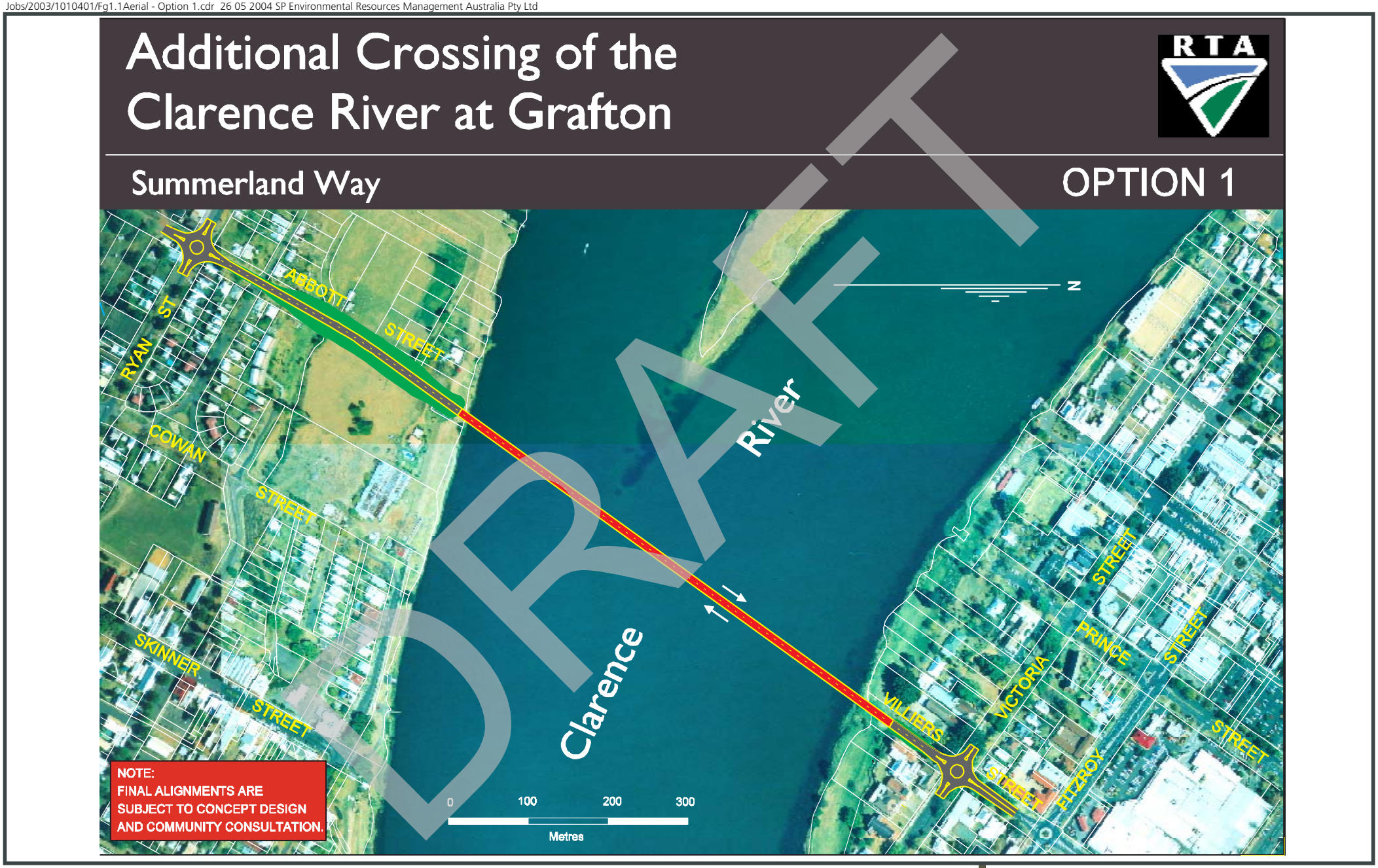


Figure 1.1 **Aerial Photograph Showing Option 1 Location**

Additional Crossing of the Clarence River at Grafton

Summerland Way

OPTION 2A

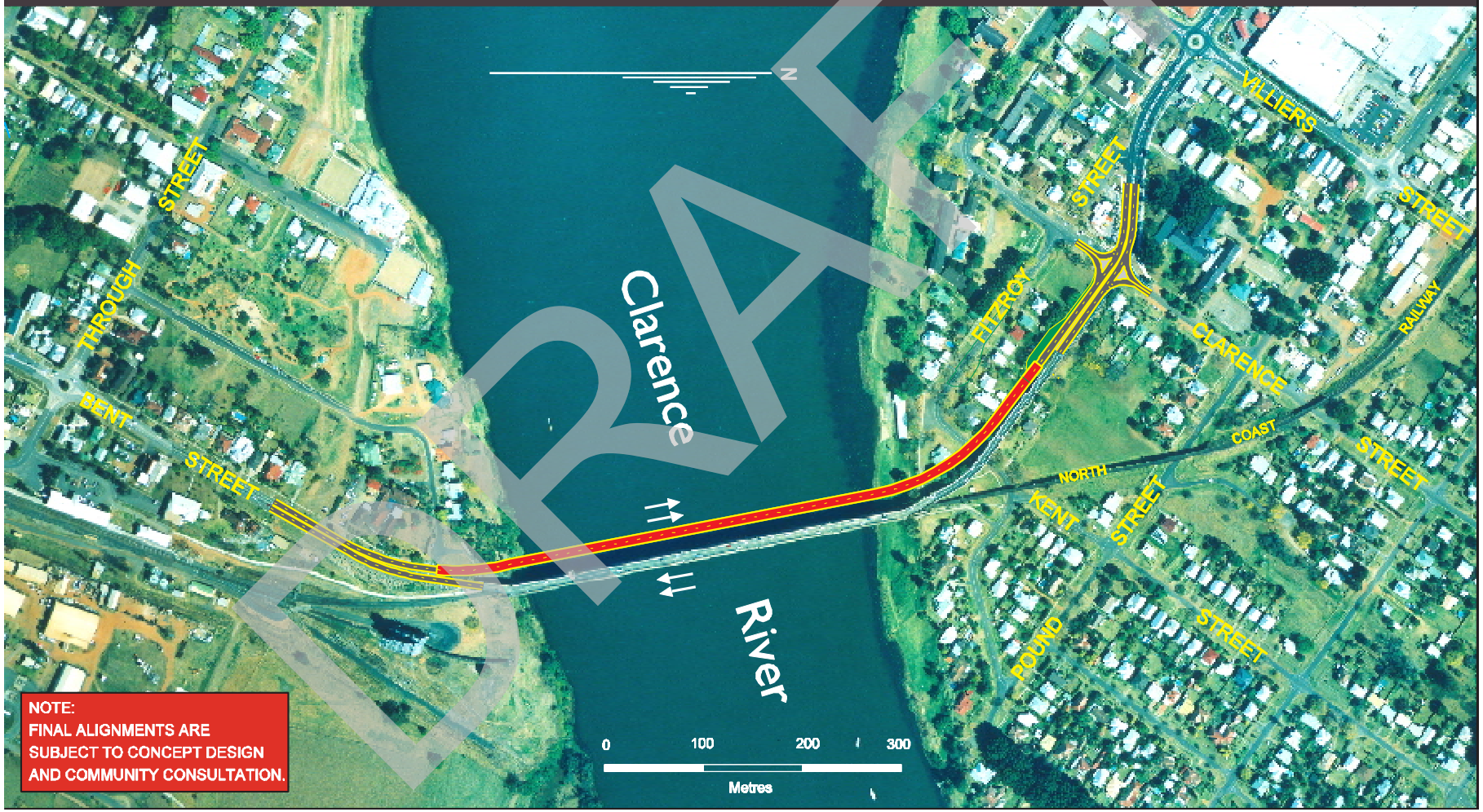


Figure 1.2 **Aerial Photograph Showing Option 2A Location**

RTA - Clarence River Options - Traffic Noise Assessment

Additional Crossing of the Clarence River at Grafton

Summerland Way

OPTION 2B

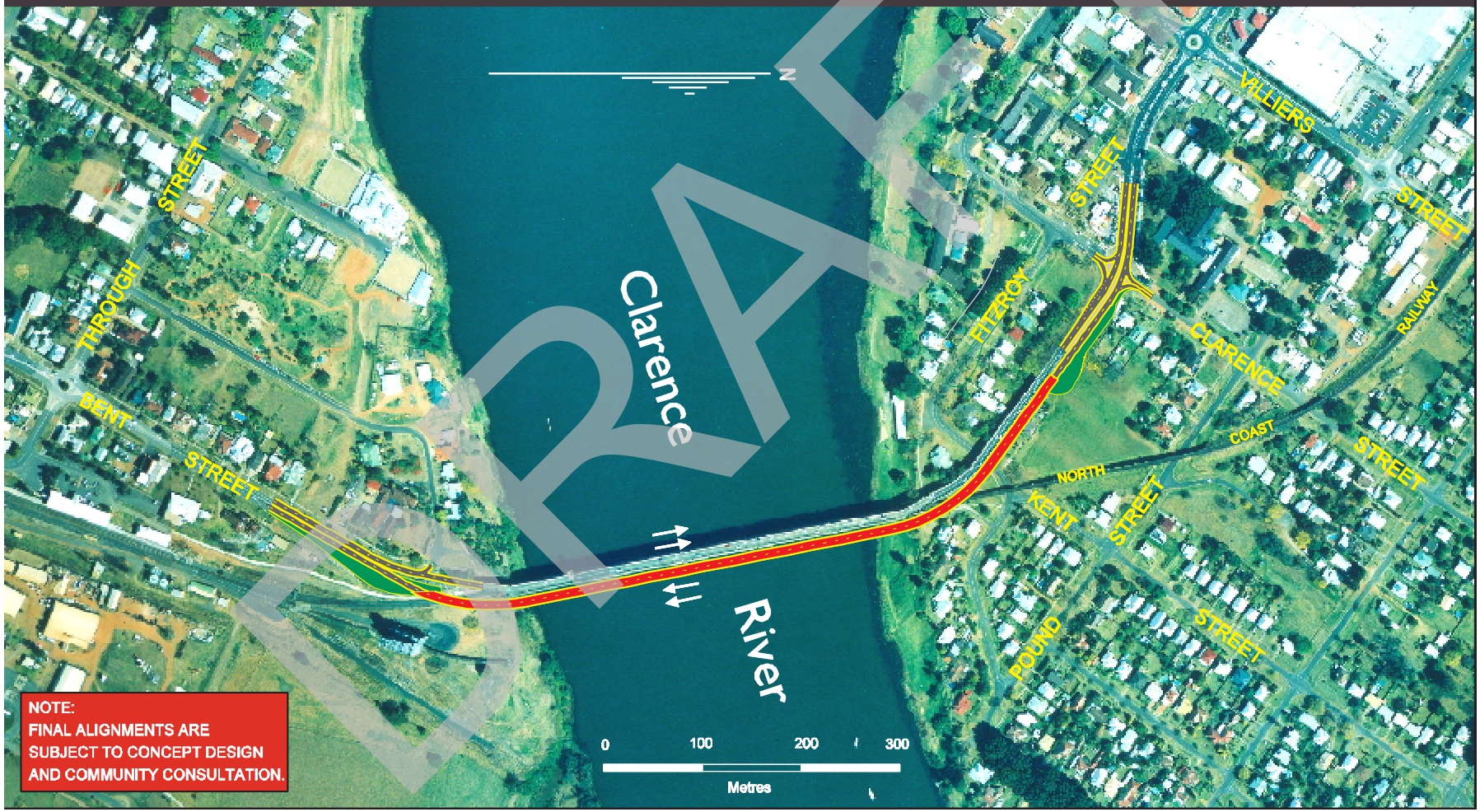


Figure 1.3 **Aerial Photograph Showing Option 2B Location**

RTA - Clarence River Options - Traffic Noise Assessment

ERM

2 TRAFFIC NOISE

2.1 CRITERIA

The DEC recommends that traffic noise impacts on potentially affected residences be assessed according to the EPA's *Environmental Criteria for Road Traffic Noise (ECRTN) (1999)*.

The RTA also has an *Environmental Noise Management Manual (ENMM) (2001)* which incorporates noise criteria from ECRTN with the addition of various assessment procedures and practice notes applicable to the RTA. ENMM Practice Note (i) sets out principals which can be applied in determining the most appropriate road development category, and hence the corresponding noise target criteria in otherwise difficult-to-interpret situations, especially where there is a transition between the road categories, including minor and substantial realignments.

For this case, applicable traffic noise criteria has been derived from ECRTN in conjunction with ENMM Practice Note (i).

The DEC's criteria is defined in terms of $L_{Aeq, T(hr)}$, which represent the continuous equivalent sound pressure level at a receiving location, measured over a specific time period (T) between 7 am to 10 pm (daytime) and between 10 pm to 7 am (night time). For the level of traffic noise to be considered acceptable, the relevant criteria in terms of $L_{Aeq, T(hr)}$ should be met for both day and night.

Residents that experience little or no traffic noise are likely to be more affected by traffic noise on a new road alignment than those residents that experience some road traffic noise where noise from traffic on a realigned or upgraded road may make little or no change. This requires road sections within each Option to be categorised according to relevant DEC classifications, rather than a single classification for the whole route.

ECRTN classifies roads according to the functional categories applied by the RTA. The RTA differentiates roads by a range of factors, including traffic volume, heavy vehicle use, through or local traffic, vehicle speeds and applicable traffic management options. ECRTN also recognises that in some cases there will be extra noise sensitivities, for example, places of worship and schools, where more stringent standards are expected.

2.1.1 *Option 1*

Table 2.1 and *Table 2.2* presents the relevant traffic noise criteria for the proposed Option 1.

Table 2.1 Option 1 - Road Traffic Noise Criteria

Road Section	Type of Development	Criteria - Day 7 am - 10 pm	Criteria - Night 10 pm - 7 am
Villiers Street	New freeway or arterial road corridor	$L_{Aeq\ (15hr)}$ of 55dB(A)	$L_{Aeq\ (9hr)}$ of 50dB(A)
From Gwydir Highway at Abbot Street	New freeway or arterial road corridor	$L_{Aeq\ (15hr)}$ of 55dB(A)	$L_{Aeq\ (9hr)}$ of 50dB(A)

Notes: 1. Source: EPA Environmental Criteria for Road Traffic Noise (1999).

Table 2.2 Locality Option 1 - Road Traffic Noise Criteria for Sensitive Land Uses

Road Section	Sensitive Land Use	Criteria - Day 7 am - 10 pm	Criteria - Night 10 pm - 7 am
Villiers Street	Proposed school classrooms	$L_{Aeq(1hr)}$ of 40dB(A) (internal)	-
Villiers Street	Existing Schools	$L_{Aeq(1hr)}$ of 45dB(A) (internal)	-
Villiers Street	Places of worship	$L_{Aeq(1hr)}$ of 40dB(A) (internal)	$L_{Aeq(1hr)}$ of 40dB(A) (internal)
Villiers Street	Passive recreation and school playgrounds	Collector and local roads: $L_{Aeq(1hr)}$ of 55dB(A) Freeway/arterial roads: $L_{Aeq(15hr)}$ of 55dB(A)	-

Notes: 1. Source: EPA Environmental Criteria for Road Traffic Noise (1999).

2.1.2 *Options 2A and 2B*

Table 2.3 presents the relevant criteria for the proposed Options 2A and 2B.

Table 2.3 Options 2A and 2B - Road Traffic Noise Criteria

Road Section	Type of Development	Criteria - Day 7 am - 10 pm	Criteria - Night 10 pm - 7 am
Merge with existing route on Craig Street	Redevelopment of existing freeway/arterial road	$L_{Aeq\ (15hr)}$ of 60dB(A)	$L_{Aeq\ (9hr)}$ of 55dB(A)
Merge with existing route on Bent Street	Redevelopment of existing freeway/arterial road	$L_{Aeq\ (15hr)}$ of 60dB(A)	$L_{Aeq\ (9hr)}$ of 55dB(A)

Notes: 1. Source: EPA Environmental Criteria for Road Traffic Noise (1999).

2.1.3 *Criteria Interpretation*

In relation to residents affected by road traffic noise in areas where these criteria are already exceeded, ECRTN recommends that:

- where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria;
- in all cases, traffic arising from the redevelopment should be designed so as not to increase existing noise levels by more than 2 dB; and
- the new road should be designed so as not to increase existing noise levels by more than 0.5 dB.

If the existing traffic noise levels lie within 2 dB of the "redeveloped road" criteria (either above or below), then a 2 dB allowance may be applied in addition to the existing levels. However all feasible and reasonable noise mitigation is recommended to be considered prior to this. Where the predicted traffic noise levels are greater than 2 dB over existing noise levels although below the relevant criterion, the traffic noise attributable to the road development may be considered acceptable. The same approach applies to a "new road" where a 0.5 dB allowance is assigned in place of 2 dB.

To determine which criteria apply to the various sections of each Option, either a "new road" or "redeveloped road", the following key points were considered from the RTA Practice Note (i):

- a site is defined as having an "existing road traffic noise exposure" if the prevailing noise level from the existing road alignment(s) is equal to or greater than 55 dB(A) $L_{eq(15hr)}$ (day) or 50 dB(A) $L_{eq\ (9hr)}$ (night);

- a "significant contribution to road traffic noise exposure" from a road development or upgrading proposal is defined as an increase in road traffic noise at any exposed facade of more than 2 dB compared to the road traffic noise level from the existing road; and

- an alignment or realignment producing noise at a receptor *from a different direction* which makes a "significant contribution to road traffic noise exposure", as defined above, on top of any increase in traffic noise from the same direction as present. If the new noise emission direction contributes more than 2 dB at any exposed facade, it is "significant", and this means the new alignment or realignment is a "new road traffic noise source".

In relation to traffic noise impacting upon sensitive land use, ECRTN recommends that:

- to achieve internal noise criteria in the short-term, the most practicable mitigation measures are often related to building or facade treatments;

- in the medium to longer term, strategies such as regulation of exhaust noise from in-service vehicles, limitations on exhaust brake use, and restricting access for sensitive areas or sensitive times to low noise vehicles can be applied to mitigate noise impacts across the road system; and

- where existing levels of traffic noise exceed the criteria, all feasible and reasonable noise control measures should be evaluated and applied. Where this has been done and the internal or external criteria (as appropriate) cannot be achieved, the proposed road should be designed so as not to increase existing road traffic noise levels by more than 0.5 dB for new roads and 2 dB for redeveloped roads.

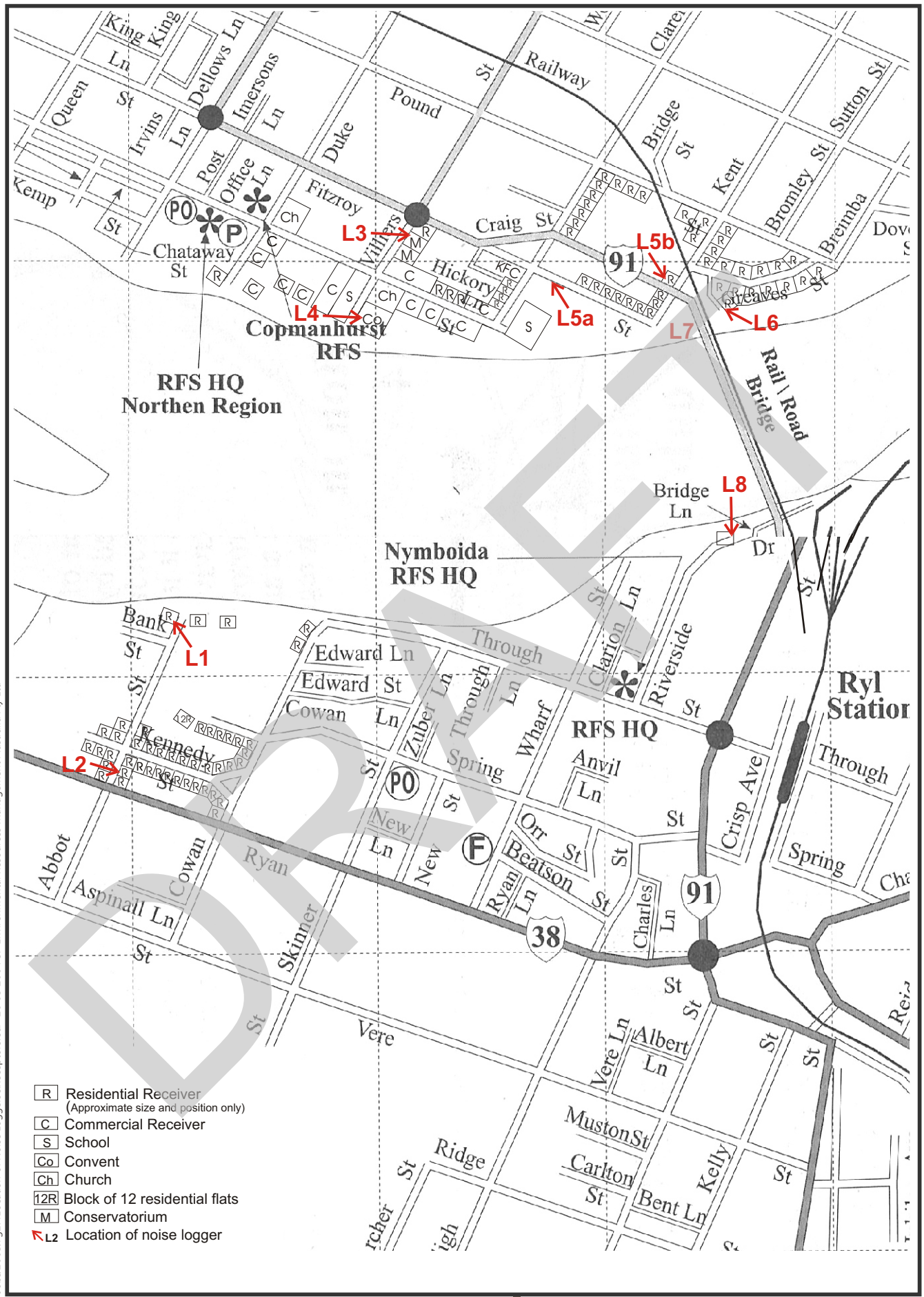
2.2 *AFFECTED RECEPTORS*

The nearest affected receptors for each Option was counted and is summarised in *Table 2.4* below and identified in *Figure 2.1*.

Table 2.4 Nearest Affected Receptors Counts

Street Name	North Side Option 1	North Side Options 2A & 2B
Victoria St, east of Duke St.	9	
Villiers St, south of Fitzroy St	1 school, 1 convent, 1 music conservatorium	
Duke St, south of Fitzroy St	7 residents, 1 church	
Clarence St, south of Fitzroy St	4 residents, 1 school	
East side of Clarence St, between Fitzroy St and Pound St		6
Fitzroy St, between Clarence St and Kent St		11
South side of Pound St, between Clarence St and Kent St		6
Kent St, between Pound St and Fitzroy St		9
Greaves St		11
McClymont Ave		2
	South Side Option 1	**South Side Options 2A & 2B**
Abbot St, north of Ryan St	11	
Kennedy St	19	
Spring St, west of Cowan St	5 residents, block of 12 flats	
West side of Cowan St, north of Ryan St	5	
Bent St north of Through St		13 residences, 1 block of flats, aged care facility
Riverside Dr		6

1. The receptor counts refer to residential houses on both sides of the street unless stated otherwise.



Jobs/2003/Fg2.1Location of Noise Loggers&Receptors.cdr 26 05 2004 SP Environmental Resources Management Australia Pty Ltd

Figure 2.1 **Location of Noise Loggers and Nearest Receptors**

2.3 EXISTING TRAFFIC NOISE

2.3.1 Noise Monitoring

The following equipment was used to measure and log environmental noise levels within the vicinity of the Clarence River Bridge and Option 1.

- (8x) ARL EL215 noise data loggers; and
- Rion NC-73 sound level calibrator.

Existing background noise levels were measured using two noise data loggers from 15th to 23rd September 2003 and six data loggers from 17th to 30th March 2004 at the closest residences on the northern and southern sides of the Clarence River, upstream and downstream of the existing bridge. The microphone position was located one metre from the residential facade most exposed to traffic noise for correlation with ECRTN as well as aid in calibration of the noise modelling process.

In reference to *Figure 2.1,* the location for each logger was as follows:

- L1 – end of Abbot Street;
- L2 - 43 Abbot Street;
- L3 - 8 Villiers Street (music conservatorium);
- L4 - 1 Villiers Street (convent);
- L5 was sited at two locations:
  - school grounds on Fitzroy Street approximately 40m east of Clarence Street (logging for 1 day); and
  - 5 Kent Street (logging for 1 week);
- L6 - 4 McClymont Place;
- L7 - Kent Street; and
- L8 - Riverside Drive.

The monitoring results include the assessment background level (ABL) for each day, evening and night period as well as the ambient noise levels for day and night. The rating background level (RBL), which is often used to assess the intrusiveness of a noise source, is defined as the median assessment background level over all days for each period.

*Table 2.5*to*Table 2.12* present the measured assessment background levels (ABL) and ambient noise levels $L_{Aeq,\ 15hr}$ and $L_{Aeq,\ 9hr}$ for each of logger locations respectively.

Table 2.5 Measured Noise Levels – Logger Location 1

Date	ABL Day	ABL Evening	ABL Night	LAeq 15hr Day	LAeq 9hr Night
Thursday, 18-03-04	-	39.0	38.5	-	47.6
Friday, 19-03-04	34.5	38.5	36.0	52.8	49.8
Saturday, 20-03-04	35.5	39.5	33.0	47.0	49.4
Sunday, 21-03-04	32.0	38.5	33.0	49.7	47.3
Monday, 22-03-04	36.0	36.5	36.0	45.9	48.9
Tuesday, 23-03-04	41.5	38.5	36.5	52.5	48.1
Wednesday, 24-03-04	39.0	41.5	37.5	56.3	49.4
Thursday, 25-03-04	40.0	40.0	-	55.0	-
Summary Values	**35.8** [2]	**38.5** [2]	**36** [2]	**52.5** [3]	**48.9** [3]

1. Day: 7:00 to 18:00 ~ Evening: 18:00 to 22:00 ~ Night: 22:00 to 7:00.
2. Rating Background Level (RBL).
3. Median ambient noise level over all days for each period.
4. '-' indicates logger installation or pick-up during a measurement period.

Table 2.6 Measured Noise Levels – Logger Location 2

Date	ABL Day	ABL Evening	ABL Night	LAeq 15hr Day	LAeq 9hr Night
Thursday, 18-03-04	-	38.5	33.5	60.6	46.6
Friday, 19-03-04	38.0	38.0	33.0	53.1	49.2
Saturday, 20-03-04	38.5	40.0	33.0	52.2	52.8
Sunday, 21-03-04	37.5	38.5	33.0	51.8	45.8
Monday, 22-03-04	37.0	34.0	32.0	64.5	47.1
Tuesday, 23-03-04	41.0	36.5	35.0	56.6	45.2
Wednesday, 24-03-04	39.0	40.0	35.0	54.3	49.0
Thursday, 25-03-04	41.0	39.0	34.0	53.3	45.9
Friday, 26-03-04	37.5	37.5	31.5	56.2	44.3
Summary Values	**38.0** [2]	**38.3** [2]	**33.0** [2]	**58.1** [3]	**47.7** [3]

1. Day: 7:00 to 18:00 ~ Evening: 18:00 to 22:00 ~ Night: 22:00 to 7:00.
2. Rating Background Level (RBL).
3. Median ambient noise level over all days for each period.
4. '-' indicates logger installation or pick-up during a measurement period.

Table 2.7 Measured Noise Levels – Logger Location 3

Date	ABL Day	ABL Evening	ABL Night	LAeq 15hr Day	LAeq 9hr Night
Thursday, 18-03-04	51.0	43.5	39.5	64.3	51.9
Friday, 19-03-04	51.5	44.5	37.5	63.3	49.9
Saturday, 20-03-04	47.5	47.5	37.5	58.8	50.4
Sunday, 21-03-04	43.5	43.5	39.0	57.1	51.3
Monday, 22-03-04	52.0	46.5	39.5	75.0	52.2
Tuesday, 23-03-04	52.5	47.0	38.0	65.2	54.8
Wednesday, 24-03-04	52.0	45.5	38.0	64.0	51.0
Thursday, 25-03-04	51.5	43.5	38.0	59.2	52.9
Friday, 26-03-04	51.5	46.5	38.5	59.3	51.9
Saturday, 27-03-04	49.5	45.5	37.5	60.1	49.2
Summary Values	**49.8** [2]	**45.0** [2]	**38.0** [2]	**61.7** [3]	**51.6** [3]

1. Day: 7:00 to 18:00 ~ Evening: 18:00 to 22:00 ~ Night: 22:00 to 7:00.
2. Rating Background Level (RBL).
3. Median ambient noise level over all days for each period.

Table 2.8 Measured Noise Levels – Logger Location 4

Date	ABL Day	ABL Evening	ABL Night	LAeq 15hr Day	LAeq 9hr Night
Thursday, 18-03-04	40.0	39.0	37.0	54.0	41.1
Friday, 19-03-04	39.5	38.5	33.0	52.4	38.9
Saturday, 20-03-04	37.5	38.5	32.5	50.5	38.9
Sunday, 21-03-04	36.5	35.5	34.5	47.1	41.1
Monday, 22-03-04	41.5	36.5	34.5	50.1	42.3
Tuesday, 23-03-04	40.5	39.5	35.5	53.0	44.3
Wednesday, 24-03-04	41.0	39.0	34.5	54.3	39.0
Thursday, 25-03-04	40.0	38.5	32.0	54.4	38.3
Friday, 26-03-04	39.0	37.0	33.0	50.3	39.8
Saturday, 27-03-04	38.0	36.5	31.5	47.3	37.2
Summary Values	**39.0** [2]	**37.5** [2]	**33.0** [2]	**51.5** [3]	**39.4** [3]

1. Day: 7:00 to 18:00 ~ Evening: 18:00 to 22:00 ~ Night: 22:00 to 7:00.
2. Rating Background Level (RBL).
3. Median ambient noise level over all days for each period.

Table 2.9 Measured Noise Levels – Logger Location 5

Date	ABL Day	ABL Evening	ABL Night	LAeq 15hr Day	LAeq 9hr Night
Wednesday, 17-03-04	-	47.0	42.5	61.8	49.9
Thursday, 18-03-04	50.5	41.5	41.5	63.4	51.5
Friday, 19-03-04	51.5	46.5	43.0	57.1	51.3
Saturday, 20-03-04	46.5	44.0	43.5	54.5	50.5
Sunday, 21-03-04	41.0	43.0	38.5	53.6	52.5
Monday, 22-03-04	52.0	44.5	42.5	57.8	51.7
Tuesday, 23-03-04	52.0	50.5	42.5	59.5	53.1
Wednesday, 24-03-04	52.0	45.5	41.5	57.7	52.4
Thursday, 25-03-04	50.5	44.0	42.0	58.5	51.6
Friday, 26-03-04	51.0	45.5	43.5	56.5	51.2
Saturday, 27-03-04	48.5	45.0	44.0	55.0	49.9
Summary Values	**50.5** [2]	**44.3** [2]	**42.5** [2]	**58.4** [3]	**51.1** [3]

1. Day: 7:00 to 18:00 ~ Evening: 18:00 to 22:00 ~ Night: 22:00 to 7:00.
2. Rating Background Level (RBL).
3. Median ambient noise level over all days for each period.
4. Shaded results refer to logging conducted on the school grounds approximately 40 metres east of Clarence Street, prior to being moved to 5 Kent Street.
5. '-' indicates logger installation or pick-up during a measurement period.

Table 2.10 Measured Noise Levels – Logger Location 6

Date	ABL Day	ABL Evening	ABL Night	LAeq 15hr Day	LAeq 9hr Night
Thursday, 18-03-04	42.0	39.8	35.9	56.1	49.4
Friday, 19-03-04	47.6	42.9	34.9	55.6	48.2
Saturday, 20-03-04	40.2	43.0	35.2	56.3	49.1
Sunday, 21-03-04	36.1	42.0	35.0	55.9	52.3
Monday, 22-03-04	48.6	39.7	34.5	55.7	50.2
Tuesday, 23-03-04	45.7	39.6	34.6	53.8	49.0
Wednesday, 24-03-04	49.2	46.6	34.0	58.2	52.8
Thursday, 25-03-04	47.0	43.1	32.8	56.5	50.7
Friday, 26-03-04	43.5	44.1	34.0	55.9	48.2
Saturday, 27-03-04	42.0	42.2	34.0	56.0	47.8
Summary Values	**42.7** [2]	**42.2** [2]	**34.3** [2]	**56.3** [3]	**49.5** [3]

1. Day: 7:00 to 18:00 ~ Evening: 18:00 to 22:00 ~ Night: 22:00 to 7:00.
2. Rating Background Level (RBL).
3. Median ambient noise level over all days for each period.

Table 2.11 Measured Noise Levels – Logger Location 7

Date	ABL Day	ABL Evening	ABL Night	LAeq 15hr Day	LAeq 9hr Night
Monday, 15-09-03	-	41.0	29.5	-	51.2
Tuesday, 16-09-03	51.5	40.0	30.0	60.1	51.6
Wednesday, 17-09-03	51.5	39.0	31.5	56.4	51.7
Thursday, 18-09-03	49.5	44.5	33.0	56.6	52.3
Friday, 19-09-03	50.5	45.0	34.0	56.5	51.5
Saturday, 20-09-03	49.0	43.0	29.5	55.3	50.4
Sunday, 21-09-03	44.5	37.0	28.5	55.0	51.2
Monday, 22-09-03	50.5	46.0	31.0	57.1	51.7
Tuesday, 23-09-03	50.0	43.5	-	56.5	-
Summary Values	**50.3** [2]	**43.0** [2]	**30.5** [2]	**57.0** [3]	**51.5** [3]

1. Day: 7:00 to 18:00 ~ Evening: 18:00 to 22:00 ~ Night: 22:00 to 7:00.
2. Rating Background Level (RBL).
3. Median ambient noise level over all days for each period.
4. '-' indicates logger installation or pick-up during a measurement period.

Table 2.12 Measured Noise Levels – Logger Location 8

Date	ABL Day	ABL Evening	ABL Night	LAeq 15hr Day	LAeq 9hr Night
Monday, 15-09-03	-	45.0	30.0	-	52.9
Tuesday, 16-09-03	52.0	44.0	30.0	56.8	53.5
Wednesday, 17-09-03	52.5	43.0	33.0	56.5	53.7
Thursday, 18-09-03	51.5	47.5	35.0	56.5	53.7
Friday, 19-09-03	52.0	48.0	36.5	56.7	53.3
Saturday, 20-09-03	50.5	44.5	29.5	57.5	51.7
Sunday, 21-09-03	48.0	42.0	29.5	59.7	52.6
Monday, 22-09-03	53.0	44.0	33.5	57.3	53.7
Tuesday, 23-09-03	51.0	44.5	36.0	57.1	54.2
Summary Values	**51.8** [2]	**44.5** [2]	**33** [2]	**57.4** [3]	**53.3** [3]

1. Day: 7:00 to 18:00 ~ Evening: 18:00 to 22:00 ~ Night: 22:00 to 7:00.
2. Rating Background Level (RBL).
3. Median ambient noise level over all days for each period.
4. '-' indicates logger installation or pick-up during a measurement period.

The graphed daily results for all monitoring sites are presented in *Annex F*.

Table 2.13 provides a summarised comparison between the measured existing noise levels for all logging locations and the appropriate assessment criteria.

Table 2.13 Measured Traffic Noise Levels Versus DEC Criteria

Receptor	Measured Leq,15 hr dB(A)	Criteria Leq,15 hr dB(A)	Criteria Exceedance dB	Measured Leq,9hr dB(A)	Criteria Leq,9hr dB(A)	Criteria Exceedance[6]
L1	52.5	55	-2.5	48.9	50	-1.1
L2	58.1	60	-1.9	47.7	55	-2.3
L3	61.7	55 (45) (1)	+6.7	51.6	n/a	-
L4	51.5	50 (40) (1)	+1.5	39.4	50 (40) (1)	-10.6
L5	58.4	60	-1.6	51.1	55	-3.9
L6	56.3	60	-3.7	49.5	55	-5.5
L7	57.0	60	- 3.0	51.5	55	- 3.5
L8	57.4	60	- 2.6	53.3	55	- 1.7

1. The external criterion (assessed during traffic peak hour [Leq,1hr]) conservatively assumes at least 10dB noise attenuation is provided by the building facade. However, it should be noted that the specified EPA criteria is an *indoor* noise level, and the external equivalent for assessment purposes is a general assumption rather than actual.

Note:

L1 – end of Abbot Street;
L2 - 43 Abbot Street;
L3 - 8 Villiers St (music conservatorium);
L4 - 1 Villiers St (convent);
L5 - 5 Kent Street;
L6 - 4 McClymont Place;
L7 - Kent Street; and
L8 - Riverside Drive.

Table 2.13 shows the measured $L_{Aeq,15hr}$ and $L_{Aeq,9hr}$ traffic noise levels at all receptor locations, with the exception of two, to be within the relevant DEC criteria.

The two locations that are over the criteria during the day relate to sensitive land uses, namely the music conservatorium (L3) and convent (L4). However, It should be noted that the specified DEC criterion is an *indoor* noise level and the external equivalent for assessment purposes is a general assumption rather than actual. The DEC generally accepts that the internal noise level should not exceed a value 10 dB below the relevant external noise level on the basis of operable windows being opened sufficiently to provide adequate ventilation.

It should be noted that the measured traffic noise levels at the convent (and general vicinity) are very low, and any significant traffic noise increase would impact the existing high amenity of this area.

2.3.2 *Traffic Count Monitoring*

Traffic movements were recorded across the existing bridge during September 2003, and are summarised in *Table 2.14*.

Table 2.14 Clarence River Bridge Traffic Counts

Period	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
	15 Sep 2003	16 Sep 2003	17 Sep 2003	18 Sep 2003	19 Sep 2003	20 Sep 2003	21 Sep 2003	5-Day	7-Day
15Hr [1]	24074	24784	25050	26692	27667	20018	15687	25653	23425
9Hr [2]	1712	1813	1697	1818	2156	1874	1230	2460	1757
24Hr	25786	26597	26747	28510	29823	21892	16917	27493	25182
AM Peak	2182	2195	2137	2276	2272	2172	1505	2212	2105
PM Peak	2479	2429	2346	2617	2627	1584	1375	2500	2208

1. ECRTN day period is 7:00am to 10:00pm.
2. ECRTN night period is 10:00pm to 7:00am.

Table 2.14 indicates weekday traffic to be relatively consistent with a significant reduction of traffic volume on the weekend, particularly Sunday with a drop of approximately 10000 vehicles per day (vpd) from the weekday average. The results also indicate that 93 percent of traffic movements occur during the day period with only seven-precent of traffic movements occurring during the night period. Heavy vehicles were counted to be an average six-percent of the total daily traffic volume.

Table 2.14 also indicates that during Peak Hour, traffic volume increases by 39 percent over the average hourly volume during the average 15-hour day period, which equates to a 1.5dB increase in traffic noise.

2.4 *PREDICTED TRAFFIC NOISE LEVELS*

2.4.1 *Modelling Method*

Noise levels were calculated using ERM's 'in-house' developed ROADent software that implements the Calculation of Road Traffic Noise (CoRTN) algorithm. The UK Department of Transport devised the CoRTN algorithm and with suitable corrections, this method has been shown to give accurate predictions of traffic noise levels under Australian conditions.

The noise model for this project incorporated the following features:

- 2003 AADT, inclusive of cars and heavy vehicles on the roadway;
- 50km/h car and heavy vehicle road speeds;

- dense grade asphalt pavement surface;
- road chainage and x,y,z coordinates of traffic lanes and topographic features imported from electronic data (DXF format) provided by the RTA;
- receptor x,y,z grid coordinates 'meshed' to topographic ground contours;
- source heights of 0.5 meters, 1.5 meters and 3.6 meters used for cars, heavy vehicles and heavy vehicle exhausts respectively;
- intervening ground cover (ie. hard or soft ground);
- attenuation from roadside or topographic barriers;
- reflections from roadside barriers (existing bridge only);
- corrections for roadway gradients;
- corrections for air absorption; and
- 2.5dB correction for facade effects.

Calculations performed by the noise model include $L_{Aeq\ (1,\ 9,\ 15,\ 24\ Hour)}$ and L_{Amax} for each receptor point. Noise contours are generated by triangulation with linear interpolation between modelled receptor grid points. To enable direct comparison between the three bridge Options, all calculated noise levels assume 2003 traffic volumes.

To calibrate the noise model, comparisons were made between predicted and attended measured noise emissions from the existing Clarence River Bridge. Comparison indicated good correlation between the results, typically within 1-2 dB at various 'line of sight' distances from the existing bridge up to 100 metres. It should be noted that the provided noise contours are inclusive of topographic (ground) contours only, barrier effects from building structures have not been modelled.

2.4.2 *Modelled Scenarios*

The following scenarios were modelled as part of this noise assessment:

1. Existing traffic conditions - one traffic lane north and southbound on the existing bridge;
2. Option 1 – one traffic lane north and southbound on the new bridge in conjunction with one traffic lane north and southbound on the existing bridge;
3. Option 2A (upstream) – two traffic lanes northbound on the new bridge in conjunction with two traffic lanes southbound on the existing bridge;

4. Option 2A (upstream) – two traffic lanes north and southbound on the new bridge with no traffic on the existing bridge;

5. Option 2B (downstream) – two traffic lanes southbound on the new bridge in conjunction with two traffic lanes northbound on the existing bridge;

6. Option 2B (downstream) – two traffic lanes southbound and one traffic lane northbound on the new bridge in conjunction with one traffic lane northbound on the existing bridge. This scenario was modelled using revised ground contours and only $L_{Aeq,15\ hr}$ and $L_{Aeq,9\ hr}$ results are provided; and

7. Option 2B (downstream) – two traffic lanes north and southbound on the new bridge with no traffic on the existing bridge.

2.4.3 Modelled Traffic Parameters

Table 2.15 provides the modelled AADT breakdown for the existing bridge and the new bridge Options 2A and 2B.

Table 2.15 Modelled Existing, Option 2A and 2B Traffic Volumes

Vehicle Class	Existing, Option 2A / 2B Traffic vpd (%)
Cars	23588 (94.4)
Buses	258 (1.0)
Light Commercial	800 (3.2)
Heavy Commercial	354 (1.4)
AADT TOTAL	**25000 (100)**

Note: vpd = vehicles per day.

Table 2.16 provides the modelled AADT breakdown for the existing bridge combined with the new bridge Option 1.

Table 2.16 Modelled Option 1 Traffic Volumes

Vehicle Class	Option 1 Traffic vpd (%)	Existing Bridge Traffic vpd (%)
Cars	10031 (93.5)	13557 (95.0)
Buses	143 (1.3)	115 (0.8)
Light Commercial	344 (3.2)	456 (3.2)
Heavy Commercial	212 (2.0)	142 (1.0)
AADT TOTAL	**10730 (100.0)**	**14270 (100.0)**

Note: vpd = vehicles per day.

2.4.4 *Predicted Results*

The predicted traffic noise results are produced as colour contours for each of the traffic scenarios (1 – 7), namely in:

- Annex A: $L_{Aeq\ (15\ Hour)}$ (daytime)
- Annex B: $L_{Aeq\ (9\ Hour)}$ (night)
- Annex C: $L_{Aeq\ (24\ Hour)}$
- Annex D: $L_{Aeq\ (1\ Hour)}$
- Annex E: L_{Amax}

2.4.5 *Summary of Results*

Presented below is a brief summary of the results for each Option and corresponding traffic lane scenarios.

Option 1

Option 1 significantly impacts sensitive land use, that is a school and place of worship, located either side of Villiers Street as well as residents on Abbot Street, all of which are not currently affected by significant traffic noise. Stringent DEC criteria for sensitive land use would significantly increase the difficulty for compliance through the implementation of feasible, cost effective noise mitigation measures.

Option 1 would generate noise levels that would exceed the recommended DEC traffic noise criteria, in some cases by 5-10dB(A), which would significantly impact upon the existing quiet local streets, with mandatory mitigation options likely to be intrusive to the area.

The implementation of this Option would marginally decrease traffic noise levels at the existing bridge, although the change is not likely to be perceptible for most receptors.

Option 2A

Option 2A (upstream) provides negligible impact when operated in conjunction with the existing bridge as a split two-lane configuration (2 lanes on each bridge). This is primarily because the existing traffic volume would be split equally over two bridges combined with the increased noise shielding of both bridges being side by side.

With the new bridge operating in four-lane configuration (therefore no traffic on the existing bridge) a perceptible noise increase to some upstream and reduction to some downstream receptors would result. The change in received noise levels would be in the order of negligible to five decibels depending upon receptor location. This is because of individual receptor to traffic distance changes and the level of noise shielding provided by either bridge.

In practice however, most residents up and downstream of the bridges are not likely to notice a significant change in traffic noise levels for either lane scenario. This is because the total traffic volume crossing the Clarence River would be the same as the existing bridge.

The recommended DEC day and night traffic noise criteria for the majority of residential receptors exposed to traffic noise, as a result of changes to the existing river crossing with Option 2A, would be met.

Option 2B

Option 2B (downstream) provides negligible impact when operated in conjunction with the existing bridge as a split two-lane configuration (ie. 2 lanes on each bridge). This is primarily because the existing traffic volume would be split equally over two bridges combined with the increased noise shielding of both bridges being side by side.

With the new bridge operating in three-lane configuration (ie. two lanes southbound and one lane northbound on the new bridge and one lane northbound on the existing bridge) a perceptible noise increase to some downstream and reduction to some upstream receptors would result. The change in received noise levels would be in the order of negligible up to five decibels depending upon receptor location.

The results for the new bridge operating in four-lane configuration (no traffic on the existing bridge) are similar to the three-lane configuration. The change in received noise levels would also be in the order of negligible up to five decibels depending upon receptor location. For both the three and four lane scenarios, the change in received noise level is due to individual receptor to traffic distance changes and the level of noise shielding provided by either bridge.

In practice however, most residents up and downstream of the bridges are not likely to notice a significant change in traffic noise levels for either lane scenario. This is because the total traffic volume crossing the Clarence River would be the same as the existing bridge.

The recommended DEC day and night traffic noise criteria for the majority of residential receptors exposed to traffic noise, as a result of changes to the existing river crossing with Option 2B, would be met.

3 CONCLUSION

In summary, either Option 2A or 2B (upstream or downstream) provide negligible impact when operated in conjunction with the existing bridge as a split two-lane configuration. As the traffic lanes move from the existing bridge to either of the new Option 2A or 2B bridges, traffic noise is marginally increased for those receptors closest to the majority of traffic volume.

Most Grafton residents affected by traffic noise from the existing bridge are not likely to perceive a noticeable change in received noise levels from either Option 2A or 2B. However, some residents very near to the existing bridge (not acquired by the RTA) may experience a noticeable reduction or increase in received noise levels depending upon the alignment Option being nearer or further away combined with the level of shielding provided by either bridge.

Option 1 impacts sensitive land use in Villiers Street, as well as residents on Abbot Street, all of which are exposed to minimal existing traffic noise. Option 1 would generate noise levels that would significantly impact upon the existing quiet local streets, with mandatory mitigation options likely to be intrusive to the area.

In conclusion, Option 1 represents a significant noise impact to all affected receptors, while Options 2A or 2B provide minimal impact in comparison to the existing bridge crossing.

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