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PACIFIC PINES ESTATE
LENNOX HEAD

ENGINEERING REPORT FOR
PART 3A CONCEPT PLAN

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FOR
PETRAC PTY LTD
FEBRUARY 2008

CONTENTS

APPENDICES

1. Traffic
   - Lennox Head South, Hutley Drive Traffic Planning issues and Hierarchy Plan
   - Excerpts; Traffic Studies on small Commercial Developments
2. Utilities
   - Correspondence and DSP Plans

3. Earthworks & Geotechnical
   - Nil

4. SEPP 55
   - Original Report 2003

5. Acid Sulphate Soil
   - Gilbert & Sutherland EMP and ASS

1 EXECUTIVE SUMMARY

1.1 Traffic And Road Hierarchy

The main roads into and out of the subdivision are Montwood and Hutley Drives. Their capacity and road type are described in Ballina Council's Road Hierarchy study for the shire. Analyses by Ardill Payne and Partners (APP) indicates that the proposed development can be adequately served by these roads with the final traffic loads being less than the road's environmental capacity allocated by Council. The limiting case for each road is the relative increase in noise levels caused by the increased traffic load. Refer to Carter Rytenskld's report for details. The increase in load on Montwood Drive does not require any noise attenuation whilst increases in noise along Hutley Drive will require special provisions in house design for proposed adjacent dwellings.

The internal road hierarchy is defined in Diecke Richards plan of the same. The plan provides for a range of road types depending on road usage and location. Generally the roads are to be tree lined with defined parking areas. Road widths vary according to road type and location also and are generally in 18 metre corridors. Carriageways vary from 5.8 metres plus parallel parking to 7 metres depending on road type. Water Sensitive Urban Design features and materials selection are to be incorporated to treat stormwater runoff and identify features of the road system or open space areas. For example, carparking, pedestrian usage, parks and commercial areas.

Commitment

To implement the Road Hierarchy Plan and conceptual road designs into the proposed subdivision.

1.2 Utilities

Water Supply
Water is supplied to the site by Ballina Shire Council. Servicing provisions are covered by Council's Development Servicing Plan (DSP) which requires developer contributions to cover headworks costs for reservoirs and mains water supply. Reticulation of water throughout the site is completed at the developer's expense from Council's water mains.

Council's DSP requires the construction of an additional water reservoir and water mains to serve Pacific Pines. Council has advised it does not intend to construct these services until demand requires them and further development takes place at the site. Existing supply services are to be used until then.

Sewer
Sewer is collected via gravity mains and falls to Council's sewerage pumping station at the bottom of the site. Sewage is pumped to Council's Sewage Treatment Plant (STP) at Lennox Head via a rising main. Future augmentation of the pump station, rising main and STP to handle increased sewage load from Lennox Head is covered by Council's DSP. Gravity services to the pump station are to be constructed by the developer.

Power
Power supply is provided by Country Energy via installation of transformers and underground power reticulation installed at the developer's expense. Existing overhead power will have to be resited underground.

Telephone
Phone services are installed free of charge by Telstra unless higher order services are required.

Commitment
To supply Water, sewer, power and phone services in accordance with existing Government standards, Development Servicing Plans and requirements.

1.3 Earthworks And Geotechnical

Existing approvals exist to complete bulk earthworks for the site including excavation of the slopes of the northern ridge and filling of the central portion of the site and areas around the Water Quality Control Pond. Cut and fill for the site will be completed as per existing approvals and environmental requirements.

A geotechnical assessment has been completed for the site by APP. The assessment concluded that:

- Conventional building construction systems were applicable for the site.

- Upon consolidation and treatment of the soft type 1 soils in the centre of the site that conventional footing designs to Class M standard under AS 2870-1996 “Residential Slabs and Footings” Code would be suitable. However, AS 2870 classifications will still be required for all lots following completion of earthworks on the site.

Commitment

To complete all earthworks in accordance with existing approvals. To provide Level 1 site supervision and certification for filled areas proposed as future building areas.

1.4 Sepp55 Land Contamination

Ardill Payne and Partners undertook a Preliminary Site Investigation for the site in September 2003 and reported their findings in a November 2003 report. This report was adopted by the Department of Planning and Ballina Shire Council at the time of their determination of the 2003 SEPP71 Masterplan application. At the time of the investigation the site was completely undeveloped and the water quality control pond had not been constructed.

The investigation found that there were no past uses likely to cause contamination of the site. Past uses consisted of cattle grazing and dairying. A judgemental sampling pattern was adopted to ensure imported fill material was suitable for residential use. The analysis indicated that some stockpiles of material soils exhibited elevated levels of chromium and manganese. Further research indicated that this was a common finding for soils of volcanic origin and were naturally occurring background levels.

Isolated composite samples exhibited elevated Mercury levels which were above acceptable limits for residential use, but suitable for commercial/industrial and open space/recreational areas. The Mercury was found to be tightly adsorbed to soil particles and thus unlikely to leach. All fill material in stockpiles was classified as “inert” in accordance with EPA guidelines and was subsequently used for construction under playing fields and roads constructed in 2003-2004.

No further sampling was recommended.

1.5 Acid Sulphate Soils

Council's GIS mapping of the site indicates possible locations for PASS on site. The extent is limited to the low lying areas in the central portion of the site to be filled. A detailed Acid Sulphate Soils assessment has been completed for the site. An Environmental Management Plan (EMP) for treatment of Acid Sulphate Soils has been prepared for the site by Gilbert and Sutherland. In summary the EMP requires monitoring and reporting of PASS if they are encountered, and, appropriate treatment of the same.

Commitment

Undertake monitoring, reporting and treatment of Acid Sulphate soils in accordance with the site EMP.

1.6 Flooding

Three flood investigations have been undertaken on the subject site in response to Shire Wide Policies and local flooding effects. The final investigation is due for completion this year and will include Climate Change effects. In response to these three studies a minimum fill level of RL 2.3 at the edge of floodways has been adopted in the design. Adjacent levels at property boundaries are approximately 0.36 metres higher than this minimum value. Filling of these areas has been previously approved by Council.

1.7 Water Cycle Magement

In summary Pacific Pines water cycle management system provides for:

1. Continued use of the existing environmental lake (WQCP) as a tertiary treatment system and main detention dam / recycling source for the subdivision.

2. Provision of small dry detention systems upstream of the WQCP.

3. Provision of numerous primary small litter traps in stormwater collection pits.

4. Provision of a Stormwater Community Education Program (CEP) by the developer describing why the strategy has been adopted and how it works.

5. Ongoing monitoring of stormwater quality and comparison to baseline data.

6. Swales, infiltration and bioretention systems in flatter areas.

7. Provision of recycled effluent and stormwater for irrigation and toilets.

8. Construction of swales and detention ponds out of the water table.

9. Provide and maintenance of buffers to environmentally sensitive areas.

Theoretical modelling of the stormwater treatment train for the development footprint by Gilbert and Sutherland concluded that the lake will provide the no net pollutant increase criteria required by Council.

Gilbert and Sutherland wrote Council's Stormwater Management Policy (Combined DCP Part13) and the modelling completed by them demonstrates compliance with the stated policy. To date Gilbert and Sutherland's conclusions have been supported by water quality monitoring results.

The additional at source treatment systems (Item 6 in above treatment system) will further improve the water quality outcomes. The impact of this strategy will produce a lower pollutant load from the site than currently exists. The theoretical modelling and subsequent ongoing monitoring demonstrates that the WQCP is achieving the desired environmental outcomes.

During approval for and construction of the WQCP the impact of the lake on groundwater hydrology was raised by Government Agencies. Subsequent to these enquiries and site meetings the lake was clay lined as agreed with Government Agencies where highly porous soils were encountered to prevent contamination of the groundwater by direct contact with stormwater runoff. Elsewhere on-site infiltration through natural soils is encouraged in accordance with WSUD. Where further detention ponds are required they are either sited above existing ground levels and mimic the existing ground topography or are located above ground water levels. Conveyance of stormwater flow behaviour across the site is reproduced from existing to developed conditions by retention of site drainage lines and floodways. Flood velocities and impacts are reproduced by provision of detention basins and landscaped flow paths. Impacts on groundwater hydrology are therefore considered negligible**.**

Buffers to environmentally sensitive areas have been created in accordance with the consent conditions determined by the Environmental Impact Statement for the WQCP. When added to the additional buffer provided by the lake and approved sports fields buffers generally exceed 100 metres.

Analysis of water recycling options concluded that stormwater recycling was preferable to effluent recycling. This contradicts Council's stated shire wide policy. However, provision for both forms of recycling is proposed.

Commitment

To implement Water Cycle Management initiatives 1 to 9 listed above.

2 DETAILED REPORT - INTRODUCTION

The current proposed Concept Plan layout of Pacific Pines represents the remaining stages of a project that commenced in the late 1980's. The first four stages were built mainly in the 1990's with the most recent stage 4 completed in 2004. The subdivision has been redesigned from the original DCP layout developed between 1989 and it's most recent amendment in 2000 to reflect changes in subdivision design principles brought about by Government policy, market expectation and requirements of the recently approved EIS into stormwater management for the site.

These changes have in the main involved:

- Establishing a more legible road system
- Enhanced connectivity and accessibility elements around the site for pedestrian, bicycle and vehicular transport
- Accommodation of water sensitive urban design principles established during EIS process for stormwater management
- Revised open space strategy to supply larger park areas linked by connectivity elements
- Establishing "neighbourhoods" within the subdivision via road hierarchy and green belts
- Providing focal points within the subdivision
- Maintaining views and orientation to surrounding significant natural and human-made items

The subdivision is required to supply the land shortage in Lennox Head and, as can be seen from the Context Plan provided elsewhere in the Concept Plan submission, is a major infill development for the Council's long term plan for release of urban land in Lennox Head.

3 TRAFFIC & ROADS

EXECUTIVE SUMMARY

This Traffic Report has been prepared for the Concept Plan Application for the proposed completion of the Pacific Pines development at Lennox Head. The traffic generation analysis in section 3.2 has been based on the loads generated for the completed development as summarised in Deicke Richards Figure "Staging and Lot Typologies" version 4H. The analysis also includes traffic generated by the existing residential development. The road design rationale and road hierarchy has been prepared taking into account our own experience in subdivision design, current design guidelines from local Councils, Amcord guidelines and Coastal Design Guidelines for NSW (UDAS, 2003).

The Traffic and Roads report discusses and investigates:

- Capacities of major roads into and out of the subdivision
- Strategic issues concerning future major roads near the site
- Internal Road Design

Capacities of existing and proposed major roads were checked against additional traffic loads generated by the development. The subject roads were found to operate within their environmental capacity with the additional load. Council's review of strategic road corridors for future Lennox Head bypass options concluded that the existing western sub-arterial bypass route should be retained as the preferred route. It was recommended in Council's most recent report[2] to downgrade the status of Hutley Drive to a major collector to reflect the lower order use incurred since the construction of driveways to houses on the alignment already constructed. An internal roads hierarchy has been prepared in response to traffic loads and location. Roads have been designed to reduce impervious areas and provide a high level of landscaping. A range of road widths and edge treatments has been proposed to suit the road hierarchy. The range of treatments is summarised in Deicke Richards Road Hierarchy Plan.

3.1 Introduction

Although Pacific Pines has been slowly developing over 13 years, the development is of a substantial size with the existing plus proposed subdivision expected to provide for approximately 2,500 residents. The site itself is contained and external to the old village of Lennox Head. Because of this the site can be considered a new settlement as defined in the Coastal Design Guidelines. The proposed road alignment, hierarchy and relationship to open space, drainage, water treatment and pedestrian access has been re-designed from the previous DCP layout to reflect the Coastal Design Guidelines, contemporary urban design goals and outcomes from the EIS approval and subsequent construction of the abutting Water Quality Control Pond (WQCP) or Environmental Lake.

[2] Cardno Eppel Olsen Report to Council 2006; "Lennox Head South, Hutley Drive Traffic Planning Issues"

3.2 Traffic Loads and Capacities

3.2.1 Introduction

The main roads into and out of the Pacific Pines Estate are Hutley Drive going north and Montwood Drive going south. A minor access is provided to the east via Stoneyhurst Road**.** Council has had a long term plan to extend Hutley Drive to the south as well. Ardill Payne and Partners (APP) has used Council's strategic traffic model in conjunction with a more detailed analysis of Pacific Pines to estimate traffic loads on the main roads with and without Hutley Drive being completed to the south. This was considered necessary to determine whether the timing of Hutley Drive construction south by Council would have an impact on the capacity of the proposed road system to handle the proposed development. The analysis below found that the proposed road system operates adequately without Hutley Drive south being constructed.

3.2.2 Strategic Issues

At a strategic level Council has been investigating various traffic options for high use roads through and around Lennox Head since 2001. Previously a road corridor had been dedicated west of Pacific Pines to be used as a sub-arterial bypass road connecting Hutley Drive southwards to North Creek Road. This route is west of the existing WQCP and is still available to Council but is not included in the Pacific Pines Estate nor is it part of the proposed Concept Plan. Council has been investigating these options through its traffic consultant Eppel Olsen, now Cardno Eppel Olsen (CEO). CEO's previous report[3] investigated the following issues:

- Bypass traffic being routed through the subdivision
- Upgrading the existing easterly bypass
- Proceeding with the westerly bypass

Eppel Olsen's 2003 report identified the limitations of using existing constructed roads through the Pacific Pines Estate. The recommendations included in the Eppel Olsen essentially restricted Council to proceeding with either of the last two options identified in the Eppel Olsen report. It is not feasible to route bypass traffic through the development as the only possible routes have:

- Already been constructed and are unable to handle bypass traffic volumes, or,
- Are located in areas where gradients are too steep (30% gradient)

[3] EO Draft Working Paper to Council 2003

The most recently (2006) updated CEO report *"Lennox Head South, Hutley Drive Traffic Planning Issues*" (see Appendix 1) provided the following advice to Council;

- Existing section of Hutley Drive through Lennox Meadows allows for direct frontage access which compromises the achievement of a traffic carrying through route on Hutley Drive through Lennox Head South.

- The section through Pacific Pines due to intersection spacing would not be consistent with the operational objectives for a traffic carrying through route through Lennox Head South.

- CEO concluded "*… that both North Creek Road and Hutley Drive should be planned as Major Collectors serving the local community of Lennox Head South, and not intended to carry through traffic as part of a longer traffic carrying route between Ballina and Lennox Head."*

As part of the Enquiry by Design (EBD) workshop for Pacific Pines in 2007 strategic issues concerning adjacent developments were investigated by APP using the EO model and RTA Traffic Generation Models to determine impacts on Pacific Pines of proposed adjacent developments if the connection south of Hutley Drive wasn't made. The values provided below in Tables 3.1 and 3.2 are based on broad land use generation values and are not as accurate as the detailed analyses provided further in the text. Although the modelling is at a strategic level, it provides clear evidence of the impact on local minor roads (particularly Montwood Drive) if Hutley Drive is not completed and adjacent developments do proceed.

Table 3.1 – Scenario 1:
Traffic Loads without adjacent Development
Strategic Analysis (Two-way vehicles per day)

Options	**Montwood Drive**	**Stoneyhurst Road**	**Hutley Drive**	**Henderson Development**
Traffic Generated by Pacific Pines Land Use **without** Hutley south connection	2000	1000	3000 north	NA
Traffic Generated by Pacific Pines Land Use **with** Hutley connection. Includes bypass Traffic loads	1000	1000	2000 south 5000 north	NA

Table 3.2 – Scenario 2

Traffic Loads with adjacent Development
Strategic Analysis (Two-way vehicles per day)

Options	Montwood Drive	Stoneyhurst Road	Hutley Drive	Henderson Development
Traffic Generated by Pacific Pines and proposed adjacent Land Use **without** Hutley south connection	3000	1000	5300 north	4000
Traffic Generated by Pacific Pines and proposed adjacent Land Use **with** Hutley south connection. Includes bypass Traffic loads	1000	1000	6000 south 6800 north	4000

Tables 3.1 and 3.2 indicate that Montwood Drive would reach its Environmental capacity as defined in Council's Road Hierarchy Plan[4] if adjacent developments proceeded without the southern connection to Hutley Drive being made. Concerns about increased noise levels would therefore need to be further investigated if adjacent development proceeded without Hutley south connection. A separate noise analysis by Carter Rytenskild provided elsewhere in this submission shows that, without adjacent proposed developments proceeding, increased traffic loads on Montwood Drive created by the completion of the Pines Estate do not require noise amelioration whilst some parts of Hutley Drive do.

Based on these strategic level reports the detailed report following, investigates the capacity of the three proposed roads into and out of Pacific Pines to accommodate the traffic load generated by Pines land uses. It includes provision for traffic going through the Pines road network to community and commercial facilities within the Pines precinct. Because of the apparent difficulties generated by adjacent proposed land development if Hutley south is not connected, the report does not provide for traffic using the internal Pines network to access adjacent proposed developments (e.g. proposed Henderson and Meadows developments). The report assumes that Hutley Drive North is constructed whilst Hutley Drive South is **not** constructed. The assumptions are based on likely current achievable outcomes in the near and medium terms. The detailed report shows that the three proposed roads into and out of Pacific Pines can accommodate the increased traffic load created by the proposed development without Hutley south being constructed.

[4] Ballina Shire Council Road Hierarchy Plan Dated 2005

3.2.3 Major Roads and Traffic Generation Values

The two major roads into and out of Pacific Pines are Montwood Drive heading to Ballina and Hutley Drive heading to Lennox Head. The extension of internal roads within Pacific Pines to connect to adjoining proposed development land is not proposed without bypass roads being available as the strategic evaluation indicates that the consequent impact on the internal road systems is not acceptable.

The analysis by Ardill Payne and Partners (APP) is for local traffic plus the external traffic attracted by the neighbourhood commercial precinct. The APP results are based on existing traffic counts completed by Ballina Shire Council.[5] These counts were performed along Montwood Drive and provide an average traffic load of 6 external trips per household (Based on 1440 AADT/251 existing dwellings = 6 trips). Based on this existing scenario and the 3:1 ratio recommended by the RTA, an estimate of 8 trips per household has been adopted for the proposed development. That is 6 external trips to 2 internal trips equals 3:1. This rate compares favourably with Austroads standard generation rates of 9 trips per lot with 25% of trips being local traffic. All calculations are in trips per day (tpd) unless otherwise noted. A trip is assumed to be a one-way journey from a place of origin.

Table 3.3 provides typical trip generation rates based on land use. The data has been sourced from various documents including the RTA's "*Guide to Traffic Generating Developments"*, Department of Main Roads *"Road Planning and Design Fundamentals",* the Institute of Transportation Engineers (ITE) "*Trip Generation"*, San Diego Municipal Code *"Trip Generation Manual"* as well as various internet resources for similar projects within Australia. See Appendix 1 for sources.

The RTA Guide is a relatively old (1995) document with some of the traffic generation values unchanged since the 1980's. More contemporary analyses for a wider range of land uses has been completed by the Authorities listed above. Where variations from the RTA's Guide have been adopted this has been for the reasons provided below. To compare the RTA figures to the adopted values, Tables 3.4, 3.6, 3.7 and 3.8 have been duplicated as versions a and b. Version a covers the recommended values whilst version b covers the RTA figures. Obviously Table 3.4b does not represent actual current traffic loads as the RTA values are greater than the actual measured loads:

[5] Traffic Counts for Montwood Drive by BSC September 2003.

Variations from RTA Traffic Generating Values

- Residential rate based on actual rates measured in Pacific Pines and confirmed in other parts of Ballina Shire by Council. This provides the most accurate assessment of actual usage and base date traffic load. So that future loads are comparable to existing it is necessary to use the same rates for both cases. In this instance the recommended value is 8 trips per standard household. This value has been used by Cardno Eppel Olsen in areas of their Shire Wide Strategic Traffic Study for Council as well.

- Seniors living. The upper range value recommended by the RTA and QLD Main Roads has been adopted as a conservative value.

- Commercial and retail area. Rates shown in RTA guide are average r ates based on large (10,000 sq.m supermarkets). The RTA guide recommends that :

"As with most land uses, it is preferable to base a traffic generation estimate for a shopping centre on a similar development."[6]

Analyses by APP on smaller shopping centres have shown the generation rate works out at a maximum of 40 trips per 100 square metres. This is based on studies of the Ocean Shores Shopping Centre (4600 square metres) from 2005 to 2007 and the redevelopment of Wigmore Arcade for Ballina Shire Council in 2007. Excerpts from these two studies are provided in Appendix 1 for sources. The ITE value shown in Table 3.3 is for small (< 3,000 square metre) centres and similar although larger than the values recorded by APP. Due to their correlation and the small size of the commercial development the ITE figure has been adopted as a conservative estimate.

[6] RTA Guide to Traffic Generating Developments December 1993 page 3-5

Table 3.3- Trip Generation Rates
Comparison of Trip Generation Values from Various Sources

Utility	Units	Adopted Trips/unit	RTA	QLD Main Roads	ITE	San Diego
Residential	Trips per house	8	9	6 – 10	9.55	10
Seniors	Trips per house	2	1 - 2	1 – 2	5.86	2.5 – 4
Assisted Living & Independent Living	Trips per bed	1	--	--	--	3
Commercial	Trips per 100 sq. m. GFA	46	121	10	46	120
Community Centre	Trips per 100 sq. m. GFA	20	--	--	--	--
Tavern	Trips per 100 sq. m. GFA	46	--	--	--	--
Childcare	Trips per 100 sq. m. GFA	86	0.8/child	0.8/child	79	80

Traffic loads have been calculated by applying these rates to the existing land use and those proposed in the Concept Plan. Splits between exit and internal trips have been based on traffic counts in Montwood Drive and are approximately 72% external to 28% internal.

Table 3.4(a) - Existing Traffic Loads by Major Road (Adopted Rates)

Residential Lots	Montwood Drive	Stoneyhurst Road	Hutley Drive
Single	205	8	121
Duplex	23	0	32
Total Trips	**2008**	**64**	**1480**
Exit Trips	1440	46	1061
Internal Trips	568	18	419

Note: Duplex site are assumed to have twice the generation rate of single dwellings.

Table 3.4(b) - Traffic Loads by Major Road (RTA Rates)

Residential Lots	Montwood Drive	Stoneyhurst Road	Hutley Drive
Single	205	8	121
Duplex	23	0	32
Total Trips	**2259**	**72**	**1665**
Exit Trips	1694	54	1249
Internal Trips	565	18	416

Note: Duplex site are assumed to have twice the generation rate of single dwell

The subdivision has been divided into traffic catchment areas for ease of calculation. These areas include residential lots as well as community, commercial and assisted living areas. A summary of the lots and areas is presented in Table 3.5.

Table 3.5 - Proposed Residential Allotments and Land Use Areas by Traffic Catchment. For Completed Development (815 lots).

Catchment	Residential	Seniors Dwellings	Assisted Living & Independent Living	Commercial	Community Centre	Tavern	Childcare
(Location)	***(Dwellings)***	***(Dwellings)***	***(Beds)***	*(m²)*	*(m²)*	*(m²)*	*(m²)*
A	22						
B	29						
C	6						
D		52					
E	40						
F	9						
G		120					
H	29						
I	56						
J	21						
K	7						
L	11						
M	11						
N	39						
O	54						
P	28						
Q	50						
R	99			1200			
S			140		300	800	600
Total	511	172	140	1200	300	800	600

Note: Total residential dwellings (823) include 16 duplex dwellings. Hence there are only 8 duplex lots (and 815 lots) described in Deicke Richards Staging and Typology Plan version 4H.

The direction of exiting traffic flows (or splits) assumed in calculations were based on assumed reasonable direction choices a driver might make depending on their final destination. It was assumed that 75% of drivers would ultimately head towards Ballina, whist the remaining 25% would head towards Lennox, Byron Bay or other northern districts. The exit route a driver takes was thus based on the location of their dwelling with respect to the three main exit routes (Hutley, and Montwood Drives and Stoneyhurst Road). The trip generation, assumed splits and the resulting impact on exiting and internal traffic are presented in Table 3.6. Traffic Catchment Locations are shown in Figure 3.1.

Table 3.6(a) - Proposed Development Traffic Generation (Adopted Rates)

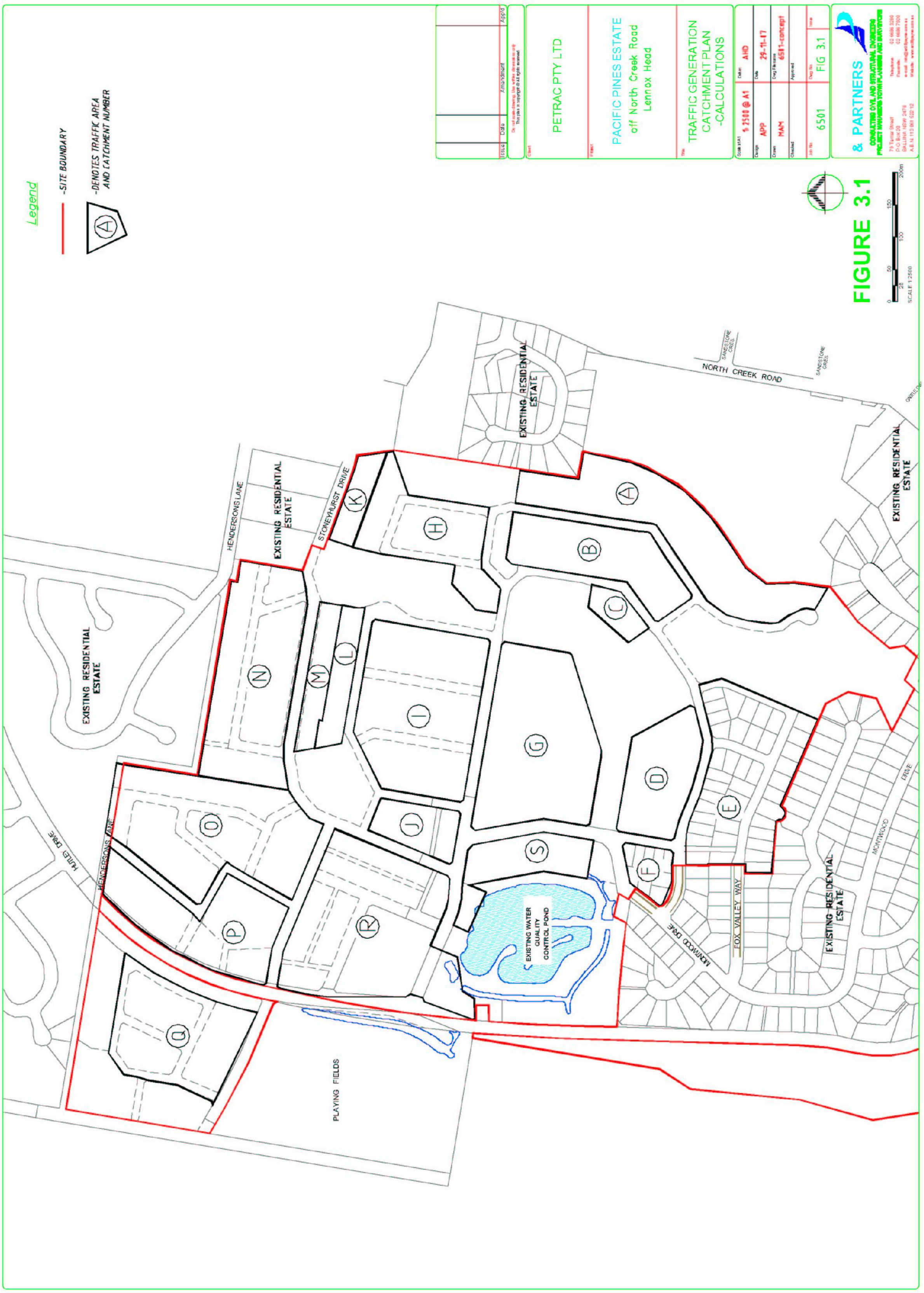
Catchment	Residential			Montwood Drive	Stoneyhurst Road	Hutley Drive	Montwood Drive	Stoneyhurst Road	Hutley Drive
(Location)	*(Total Trips)*	*(Exit Trips)*	*(Internal Trips)*	*External Usage Ratios*			*External Trips*		
A	176	126	50	0.5	0	0.5	63	0	63
B	232	166	66	0.5	0	0.5	83	0	83
C	48	34	14	0.75	0	0.25	26	0	9
D	0	0	0	0.75	0	0.25	0	0	0
E	320	229	91	0.75	0	0.25	172	0	57
F	72	52	20	0.75	0	0.25	39	0	13
G	0	0	0	0.25	0	0.75	0	0	0
H	232	166	66	0.25	0	0.75	42	0	125
I	448	321	127	0.1	0.3	0.6	32	96	193
J	168	120	48	0.2	0	0.8	24	0	96
K	56	40	16	0	1	0	0	40	0
L	88	63	25	0	0.75	0.25	0	47	16
M	88	63	25	0	1	0	0	63	0
N	312	224	88	0	0.9	0.1	0	201	22
O	432	310	122	0	0.5	0.5	0	155	155
P	224	161	63	0	0	1	0	0	161
Q	400	287	113	0	0	1	0	0	287
R	792	568	224	0	0	1	0	0	568
S	0	0	0	0	0	1	0	0	0
Sub Total	4088	2931	1157				**481**	**603**	**1847**
Seniors	344	247	97	0.5	0	0.5	123	0	123
Assisted Living & Independent Living	140	100	40	0.5	0	0.5	50	0	50
Sub Total	484	347	137				**174**	**0**	**174**
						TOTAL	**654**	**603**	**2021**

Note: Results have been rounded to nearest whole number

Table 3.6(b) - Proposed Development Traffic Generation (RTA Rates)

Catchment	Residential			Montwood Drive	Stoneyhurst Road	Hutley Drive	Montwood Drive	Stoneyhurst Road	Hutley Drive
(Location)	*(Total Trips)*	*(Exit Trips)*	*(Internal Trips)*	*External Usage Ratios*			*External Trips*		
A	198	149	50	0.5	0	0.5	74	0	74
B	261	196	65	0.5	0	0.5	98	0	98
C	54	41	14	0.75	0	0.25	30	0	10
D	0	0	0	0.75	0	0.25	0	0	0
E	360	270	90	0.75	0	0.25	203	0	68
F	81	61	20	0.75	0	0.25	46	0	15
G	0	0	0	0.25	0	0.75	0	0	0
H	261	196	65	0.25	0	0.75	49	0	147
I	504	378	126	0.1	0.3	0.6	38	113	227
J	189	142	47	0.2	0	0.8	28	0	113
K	63	47	16	0	1	0	0	47	0
L	99	74	25	0	0.75	0.25	0	56	19
M	99	74	25	0	1	0	0	74	0
N	351	263	88	0	0.9	0.1	0	237	26
O	486	365	122	0	0.5	0.5	0	182	182
P	252	189	63	0	0	1	0	0	189
Q	450	338	113	0	0	1	0	0	338
R	891	668	223	0	0	1	0	0	668
S	0	0	0	0	0	1	0	0	0
Sub Total	4599	3449	1150				**566**	**710**	**2174**
Seniors	344	258	86	0.5	0	0.5	129	0	129
Assisted Living & Independent Living	140	105	35	0.5	0	0.5	53	0	53
Sub Total	484	363	121				182	0	182
						TOTAL	**747**	**710**	**2355**

Note: Results have been rounded to nearest whole number



Legend
-SITE BOUNDARY
-DENOTES TRAFFIC AREA AND CATCHMENT NUMBER
PETRAC PTY LTD
PACIFIC PINES ESTATE
off North Creek Road
Lennox Head
TRAFFIC GENERATION
CATCHMENT PLAN
-CALCULATIONS
6501
FIG 3.1
& PARTNERS
FIGURE 3.1
NORTH CREEK ROAD
EXISTING RESIDENTIAL ESTATE
STONEYHURST DRIVE
HENDERSONS LANE
EXISTING WATER QUALITY CONTROL POND
FOX VALLEY WAY
PLAYING FIELDS

The RTA Traffic Generation Handbook recommends that approximately 25% of trips generated by a residential development will comprise internal trips within the development. These trips would include outings to shops, community facilities, taverns and visits to other dwellings. The residential rate of 6 external and 2 internal trips confirms the findings of BSC's traffic count on Montwood Drive. Trip generation rates for land uses other than residential have been presented below in Table 3.7. These values have been determined by multiplying relevant land use areas defined in Table 3.5 by the attributable rate provided in Table 3.3.

Table 3.7(a) - Trip Generation - Other Land Uses (Adopted Rates)

Land Use	Trips
Commercial	552
Community Centre	60
Tavern	368
Childcare	516
Total	**1496**

Table 3.7(b) - Trip Generation - Other Land Uses (RTA Rates)

Land Use	Trips
Commercial	1452
Community Centre	60
Tavern	368
Childcare	516
Total	**2396**

Senior's living and assisted living generation rates are included in the residential generation Table 3.6

The shortfall between the 1496 trips calculated for other land uses and the 1294 internal trips from the proposed subdivision calculated in Table 3.6 is assumed to be supplemented from outside the development. Hence 202 trips per day come from external areas. Based on travel distances to access roads it is assumed that the majority of the external traffic would in fact originate from the Lennox Meadows Estate and thus at least 55% of the traffic has been split down Hutley Drive, whilst 20% and 25% are assumed to originate from Montwood and Stoneyhurst respectively.

Total traffic loads on the three main access roads can be calculated by combining all of the loads. This is presented in Tables 3.8(a & b). Hutley Drive 1 is assumed to be a point immediately between the proposed development and the existing Lennox Meadows Drive, whilst Hutley Drive 2 is assumed to be at the eastern extent of Hutley Drive after the Lennox Meadows Estate.

Table 3.8(a) - Total Traffic Loads (Trips/Day) (Adopted Rates)**

GRAND TOTAL	Montwood Drive	Stoneyhurst Road	Hutley Drive 1	Hutley Drive 2	TOTAL*
Existing	1440	46	NA	1061	2547
Proposed residential directed traffic	654	603	2021	2021	3278
Estimated External Traffic through Pines to other land uses	40	51	111	111	202
Total Daily Trips	**2134**	**700**	**2132**	**3193**	**6027**

Table 3.8(b) - Total Traffic Loads (Trips/Day) (RTA Rates)**

GRAND TOTAL	Montwood Drive	Stoneyhurst Road	Hutley Drive 1	Hutley Drive 2	TOTAL*
Existing	1694	54	NA	1249	2997
Proposed residential directed traffic	747	710	2355	2355	3812
Estimated External Traffic through Pines to other land uses	225	281	619	619	1125
Total Daily Trips	**2666**	**1045**	**2974**	**4223**	**7934**

*Total at assumed location of Hutley Drive 2.
** A trip is defined as a one-way vehicular movement from one point to another excluding the return journey. Therefore, a return trip to/from a land use is counted as two trips.
Note: Discrepancies accounted for in figure rounding.

The capacity of Hutley and Montwood Drives can be expressed in terms of their environmental capacity or, alternatively, as a level of service for the mid-block capacity measured in vehicles per hour.

Montwood Drive is rated as a Minor Collector street in Ballina Council's Road Hierarchy Plan. The environmental capacity for Montwood Drive (2 lane interrupted urban road with frontage access) is 3,000 vpd as described in the subject plan. Hutley Drive is classified as a Sub Arterial Traffic Distributor with unlimited traffic volume. By way of comparison a lesser order road (e.g. sub-arterial main street) has an environmental capacity of 10,000 vpd. As stated above in CEO's 2006 report to Council the recommendation to Council is to down grade the Hutley Drive to a Major Collector due to the driveways already constructed along its alignment through Lennox Meadows. The 10,000 vpd rating can therefore be considered a reasonable capacity allocation.

Hence with access to Hutley Drive and Montwood Drive limited to Pacific Pines and Lennox Meadows only, both roads are within environmental load recommendations irrespective of what Traffic Generation rate is used. Hutley Drive has road capacity to accept further loads.

Similarly Montwood Drive has capacity for an additional 866 vpd. However, as it is rated a minor collector street, increases in noise levels may limit vehicle flow rates to those set out in Table 3.8.

Peak hourly rates can be approximated at between 10 and 15% of the AADT volume provided in Table 3.8.3. This provides a peak hourly flow of between 213 and 320 vehicles per hour (vph) on Montwood Drive. The recorded peak flow rate for the existing 251 allotments on Montwood Drive was 165 vph or 11.5% of AADT. The recommended maximum mid block flow for a two lane interrupted urban road with partial street side parking is 600 vehicles per hour. Peak flow rates on Montwood Drive are therefore well within acceptable levels. Therefore both Stoneyhurst and Hutley Drive are also within acceptable limits.

Council's Strategic Study for alternative bypass routes to the proposed western sub –arterial indicates bypass volumes are in the order of 5,000 to 8,000 vpd depending on road location. It is apparent from the above that such volumes could not be routed along Montwood Drive. Alternative routes north of Montwood were investigated also but discounted due to excessive grades (>25%). Eppel Olsen's conclusion was to construct the Western Bypass (Hutley Drive South) at some future date in its current alignment.

3.3 Internal Road Hierarchy

The internal road hierarchy is defined in Diecke Richards plan of the same. The plan provides for a range of road types depending on road usage and location. Generally the roads are to be tree lined with defined parking areas. Road widths vary according to road type and location also and are generally in 18 metre corridors. Carriageways vary from 5.8 metres plus parallel parking to 7 metres depending on road type. Water Sensitive Urban Design features and materials selection are to be incorporated to treat stormwater runoff and identify features of the road system or open space areas. For example, carparking, pedestrian usage, parks and commercial areas. See Figure 3.2

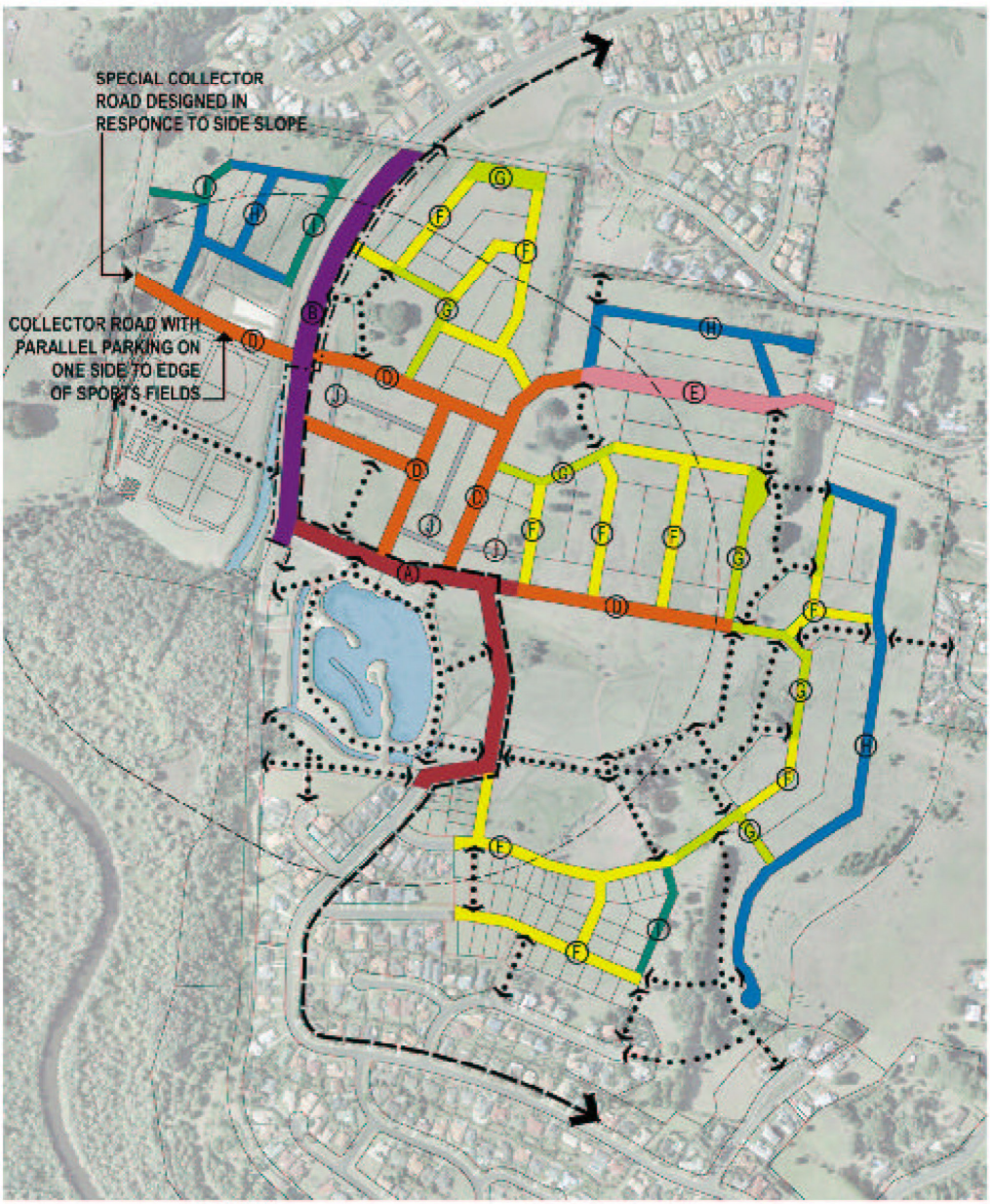


FIGURE 3.2

SOURCE:
Deike Richards
20 Sept 2007

Issue / Date / Amendment	PETRAC PTY LTD	PACIFIC PINES ESTATE off North Creek Road Lennox Head	INTERNAL ROAD HIERARCHY	ARDILL PAYNE & PARTNERS	Scale at A1: As Shown; Date: N/A; Design: DR; Date: 21-09-07; Drawn: MAM; Dwg Filename: 6501-concept; Checked; Approved; Job No: 6501; Dwg No: FIG 3.2