 **Objective** protection of conservation values	The Wallarah Peninsula has been identified as a regional priority for conservation by the Department of Environment and Conservation. As a result of this project some 84% of the site including sensitive habitat areas and areas of beach, headland and lake foreshore will be dedicated to the Government and protected. Development is to be largely restricted to despoiled areas and will be broken into a series of small elements that respond to the topography such that the landscape dominated the image of the site. As part of this a number of vegetated corridors will be provided through the developed area as well as in the dedication.
1.1.1 NSW govt to strengthen ecosystem reserve system	DEC has identified lands to be reserved approximately 84% of site to be dedicated.
1.1.2 where privately owned land assessed for inclusion in reserve system	Lands are to be dedicated to NPWS.
1.1.3 crown lands	Government Action.
1.1.4 crown land plans of management	Government Action.
1.1.5 Council lands	Government Action.
1.1.6 Voluntary conservation agreements	A major conservation agreement has been struck. See 1.1.1 & 1.1.2
1.1.7 wetlands & estuaries conservation	Wetland areas will remain undeveloped and will be protected by WSUD.
1.1.8 SEPP 14	Nearby SEPP 14 areas protected by proposed drainage controls.
1.1.9 appropriate zones for conservation area	Associated SSSP zones conservation areas as national park.
1.1.10 areas adjacent to marine parks	NA
1.1.11 use regional open space corridors	Corridors protected & strengthened by proposed dedications and

	proposed design layout.
1.2 **Objective** conserve biodiversity	Biodiversity conservation will be significantly enhanced by the dedication areas which provide connectivity from the adjoining State Recreation area along the peninsula.
1.2.1 Investigate conservation significance	DEC have determined the offset area to be of regional significance, See 1.1.1
1.2.2 establish & develop survey priorities & design etc	Government Action.
1.2.3 fish populations	NA
1.2.4 whale & dolphin strandings	NA
1.2.5 review listing of threatened species	Government Action.
1.2.6 recovery & threat abatement plans	Government Action.
1.2.7 threatening processes identification	Government Action – We have proposed to remove some invasive plant species in the development area.
1.3 **Objective** improve water quality	While many of the actions listed under this section are for Government Agencies, Rosecorp will assist wherever possible with achieving overall objectives. Water sensitive urban design will be used to ensure that water quality is not adversely affected by the development. Stormwater on the site will be reused. The development will allow the provision of reticulated sewerage services to existing dwellings at Catherine Hill Bay for the first time reducing pollution risks.
1.3.1 EPA licences	Government Action.
1.3.2 non point source pollution	Best Practice stormwater management proposed.
1.3.3 water quality monitoring programs & studies	Government Action.
1.3.4 water quality objectives review responsibilities	Government Action.
1.3.5 marine contaminants responsibilities	Government Action.
1.3.6 beaches & recreational water monitoring responsibilities	Government Action..
1.3.7 coastal water quality responsibilities	Government Action.
1.3.8 contaminated stormwater discharges	Complies See 1.3.2
1.3.9 trade waste policies	NA

1.3.10fish kills & algae blooms	Government Action.
1.3.11 marine pollution & oil spills	Government Action.
1.3.12 vessel discharges	NA
1.3.13 investigate reuse of effluents and biosolids	Government Action.
1.3.14 groundwater policy	Government Action.
1.3.15 ocean outfalls enquiry	Government Action.
1.3.16 sydney ocean outfalls	Government Action.
1.3.17 ballast water	NA
1.4 **objective** management of coastlines and estuaries	The dedication will involve the dedication of 1.8 km of lake frontage and 1.5km of coastal foreshore as well as some 8ha of headland. There will also be rehabilitation of some areas of the site suffering from weed infestation.
1.4.1 rehabilitation research	Government Action.
1.4.2emergency responses	Government Action.
1.4.3 coast & estuary management plans preparation	Government Action.
1.4.4 NSW Coastal management program	Government Action.
1.4.5 coastal hazards & development proposals	Cliff stability assessment prepared for CHB, Moonee village perimeter is set well back from coastal hazard zone.
1.4.6 NSW estuary management program	NA
1.4.7 development in or adjacent to estuaries	NA
1.4.8 Bitou bush control methods for foreshores	Opportunities for enhanced management of coastal vegetation with development and removal of intrusive plant species within the development area and creation of a Landscape management Plan.
1.5 **objective** community restoration of degraded costal areas	
1.5.1 community involvement in coastcare dune care etc	Not directly relevant but opportunities for participation will increase with community size.
1.5.2 catchment management committees	NA
2 Goal To Recognise And Accommodate Natural Process And	

Climate Change	
2.1 **objective** to give hazards and processes a high priority	No known hazards.
2.1.1 coastal, floodplain & estuary plans preparation	Government Action.
2.1.2 river traffic	NA
2.1.3 consideration of hazards in DAs	Under way – see 1.4.5
2.1.4 acid sulphate soils	No ASS or PASS likely to be disturbed by development.
2.2 **Objective** climate change consideration	
2.2.1 CSIRO studies collaboration	Government Action.
2.2.2 sea levels change policy	The foreshore is not being developed.
2.2.3 sea level monitoring	NA
Goal 3 Protect And Enhance The Aesthetic Qualities Of The Coastal Zone	Development is to be largely restricted to despoiled areas and will be broken into a series of small elements that respond to the topography such that the landscape dominated the image of the site.
3.1 **objective** protection of aesthetic quality	
3.1.1 acquire lands of significant scenic qualities	Significant amounts of coastal headland area, beach and lake foreshore areas will be dedicated as part of the proposal and preserved.
3.1.2 prepare policies for protection of high aesthetic value areas	Some elements of the design will be visible from the shoreline however; the Concept Plan will be developed to ensure that major elements of the development lie below the natural ridge line of the site allowing the natural landscape to dominate the view shed.
3.2 objective design & development to complement location & aesthetics	
3.2.1 guidelines to encourage good development	Government Action.
3.2.2 design principles	A compact settlement pattern is proposed with characteristics consistent with small hamlets and villages.
3.2.3 tourist signage	Development will comply with any signage requirements.
3.2.4 design & location principles	See comments on appendix c to coastal policy
3.2.5 waterways management	NA

3.3 **objective** towns identity form & natural beauty	
3.3.1 local and regional housing strategies to encourage compact towns	Compact development proposed with a variety of building forms and housing types.
3.3.2 main st programs	A village centre and walkable Main Street precinct is to be provided.
4 Goal To Protect And Conserve Cultural Heritage	
4.1 objective to manage and conserve cultural places	
4.1.1 shipwrecks	NA
4.1.2 heritage protection achievement through studies and LEPS	Development is proposed to respect extant heritage structures and build on the form of the cultural landscape of the former mining facilities.
4.1.3 commonwealth land	NA
4.1.4 protection of significant views, street patterns and layout through LEP/DCP etc	No modifications to CHB village are included in proposal. The existing street pattern will remain in place. The major views from the north and south will be dominated by the natural ridge of the site which will remain undeveloped.
4.2 **objective** aboriginal heritage	
4.2.1 heritage committees	Government Action.
4.2.2 assessment of Crown lands	Government Action.
4.2.3 criteria for identifying significant coastal sites	Government Action.
5 Goal to identify and facilitate the ecologically sustainable development and use of resources	
5.1 **Objective** to identify opportunities	
5.1.1 land resource mapping	Government Action.
5.1.2 industry and tourism requirements in REPs and LEPs	Government Action.
5.1.3 rural land capability mapping	Government Action.
5.1.4 sustainable fisheries	Government Action.
5.1.5 fisheries access	NA

5.1.6 fisheries harvesting methods	NA
5.1.7 aquaculture	NA
5.1.8 minerals exploration facilitation	No viable coal reserves remain on the site.
5.1.9 NSW tourism masterplan	Tourist accommodation is to be augmented by the development with B&B style accommodation and home letting available.
5.1.10 nature based tourism opportunities recognition	The development enhances the reserve network and provides access to areas of beach and foreshore not previously accessible to the public.
5.1.11 tourism guidelines	Government Action.
5.2 **objective** to develop land use management plans	
5.2.1 management planning approaches	Government Action.
5.2.2 local government management plans preparation	Government Action.
5.2.3 REP/LEP/DCP to consider management plans	Government Action.
5.2.4 aquatic habitat management policy	Government Action.
5.2.5 restoration program development and implementation	Government Action.
5.2.6 aquaculture processes	NA
5.2.7 fisheries stock enhancement	NA
5.2.8 provision of mineral and extractive resource information	Government Action.
5.2.9 sand mining	Government Action.
5.2.10 port management	NA
5.2.11 preparation of local tourism plans	Government Action.
5.3 **objective** best practise approaches to management	The development is committed to achieving best practices in sustainable development and to supporting NSW and national initiatives in this regard.
5.3.1 community participation in committees and trusts	Sustainable development practices will be implemented in the development.
5.3.2 state agency actions on ESD	Government Action.
5.3.3 aquaculture procedures & permits	NA
5.3.4 mineral resources recovery	Government Action.
5.3.5 discharge of trade waste to sewerage systems	NA

5.3.6 reuse & recycling of effluent and biosolids	NA
6 Goal Ecologically Sustainable Human Settlement	
6.1 **objective** avoid or minimise impacts on environmentally sensitive areas and cultural heritage	Development is planned for areas already disturbed by mining activities so as to minimise impacts on environmentally sensitive areas.
6.1.1 coastal planning strategies recognise suitable areas for growth	Site is identified for growth in Lower Hunter Regional Strategy.
6.1.2 councils to prepare land release strategies	Government Action.
6.1.3 coastal population projections to be published	Government Action.
6.1.4 no canal estates	NA
6.2 **objective** compact and contained planned urban development	The development is planned to follow a compact and contained footprint away from the undeveloped ridge lines of the site and pulled back from the projecting headland.
6.2.1 planning instrument & DCP provisions	Government Action.
6.2.2 energy efficiency principles eg compact town design	Compact form achieved BASIX standards are to be met. The development will provide a walkable environment where shops, recreation areas, coastal access and community facilities will be within a pleasant and walkable environment.
6.3 **objective** rural residential developments location	Development is planned for areas already disturbed by mining activities so as to minimise impacts on the natural environment.
6.3.1 rural release strategies	Government Action.
6.4 **objective** choice in hosing and lifestyles	Development is planned to offer a range of housing choices and building forms.
6.4.1 encourage choice through strategies	Government Action.
6.4.2 higher densities encouraged	A compact village centre with some higher density is proposed in concept plan.
7 Goal Appropriate Public Access And Use	
7.1 **objective** increase public access to foreshores	Will be achieved as part of dedications and with access through

	development areas
7.1.1 acquisition of significant sites	Achieved.
7.1.2 public facilities	To be provided as required.
7.1.3 council owned coastal lands	Will assist in access.
7.1.4 recreational vehicles	Parking will be provided to allow vehicle access to beach areas but not onto beach or into bush lands.
7.1.5 new tourism development to provide access	Some small scale tourist facilities will be included in the development and will allow public access through to foreshores.
7.2 **objective** minimise human risk	
7.2.1 safe recreational use	NA
7.2.2 safe waterways use	NA
7.2.3 council coastal safety assessment	Government Action.
7.2.4 developer contributions for surf life saving services	Could be included in developer agreement.
7.2.5 beach signs	Government Action.
7.2.6 cliff hazard warning signs	Could be provided if necessary.
.	
8 Goal To Provide Information To Enable Effective Management	
8.1 **objective** to coordinate and integrate data collection	Government Action.
8.1.1 sharing land and water use information	Government Action.
8.1.2 coastal council activities	Government Action.
8.1.3 information gaps	Government Action.
8.2 **objective** compatible data bases	
8.2.1 information exchange processes	Government Action.
8.2.2 data bases review	Government Action.
8.3 **objective** information accessibility	
8.3.1 coastal inventories	Government Action.
8.3.2 directory of information	Government Action.
8.3.3 council SoE reporting	Government Action.
8.3.4 council annual reports	Government Action.

8.4 **objective** education and awareness	
8.4.1 media activities	Government Action.
8.4.2 skills improvement	Government Action.
9 Goal to provide for integrated planning and management	
9.1 **objective** government decision making	
9.1.1 national strategy implementation	Government Action.
9.1.2 plans consistent with coastal policy	Government Action.
9.2 **objective** coastal policy implementation	
9.2.1 management consistent with policy	Government Action.
9.2.2 reporting of Coastal policy strategic actions	Government Action.
9.2.3 coastal policy review	Government Action.
9.3 **objective** community participation in planning & management	
9.3.1 advice to community groups	Government Action.
9.3.2 preparation of local government plans	Government Action.
9.3.3 Council reporting	Government Action.
9.4 **objective** national strategy	
9.4.1 commonwealth/state agency participation	Government Action.
9.4.2 state/state agency particpation	Government Action.
Coastal Policy Appendix C – Development Control	
Table 3 Design and Locational Principles	
Development on beaches and frontal dunes	None proposed.
Rehabilitation works for beaches and dunes	No requirement for works identified.
Undeveloped headlands to be preserved for visual amenity	The headland is currently developed in various places. Views from Middle Camp Beach and the north have the significant elements of the jetty, surf club and some mine infrastructure on the

	headland. Viewed from the south (Moonee Beach) the headland has no development although walking tracks are visible. The development as proposed will be set back from headland and visually will not extend past the line of Moonee Beach.
Height of development on already developed headlands. Limits on height and scale and the visual effect from nearby beaches are the key considerations.	Proposed buildings are significantly smaller in scale than the jetty and former mining buildings which were on the site prior to recent demolition. Development visible from Middle Camp Beach will be limited to two stories and be set into the contours below the natural ridge line of the site. Development visible from Moonee Beach will be no greater than 2 storeys and with setbacks of 150 metres and more from the beach will have very little effect on beach or visual amenity.
Beaches and water front open space protected from overshadowing	No overshadowing will affect beaches or foreshores.
Tall buildings over 14 metres	None proposed.
Tall buildings assessment	None proposed.
Public setback lines	The proposed setbacks provide for adequate public access taking into account topography, scenic factors and existing development.
Tourist and recreational development must not compromise the values of adjoining State Recreational Areas	The proposed development is predominantly residential but in all likelihood will increase utilisation of Middle Camp Beach and Moonee Beach which is in the adjoining State Conservation Area. It is intended only to provide managed walking access to the beach to provide for use consistent with the management plan for the Area. Recreation facilities will be open to all and be of a type and scale consistent with small scale resident settlement.

Appendix U

EPBC DRAFT PUBLIC ENVIRONMENT REPORT

Prepared by:

ASQUITH & deWITT PTY LTD

EPBC DRAFT PUBLIC ENVIRONMENT REPORT

Location:

Catherine Hill Bay/Gwandalan

Owner:

Rose Property Group

ROSE
Creating a quality way of living

7 Canberra Street, Charlestown NSW 2290
PO Box 179 Charlestown DX12610 Charlestown
Tel: (02) 4943 6111 Fax: (02) 4943 5955
www.asquithdewitt.com.au

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Section 1
Introduction

The Catherine Hill Bay and Gwandalan Concept Plan is a controlled action under the EPBC Act and is subject to assessment under the Bilateral Agreement between the Commonwealth and NSW governments.

Under the Bilateral Agreement the matters specified in Schedule 4 of the EPBC Act must be addressed. The matters are addressed as a draft public environment report and environmental impact statement.

The Catherine Hill Bay and Gwandalan Concept Plan and Environmental Assessment form the environmental impact statement.

Attached to this report is an EPBC Protected Matters Report. This report identifies and demonstrates:

The range of EPBC threatened species potentially affected by the action;

No RAMSAR wetlands will be affected by the action;

No effects on listed migratory species are likely;

No effects on the Commonwealth marine environment are likely; and

No effects on world heritage properties are likely.

No effects on national heritage places are likely

Additionally no nuclear actions are involved.

This report has been prepared in accordance with the NSW DoP Commonwealth Environment Protection and Biodiversity Conservation Act Guidelines, May 2007. The information provided meets the requirements specified in the Guidelines and Schedule 4 of the EPBC Regulation.

The format of the following report follows the outline prescribed in Schedule 4 of the EPBC Act. To this structure a conclusion has been added that addresses matters identified in the Commonwealth EPBC Guidelines.

Section 2
General Information

2.1 BACKGROUND OF THE ACTION

2.1.1 The title of the action;

Catherine Hill Bay Gwandalan Concept Plan

2.1.2 The full name and postal address of the designated proponent

Bryan Rose

Rose Property Group

51 Riley St

Woolloomoolo

2.1.3 A clear outline of the objective of the action;

The objective of the action is to permit residential subdivision and development.

2.1.4 The location of the action;

The location of the action is described in the Concept Plan and Environmental Assessment.

2.1.5 The background to the development of the action

The land is subject to a Memorandum of Understanding between the land owners and the NSW Government that provides for development and conservation outcomes.

2.1.6 How the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action

The action is not known to relate to any other action or proposed action.

2.1.7 The current status of the action

The action is in the approval stage.

2.1.8 The consequences of not proceeding with the action

Not proceeding with the action will compromise regional strategic planning development and outcomes.

Section 3
Description

A description of the action, including:

3.1 The components of the action

Site preparation works including any necessary remediation.

Civil construction of roads and urban service infrastructure including parks, opening space and bushfire asset protection zones.

Staged construction of housing.

The action will affect or potentially affect a number of vulnerable species listed under the EPBC Act, see 2(g)(ii) and attached EPBC Protected Matters Report.

3.2 The location of works to be undertaken

The location of the works is described in detail in the Catherine Hill Bay and Gwandalan Concept Plan;

3.3 How the works are to be under taken

The works are described in overview in the Concept Plan and Concept Plan Environmental Assessment and described in detail in the Project Applications for individual works components and their accompanying Environmental Assessments;

3.4 The relevant impacts of the action including the effect on listed EPBC species

The impacts are addressed in the Concept Plan Environmental Assessment Report. The action involves a loss of 28 hectares of bushland. There is an agreed environmental offset for bushland and threatened species loss consisting of public dedication of some 310 hectares of land. The most relevant impact is the loss of threatened species habitat;

3.5 Proposed safeguards and mitigation measures to deal with relevant impacts of the action

The impacts of the action on EPBC threatened species are addressed through environmental offsets;

3.6 Requirements for approval and conditions will be specified as part of any approval received for the Concept Plan.

The proponent will be bound by the conditions of approval that are likely to reflect the Statement of Commitments provided as part of the approval documentation

See Appendix A of the Concept Plan Environmental Assessment.

3.7 Feasible Alternatives

The proposal is based on agreed and linked planning development and conservation outcomes via a Memorandum of Understanding (MoU).

The MoU is one of a number of similar documents that provides for broad scale regional outcomes under the Lower Hunter Regional Strategy, the Lower Hunter Conservation Strategy and the Draft Control Coast Regional Strategy. MoU's have been negotiated with a range of landowners to provide for regional outcomes.

No Action Alternatives

(i) The no action alternative

While protecting some smaller areas of threatened species habitat the no action alternative would compromise the achievement of regional conservation goals and regional development goals.

Securing the required conservation outcomes is linked via the MoU to development of the site in the proposed areas. The no action alternatives have potentially significant negative consequences.

(ii) Comparative description of the impacts of each alternative

There are potentially 3 options:

- No action, or
- The outcome foreshadowed by the MoU i.e. development of some 58 ha of land, or
- Partial MoU development with no bushland loss.

Options comparison table

Impact	No Action	Full MoU implementation 58 ha of development	Partial MoU Implementation 30 ha of development
Bushland loss	Nil	Approx 28 ha loss	Nil
Threatened Loss of Species Habitat	Nil	Approx 18 ha loss	Nil
Housing Provision	Nil	Approx 815 dwellings	Approx 400 dwellings
Economic Benefits	Nil	Investment $390m with 2500 jobs	Approx $195m investment and 1250 jobs
Public Access Benefits	Nil	Lake and Coastal foreshore returned to public ownership	Potential loss of foreshore dedication
Conservation Management Gains	Nil	310 ha including threatened species habitat be included National Park	155 ha dedication

Preferred Alternatives

(iii) The preferred option is development in accordance with the MoU option as the benefits identified in the above table demonstrates.

The development will occur over what is a mostly degraded former mining land with remnant habitat.

The minor conservation gain being of 28 ha of bushland is a relatively poor return to the broader community with the potential economic, public access, policy and broad scale conservation outcomes to which full development of the proposal would contribute are taken into account. The full MoU option is consistent with the full achievement of regional, conservation and development goals as contained in the Lower Hunter Regional Strategy.

3.8 Any consultation about the action

(i) Any consultation that has already taken place.

The NSW Minister for the Environment is a party to the MoU and its outcomes. The action has already been extensively exhibited via the original concept plan and the referral of the site under the EPBC Act.

(ii) Further consultation

The action will be further consulted on via exhibition of the revised concept plan and the draft public environmental report. The public and NSW Authorities will have the opportunity for further comment.

(iii) Response to prior consultation

The matter was referred under the EPBC Act and found to be a controlled action.

The Bilateral Agreement applies and the matter is assessed under Part 3A of the EPA Act by the NSW Minister of Planning.

(iv) Identification of affected parties including any affected communities and their views.

No community will be directly affected by loss of bushland on privately owned land. The resulting population increase will have some manageable effects on existing communities.

Some sections of the broader community are opposed to the action. The opposition is based on a large range of matters not necessarily including the effects on threatened species

Section 4
Relevant Impacts

4.1 DESCRIPTION OF THE RELEVANT IMPACTS OF THE ACTION.

A large range of species listed under the EPBC Act have been identified as potentially using the site. See attached EPBC Protected Matters Report.

Flora and Fauna Surveys since 2003 have narrowed the list of species potentially affected by the action to:

- Tetratheca Juncea
- Cryptostylis Hunteriana
- Diuris Praecox
- Caladenac tessellatea
- Microtis Angusii

Of these species only *Tetratheca juncea* has been confirmed as being affected by the action. An estimated 18 hectares of *Tetratheca* habitat will be lost as a result of the action.

The other 3 species are orchids. Orchids are cryptic in habitat and the subject species can only be detected by targeted surveys in known flowering periods.

Targeted surveys have been completed but there is the possibility that two orchid species may still occur on the site.

Species	CHB/Moonee	Gwandalan
Tetratheca Juncea	Present	Present
Cryptostylis Hunteriana	Not found	May be present
Diuris Praecox	Not found	May be present
Caldenia Tesselata	Not found	Not found
Microtis angusii	Not found	Not found

Loss of bushland at Catherine Hill Bay is likely to be 15 ha. This includes Tetratheca habitat and potential pygmy possum habitat (not an EPBC listed species). Targeted searches failed to find pygmy possums on the site.

Loss of bushland at Gwandalan is likely to be 13 ha. This includes Tetratheca habitat and potential orchid habitat

The proposed offset area is 310 hectares. This area contains bushland similar to that proposed for loss. Although the dedicated area has not been fully surveyed it appears to contain at least 100 hectares of Tetratheca and orchid habitat.

4.2 (B) & (C) SHORT AND LONG TERM IMPACTS

The likely impacts of the action are:

- Loss of 28 ha of bushland
- Introduction of new population and approximately 815 dwellings and consequent streets.
- 310 hectares of dedication/offsets land

Short term impacts will be the loss of bushland, this will be irreversible.

Medium to long term effects will be because of the addition of new population; these effects are largely predictable and manageable. Additional landscaping at Catherine Hill Bay will partly off set the bushland loss.

Long term effects will be the conservation gains arising from the dedication of 310 hectares of land and offsets. While the long term effects are likely to be beneficial they are not fully predictable.

4.3 SIGNIFICANCE OF RELEVANT IMPACTS

The short-term impacts, while irreversible, are unlikely to be significant because of the proposed offsets dedication. The habitat loss is offset many times as the dedication lands contain a large area of similar habitat, which will come under the management of NSW National Parks.

The medium to long term effects are unlikely to be significant as they are largely predictable and manageable.

The long-term effect of dedication is likely to be highly significant for conservation. Although the effects are not predictable, mainly due to extended time frames and the operations and variations of natural systems, the management of land for conservation will allow these systems to function in a regionally managed and thus more sustainable context.

4.4 DATA USED TO ASSESS IMPACTS

The effects on threatened species have been assessed on the basis of a range of surveys carried out between 2003 and 2007. More information on these surveys can be found in the Concept Plan Environmental Assessment and Appendices and Section 7 of this report.

Section 5
Proposed Safeguards and Mitigation Measures

5.1 THE PROPOSED MITIGATION MEASURES

The effects on threatened species are expected to be mitigated by the proposed dedication of land as an environmental offset and its subsequent incorporation into the Munmorah State Conservation Area and management by the NSW National Parks and Wildlife Service.

Some 310 hectares is proposed to be dedicated. While some of this area will be remediated mining land, including the Wallarah Colliery site and a reject storage area, the majority is bushland in a reasonably intact ecological condition.

Since the dedicated land will be managed by National Parks and contains like-for-like offsets for the proposed threatened species losses, the mitigation is likely to be highly effective.

5.2 STATUTORY OR POLICY BASIS FOR THE MITIGATION MEASURE

The mitigation, i.e. the 310 hectare dedication, is consistent with the Lower Hunter Conservation Strategy and the MoU to which the NSW Ministers for Planning and Environment are signatories.

5.3 COST OF THE MITIGATION MEASURES

The 310 hectare dedication will involve no public expense. Costs will be borne by the landowner.

Ongoing management costs will depend on the efforts of the NSW National Parks and Wildlife Services.

5.4 CONTINUING MANAGEMENT

Ongoing management of the offset area will be by NSW National Parks. It is expected that the dedication areas will become part of the Munmorah State

Conservation Area, which has a primary management objective of biodiversity conservation.

5.5 RESPONSIBLE AGENCY

Initial responsibility for ensuring the dedication will be with the NSW Department of Planning. Responsibility will likely pass to the NSW National Parks and Wildlife Service.

5.6 LIST OF MITIGATION MEASURES

Dedication of offset lands only.

Section 6
Other Approvals

6.1 THE ACTION IS SUBJECT TO APPROVAL UNDER PART 3A OF THE NSW EPA ACT 1979.

(i) Assessment of the action is being carried out via the Concept Plan provisions of Part 3A which requires the preparation of an Environmental Assessment Report to the specification provided in "Director Generals Requirements".

The applicable DGR's require environmental assessment reports under the EPBC Act.

(ii) Part 3A provides for management of impacts by applying legally enforceable conditions of approval. Under Part 3A proponents must prepare a draft Statement of Commitments that is binding on the action and its proponents.

6.2 (B) & (C)OTHER APPROVALS

No other approvals have been sought or granted in respect of the proposed action.

6.3 MONITORING ENFORCEMENT AND REVIEW PROCEDURES

The action, being residential development, is not subject to specific monitoring, enforcement and review procedures.

Any monitoring or review procedures applied by the NSW Department of Planning as conditions of approval would be enforceable under the NSW EPA Act.

Section 7
Environmental record of person proposing to take the action

6.01 & 6.02 The proponent Rose Property Group and its constituent companies have not been subject to proceedings on the basis of protection of the environment or the conservation and use of natural resources.

Planning & Environment Policy

Rose has no formal policies in this regard but is committed to quality development. The effect of this commitment is high levels of compliance with planning, environment and development approvals.

Section 8
Information sources

This report is based on a series of flora and fauna assessments undertaken over the land on which the action is proposed.

8.1 (a) & (b) Source and currency of information

The studies are detailed in Section 2.5 of the Concept Plan EA.

The studies are:

CHB Washery Site 2004

Moonee Colliery Site 2003

Moonee Colliery Site 2005-2006

Crangan Bay Site 2003

Snake and Possum Gully Site 2004

Gwandalan Ecological Constraints 2003

CHB MoU area ecological constraints 2006

Gwandalan Orchid Survey 2007

8.2 (c) How the reliability of the information was tested

Studies have been conducted since 2003.

Studies and surveys of the Catherine Hill Bay/Moonee site while not agreeing on vegetation type boundaries are consistent on the presence or absence of threatened species. Specific targeted threatened species searches identified only tetratheca juncea on the site. The consistencies were achieved over the period 2003-2006.

A study of the Gwandalan site was undertaken in 2003 and supplemented in 2007. The findings of the 2 studies are consistent. Both identified Tetratheca Juncea on the site. The studies however, have not conclusively

eliminated the possibility of threatened orchids occurring on the site and have identified the presence of orchids on the site.

8.3 (D) UNCERTAINTIES IN THE INFORMATION

The studies and surveys were conducted in accordance with the guidelines for this work that apply in the Lake Macquarie and Wyong LGA's.

Based on the guidelines, the survey periods were not matched to the likely occurrence of the orchid species Cryptostylis Hunteriana on the Gwandalan site. However, this orchid is known to occur with other closely related orchid species which were found on the Gwandalan site and at Crangan Bay which is part of the dedication and offsets area. It is thus clear that any potential loss of orchid habitat at Gwandalan is offset by the dedication of a large area of potential habitat at Crangan Bay.

Surveys have not been completed over the whole of the dedication/offsets area. While this area totals some 310 ha, surveys have been conducted over approximately one third of this. The survey of the Crangan Bay site, which is 90 ha, confirmed the presence of large areas of Tetratheca juncea habitat. Based on this part of the dedication area, the loss of Tetratheca habitat is adequately offset.

Section 9
Summary and Conclusion

In summary, threatened species survey work has been conducted in accordance with appropriate standards, the information can be considered reliable and the proposed offsets represent a like-for-like match to the bushland and habitat loss arising from the action.

Given the extent of local populations of Tetratheca juncea and the habitat loss relative to the proposed offset the action will not have a significant impact through:

Long term decrease in the size of an important population

Reduction in area of an important population

Fragment aT existing important population

Adversely affect critical habitat

Disrupt the breeding cycle

Reduce the availability of quality habitats

Result in invasive species

Introduce disease

Interfere with the recovery of the species

It is considered that the approximate 18 hectares loss of Tetratheca does not represent an “important population”. The 18 hectares is in the area of the South East population identified by Payne 2001 (Lake Macquarie Tetratheca juncea Managment Plan). Given the improved conservation outcomes achieved with proposed dedication of the land to NPWS, the South East population will be more secure.

Assuming that threatened orchids are present on the site and will be affected by the action, the proposed offsets area is adequate and will secure areas of potential habitat.

The proposed action adequately mitigates its effects on threatened species.

The significance of the likely impacts in accordance with EPBC Act policy statement 1.1 is as follows.

9.1 SENSITIVITY OF THE IMPACTED ENVIRONMENT

The impacted development area is not considered to be particularly sensitive having been heavily affected by former mining use at Catherine Hill Bay and fire and existing development at Gwandalan.

Large portions of the dedication area are more sensitive being relatively soundly vegetated and containing NSW endangered ecological communities.

9.2 TIMING DURATION AND FREQUENCY OF IMPACTS

The effect will be a one off loss of habitat and vegetation on the development areas but a permanent conservation gain in dedication areas arising from the proposed offsets of 310 ha.

9.3 ALL ON SITE AND OFFSITE IMPACTS

The on site impacts are loss of habitat, some off site impacts may occur as a result of the overall decrease in threatened species habitat. The impacts are unlikely to be significant when balanced against the offsite potential local and regional conservation gains for the affected habitat types.

9.4 ALL DIRECT AND INDIRECT IMPACTS

The direct impacts are loss of habitat which is negative. The indirect and positive effects are likely from increased regional conservation and open space gains.

9.5 TOTAL IMPACT OVER TIME OVER THE ENTIRE GEOGRAPHIC AREA AFFECTED

While direct effects are limited to the site indirect effects are linked to the regional conservation outcomes specified in the Lower Hunter Conservation Strategy. Generally the total impact over time and the region is expected to be positive given the conservation gains through larger conservation areas and specific conservation management of the land in a regional context.

9.6 EXISTING LEVELS OF IMPACT FROM OTHER SOURCES

At present the Catherine Hill Bay land is a managed mine site. There are no significant levels of impact from other sources. The Gwandalan land is affected by the current occupation with few outside impacts.

9.7 THE DEGREE OF CONFIDENCE WITH WHICH THE IMPACTS ARE KNOWN AND UNDERSTOOD

There high degree of confidence with the negative impacts being the loss of vegetation and habitat.

The level of confidence associated with the proposed offsets and ongoing management of the offset land is high. The high confidence is based on the availability of like-for-like land offsets and the future management of the land as part of the NSW National Parks estate.

Australian Government
Department of the Environment and Water Resources

Protected Matters Search Tool

You are here: Environment Home > EPBC Act > Search

9 March 2007 16:50

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at http://www.environment.gov.au/atlas may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Search Type: Area

Buffer: 0 km

Coordinates: -33.11609,151.56813, -33.18412,151.56813, -33.18412,151.64670, -33.1160,151.64670

This map may contain data which are
© Commonwealth of Australia
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Report Contents:

Summary
Details
- Matters of NES
- Other matters protected by the EPBC Act
- Extra Information

Caveat
Acknowledgments

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance: (Ramsar Sites)	None
Commonwealth Marine Areas:	Relevant
Threatened Ecological Communities:	None
Threatened Species:	42
Migratory Species:	37

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Places on the RNE:	None
Listed Marine Species:	57
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Other Commonwealth Reserves:	None
Regional Forest Agreements:	1

Details

Matters of National Environmental Significance

Commonwealth Marine Areas [Dataset Information]

Approval may be required for a proposed activity that is likely to have a significant impact on the environment in a Commonwealth Marine Area, when the action is outside the Commonwealth Marine Area, or the environment anywhere when the action is taken within the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Within 3 Nautical Mile Limit

Threatened Species [Dataset Information]	Status	Type of Presence
Birds		
Diomedea amsterdamensis * Amsterdam Albatross	Endangered	Species or species habitat may occur within area
Diomedea antipodensis * Antipodean Albatross	Vulnerable	Species or species habitat may occur within area
Diomedea dabbenena * Tristan Albatross	Endangered	Foraging may occur within area
Diomedea exulans * Wandering Albatross	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni * Gibson's Albatross	Vulnerable	Species or species habitat may occur within area
Lathamus discolor * Swift Parrot	Endangered	Species or species habitat may occur within area
Macronectes giganteus * Southern Giant-Petrel	Endangered	Species or species habitat may occur within area
Macronectes halli * Northern Giant-Petrel	Vulnerable	Species or species habitat may occur within area
*Pterodroma leucoptera leucoptera** Gould's Petrel	Endangered	Species or species habitat may occur within area
*Pterodroma neglecta neglecta** Kermadec Petrel (western)	Vulnerable	Species or species habitat may occur within area
Rostratula australis * Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri *	Vulnerable	Species or species habitat may

Buller's Albatross		occur within area
Thalassarche cauta * Shy Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche impavida * Campbell Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris * Black-browed Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini * Salvin's Albatross	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi * White-capped Albatross	Vulnerable	Species or species habitat may occur within area
Xanthomyza phrygia * Regent Honeyeater	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria aurea * Green and Golden Bell Frog	Vulnerable	Species or species habitat may occur within area
Litoria littlejohni * Littlejohn's Tree Frog, Heath Frog	Vulnerable	Species or species habitat may occur within area
Mixophyes iteratus * Southern Barred Frog, Giant Barred Frog	Endangered	Species or species habitat likely to occur within area
Mammals		
Balaenoptera musculus * Blue Whale	Endangered	Species or species habitat may occur within area
Chalinolobus dwyeri * Large-eared Pied Bat, Large Pied Bat	Vulnerable	Species or species habitat may occur within area
*Dasyurus maculatus maculatus (SE mainland population)** Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat may occur within area
Eubalaena australis * Southern Right Whale	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae * Humpback Whale	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata * Brush-tailed Rock-wallaby	Vulnerable	Species or species habitat may occur within area
*Potorous tridactylus tridactylus** Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus * Grey-headed Flying-fox	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Chelonia mydas * Green Turtle	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea * Leathery Turtle, Leatherback Turtle, Luth	Vulnerable	Species or species habitat may occur within area
Hoplocephalus bungaroides * Broad-headed Snake	Vulnerable	Species or species habitat likely to occur within area
Sharks		

*Carcharias taurus (east coast population)** Grey Nurse Shark (east coast population)	Critically Endangered	Species or species habitat may occur within area
Carcharodon carcharias * Great White Shark	Vulnerable	Species or species habitat may occur within area
Rhincodon typus * Whale Shark	Vulnerable	Species or species habitat may occur within area
Plants		
Angophora inopina *	Vulnerable	Species or species habitat likely to occur within area
Caladenia tessellata * Thick-lipped Spider-orchid, Daddy Long-legs	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana * Leafless Tongue-orchid	Vulnerable	Species or species habitat may occur within area
Diuris praecox * Newcastle Doubletail	Vulnerable	Species or species habitat likely to occur within area
Microtis angusii *	Endangered	Species or species habitat likely to occur within area
Syzygium paniculatum * Magenta Lilly Pilly, Magenta Cherry, Pocket-less Brush Cherry, Scrub Cherry, Creek Lilly Pilly, Brush Cherry	Vulnerable	Species or species habitat likely to occur within area
Tetratheca juncea *	Vulnerable	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Migratory	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat likely to occur within area
Migratory Wetland Species		
Birds		
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew	Migratory	Species or species habitat likely to occur within area

Pluvialis fulva Pacific Golden Plover	Migratory	Species or species habitat likely to occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Diomedea amsterdamensis Amsterdam Albatross	Migratory	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross	Migratory	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross	Migratory	Foraging may occur within area
Diomedea exulans Wandering Albatross	Migratory	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross	Migratory	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel	Migratory	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel	Migratory	Species or species habitat may occur within area
Pterodroma leucoptera leucoptera Gould's Petrel	Migratory	Species or species habitat may occur within area
Puffinus leucomelas Streaked Shearwater	Migratory	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross	Migratory	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross	Migratory	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross	Migratory	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross	Migratory	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross	Migratory	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross	Migratory	Species or species habitat may occur within area
Migratory Marine Species		
Mammals		
Balaenoptera edeni Bryde's Whale	Migratory	Species or species habitat may occur within area
Balaenoptera musculus * Blue Whale	Migratory	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale	Migratory	Species or species habitat may occur within area
Eubalaena australis * Southern Right Whale	Migratory	Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin	Migratory	Species or species habitat may occur within area

Megaptera novaeangliae * Humpback Whale	Migratory	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca	Migratory	Species or species habitat may occur within area
Reptiles		
Chelonia mydas * Green Turtle	Migratory	Species or species habitat may occur within area
Dermochelys coriacea * Leathery Turtle, Leatherback Turtle, Luth	Migratory	Species or species habitat may occur within area
Sharks		
Carcharodon carcharias Great White Shark	Migratory	Species or species habitat may occur within area
Rhincodon typus Whale Shark	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater	Listed	Species or species habitat may occur within area
Catharacta skua Great Skua	Listed	Species or species habitat may occur within area
Diomedea amsterdamensis Amsterdam Albatross	Listed	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross	Listed	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross	Listed	Foraging may occur within area
Diomedea exulans Wandering Albatross	Listed	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross	Listed	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster	Listed	Species or species habitat likely to

White-bellied Sea-Eagle		occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Lathamus discolor * Swift Parrot	Listed - overfly marine area	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel	Listed	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel	Listed	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Listed - overfly marine area	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Numenius madagascariensis Eastern Curlew	Listed	Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover	Listed	Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail	Listed - overfly marine area	Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Sterna albifrons Little Tern	Listed	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross	Listed	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross	Listed	Species or species habitat may occur within area
Thalassarche chlororhynchos Yellow-nosed Albatross, Atlantic Yellow-nosed Albatross	Listed	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross	Listed	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross	Listed	Species or species habitat may occur within area

Thalassarche salvini Salvin's Albatross	Listed	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross	Listed	Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri New Zealand Fur-seal	Listed	Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal	Listed	Species or species habitat may occur within area
Ray-finned fishes		
Acentronura tentaculata Hairy Pygmy Pipehorse	Listed	Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish	Listed	Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish	Listed	Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish	Listed	Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish	Listed	Species or species habitat may occur within area
Hippocampus abdominalis Eastern Potbelly Seahorse, New Zealand Potbelly, Seahorse, Bigbelly Seahorse	Listed	Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse	Listed	Species or species habitat may occur within area
Histiogamphelus briggsii Briggs' Crested Pipefish, Briggs' Pipefish	Listed	Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish	Listed	Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish	Listed	Species or species habitat may occur within area
Notiocampus ruber Red Pipefish	Listed	Species or species habitat may occur within area
Phyllopteryx taeniolatus Weedy Seadragon, Common Seadragon	Listed	Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse	Listed	Species or species habitat may occur within area
Solenostomus cyanopterus Blue-finned Ghost Pipefish, Robust Ghost Pipefish	Listed	Species or species habitat may occur within area
Solenostomus paradoxus Harlequin Ghost Pipefish, Ornate Ghost Pipefish	Listed	Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish	Listed	Species or species habitat may occur within area
Stigmatopora nigra Wide-bodied Pipefish, Black Pipefish	Listed	Species or species habitat may occur within area

Syngnathoides biaculeatus Double-ended Pipehorse, Alligator Pipefish	Listed	Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bend Stick Pipefish, Short-tailed Pipefish	Listed	Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish	Listed	Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish	Listed	Species or species habitat may occur within area
Reptiles		
Chelonia mydas * Green Turtle	Listed	Species or species habitat may occur within area
Dermochelys coriacea * Leathery Turtle, Leatherback Turtle, Luth	Listed	Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake	Listed	Species or species habitat may occur within area
Whales and Other Cetaceans [Dataset Information]	Status	Type of Presence
Balaenoptera acutorostrata Minke Whale	Cetacean	Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale	Cetacean	Species or species habitat may occur within area
Balaenoptera musculus * Blue Whale	Cetacean	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale	Cetacean	Species or species habitat may occur within area
Delphinus delphis Common Dolphin	Cetacean	Species or species habitat may occur within area
Eubalaena australis * Southern Right Whale	Cetacean	Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus	Cetacean	Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin	Cetacean	Species or species habitat may occur within area
Megaptera novaeangliae * Humpback Whale	Cetacean	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca	Cetacean	Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin	Cetacean	Species or species habitat may occur within area
Tursiops aduncus Spotted Bottlenose Dolphin	Cetacean	Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin	Cetacean	Species or species habitat may occur within area
Commonwealth Lands [Dataset Information]		
Communications, Information Technology and the Arts - Telstra Corporation Limited		

Extra Information

Regional Forest Agreements [Dataset Information]
Note that all RFA areas including those still under consideration have been included.

Lower North East NSW RFA, New South Wales

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the *Environment Protection and Biodiversity Conservation Act 1999*. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the migratory and marine provisions of the Act have been mapped.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgments

This database has been compiled from a range of data sources. The Department acknowledges the following custodians who have contributed valuable data and advice:

- New South Wales National Parks and Wildlife Service
- Department of Sustainability and Environment, Victoria
- Department of Primary Industries, Water and Environment, Tasmania
- Department of Environment and Heritage, South Australia Planning SA
- Parks and Wildlife Commission of the Northern Territory
- Environmental Protection Agency, Queensland
- Birds Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection
- Natural history museums of Australia
- Queensland Herbarium
- National Herbarium of NSW
- Royal Botanic Gardens and National Herbarium of Victoria
- Tasmanian Herbarium
- State Herbarium of South Australia
- Northern Territory Herbarium
- Western Australian Herbarium
- Australian National Herbarium, Atherton and Canberra
- University of New England
- Other groups and individuals

ANUCliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Last updated:

Department of the Environment and Water Resources
GPO Box 787 Canberra ACT 2601 Australia
Telephone: +61 (0)2 6274 1111

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Appendix V

COMMERCIAL FLOOR SPACE JUSTIFICATION

Property & Development Advisory

3rd Floor 234 George Street Sydney
GPO Box 2748 Sydney, NSW, 2001
t . +61 9252 8777
f. +61 2 9252 6077
e. consulting @hillpda.com
w. www.hilllpda.com
abn. 52 003 963 755

31 July, 2007

Nick Jackman
Senior Development Manager
Rosecorp

Email: njackman@rosecorp.net.au

Dear Nick,

Re: Catherine Hill Bay – Demand for Retail Space

As instructed we have assessed the demand for retail space in Catherine Hill Bay. We understand that the concept is for 6 to 8 convenience outlets, say general store (possibly 200-250sqm), coffee shop, bakery, fish and chips, hair/beauty salon, surf/diving shop and restaurant, located in the Village Centre and serving a local trade area of around 700 dwellings (114 existing). It is acknowledged that that viability of such a Centre may require subsidy in its early years. It is also acknowledged that additional space is sought for potential commercial users and home based businesses. This can include for example medical practitioners and other health services, an accountant, real estate agent, solicitor and/or other professional persons, creative industries such as web designing, glass blowing or pottery making. The beach location provides a significant attraction for these professionals and para-professionals that want to start up local, small and/or home-based businesses.

In assessing viability the following tasks were undertaken:

- The trade area was identified having regard to surrounding centres, travel times and the like.
- Likely demographic profiles of the trade area were prepared based on demographic characteristics of the surrounding areas and the Social Sustainability report prepared by Key Insights Pty Ltd.
- Competitive retail centres were identified, their location, travel times, roles and functions of the centres, etc to establish the level of competitiveness and likely expenditure that is captured from the trade area.
- Household expenditure generated by the trade area was forecast based on household numbers, household types and income levels using the Hill PDA expenditure model.

- Turnover captured by the retail centre was forecast having regard to likely capture rates by broad commodity type and compared to industry benchmark levels to test sustainability.

The primary trade area (PTA) for the centre was defined as a single statistical collection district being Catherine Hill Bay itself. The success of the proposed retail centre may depend upon the retail mix, reputation of tenants, etc that will attract people from beyond the PTA. A considerable level of trade is also likely to come from the day-trippers and beach goers.

The primary trade area when fully developed will generate around $24.6m retail expenditure ($34,500 per household[1]). Typically these neighbourhood centres at the very most capture around 7.5% of the primary trade area's expenditure. Residents in the PTA will continue to go to Swansea to undertake the majority of their food and grocery and other regular shopping needs but will use the neighbourhood centre for top-up shopping.

Average turnover for all retail stores other than bulky goods is around $5,500/sqm based on the 1998-99 ABS Retail Survey escalated to today's dollars. This level however is well above sustainable levels. We are aware of some IGA and Bi-Lo supermarkets outside the Sydney metropolitan area that turnover around $5,500/sqm and other retailers in strip centres turning over less $3,500/sqm. Many personal services such as hair dressers in non-metropolitan strip centres turnover less than $2,500/sqm.

If we use a rate of $3,800/sqm as a sustainable level then 7.5% of the PTA total expenditure equates to $1.85m which translates to a demand for around 480sqm of retail floor space. The success of the centre may depend on the tenants that locate to the centre. Some restaurants for example can develop a strong reputation and attract people from an area much wider than just the PTA.

We consider the shops will develop a strong nexus relationship with the beach. Unfortunately there are no visitation numbers to the beach making it difficult to quantify retail spend from day trippers. Nevertheless it is not unusual for a shopping centre on the coast to capture the majority of its expenditure from tourism. Merimbula (20,000sqm) is an example of a centre that is around two and half times the size it should be for its permanent population of 10,000. This is because it captures as much tourism spend as it does local spend. Narooma Plaza doubles its turnover during holiday times. Whilst these are larger centres there are examples of beach side locations with small resident numbers such as Tuross Heads, Tathra, Tura Beach and Pambula Beach that have small shopping centres largely to cater for beach goers, day trippers and the tourist market.

In summary we believe that the sources of turnover for the centre are as follows:

PTA (7.5% of total household expenditure) =	$1.85m
Other Day trippers, tourists and beach goers (say)=	$2.15m
Total	$4.00m

[1] This is equivalent to the 95 percentile of collection districts average retail spend per household in the Shire of Wyong in 2006. In other words 12 of the 240 collection districts in the Shire of Wyong (in 2001) had a higher average household spend. This is level of expenditure we would expect from a new beach side area with income levels above the LGA average.

Using a sustainable rate of $3,800/sqm this level of expenditure will generate demand for retail floor space of around 1,050sqm. This is a sufficient size to support the uses suggested above including a grocer or mixed business store, hairdresser, surf/dive shop, fish and chips, take-away, restaurant and coffee shop.

Again the success of the centre depends much upon the reputation of the retail operators. Two or three restaurants, that develop a level of good will, can make a strong difference to the performance of the centre. Such restaurants may be attracted to this locality given the synergy with the beach and such restaurants can bring people from well beyond the PTA.

We understand the maximum area sought is around 1,800sqm. If retailers occupied around half of this space the remaining space can be taken up with non-retail commercial operators including for example a general practitioner, other medical specialists (say dentist and remedial massager), accountant, solicitor, professional photographer, web designer, artist, home-based/creative industry, etc.

Please do not hesitate to call if I can be of further assistance.

Yours sincerely

Adrian Hack
Principal

Job No. C07140