

Roads and Traffic Authority



MR 535 – Liverpool and Fairfield Councils Proposed Reconstruction and Widening of Elizabeth Drive between Cabramatta Road (at Bonnyrigg) and Wallgrove Road (at Cecil Park) – Addendum for Section from Windsor Road to Wallgrove Road, Cecil Hills

Review of Environmental Factors



Macoun Environmental Consulting

**Proposed Upgrading of Elizabeth Drive between Cabramatta Road (at Bonnyrigg) and
Wallgrove Road (at Cecil Park) –
Addendum for Section from Windsor Road to Wallgrove Road, Cecil Hills**

Review of Environmental Factors

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Prepared for:
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September 2002

Job No: 02/10 File: rta/ed/doc.	Date: 18 September 02 Rev.No 4	Principal: Tim Macoun QA: David Ledlin, RTA
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Cover Photo View looking east along Elizabeth Drive from approximate Distance 5000

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Section A – Preliminaries

1. INTRODUCTION

In 1995 the Roads and Traffic Authority (RTA) proposed the construction of improvement works to Elizabeth Drive between Cabramatta Road, Bonnyrigg and Wallgrove Road, Cecil Park.

A Review of Environmental Factors was prepared in March 1996 (*Review of Environmental Factors, Main Road 535, Proposed Upgrading of Elizabeth Drive between Cabramatta Road, Bonnyrigg and Wallgrove Road, Cecil Park, McKenzie Land Planning*) and the project was approved to proceed to construction in April 1996.

The proposed upgrade was to include (inter alia), the following works:

- *Construction of two lanes in each direction with facilities for pedestrians and cyclists.*
- *Upgrading of some six intersections with Elizabeth Drive.*
- *Landscaping and tree planting in the median and roadside verge.*
- *Noise attenuation walls along critical sections of the road.*

The construction of the proposed link was to be funded by the RTA.

The reconstruction of the eastern half of this section of Elizabeth Drive (Cabramatta Road to Cowpasture Road) was constructed over the period 1996 to 2000. The western half between Cowpasture Road and Wallgrove Road was to be constructed as a stage 2, subject to funding.

The first part of the western section, immediately west of the Cowpasture Road intersection through to the Windsor Road intersection, was the subject of an Addendum REF in May 2002 (Macoun Environmental Consulting). It was approved for construction in June 2002. This work is to be carried out in conjunction with the upgrading of the intersection with Cowpasture Road and the upgrading of the section of Cowpasture Road south of Elizabeth Drive through to North Liverpool Road. These works are scheduled for completion in 2004.

The final section to complete the upgrading of Elizabeth Drive from Bonnyrigg to Cecil Park, is the subject of this Addendum REF. It is the 1700 metre section between the existing roundabout intersections with Windsor Road and Wallgrove Road.

It is proposed that it be funded and constructed as a connecting link to the Western Sydney Orbital (WSO), a tollway of four lanes (two lanes in each direction) extending from the Hume Highway/M5 Motorway at Prestons north to the M2 at West Baulkham Hills. The Motorway will be a Build-Own-Operate-Transfer (BOOT) scheme whereby a consortium will be engaged to fund its construction, operation and maintenance (including detail design), for a period of approximately 30 years before it is transferred back to the State.

This REF is an addendum to the 1996 REF, identifying and assessing changes to the original proposal, in terms of justification, road design, funding, etc, and updating the environmental impact assessment (in terms of legislative changes and changes to the site environment).

2. PROPOSAL IDENTIFICATION

Name of Proposal:	Reconstruction and widening of Elizabeth Drive from a new intersection with Windsor Road through to the existing intersection with Wallgrove Road, Cecil Park.
RTA Directorate:	Client Services
Local Government Area:	Liverpool City Council and Fairfield City Council
Construction Program:	2002 – 2006
Estimated Construction Cost:	\$20 million

3. PROPOSAL DESCRIPTION

The proposal is the upgrade (reconstruction and widening) of Elizabeth Drive from the existing intersection with Windsor Road through to the existing intersection with Wallgrove Road, a distance of approximately 1700 metres. It should be noted that the western end of this work is the interchange between the WSO and Elizabeth Drive. An Environmental Impact Statement for the WSO was released in January 2001 and the Minister for Planning approved the project subject to conditions in February 2002. Hence work at the western end has received separate environmental approval.

The description set out in this section is based on the amended concept design developed by the RTA Design Group. The Concept Design provides details of the horizontal alignment and standard cross sectional detail.

Final detailed design will be the responsibility of the WSO consortium. Final design must take into account environmental constraints and mitigative measures identified in this Addendum REF.

3.1 Location

The proposed works are located partly in Fairfield and partly in Liverpool Council areas, in the suburb of Cecil Hills. (The local government boundary west of Cowpasture Road is located along the centre of the Elizabeth Drive road reserve.)

The upgrade section has a length of approximately 1700 metres, from distance 3900m to distance 5600m approximately, on the original 1996 Concept Design distances – see Section 3.2.

3.2 Features of the Proposal

Elizabeth Drive has been upgraded through to Cowpasture Road to two lanes each way (plus turning lanes) with provision made for the construction of a further lane in each direction at a latter stage, through widening into the median.

The original concept design, incorporating the general design standards, carriageway cross sectional design, drainage standards, signposting, provisions for bicycles/pedestrians and bus provisions, are set out in Section 3.2 of the 1996 REF. They still generally apply to this modified proposal.

The changes that are proposed are relatively minor and have come about predominantly as a result of changes since 1996 in 'design detail' now followed by the RTA.

The proposed upgrade still involves the reconstruction and widening of an existing 2 lane undivided road to a 4 lane divided road of 2 carriageways, each of 2 lanes. The proposed upgrade is also still within the existing road reserve. (The road reservation along this section of Elizabeth Drive varies from 38.4 to 46.4 metres.)

The changes from the 1996 development concept are summarised below:

- Median width reduced to 6m (12m average width in original design), probably as a raised median in lieu of a depressed median. This is to ensure the work does not intrude into areas of landscaping on the southern (residential) side of Elizabeth Drive in view of the wider cycleway proposed (see below);
- A combined pedestrian path/off-road cycleway on the southern side of the corridor. The path would be 4 metres wide and would have a concrete surface. It would connect with the proposed off-road cycleway on Cowpasture Road and the WSO Motorway. The original proposal was for a 1.5m wide cycleway; and
- Deletion of an entrance/exit to the Western Sydney Regional Park at the Windsor Road roundabout.

The diagram on the following page, entitled **Western Sydney Orbital - Amended Concept Design** shows the plan alignment of the amended concept design superimposed on a 1:5000 aerial photograph of the site. The diagram also contains typical cut and fill cross sections for the amended design.

Section 13, Appendices contains Sheets 15 to 21 providing the Plan and Longitudinal Section drawings for this amended design.

The proposed new dual carriageway road would be contained within the existing road reservation and not encroach into private property or impact on existing fencing and landscaping along the southern boundary of Elizabeth Drive.

The new westbound carriageway to be built on the southern side of the existing road reservation is generally clear of the existing road and the majority can be built without disruption to the existing traffic. It could be built clear of the existing carriageway and then traffic transferred/switched to the new carriageway while the existing carriageway is reconstructed.

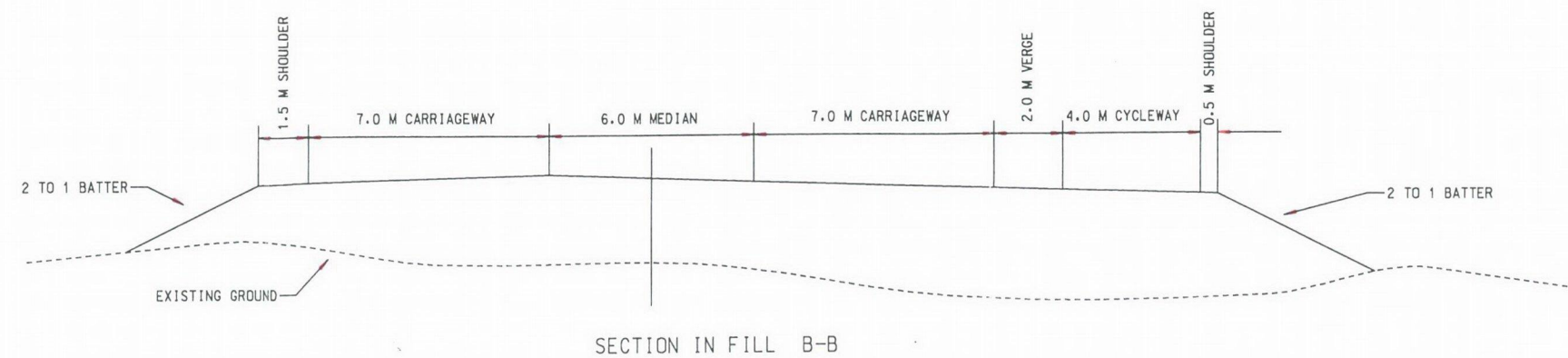
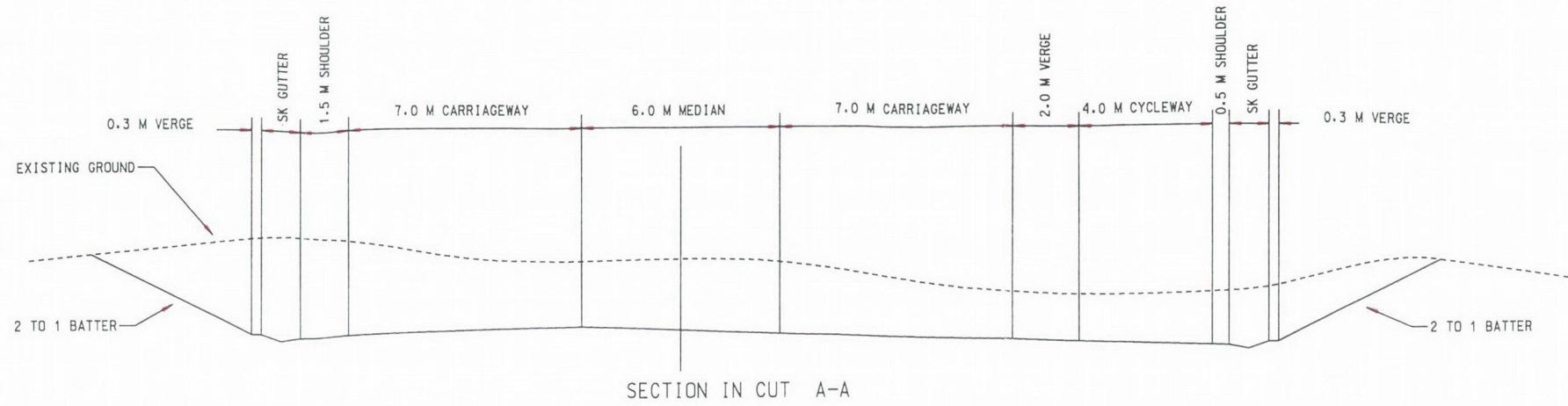
There is likely to be a barrier kerb on the left-hand side of the westbound carriageway to delineate the footway/cycleway area from the through carriageway

The other change proposed is at the roundabout at the Elizabeth Drive/Windsor Road intersection. The National Parks and Wildlife Service has advised that it is not proposing a major access to the Western Sydney Regional Park at the Windsor Road roundabout. Hence the current T-junction and roundabout may remain for some time. This is contrary to the original proposal that was for an upgrading of this intersection to a signalised 4-way intersection.

Conditions at the roundabout would be monitored and if conditions deteriorate then consideration would be given to its replacement with traffic control signals.

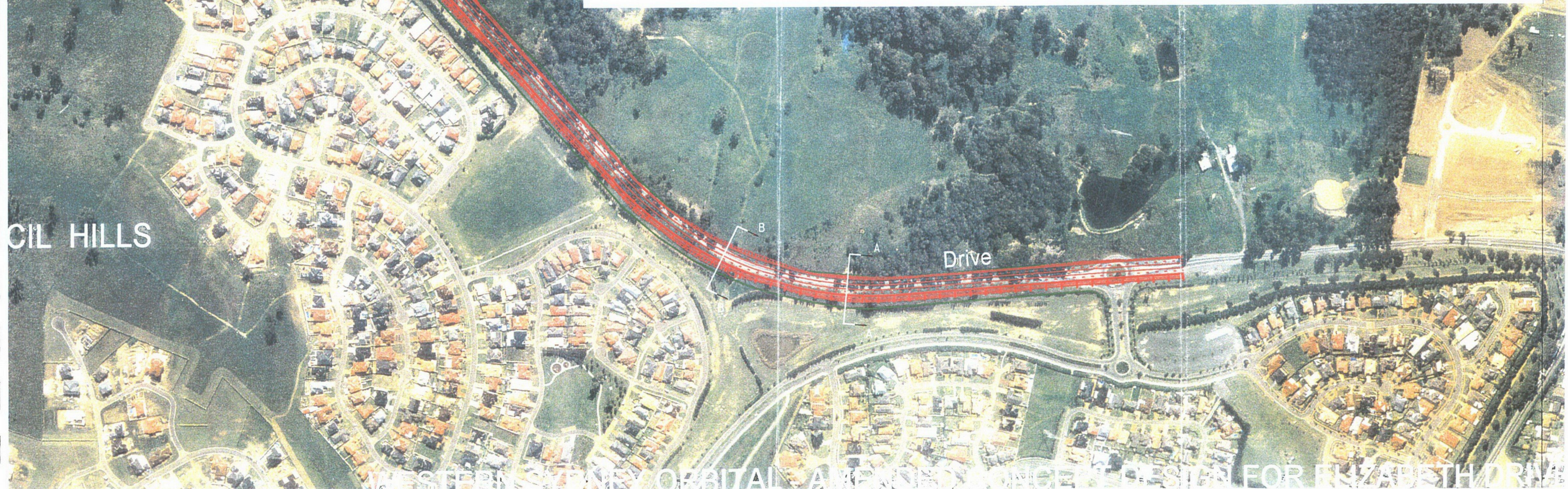
The northern road corridor boundary would be fenced after consultation with the Service.

The southern road corridor boundary is already fenced. A 'setback' of between 5m and 7m will exist between the edge of the road batter and the fenced boundary. It is proposed that this area would be extensively landscaped to maintain the open space character of this area and to compensate for the loss of the local woodland association in constructing the road.



TYPICAL CROSS SECTIONS

(NOT TO SCALE)



Other general design standards including drainage, sign posting, lighting, bus bays, etc are described in Section 3.2 of the 1996 REF.

3.3 Costs

A preliminary estimate for the cost of construction is \$20 million, or approximately \$11 700 per metre. This does not include the cost of the WSO interchange with Elizabeth Drive.

3.4 Timing

The award of the BOOT contract for the WSO is scheduled for later in 2002. Construction would then commence in late 2002 with the requirement for the full length of the Orbital to be open to traffic by 2006. Associated works such as this final section of the Elizabeth Drive Upgrade would be constructed during this period. The successful consortium in consultation with the RTA would decide the scheduling for specific works.

4. STATUTORY POSITION

4.1 Zoning of the proposed activity

The road reservation for Elizabeth Drive west of Windsor Road is located in the Fairfield City Council LGA for the northern half of the reservation and in Liverpool City Council's LGA for the southern half. Within Fairfield City Council's area the road is zoned 5(b) Special Uses – Arterial Road and Arterial Road Widening, under the provisions of Fairfield LEP 1994. (This has not changed.)

The southern half of the reservation within the Liverpool City Council LGA was zoned 9(a) Arterial Road Reservation, under LEP 108, at the time of the 1996 REF. Council, at the time, was in the process of preparing a consolidating LEP. This LEP has now been gazetted and is the Liverpool LEP 1997. Under the LEP the zoning is now 5(c) Special Uses (Arterial Road).

Roads are permitted with consent under the provisions of both LEPs. However, SEPP 4, *Development without Consent*, Clause 11C(2) provides an exemption for the RTA from the need to obtain development consent.

Zoning of land to the north of the road reservation was at the time of the 1996 REF, zoned 6(c) Recreation – Corridor. In 2001 this land became subject to Sydney Regional Environmental Plan No. 31 Sydney Parklands (gazetted in June 2001) which repealed the Fairfield LEP 1994 over this area.

Land to the south of the road reservation is zoned 6(a) Recreation Public and 6(c) Recreation Corridor, providing a buffer to the 2(a) Residential land.

All of the proposed road and drainage works would be entirely within the existing road reservation.

4.2 Other statutory matters

The provisions of SEPP No.4, *Development without Consent* enables the RTA to construct any component of the proposed works within the road reserve without the need for Council's consent.

SEPP No. 19, *Bushland in Urban Areas* applies also. However as the upgrading is within an existing regional road corridor the works are exempt.

SEPP No. 14, *Koala Habitat Protection*, lists the Liverpool and Fairfield LGAs under Schedule 1, as areas where the SEPP applies. The application of the SEPP is assessed in Section 8.3.6, Flora and Fauna.

There are no other provisions of other State Environmental Planning Policies that directly apply to the proposed works.

Sydney Regional Environmental Plan No. 31 Regional Parklands, provides for the Western Sydney Regional Parklands. SREP No. 31 does not directly affect the proposal.

Potentially relevant new or amended legislation/regulation that has been gazetted since 1996 is as follows:

- *NSW Water Management Act, 2000*
- *NSW Environmental Planning and Assessment Regulation, 2000*
- *NSW Protection of the Environment Operations Act, 1997*
- *NSW Contaminated Land Management Act, 1997*
- *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999*

There have also been State Environmental Planning Policies and Sydney Regional Environmental Plans that have been gazetted in this period but apart from those already discussed, none have relevance to the proposal or the land adjacent to the proposal.

The new or amended legislation that has relevance to the proposal is:

- *NSW Environmental Planning and Assessment Regulation, 2000* – The 1994 Regulation was updated with a new regulation gazetted in 2000. Although the changes to the Regulation are significant there are no changes that specifically change the form or content of this assessment
- *NSW Protection of the Environment Operations Act, 1997*, - An Environment Protection Licence is required from the EPA for construction of a freeway or tollway (dual carriageway of four or more lanes), if there is greater than 1km between access points. The proposed upgrade section of Elizabeth Drive is not a freeway or tollway but is classified as a main road connecting to a proposed freeway. This matter is still to be clarified.
- *Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act* – All RTA environmental impact assessments have now to consider the implications of the Commonwealth Act. The requirements are set out in Appendix N of the RTA's *Environmental Impact Assessment Policy Guidelines Procedures, Version 4, (April 2001)*. There is a requirement to assess whether there is likely to be a significant impact on a matter of national environmental significance and/or a significant impact on Commonwealth land. An assessment of significance under the EPBC Act is included in this addendum.

There are no other changes necessary to the assessment as a result of any changes to legislation since March 1996.

4.3 Confirmation of Part 5 position

The proposed upgrade is permissible with consent under the provisions of the local environmental planning instruments.

Under SEPP 4, *Development without Consent*, Clause 11C(2) provides an exemption from the need to obtain development consent.

The RTA is the proponent, and in accordance with the RTA's *Environmental Impact Assessment – Policy Guidelines Procedures Manual*, a REF is required to be prepared in accordance with Section 112 of the *EP&A Act*.

A REF was prepared for the original concept design in 1996 (to a Proforma 2 standard). This Addendum REF has been prepared to address the changes and modifications that have occurred to the design and to relevant planning legislation and planning instruments since 1996. The Addendum REF has also been prepared to a Proforma 2 standard.

5. SPECIALIST STUDIES AND COMMUNITY INVOLVEMENT

5.1 Specialist Studies

Six specialist studies were carried out for the original REF – strategic route analysis (RTA), traffic assessment (RTA), economic appraisal (SKM), flora and fauna (Lesryk), landscape (RTA), air quality (Holmes), noise (Koikas) and stormwater (Bewsher). In addition a value management study that involved stakeholders and community representatives was also undertaken.

The key conclusions arising from these original studies that had some relevance to this section of the project were:

1. *'The proposed road upgrade is in a residential area where pedestrian and cycle movement is of major importance;*
2. *Recent residential development west of Cowpasture Road has taken into account future traffic noise along Elizabeth Drive and setbacks and noise mounding have been incorporated into the design to the residential estate (Cecil Hills). No (additional) noise attenuation measures are proposed along this section of road. Open grade asphalt may be used in some locations in order to achieve the noise level objective;*
3. *No endangered fauna were identified in the road corridor however endangered fauna is known in the broader area;*
4. *No vegetation of national conservation significance would be affected by the road construction, however, where mature trees adjacent to native vegetation stands are removed, the potential edge effects should be minimised by planting a buffer of shrub species;*
5. *The proposal would not constitute a significant impact on any threatened species, populations or ecological communities or their habitats in the vicinity of the site.*
6. *Creek lines should be rehabilitated after culverts have been installed to minimise weed infestation and improve the resources for aquatic fauna'.(Emphasis added)*

These conclusions are still largely relevant.

For the purposes of this addendum to verify the conclusions of the original REF, three additional specialist studies have been prepared:

- Flora and Fauna Assessment (Lesryk Environmental Consultants, June 2002);
- Traffic Noise assessment (Koikas Acoustics Pty Ltd, June 2002); and
- Heritage Assessment (Helen Brayshaw Heritage Consultants Pty Ltd and Casey & Lowe Associates, June 2002).

The findings of these assessments are presented in Section 8, Detailed Assessment Stage and the full reports are contained in Section 13, Appendices.

5.2 Community Involvement

An extensive community consultation program was undertaken for the preparation of the 1996 REF. A total of 235 individual submissions were received and a number of changes to the design were made as a result of the feedback.

It is not proposed to review that program as it covered the complete upgrading from Cabramatta Road to Wallgrove Road and took into account the concerns of residents along all of the route. Issues that relate specifically to the proposed upgrading are addressed in Section 8, Detailed Assessment Stage.

Prior to construction commencing, further consultation with both Councils and local residents would be undertaken by the WSO Consortium or its contractor.

Section B – Environmental impact assessment

6. STRATEGIC STAGE

6.1 Planning and Environmental Background

The 1996 REF identified the proposed upgrading of Elizabeth Drive from Cabramatta Road to Cowpasture Road and subsequently to Wallgrove Road as providing a high standard road link between these important regional roads. The recent approval to the Western Sydney Orbital allows for the completion of the original transport strategy.

The proposed upgrading of Elizabeth Drive will serve both residential and commercial users and provide a link from the residential and commercial areas of Liverpool and Fairfield to other parts of the transport system.

6.2 Strategic Justification and Needs Definition

The 1996 REF noted that:

- *'The corridor for upgrading Elizabeth Drive has been incorporated in planning schemes of Fairfield and Liverpool Councils for a number of years.'*
- *'Elizabeth Drive has been upgraded over time as traffic demand has warranted. It is logical to continue to provide a satisfactory level of service to road users by expanding the "next section of Elizabeth Drive".'*

The justification at that time was:

'In addition to the local requirements for upgrading Elizabeth Drive, the regional function of the arterial road to provide a connection to the Western Sydney Orbital (WSO) and the Sydney West Airport, requires that the standard of road be improved.'

Despite the indefinite postponement of the Sydney West Airport the justification for an upgraded east-west link to connect Liverpool and Fairfield with the WSO still remains.

The WSO, scheduled to open to traffic in 2006, is expected to result in a reduction of traffic on the section of Elizabeth Drive east of the WSO – through to Cowpasture Road. This is as a result of traffic switching from the Cowpasture Road/Elizabeth Drive/Wallgrove Road route to the WSO route.

Measured 1999 traffic volumes on Elizabeth Drive just east of Wallgrove Road were about 23,700 vpd (vehicles per day). This was up on the 1996 volume of 19,755 vpd. Volumes on this section of Elizabeth Drive had remained around these figure for many years - (1985 volumes were 20,872 vpd, 1991 volumes were 21,890 vpd).

The WSO EIS (Department of Transport and Regional Services and RTA, October 2000) indicated that morning peak hour volumes on Elizabeth Drive east of Wallgrove Road (the WSO crosses Elizabeth Drive just east of Wallgrove Road) without the WSO being built are predicted to steadily rise - Year 1997: 2201 vph (two way); Year 2006: 2438 vph; Year 2016:

2583 vph. With the provision of the WSO morning peak hour volumes in 2006 fall to 1688 vph and in 2016 volumes are predicted to be 1695 vph.

So predicted volumes in 2016 would be lower than 1997 volumes.

Based on traffic modelling undertaken for the RTA, in Year 2016 without the WSO, daily volumes would have been over 30,000 vehicles per day. With the WSO volumes would be around 20,000 vpd. Morning peak hour volumes would drop from around 2660 vph to around 1,600 vph. Both predictive analyses have similar trends and impacts.

One of the key points of justification in the 1996 REF was to *“improve safety and flows for through vehicular traffic”*.

Having a divided carriageway means a safer road, that is no need to overtake against on-coming traffic. Heavy vehicles can delay westbound light vehicle traffic on the steep upgrade to Wallgrove Road and as duplication means another lane for westbound traffic then this would allow for safe overtaking. Eastbound is less of a problem but eastbound peak hour volumes in 2016 would be over 1,000 vph. Some delays could be expected and overtaking would be difficult given the opposing volume of over 500 vph. A second lane would ensure that delays are minimised and safety is enhanced.

Hence the justification for reasons of level of service and traffic growth are diminished due to the provision of the WSO. The justification is in terms of serving local requirements and traffic safety. These matters are discussed further in Section 7.

7. CONCEPT STAGE

7.1 Objectives

The strategic regional objectives and the specific objectives of the proposal remain unchanged.

7.2 Options

Four options were originally considered in relation to the proposed upgrade. They were:

- *'Do nothing and leave the existing road to continue to function.*
- *Upgrade the road to its ultimate capacity of six lanes.*
- *Stage the upgrade and build four lanes now.*
- *As above, but build the four lanes on the outside of the reservation and leave a wide median footage for additional lanes.'*

The selected option was the fourth one and that has been followed in the major section constructed to date, through to Cowpasture Road.

7.3 Selection of the Proposed Concept

The original considerations in the 1996 REF for the proposed upgrading and the justification for the modified concept are addressed below.

1) Biophysical context

In respect to biophysical issues:

- *'The environment of the road corridor reservation has generally been disturbed by past land use activities, however there are sections of the corridor which still retain isolated remnants of mature vegetation.*
- *No significant wildlife corridors or habitat areas occur in the road corridor area although there are some areas of mature tree-vegetation which fringes more extensive stands on adjoining properties... The proposal would not constitute a significant impact on any threatened or endangered species, populations or ecological communities or their habitats in the vicinity of the site.*
- *The elimination of traffic congestion, improved travel conditions and higher number of vehicles using the road is not likely to cause an exceedance in air quality goals for the area.'*

It was concluded that the construction of the upgraded road in the proposed location was considered to have overall minimal adverse impact on the biophysical environment of the area and some positive benefits would result.

2) Social/community context

The main community/social concerns arising from the original proposal were:

- o *'Increased traffic noise for residents along the proposed route.*
- o *More traffic congestion particularly along Cowpasture Road.*
- o *Light spillage from relocation and addition of street lighting.*
- o *Visual impact and vandalism/graffiti.*
- o *Pedestrian and cycle facilities.*
- o *North south access from residential areas across Elizabeth Drive.*
- o *Access from Cecil Park onto Elizabeth Drive.*
- o *Air quality.'*

The major issues were the increased traffic noise for residents along the proposed route and the greater traffic congestion that was predicted on associated roads, particularly Cowpasture Road.

The response to increased traffic noise was as follows:

There would be greater traffic noise generated by more traffic travelling along Elizabeth Drive. (However,) no noise attenuation measures are proposed west of Cowpasture Road as this has been attended to in the development of the Cecil Hills residential area.

It is noted that extensive traffic noise attenuation measures were incorporated into the design of the Cecil Hills estate. Further, future traffic levels are now forecast to be less than was originally predicted. However the upgrading would bring traffic closer to residential areas. A noise assessment has been carried out for the purposes of this Addendum REF and the report is contained in Section 13, Appendices and addressed in Section 8.3.2.

In regard to the forecast traffic congestion particularly along Cowpasture Road, the comments were:

'One of the main functions of the upgraded section of Elizabeth Drive is to cater for additional traffic volumes expected to be generated by the continuing urban development in the Liverpool and Fairfield urban release areas and attraction of traffic to the Sydney West Airport and related businesses which may develop in the area. The upgraded road with provision for future lanes for additional traffic and mass transit systems will enable that traffic growth to be handled more efficiently than at present. It is also recognised by the RTA that there is considerable congestion along Cowpasture Road. While this road is not directly the responsibility of the RTA, the State/Commonwealth Governments have allocated some funds for Council to undertake some improvement works along Cowpasture Road.'

The RTA has now been given responsibility for the upgrading of Cowpasture Road. (Cowpasture Road has been reclassified as a State Road, MR 648). As a result works have been undertaken and further works are proposed to upgrade and increase the capacity of Cowpasture Road.

In respect to social and community issues it was concluded:

'The anticipated benefits of the proposal relate to improved travel times and access to residential areas and businesses, reduced accidents and improved safety for vehicles, pedestrians and cyclists. Additionally, it creates an improved major access to SWA and the Sydney West Orbital road system. The upgraded road would also provide improved cross regional and local public transport by providing for bus movements and designated pick up/set down areas.'

The needs justification has therefore changed somewhat by the upgrading of Cowpasture Road and the elimination of SWA, at least for the foreseeable future. However the improved safety, improved access to SWO (now the WSO) and the local requirements still remain.

3) Economic context

The benefit cost analysis of the original assessment was based on a ratio value of 1.76, well above the minimum of 1 prescribed by NSW Treasury. In addition the analysis did not include a number of external and environmental factors, or the perceived impacts on local businesses.

Justification of Modified Concept

It was concluded in the 1996 REF that in respect to the biophysical context, the social and community context and the economic context that the preferred option for the upgrading of Elizabeth Drive from Cabramatta Road to Wallgrove Road could be justified.

Whilst most of the reasons for the justification of the original concept remain unchanged, changes in future regional developments and other changes related to safety for pedestrians and cyclists have resulted in the changes that are now proposed. The justifications for these changes are:

- The completion of the upgrading program for Elizabeth Drive is justified in regional planning terms. It will provide a uniform standard of road from Bringelly to the WSO with the provision for a third lane in each direction where necessary and climbing lanes now where traffic capacity is adequate.
- The upgrading of Cowpasture Road, the indefinite postponement of the Sydney West Airport and the future diversion of traffic to the WSO will result in lesser traffic levels than were originally predicted. Accordingly the reduction in the median width from 12m to 6m is proposed.
- An entrance/exit to the Western Sydney Regional Park at the Windsor Road roundabout is not required at this time. Upgrading of the intersection from roundabout to signalised is therefore not proposed at this time.
- The provision of a wider cycleway/footpath is the result of safety and general policy changes in the provision of these ancillary facilities. Off-road bicycle facilities are preferred to on-road facilities (shoulders or wider kerbside lanes) on safety grounds, particular where inexperienced cyclists could use the facility.

8. DETAILED ASSESSMENT STAGE

8.1 Design considerations

The completion of the final section of the proposed upgrade of Elizabeth Drive would result in a dual carriageway standard arterial road between Bonnyrigg and the Western Sydney Orbital, at Cecil Park.

The road has a design speed of 80kph and would have a 70kph sign posted speed limit. There would be two lanes in each direction.

Provision for pedestrians, cyclists and buses have been an important part of the upgrade. Direct property access for vehicles has been limited and access is generally only possible at designated intersections. Most intersections are signalised. Extensive landscaping is another feature of the upgrade.

Construction to date of 3.9km of the 5.6km total upgrade has been successfully completed.

8.2 Description of site and surroundings

There has been no substantive change to the site or its surroundings since 1996. The land to the north is as it was in 1996, open space land identified for incorporation in the Western Sydney Regional Park. It has since been incorporated.

The residential development of Cecil Hills was occurring at the time of the 1996 REF. The estate was designed with only one entrance onto Elizabeth Drive, at Windsor Road. The roundabout has operated without significant congestion.

8.3 Environmental impacts

8.3.1 Introduction

This section addresses the changes to the environmental impacts as a result of the modified proposal.

There is no change from the 1996 REF assessment for:

- Visual and landscape (see Section 7.3.5)
- Road drainage and stormwater management (see Section 7.3.7)
- Adjacent land uses (see Section 7.3.8 and above comments)
- Relocation of transmission lines (see Section 7.3.9)

Aspects that have been reassessed are:

- Traffic (see Section 7.3.1 of 1996 REF)
- Noise and Vibration (see Section 7.3.2 of 1996 REF)
- Water quality and sediment control (see Section 7.3.3 of 1996 REF)
- Air quality (see Section 7.3.4 of 1996 REF)
- Flora and fauna (see Section 7.3.6 of 1996 REF)

In addition indigenous and non-indigenous heritage aspects have been assessed.

8.3.2 Traffic

Section 6.2 discussed the likely reduction in traffic volumes as a result of the construction of the WSO. Expected to open to traffic in 2006 it is predicted to result in a reduction of traffic on the section of Elizabeth Drive east of the WSO to Cowpasture Road. This is as a result of traffic switching from the Cowpasture Road/Elizabeth Drive/Wallgrove Road route to the WSO route.

Notwithstanding the reduction in forecast traffic levels some delays during peak hour flows can occur particularly for road users wishing to enter Elizabeth Drive from adjoining residential areas. In addition heavy vehicle traffic on the sections of Elizabeth Drive that have not been upgraded can cause delays to non truck traffic.

8.3.3 Noise and Vibration

The noise assessment for the 1996 REF (Koikas Acoustics Pty Limited) undertook traffic noise level measurements at eight sites adjacent to Elizabeth Drive. Taken over seven days at each location in September 1995, the data was used to carry out a noise assessment of potential traffic impacts on adjacent residences due to the proposed upgrading of Elizabeth Drive. Only one of the noise assessment locations was located west of Cowpasture Road.

The 1996 traffic noise assessment was based on the criteria set down in the RTA's *Interim Traffic Noise Guidelines*, which for residential areas required a base "daytime" objective of 60dB(A) and a "night time" objective of 55dB(A).

The assessment found that *"some traffic noise mitigation measures would be required"*. However in relation to the area west of Cowpasture Road the REF noted that:

- *'A detailed assessment was not undertaken as it is understood that it will be the developer's responsibility to protect the development from traffic noise. The RTA will not provide any noise attenuation measures between Cowpasture Road and Wallgrove Road on the Cecil Park side of the road upgrade*
- *The results of the predictions show that the RTA's Interim Noise Level objectives would not be met at the (only) monitoring location between Cowpasture and Windsor Roads'.*

A traffic noise assessment was undertaken for this REF (Koikas Acoustics, July 2002). That assessment is included in the REF in Section 13, Appendices.

The assessment was carried out in accordance with the

- Environment Protection Authority's *Environmental Criteria for Road Traffic Noise (ECRTN)*, May 1999,
- Roads and Traffic Authority's *Environmental Manuals Volume 2*,
- *Australian Standard 2702-1984, Acoustics – Methods of Measurement of Road Traffic Noise*, and
- RTA's *Environmental Noise Management Manual (ENMM)*, December 2001.

The ideal standard to be achieved for traffic noise for the type of roadworks proposed is, for day and night time situations:

- Daytime, 60dB(A) L_{eq} , 15 hours, taken between 07:00 and 22:00 hours, and
- Nighttime, 55dB(A) L_{eq} , 9 hours, taken between 22:00 and 07:00 hours.

If this is not achievable then provided the levels are less than:

- Daytime, 65dB(A) L_{eq} , 15 hours, taken between 07:00 and 22:00 hours, and
- Nighttime, 60dB(A) L_{eq} , 9 hours, taken between 22:00 and 07:00 hours,

and any increase is less than 2dB(A), then no traffic noise mitigation is required.

However if the existing levels are in excess of the higher levels, then irrespective of whether any change is predicted, traffic noise attenuation measures are required to the extent that is feasible and cost effective.

These criteria are similar to those used in the original noise assessment for the 1996 REF.

Existing traffic noise levels

Existing traffic noise levels were obtained from noise monitoring undertaken over a one week period at a location on the southern side of Elizabeth Drive at the front of No. 25 Balmoral Circuit, Cecil Hills. The daytime (seven day average) background traffic noise level was 61.8dB(A) and the night time figure (seven day average) was 59.9dB(A).

Additional short term monitoring of existing traffic noise was also undertaken at five other locations in the Cecil Hills residential area at locations closest to the Elizabeth Drive road reservation. At two of the other locations that was also at the front of the residence but at the remainder it was at the rear. The locations were:

- No. 19 Balmoral Circuit (front);

- No. 122 Lancaster Avenue (rear);
- No. 3 Albemarle Place (rear);
- No. 3 Burgundy Close (front), and
- No. 18B Isabel Close (rear).

The existing daytime levels at all of the above locations were higher than measured over the weekly period at 25 Balmoral Circuit, varying between 63.3dB(A) and 67.0dB(A). The levels generally increased the closer the residence was to the road with the residences in Isabel Close and Albermarle Place recording the highest levels.

Predicted traffic noise levels

Predicted traffic noise levels were then calculated using the traffic noise prediction model called the United Kingdom, Department of Transport, 1998 Calculation of Road Traffic Noise method. (CORTN)

Based on forecast average annual daily traffic (AADT) levels for the years 2006 (without the WSO) and 2016 (10 years after opening), predicted traffic noise levels were calculated for these six sites representative of residences closest to Elizabeth Drive.

The daytime results (in dB(A)) for locations 1 to 6 were

Existing/Predicted Traffic Noise Levels
of Existing Alignment (Year 2002)

62.0 63.0 63.5 66.0 64.5 66.0

Predicted Traffic Noise Levels of:

- Existing Alignment (Year 2006)

62.2 63.2 63.7 66.2 64.7 66.2

- New Alignment (Year 2006)

63.6 64.5 65.2 67.4 65.5 66.9

Predicted Traffic Noise Levels of
New Alignment (Year 2016)

62.5 63.9 65.0 66.4 64.9 67.0

The increases in noise levels predicted between the existing situation and 2016 are small, and range between 0.2dB(A) and 1.3dB(A) and average around 0.6dB(A). All increases predicted are well less than 2dB(A). This small level of additional noise impact is the result primarily of the predicted reduction in traffic levels on Elizabeth Drive with the opening of the WSO.

However the levels are of the order of 65dB(A) and three (3) of the locations are predicted to have daytime levels of 65dB(A) or above.

It was also noted that some of the residential properties affected are double storey dwellings. The traffic noise levels on the first floor would be higher as the view of traffic along Elizabeth Drive would be less shielded by the existing noise barriers or mounds compared to the ground floor level. It was estimated that the upstairs floor levels would be generally about 2dB(A) higher than the predicted or measured ground floor levels.

The most noise sensitive dwellings are located in Isabel Close and Burgundy Close/Albemarle Place in the very north-west corner of the estate. However including the three that were monitored there is only an additional 1 or 2 properties that would be similarly exposed. In Lancaster Avenue there are an additional 10 properties a similar distance from Elizabeth Drive but most are not double storey and all are slightly better located compared with No.122

It is recommended that noise mitigation measures be evaluated for these 10 or so properties that are predicted to be exposed to daytime noise levels greater than 65dB(A) or night time levels greater than 60dB(A). Increasing the height of the existing noise barriers is unlikely to be the solution. Mechanical ventilation would be the preferable alternative so as to allow windows to be kept closed in order to achieve the better noise amenity, particularly within the houses with upper floor levels. It is possible that many of these dwelling could have been fitted with some noise attenuation measures to the top floor level when they were constructed, as a condition of consent imposed by the Council.

So in summary, while the duplication will move the westbound traffic closer to the Cecil Hills residences, both AADT levels and heavy vehicle volumes are predicted to fall with the provision of the WSO.

Further noise impact assessment studies are recommended to assess the locations where additional noise attenuation is required and the form of the architectural modifications that would be the most cost effective.

Construction noise was not assessed in the recent traffic noise assessment. However in the 1995 assessment it was found that:

'The expected noise level for typical construction operations would generally be expected to meet the goals....When activities are closest to residential areas some impact would be expected, however the duration of the work is expected to be over a short period of time. Impacts can be further minimised if temporary barriers are used or noise attenuation barriers are in place prior to road construction activities commencing.'

The proposed mitigation measures contained in the original 1996 REF for noise control were:

- All equipment on site would have current certification of EPA noise compliance.
- Noise attenuation barriers would be constructed as part of the initial works to minimise construction noise impacts on nearby residences
- Noise attenuation measures as proposed would be undertaken and noise levels in Cecil Hills estate monitored to assess adequacy of attenuation measures provided by land developer.

The modified recommendations now become:

- Construction equipment would be maintained to meet EPA requirements;
- Further noise impact assessment studies would be carried out to assess the locations

where additional noise attenuation is required and the form of the architectural modifications that would be the most cost effective.;

- Construction noise would be limited to EPA requirements as far as practicable;
- Noisy construction plant and equipment (eg. use of jackhammers and vibrating rollers) would only be used during weekday time periods corresponding to the highest background noise levels from 7am to 6pm;
- For periods where noise activities are likely to take more than 4 weeks, temporary barriers would be erected as close as practicably possible to the earth moving plant prior to the earthwork commencing. Barriers would be at least 1m above the exhaust stack of such plant. Barriers should be constructed from solid materials capable of attenuating noise levels by 20dBA at 125 Hertz octave band frequency;
- Nearby residents would be warned in advance of noisy construction periods;
- The contractor would use the best available techniques not entailing excessive costs with the L10 (15 minutes) level measured at dwellings near Elizabeth Drive not to exceed 5dB(A) above background noise levels;
- Any additional permanent noise attenuation measures would be finalised in consultation with Liverpool City Council; and
- Traffic noise would be monitored within 1 year of commissioning of the proposal to determine whether any installed noise control measures are effective.

8.3.4 Air Quality

In the 1996 REF an air quality assessment was prepared by Nigel Holmes & Associates to assess the air quality impacts of the proposed reconstruction of Elizabeth Drive over the full length of 5.6km. The assessment monitored existing air quality in the vicinity of the route and predicted kerb side concentrations of the roadway air emissions.

The assessment was based on the use of a computer model to determine the dispersion of emissions and the predict ground level concentrations of the various exhaust compounds in the area close to the road. Predictions were made for levels of carbon monoxide, nitrogen dioxide, hydrocarbons and particulate matter for the years 2006 and 2011.

The predicted levels were then compared with the NSW Air Quality Goals to identify whether emission levels would be excessive or acceptable. The conclusions for projected traffic conditions for the years 2006 and 2011 were as follows:

- EPA's carbon monoxide 1 hour and 8 hour goals for any section of the route were not expected to be exceeded;
- The annual and 24 hour maximum air quality goals for particulates were not expected to be exceeded.

- The predicted concentration of nitrogen dioxide was not expected to exceed EPA goals at residences along the proposed upgrade route.

No exceedances of air quality goals were predicted at residential locations.

The current estimated peak hour traffic flows for the subject section of Elizabeth Drive were compared with the figures used in the study. For year 2006, vehicles per hour were reduced from 4,200 to 2,400 and for 2011 after the opening of the WSO, the predicted level from the 1996 study of 4,800 compared with the current prediction of less than 2,000.

By this comparison it can be seen that forecast levels of pollutants will be significantly less than the air quality goals.

However, Sydney's location topography and size favour the development of poor air quality under certain meteorological conditions. Continuing development particularly in the western part of the Sydney basin has the potential to have serious impacts on air quality and health throughout the region. In the Sydney region, motor vehicles are a major source of carbon monoxide, reactive organic compounds, oxides of nitrogen, particulate matter and air toxics such as benzene and diesel soot.

The RTA is implementing the *Plan for Reducing Vehicle Emissions* to help reduce greenhouse and other motor vehicle emissions and continues to engage in approaches to encourage the tightening of vehicle emission standards.

The 1996 air quality study also undertook a construction impact assessment in respect to air quality. The study indicated that the level of dust generation associated with road construction can under worse case meteorological conditions result in short term dust impacts. Exceedances of the 24 hour air quality goal for total suspended particulates can occur up to 600m from the construction site and for worse case dispersion conditions at up to 300m for typical conditions.

It is important therefore that exposed areas of the construction site be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep impacts to a minimum. These would include the covering of loads during transport, the watering or covering of stockpiles, the watering or stabilising of access roads and spraying construction areas to minimise dust emission during grading and dozing operations.

8.3.5 Water Quality and Drainage Control

Section 7.3.3, Water Quality and Soil Erosion and Section 7.3.7, Road Drainage and Stormwater Control of the 1996 REF addressed issues of drainage control and water quality management. Both topics are considered together in this REF because of the interrelated nature of the two.

The drainage catchment for the Cowpasture to Wallgrove Road section of Elizabeth Drive was identified as being part of the Hinchinbrook Creek drainage system that drains through Cecil Hills. Flow direction is to the south.

Stormwater runoff from the proposed upgraded road would discharge into surface and cross road drainage systems to be installed under the road, and be discharged to the existing stormwater system that flows through the Cecil Hills and into Hinchinbrook Creek.

For this section of Elizabeth Drive there are two proposed culverts across Elizabeth Drive – one at chainage 4370 comprising a new single cell box culvert to replace an existing smaller culvert, and an existing twin cell box culvert at distance 4625. Both culverts also require minor drainage works on the upstream or northern side to modify inflow channels.

One of the key aspects in the design of new RTA roadworks drainage systems is the separation of the two systems - one for runoff from the roadway area and the other for runoff from catchments upstream of the road. The strategy is to treat and retard runoff from the roadway while runoff from the other areas not affected by the road is either maintained along its existing route or re-routed via catch drains and discharged directly to existing water courses at the road crossings. The primary purpose of this strategy is that the runoff containing sediment, trash, wear products from motor vehicles and potential spills from any traffic accidents will be isolated from the relatively clean runoff from adjacent catchments.

Such water quality devices to reduce pollutants by trapping oil, removing litter and sediments in stormwater runoff would be required to be installed on all outlets of the road drainage system before discharging to local drainage courses. Details would be developed in detail design and be subject to approval by the RTA.

An Erosion and Sediment Control Plan would also be prepared for the construction phase with the measures to minimise potential water quality impacts of construction including silt fences, straw bale sediment traps, etc. Such a plan would form part of the Contractors Environmental Management Plan (CEMP).

The 1996 REF concluded that the potential impacts on water quality would be small and restricted to sediment-laden runoff during construction and pollutants contained in road runoff during operation of the road. The erosion and sediment control provisions would ensure that any potential impacts on receiving waters are minimised.

8.3.6 Flora and Fauna

A flora and fauna survey and assessment was carried out in the original REF (Lesryk Environmental Consultants, February 1996). The same consultant prepared a full flora and fauna assessment again for this Addendum REF.

The recent report is included Section 13, Appendices.

The conclusions of the flora assessment from the 1996 REF were:

- *'Clearing for road widening will mainly involve the removal of single lines of trees or small, disjunct stands of grassland or shrub land. ... No complete stands of native vegetation according to the criteria of SEPP19 occur in the study area.'*
- *'Removal of trees in the road reserve will not represent a significant reduction of the vegetation stands, although potential edge effects should be considered.'*

The 2002 assessment was undertaken to determine the current status and ecological value of the native vegetation present within the subject area.

No plants of national or State conservation significance listed as a Rare or Threatened Australian Plant or on the Schedules of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* or the NSW *Threatened Species Conservation Act 1995* were located within the proposed roadworks area. Similarly no species currently being considered for listing under either State or Commonwealth legislation were identified.

There is a vegetation community listed under both the NSW legislation and the Commonwealth legislation on the site. This is the Cumberland Plain Woodland listed under the *Threatened Species Conservation Act, 1995* as an endangered ecological community and similarly listed under the Commonwealth Act.

The woodland on the site is more correctly described as Grey Box/Ironbark woodland, a sub-unit of the listed woodland. Due to the highly degraded nature of the woodland within this study site and the NSW Scientific Committee's declaration that small fragmented stands in such condition are not sufficient to ensure the long term conservation of a community, it was considered that the community did not pose significant habitat.

An eight-part test was however carried out to assess whether the proposed roadworks would have a significant impact on the woodland community and consequently whether a species impact statement would need to be prepared.

Consideration was also given as to whether the proposed works would require the referral of the matter to the Federal Minister for the Environment for further assessment and consideration.

It was concluded that the undertaking of the proposed reconstruction and widening would not require the preparation of a species impact or the referral of the matter to the Federal Minister for the Environment.

A fauna assessment was undertaken in the 1996 survey and included a survey of the habitats available within the proposed roadworks area as well as adjacent vegetation communities.

It concluded

- *'Based on an assessment of those habitats present and a literature review of previous studies that no threatened or vulnerable species, populations or ecological communities or their habitats are expected to be adversely impacted by the proposal, and*
- *The upgrade of Elizabeth Drive is not expected to have a significant impact of the environment of either threatened or protected fauna.'*

The conclusion of the 2002 study was as follows.

As no threatened plants, animals, or their habitats were recorded within the study area and as the works would only be removing a select number of trees from the Cumberland Plain woodland remnant, it is not considered that the works would have a significant impact on any threatened species or their habitats. The works would not affect any fauna corridors and would not isolate any habitat areas critical to any native

species. The works therefore may proceed as planned without requiring either the referral to the Federal Minister for the Environment or the preparation of a Species Impact Statement (SIS) to further consider the impacts of the development on threatened flora or fauna.

The proposed upgrade to Elizabeth Drive includes the removal of 14 trees from the proposed road carriageway while the remaining trees will exist within a 6 metre wide median strip between the east and west traffic. Although the remaining trees are not of conservation value, consideration should be given to general ecological and biodiversity principles and as such these trees should remain on site as long as they do not represent a danger to commuters.

The general conclusion was as follows:

'As no threatened plants, animals or their habitats were recorded within the study area, and as the works would only be removing a select number of trees from the Cumberland Plain Woodland remnant, it is not considered that the works would have a significant impact on any threatened species or their habitats. The works would not affect any fauna corridors and would not isolate any habitat areas critical to any native species. The works, therefore, may proceed as planned without requiring either the referral of the matter to the Federal Minister for the Environment or the preparation of a Species Impact Statement to further consider the impacts of the development on threatened flora or fauna.'

The proposed upgrade of Elizabeth Drive includes the removal of fourteen trees from the proposed road carriageway while the remaining trees would exist within a 16m wide median strip between the east and west traffic. Although the remaining trees are not of conservation value, consideration should be given to general ecological and biodiversity principles, and as such, these trees should remain on site as long as they do not represent a danger to commuters.

The recommendations were as follows:

- Prior to their removal, all hollow-bearing trees should first be checked for the presence of birds nesting and arboreal animals such as possums. Animals found to be occupying these trees should be safely removed before clearing. Removed animals should be relocated to adjacent woodland habitats by a qualified ecologists;*
- Tree hollows should be checked for animals after felling or pushing, and injured animals should be taken to a local vet or the local wildlife rescue service should be notified;*
- Trees should be removed and felled in such a way that they minimise the extent of disturbance on adjacent vegetation;*
- Post-construction, the road verges and median strips should be landscaped with a suite of locally occurring plants that complement the Grey Box Ironbark Woodlands. To ensure genetic integrity, it is preferable that the propagules are collected from within or in close proximity to the study area;*

- *Weed control measures that inhibit the growth of exotic species should be undertaken. The use of mulch within the re-vegetation site will be determined by the choice of plant propagules used. Mulching heavily around planted tube stock is beneficial in minimising weed competition, however native seedlings may also be inhibited if broad cast seeds are spread on site. Mulch may consist of chipped eucalypts from site, or one of the many suitable commercial leaf mulches that exist, or maybe a commercial weed mat. All imported mulch to the site should be of known provenance and be weed-free. Should a weed-mat be chosen to suppress weed growth, ensure that a commercial brand that does not have a plastic net backing on the natural fibres is used. (This netting has been observed to remain for a period of time following decomposition of the product).*

8.3.7 Indigenous and Non-Indigenous Heritage

An archaeological assessment of Aboriginal and historical heritage along the Elizabeth Drive corridor between Windsor Road and the Western Sydney Orbital at Cecil Hills was undertaken for this Addendum REF (Brayshaw, 2002). The report is included in Section 13, Appendices of the REF.

Elizabeth Drive forms the boundary between the Gandangara Local Aboriginal Land Council to the south and the Deerubbin Local Aboriginal Land Council to the north. In addition, the Daruk Tribal Aboriginal Corporation has an interest in the area. Representatives of the Daruk Tribal Aboriginal Corporation and the Deerubbin LALC were involved in the site inspections and surveys. It was not possible to arrange field inspections with the Gandangara LALC within the available time. The RTA Aboriginal Liaison Officer would be involved in inspections with this Council.

Artefacts were found along the southern side of Elizabeth Drive road reservation, over a distance of approximately 100m. The artefacts appeared to have been considerably disturbed which would contribute little archaeological information.

It was recommended that an application be sought for Consent to Destroy for the site (identified as HC/ED1), without further archaeological work being required. It was further recommended that Aboriginal stakeholder groups should have an opportunity to monitor certain ground surface disturbance during construction for the purpose of retrieving any artefacts exposed during this process.

In respect to historic heritage it was identified that the section of Elizabeth Drive was formally within the boundary of the Cecil Hills Farm Grant. This grant, made in 1817 and taken up in 1818 by Judge Advocate John Wylde was for the purpose of cattle grazing and sale to the government stores.

The site was inspected by an heritage archaeologist and searches undertaken of the heritage office and Register of the National Estate databases. A number of sites were identified within the general area but none of these sites would be affected by the proposed road widening.

No historic structural remains or artefacts were sighted. It was concluded that the proposed works would not impact on any items of historic heritage significance.

8.4 Cumulative environmental effects

In the 1996 REF cumulative environmental impact was addressed in Section 7.4.

The assessment found that the cumulative effects of the road upgrading proposal would likely be minimal and more related to long term traffic growth. It was found that the proposal would also improve traffic access for existing and future residents and business travellers as well as those accessing the Sydney West Airport and the WSO.

It was further concluded that the construction of the road was unlikely to have any adverse cumulative impacts on the environment. Although noting that there may be some additional contribution to noise and dust it was found that this would generally be of short duration and intermittent over the period of construction.

It was not envisaged at the time of the previous assessment that the construction of this western part of the Elizabeth Drive upgrading could be carried out in parallel with the construction of the WSO. There is now a possibility that this could occur. Both projects would be constructed in the 2002 to 2007 period. Cumulative impacts would only affect those residents in the northwestern corner of the Cecil Hills estate. It would be a requirement on the WSO consortium that the key aspects of the construction of the two works be scheduled at different times.

It was and is now concluded that provided the safeguards are implemented that the cumulative environmental impacts of the proposal are generally positive and outweigh the adverse impacts.

8.5 Matters of national environmental significance and effects on Commonwealth land

Under the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act, 1999* if there is potential for adverse impact to items on National Environmental Significance or to Commonwealth land, the proposal is required to be referred to the Commonwealth Minister for the Environment. The potential for such impact is assessed below:

a) Any impact on a World Heritage property?

The Proposal would not have any impact on a World Heritage Property.

b) Any environmental impact on wetlands of International importance?

The Proposal would not have any impact on wetlands of international importance.

c) Any environmental impact on Commonwealth listed threatened species or ecological communities?

The Proposal would have an impact on a Commonwealth listed threatened ecological communities – Cumberland Plain Woodland. However that impact has been assessed by a specialist ecological consultant as not being of significance, and not requiring referral under the Act.

d) Any environmental impact on Commonwealth listed migratory species?

The Proposal would not have any impact on Commonwealth listed migratory species.

e) Does any part of the Proposal involve a nuclear action?

The Proposal would not involve a nuclear reaction.

f) Any environmental impact on a Commonwealth marine area?

The Proposal would not impact on a Commonwealth marine area.

g) Any impact on Commonwealth land?

Commonwealth land would not be affected, indirectly or directly, as part of this Proposal.

8.6 Ecologically sustainable development

It was not a requirement of the RTA's *Environmental Impact Assessment Manual* in 1996 for ecologically sustainable development (ESD) issues to be addressed. The principles of ESD are now required to be considered under the *Environmental Planning and Assessment Act* and the RTA Environmental Impact Assessment manual.

The four principles of ESD are:

- The precautionary principle - if there are any threats of serious or irreversible environmental damage, lack of full scientific certainty it should not be used as a reason for postponing measures to prevent environmental degradation.
- Inter-generational equity - the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
- Conservation of biological diversity and ecological integrity.
- Improved valuation and pricing of environmental resources.

Elizabeth Drive is an integral part of the Sydney metropolitan main road network and the completion of the upgrading program that commenced in 1996 provides for completion of a strategy to effect improvements to this network

The approval for and construction of the first half of the Elizabeth Drive upgrade and the recent approval of the Western Sydney Orbital preconditions the need for the construction of this final section through to Wallgrove Road

It was and can still be concluded that the reconstruction and widening of this section of Elizabeth Drive provides a sustainable balance between the environmental and economic objectives and complements the use of other forms of transport including provision for pedestrians, cyclists and buses.

9. IMPLEMENTATION STAGE

9.1 Safeguards Process

Environmental safeguards that are identified below would be incorporated into the detailed design of the project and as part of its construction and operation. These safeguards would reduce any potential adverse impact arising from the proposed works on the surrounding environment. All the safeguards described in Section 9.2 would be incorporated into the Contractors Environmental Management Plan (CEMP).

The CEMP would identify the requirements for compliance with relevant legislation, requirements for ensuring implementation of the environmental safeguards and development of self-assessment and auditing schedules.

A contractor under supervision of a RTA project engineer will undertake the works.

9.2 Summary of Proposed Safeguards

The safeguards adopted in the 1996 REF were listed in Section 8.1 of that REF.

Although they are still generally applicable to the proposed works, they have been reviewed in the light of the findings of this Addendum REF and RTA current best practice. A new and updated list of proposed safeguards has been prepared.

There would be some short termed, localised adverse impacts associated with the proposal particularly during construction. The long-term beneficial effects of the proposal would outweigh any adverse impacts of the construction proposal. The safeguards that would be implemented for the proposal are listed below and would be included in the Contractors Environmental Management Plan (CEMP).

1. Inconvenience to Elizabeth Drive travellers and nearby residential communities would be minimised through the best construction and traffic management practices.
2. Use of current and best available design criteria to ensure the proposal is correctly constructed, maintained and operated with adequate safety and capacity to meet all reasonable traffic needs for the next 30 years.
3. Implementation of environmental protection requirements of the RTA's Contract Manual and Guidelines which includes the following specifications as a minimum:

G1	Job specific requirements
G2	General requirements
G3	OHS requirements
G36	Environmental protection requirements
G10	Control of traffic
R1	Erosion and sediment control
R11	Stormwater drainage (general)
R13	Drainage structures
R41	Clearing and grubbing

R43	Earthworks (cut, fill and imported fill)
R50	Stabilisation of earthworks
RG92	Batter protection treatment
RG93	Retaining structures
R162	Vegetation
Q7	Quality system

4. A safety audit of the detailed design of the proposal would be completed before construction of the proposal and any findings implemented.
5. Traffic during construction would be managed in accordance with the requirements of Australian Standard 1742.3 – 1996 *Manual of Uniform Traffic Control Devices Part 3: Traffic Control Devices for Works on Roads*.
6. Two lanes of Elizabeth Drive would be available for traffic at all times.
7. Traffic arrangements during construction would be subject to RTA approval.
8. Construction areas would be maintained in a clean and tidy state at all times.
9. Regular road sweeping of Elizabeth Drive travel lanes adjacent to the construction works would be required, to ensure a clean and safe pavement.
10. Sedimentation potential from construction works requiring installation of selected temporary sedimentation controls along and around the construction areas would be documented in a Soil and Water Management Plan.
11. The Soil and Water Management Plan would also detail surface water control, stormwater drainage, landscaping and erosion and sediment control measures required during construction to minimise sedimentation impacts.
12. Regular monitoring and maintenance of the sedimentation controls to ensure they perform in a fully functioning condition at all times would be required.
13. Sediments and pollutants would be removed from temporary sedimentation basins on a regular basis and their contents disposed of in accordance with the requirements of the EPA.
14. Any materials stockpiles would be located in or adjacent to the road reserve and protected from possible erosion.
15. A construction compound for the work would be located at a suitable site to the satisfaction of the RTA.
16. The construction compound would be security fenced and lit at night and include amenities shed, portable toilets, plant and equipment storage areas, bunded areas for the storage of petroleum, distillate and other chemicals to comply with EPA and Work Cover Authority requirements.

- 17 On site domestic waste and sullage facilities would be provided in the construction compound.
- 18 Construction hours would generally be from 7am to 6pm Monday to Friday and 7am to 1pm on Saturdays.
- 19 From 7am to 8pm on Saturdays only inaudible work would be allowed.
- 20 Work would not be permitted on Sundays and public holidays or at night unless authorised by the RTA and EPA where required.
- 21 Any night work would follow the existing procedure used by the RTA Sydney Operators Directorate and endorsed by the EPA with regard to nighttime roadwork noise.
- 22 A temporary bund would encompass any area where washing out of trucks or containers may be required.
- 23 No blasting would be permitted during construction.
- 24 Exposed earthwork areas would be stabilised as quickly as possible.
- 25 Materials transported in trucks travelling on public roads would be covered.
- 26 Tailgates of all vehicles transporting material on public roads would be securely fixed, sealed and loads covered.
- 27 No contaminated material would be used in any earthworks.
- 28 Construction work would be regularly monitored and a dedicated water tank would suppress dust as required.
- 29 Any dust fall out generated by the construction works would not normally exceed an annual average of 2gm per m^2 per month above background levels.
- 30 Any excavated or excess pavement material and concrete would be incorporated in the earthworks for the proposal as a first priority or transported off site for recycling.
- 31 No burning or burying of waste would be permitted on site.
- 32 All non-recyclable waste would be disposed of regularly at operating waste disposal sites.
- 33 All internal combustion motors would not be permitted to emit continuous visible smoke for greater than 10 seconds on public lands.
- 34 No heavy duty vibratory rollers would be permitted to operate within 20m of any dwelling.
- 35 The RTA would complete a condition survey of all dwellings with a common boundary to Elizabeth Drive road reserve and a copy provided to owners before construction commenced.

36. A landscaped plan would be developed and implemented by the contractor.
37. Environmental resources would be maximised by retention of existing vegetation and resources where possible.
38. The number of trees to be removed would be the minimum necessary for the safe excavation and construction operations.
39. Site topsoil would be reused on site in landscaping works.
40. Trees with limbs overhanging Elizabeth Drive would not be removed unless absolutely necessary for safety or construction reasons. Any overhanging limbs would be cut back where possible.
41. Prior to their removal, all hollow-bearing trees would first be checked for the presence of birds nesting and arboreal animals such as possums. Animals found to be occupying these trees would be safely removed before clearing. Removed animals would be relocated to adjacent woodland habitats by a qualified ecologists;
42. Tree hollows would be checked for animals after felling or pushing, and injured animals would be taken to a local vet or the local wildlife rescue service should be notified;
43. Trees would be removed and felled in such a way that they minimise the extent of disturbance on adjacent vegetation;
44. Post-construction, the road verges and median strips would be landscaped with a suite of locally occurring plants that complement the Grey Box Ironbark Woodlands. To ensure genetic integrity, it is preferable that the propagules are collected from within or in close proximity to the study area;
45. Weed control measures that inhibit the growth of exotic species would be undertaken. The use of mulch within the re-vegetation site would be determined by the choice of plant propagules used. (Mulching heavily around planted tube stock is beneficial in minimising weed competition, however native seedlings may also be inhibited if broad cast seeds are spread on site. Mulch may consist of chipped eucalypts from site, or one of the many suitable commercial leaf mulches that exist, or maybe a commercial weed mat.) All imported mulch to the site would be of known provenance and be weed-free. Should a weed-mat be chosen to suppress weed growth, a commercial brand that does not have a plastic net backing on the natural fibres would be used. (This netting has been observed to remain for a period of time following decomposition of the product).
46. The boundary of the area to be cleared and the native trees to be retained would be clearly delineated and fenced by 'Paraweb' or similar fencing to prevent damage from workers and machinery.
47. Parking of vehicles or storage of materials would not be permitted beneath the canopy of trees to be retained.

- 48 Exposed earthworks construction areas would be progressively landscaped with native species as soon as possible following completion of stages of construction.
- 49 Landscaped areas would be maintained for at least 12 months with 3 monthly inspections following completion of construction.
- 50 Utilities and infrastructure would be relocated as required by the providers.
- 51 Road drainage requirements would be determined in conjunction with Liverpool and Fairfield City Councils.
- 52 Water quality devices would be installed on each drainage outlet.
- 53 Construction equipment would be maintained to meet EPA requirements.
- 54 No vehicle maintenance would be permitted outside the construction compound except in emergencies.
- 55 Mufflers would be fitted to all construction plant and equipment to meet EPA requirements.
- 56 Heavy vehicle traffic generation during construction would be confined to Cowpasture Road and other main roads where possible.
- 57 Concrete and asphaltic concrete would be transported from legally operated batching plants located near the proposal.
- 58 No batching plant would be permitted on site.
- 59 Cleaning out of batched concrete mixing plant and equipment would be at approved areas within the road reserve, to permit drying out and incorporation into the earthworks.
- 60 The RTA's Aboriginal Liaison Officer would arrange for a site inspection with a representative of the Gandangan LALC prior to any construction work commencing on this site.
- 61 An application for a Consent to Destroy under the *National Parks and Wildlife Act*, for the site identified as HC/ED1 would be lodged by, or on behalf of, the RTA. It is noted that further archaeological assessment of the site has not been recommended.
- 62 Aboriginal stakeholder groups would be invited to monitor initial site and ground disturbance works for the purposes of identifying and retrieving artefacts that may be exposed.
- 63 Construction 'hold points' would be enforced where there is a risk of irreversible environmental damage to indigenous and non-indigenous sites or artefacts.
- 64 If any Aboriginal archaeological sites or artefacts are found during construction then work must cease within 50m of the site and the NSW NPWS and the RTA's

Environmental Services Branch, Aboriginal Liaison Officer would be contacted for further advice and action.

- 65 If European relics were unearthed during construction then the Heritage Office would be contacted for advice and/or a permit to remove or destroy the item.
- 66 Construction noise would be limited to EPA requirements as far as practicable.
- 67 Noisy construction plant and equipment (eg. use of jackhammers and vibrating rollers) would only be used during weekday time periods corresponding to the highest background noise levels from 7am to 6pm.
- 68 For periods where noise activities are likely to take more than 4 weeks, temporary barriers would be erected as close as practicably possible to the earth moving plant prior to the earthwork commencing. Barriers would be at least 1m above the exhaust stack of such plant. Barriers should be constructed from solid materials capable of attenuating noise levels by 20dBA at 125 Hertz octave band frequency.
- 69 Nearby residents would be warned in advance of noisy construction periods.
- 70 The contractor would use the best available techniques not entailing excessive costs with the L10 (15 minutes) level measured at dwellings near Elizabeth Drive not to exceed 5dB(A) above background noise levels.
- 71 Any additional permanent noise attenuation measures would be finalised in consultation with Liverpool City Council.
- 72 Traffic noise would be monitored within 1 year of commissioning of the proposal to determine whether any installed noise control measures are effective.
- 73 The requirements of all relevant legislation relating to air quality, water quality and noise would be met.
- 74 All approvals and licences needed to construct the proposal including any air, noise and water environment protection licences from the EPA would be obtained.
- 75 Nearby residents would be informed by letterbox drop of the works before construction commences.
- 76 Nearby residents of Elizabeth Drive would be informed of any nighttime construction work at least 3 days in advance.
- 77 The EPA's hotline would be informed of any night construction work and the name of the project or site manager to contact in emergency.
- 78 Procedures for monitoring community comments and taking appropriate actions would be implemented.
- 79 The RTA would consult with Liverpool and Fairfield Councils concerning ongoing maintenance of landscaped areas and water quality devices.

- 80 All the safeguards would be incorporated in a Contractor Environmental Management Plan to be prepared by the contractor to minimise adverse environmental impacts and before construction commences. The CEMP would include provision for hold points where environmental damage may occur, regular reports and audits of the environmental management of the project, details of non conformances, verification activities and emergency responses.

The above list of safeguards is a minimum for implementation and may not be exhaustive and may change as a result of public authorities requirements, changes in legislation, community consultation and detailed design development.

The safeguards identified above are a minimum for implementation and may not be exhaustive. They may also change as a result of public authorities requirements, changes in legislation, community consultation and as detailed design is finalised.

9.3 Implementation process

Construction would commence after the environment assessment process is complete and tenders have closed, been evaluated and the contract to the successful consortium awarded for all of the WSO. Construction "hold points" would be as specified in the RTA 936 Environmental Management (Management System) specification .

The successful tenderer would be required as part of the contract to meet the specifications and safeguards detailed in this Addendum REF and in the RTA's Decision Report. The safeguards include all measures that might be reasonably taken to minimise adverse environmental impacts during construction and operations of the proposal.

Reference should also be made to the Mitigation Measures for the WSO.

Section C – Finalisation

10. OUTCOMES AND JUSTIFICATION

10.1 Major beneficial effects

The major beneficial effects identified in the 1996 REF were:

- *'Improved travel times for through traffic from Liverpool to the Sydney West Airport, Penrith and Wallacia.*
- *Improved bus facilities.*
- *Improved access for the residents in the area to Liverpool and other parts of metropolitan Sydney.*
- *Lessened through-traffic using local streets as shortcuts.*
- *Improved local access from nearby residential areas to Elizabeth Drive.*
- *Improved access for schoolchildren crossing Elizabeth Drive at Cowpasture Road.*
- *Improved safety for pedestrians, cyclists and motorists.*
- *Improved visual appearance of the area by landscaping along the road verge and median areas.'*

These beneficial effects are in place for the upgrading that has been completed to date. The Western Sydney Orbital now approved for construction provides the ability to complete the full regional road strategy for western metropolitan Sydney.

The conclusion of the 1996 REF in respect to beneficial effects was as follows:

'Elizabeth Drive is an integral part of the regional arterial road network connecting Sydney's outer western region to Liverpool and the inner suburbs of the city. The proposed road upgrade provides a sustainable balance between environmental and economic objectives and complements the use of all forms of transport with provision for buses, pedestrians and cyclists.'

The major beneficial effect of the construction of this final link of the upgrade of Elizabeth Drive is the completion of the regional arterial road network upgrade.

10.2 Major adverse effects

The adverse effects have been identified within the REF. All adverse effects are of a short-term nature during construction with the major beneficial effects being secured once the road is fully upgraded.

The major adverse effect would be the loss of some of the native vegetation from within the road reserve. Also during construction local residents would experience increased levels of noise, dust and vibration and there would be increased traffic generation and general disruption to road users. There would also be a medium term loss of some visual amenity for some of nearby residents until landscaped areas matured.

It was however the conclusion of the 1996 REF that there were no major adverse effects associated with the construction of the proposed upgrade of Elizabeth Drive. This is largely supported by the findings of this Addendum REF.

10.3 The extent and nature of the impacts

The impacts during construction would be medium term; adverse and localised. The main construction impacts include construction noise, loss of native vegetation, some disruption to traffic and some minor water quality impacts.

The extent of the positive impacts during operations would be long term beneficial and cumulative on a regional scale and include improved accessibility to the western Sydney metropolitan area, improved safety, better traffic flow and a better landscaped Elizabeth Drive environment. It is considered that the long term and regional benefits of the proposal outweigh the medium term localised and acceptable environmental impacts, subject to all safeguards being implemented.

Based on experience of similar reconstruction projects including the previous stages of the Elizabeth Drive upgrade, the level of confidence in the prediction of environmental impacts is relatively high. It is anticipated that the affected environment would have the resilience to cope with the predicted environmental impacts. With the safeguards implemented during construction it is considered that the environmental impacts are manageable although irreversible. It is also considered that the environmental impacts are likely to be acceptable to the public with the implementation of the safeguards.

11. CLAUSE 228 CHECKLIST

Under Clause 228(2) of the NSW *Environmental Planning and Assessment Regulation 2000*, the factors that must be taken into account concerning the impact of an activity on the environment are:

a) Any environmental impact on a community?

Short-term negative impacts include construction noise and dust from construction operations. They are not long term impacts and will occur only during construction.

b) Any transformation of a locality?

There would be a transformation of the locality as a result of the Proposal. However it would be a positive change.

c) Any environmental impact on the ecosystems of the locality?

The proposed works are not expected to have an impact on the ecosystems of the locality. Monitoring systems would be implemented to ensure that during and following the proposed works the risk for any adverse effect on local air, water and soils is managed.

d) Any diminution of the aesthetic, recreational, scientific or other environmental quality or value of a locality?

There would be no reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality.

e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?

There would be no adverse effects on any locality, place or building in these terms.

f) Any impact on the habitat of any protected or endangered fauna?

No impacts are expected as a result of the Proposal on the habitats of any protected or endangered species.

g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?

No impacts are expected as a result of the Proposal on protected or endangered species or habitats. There would be an impact on remnant parts of a protected woodland.

h) Any long-term effects on the environment?

There is minimal risk of any adverse long term effects on the environment

i) Any degradation of the quality of the environment?

There would be short-term impacts on the environment as a result of the proposed works. However there would be no long-term degradation to the environment.

j) Any risk to the safety of the environment?

The Proposal would not result in any risk to the safety of the environment in the long term.

k) Any reduction in the range of beneficial uses of the environment.

The Proposal would not result in any reduction in the range of beneficial uses of the environment.

l) Any pollution of the environment?

Short term, the greatest risk of the pollution of the environment would be as a result of increased local noise levels. This would be minimised through the implementation of controls.

m) Any environmental problems associated with the disposal of waste?

Minimal waste would be generated as a result of the Proposal. All waste would be collected, handled and transported to, approved waste disposal facilities.

n) Any increased demands on resources, natural or otherwise which are, or are likely to become in short supply?

There would not be any increased demand on resources, natural or otherwise which are, or are likely to become in short supply as a result of the Proposal.

o) Any cumulative environmental effect with other existing or likely future activities?

There could be some adverse cumulative effect from the construction of the WSO at the western end of the works if construction activities overlap.

12. CERTIFICATION

This Review of Environmental Factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to effect the environment as a result of the proposed activity.

Macoun Environmental Consulting

Name (print)..... *T. Macoun*

Signed:..... *[Signature]*

Designation:..... *Principal*

Date:..... *23rd September 2002*

Roads and Traffic Authority

Name (print)..... *M W Cross*

Signed:..... *[Signature]*

Designation:..... *Planning Development Manager (WSD)*

Date:..... *23/9/02*

13. APPENDICES TO THE REF

CONCEPT DESIGN FIGURES

SITE PHOTOGRAPHS

FLORA AND FAUNA ASSESSMENT

TRAFFIC NOISE ASSESSMENT

HERITAGE ASSESSMENT

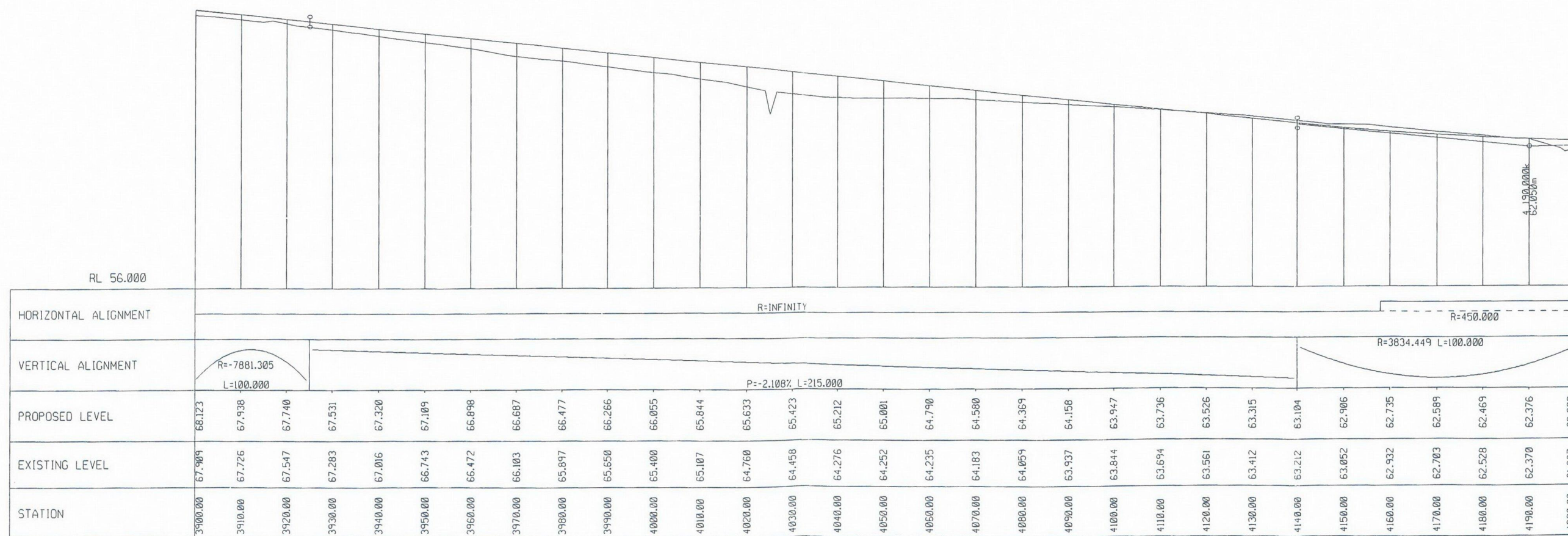
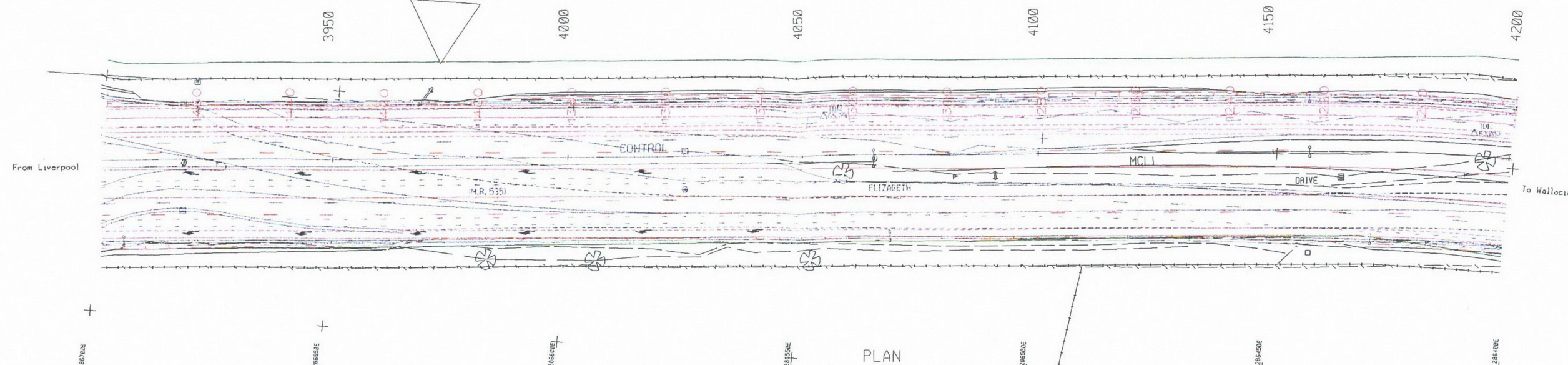
CONCEPT DESIGN FIGURES

Western Sydney Orbital – Amended Concept Design for Elizabeth Drive. Scale 1:5000

Plans and Longitudinal Sections: Sheet 15 to Sheet 21 inclusive

ADJOINS SHEET 15

ADJOINS SHEET 17

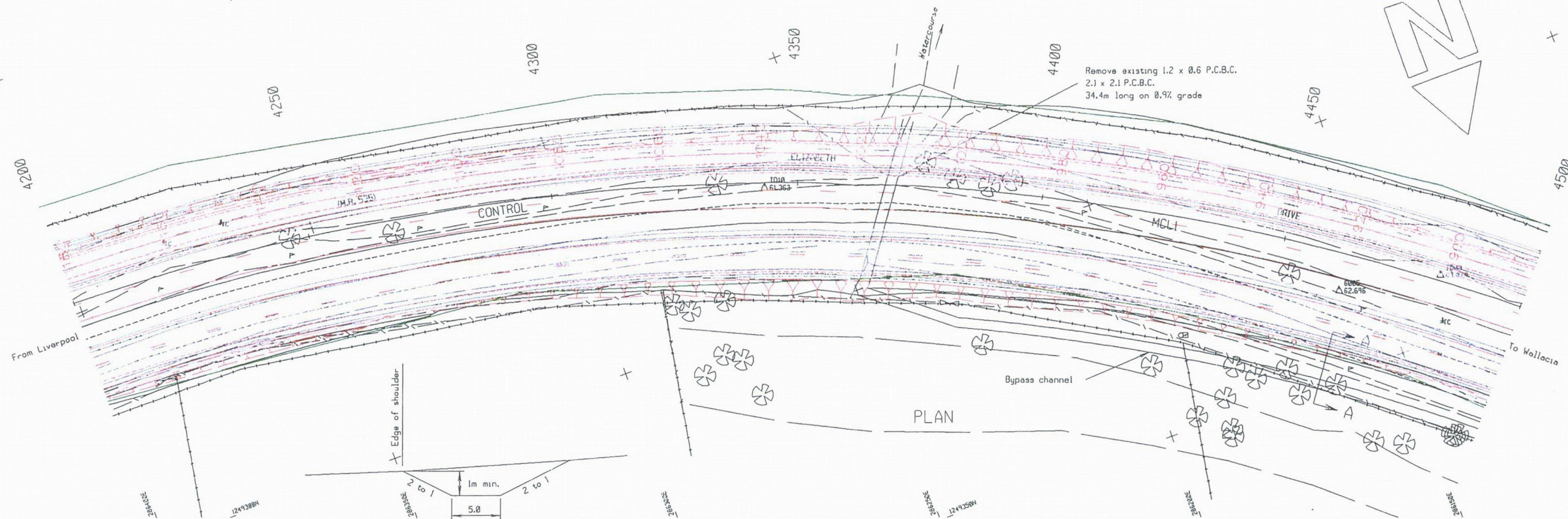


LONGITUDINAL SECTION - MCL1

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ADJOINS SHEET 16

ADJOINS SHEET 18



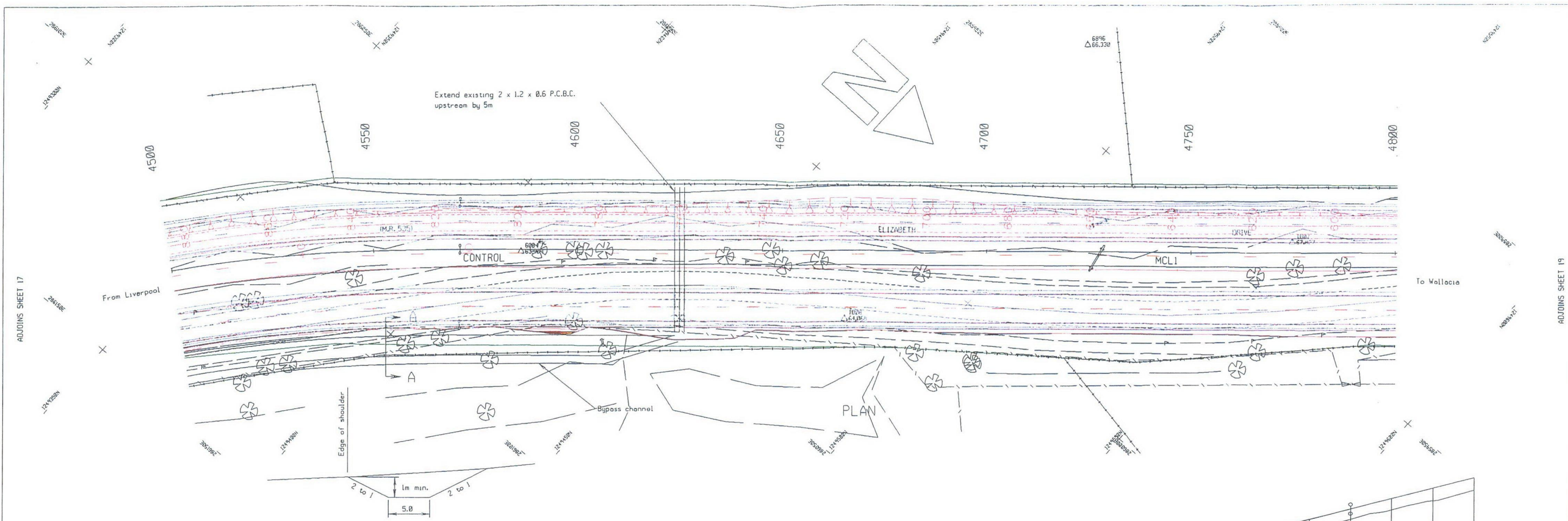
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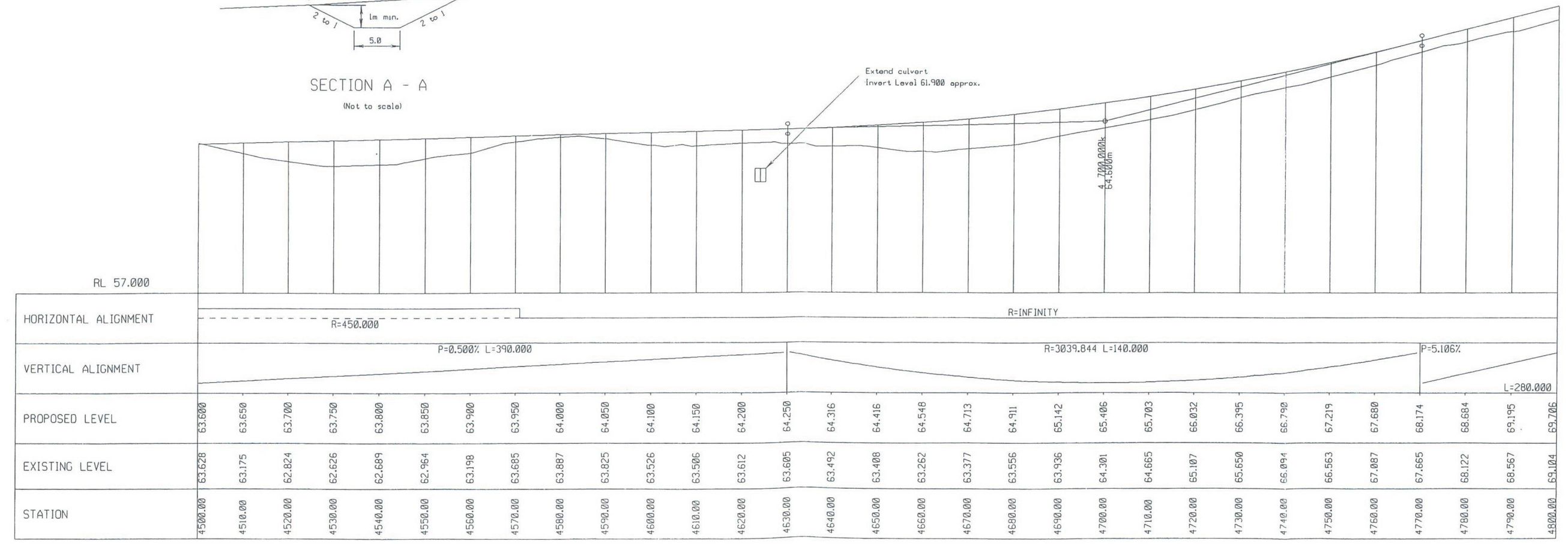
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EXISTING LEVEL	61.967	62.249	62.385	62.225	62.122	61.808	61.297	61.138	61.040	60.963	60.946	60.955	61.006	61.177	61.227	61.421	61.576	61.653	61.599	61.428	61.052	60.814	61.312	61.767	62.177	62.577	63.087	63.574	63.697	63.735	63.628	
STATION	4200.00	4210.00	4220.00	4230.00	4240.00	4250.00	4260.00	4270.00	4280.00	4290.00	4300.00	4310.00	4320.00	4330.00	4340.00	4350.00	4360.00	4370.00	4380.00	4390.00	4400.00	4410.00	4420.00	4430.00	4440.00	4450.00	4460.00	4470.00	4480.00	4490.00	4500.00	

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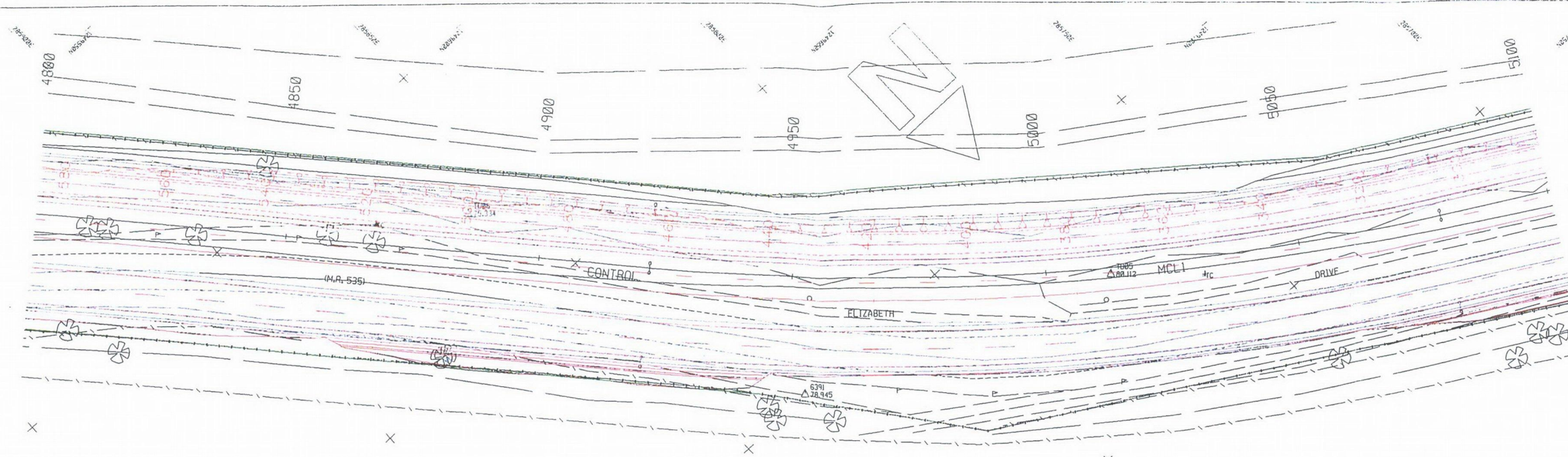


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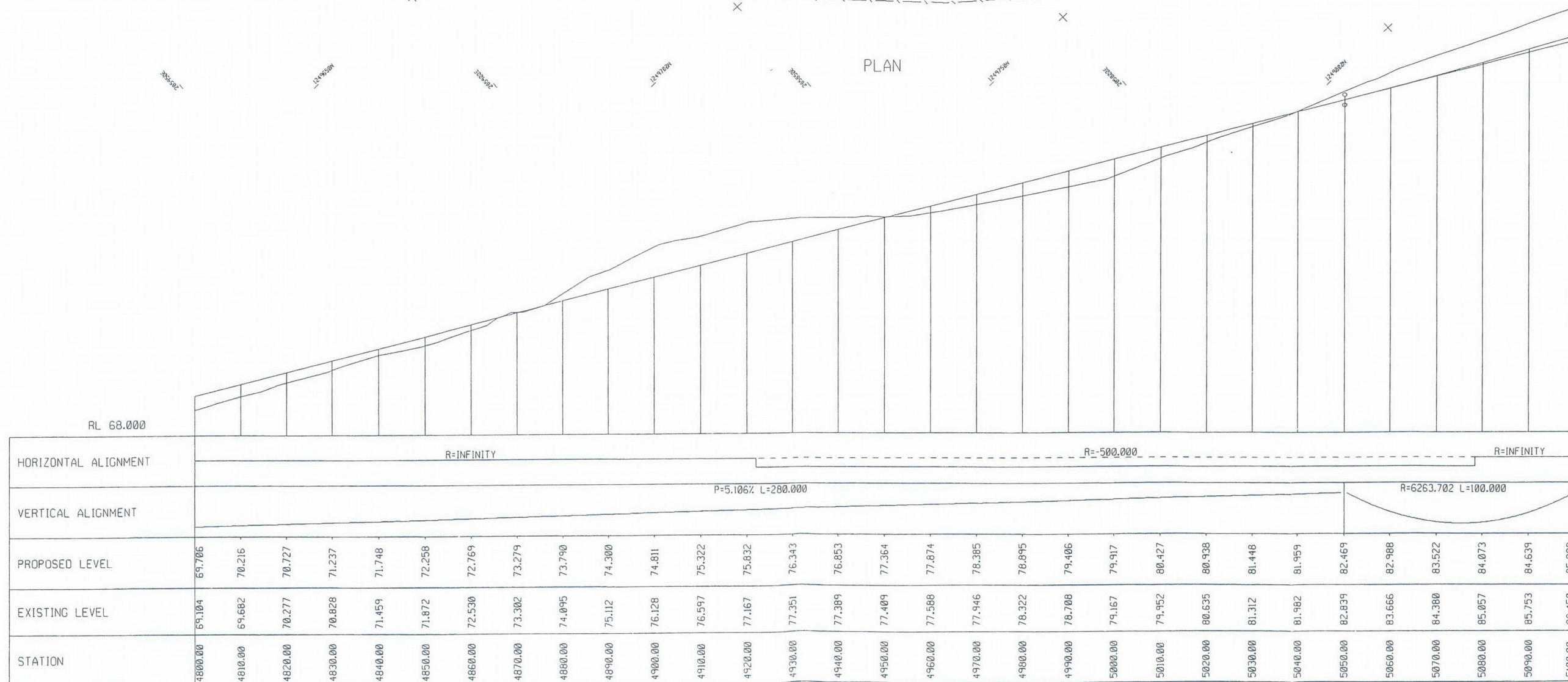
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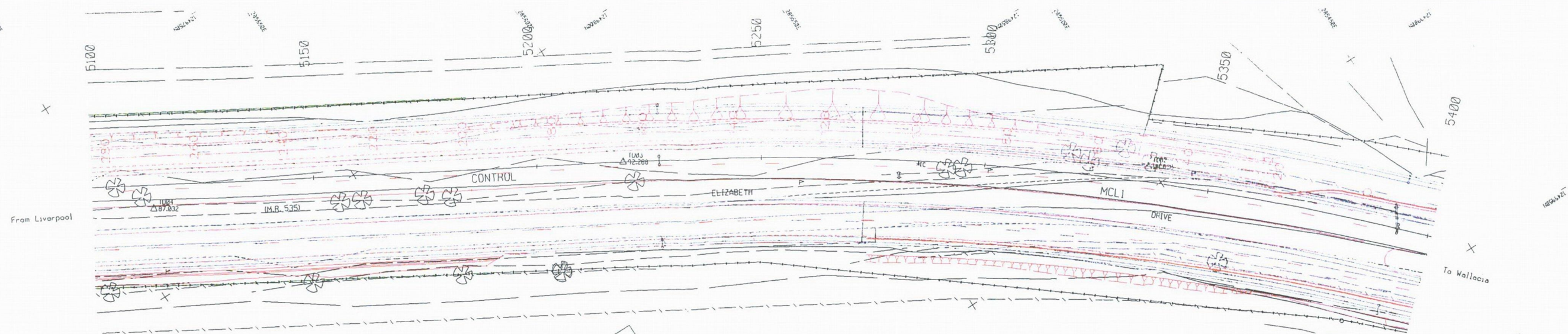
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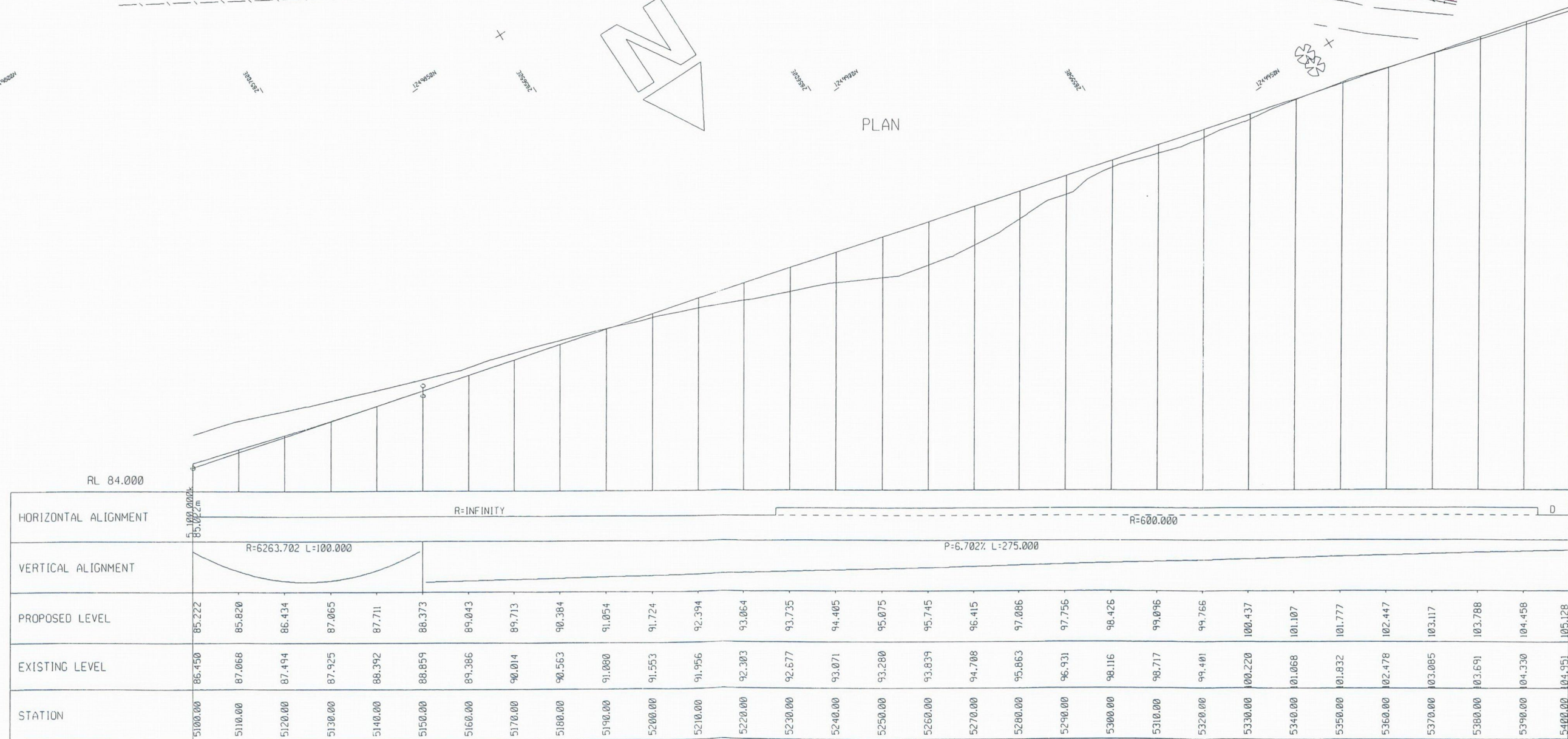
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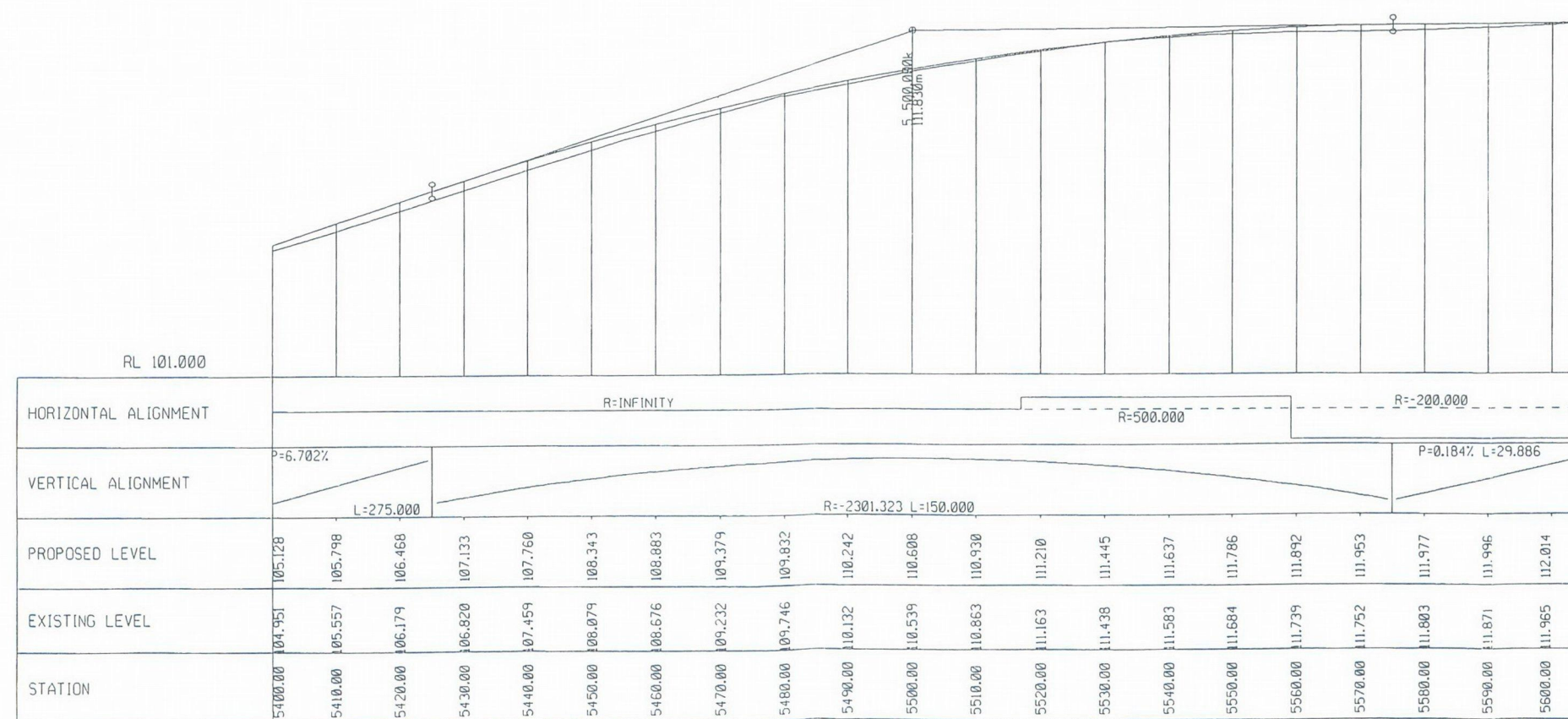
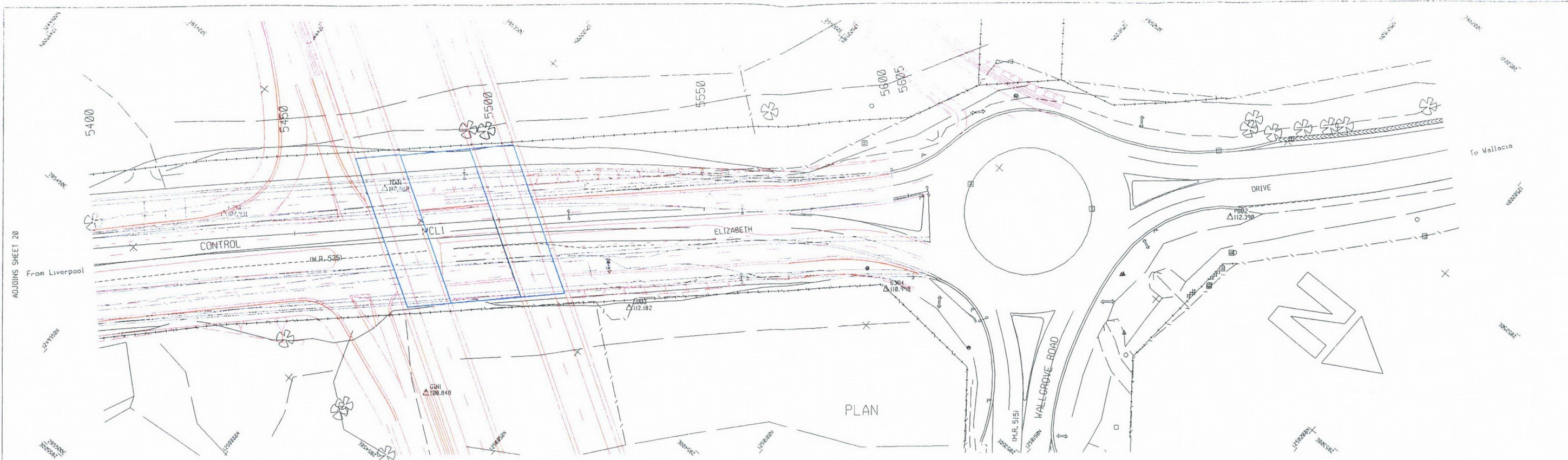


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SITE PHOTOGRAPHS

Cover: View looking west along Elizabeth Drive road reserve at approximate Distance 5000 metres



Above: Roundabout at Windsor Road – eastern end of proposed upgrade at approximate Distance 3850 metres



Above: Approaching roundabout with Wallgrove Road – western extent of proposed upgrade at approximate Distance 5500 metres

FLORA AND FAUNA ASSESSMENT

LesryK Environmental Consultants

***Elizabeth Drive Upgrade:
Wallgrove Road to Windsor Road***

***Flora and Fauna
Assessment***

June 2002

Report prepared for
Macoun Environmental Consulting
on behalf of the NSW Roads and Traffic Authority
by
LesryK Environmental Consultants
PO Box 3001
Bundeena NSW 2230

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Reference citation:

Engel D., Speight J., Lloyd M. and Hawkins P. (2002) *Elizabeth Drive Upgrade Walgrove Rd to Windsor Rd: Flora and Fauna Assessment*. Report prepared for the NSW Roads and Traffic Authority by LesryK Environmental Consultants, Bundeena.

1.0 INTRODUCTION

At the request of Macoun Environmental Consulting a flora and fauna survey of a 1700 metre section of Elizabeth Drive, between Wallgrove and Windsor Roads, Cecil Park, was undertaken. For ease of reference, this section of Elizabeth Drive will hereafter be referred to as the study area. The survey was undertaken as the RTA proposes to upgrade this section of Elizabeth Drive from the existing two lane undivided road to a four lane divided road, with the addition of a 4 metre cycle way and a 6 metre median strip. The majority of the proposed construction works will affect the southern side of Elizabeth Drive with only a small portion of the northern side being affected close to Windsor Road. As part of the proposed construction of the Western Sydney Orbital, Elizabeth Drive will serve as a link road.

In 1996 a Review of Environmental Factors for the upgrading of Elizabeth Drive was prepared and approved, these works being similar to the existing proposal except that the plans indicated the retention of a 12 metre wide median for the future provision of additional lanes. The current proposal includes a reduction of this median width to 6 metres, thereby requiring the clearing of up to twenty (20) mature trees from the road corridor. This has been determined by the ground survey and referenced to the RTA Concept Plans and air photo overlay map of the Proposal. The boundaries of the carriageways was not pegged out on the ground however, so some inaccuracy regarding the number of trees to be removed is likely. However, the estimate of twenty trees is an upper estimate.

The site investigation was conducted to identify the conservation status of the plants, animals, vegetation communities and fauna habitats present, and whether the removal or disturbance of these would constitute a significant impact. The assessments undertaken within this report have considered the obligations and Schedules to the *NSW Threatened Species Conservation Act 1995* and *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* and whether the proposed road works would require the preparation of a Species Impact Statement and/or the referral of the matter to the Federal Minister for the Environment.

2.0 METHODS

A survey of the study area was undertaken by Michael Lloyd (B.Sc [Hort]) and Peter Hawkins (BE Env) on the 21st June 2002. The entire study area within and adjacent to the boundaries of the proposed road works (up to a distance of 10 metres beyond the limits of the likely construction area) was surveyed on foot. The field survey used the 'Random Meander Method' described by Cropper (1993). This method involves walking randomly throughout the study site while ensuring that the full range of potential habitats was surveyed, and recording every animal, plant, vegetation community and fauna habitat present (Cropper 1993). Prior to the field investigation, a literature search was undertaken to identify the presence of any State or Nationally listed threatened species that may occur within, or rely on, the study area. A systematic survey for these species was undertaken within, and close to, the study area as discussed by (Keith 2000).

The weather conditions experienced during the field survey were mild, light westerly breezes and partial cloud cover, with visibility within and access to all parts of the survey area being high. By the completion of the study, seven (7) person hours of site investigations had been accumulated. Given the nature of the proposal, and the condition of the study area, this length of time is considered more than adequate when endeavouring to document the species present, their habitat associations and conservation value. In relation to the conservation status of the species present, this was determined through reference to the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*, *NSW Threatened Species Conservation Act 1995* and Briggs and Leigh (1996) in the State and National context.

During the field survey, one limitation to the success of the fauna component was encountered, this being the winter timing of the investigation. At this time of year a number of reptiles, frogs and microchiropteran bats (insectivorous bats) have entered hibernation, thereby reducing their detectability. Due to the presence of hollow-bearing trees, there is the

potential that individuals and populations of those threatened and protected microchiropterans previously recorded in the surrounding region may be present. In regards to the potential presence and impact of the road works on these species, it is noted that the fauna survey was undertaken under the premise that the majority of hollow-bearing mature trees would be retained within the 6 metre wide median strip. Therefore, with the retention of these trees and the winter timing of the study, no nocturnal work was undertaken that specifically targeted the presence of microchiropterans.

To determine the diversity of potentially occurring native plants and animals that may occur within the study area, the following literature sources and databases were consulted:

- The National Parks and Wildlife Service's Atlas of NSW Wildlife Database (NPWS June 2002) (search area 10 x 10 kilometres centred on study area);
- The Environment Australia Online Database (Environment Australia June 2002) (search area 10 x 10 kilometres centred on study area);
- A supplementary fauna assessment of the habitats within and adjacent to the proposed Western Sydney Orbital (LesryK Environmental Consultants 1998);
- A fauna assessment for the proposed realignment of the Western Sydney Orbital, Cecil Hills (LesryK Environmental Consultants 2001a);
- An ecological assessment of the impacts associated with the construction and operation of the proposed Western Sydney Orbital on five threatened microchiropteran species (LesryK Environmental Consultants 2001b);
- A targeted survey to detect bat species within and in close proximity to the alignment of the proposed Western Sydney Orbital (LesryK Environmental Consultants 2002);
- The National Parks Western Sydney Biodiversity Report (NPWS 1997); and
- A report outlining the flora and fauna assessment of the upgrading of Elizabeth Drive (Fanning *et al.* 1995).

Field guides and standard texts used were:

- Harden (1992, 1993, 2000 and 2002) and Robinson (1991) – plants;
- Simpson and Day (1999) – birds;
- Strahan (1995) – mammals; and
- Triggs (1996) – identification of scats, tracks and markings.

The nomenclature of native species recorded follows those presented in these texts.

3.0 ENVIRONMENTAL SETTING

Within the study area, Elizabeth Drive is a two-laned, sealed road with unformed edges. Lane widths are generally around 3.5 metres with formed, earth shoulders and batters 0.5 to 1.0 metre wide. The road reserve within the study area is approximately 40 metres wide, with the majority of the undeveloped reserve occurring on the southern side of Elizabeth Drive. Within the road reserve, depending on the past disturbance history of the site, the structure of the vegetation varies between regularly mown grasses to remnant strips of eucalypt woodland. In relation to the eucalypt woodlands, these mainly occur as a four metre wide band on the southern side of Elizabeth Drive.

A residential development occurs to the south of the study area, with Western Sydney Regional Park being present to the north. Adjacent to the residential development, an earthen noise mound has been constructed this being approximately 2.5 metres high. In regards to this barrier, the top has been rehabilitated and is now vegetated by semi-mature native trees.

Western Sydney Regional Park extends northwards beyond the limits of the study area and is dominated by remnant eucalypt woodlands, with canopy species similar to those present within the study area.

The study area experiences warm to hot summers, with average temperatures ranging between a winter low of approximately 17.2°C to a summer high of around 28.0°C (Bureau of Meteorology, Prospect Reservoir, 2002). The study area has an average annual rainfall of 878.5 mm, with the highest fall being experienced during the summer months (Bureau of Meteorology, Prospect Reservoir, 2002). Natural elevations within the study area range from around 60 metres Australian Height Datum (AHD) in the vicinity of Windsor Road, to 112 metres AHD near Wallgrove Road. The study area occurs within both the Fairfield and Liverpool Local Government Areas.

Conservation reserves that occur north of the study area include Western Sydney Regional Park and the Western Sydney Regional Park. In relation to these conservation reserves, they cover an area of approximately 105 and 1000 hectares respectively. In addition to these major conservation areas, a series of smaller, council managed reserves and parklands are also present in association with the nearby residential areas.

4.0 RESULTS

4.1 Species and Communities Recorded

A list of the plants and animals recorded within the study area is provided in Appendix 1. This is not a comprehensive list of all the exotic or weed species present, and only represents those species recorded while searching for species of National, State or regional conservation concern that are known, or expected to occur in the region.

The majority of the vegetation within the study areas has been modified and degraded by previous land-use activities, weed invasion, and earthworks. Clearing of the vegetation within the study area has occurred between Elizabeth Drive and the vegetated noise mounds to the south. A linear strip of vegetation approximately four metres wide parallels both sides of Elizabeth Drive. On the southern side of Elizabeth Drive this vegetated strip is not continuous along the whole length of the study area; clearing has resulted in the existing remnant vegetation being replaced by an exotic grass cover that is periodically maintained.

Within the study area, the remnant tree species occur as a number of mature and regenerating *Eucalyptus* and *Corymbia* species, these being up to a height of 25 metres. A number of the trees present did support hollows suitable for the life cycle requirements of hollow-dependant native species, these hollows being up to 300 millimetres in diameter. Of those hollow-bearing trees present, several would require removal, these supporting holes that were only up to 150 millimetres in diameter. Throughout the study area, the trees surveyed occur as either isolated individuals or within a linear band of remnant woodland. Depending on the disturbance history, canopy connectivity throughout the study area is either within the line of trees adjacent to the Elizabeth Drive, or non-existent. The middle storey layer contains a sparse distribution of semi-mature native trees, these being up to 15 metres. The ground cover constitutes a high-density layer of native and exotic grasses and climbers, these being to a height of 1.5 metres. This layer has been regularly maintained on the southern side of Elizabeth Drive, with exotic grass species dominating this area. Towards the central portion of the study area, south of Elizabeth Drive, a grove of *Casuarina cunninghamiana* has been planted alongside the fenceline delineating the existing road carriageway from the residential area.

No species of National or State conservation significance, as listed on the Schedules to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the NSW *Threatened Species Conservation Act 1995* or as a ROTAP species (Rare or Threatened Australian Plant, Briggs and Leigh 1996), were located during the survey. Similarly, none of the species recorded within the study area are considered to be of regional or local conservation significance. All native species recorded are protected and are frequently recorded within similar habitats throughout the region.

From a fauna perspective, the species recorded are known to be regularly found within the adjacent habitats, with none being restricted to the limits of the proposed works area. Within

the study area, no significant habitats were recorded which would be important to the life cycle requirements of any of the native species observed.

The following two species located within the study area are listed as noxious weeds within the Fairfield City Local Government Area.

- Blackberry (*Rubus fruticosus*), and
- Prickly Pear (*Opuntia* spp).

Under the *Noxious Weeds Act* 1993, all private land owners/occupiers must take action to control these listed species. The required actions for these weeds are presented in Appendix 1.

The majority of the native vegetation on the southern side of Elizabeth Drive occurs within the proposed 6 metre wide median strip that would separate the dual carriageways. The vegetation traversing the northern boundary of Elizabeth Drive contains a greater number of native species despite degrading factors impacting on the continuity of the native community along the study boundary.

4.2 Conservation Value of those Species and Communities Recorded

The flora and fauna identified during the field survey are considered to be common to abundant species within the surrounding region. The fauna observed are adaptable to living in urbanised areas, these species being associated with the remnant woodlands that occur in this region. During the field investigation, no flora and fauna species of National or State conservation significance as listed as a Rare or Threatened Australian Plant (ROTAP) (Briggs and Leigh 1996), or on the Schedules to the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 or the NSW *Threatened Species Conservation Act* 1995 were located within the proposed road works area. Similarly, no species currently being considered for listing under either the State or Commonwealth legislations (ie a Preliminary Determination) were identified. Within the proposed road works, excluding the remnant woodland proposed for retention within the 6 metre wide median, no habitats important to the life cycle needs of any of the State or Nationally listed threatened species previously recorded or potentially occurring in the surrounding region were recorded. As such, the degraded portions of the site are not considered to be significant for the life cycle requirements of a locally viable population of these plants or animals.

The overstorey species recorded in the study area are characteristic of those that occur within the Cumberland Plain Woodland, specifically the Grey Box Ironbark Woodland community (*Eucalyptus moluccana*, *E. tereticornis*, *E. crebra*). This woodland is an endangered ecological community listed under both the NSW *Threatened Species Conservation Act* 1995 and Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999. Clearing for agriculture and urban developments has resulted in the Cumberland Plain ecological communities being reduced to only eight percent of their original range with a further 13% occurring as scattered overstorey plants across the landscape (NPWS 2001). The JANIS criteria (JANIS 1996) states that for communities that are not naturally rare, a minimum of 15% of the original distribution should be protected to ensure adequate reservation (Sinclair Knight Merz 2000). On this basis, the Cumberland Plain Woodland community is inadequately reserved.

The NSW Scientific Committee have declared that, by themselves, small fragmented stands within conservation reserves are not considered sufficient to ensure the long-term conservation of a community unless the factors that threaten the integrity and survival of the community are ameliorated (Sinclair Knight Merz 2000). Given the highly disturbed environment that exists within the study area, it is not thought that the up to 20 trees identified for removal within the current proposal would appreciably decrease the conservation significance of the Cumberland Plain Woodland community that occurs within the study area.

5.0 THREATENED SPECIES PREVIOUSLY RECORDED IN THE REGION.

Through consultation of known literature sources and databases, it was identified that a number of threatened species have been previously recorded in the study region (Table 1).

During the field survey, although their documented vegetation associations were targeted, none of the threatened plants listed in Table 1 were recorded within the study area. Similarly, excluding the microchiropterans that may be present in association with several of the hollow bearing trees, no individuals of those threatened fauna previously recorded were observed or indicated. For these fauna species, within the boundaries of the proposed road works, no habitats important to these animals were recorded. Within the boundaries of the proposed road works area there are no significant occurrences of nectar producing eucalypt trees, no wetlands, drainage lines or well developed woodlands. As such, none of these threatened species would occur as a resident population within the limits of the road works area.

Individuals of the hollow-dependant microchiropterans (insectivorous bats) may be present within those trees that support hollows. Although this is the case, the loss of several hollow-bearing trees from the road reserve, is not considered to present a significant impact, particularly as:

- a) Other hollow bearing trees are present (and would be retained) within the study area; and
- b) Large portions of the surrounding lands (which include more intact stands of hollow bearing trees) are protected within the region's designated conservation reserve network.

The removal of several hollow-bearing trees, in comparison with the resources provided by both the adjacent and nearby conservation reserves, is not considered to have a significant impact on any hollow-dependant microchiropterans, their populations, ecological communities or habitats. In relation to this issue, it is considered that the loss of several trees, given the extent of similar resources both within, and adjacent to, the study area, would be equivalent to a natural tree fall within a woodland due to senescence or an adverse climatic condition. It is considered that, if microchiropterans are roosting within the two trees to be removed, as long as suitable mitigative measures are adopted to provide these animals with sufficient opportunity to flee the area (refer to Section 8.0), then no microchiropterans would be significantly affected such that a species would be placed at risk of extinction. Therefore, it is considered that the road works may proceed as proposed, without negatively affecting any populations of threatened microchiropterans.

6.0 ECOLOGICAL ASSESSMENTS

6.1 Commonwealth Legislative Considerations

At the completion of the field surveys, no plant or animal species listed under the Schedules to the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 had been recorded. Furthermore, the undertaking of the proposed road works would not result in the loss, modification, disturbance or fragmentation of any habitat resources important to those Commonwealth Scheduled plant or animal species previously recorded in either the Fairfield or Liverpool City Local Government Areas. No resources significant to those Commonwealth listed species would be either directly or indirectly affected by the proposed road works. As such, the proposed works could proceed as planned without requiring the referral of the matter to the Federal Minister of the Environment on the grounds of having an adverse impact on Commonwealth threatened species or their habitats.

Table 1: Threatened species previously recorded in the study region.

COMMUNITIES	Bar-tailed Godwit <i>Limosa lapponica</i>
Cumberland Plain Woodland	Sharp-tailed Sandpiper <i>Calidris acuminata</i>
PLANTS	Bush-stone Curlew <i>Burhinus grallarius</i>
<i>Acacia bynoeana</i>	Osprey <i>Pandion haliaetus</i>
<i>Acacia pubescens</i>	Square-tailed Kite <i>Lophoictinia isura</i>
<i>Allocasuarina glaireicola</i>	White-bellied Sea-eagle <i>Haliaeetus leucogaster</i>
<i>Cynanchum elegans</i>	Superb Fruit-dove <i>Ptilinopus superb</i>
<i>Dichelachne parva</i>	Latham's Snipe <i>Gallinago hardwickii</i>
<i>Dillwynia tenuifolia</i>	Bar-tailed Godwit <i>Limosa lapponica</i>
<i>Grevillea obtusiflora</i>	Sharp-tailed Sandpiper <i>Calidris acuminata</i>
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Bush-stone Curlew <i>Burhinus grallarius</i>
<i>Lepidium hyssopifolium</i>	Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i>
<i>Leptospermum deanei</i>	Superb Parrot <i>Polytelis swainsonii</i>
<i>Persoonia nutans</i>	Swift Parrot <i>Lathamus discolor</i>
<i>Pimelea spicata</i>	Turquoise Parrot <i>Neophema pulchella</i>
<i>Pterostylis saxicola</i>	Powerful Owl <i>Ninox strenua</i>
<i>Pultenaea parviflora</i>	Barking Owl <i>Ninox connivens</i>
<i>Pultenaea pedunculata</i>	Sooty Owl <i>Tyto tenebricosa</i>
<i>Thesium australe</i>	White-throated Needletail <i>Hirundapus caudacutus</i>
INVERTEBRATES	Rainbow Bee-eater <i>Merops ornatus</i>
Cumberland Plain Land Snail <i>Meridolum comeovirens</i>	Regent Honeyeater <i>Xanthomyza phrygia</i>
BIRDS	Painted Honeyeater <i>Grantiella picta</i>
Freckled Duck <i>Stictonetta naevosa</i>	Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i>
Blue-billed Duck <i>Oxyura australis</i>	Superb Parrot <i>Polytelis swainsonii</i>
Cattle Egret <i>Ardea ibis</i>	Swift Parrot <i>Lathamus discolor</i>
Great Egret <i>Ardea alba</i>	Turquoise Parrot <i>Neophema pulchella</i>
Black Bittern <i>Ixobrychus flavicollis</i>	Powerful Owl <i>Ninox strenua</i>
Australasian Bittern <i>Botaurus poiciloptilus</i>	Barking Owl <i>Ninox connivens</i>
Common Sandpiper <i>Actitis hypoleucos</i>	Sooty Owl <i>Tyto tenebricosa</i>
Latham's Snipe <i>Gallinago hardwickii</i>	Bar-tailed Godwit <i>Limosa lapponica</i>

The removal of up to twenty mature trees that form part of the Cumberland Plain Woodlands that occur within the study area would not result in a significant reduction in the area of Cumberland Plain Woodland remaining either adjacent to the study site or in the Sydney region. The stand is degraded by loss of understorey species and soil compaction, and these impacts are likely to continue given the sites current use. The removal of up to twenty mature trees would not be considered to significantly affect the viability of a Nationally listed Endangered Ecological Community, and therefore the matter would not require referral to the Federal Minister of the Environment.

6.2 State Legislation Considerations

6.2.1 State Environmental Planning Policy No 44 - Koala Habitat Protection

The Liverpool Local Government Area is identified under Schedule 1 – Local Government Areas of State Environmental Planning Policy No 44 (SEPP 44) – Koala Habitat Protection. This policy seeks to encourage the proper conservation and management of areas that provide habitat for Koalas.

Within, and adjacent to the study area, four eucalypts listed under Schedule 2 (Koala feed trees) of SEPP 44 were recorded, these being the Narrow-leaved Ironbark *Eucalyptus crebra*,

Grey Box *Eucalyptus molluccana*, Forest Red Gum *Eucalyptus tereticornis* and Cabbage Gum *Eucalyptus amplifolia*. These trees combined constitute greater than 15% of the total tree canopy present within the study area. Thus, in accordance with the definitions provided under SEPP 44, the study area is considered to constitute potential Koala habitat. When undertaking the field investigation, efforts were made to survey these feed trees looking for signs of likely use of the study area by Koalas. Evidence sought included scratches and scats, or any indirect evidence linking the Koala to the study area. By the completion of the investigation, no evidence to suggest the presence of a resident Koala population was found. As such, in accordance with SEPP 44, the study area is not considered to constitute core Koala habitat.

The proposed road works would, therefore, not be considered to significantly affect any Koala populations or their habitat areas. Therefore, a Plan of Management for the conservation and management of areas of Koala habitat is not required to be prepared as part of the current proposal.

6.2.2 Section 5A of the *Environmental Planning and Assessment Act 1979*

An eight-part test under Section 5A of the *Environmental Planning and Assessment Act 1979* is designed to determine "whether there is likely to be a significant effect on threatened species, populations, ecological communities, or their habitats" listed on the Schedules to the *Threatened Species Conservation Act 1995*, and consequently, whether a Species Impact Statement is required. The eight-part test, therefore, refers only to those species, populations or ecological communities listed on the Schedules to the *Threatened Species Conservation Act 1995*. It does not refer to ROTAP species, or species of local or regional conservation significance.

No threatened plant or animals species or populations were recorded or indicated as occurring within the study area. Similarly, the vegetation communities and fauna habitats to be removed or temporarily affected by the proposed road works are not considered significant for the life cycle requirements of any threatened species identified as having been previously recorded in the study region.

Within the area proposed for the 6 metre wide median, the canopy species recorded are characteristic of the Grey Box Ironbark Woodland, a sub-unit of the listed Cumberland Plain Woodland. Due to the degraded nature of the woodland within this portion of the study site, and the NSW Scientific Committee declaring that small fragmented stands in such condition are not sufficient to ensure the long-term conservation of a community unless the degrading factors are ameliorated, it is not thought that the vegetation community within the study area poses significant habitat. Although this is the case, the following assessment has been undertaken to ensure that greater consideration has been given to the current proposal and its potential to have an adverse impact on the natural environment and those native species that are supported by it.

(a) "...in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction..."

Though targeted, no threatened plants or animals listed under the Schedules to the NSW *Threatened Species Conservation Act 1995* were recorded or indicated as being present within the study site. Therefore, it is not expected that any threatened species exist in numbers large enough to constitute a viable local population.

(b) "...whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised..."

No endangered populations listed on Schedule 1 (Part 2) of the NSW *Threatened Species Conservation Act 1995* occur within the study site.

(c) *"...in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed..."*

No significant area of habitat exists within the study area in relation to the regional distribution of the habitat of a threatened plant or animal species, population or ecological community.

The area to be impacted by the proposed road work will not significantly impact the Grey Box Ironbark Woodland, a sub-unit of the listed Cumberland Plain Woodland. All of the areas to be cleared by the proposed Elizabeth Drive upgrade have been previously disturbed by processes such as vegetation removal, soil compaction and weed infestation.

(d) *"...whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community..."*

The adjacent Western Sydney Regional Park, which is dominated by larger, more intact stands of Cumberland Plain Woodlands, is currently an isolated fragment of what was once a widespread vegetation community. The proposed removal of up to twenty (20) mature trees from the study area is not expected to significantly increase the fragmentation of any area of native vegetation.

(e) *"...whether critical habitat will be affected..."*

Due to the land clearing that has previously taken place, no habitats considered critical to the life cycle needs of any of the threatened flora or fauna species, populations or ecological communities previously recorded in the region occur within the study area. The area is not listed as critical habitat under Part 3 Division 1 of the NSW *Threatened Species Conservation Act 1995*.

(f) *"...whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region..."*

Threatened species and their populations are known to be present within the region's conservation reserve system, though whether they are adequately represented in these areas is unknown. Although this is the case, it is not expected that any threatened species would significantly rely upon the disturbed environments impacted by the current proposal such that the further disturbance of these resources would compromise the viability of any resident local populations.

The Cumberland Plain Woodland is not adequately reserved according to the JANIS criteria (Section 4.2). Although this is the case, whether the plant species complex within the study area constitutes Grey Box Ironbark Woodland, a sub-unit of the listed Cumberland Plain Woodland, is debateable. Given the land clearing and ecological degradation that has taken place within the study area, it is unlikely that the proposed removal of up to 20 mature trees with negligible understorey would represent a loss of a threatened ecological community.

(g) "...whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process..."

Currently eleven threatening processes for mainland New South Wales are listed under Schedule 3 of the *NSW Threatened Species Conservation Act 1995*. Of these "clearing of native vegetation" would be applicable to the current proposal.

Although it is acknowledged that the current proposal will result in the clearance of some native vegetation, it is not considered that the clearance likely to take place as a result of the works would result in an overall loss of any botanical biodiversity from the region. This is due to:

- The value of the existing native vegetation to be modified or removed within the study site;
- The disturbance history of the vegetation to be modified or removed within the study site (both past and present);
- The assemblage of species recorded during the field investigations;
- The local, regional, State and National status of the species recorded during the field investigations; and
- The assessment of the value of the habitat to be modified or removed for those threatened species previously recorded for the region.

(h) "...whether any threatened species, populations or ecological community is at the limit of its known distribution..."

No species, populations or communities observed within or adjacent to the site are considered to be at the limit of their known distribution patterns.

6.2.2.1 Expected impact on the habitats of threatened species

By the completion of the field survey, no plants, animals or populations listed on the Schedules to the *NSW Threatened Species Conservation Act 1995* had been recorded within the proposed road works area. Components of the endangered ecological community, Cumberland Plain Woodland, are present, the majority being retained within a six metre wide median strip. In relation to this community, the works would require the removal of up to twenty mature trees. This is not considered to constitute a significant component of this vegetation type. Within the study area, no habitats significant to those threatened plants or animals previously recorded in the region were observed in association with any of the trees proposed for removal. Giving consideration to the assessment criteria listed under Section 5A of the *Environmental Planning and Assessment Act 1979*, the scale of the works proposed, the species recorded and the documented life cycle requirements of those threatened species potentially occurring, it is not considered that the proposed upgrade to Elizabeth Drive between Wallgrove and Windsor Roads would have an impact on any threatened species, populations, ecological communities or their habitats. Similarly, the works would not be considered to constitute a Key Threatening Process to any of the threatened species, populations or communities that occur within both the study area and surrounding region. As such, it is not considered that the undertaking of the proposed upgrade to Elizabeth Drive would require the preparation of a Species Impact Statement.

7.0 CONCLUSIONS

As no threatened plants, animals, or their habitats were recorded within the study area, and as the works would only be removing a select number of trees from the Cumberland Plain Woodland remnant, it is not considered that the works would have a significant impact on any threatened species or their habitats. The works would not affect any fauna corridors and would not isolate any habitat areas critical to any native species. The works, therefore, may

proceed as planned without requiring either the referral of the matter to the Federal Minister for the Environment or the preparation of a Species Impact Statement.

The proposed upgrade to Elizabeth Drive would involve the removal of up to twenty mature trees while the remaining trees will be retained within a 6 metre wide median strip between the east-west traffic. Although the remaining trees are not of conservation value, consideration should be given to general ecological and biodiversity principles and, as such, these trees should remain on site as long as they do not represent a danger to commuters.

8.0 RECOMMENDATIONS

- Prior to their removal, all hollow bearing trees should first be checked for the presence of birds nesting and arboreal animals such as possums. Animals found to be occupying these trees should be safely removed before clearing. Removed animals should be relocated to adjacent woodland habitats by a qualified ecologist.
- Tree hollows should be checked for animals after felling or pushing, and injured animals should be taken to a local vet, or the local wildlife rescue service should be notified.
- Trees should be removed and felled in such a manner that they minimise the extent of disturbance on adjacent vegetation that is to be retained.
- Post-construction, the road verges and median strip should be landscaped with a suite of locally occurring native plants that compliment the Grey Box Ironbark Woodlands (Appendix 2). To ensure genetic integrity, it is preferable that the propagules are collected from within or in-close proximity to the study region.
- Weed control measures that inhibit the growth of exotic species should be undertaken. The use of mulch within the revegetation site will be determined by the choice of plant propagules used. Mulching heavily around planted tubestock is beneficial in minimising weed competition, however, native seedlings may also be inhibited if broadcast seeds are spread on site. Mulch may consist of chipped eucalypts from site, one of the many suitable commercial 'leaf mulches' that exist, or it may be a commercial weed mat. All imported mulch to site should be of known provenance and be weed-free. Should a weed-mat be chosen to suppress weed growth, ensure that a commercial brand that does not have a plastic net backing on the natural fibres is chosen. This netting has been observed to remain for a period of time following decomposition of the product.

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APPENDIX 1

Appendix 1: Fauna and flora species recorded for the Elizabeth Drive study area, between Wallgrove Road and Windsor Road.

Key

* - exotic, naturalised or non-indigenous species (Noxious Weed Status where reported).

FAMILY	SCIENTIFIC NAME	COMMON NAME	
FAUNA			
Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron	
Columbidae	<i>Streptopelia chinensis</i>	Spotted Turtle-dove	*
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	
	<i>Grallina cyanoleuca</i>	Magpie Lark	
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	
Artamidae	<i>Gymnorhina tibicen</i>	Australian Magpie	
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow	
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling	*
	<i>Acridotheres tristis</i>	Common Myna	*
Scincidae	<i>Lampropholis guichenoti</i>	Garden Skink	
FLORA			
Asclepiadaceae	<i>Araujia hortorum</i>	Mothvine	*
	<i>Gomphocarpus fruticosus</i>	Narrow-leaved cotton bush	*
Asparagaceae	<i>Myrsiphyllum asparagoides</i>	Bridal creeper	*
Asteraceae	<i>Bidens pilosa</i>	Cobbler's pegs	*
	<i>Cirsium vulgare</i>	Spear thistle	*
	<i>Conyza bonariensis</i>	Fleabane	*
	<i>Senecio madagascariensis</i>	Fireweed	*
Cactaceae	<i>Opuntia</i> sp.	Prickly pear	* w4f
Caesalpinioideae	<i>Senna pendula</i> var. <i>glabrata</i>		*
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River oak	
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	
Epacridaceae	<i>Lissanthe strigosa</i>	Peach heath	
Euphorbiaceae	<i>Phyllanthus</i> sp.		
Fabaceae: Faboideae	<i>Glycine clandestina</i>		
	<i>Hardenbergia violacea</i>	False sarsaparilla	
	<i>Medicago</i> sp.	Medic	*
	<i>Trifolium repens</i>	White clover	*
Fabaceae: Mimosideae	<i>Acacia implexa</i>		
Malvaceae	<i>Sida rhombifolia</i>	Paddy's lucerne	*
Myrtaceae	<i>Corymbia maculata</i>	Spotted gum	
	<i>Eucalyptus crebra</i>	Narrow-leaved ironbark	
	<i>Eucalyptus molluccana</i>	Grey box	
	<i>Eucalyptus tereticomis</i>	Forest red gum	
	<i>Eucalyptus amplifolia</i> subsp. <i>amplifolia</i>	Cabbage gum	
Oleaceae	<i>Olea europaea</i> subsp. <i>africana</i>	Common olive	*
Phormiaceae	<i>Dianella longifolia</i> var. <i>longifolia</i>		
Pittosporaceae	<i>Bursaria spinosa</i>	Native blackthorn	*

FAMILY	SCIENTIFIC NAME	COMMON NAME	
Plantaginaceae	<i>Plantago lanceolata</i>	Lamb's Tongue	*
Poaceae	<i>Andropogon virginicus</i>	Whisky Grass	
	<i>Axonopus affinis</i>	Narrow-leaved Carpet Grass	*
	<i>Chloris gayana</i>	Rhodes Grass	*
	<i>Cynodon dactylon</i>	Couch	*
	<i>Lolium perenne</i>	Perennial Ryegrass	*
	<i>Microlaena stipoides</i> var. <i>stipoides</i>		
	<i>Paspalum dilatatum</i>	Paspalum	*
	<i>Setaria gracilis</i>	Slender Pigeon Grass	*
	<i>Sporobolus elongatus</i>	Slender Rat's Tail Grass	
	<i>Themeda australis</i>	Kangaroo Grass	
Proteaceae	<i>Grevillea robusta</i>	Silky Oak	
Rosaceae	<i>Rubus fruticosus</i> (agg. spp.)	Blackberry	* w2
Salicaceae	<i>Salix</i> sp.	Willow	*
Solanaceae	<i>Lycium ferocissimum</i>	African Boxthorn	*
Umbelliferae	<i>Foeniculum vulgare</i>	Fennel	*
Verbenaceae	<i>Verbena bonariensis</i>	Purple Top	*

Action For Noxious Weed Categories:

W2 weeds must be fully and continuously suppressed and destroyed.

W4f weeds shall not be sold, propagated or knowingly distributed. Occupier must implement biological control or other control program directed by the Local Control Authority.

APPENDIX 2

Appendix 2: Flora species suitable for inclusion in any revegetation works within the study area.

FAMILY	SCIENTIFIC NAME
Acanthaceae	<i>Brunoniella australis</i>
Anthericaceae	<i>Arthropodium milleflorum</i>
	<i>Tricoryne elatior</i>
Asphodelaceae	<i>Bulbine bulbosa</i>
Asteraceae	<i>Vernonia cineria</i>
Campanulaceae	<i>Wahlenbergia gracilis</i>
Chenopodiaceae	<i>Einadia</i> sp.
Clusiaceae	<i>Hypericum gramineum</i>
Commelinaceae	<i>Commelina cyanea</i>
Convolvulaceae	<i>Dichondra repens</i>
Cyperaceae	<i>Cyperus gracilis</i>
	<i>Lepidosperma laterale</i>
Dilleniaceae	<i>Hibbertia diffusa</i>
Epacridaceae	<i>Leucopogon juniperinus</i>
	<i>Lissanthe strigosa</i>
Euphorbiaceae	<i>Phyllanthus filicaulis</i>
Fabaceae: Fabiodeae	<i>Daviesia ulicifolia</i>
	<i>Dillwynia sieberi</i>
	<i>Glycine clandestina</i>
	<i>Glycine tabacina</i>
	<i>Hardenbergia violacea</i>
	<i>Indigofera australis</i>
	<i>Pultenaea microphylla</i>
Fabaceae: Mimosideae	<i>Acacia decurrens</i>
	<i>Acacia falcata</i>
	<i>Acacia implexa</i>
	<i>Acacia parramattensis</i>
Goodeniaceae	<i>Goodenia hederacea</i>
Hypoxidaceae	<i>Hypoxis hygrometrica</i>
Lamiaceae	<i>Ajuga australis</i>
Lobeliaceae	<i>Pratia purpurascens</i>
Lomandraceae	<i>Lomandra filiformis</i>
	<i>Lomandra multiflora</i>
Myoporaceae	<i>Eremophila debilis</i>
Myrtaceae	<i>Eucalyptus crebra</i>
	<i>Eucalyptus eugenioides</i>
	<i>Eucalyptus fibrosa</i>
	<i>Eucalyptus maculata</i>
	<i>Eucalyptus moluccana</i>
	<i>Eucalyptus tereticomis</i>
	<i>Melaleuca decora</i>
Oxalidaceae	<i>Oxalis exilis</i>
Phormiaceae	<i>Dianella longifolia</i>
	<i>Dianella revoluta</i>
Pittosporaceae	<i>Bursaria spinosa</i>

Poaceae	<i>Aristida ramosa</i>
	<i>Aristida vagans</i>
	<i>Chloris ventricosa</i>
	<i>Dichelachne micrantha</i>
	<i>Echinopogon caespitosus</i>
	<i>Echinopogon ovatus</i>
	<i>Entolasia marginata</i>
	<i>Eragrostis leptostachya</i>
	<i>Microlaena stipoides</i>
	<i>Notodanthonia racemosa</i>
	<i>Oplismenus aemulus</i>
	<i>Panicum simile</i>
	<i>Poa sieberiana</i>
	<i>Themeda australis</i>
Rubiaceae	<i>Asperula conferta</i>
Santalaceae	<i>Exocarpos cuppressiformis</i>
Sinopteridaceae	<i>Cheilanthes sieberi</i>
Solonaceae	<i>Solanum pungetium</i>

TRAFFIC NOISE ASSESSMENT

Koikas Acoustics Pty Ltd

KOIKAS ACOUSTICS PTY LTD

CONSULTANTS IN NOISE AND VIBRATION ACN 058 524 771 ABN 12 058 524 771
60 GLENFARNE STREET, BEXLEY NSW 2207 AUSTRALIA
EMAIL : nick_koikas@mail2me.com.au FAX: 02 9587 5337 PH: 02 9587 9702

TRAFFIC NOISE ASSESSMENT OF ELIZABETH DRIVE BETWEEN 70 m EAST OF WINDSOR ROAD ROUND- ABOUT, AND 250 m EAST OF WALLGROVE ROAD, CECIL HILLS

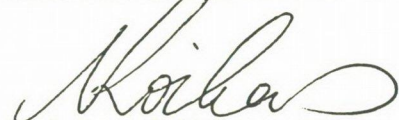
Date: 18 September, 2002

Project No.: 962

Report Reference: R03072a2.nk

Prepared For: Tim Macoun
Macoun Environmental Consulting

Prepared By: KOIKAS ACOUSTICS PTY LTD



Nicholas G. Koikas, BAppSc, MAAS
Principal Consultant

TRAFFIC NOISE ASSESSMENT OF ELIZABETH DRIVE BETWEEN 70 m EAST OF WINDSOR ROAD ROUND-ABOUT, AND 250 m EAST OF WALLGROVE ROAD, CECIL HILLS

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1.0 INTRODUCTION

Koikas Acoustics Pty Ltd was requested by Macoun Environmental Consulting on behalf of the Roads and Traffic Authority to undertake further traffic noise measurements and modelling of Elizabeth Drive between Windsor Road, and Wallgrove Roads, Cecil Hills.

This study has been assessed in accordance with the Environment Protection Authority's *Environmental Criteria for Road Traffic Noise (ECRTN)*, May 1999, the Roads and Traffic Authority's *Environmental Manuals Volumes 2 and Australian Standard 2702-1984 "Acoustics - Methods of Measurement of Road Traffic Noise*, and the RTA's *Environmental Noise Management Manual (ENMM)*".

This assessment discusses:

- traffic noise survey results taken over a week at one site adjacent to Elizabeth Drive;
- a desk top study based on traffic data provided by the Roads and Traffic Authority;

2.0 TRAFFIC NOISE CRITERIA

In May 1999, the EPA released its traffic noise policy entitled "Environmental Criteria for Road Traffic Noise".

This road upgrade is defined by the EPA's ECRTN as a road upgrade which is not "**Redevelopment**". Redevelopment is defined as "*where it is proposed to increase road carrying capacity, change the traffic mix or change the road alignment through design or engineering changes*".

However, based on the interpretation of the RTA's ENMM;

- these works are to be undertaken entirely within an existing same category road corridor;
- the works were not intended to increase traffic carrying capacity or change the traffic mix;
- will not make a significant contribution to road traffic noise as defined in the ENMM practice notes;
- the catchment area is currently exposed to high levels of traffic noise along the fringes adjacent to Elizabeth Drive.

If however, the noise levels are expected to increase by more than 2 dB(A), the traffic noise descriptor levels and the criteria which apply for redevelopment of existing arterial roads is:

- ▶ Daytime, 60 dB(A) *Leq*, 15 hours taken between 07:00 and 22:00 hours; and
- ▶ Night time, 55 dB(A) *Leq*, 9 hours taken between 22:00 and 07:00 hours.

If the increase is less than 2 dB(A) and the levels are below 65 dB(A) daytime and 60 dB(A) night time then no noise mitigation as required. If however levels are above these levels then the RTA's ENMM requires consideration of noise attenuation (not necessarily architectural) regardless of the expected increase in noise levels.

3.0 TRAFFIC NOISE SURVEY

3.1 TRAFFIC NOISE

The Environment Protection Authority's (EPA) Environmental Criteria for Road Traffic Noise (May 1999) is currently used by the RTA to assess traffic noise criteria for new and existing roads. The traffic noise descriptor levels used in this assessment are:

- ▶ daytime $L_{Aeq, 15 \text{ hours}}$ calculated by taking the logarithmic average of all the $L_{Aeq, 15 \text{ minutes}}$ levels between 07:00 and 22:00 hours; and
- ▶ night time $L_{Aeq, 9 \text{ hours}}$ calculated by taking the logarithmic average of all the $L_{Aeq, 15 \text{ minutes}}$ levels between 22:00 and 07:00 hours.

3.2 TRAFFIC NOISE MONITORING SITES

Appendix A consists of an aerial photograph showing the existing and proposed road alignment of the subject length of road.

Appendix B consists of terrestrial photographs showing the view of the road from the monitoring sites and the location of the noise monitoring equipment.

Traffic noise monitoring over a one week period was undertaken at No. 25 Balmoral Circuit, Cecil Hills. Measurements were taken in front of the front facade.

Additional short term noise measurements referenced to No. 25 Balmoral Circuit were undertaken at:

- No. 19 Balmoral Circuit, Cecil Hills. Measurements were taken in front of the front facade;
- No. 122 Lancaster Avenue, Cecil Hills. Measurements were taken in free field conditions at the rear of the property;
- No. 3 Albermarle Place. Measurements were taken in free field conditions at the rear of the property;
- No. 3 Burgundy Close. Measurements were taken in free field conditions at the front of the property;
- No. 18B Isabel Close. (Address No. not certain) Measurements were taken in free field conditions at the rear of the property.

Appendix B is a map showing the location of monitoring.

3.3 NOISE MONITORING EQUIPMENT

All traffic noise level measurements were taken outdoors. All noise monitoring equipment used are Class 1 sound level meters:

At No 25 Balmoral Circuit, a SVAN 912 meter S/N 2066 was used to take measurements over a one week period.

Noise measurements were taken over two 15 minute periods with a Class 1 SVAN 912 AE

S/N 2312 sound level meter at the other monitoring sites.

All sound level meters were calibrated with a reference sound source before and after the measurements with a Rion Sound Level Meter Calibrator NC-73 S/N 10702593. Calibration drifts of less than 0.2 dB(A) were recorded for these instruments. All equipment used have been calibrated by a NATA certified laboratory.

Appendix C consists of recent calibration certification.

3.4 MEASUREMENT METHODOLOGY

The sound level meter microphone was placed 1 metre from the closest noise sensitive facade and 1.5 metres off the ground at 25 and 19 Balmoral Circuit. Noise measurements undertaken at the other sites were taken in free field conditions. For those sites, traffic noise levels were increased by 2.5 dB(A).

All noise level measurements were A-weighted and the sampling time weighting was set on Fast. For the long term monitoring station, exceedance L_x and equivalent continuous L_{eq} levels were calculated over fifteen minute consecutive periods for a minimum of seven days. Noise levels of L_1 , L_{10} , L_{90} and L_{eq} were graphed to assist with the identification of anomalous trends.

All equipment used and measurement methodologies were undertaken in accordance with the requirements of relevant Australian Standards such as AS 2702 - 1984 "Methods for the Measurement of Road Traffic Noise" and the EPA's measurement procedures outlined in Appendix C of the Environmental Criteria for Road Traffic Noise.

4.0 RESULTS OF MEASUREMENTS

4.1 METEOROLOGICAL CONDITIONS

Meteorological conditions during the taking of the traffic noise survey was generally fine and therefore, unlikely to have affected the outcome of the results.

4.2 OUTDOOR NOISE LEVEL MEASUREMENTS

Appendix D consists of tabular and graphical presentation of the traffic noise levels over seven days the monitoring site. Table 1 is a summary of the daily traffic noise levels at 25 Balmoral Circuit, Cecil Hills.

Table 1 Measured Traffic Noise Levels at No. 25 Balmoral Circuit, Cecil Hills

DATE	Outdoor Traffic Noise Levels [dB(A)]							
	Thursday 20-06-02	Friday 21-06-02	Saturday 22-06-02	Sunday 23-06-02	Monday 24-06-02	Tuesday 25-06-02	Wednesday 26-06-02	7 Day Average
L_{Aeq}, 24 hours (0000 - 2400)	61.7	61.9	60.7	59.4	61.8	61.7	61.0	61
L_{Aeq}, 8 hours (2200 - 0600)	58.7	58.6	59.1	58.0	58.7	59.3	59.9	59
L_{Aeq}, 15 hours (0700 - 2200)	62.3	62.8	61.1	60.1	62.6	62.2	61.2	62
L_{Aeq}, 9 hours (2200 - 0700)	60.1	59.8	59.8	58.2	60.1	60.5	60.6	60
L_{A10,18 hours} (0600 - 2400)	64.5	64.8	63.2	62.0	64.5	64.6	63.6	64

Table 2 is a summary of the calculated day and night time traffic noise levels for the additional five monitoring stations.

Table 2 Measured / Calculated Traffic Noise Levels at Five Additional Monitoring Sites

DATE	Outdoor Traffic Noise Levels [dB(A)]				
	19 Balmoral (Facade 0 dBA adjustment)	122 Lancaster (Facade 0 dB adjustment)	3 Albermarle (Free Field 2.5 dBA adjustment)	3 Burgundy Close (Free Field 2.5 dBA adjustment)	18B Isabel Close (Free Field 2.5 dBA adjustment)
L_{Aeq}, 15 hours (0700 - 2200)	63	64	66	65	67
L_{Aeq}, 9 hours (2200 - 0700)	61	62	64	63	65

Although the distance between this site, No 25 Balmoral Circuit is approximately the same distance away from Elizabeth Drive as No. 139 and 125 Edinburgh Circuit, the sound propagation path between the traffic to the receiver point is considerably different. Background noise levels at 25 Balmoral Circuit were found to be higher. This is attributed to the field of view of the tyre/road interaction as compared to the Edinburgh monitoring sites.

5.0 TRAFFIC NOISE PREDICTIONS

5.1 CORTN METHOD

Predicted traffic noise levels were calculated using a traffic noise prediction model called the United Kingdom, Department of Transport, 1988 Calculation Of Road Traffic Noise (UK DoT 1988 CORTN) method. This is the RTA's preferred method of use over the United Kingdom Department of Environment, 1975 Calculation of Road Traffic Noise (UK DoE 1975 CORTN) method. Incorporated in the later version of the UK DoT 1988 CORTN method are all the procedures and algorithms of the former UK DoE 1975 CORTN method along with the provisions for a wider variety of road surface textures and other amendments. In addition, amendments were made for Australian topography and road surface conditions. These amendments are outlined in Appendix B of the RTA Environment Manual, Volume 2.

5.2 TRAFFIC DATA USED WITH THE 1988 UK CORTN MODEL

AADT refers to Average Annual Daily Traffic.

The RTA provided the following traffic data:

5.2.1 Traffic Volumes

Existing AADT	Year 2002 :	23669	w/o WSO	
Proposed AADT	Year 2004 :	24616	w/o WSO	
Koikas Estimated	Year 2006 :	25000	w/o WSO	Proposed year of opening
Proposed AADT	Year 2016 :	>30000	w/o WSO	10 years after opening
Proposed AADT	Year 2016 :	<20000	w WSO	as above

5.2.2 Percentage of Heavy Vehicles

Year 2002 : 8 %
Year 2006 : 8 %
Year 2016 : 10 %

5.2.3 Traffic Speed [km/hr]

The statutory traffic speed is 70 km/hr. Traffic speeds approaching and leaving the two roundabouts was assumed to be about 50 km/hr, and on the roundabouts traffic speeds were assumed to be 40 km/hr.

5.2.4 Road Surface Type

Dense graded asphaltic concrete (DGAC) was assumed for the subject length of Elizabeth Drive.

5.3 TRAFFIC NOISE PREDICTION RESULTS

Predicted traffic noise levels were calculated at six sites adjacent to Elizabeth Drive. The results of these calculations are summarised in Table 3.

Table 3 Summary of Measured and Calculated Traffic Noise Level Results

	Daytime Traffic Noise Level L _{Aeq} , 15 hours					
	Front 25 Balmoral Circuit	Front 19 Balmoral Circuit	Rear 122 Lancaster Avenue	Rear 3 Albemarle Place	Front 3 Burgundy Close	Rear 18B Isabel Close ?
Measured/Calculated Level <u>Existing Road Alignment</u> (Year 2002)	62	63	64	66	65	67
Predicted Traffic Noise Levels <u>Existing Road Alignment</u> (Year 2002) CALIBRATION PURPOSES	62.0	63.0	63.5	66.0	64.5	66.0
Predicted Increase in Traffic Noise Between Year 2002 and Year 2006 for <u>Existing Road Alignment</u>	+0.2	+0.2	+0.2	+0.2	+0.2	+0.2
Predicted Increase in Traffic Noise Between <u>Existing and Proposed Road</u> <u>Alignments</u> (Year 2006)	+1.4	+1.3	+1.5	+1.2	+0.8	+0.7
Predicted Traffic Noise Levels <u>Proposed Road Alignment</u> (Year 2016)	62.5	63.9	65.0	66.4	64.9	67.0
Predicted Increase in Traffic Noise Between Year 2006 (Existing Road Alignment) and 2016 (Proposed Road Alignment)	+0.3	+0.7	+1.3	+0.2	+0.2	+0.8

It is noted, that there are a significant proportion of homes adjacent to Elizabeth Drive that are not double storey.

6.0 CONCLUSIONS

6.1 ASSESSMENT OUTCOMES

When the Western Sydney Orbital is open, a significant decrease in traffic is expected along the subject length of Elizabeth Drive between the year 2016 proposed new road alignment (AADT <20,000) and year 2006 existing road alignment (AADT ~ 25,000). The result of this is a reduction in traffic noise.

The new road alignments will bring traffic closer to the receiver points. The result of this is traffic noise levels will increase.

The reduction of ground attenuation will result in an increase in traffic noise.

The path length difference between the source, the 2.5 metre high noise mound and the receiver point will marginally change. There will be a marginal reduction in traffic noise.

Based on the survey results, and predicted increase in traffic noise for residential properties adjacent to Elizabeth Drive between Windsor Road and Wallgrove Road, Cecil Hills, the cumulative traffic noise increase will be less than 2 dB(A), and therefore no traffic noise mitigation measures are warranted.

However as three of the model locations are predicted to be in excess of 65 dB(A) daytime then consideration of noise attenuation measures are necessary.

6.2 MITIGATION MEASURES

6.2.1 Increasing Height of Noise Barriers

If a noise wall was considered to be erected on top of the existing earth mound, a minimal traffic noise reduction would result. The location of the barrier/earth mound is approximately midway between the source and receiver points. The greatest degree of sound diffraction occurs when a barrier is placed midway between a sound source and a receiver. Increasing the height of the barrier would therefore result in minimal noise attenuation. Installation of noise barriers would therefore not prove to be cost effective or practical.

If a noise barrier was considered in order to achieve the EPA's Base Noise Goals, the estimated height of the noise barrier required for each of the assessment sites is as follows:

- | | |
|------------------------------|--|
| • No. 25 Balmoral Circuit : | 2 metres high along the existing earth mound |
| • No. 19 Balmoral Circuit : | 2 metres high along the existing earth mound |
| • No. 122 Lancaster Avenue : | 2.5 metres high along the existing earth mound |
| • No. 3 Albermarle Place : | 3 metres high along the existing earth mound |
| • No. 3 Burgundy Close : | 3 metres high along the existing earth mound |
| • No. 18B Isabel Close : | 4 metres high along the existing earth mound |

The heights of these barriers would provide significantly less light for residents along Lancaster Avenue, Albermarle Place and Isabel Close.

6.2.2 Architectural Noise Attenuation

It is noted, that there are a significant proportion of homes adjacent to Elizabeth Drive that are not double storey.

For the few residential properties adjacent to Elizabeth Drive that are double storey dwellings, traffic noise levels on the 1st floor level would be higher as the view of traffic along Elizabeth Drive would be less shielded compared to the ground floor level.

Calculated noise level on the 1st floor level would generally be 2 dB(A) higher compared to the ground floor level at most sites.

The most noise sensitive sites are located adjacent to the rear of residential properties of Isabel Close, Albermarle Place and the front of Burgundy Close residential properties.

In Lancaster Avenue there are also about 10 properties a similar distance from Elizabeth Drive (but most are not double Storey).

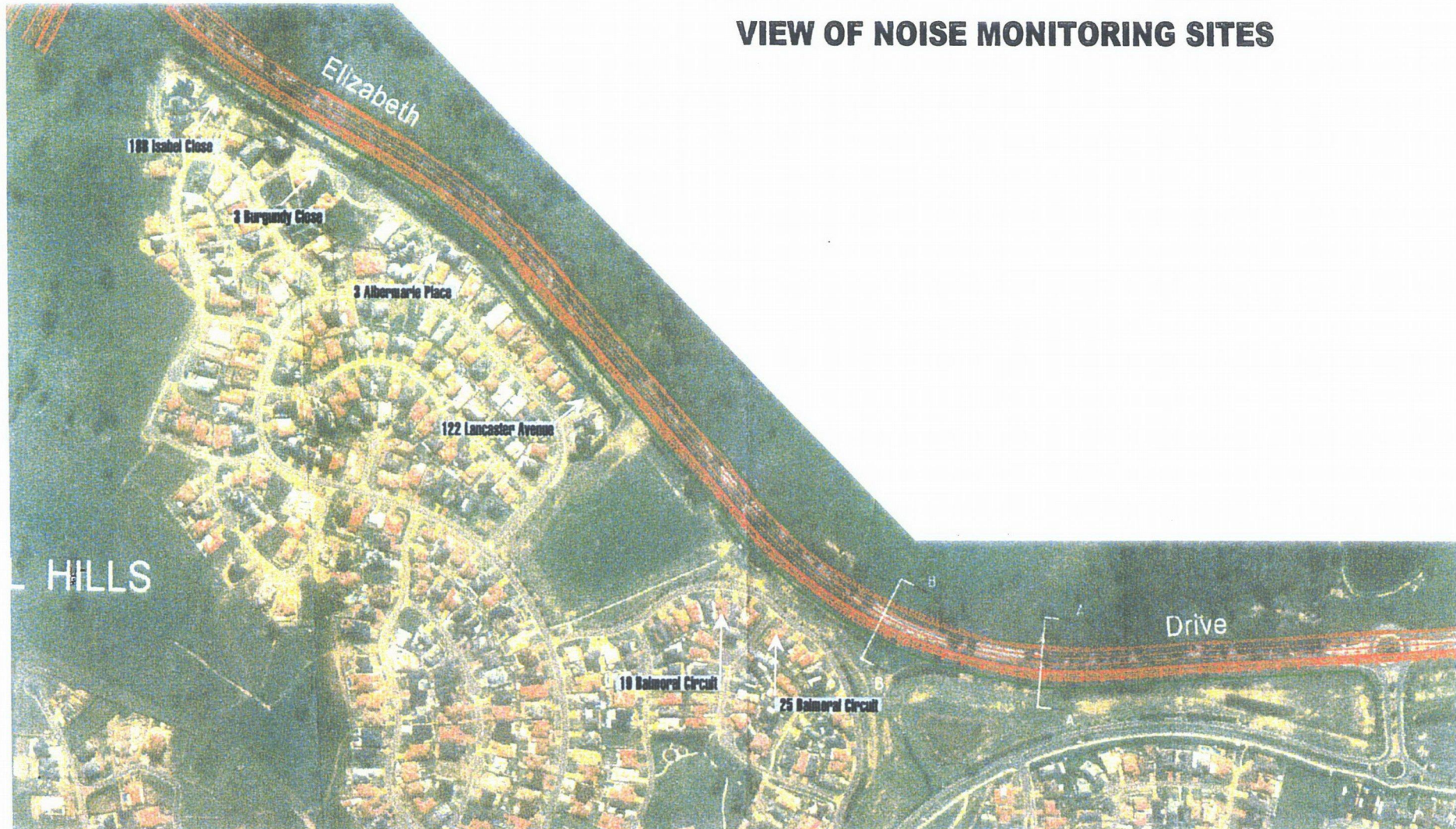
If noise mitigation measures were considered for residential dwellings on the 1st floor level, only mechanical ventilation would be suitable so that windows can be kept closed in order to achieve satisfactory indoor noise levels.

It is possible however, that Council may have imposed a condition of consent at the time of processing Development Applications so that potential noise affected dwellings are fitted with acoustic attenuation materials. This would also include provisions for mechanical ventilation system for at least the 1st floor levels.

It is recommended that noise mitigation measures be considered for these properties (potentially for some 10 - 15 properties) that are predicted to be exposed to daytime noise levels in-excess of 65 dB(A) daytime or night time in-excess of 60 dB(A).

APPENDIX A

VIEW OF NOISE MONITORING SITES



APPENDIX B

APPENDIX C

CERTIFICATE OF CALIBRATION

CERTIFICATE No.: SLM01658 & FILT0631

Equipment Description: Noise Analyzer

Manufacturer: SVANTEK

Model No: 912 Serial No: 2066

Microphone Type: 40AF Serial No: 5218

Filter Type: 1/3 Octave Serial No: 2066

Comments: All tests passed for type 1.
-

Owner: Koikas Acoustics Pty.Ltd.
60 Glenfarne Street
Bexley NSW 2207

Ambient Pressure: 1004 mbar

Temperature: 21 °C Relative Humidity: 62 %

Date of Calibration: 23.11.2000 Calibration Due Date: 23.11.2002

CHECKED BY: JK

AUTHORISED SIGNATORY:


Jack Kiet

The equipment listed above has been calibrated in this laboratory. The equipment performed satisfactorily in all the tests conducted.

This certificate is effective for 24 months from the date of calibration.



Reg. Lab. No. 9262
Acoustic and Vibration
Measurements

ACU-VIB Electronics

Acoustic and Vibration Electronics
HEAD OFFICE

Unit 3, 10 Salisbury Rd. Castle Hill NSW 2154
Tel: (02) 9894 2377 Fax: (02) 9894 2386
Mobile: 0408 470 179



National Association of Testing
Authorities, Australia

NATA Endorsed Calibration Certificate
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reproduced except in full.

CERTIFICATE OF CALIBRATION

CERTIFICATE No.: SLM01514 & FILT0584

Equipment Description: Sound & Vibration Analyzer

Manufacturer: Svantek
Model No: 912AE Serial No: 2312
Microphone Type: 40AF Serial No: 16774
Filter Type: 1/3 Octave Serial No: 2312
Comments: All tests passed for type 1.
-

Owner: Koikas Acoustics Pty.Ltd.
60 Glenfarne St.
Bexley NSW 2207

Ambient Pressure: 1020 mbar

Temperature: 21 °C Relative Humidity: 51 %

Date of Calibration: 23.05.2000 Calibration Due Date: 23.05.2002

CHECKED BY: TJ

AUTHORISED SIGNATORY: 

The equipment listed above has been calibrated in this laboratory. The equipment performed satisfactorily in all the tests conducted.

This certificate is effective for 24 months from the date of calibration.



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Measurements

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Mobile 0408 470 179



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Authorities, Australia

NATA Endorsed Calibration Certificate
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CERTIFICATE OF CALIBRATION

CERTIFICATE No: 3967

EQUIPMENT TESTED: Sound Level Calibrator

Rion

Type No:

NC-73

Serial No: 10702593

Owner:

Koikas Acoustics
60 Glenfarne Street
Bexley NSW 2207

Tests Performed:

Output sound pressure level corrected to
1013 hecto Pascals was found to be:
93.93 dB re 20 uPa at 972.0 Hz.
Distortion: < 1% THD, Uncertainty: +/- 0.1 dB

CONDITION OF TEST:

Ambient Pressure: 1015 mbar Relative Humidity: 54 %
Temperature: 21 °C
Date of Calibration: 25.07.2001 Calibration Due Date: 25.07.2002

Test Method: IEC 60942 -1988 Clauses 3.1.2, 3.2.2 and ACU-VIB No:3

CHECKED BY: TJ

AUTHORISED SIGNATORY:

Jack Kidd

An endorsed Certificate of Calibration may not be published or reproduced except in full without the written permission of this testing Laboratory.

Instruments used in these tests are traceable to Australian Physical Standards held at C.S.I.R.O.
N.M.L (National Measurement Laboratory) Sydney, Australia.



Reg. Lab. No. 9262
Acoustic and Vibration
Measurements

ACU-VIB Electronics

Acoustic and Vibration Electronics

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Mobile: 0408 470 179

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Number:



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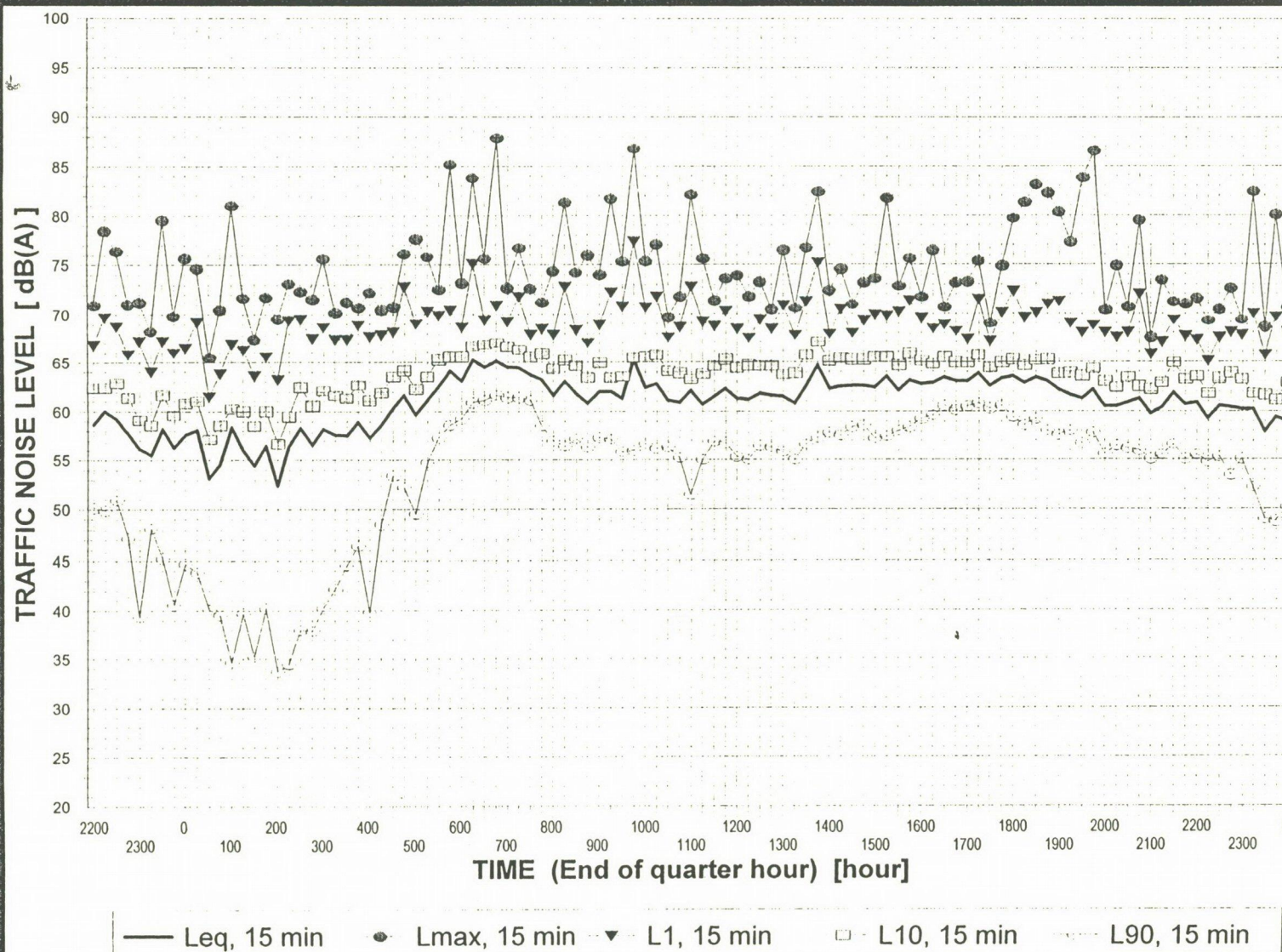
APPENDIX D

25 Balmoral Circuit Cecil Hills

DAY 1

Thursday 20 June 2002

Svan 912 S/N 2066

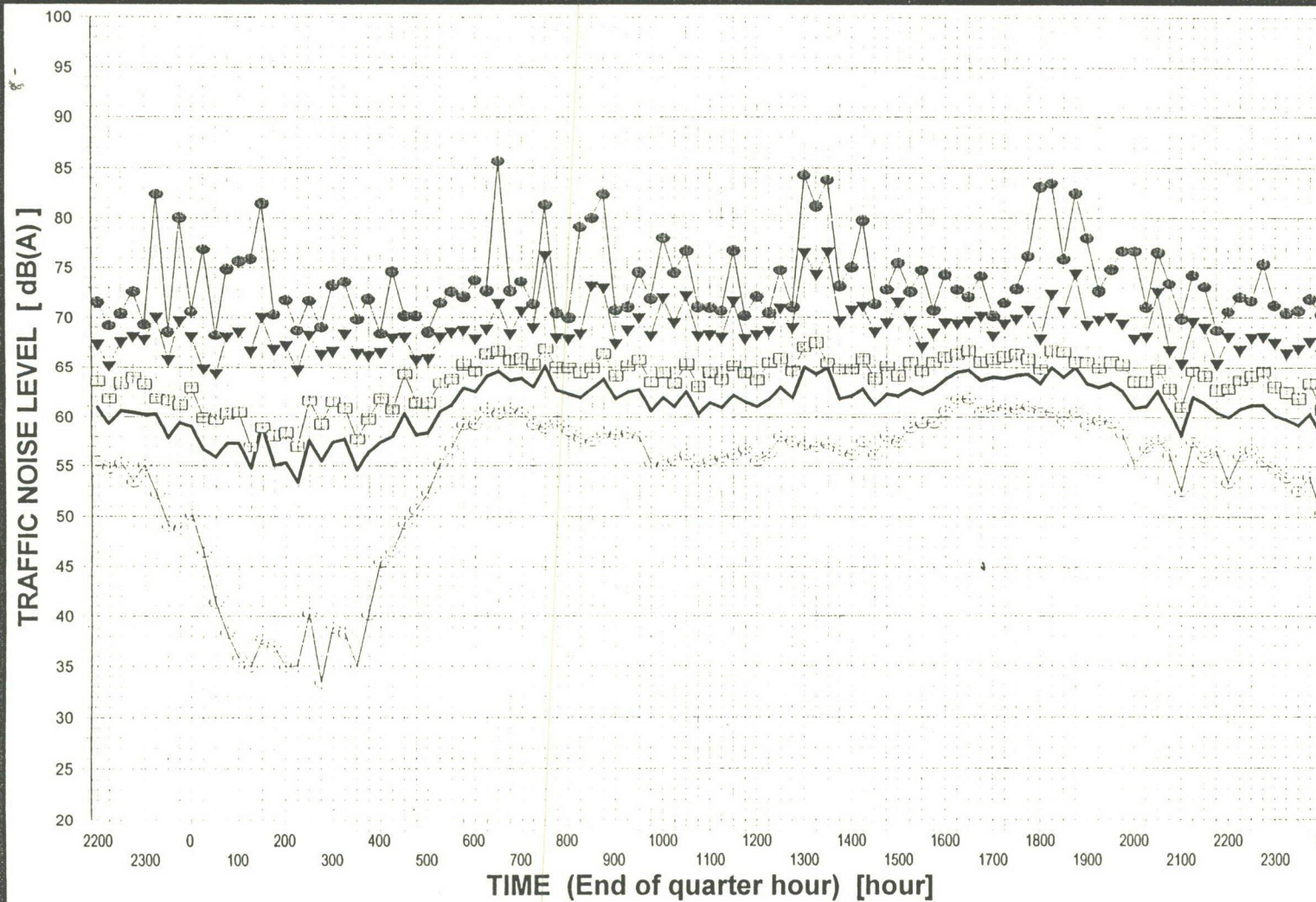


25 Balmoral Circuit Cecil Hills

DAY 2

Friday 21 June 2002

Svan 912 S/N 2066

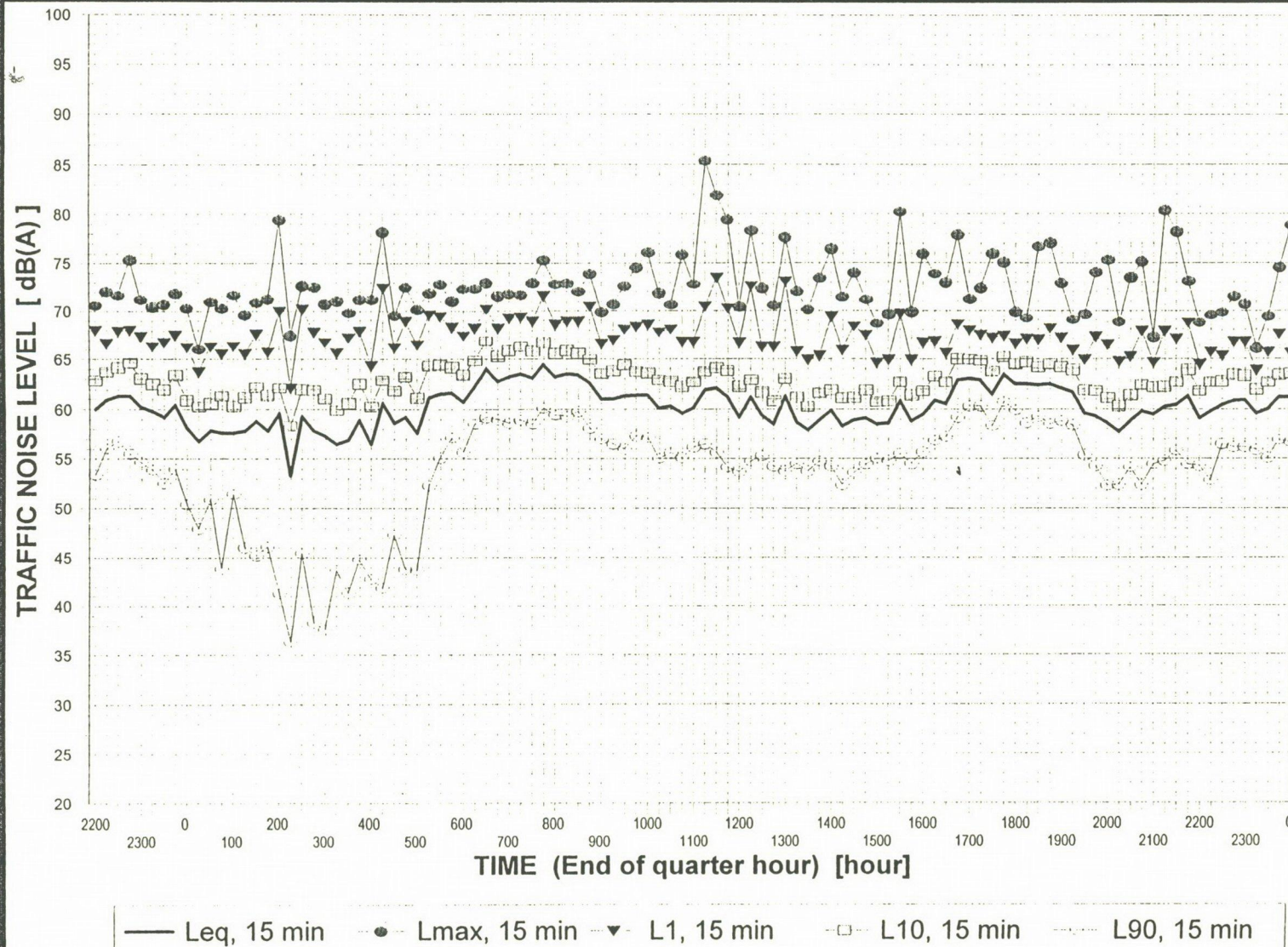


25 Balmoral Circuit Cecil Hills

DAY 3

Saturday 22 June 2002

Svan 912 S/N 2066

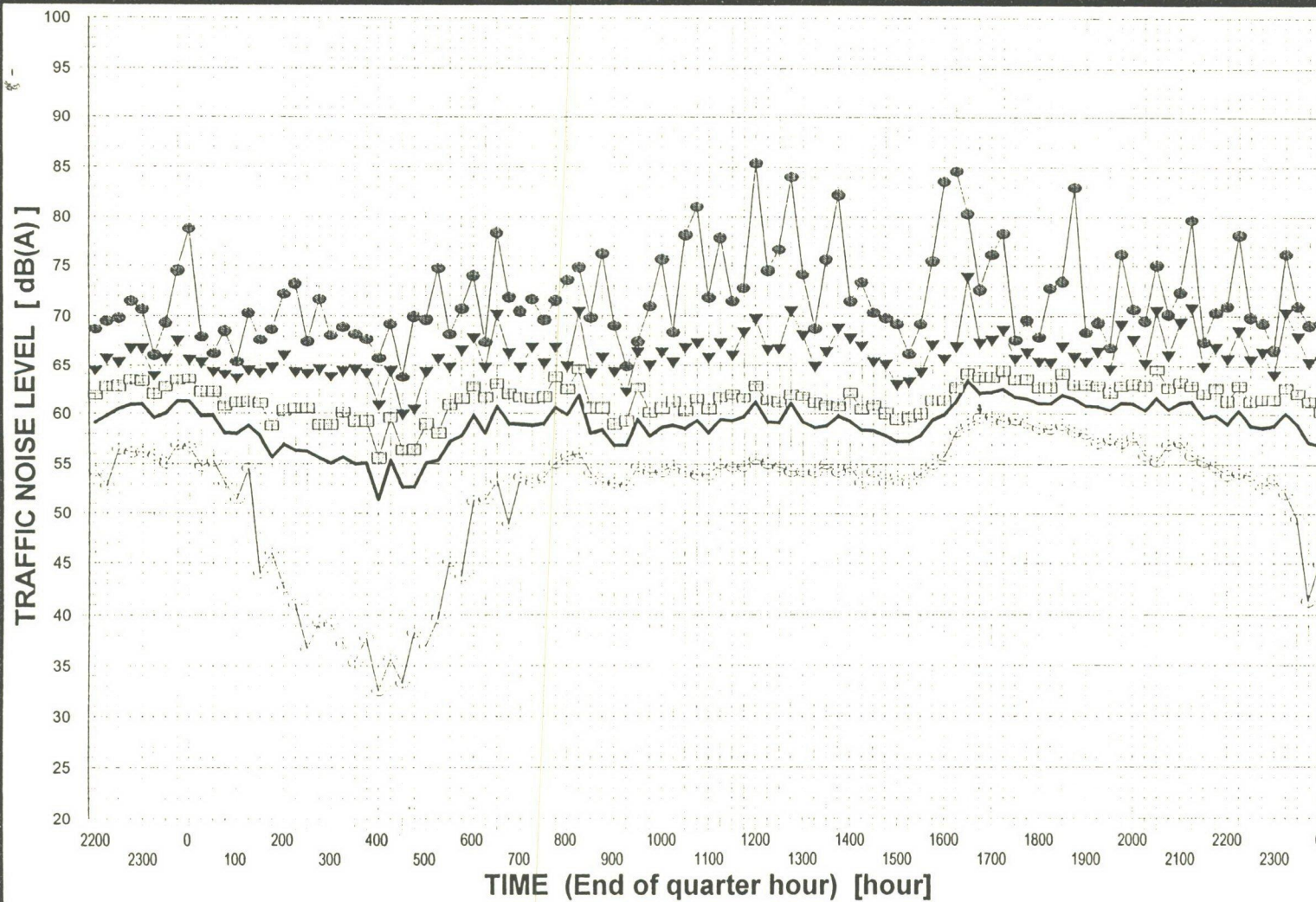


25 Balmoral Circuit Cecil Hills

DAY 4

Sunday 23 June 2002

Svan 912 S/N 2066

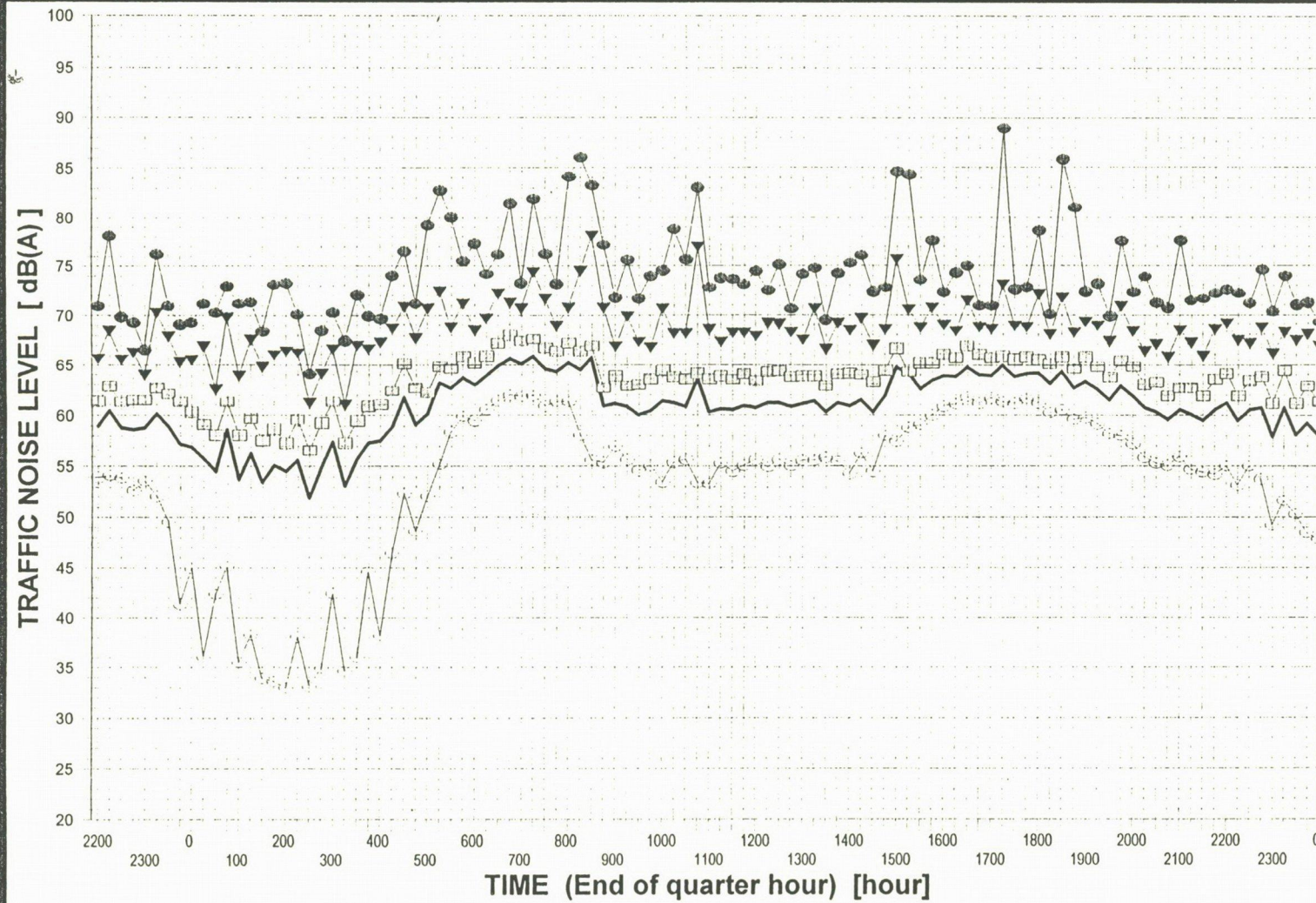


25 Balmoral Circuit Cecil Hills

DAY 5

Monday 24 June 2002

Svan 912 S/N 2066



— Leq, 15 min

• Lmax, 15 min

▼ L1, 15 min

□ L10, 15 min

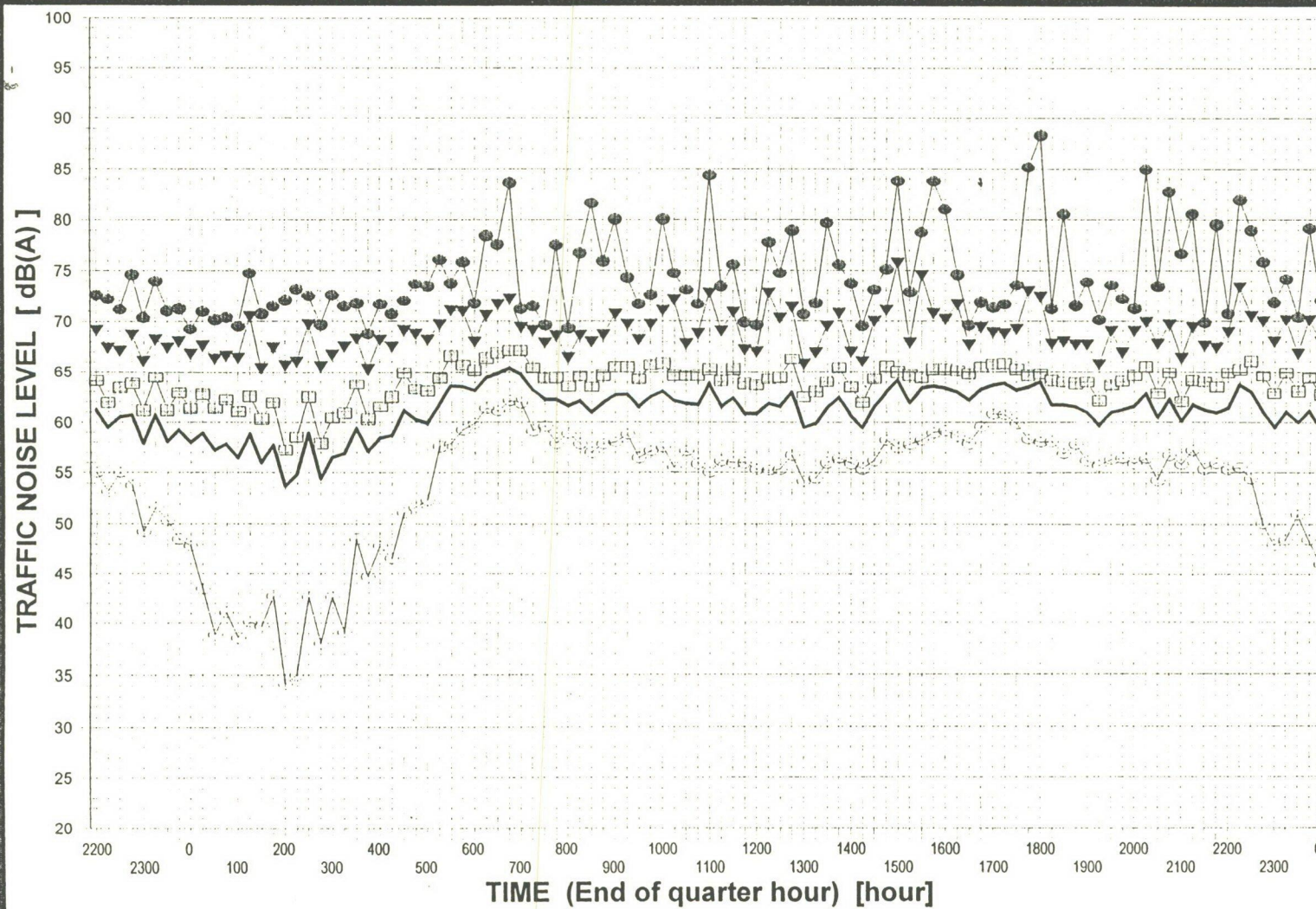
◇ L90, 15 min

25 Balmoral Circuit Cecil Hills

DAY 6

Tuesday 25 June 2002

Svan 912 S/N 2066

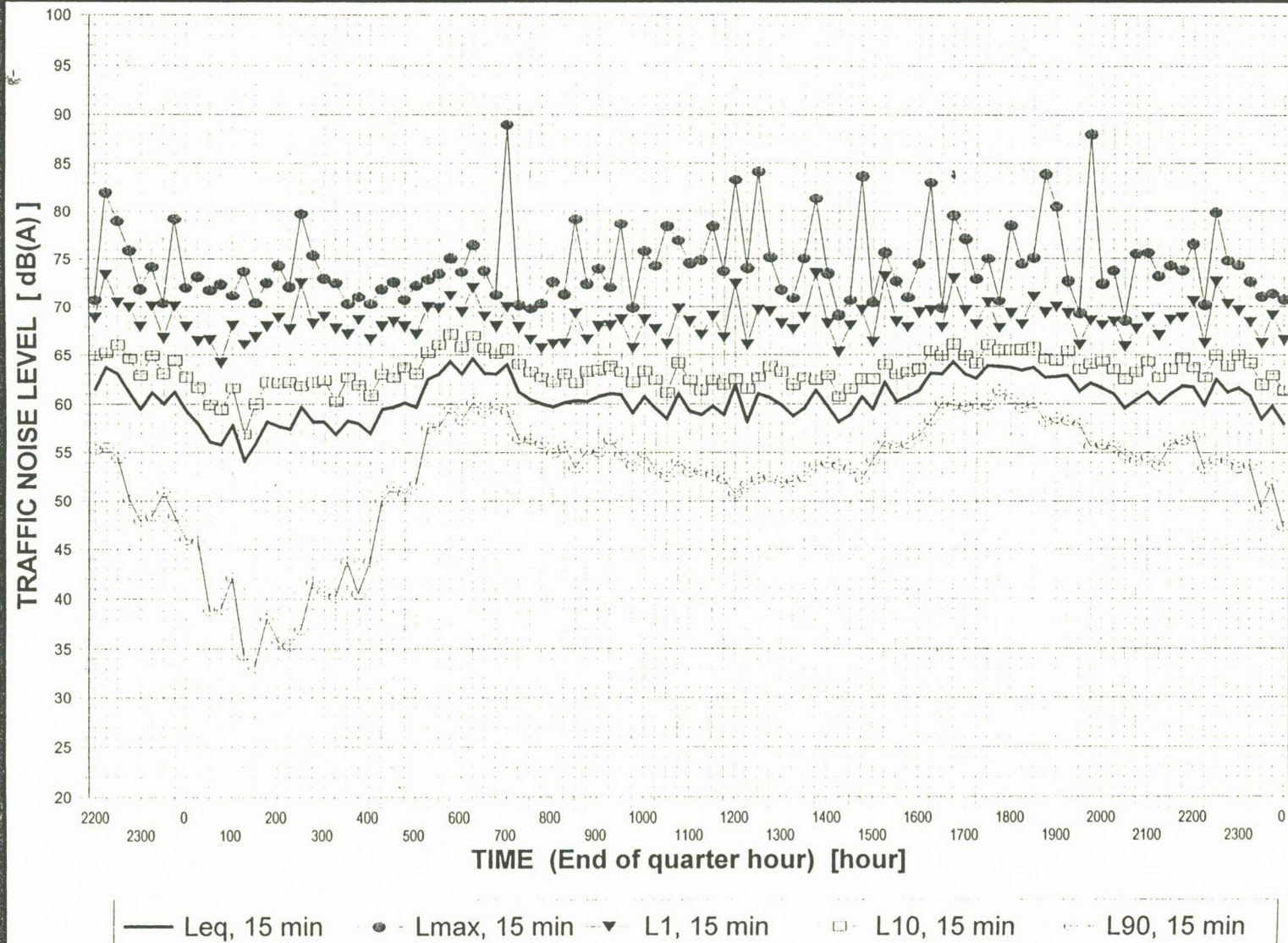


25 Balmoral Circuit Cecil Hills

DAY 7

Wednesday 26 June 2002

Svan 912 S/N 2066



25 Balmoral Circuit Cecil Hills

DAY 1

Thursday 20 June 2002

Svan 912 S/N 2066

YEAR	MoDy	TIME	Leq	Lmax	L1	L5	L10	L50	L90	Lmin	Lmax - Leq
2002	619	2215	60.0	78.5	69.7	64.8	62.4	54.9	49.9	40.3	18.5
2002	619	2230	59.2	76.4	68.8	64.5	62.9	56.1	50.9	38.9	17.2
2002	619	2245	57.7	71.1	65.9	63.6	61.4	55.0	47.2	34.4	13.4
2002	619	2300	56.2	71.3	67.2	62.5	59.1	51.8	39.3	33.6	15.1
2002	619	2315	55.5	68.3	64.0	60.6	58.6	53.3	48.1	40.7	12.8
2002	619	2330	58.2	79.6	67.2	63.9	61.7	55.4	45.2	34.7	21.4
2002	619	2345	56.3	69.8	66.0	61.6	59.6	53.6	40.6	34.5	13.5
2002	620	0	57.6	75.7	66.5	62.7	60.8	54.8	44.7	33.0	18.1
2002	620	15	58.1	74.7	69.2	63.4	61.0	53.6	43.8	36.1	16.6
2002	620	30	53.2	65.5	61.5	58.6	57.1	50.5	40.1	33.6	12.3
2002	620	45	54.5	70.5	63.8	60.1	58.6	50.2	39.5	35.1	16.0
2002	620	100	58.4	81.0	66.9	62.6	60.2	52.8	34.6	31.5	22.6
2002	620	115	56.0	71.7	66.3	61.8	60.0	50.9	39.7	33.6	15.7
2002	620	130	54.4	67.4	63.6	60.8	58.5	51.0	35.2	30.4	13.0
2002	620	145	56.5	71.8	65.6	61.5	60.0	53.5	40.2	33.6	15.3
2002	620	200	52.4	69.5	63.2	59.5	56.7	41.8	33.7	30.9	17.1
2002	620	215	56.4	73.1	69.4	63.4	59.5	42.3	34.4	31.4	16.7
2002	620	230	58.3	72.3	69.5	66.3	62.5	50.4	38.0	34.1	14.0
2002	620	245	56.6	71.6	67.5	63.4	60.6	50.4	37.9	32.7	15.0
2002	620	300	58.2	75.6	68.7	64.2	62.1	52.2	40.2	36.0	17.4
2002	620	315	57.6	70.2	67.4	64.1	61.6	53.5	42.2	35.9	12.6
2002	620	330	57.5	71.3	67.4	63.7	61.3	53.3	44.5	36.3	13.8
2002	620	345	58.9	70.7	68.9	64.8	62.7	55.1	46.4	37.1	11.8
2002	620	400	57.3	72.2	67.7	62.9	61.1	52.2	39.8	34.6	14.9
2002	620	415	58.6	70.5	67.9	64.0	61.9	56.0	48.5	41.0	11.9
2002	620	430	60.3	70.8	68.2	65.2	63.5	58.5	53.4	44.1	10.5
2002	620	445	61.6	76.1	72.8	66.3	64.2	58.2	52.2	39.1	14.5
2002	620	500	59.7	77.7	69.0	64.6	62.3	57.1	49.5	43.9	18.0
2002	620	515	61.1	75.8	70.3	65.1	63.5	59.1	54.7	50.2	14.7
2002	620	530	62.5	72.5	69.9	66.7	65.3	61.1	57.3	52.1	10.0
2002	620	545	64.1	85.2	70.4	66.8	65.6	61.8	58.6	54.2	21.1
2002	620	600	63.1	73.2	68.7	66.7	65.6	62.3	59.3	53.1	10.1
2002	620	615	65.2	83.8	75.1	68.1	66.7	63.3	60.9	56.5	18.6
2002	620	630	64.5	75.6	69.4	67.7	66.8	63.8	61.1	58.4	11.1
2002	620	645	65.1	87.9	70.9	68.7	67.0	63.7	61.6	58.8	22.8
2002	620	700	64.5	72.7	69.2	67.5	66.6	64.0	61.4	58.5	8.2
2002	620	715	64.4	76.7	71.8	67.4	66.2	63.4	61.4	58.4	12.3
2002	620	730	63.7	72.6	67.9	66.3	65.5	63.3	61.1	56.1	8.9
2002	620	745	63.2	71.2	68.5	67.0	65.9	62.6	58.5	55.0	8.0
2002	620	800	61.6	74.4	67.9	65.4	64.3	60.6	57.0	53.7	12.8
2002	620	815	63.0	81.3	72.8	67.0	65.2	60.4	56.4	52.0	18.3
2002	620	830	61.8	74.2	68.4	65.8	64.6	60.5	57.2	53.4	12.4
2002	620	845	60.8	76.0	67.0	65.0	63.4	59.6	56.3	52.0	15.2
2002	620	900	62.0	74.0	68.9	66.2	64.9	60.3	57.3	53.1	12.0
2002	620	915	62.0	81.7	72.2	65.7	63.4	59.7	57.1	53.6	19.7
2002	620	930	61.3	75.3	70.8	64.8	63.5	59.7	55.8	50.9	14.0
2002	620	945	65.3	86.8	77.4	68.1	65.4	59.2	56.0	51.4	21.5
2002	620	1000	62.4	75.4	70.7	67.4	65.5	60.1	56.7	53.2	13.0
2002	620	1015	62.8	77.1	71.8	67.4	65.7	60.4	56.2	50.1	14.3
2002	620	1030	61.1	69.7	67.6	65.7	64.1	59.8	56.3	50.7	8.6
2002	620	1045	60.9	71.8	68.7	65.4	63.9	59.3	55.2	47.8	10.9
2002	620	1100	62.1	82.1	72.8	64.9	63.2	57.1	51.4	42.6	20.0
2002	620	1115	60.7	75.6	69.2	65.6	63.8	58.3	55.0	46.4	14.9
2002	620	1130	61.5	71.4	68.8	65.7	64.6	59.9	56.9	52.7	9.9
2002	620	1145	62.3	73.6	70.3	66.8	65.3	60.6	56.8	51.8	11.3
2002	620	1200	61.3	73.9	68.5	65.8	64.4	59.9	55.3	49.2	12.6
2002	620	1215	61.2	71.8	67.5	65.7	64.7	59.6	55.0	49.0	10.6
2002	620	1230	61.8	73.3	69.4	65.8	64.6	60.3	56.5	50.0	11.5
2002	620	1245	61.6	70.5	68.5	65.8	64.6	60.2	56.3	52.5	8.9
2002	620	1300	61.5	76.5	70.9	65.3	63.7	59.8	55.8	50.1	15.0
2002	620	1315	60.8	70.6	67.8	65.6	63.9	59.3	55.0	51.2	9.8
2002	620	1330	62.5	76.7	71.3	67.3	65.7	60.2	56.6	50.5	14.2
2002	620	1345	64.7	82.4	75.2	68.6	67.0	61.3	57.3	53.4	17.7
2002	620	1400	62.3	72.4	67.9	66.1	65.1	61.1	57.8	52.7	10.1
2002	620	1415	62.5	74.6	70.5	66.9	65.4	60.8	57.5	53.4	12.1
2002	620	1430	62.6	71.0	68.0	66.3	65.3	61.8	58.4	52.6	8.4
2002	620	1445	62.6	73.2	69.3	66.4	65.3	61.4	58.6	55.2	10.6
2002	620	1500	62.4	73.6	69.9	67.0	65.5	60.7	57.2	52.7	11.2
2002	620	1515	63.5	81.8	69.8	67.1	65.5	61.2	57.4	52.7	18.3
2002	620	1530	62.1	72.8	70.2	66.1	64.7	60.7	58.0	53.0	10.7
2002	620	1545	63.1	75.6	71.4	67.3	65.9	61.6	58.4	53.6	12.5
2002	620	1600	62.8	71.8	69.6	66.4	65.1	61.7	59.3	55.2	9.0
2002	620	1615	62.9	76.5	68.5	66.0	64.8	62.1	59.6	56.8	13.6
2002	620	1630	63.4	70.7	68.9	66.7	65.5	62.7	60.6	57.4	7.3
2002	620	1645	63.0	73.2	68.2	66.1	65.0	62.5	60.1	56.2	10.2
2002	620	1700	63.0	73.3	67.3	65.7	64.9	62.6	60.5	54.3	10.3
2002	620	1715	63.8	75.4	71.5	67.3	65.7	62.6	60.8	58.0	11.6
2002	620	1730	62.6	69.0	67.1	65.1	64.4	62.2	60.3	58.5	6.4
2002	620	1745	63.3	74.9	70.1	66.5	65.0	62.3	60.6	57.3	11.6
2002	620	1800	63.5	79.7	72.3	66.9	65.3	62.1	59.4	55.4	16.2
2002	620	1815	62.9	81.3	69.6	65.9	64.7	61.9	58.6	52.8	18.4
2002	620	1830	63.4	83.2	70.1	66.5	65.2	61.9	59.3	55.9	19.8
2002	620	1845	63.0	82.3	71.0	67.1	65.3	61.0	58.0	52.2	19.3
2002	620	1900	62.2	80.4	71.3	65.8	63.8	60.6	57.6	53.6	18.2
2002	620	1915	61.7	77.3	69.0	65.2	63.9	60.6	58.0	53.7	15.6
2002	620	1930	61.3	83.8	68.0	64.9	63.6	59.6	56.7	53.4	22.5
2002	620	1945	62.2	86.6	68.8	65.6	64.3	60.7	57.8	52.6	24.4
2002	620	2000	60.5	70.4	68.0	64.6	63.0	59.2	55.6	52.1	9.9
2002	620	2015	60.5	74.9	67.5	63.6	62.4	59.6	56.5	47.4	14.4
2002	620	2030	60.9	70.7	68.0	65.2	63.4	59.7	56.2	51.3	9.8
2002	620	2045	61.3	79.5	72.0	64.3	62.6	59.0	56.0	50.6	18.2
2002	620	2100	59.8	67.5	65.8	63.6	62.3	59.1	55.1	45.5	7.7
2002	620	2115	60.4	73.4	67.0	64.3	62.9	59.3	55.5	49.7	13.0
2002	620	2130	61.9	71.2	69.3	66.3	64.9	60.6	56.6	44.5	9.3
2002	620	2145	60.7	71.0	67.6	64.5	63.2	59.8	55.1	45.4	10.3
2002	620	2200	60.9	71.6	67.2	64.5	63.5	60.0	55.5	44.8	10.7
2002	620	2215	59.3	69.2	65.1	63.0	61.8	58.3	54.8	50.4	9.9
2002	620	2230	60.6	70.5	67.5	64.8	63.4	59.3	55.3	47.6	9.9
2002	620	2245	60.4	72.6	68.0	65.5	63.9	58.2	53.5	41.4	12.2
2002	620	2300	60.2	69.3	67.7	65.0	63.2	58.6	55.1	50.4	9.1
2002	620	2315	60.2	82.4	70.0	63.9	61.8	57.2	52.2	43.5	22.2
2002	620	2330	57.9	68.6	65.7	63.3	61.7	55.7	49.0	37.9	10.7
2002	620	2345	59.4	80.1	69.6	63.4	61.2	55.5	48.8	40.4	20.7
2002	621	0	59.0	70.6	68.0	65.2	62.9	55.8	50.2	40.5	11.6

DAY 1	DESCRIPTOR	PERIOD	LEVEL	UNIT
Full Day	Leq, 24 hours	between 00:00 and 24:00 hours	61.7	dB(A)
Night Time	Leq, 8 hours	between 22:00 and 06:00 hours	58.7	dB(A)
Daytime	Leq, 15 hours	between 07:00 and 22:00 hours	62.3	dB(A)
Night Time	Leq, 9 hours	between 22:00 and 07:00 hours	60.1	dB(A)
Daytime	L10, 18 hours	between 06:00 and 24:00 hours	64.5	dB(A)
Daytime	minimum L90, 15 min	between 07:00 and 18:00 hours	51.4	dB(A)

25 Balmoral Circuit Cecil Hills

DAY 2

Friday 21 June 2002

Svan 912 S/N 2066

YEAR	Mo	Di	TIME	Leq	Lmax	L1	L5	L10	L50	L90	Lmin	Lmax - Leq
2002	620	2215	59.3	69.2	65.1	63.0	61.8	58.3	54.8	50.4	9.9	
2002	620	2230	60.6	70.5	67.5	64.8	63.4	59.3	55.3	47.6	9.9	
2002	620	2245	60.4	72.6	68.0	65.5	63.9	58.2	53.5	41.4	12.2	
2002	620	2300	60.2	69.3	67.7	65.0	63.2	58.6	55.1	50.4	9.1	
2002	620	2315	60.2	82.4	70.0	63.9	61.8	57.2	52.2	43.5	22.2	
2002	620	2330	57.9	68.6	65.7	63.3	61.7	55.7	49.0	37.9	10.7	
2002	620	2345	59.4	80.1	69.6	63.4	61.2	55.5	48.8	40.4	20.7	
2002	621	0	59.0	70.6	68.0	65.2	62.9	55.8	50.2	40.5	11.6	
2002	621	15	56.7	76.9	64.8	61.5	59.9	53.3	46.4	34.8	20.2	
2002	621	30	55.9	68.2	64.3	61.3	59.7	53.3	41.4	32.4	12.3	
2002	621	45	57.3	74.9	68.0	62.5	60.3	51.6	38.4	33.2	17.6	
2002	621	100	57.3	75.7	68.5	63.5	60.4	50.8	35.8	31.7	18.4	
2002	621	115	54.8	75.9	66.5	59.8	56.9	49.8	34.9	30.3	21.1	
2002	621	130	59.1	81.5	70.0	61.9	58.9	49.4	37.7	33.2	22.4	
2002	621	145	55.1	70.3	66.7	60.8	58.1	50.1	37.0	32.7	15.2	
2002	621	200	55.3	71.8	67.1	60.5	58.4	49.3	34.9	32.8	16.5	
2002	621	215	53.4	68.7	64.7	60.2	57.0	46.0	35.1	31.2	15.3	
2002	621	230	57.6	71.7	68.2	64.3	61.6	52.0	40.3	32.2	14.1	
2002	621	245	55.5	69.0	66.2	62.1	59.3	50.7	33.4	30.3	13.5	
2002	621	300	57.4	73.3	66.5	63.5	61.5	53.5	38.9	31.4	15.9	
2002	621	315	57.7	73.6	68.3	64.0	60.9	53.0	38.3	30.7	15.9	
2002	621	330	54.6	69.8	66.3	59.8	57.7	50.4	35.0	32.1	15.2	
2002	621	345	56.4	71.9	66.1	62.4	59.8	52.7	40.1	34.5	15.5	
2002	621	400	57.4	68.4	66.4	63.9	61.8	53.9	45.4	36.6	11.0	
2002	621	415	58.0	74.7	67.9	64.1	60.7	54.1	46.5	37.6	16.7	
2002	621	430	60.3	70.2	68.0	66.0	64.3	57.9	49.3	42.3	9.9	
2002	621	445	58.2	70.2	65.7	62.8	61.4	56.5	50.7	39.9	12.0	
2002	621	500	58.4	68.6	65.8	62.8	61.4	56.9	52.4	44.9	10.2	
2002	621	515	60.5	71.5	68.0	64.8	63.4	59.1	55.2	50.0	11.0	
2002	621	530	61.2	72.6	68.5	65.0	63.8	59.9	56.8	49.6	11.4	
2002	621	545	62.9	72.1	68.7	66.4	65.3	62.0	59.3	54.3	9.2	
2002	621	600	62.5	73.8	67.8	65.6	64.6	61.9	59.3	56.5	11.3	
2002	621	615	64.1	72.7	68.8	67.1	66.3	63.5	60.9	56.3	8.6	
2002	621	630	64.6	85.7	71.4	67.9	66.6	63.3	60.3	56.7	21.1	
2002	621	645	63.7	72.7	68.3	66.5	65.7	63.2	60.9	57.4	9.0	
2002	621	700	63.9	73.6	70.6	67.4	65.9	63.1	60.4	55.5	9.7	
2002	621	715	63.0	71.4	68.9	66.3	65.3	62.3	59.3	54.2	8.4	
2002	621	730	65.1	81.3	76.2	68.6	66.8	62.6	58.8	53.4	16.2	
2002	621	745	62.7	70.5	67.9	66.0	65.0	62.1	59.6	55.5	7.8	
2002	621	800	62.3	70.0	67.8	65.9	64.9	61.5	58.6	55.6	7.7	
2002	621	815	61.9	79.1	68.3	65.8	64.5	60.7	57.8	54.7	17.2	
2002	621	830	62.9	80.0	73.1	66.4	64.9	60.7	57.5	52.3	17.1	
2002	621	845	63.8	82.4	72.9	68.7	66.3	61.0	58.3	53.6	18.6	
2002	621	900	61.8	70.8	67.3	65.3	64.2	61.1	58.2	55.0	9.0	
2002	621	915	62.5	71.1	68.7	66.5	65.1	61.4	58.4	54.1	8.6	
2002	621	930	62.8	74.6	69.9	66.9	65.7	61.4	58.0	53.8	11.8	
2002	621	945	60.6	71.9	68.1	64.7	63.5	59.2	55.3	50.5	11.3	
2002	621	1000	61.9	78.0	71.9	67.0	64.5	58.7	55.1	50.5	16.1	
2002	621	1015	61.0	74.5	69.4	64.9	63.4	59.5	55.6	50.9	13.5	
2002	621	1030	62.6	76.8	72.1	66.5	65.3	60.4	56.2	52.7	14.2	
2002	621	1045	60.3	71.1	68.1	64.8	63.1	58.7	54.9	48.7	10.8	
2002	621	1100	61.4	71.0	68.2	65.6	64.5	60.2	55.6	50.2	9.6	
2002	621	1115	60.9	70.7	68.0	65.2	63.8	59.5	55.9	50.4	9.8	
2002	621	1130	62.2	76.8	71.6	66.7	65.1	59.8	56.2	51.6	14.6	
2002	621	1145	61.5	70.2	67.8	65.6	64.4	60.2	56.8	52.0	8.7	
2002	621	1200	61.0	72.1	68.2	65.2	63.7	59.7	55.5	49.8	11.1	
2002	621	1215	61.8	70.5	68.6	66.6	65.4	60.2	56.3	52.7	8.7	
2002	621	1230	63.0	74.8	70.9	67.2	65.9	61.4	58.0	53.3	11.8	
2002	621	1245	62.0	71.1	68.9	66.0	64.6	60.8	57.5	53.4	9.1	
2002	621	1300	65.0	84.3	76.5	70.5	67.0	60.4	57.1	52.6	19.3	
2002	621	1315	64.3	81.2	74.3	69.2	67.5	61.2	57.0	51.9	16.9	
2002	621	1330	64.9	83.8	76.6	67.9	65.4	60.7	57.3	51.2	18.9	
2002	621	1345	61.9	73.2	69.6	66.6	64.8	60.0	56.6	52.5	11.3	
2002	621	1400	62.2	75.1	70.7	66.4	64.8	60.6	56.2	50.6	12.9	
2002	621	1415	62.9	79.8	71.1	67.3	65.9	60.8	57.5	53.2	16.9	
2002	621	1430	61.2	71.4	68.5	64.9	63.9	59.9	56.2	50.4	10.2	
2002	621	1445	62.4	72.8	69.4	66.6	65.1	61.3	58.1	52.7	10.4	
2002	621	1500	62.2	75.5	71.5	65.9	64.2	60.3	57.4	53.6	13.3	
2002	621	1515	62.9	72.6	69.6	66.9	65.5	61.7	59.0	55.1	9.7	
2002	621	1530	62.4	74.8	67.0	65.7	64.7	61.8	59.4	56.6	12.4	
2002	621	1545	62.9	70.8	68.4	66.5	65.5	62.0	59.5	55.5	7.9	
2002	621	1600	63.8	74.4	69.4	67.3	66.0	62.9	60.6	57.2	10.6	
2002	621	1615	64.5	72.8	69.3	67.0	66.3	64.1	61.9	56.7	8.3	
2002	621	1630	64.7	72.1	69.6	67.6	66.7	64.3	62.0	58.2	7.4	
2002	621	1645	63.7	74.2	70.1	66.8	65.6	63.1	60.5	56.5	10.5	
2002	621	1700	64.0	70.2	68.1	66.7	65.9	63.6	61.2	57.1	6.2	
2002	621	1715	63.9	71.5	69.3	67.1	66.1	63.3	60.9	58.2	7.6	
2002	621	1730	64.2	72.9	69.8	67.4	66.3	63.6	60.8	56.2	8.7	
2002	621	1745	64.3	76.2	70.7	66.7	65.9	63.6	61.2	57.5	11.9	
2002	621	1800	63.4	83.2	67.8	65.8	64.8	62.3	60.5	57.3	19.8	
2002	621	1815	65.0	83.5	72.3	68.0	66.7	63.5	60.5	55.8	18.5	
2002	621	1830	64.0	75.9	70.6	67.8	66.5	62.9	59.6	55.8	11.9	
2002	621	1845	65.0	82.5	74.4	66.7	65.6	63.0	60.6	55.5	17.5	
2002	621	1900	63.4	78.0	69.2	66.6	65.5	62.6	59.3	53.4	14.6	
2002	621	1915	63.0	72.7	69.7	66.2	64.9	62.2	59.7	54.2	9.7	
2002	621	1930	63.4	74.9	70.0	66.9	65.6	62.6	59.5	54.5	11.5	
2002	621	1945	62.7	76.7	69.3	66.6	65.3	61.7	58.3	52.5	14.0	
2002	621	2000	61.0	76.7	67.8	65.0	63.6	59.8	55.2	48.3	15.7	
2002	621	2015	61.2	71.1	68.0	65.0	63.6	60.1	56.9	51.1	9.9	
2002	621	2030	62.7	76.6	72.5	66.7	64.8	60.6	57.7	52.5	13.9	
2002	621	2045	60.5	73.4	66.6	64.0	62.9	59.5	56.2	52.6	12.9	
2002	621	2100	58.2	69.9	65.3	62.5	61.1	56.7	52.5	45.6	11.7	
2002	621	2115	62.1	74.3	69.5	65.9	64.6	60.8	57.5	51.9	12.2	
2002	621	2130	61.5	73.1	68.9	65.7	64.2	60.2	56.0	49.3	11.6	
2002	621	2145	60.5	68.7	65.3	63.7	62.8	60.0	56.6	50.4	8.2	
2002	621	2200	60.0	70.6	68.0	65.1	62.9	58.3	53.4	46.9	10.6	
2002	621	2215	60.9	72.1	66.7	64.8	63.7	59.9	56.1	50.4	11.2	
2002	621	2230	61.3	71.7	67.9	65.8	64.2	59.9	56.8	52.6	10.4	
2002	621	2245	61.3	75.4	68.0	65.9	64.6	59.8	55.5	50.3	14.1	</

DAY 2	DESCRIPTOR	PERIOD	LEVEL	UNIT
Full Day	Leq, 24 hours	between 00:00 and 24:00 hours	61.9	dB(A)
Night Time	Leq, 8 hours	between 22:00 and 06:00 hours	58.6	dB(A)
Daytime	Leq, 15 hours	between 07:00 and 22:00 hours	62.8	dB(A)
Night Time	Leq, 9 hours	between 22:00 and 07:00 hours	59.8	dB(A)
Daytime	L10, 18 hours	between 06:00 and 24:00 hours	64.8	dB(A)
Daytime	minimum L90, 15 min	between 07:00 and 18:00 hours	54.9	dB(A)

25 Balmoral Circuit Cecil Hills

DAY 3

Saturday 22 June 2002

Svan 912 S/N 2066

YEAR	MoDy	TIME	Leq	Lmax	L1	L5	L10	L50	L90	Lmin	Lmax - Leq
2002	621	2215	60.9	72.1	66.7	64.8	63.7	59.9	56.1	50.4	11.2
2002	621	2230	61.3	71.7	67.9	65.8	64.2	59.9	56.8	52.6	10.4
2002	621	2245	61.3	75.4	68.0	65.9	64.6	59.8	55.5	50.3	14.1
2002	621	2300	60.2	71.2	67.3	64.9	63.1	58.8	54.7	47.7	11.0
2002	621	2315	59.8	70.5	66.3	63.7	62.6	59.0	53.9	42.8	10.7
2002	621	2330	59.2	70.8	66.8	63.9	62.0	57.8	52.5	42.8	11.6
2002	621	2345	60.4	71.9	67.5	64.6	63.4	59.2	54.0	40.2	11.5
2002	622	0	58.1	70.3	66.2	63.0	60.9	56.5	50.4	37.9	12.2
2002	622	15	56.8	66.0	63.7	61.3	60.2	55.4	48.0	38.0	9.2
2002	622	30	57.9	71.0	66.3	62.4	60.6	56.1	50.9	41.7	13.2
2002	622	45	57.6	70.3	65.5	62.6	61.3	55.7	43.9	35.7	12.7
2002	622	100	57.6	71.7	66.3	61.8	60.3	55.7	51.4	45.5	14.1
2002	622	115	57.8	69.6	65.5	62.8	61.2	55.9	46.0	35.9	11.8
2002	622	130	58.8	70.9	67.6	63.7	62.2	56.6	45.2	32.7	12.1
2002	622	145	57.8	71.3	65.7	62.7	61.4	55.6	46.1	35.4	13.5
2002	622	200	59.6	79.4	70.0	64.1	62.1	54.3	41.3	35.2	19.8
2002	622	215	53.3	67.5	62.1	59.9	58.3	46.0	36.3	31.7	14.2
2002	622	230	59.3	72.7	70.2	64.9	62.0	55.4	45.4	31.8	13.4
2002	622	245	57.8	72.5	67.8	64.3	61.9	51.7	38.3	31.2	14.7
2002	622	300	57.3	70.8	66.7	63.4	61.0	54.1	37.6	31.6	13.5
2002	622	315	56.5	71.1	65.6	61.6	59.9	54.0	43.7	36.2	14.6
2002	622	330	56.9	69.8	67.2	63.3	60.6	52.6	41.4	33.7	12.9
2002	622	345	58.9	71.2	67.9	64.8	62.6	55.9	44.8	36.5	12.3
2002	622	400	56.5	71.2	64.3	61.8	60.2	54.3	42.8	31.8	14.7
2002	622	415	60.6	78.2	72.4	65.5	62.9	55.1	41.9	33.4	17.6
2002	622	430	58.6	69.5	66.1	63.2	61.8	57.3	47.3	33.6	10.9
2002	622	445	59.2	72.5	68.9	64.8	63.2	55.9	43.8	33.7	13.3
2002	622	500	57.6	70.2	66.4	63.0	61.1	55.1	43.7	33.5	12.6
2002	622	515	61.1	71.9	69.6	66.2	64.3	59.1	52.3	44.1	10.8
2002	622	530	61.5	72.8	69.4	66.0	64.4	59.8	55.1	46.0	11.3
2002	622	545	61.6	71.1	68.3	65.9	64.2	60.4	57.1	51.4	9.5
2002	622	600	60.7	72.3	67.4	64.7	63.4	59.6	55.7	47.3	11.6
2002	622	615	62.2	72.3	68.2	65.9	64.8	61.3	58.5	54.3	10.1
2002	622	630	64.0	73.0	70.2	68.3	66.8	62.9	59.2	52.4	9.0
2002	622	645	62.8	71.6	68.2	66.2	65.3	62.0	59.0	53.8	8.8
2002	622	700	63.2	71.8	69.2	67.0	65.9	62.2	58.6	53.7	8.6
2002	622	715	63.5	71.7	69.3	67.3	66.2	62.7	58.9	53.1	8.2
2002	622	730	63.1	73.0	68.9	66.9	65.8	62.1	58.5	52.0	9.9
2002	622	745	64.4	75.3	71.6	68.2	66.7	63.4	60.1	54.9	10.9
2002	622	800	63.2	72.8	68.6	66.4	65.6	62.5	59.4	54.4	9.6
2002	622	815	63.5	72.9	68.9	66.9	65.9	62.9	59.3	53.6	9.4
2002	622	830	63.4	72.0	68.9	66.6	65.6	62.7	59.8	54.9	8.6
2002	622	845	62.6	73.9	70.5	66.6	64.9	61.3	58.1	53.3	11.3
2002	622	900	61.0	69.9	66.5	64.4	63.5	60.4	57.0	52.7	8.9
2002	622	915	61.0	70.8	66.9	64.9	63.8	60.1	56.5	52.4	9.8
2002	622	930	61.3	72.6	68.1	65.7	64.4	59.8	56.0	51.0	11.3
2002	622	945	61.4	74.6	68.4	65.7	63.7	60.0	57.3	52.0	13.2
2002	622	1000	61.4	76.1	68.6	65.3	63.6	60.1	57.1	50.5	14.7
2002	622	1015	60.1	71.9	67.8	64.5	62.9	58.8	55.0	49.5	11.8
2002	622	1030	60.3	70.7	68.1	64.9	62.8	58.7	55.6	52.2	10.4
2002	622	1045	59.6	75.9	66.7	63.6	62.3	58.1	55.1	50.5	16.3
2002	622	1100	60.1	72.8	66.7	64.0	62.7	58.9	56.2	53.6	12.7
2002	622	1115	61.9	85.4	70.5	65.3	63.7	59.9	56.5	49.3	23.5
2002	622	1130	62.1	81.9	73.5	66.1	64.1	59.0	55.6	51.4	19.8
2002	622	1145	61.2	79.4	70.3	65.8	63.8	58.6	54.1	49.9	18.2
2002	622	1200	59.2	70.5	66.6	64.0	62.3	57.6	53.7	48.8	11.3
2002	622	1215	61.2	78.3	72.6	65.2	62.9	58.0	54.7	50.3	17.1
2002	622	1230	59.4	72.4	66.2	63.0	61.7	58.4	55.3	52.0	13.0
2002	622	1245	58.5	70.6	66.2	62.4	60.8	57.3	54.2	50.0	12.1
2002	622	1300	61.3	77.7	73.1	66.9	63.0	57.2	53.8	47.8	16.4
2002	622	1315	58.7	72.1	65.8	62.6	61.2	57.5	54.5	50.3	13.3
2002	622	1330	57.9	70.1	64.9	62.2	60.2	56.6	53.8	50.4	12.2
2002	622	1345	58.9	73.5	65.3	62.7	61.6	57.6	54.7	50.6	14.8
2002	622	1400	59.9	76.5	69.4	64.1	61.9	57.6	54.2	49.9	16.6
2002	622	1415	58.3	71.5	65.9	62.8	61.1	56.9	52.4	48.1	13.2
2002	622	1430	58.9	74.1	68.4	62.9	61.2	57.0	53.6	49.0	15.2
2002	622	1445	59.1	71.2	67.4	63.7	61.9	57.2	54.4	50.1	12.1
2002	622	1500	58.5	68.7	64.6	62.0	60.7	57.6	55.0	52.4	10.2
2002	622	1515	58.6	69.7	64.9	62.2	60.8	57.6	54.8	51.0	11.1
2002	622	1530	60.8	80.2	69.7	64.3	62.7	58.4	55.5	49.5	19.4
2002	622	1545	58.8	69.9	64.9	62.6	61.4	57.7	54.5	50.1	11.1
2002	622	1600	59.5	76.0	66.6	63.3	61.8	58.2	55.7	51.0	16.5
2002	622	1615	60.9	73.9	66.8	64.4	63.2	59.9	56.9	52.2	13.1
2002	622	1630	60.5	73.0	65.6	63.8	62.7	59.8	57.2	53.7	12.5
2002	622	1645	62.9	77.9	68.6	66.1	65.0	62.0	59.2	54.3	15.0
2002	622	1700	63.0	71.3	67.9	65.8	64.9	62.4	60.3	58.1	8.3
2002	622	1715	62.9	72.4	67.4	65.6	64.8	62.6	60.3	55.5	9.5
2002	622	1730	61.5	76.0	67.1	64.8	63.7	60.6	58.3	54.1	14.5
2002	622	1745	63.4	75.1	67.3	65.8	65.2	63.1	60.7	56.0	11.7
2002	622	1800	62.5	69.9	66.5	65.1	64.5	62.2	59.9	55.8	7.4
2002	622	1815	62.5	69.2	67.0	65.4	64.7	62.1	58.6	54.1	6.7
2002	622	1830	62.4	76.7	66.9	64.9	64.2	62.0	59.3	55.8	14.3
2002	622	1845	62.5	77.1	68.1	65.3	64.5	61.9	58.5	53.5	14.6
2002	622	1900	62.1	72.9	67.1	65.0	64.2	61.4	58.8	55.3	10.8
2002	622	1915	61.7	69.0	65.9	64.7	63.9	61.2	58.4	51.7	7.3
2002	622	1930	59.6	69.6	64.9	62.8	61.9	58.9	55.4	50.8	10.0
2002	622	1945	59.3	74.1	67.2	63.6	61.8	57.7	54.3	48.6	14.8
2002	622	2000	58.6	75.3	66.4	62.7	61.1	57.1	52.3	46.5	16.7
2002	622	2015	57.7	68.8	64.7	61.5	60.3	56.5	52.4	47.8	11.1
2002	622	2030	58.8	73.5	65.2	62.6	61.4	57.7	54.1	46.9	14.7
2002	622	2045	59.8	75.2	67.8	64.1	62.4	58.3	52.4	41.4	15.4
2002	622	2100	59.5	67.2	64.6	63.1	62.2	58.7	54.4	43.9	7.7
2002	622	2115	60.2	80.4	67.8	63.5	62.3	58.9	54.8	47.0	20.2
2002	622	2130	60.4	78.2	67.0	63.6	62.7	59.3	55.8	50.7	17.8
2002	622	2145	61.3	73.1	68.7	65.3	63.9	60.2	54.4	46.4	11.8
2002	622	2200	59.1	68.7	64.4	62.8	61.8	58.4	54.3	46.3	9.6
2002	622	2215	59.8	69.5	65.7	63.7	62.7	59.0	52.8	44.0	9.7
2002	622	2230	60.4	69.8	65.3	63.6	62.8	59.8	56.5	51.1	9.4
2002	622	2245	60.8	71.5	66.7	64.4	63.4	60.0	56.2	51.0	10.7
2002	622	2300	60.9	70.7	66.7	64.3	63.3	60.4	56.2	50.8	9.8
2002	622	2315	59.6	66.1	63.8	62.7	62.0	59.2	55.9	50.5	6.5
2002	622	2330	60.0	69.4	65.7	63.7	62.7	59.1	55.1	47.1	9.4
2002	622	2345	61.2	74.6	67.5	64.6	63.4	60.3	56.9	48.6	13.4
2002	623	0	61.2	78.8	65.6	64.3	63.5	60.7	56.7	51.0	17.6

DAY 3	DESCRIPTOR	PERIOD	LEVEL	UNIT
Full Day	Leq, 24 hours	between 00:00 and 24:00 hours	60.7	dB(A)
Night Time	Leq, 8 hours	between 22:00 and 06:00 hours	59.1	dB(A)
Daytime	Leq, 15 hours	between 07:00 and 22:00 hours	61.1	dB(A)
Night Time	Leq, 9 hours	between 22:00 and 07:00 hours	59.8	dB(A)
Daytime	L10, 18 hours	between 06:00 and 24:00 hours	63.2	dB(A)
Daytime	minimum L90, 15 min	between 07:00 and 18:00 hours	52.4	dB(A)

25 Balmoral Circuit Cecil Hills

DAY 4

Sunday 23 June 2002

Svan 912 S/N 2066

YEAR	MoDy	TIME	Leq	Lmax	L1	L5	L10	L50	L90	Lmin	Lmax - Leq
2002	622	2215	59.8	69.5	65.7	63.7	62.7	59.0	52.8	44.0	9.7
2002	622	2230	60.4	69.8	65.3	63.6	62.8	59.8	56.5	51.1	9.4
2002	622	2245	60.8	71.5	66.7	64.4	63.4	60.0	56.2	51.0	10.7
2002	622	2300	60.9	70.7	66.7	64.3	63.3	60.4	56.2	50.8	9.8
2002	622	2315	59.6	66.1	63.8	62.7	62.0	59.2	55.9	50.5	6.5
2002	622	2330	60.0	69.4	65.7	63.7	62.7	59.1	55.1	47.1	9.4
2002	622	2345	61.2	74.6	67.5	64.6	63.4	60.3	56.9	48.6	13.4
2002	623	0	61.2	78.8	65.6	64.3	63.5	60.7	56.7	51.0	17.6
2002	623	15	59.8	67.9	65.3	63.2	62.2	59.3	54.8	45.9	8.1
2002	623	30	59.8	66.2	64.3	62.9	62.2	59.4	55.3	50.2	6.4
2002	623	45	58.1	68.6	64.0	61.7	60.7	57.5	53.1	45.0	10.5
2002	623	100	58.0	65.4	63.6	61.9	61.1	57.1	51.4	39.2	7.4
2002	623	115	58.8	70.3	64.5	62.1	61.2	57.9	54.6	47.0	11.5
2002	623	130	57.8	67.6	64.2	62.2	61.0	56.8	44.1	33.7	9.8
2002	623	145	55.7	68.7	64.8	60.3	58.8	53.5	45.9	39.2	13.0
2002	623	200	57.0	72.2	66.0	61.9	60.3	54.7	42.6	33.0	15.2
2002	623	215	56.4	73.3	64.3	62.2	60.5	53.7	41.0	31.3	16.9
2002	623	230	56.3	67.5	64.1	62.0	60.5	53.8	36.7	31.0	11.2
2002	623	245	55.6	71.7	64.6	60.8	58.9	52.9	39.3	31.9	16.1
2002	623	300	55.1	68.1	63.8	60.7	58.9	52.5	39.2	33.4	13.0
2002	623	315	55.7	68.9	64.4	61.6	60.1	51.5	37.3	32.5	13.2
2002	623	330	55.0	68.2	64.6	60.9	59.3	49.3	35.4	31.0	13.2
2002	623	345	55.1	67.7	64.2	61.1	59.3	51.1	37.8	31.9	12.6
2002	623	400	51.4	65.8	60.8	57.3	55.7	47.0	32.5	30.4	14.4
2002	623	415	55.4	69.2	64.4	61.3	59.6	52.0	35.7	31.4	13.8
2002	623	430	52.7	63.8	59.9	57.7	56.4	51.1	33.3	30.3	11.1
2002	623	445	52.7	70.0	60.4	58.0	56.5	50.3	38.3	29.9	17.3
2002	623	500	55.1	69.7	64.3	60.9	59.0	51.6	37.0	29.5	14.6
2002	623	515	55.4	74.8	65.7	60.8	58.1	51.8	39.7	33.4	19.4
2002	623	530	57.2	68.2	64.8	62.3	60.9	55.2	45.1	32.5	11.0
2002	623	545	57.8	70.8	66.5	62.8	61.5	55.4	43.7	33.6	13.0
2002	623	600	59.8	74.1	67.8	64.5	62.8	58.0	51.3	33.6	14.3
2002	623	615	58.1	67.4	64.8	62.7	61.6	56.5	51.4	43.2	9.3
2002	623	630	60.7	78.4	70.1	64.6	63.1	58.9	53.3	44.0	17.7
2002	623	645	59.0	71.9	66.2	63.0	62.0	57.9	48.9	36.8	12.9
2002	623	700	58.9	70.5	64.8	62.7	61.6	58.0	53.7	46.5	11.6
2002	623	715	58.8	71.7	66.8	63.3	61.5	57.1	53.1	41.8	12.9
2002	623	730	59.0	69.6	65.2	62.8	61.7	58.0	53.7	46.4	10.6
2002	623	745	60.6	71.6	66.8	65.0	63.8	59.4	55.1	48.6	11.0
2002	623	800	59.9	73.6	64.9	63.3	62.5	59.4	55.8	49.5	13.7
2002	623	815	61.8	74.9	70.4	66.4	64.6	59.8	56.1	48.2	13.1
2002	623	830	58.1	69.8	64.2	61.7	60.6	57.1	54.1	49.5	11.7
2002	623	845	58.4	76.3	65.8	62.3	60.6	56.7	53.2	48.6	17.9
2002	623	900	56.9	69.0	64.3	60.0	59.0	56.0	53.1	45.3	12.1
2002	623	915	56.9	64.9	62.2	60.2	59.3	56.3	52.9	47.4	8.0
2002	623	930	59.4	67.5	66.3	64.4	62.7	57.7	54.7	50.7	8.1
2002	623	945	57.8	71.0	65.0	61.5	60.1	56.8	54.1	49.2	13.2
2002	623	1000	58.6	75.7	66.3	62.1	60.6	57.0	54.2	47.6	17.1
2002	623	1015	58.8	68.4	65.3	62.8	61.2	57.8	54.9	49.8	9.6
2002	623	1030	58.5	78.2	66.8	61.9	60.2	57.2	54.2	47.5	19.7
2002	623	1045	59.3	81.0	67.3	63.1	61.5	57.3	54.0	50.6	21.7
2002	623	1100	58.1	71.9	65.8	62.5	60.4	56.7	54.0	50.2	13.8
2002	623	1115	59.4	77.9	67.3	63.8	61.7	57.7	55.0	50.4	18.5
2002	623	1130	59.3	71.5	66.0	63.5	62.0	58.1	54.7	49.2	12.2
2002	623	1145	59.7	72.8	68.4	63.9	61.6	58.2	54.8	50.2	13.1
2002	623	1200	61.1	85.4	69.7	65.5	62.9	58.0	55.5	52.8	24.3
2002	623	1215	59.2	74.6	66.6	62.9	61.3	58.0	55.1	51.5	15.4
2002	623	1230	59.1	76.7	66.7	62.8	61.2	57.7	54.7	50.7	17.6
2002	623	1245	61.0	84.0	70.5	64.4	62.0	57.7	54.3	49.1	23.0
2002	623	1300	59.2	74.2	68.1	63.8	61.8	57.3	54.3	48.3	15.0
2002	623	1315	58.6	68.8	64.9	62.1	61.1	57.7	54.2	47.2	10.2
2002	623	1330	58.8	75.7	66.4	62.2	60.8	57.6	55.0	50.6	16.9
2002	623	1345	59.8	82.3	68.8	62.3	60.7	57.0	54.2	50.7	22.5
2002	623	1400	59.3	71.5	67.8	64.3	62.2	57.4	54.7	49.7	12.2
2002	623	1415	58.4	73.4	67.0	62.7	60.4	56.6	53.2	46.5	15.0
2002	623	1430	58.3	70.4	65.4	62.4	60.9	57.0	54.3	49.2	12.0
2002	623	1445	57.9	69.8	65.2	61.7	60.1	56.6	53.2	45.6	12.0
2002	623	1500	57.3	69.2	63.0	60.5	59.5	56.5	53.9	48.7	11.9
2002	623	1515	57.3	66.2	63.3	60.7	59.7	56.6	53.1	44.7	8.9
2002	623	1530	57.9	69.2	64.3	61.2	60.0	57.1	54.1	49.1	11.3
2002	623	1545	59.4	75.5	67.1	63.2	61.4	58.1	55.0	49.4	16.1
2002	623	1600	59.9	83.6	65.7	62.9	61.4	58.4	55.8	48.0	23.7
2002	623	1615	61.3	84.6	66.9	63.7	62.8	60.4	58.2	55.8	23.3
2002	623	1630	63.4	80.4	73.9	66.4	64.2	61.2	59.0	56.1	17.0
2002	623	1645	62.2	72.7	67.3	64.7	63.8	61.8	59.6	55.0	10.5
2002	623	1700	62.3	76.2	67.6	64.6	63.8	61.7	59.7	55.8	13.9
2002	623	1715	62.6	78.3	68.6	65.8	64.5	61.8	59.3	54.3	15.7
2002	623	1730	61.8	67.6	65.7	64.2	63.5	61.4	59.5	56.6	5.8
2002	623	1745	61.6	69.6	66.3	64.4	63.6	61.1	59.1	55.2	8.0
2002	623	1800	61.1	67.9	65.4	63.7	62.8	60.7	58.6	54.0	6.8
2002	623	1815	61.1	72.8	65.3	63.6	62.8	60.6	58.5	55.1	11.7
2002	623	1830	62.0	73.5	66.9	65.1	64.2	61.4	59.0	55.2	11.5
2002	623	1845	61.6	83.0	65.9	63.8	63.0	60.7	58.2	53.1	21.4
2002	623	1900	60.9	68.4	65.4	63.8	63.0	60.5	58.1	53.8	7.5
2002	623	1915	60.8	69.4	66.4	63.9	62.9	60.3	57.1	45.8	8.6
2002	623	1930	60.4	66.8	64.6	63.0	62.3	60.1	57.6	53.9	6.4
2002	623	1945	61.2	76.3	69.1	64.6	62.9	59.8	57.1	52.7	15.1
2002	623	2000	61.1	70.7	67.6	64.2	63.1	60.4	57.7	54.7	9.6
2002	623	2015	60.4	69.5	65.2	63.8	62.9	59.9	56.0	50.3	9.1
2002	623	2030	61.7	75.1	70.5	67.0	64.6	59.3	55.3	46.0	13.4
2002	623	2045	60.5	70.2	66.0	63.7	62.7	59.7	57.0	50.9	9.7
2002	623	2100	61.2	72.4	69.3	64.9	63.2	59.9	57.2	54.2	11.2
2002	623	2115	61.3	79.7	70.8	64.2	62.9	59.3	56.0	48.5	18.4
2002	623	2130	59.6	67.4	64.9	63.2	62.1	59.0	55.3	47.5	7.8
2002	623	2145	59.9	70.4	66.8	64.1	62.7	58.5	54.8	48.5	10.5
2002	623	2200	59.0	71.0	65.7	62.4	61.4	58.2	54.0	47.9	12.0
2002	623	2215	60.4	78.2	68.5	64.4	62.9	58.9	54.1	41.8	17.8
2002	623	2230	58.8	69.9	65.6	62.7	61.3	57.8	53.9	45.8	11.1
2002	623	2245	58.6	69.3	66.3	62.9	61.5	57.1	52.7	46.6	10.7
2002	623	2300	58.8	66.6	64.0	62.4	61.5	58.2	53.6	44.1	7.8
2002	623	2315	60.1	76.3	70.3	64.7	62.7	57.3	52.1	43.6	16.2
2002	623	2330	58.9	71.0	67.9	63.9	62.1	56.9	49.5	34.5	12.1
2002	623	2345	57.2	69.1	65.3	62.7	61.3	54.1	41.4	33.5	11.9
2002	624	0	56.9	69.3	65.5	61.7	60.3	55.0	45.0	36.0	12.4

DAY 4	DESCRIPTOR	PERIOD	LEVEL	UNIT
Full Day	Leq, 24 hours	between 00:00 and 24:00 hours	59.4	dB(A)
Night Time	Leq, 8 hours	between 22:00 and 06:00 hours	58.0	dB(A)
Daytime	Leq, 15 hours	between 07:00 and 22:00 hours	60.1	dB(A)
Night Time	Leq, 9 hours	between 22:00 and 07:00 hours	58.2	dB(A)
Daytime	L10, 18 hours	between 06:00 and 24:00 hours	62.0	dB(A)
Daytime	minimum L90, 15 min	between 07:00 and 18:00 hours	52.9	dB(A)

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DAY 5

Monday 24 June 2002

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YEAR	MoDy	TIME	Leq	Lmax	L1	L5	L10	L50	L90	Lmin	Lmax - Leq
2002	623	2215	60.4	78.2	68.5	64.4	62.9	58.9	54.1	41.8	17.8
2002	623	2230	58.8	69.9	65.6	62.7	61.3	57.8	53.9	45.8	11.1
2002	623	2245	58.6	69.3	66.3	62.9	61.5	57.1	52.7	46.6	10.7
2002	623	2300	58.8	66.6	64.0	62.4	61.5	58.2	53.6	44.1	7.8
2002	623	2315	60.1	76.3	70.3	64.7	62.7	57.3	52.1	43.6	16.2
2002	623	2330	58.9	71.0	67.9	63.9	62.1	56.9	49.5	34.5	12.1
2002	623	2345	57.2	69.1	65.3	62.7	61.3	54.1	41.4	33.5	11.9
2002	624	0	56.9	69.3	65.5	61.7	60.3	55.0	45.0	36.0	12.4
2002	624	15	55.8	71.2	66.9	60.5	59.1	51.7	36.1	32.5	15.4
2002	624	30	54.5	70.3	62.6	59.6	58.1	52.2	42.3	34.2	15.8
2002	624	45	58.6	73.0	69.8	64.3	61.3	54.5	45.1	37.1	14.4
2002	624	100	53.8	71.2	63.9	60.4	58.1	47.7	35.5	31.9	17.4
2002	624	115	56.3	71.4	67.6	61.4	59.7	52.1	38.3	34.2	15.1
2002	624	130	53.5	68.4	64.8	60.1	57.6	46.1	33.9	31.1	14.9
2002	624	145	55.1	73.1	66.0	61.3	58.7	47.8	33.6	31.4	18.0
2002	624	200	54.5	73.3	66.4	60.2	57.3	44.4	33.0	30.6	18.8
2002	624	215	55.6	70.1	66.2	62.3	59.6	49.6	38.1	32.7	14.5
2002	624	230	51.9	64.1	61.2	58.2	56.6	45.4	33.2	30.9	12.2
2002	624	245	54.9	68.5	64.1	60.9	59.3	49.8	34.9	31.4	13.6
2002	624	300	57.4	70.3	66.6	63.3	61.3	53.8	42.4	33.7	12.9
2002	624	315	53.1	67.5	61.0	58.8	57.3	50.0	34.6	31.6	14.4
2002	624	330	55.7	72.1	67.0	62.5	59.5	48.5	36.0	31.6	16.4
2002	624	345	57.3	70.0	66.6	62.7	60.9	54.6	44.6	33.8	12.7
2002	624	400	57.5	69.7	67.3	63.5	61.0	54.4	38.2	33.1	12.2
2002	624	415	58.9	74.1	68.7	64.0	62.4	55.0	46.4	37.1	15.2
2002	624	430	61.7	76.6	70.9	67.1	65.1	58.7	52.4	37.9	14.9
2002	624	445	59.1	71.2	67.7	64.8	62.7	56.1	48.6	40.4	12.1
2002	624	500	60.1	79.3	70.7	65.1	62.3	57.2	52.1	41.4	19.2
2002	624	515	63.2	82.8	72.4	66.7	64.8	59.8	55.2	47.3	19.6
2002	624	530	62.7	80.1	68.8	65.8	64.6	61.3	58.4	49.6	17.4
2002	624	545	63.7	75.5	71.2	68.1	65.8	62.4	59.9	56.2	11.8
2002	624	600	63.0	77.4	68.5	66.3	65.2	62.1	59.5	55.7	14.4
2002	624	615	63.9	74.2	69.7	66.8	65.9	63.3	60.5	56.5	10.3
2002	624	630	64.9	76.2	72.2	68.7	67.2	63.9	61.4	58.5	11.3
2002	624	645	65.6	81.5	71.3	68.9	68.0	64.7	62.0	58.2	15.9
2002	624	700	65.1	73.3	70.7	68.5	67.4	64.4	61.8	58.4	8.2
2002	624	715	65.8	81.9	74.4	69.6	67.6	64.1	61.9	55.7	16.1
2002	624	730	64.6	76.3	71.7	67.8	66.7	63.8	60.9	57.9	11.7
2002	624	745	64.3	73.2	68.9	67.0	66.3	63.9	61.3	56.6	8.9
2002	624	800	65.2	84.1	70.8	68.4	67.2	64.1	61.3	57.8	18.9
2002	624	815	64.5	86.1	74.5	68.7	66.3	61.2	58.1	54.0	21.6
2002	624	830	65.7	83.3	78.1	70.4	66.9	60.2	55.6	50.0	17.6
2002	624	845	60.9	77.2	70.8	64.6	62.7	58.7	55.4	51.5	16.3
2002	624	900	61.1	71.8	66.8	65.2	63.9	60.0	57.0	54.0	10.7
2002	624	915	60.8	75.6	69.9	65.4	62.9	58.8	55.7	51.3	14.8
2002	624	930	60.0	71.7	67.3	64.7	63.0	58.4	54.6	49.1	11.7
2002	624	945	60.4	74.0	66.7	64.9	63.6	59.0	55.1	50.1	13.6
2002	624	1000	61.4	74.6	70.7	66.0	64.5	59.0	53.5	48.9	13.2
2002	624	1015	61.2	78.8	68.2	65.6	63.8	59.4	55.4	49.6	17.6
2002	624	1030	60.8	75.7	68.2	65.5	63.6	59.2	55.7	50.6	14.9
2002	624	1045	63.6	83.1	77.0	66.4	64.2	58.2	53.4	47.6	19.5
2002	624	1100	60.3	72.8	68.6	65.4	63.6	58.0	53.3	49.5	12.5
2002	624	1115	60.6	73.8	67.3	65.0	63.9	59.1	55.3	49.4	13.2
2002	624	1130	60.5	73.7	68.3	65.0	63.5	58.7	54.5	50.6	13.2
2002	624	1145	60.9	73.2	68.3	65.4	64.1	59.3	55.1	48.5	12.3
2002	624	1200	60.7	74.5	67.9	64.6	63.4	59.3	55.7	51.6	13.8
2002	624	1215	61.2	72.5	69.2	65.8	64.3	59.5	54.9	47.5	11.3
2002	624	1230	61.2	75.2	69.1	66.2	64.4	59.1	55.7	50.4	14.0
2002	624	1245	60.8	70.7	68.3	65.3	63.8	59.3	55.0	51.0	9.9
2002	624	1300	61.1	74.2	67.5	65.3	63.9	59.8	55.6	48.6	13.1
2002	624	1315	61.4	74.8	70.7	65.4	63.9	59.7	55.6	51.1	13.4
2002	624	1330	60.3	69.5	66.5	64.1	62.9	59.2	55.9	50.3	9.2
2002	624	1345	61.2	74.3	69.2	65.7	64.1	59.4	55.5	51.1	13.1
2002	624	1400	60.9	75.3	68.5	66.0	64.2	58.8	54.3	48.2	14.4
2002	624	1415	61.5	78.1	69.7	65.1	64.0	59.9	56.3	52.2	14.6
2002	624	1430	60.3	72.4	66.9	64.5	63.3	59.3	54.5	48.1	12.1
2002	624	1445	61.9	72.8	68.6	65.8	64.5	60.9	58.0	55.2	10.9
2002	624	1500	64.8	84.6	75.7	68.9	66.6	60.8	57.4	54.2	19.8
2002	624	1515	64.2	84.3	70.6	66.0	64.3	61.0	58.8	55.5	20.1
2002	624	1530	62.6	73.6	68.8	66.6	65.2	61.6	59.1	54.8	11.0
2002	624	1545	63.4	77.7	70.8	66.6	65.2	62.1	60.0	57.1	14.3
2002	624	1600	63.9	72.3	69.0	67.1	66.0	63.4	60.9	56.1	8.4
2002	624	1615	63.8	74.4	68.4	66.5	65.7	63.3	61.1	57.0	10.6
2002	624	1630	64.8	75.0	71.5	68.2	66.8	63.8	61.8	58.6	10.2
2002	624	1645	64.0	71.0	68.8	66.9	66.0	63.6	61.2	57.0	7.0
2002	624	1700	63.9	71.0	68.6	66.5	65.7	63.5	61.7	58.7	7.1
2002	624	1715	65.0	89.0	73.1	67.2	65.9	63.4	61.3	58.0	24.0
2002	624	1730	63.8	72.6	68.9	66.7	65.6	63.3	61.2	59.1	8.8
2002	624	1745	64.1	72.8	68.8	66.7	65.8	63.6	61.6	59.2	8.7
2002	624	1800	64.2	78.7	72.1	66.9	65.5	62.8	61.2	58.9	14.5
2002	624	1815	63.1	70.1	68.0	65.9	65.1	62.6	60.2	57.6	7.0
2002	624	1830	64.3	85.9	71.8	67.1	65.8	62.8	60.5	56.9	21.6
2002	624	1845	62.7	81.0	68.2	65.5	64.6	62.1	59.6	55.6	18.3
2002	624	1900	63.3	72.4	69.3	67.3	65.8	62.2	59.8	56.1	9.1
2002	624	1915	62.6	73.2	68.9	66.2	64.8	61.8	59.2	55.4	10.6
2002	624	1930	61.5	69.9	67.3	64.9	63.7	60.9	58.2	53.6	8.4
2002	624	1945	62.9	77.6	70.9	66.7	65.4	61.4	58.0	52.6	14.7
2002	624	2000	61.9	72.3	68.3	65.9	64.8	60.8	57.2	51.7	10.4
2002	624	2015	60.7	73.9	66.3	63.8	63.0	60.2	55.9	49.1	13.2
2002	624	2030	60.3	71.3	67.0	64.5	63.2	59.1	55.3	45.7	11.0
2002	624	2045	59.6	70.8	65.8	62.9	61.9	58.8	55.1	50.0	11.2
2002	624	2100	60.5	77.7	68.4	64.6	62.7	58.9	56.0	51.3	17.2
2002	624	2115	60.1	71.5	67.2	64.1	62.7	58.8	54.7	48.5	11.5
2002	624	2130	59.5	71.7	65.9	63.4	61.9	58.6	54.4	46.5	12.2
2002	624	2145	60.5	72.2	68.5	65.2	63.5	58.7	54.2	46.9	11.7
2002	624	2200	61.2	72.6	69.1	65.7	64.1	59.5	55.0	48.8	11.4
2002	624	2215	59.5	72.2	67.4	63.3	61.9	58.3	53.2	43.8	12.7
2002	624	2230	60.5	71.2	67.1	64.6	63.4	59.4	55.0	49.8	10.7
2002	624	2245	60.7	74.7	68.7	65.6	63.8	58.6	53.8	40.0	14.0
2002	624	2300	57.9	70.4	66.1	62.6	61.2	56.3	49.2	39.6	12.5
2002	624	2315	60.7	74.0	68.2	65.8	64.4	58.5	51.6	46.0	13.3
2002	624	2330	58.1	71.1	67.4	63.2	61.2	55.6	50.3	43.4	13.0
2002	624	2345	59.2	71.3	68.0	64.6	62.9	56.3	48.5	39.2	12.1
2002	625	0	58.0	69.2	66.8	62.9	61.3	56.0	47.8	40.8	11.2

DAY 5	DESCRIPTOR	PERIOD	LEVEL	UNIT
Full Day	Leq, 24 hours	between 00:00 and 24:00 hours	61.8	dB(A)
Night Time	Leq, 8 hours	between 22:00 and 06:00 hours	58.7	dB(A)
Daytime	Leq, 15 hours	between 07:00 and 22:00 hours	62.6	dB(A)
Night Time	Leq, 9 hours	between 22:00 and 07:00 hours	60.1	dB(A)
Daytime	L10, 18 hours	between 06:00 and 24:00 hours	64.5	dB(A)
Daytime	minimum L90, 15 min	between 07:00 and 18:00 hours	53.3	dB(A)

25 Balmoral Circuit Cecil Hills

DAY 6

Tuesday 25 June 2002

Svan 912 S/N 2066

YEAR	MoDy	TIME	Leq	Lmax	L1	L5	L10	L50	L90	Lmin	Lmax - Leq
2002	624	2215	59.5	72.2	67.4	63.3	61.9	58.3	53.2	43.8	12.7
2002	624	2230	60.5	71.2	67.1	64.6	63.4	59.4	55.0	49.8	10.7
2002	624	2245	60.7	74.7	68.7	65.6	63.8	58.6	53.8	40.0	14.0
2002	624	2300	57.9	70.4	66.1	62.6	61.2	56.3	49.2	39.6	12.5
2002	624	2315	60.7	74.0	68.2	65.8	64.4	58.5	51.6	46.0	13.3
2002	624	2330	58.1	71.1	67.4	63.2	61.2	55.6	50.3	43.4	13.0
2002	624	2345	59.2	71.3	68.0	64.6	62.9	56.3	48.5	39.2	12.1
2002	625	0	58.0	69.2	66.8	62.9	61.3	56.0	47.8	40.8	11.2
2002	625	15	58.9	71.0	67.6	64.9	62.8	56.0	43.4	35.8	12.1
2002	625	30	57.2	70.2	66.3	62.8	61.3	53.7	38.9	35.5	13.0
2002	625	45	57.8	70.4	66.6	63.7	62.2	53.3	41.1	34.3	12.6
2002	625	100	56.5	69.5	66.4	63.2	61.0	50.8	38.6	33.6	13.0
2002	625	115	58.8	74.8	70.5	64.9	62.6	51.7	40.1	34.1	16.0
2002	625	130	56.0	70.8	65.4	62.6	60.3	50.9	39.6	34.7	14.8
2002	625	145	57.7	71.5	67.4	63.7	61.9	53.2	42.7	34.2	13.8
2002	625	200	53.7	72.1	65.7	60.2	57.2	39.1	34.1	31.8	18.4
2002	625	215	54.8	73.2	66.0	61.3	58.5	46.3	35.0	32.0	18.4
2002	625	230	58.9	72.5	69.7	65.4	62.5	54.5	42.6	34.7	13.6
2002	625	245	54.4	69.7	65.6	60.3	57.9	47.9	38.0	34.1	15.3
2002	625	300	56.5	72.6	66.7	62.6	60.4	50.9	42.6	36.1	16.1
2002	625	315	56.9	71.5	67.5	63.1	60.9	51.2	39.1	34.4	14.6
2002	625	330	59.4	71.8	68.3	65.5	63.7	56.2	48.5	40.1	12.4
2002	625	345	57.1	68.8	65.3	62.0	60.3	55.3	44.7	40.8	11.7
2002	625	400	58.4	71.7	68.2	64.4	61.5	55.3	47.8	38.2	13.3
2002	625	415	58.7	70.8	67.5	64.4	62.5	55.8	46.6	36.6	12.1
2002	625	430	61.1	72.0	69.1	66.4	64.9	58.8	51.1	44.6	10.9
2002	625	445	60.2	73.7	68.8	64.7	63.2	58.4	51.6	43.9	13.5
2002	625	500	59.9	73.5	68.2	64.6	63.1	57.6	52.3	46.4	13.6
2002	625	515	61.8	76.1	69.7	66.1	64.4	60.2	57.6	54.2	14.3
2002	625	530	63.6	73.8	71.1	68.1	66.6	62.2	57.8	51.4	10.2
2002	625	545	63.5	75.9	71.0	67.0	65.7	62.3	59.3	54.4	12.4
2002	625	600	63.1	71.8	68.0	66.2	65.2	62.5	59.9	57.3	8.7
2002	625	615	64.5	78.5	70.6	67.5	66.4	63.6	61.4	57.4	14.0
2002	625	630	64.9	77.7	71.7	68.4	66.9	64.0	61.1	57.3	12.8
2002	625	645	65.4	83.7	72.2	68.2	67.1	64.3	62.1	59.2	18.3
2002	625	700	64.8	71.3	69.4	67.9	67.1	64.2	61.9	58.2	6.5
2002	625	715	63.2	71.5	69.1	66.5	65.4	62.6	59.2	54.5	8.3
2002	625	730	62.2	69.6	67.9	65.4	64.4	61.5	59.6	57.0	7.4
2002	625	745	62.2	77.6	68.6	65.5	64.5	60.9	57.9	55.0	15.4
2002	625	800	61.6	69.3	66.4	64.6	63.6	61.1	58.9	56.6	7.7
2002	625	815	62.1	76.8	68.7	65.9	64.6	60.7	57.9	54.8	14.8
2002	625	830	61.0	81.6	68.0	64.8	63.5	59.8	57.0	51.6	20.6
2002	625	845	61.9	76.0	68.7	66.3	64.7	60.4	57.8	54.5	14.1
2002	625	900	62.7	80.1	70.7	67.2	65.5	60.7	58.0	54.6	17.4
2002	625	915	62.8	74.4	69.7	67.0	65.5	61.4	58.8	56.0	11.6
2002	625	930	61.5	71.7	68.2	65.6	64.3	60.2	56.5	51.0	10.2
2002	625	945	62.5	72.6	69.7	67.4	65.7	60.7	57.1	49.8	10.1
2002	625	1000	63.1	80.1	71.1	67.9	65.9	61.1	57.5	52.0	17.0
2002	625	1015	62.1	74.8	72.1	66.4	64.7	60.0	55.5	49.8	12.7
2002	625	1030	61.8	73.1	67.8	65.7	64.6	60.7	57.1	52.5	11.3
2002	625	1045	61.7	71.7	68.8	66.2	64.7	60.4	55.9	51.5	10.0
2002	625	1100	63.9	84.4	72.8	66.7	65.3	60.0	55.0	50.1	20.5
2002	625	1115	61.5	73.5	69.0	65.7	64.2	60.2	56.2	50.6	12.0
2002	625	1130	62.4	75.6	70.9	66.8	65.3	60.6	56.0	49.7	13.2
2002	625	1145	60.8	69.9	67.2	65.4	63.9	59.5	56.0	52.4	9.1
2002	625	1200	60.8	69.6	67.0	64.8	63.7	60.0	55.3	48.3	8.8
2002	625	1215	61.8	77.8	72.8	65.9	64.3	59.2	55.2	52.2	16.0
2002	625	1230	61.5	74.8	70.3	66.0	64.5	59.5	55.3	49.3	13.3
2002	625	1245	63.0	79.0	71.4	68.2	66.2	60.6	56.7	49.8	16.0
2002	625	1300	59.5	70.7	65.8	63.8	62.6	58.2	54.1	45.9	11.2
2002	625	1315	59.9	71.8	66.9	64.6	63.1	58.3	54.4	50.0	11.9
2002	625	1330	61.4	79.7	69.5	65.5	64.0	59.5	56.0	52.9	18.3
2002	625	1345	62.5	75.6	70.8	67.3	65.4	60.4	56.4	52.0	13.1
2002	625	1400	60.6	73.8	67.0	64.6	63.5	59.5	55.9	48.4	13.2
2002	625	1415	59.5	69.5	66.0	63.6	62.0	58.5	55.4	49.4	10.0
2002	625	1430	61.5	73.1	70.0	66.2	64.3	59.7	56.2	51.8	11.6
2002	625	1445	63.0	75.2	71.1	67.2	65.6	61.3	58.2	55.7	12.2
2002	625	1500	64.2	83.8	75.8	67.1	65.0	60.3	57.4	52.8	19.6
2002	625	1515	62.0	72.9	67.9	65.6	64.7	60.8	57.8	54.4	10.9
2002	625	1530	63.4	78.8	74.6	66.0	64.5	61.3	58.2	53.8	15.4
2002	625	1545	63.6	83.8	70.8	66.7	65.3	61.8	59.0	55.4	20.2
2002	625	1600	63.4	81.0	70.2	66.4	65.3	61.7	59.2	55.9	17.6
2002	625	1615	63.0	74.7	71.7	67.2	65.1	61.4	58.6	54.7	11.7
2002	625	1630	62.3	69.6	67.7	65.8	64.8	61.6	57.9	51.3	7.3
2002	625	1645	63.3	71.9	69.4	66.7	65.5	62.5	59.6	56.1	8.6
2002	625	1700	63.7	71.4	68.9	66.8	65.8	63.2	60.8	55.2	7.7
2002	625	1715	63.9	71.7	68.8	66.8	65.9	63.5	60.7	53.4	7.8
2002	625	1730	63.2	73.6	69.2	66.7	65.3	62.4	59.9	56.8	10.4
2002	625	1745	63.5	85.2	73.0	66.4	64.7	61.3	58.3	53.1	21.7
2002	625	1800	64.0	88.4	72.4	66.9	64.8	61.6	58.0	53.4	24.4
2002	625	1815	61.8	71.3	67.8	65.6	64.2	61.0	58.1	55.1	9.5
2002	625	1830	61.8	80.6	68.0	65.2	64.0	60.7	56.9	50.0	18.8
2002	625	1845	61.6	71.6	67.7	65.1	63.9	60.6	57.8	53.1	10.0
2002	625	1900	61.0	73.9	67.7	65.5	64.0	59.6	56.2	52.3	12.9
2002	625	1915	59.7	70.1	65.8	63.2	62.2	58.7	55.7	51.3	10.4
2002	625	1930	61.0	73.6	69.0	65.3	63.7	59.4	56.3	52.2	12.6
2002	625	1945	61.3	72.2	66.9	65.3	64.1	60.4	56.5	51.6	10.9
2002	625	2000	61.7	71.3	69.0	66.0	64.7	60.2	55.9	51.4	9.6
2002	625	2015	62.9	85.0	69.9	67.2	65.6	60.9	56.4	50.5	22.1
2002	625	2030	60.5	73.5	67.8	64.2	62.9	59.4	54.3	48.3	13.0
2002	625	2045	62.4	82.8	69.7	66.6	64.9	60.5	56.8	50.8	20.5
2002	625	2100	60.1	76.7	66.4	63.1	62.1	59.1	55.8	50.7	16.6
2002	625	2115	61.8	80.6	69.4	65.9	64.2	60.1	57.2	51.1	18.8
2002	625	2130	61.3	69.9	67.6	65.2	64.0	60.4	55.4	47.8	8.6
2002	625	2145	61.0	79.6	67.4	64.5	63.5	59.9	56.0	50.4	18.6
2002	625	2200	61.5	70.8	68.9	66.4	64.9	59.6	55.3	49.5	9.3
2002	625	2215	63.7	82.0	73.4	67.7	65.3	60.3	55.5	49.7	18.3
2002	625	2230	63.0	79.0	70.5	67.5	66.1	61.1	54.4	42.9	16.0
2002	625	2245	61.1	75.9	70.0	66.8	64.6	58.3	50.1	44.0	14.8
2002	625	2300	59.5	71.9	68.0	64.6	62.9	57.6	48.0	37.5	12.4
2002	625	2315	61.1	74.2	70.1	66.9	64.9	58.2	48.4	40.4	13.1
2002	625	2330	60.0	70.4	66.8	64.3	63.1	58.8	50.9	40.8	10.4
2002	625	2345	61.2	79.2	70.1	66.1	64.4	58.2	48.4	41.9	18.0
2002	626	0	59.3	72.0	68.0	64.7	62.8	56.9	46.0	37.9	12.7

DAY 6	DESCRIPTOR	PERIOD	LEVEL	UNIT
Full Day	Leq, 24 hours	between 00:00 and 24:00 hours	61.7	dB(A)
Night Time	Leq, 8 hours	between 22:00 and 06:00 hours	59.3	dB(A)
Daytime	Leq, 15 hours	between 07:00 and 22:00 hours	62.2	dB(A)
Night Time	Leq, 9 hours	between 22:00 and 07:00 hours	60.5	dB(A)
Daytime	L10, 18 hours	between 06:00 and 24:00 hours	64.6	dB(A)
Daytime	minimum L90, 15 min	between 07:00 and 18:00 hours	54.1	dB(A)

25 Balmoral Circuit Cecil Hills

DAY 7

Wednesday 26 June 2002

Svan 912 S/N 2066

YEAR	Mo/Dy	TIME	Leq	Lmax	L1	L5	L10	L50	L90	Lmin	Lmax - Leq
2002	625	2215	63.7	82.0	73.4	67.7	65.3	60.3	55.5	49.7	18.3
2002	625	2230	63.0	79.0	70.5	67.5	66.1	61.1	54.4	42.9	16.0
2002	625	2245	61.1	75.9	70.0	66.8	64.6	58.3	50.1	44.0	14.8
2002	625	2300	59.5	71.9	68.0	64.6	62.9	57.6	48.0	37.5	12.4
2002	625	2315	61.1	74.2	70.1	66.9	64.9	58.2	48.4	40.4	13.1
2002	625	2330	60.0	70.4	66.8	64.3	63.1	58.8	50.9	40.8	10.4
2002	625	2345	61.2	79.2	70.1	66.1	64.4	58.2	48.4	41.9	18.0
2002	626	0	59.3	72.0	68.0	64.7	62.8	56.9	46.0	37.9	12.7
2002	626	15	58.0	73.2	66.5	63.3	61.7	55.5	45.8	39.0	15.2
2002	626	30	56.1	71.8	66.6	62.0	59.9	50.6	38.8	32.8	15.7
2002	626	45	55.8	72.4	64.2	61.1	59.4	53.3	39.0	33.2	16.6
2002	626	100	57.8	71.2	68.1	64.3	61.6	52.8	42.1	33.2	13.4
2002	626	115	54.1	73.7	66.1	59.3	56.9	44.6	34.3	31.1	19.6
2002	626	130	55.9	70.4	66.9	62.5	60.0	49.3	33.2	31.0	14.5
2002	626	145	58.2	72.5	68.0	64.3	62.2	54.2	38.0	32.4	14.3
2002	626	200	57.7	74.4	68.9	64.2	62.1	48.5	35.7	30.5	16.7
2002	626	215	57.4	72.1	67.7	64.2	62.2	50.3	35.4	29.8	14.7
2002	626	230	59.7	79.7	72.5	64.9	61.8	50.6	36.9	33.0	20.0
2002	626	245	58.2	75.4	68.3	64.2	62.2	52.3	41.7	34.4	17.2
2002	626	300	58.2	73.0	69.0	64.8	62.4	50.8	40.7	31.5	14.8
2002	626	315	56.9	72.5	67.8	62.3	60.2	52.5	40.2	33.2	15.6
2002	626	330	58.3	70.3	67.2	64.1	62.7	54.6	43.7	38.1	12.0
2002	626	345	58.0	71.1	68.7	64.6	61.9	52.4	40.5	35.7	13.1
2002	626	400	57.0	70.3	66.7	62.9	60.9	52.9	43.7	37.5	13.3
2002	626	415	59.5	71.9	68.0	65.0	63.0	57.0	50.0	39.1	12.4
2002	626	430	59.7	72.6	68.5	64.4	62.7	57.8	51.5	39.1	12.9
2002	626	445	60.1	70.8	68.0	65.3	63.7	58.4	50.8	43.7	10.7
2002	626	500	59.7	72.2	67.2	64.5	63.1	58.0	51.8	41.2	12.5
2002	626	515	62.5	72.9	70.0	66.7	65.3	61.2	57.6	53.9	10.4
2002	626	530	63.0	73.5	69.9	67.4	66.0	61.7	57.7	52.5	10.5
2002	626	545	64.3	75.1	71.2	68.4	67.2	62.9	59.6	55.1	10.8
2002	626	600	63.1	73.7	69.5	67.1	65.9	62.0	58.5	54.1	10.6
2002	626	615	64.6	76.5	72.0	68.3	67.0	63.5	60.1	55.5	11.9
2002	626	630	63.1	73.8	69.0	66.8	65.7	62.2	59.2	55.7	10.7
2002	626	645	63.0	71.3	68.0	66.1	65.1	62.3	60.0	56.3	8.3
2002	626	700	64.0	89.0	70.0	67.2	65.6	62.1	59.3	55.8	25.0
2002	626	715	61.2	70.2	67.9	65.2	64.0	60.0	56.4	51.4	9.0
2002	626	730	60.4	69.8	66.6	64.6	63.2	59.4	56.4	51.1	9.4
2002	626	745	60.0	70.3	65.7	63.7	62.7	58.9	56.0	53.6	10.3
2002	626	800	59.7	72.6	66.1	63.7	62.3	58.9	54.9	51.3	12.9
2002	626	815	60.1	71.4	66.2	64.2	63.0	58.9	55.6	51.2	11.2
2002	626	830	60.3	79.1	69.3	63.9	62.1	57.6	53.5	48.6	18.8
2002	626	845	60.2	72.4	66.6	64.6	63.3	58.8	55.2	48.8	12.2
2002	626	900	60.7	74.0	68.0	64.6	63.4	59.4	55.0	50.2	13.3
2002	626	915	61.0	72.0	68.1	65.2	63.8	59.6	56.3	50.9	11.0
2002	626	930	60.9	78.6	68.7	64.9	63.2	58.2	54.7	49.9	17.7
2002	626	945	59.1	69.9	65.7	63.4	62.2	57.8	53.7	46.7	10.8
2002	626	1000	60.7	75.8	68.7	64.7	63.3	58.8	54.9	51.0	15.1
2002	626	1015	59.6	74.3	67.7	64.0	62.4	57.7	53.3	46.7	14.7
2002	626	1030	58.5	78.4	66.1	63.3	61.1	56.2	52.5	48.8	19.9
2002	626	1045	61.0	76.9	69.8	66.3	64.2	58.2	54.1	48.9	15.9
2002	626	1100	59.3	74.6	68.5	63.9	62.4	56.8	53.0	46.7	15.3
2002	626	1115	58.9	74.9	67.1	62.7	61.4	56.9	53.2	48.7	16.0
2002	626	1130	59.8	78.4	69.0	65.0	62.4	57.4	52.7	48.9	18.6
2002	626	1145	58.9	73.7	66.8	63.7	62.0	56.8	52.3	46.7	14.8
2002	626	1200	61.9	83.3	72.4	64.7	62.6	56.8	50.8	45.7	21.4
2002	626	1215	58.2	74.1	66.0	62.9	61.5	55.7	51.7	44.6	15.9
2002	626	1230	61.0	84.1	69.7	64.7	62.7	56.7	52.4	47.1	23.1
2002	626	1245	60.6	75.2	69.5	65.6	63.8	57.8	52.5	45.3	14.6
2002	626	1300	59.9	71.8	68.3	65.4	63.3	57.5	51.9	45.1	11.9
2002	626	1315	58.8	70.9	67.7	64.2	62.0	56.1	52.1	47.3	12.1
2002	626	1330	59.6	75.0	68.9	64.8	62.7	56.6	52.6	48.1	15.4
2002	626	1345	61.4	81.3	73.5	64.9	62.4	56.8	53.7	48.7	19.9
2002	626	1400	59.8	73.5	68.3	64.5	62.9	57.6	54.0	47.3	13.7
2002	626	1415	58.2	69.1	65.3	62.3	60.7	57.0	53.8	44.3	10.9
2002	626	1430	58.9	70.7	68.1	63.5	61.5	57.0	53.3	46.1	11.8
2002	626	1445	60.7	83.7	69.7	64.6	62.6	57.0	52.3	46.0	23.0
2002	626	1500	59.5	70.5	66.3	63.9	62.6	58.0	54.2	49.2	11.0
2002	626	1515	62.2	75.7	73.2	67.0	64.0	59.0	56.2	51.8	13.5
2002	626	1530	60.2	72.7	68.5	64.5	63.0	58.5	55.5	48.9	12.5
2002	626	1545	60.7	71.0	67.9	65.0	63.2	59.4	56.0	51.9	10.3
2002	626	1600	61.4	74.5	69.4	65.4	63.6	59.9	56.8	53.6	13.1
2002	626	1615	63.1	83.0	69.6	67.2	65.4	61.8	58.4	55.7	19.9
2002	626	1630	63.0	69.9	67.9	66.0	64.9	62.4	60.1	55.4	6.9
2002	626	1645	64.3	79.6	73.0	67.7	66.1	62.6	59.9	56.9	15.3
2002	626	1700	63.0	77.1	69.6	66.2	64.9	62.0	59.8	57.2	14.1
2002	626	1715	62.6	72.9	68.2	65.1	64.2	62.0	60.0	56.8	10.3
2002	626	1730	63.9	75.0	70.5	67.1	66.0	63.2	59.9	56.1	11.1
2002	626	1745	63.8	70.6	67.8	66.0	65.5	63.5	61.4	58.1	6.8
2002	626	1800	63.7	78.5	69.3	66.3	65.5	63.2	60.5	51.7	14.8
2002	626	1815	63.4	74.5	68.2	66.4	65.6	63.1	59.6	54.1	11.1
2002	626	1830	63.7	75.1	71.1	67.8	65.8	62.7	60.1	53.4	11.4
2002	626	1845	62.7	83.9	69.4	66.5	64.6	61.3	58.2	51.8	21.2
2002	626	1900	62.8	80.5	70.0	65.9	64.5	61.2	58.6	53.3	17.7
2002	626	1915	62.9	72.7	69.3	66.5	65.4	62.0	58.3	53.6	9.8
2002	626	1930	61.3	69.3	66.0	64.4	63.5	60.7	58.0	51.5	8.0
2002	626	1945	62.1	88.1	68.6	65.7	64.1	59.9	55.7	48.5	26.0
2002	626	2000	61.6	72.4	68.1	65.8	64.3	60.5	55.8	51.3	10.8
2002	626	2015	61.0	73.8	68.5	64.8	63.5	59.7	55.7	50.5	12.8
2002	626	2030	59.6	68.6	65.9	63.8	62.6	58.4	54.8	51.1	9.0
2002	626	2045	60.4	75.5	67.7	64.4	63.2	59.0	54.1	41.7	15.1
2002	626	2100	61.2	75.6	68.9	65.9	64.3	59.4	54.6	48.6	14.4
2002	626	2115	60.0	73.2	67.0	64.1	62.7	58.8	53.7	46.7	13.2
2002	626	2130	61.0	74.3	68.7	65.0	63.6	59.5	55.8	49.8	13.3
2002	626	2145	61.8	73.8	68.9	66.6	64.7	60.4	56.3	51.4	12.0
2002	626	2200	61.7	76.6	70.6	65.1	63.7	60.0	56.7	51.1	14.9
2002	626	2215	59.9	70.2	66.2	63.8	62.7	59.1	53.4	46.6	10.3
2002	626	2230	62.5	79.9	72.6	67.0	65.0	60.0	54.3	45.6	17.4
2002	626	2245	61.2	74.8	70.3	65.7	63.9	59.2	54.2	44.9	13.6
2002	626	2300	61.6	74.4	69.6	66.4	65.0	59.5	53.5	43.9	12.8
2002	626	2315	60.8	72.6	68.4	65.8	64.2	58.9	53.8	45.4	11.8
2002	626	2330	58.5	71.1	66.2	63.2	62.0	56.5	49.3	36.9	12.6
2002	626	2345	59.8	71.4	69.1	64.8	62.9	57.4	51.8	42.5	11.6
2002	627	0	58.0	70.8	66.5	63.2	61.3	55.7	47.3	40.3	12.8

DAY 7	DESCRIPTOR	PERIOD	LEVEL	UNIT
Full Day	Leq, 24 hours	between 00:00 and 24:00 hours	61.0	dB(A)
Night Time	Leq, 8 hours	between 22:00 and 06:00 hours	59.9	dB(A)
Daytime	Leq, 15 hours	between 07:00 and 22:00 hours	61.2	dB(A)
Night Time	Leq, 9 hours	between 22:00 and 07:00 hours	60.6	dB(A)
Daytime	L10, 18 hours	between 06:00 and 24:00 hours	63.6	dB(A)
Daytime	minimum L90, 15 min	between 07:00 and 18:00 hours	50.8	dB(A)

TOTAL	DESCRIPTOR	PERIOD - 7 DAY SUMMARY	LEVEL	UNIT
Full Day	Leq, 24 hours	between 00:00 and 24:00 hours	61.2	dB(A)
Night Time	Leq, 8 hours	between 22:00 and 06:00 hours	58.9	dB(A)
Daytime	Leq, 15 hours	between 07:00 and 22:00 hours	61.8	dB(A)
Night Time	Leq, 9 hours	between 22:00 and 07:00 hours	59.9	dB(A)
Daytime	L10, 18 hours	between 06:00 and 24:00 hours	63.9	dB(A)

HERITAGE ASSESSMENT

Helen Brayshaw Heritage Consultants Pty Ltd

**ELIZABETH DRIVE ADDENDUM REF
WESTERN SYDNEY ORBITAL TO WINDSOR
ROAD CECIL PARK
HERITAGE ASSESSMENT**

June 2002

**Report to the RTA through
Macoun Environmental Consulting**

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- A: Aboriginal Community Statement
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- 1 Location Map
- 2 Concept Plan Showing Location of Site HC/ED1

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- 1 Site HC/ED1, southern side of Elizabeth Drive, camera facing north west. Artefacts were found on the rise and as far as the smallish tree centre background.
- 2 One of the artefacts identified at Site HC/ED1.

1 INTRODUCTION

1.1 Project Overview

The subject of this report is an archaeological assessment of Aboriginal and historic heritage along Elizabeth Drive corridor between the Western Sydney Orbital and Windsor Road, Cecil Hills [Figure 1]. The report forms part of an addendum to the 1996 REF prepared by McKenzie Land Planning, which did not address heritage issues, and was commissioned by Macoun Environmental Consulting on behalf of the RTA.

1.2 Structure of Report

The report

- ◆ provides a brief description of the landscape traversed by the route corridor and the types of sites likely to occur there;
- ◆ provides a preliminary assessment of the archaeological resource in the region as presently known, by reference to the National Parks & Wildlife Service [NPWS] site register, Heritage Office register, consultant reports and other relevant literature;
- ◆ details consultation with Aboriginal stakeholder groups regarding their interests in the development area;
- ◆ gives a description of the archaeological surveys of the road corridor;
- ◆ provides an inventory of Aboriginal cultural items identified during the field survey;
- ◆ assesses the potential impacts of the upgrade of this section of Elizabeth Drive; and
- ◆ makes management recommendations on the basis of survey results and requirements of the *National Parks & Wildlife Act 1974* [as amended].

1.3 Summary of Results

Several Aboriginal stone artefacts and several pieces of raw material were found on the southern side of Elizabeth Drive. The artefacts were approximately 550-650 metres south east of the Western Sydney Orbital centreline at Site HC/ED1 [Figure 2, Plates 1-2]. This area has been disturbed and is not seen as having potential for further archaeological significance, so Consent to Destroy will be recommended. No items of European heritage were identified.

1.4 Acknowledgments

This report was written by Helen Brayshaw with sections relating to European heritage being written by Tony Lowe of Casey & Lowe & Associates. Helen Brayshaw carried out the archaeological survey for Aboriginal sites. The Deerubbin Local Aboriginal Land Council was represented in the field by Steve Randall, and the Darug Aboriginal Tribal Corporation was represented in the field by Peter Gale.

2 ENVIRONMENTAL CONTEXT

2.1 Location

Situated on the southern Cumberland Plain, the subject section of Elizabeth Drive is about 33 kilometres south west of the city of Sydney. Elizabeth Drive is currently a two lane single carriageway. It will be widened to dual carriageway, each with two lanes of 3.5 metres, a 6 metre median strip, a verge/bikeway/shoulder on southern side and a 1.5m shoulder on northern side. The total pavement width will be 29m, located entirely within the existing 40.2 metre road reserve. The proposed works extend from 70m east of the Windsor Road roundabout to 250m east of the Wallgrove Road roundabout, which is the reserve boundary for the Western Sydney Orbital. The total length of the proposed works is 1700m.

2.2 Geology and Soils

Bedrock in this area of the Cumberland Plain is comprised of Bringelly Shales of the Wiannamatta Group. Bringelly shales consist of shale, carbonaceous claystone, laminite, fine to medium grained lithic sandstone, rare coal and tuff. Overlying the shale bedrock along major drainage lines are alluvial deposits of fine grained sand, silt and clay. Soils are shallow to moderately deep [$<100\text{cm}$] red and brown podsolc soils on crests grading to yellow podsolc soils on lower slopes and in drainage lines. Little erosion occurs, although minor sheet and gully erosion may occur where surface vegetation is not maintained [Bannerman and Hazelton 1990].

2.3 Topography

The route is located within erosional Luddenham landscape described by Bannerman and Hazelton [1990:63] as typified by low rolling to steep low hills, local relief 50-120 metres, and slopes of 5-20%. Narrow ridges and hillcrests grade into moderately steep slopes.

Elevation at the western end, near the WSO corridor, is about 100m ASL. For about 900 metres it descends south east along a spurline, and the remaining 600 metres of the route is on relatively level ground.

This section of Elizabeth Drive is located within the catchment of the Georges River, which drains into Botany Bay. Drainage from the south is via Hinchinbrook Creek and Cabramatta Creek. The road passes over two drainage lines in the upper reaches of Hinchinbrook Creek.

Lower down Hinchinbrook, Cabramatta and other creeks are flat to gently sloping flood plains [local relief $<10\text{m}$] with incised or artificially excavated channels. There are many areas of erosion and deposition here. Stream bank erosion and sheet erosion of flood plains are common. Flooding is frequent and low lying areas in the vicinity of the confluences of Hinchinbrook, Cabramatta and Maxwells Creeks sustain [or have until very recently] extensive paperbark [*Melaleuca* sp] swamps [Bannerman and Hazelton 1990].

2.4 Vegetation

According to Benson and Howell [1990] natural vegetation over this part of the Cumberland Plain at the time of European settlement was Cumberland Plain woodland, with Grey Box [*Eucalyptus moluccana*] and Forest Red Gum [*E tereticornus*] predominating. On steeper slopes dominant species would have included Sydney Blue Gum [*E saligna*], Blackbutt [*E pilularis*], Grey Ironbark [*E paniculata*] and Rough-barked Apple [*Angophora floribunda*], with Pittosporum [*Pittosporum undulatum*] occurring commonly. Grey Box [*E moluccana*] and Spotted Gum [*E maculata*] would have predominated on gentler slopes. Soon after European settlement *Bursaria spinosa* became the most common shrub species. Native grasses include *Themeda australis* and *Aristida* spp, with *Lomandra* spp a commonly occurring herb. Along the creeks river flat forests would have included Paperbark [*Melaleuca* spp] Tea Tree [*Leptospermum* spp], and *Casuarina cunninghamiana*. *Acacias* and *Lomandra longifolia* would also have been common.

2.5 Land Use Effects

Most of the present survey area was considered to have sustained moderate to heavy disturbance, largely because of previous road works. Although the road corridor passes over a creekline, modification of land within the corridor is such that there are no intact creek banks or associated flats.

2.6 Ground Exposure and Visibility

Ground exposure greatly influences the detectability of scatters of Aboriginal stone artefacts and hence survey effectiveness. In areas where the ground surface is exposed because of lack of vegetation, or where it has been lowered by erosion or disturbed for example by ploughing, the chances of identifying artefact locations are enhanced. Most of the proposed road corridor had been disturbed to some degree, as indicated above, and the degree of ground visibility was limited principally by vegetation, grass cover and leaf litter.

North of Elizabeth Drive there is virtually no ground visibility amongst trees, shrubs, thick leaf litter and dense grass. The southern side is thickly grassed, albeit mown, on the flat, and here visibility is also low. On the slope there is intermittent visibility, with extensive patches up to 80% interspersed with areas of 0-5% visibility.

Table 1: Landforms, Ground Disturbance and Exposure

	Landform Unit	Area /ha	Average Ground Exposure	Area of Exposure /ha	Degree of Disturbance	Artefacts
Northern side	Slope	0.36	0-5%	0.018	Moderate	0
	Flat	0.24	0-5%	0.012	Moderate	0
Southern side	Slope	0.9	20%	0.18	Moderate/high	2
	Flat	0.6	0-5%	0.03	Moderate/high	0
Total		2.1		0.24		2

3 ARCHAEOLOGICAL CONTEXT

3.1 Regional Prehistory

The Sydney region has been inhabited by Aboriginal people for at least 20,000 years and probably longer [Stockton & Holland 1974, Nanson *et al* 1987]. The Blue Mountains to the west and the Hawkesbury/Nepean River system have been the focus of archaeological research for some time. Research has been carried out in the Blue Mountains and on the eastern slopes by Stockton [1970], McCarthy [1948, 1964, 1978], Tindale [1961], Johnson [1979], Kohen, Stockton *et al* [1981, 1984]. Research into the Nepean valley includes that by Kohen [1981, 1984, 1986] and Nanson *et al* [1987]. Archaeological sites excavated in the lower Blue Mountains, for example Shaws Creek Kill on the west bank of the Nepean north of Penrith - 13,000 BP [years before present], and on the south coast Burrill Lake - 20,000 BP, provide the earliest firm evidence for occupation.

To begin with it appears that occupation was sporadic and the population fairly low. About 5,000 years ago, according to Attenbrow [1981:169], "an increasing and continued use of sites began, or was frequent enough to be archaeologically visible". That the area became more intensively occupied is indicated by the fact that the majority of excavated sites within the entire region, shelter sites as well as open sites, date to 2,500 years ago or less. Kohen's research suggests that there was more intensive use of open sites during the last 1,500 years, many being used for the first time, with the result, he maintains, that most campsites would date from this time [Kohen 1986].

Over the thousands of years of occupation in the region, changes in the stone tool assemblage have been observed and temporal markers established [McCarthy 1948, Lampert 1971, Megaw 1965, Attenbrow 1981, 1987, Koettig 1985]. In the Sydney region the most widely used terminology for phases within what is known as the Eastern Regional Sequence are *Capertian* followed by Early, Middle and Late *Bondaian*.

The Capertian consists of large heavy artefacts, uniface pebble tools, core tools, denticulate saws, scrapers, hammerstones, some bipolars and burins. The change to Bondaian took place some time after 5,000 and is characterised by a shift in raw material use and a developing predominance of smaller implements. Phases within the Bondaian are based on the introduction and subsequent decline of backed implements, and the increasing use of the bipolar flaking technique. Change in the proportion of raw materials is also a factor. Other technological innovations include the introduction of ground implements around 4,000 BP and shell fishhooks in the last 1,000 years. In the Early Bondaian phase [c5,000 - 2,800 BP] fine grained siliceous materials [eg silcrete and chert] predominated. Features of the Capertian continued, but backed and edge ground implements were introduced. During the Middle Bondaian [c2,800 - 1,600 BP] the percentage of bondi points [backed and pointed implements characteristic of Bondaian assemblages] increased and was still greater than the percentage of bipolar pieces. Edge ground implements were present. The proportion of quartz increased. In the late Bondaian [c1,600 BP on] quartz was the predominant material, and bondi points disappeared. Eloueras and bipolar pieces predominated in the assemblage and edge ground implements were more common. Bone and shell implements occur in some sites.

3.2 Archaeological Site Types Occurring in the Region

The distribution of most types of Aboriginal sites is closely related to the bedrock formation and local topographical features. For example, art sites such as shelters or rock exposures with painted, drawn or engraved art, shelters with archaeological deposit and rock exposures with grinding grooves can only exist where suitable rock formations [usually sandstone] exist. Scarred or carved trees can only exist where sufficiently old trees remain. Stone arrangements occur mostly in rocky areas, but some may have been created some distance away from the rock source; they are easily rendered unrecognisable if disturbed, for example by stock, ploughing or development.

This section of Elizabeth Drive traverses shale country with some alluvium along streams. Here occupation sites, the most common type, would take the form of open camp sites. Grinding grooves and quarry sites can occur if there are suitable rock outcrops of eg sandstone in the shale, or volcanic rock in exposed dykes. If such conditions are rare the locations may have been sought after. A few scarred trees and an occasional rare carved tree have been recorded on the Cumberland Plain. The small numbers are probably largely due to the extent and intensiveness of development which has occurred in the area over the last two hundred years.

i. Open Sites

There are over three hundred sites which have been recorded on the Cumberland Plain [Smith 1989a]. Over 90% of these are open camp sites or artefact scatters. The majority are situated on the northern Cumberland Plain, probably a result of archaeological survey focus on areas to be developed rather than a reflection of Aboriginal occupation patterns. Most sites consist of shallow surface scatters and do not contain stratified deposits, although there are exceptions, eg Second Ponds Creek [Kohen 1984] Power Street, Doonside [McDonald 1993a], and several sites at Rouse Hill [McDonald and Rich 1993].

Kohen's [1986] research and test excavations at Rouse Hill [McDonald and Rich 1993] have demonstrated that low density surface sites are also important for investigating patterns of resource utilisation. Kohen developed a model whereby archaeological data are viewed as a continuum across the landscape; "sites" represent concentrated occupation, while small, sparse "off-sites" represent a range of activity areas.

ii. Grinding Grooves

Produced during the manufacture and maintenance of edge ground hatchets or chisels, these grooves tend to occur on areas of flat and homogeneous sandstone. They may occur in association with occupation sites, and are generally adjacent to river or creek beds as water is essential to the grinding process. In some areas there are also shallow ovate depressions which may result from food processing.

iii. Quarries

Extraction or quarry [sometimes also artefact manufacturing] sites have been recorded on the northern and central Cumberland Plain, for example Plumpton Ridge, Riverstone and Glossodia. They occur in limited numbers and in geographically and geologically restricted locations [Dallas 1989, McDonald 1986,

1991a, Smith 1989a]. Silcrete sources occur at Luddenham [Dallas 1988] and quartz occurs east of the Georges River [Haglund 1992]. Towards the west of the Cumberland Plain the Nepean gravels are likely to have been an important source of raw materials for artefacts, notably chert. Other as yet unidentified sources may have existed and been used in the past.

iv. Carved or Scarred Trees

In the Sydney region trees with designs or figures carved into the trunk were often associated with graves or burial grounds. Scarred trees are the result of bark or wood removal to make shields, shelter, canoes or containers. Other scars on trees might relate to toe holds cut at intervals up a tree to facilitate the extraction of honey or small game. Carved and scarred trees are rare because of rates of deterioration and destruction due to timber clearance and bushfire.

v. Stone Arrangements

Often consisting of cairns carefully constructed from loose stones to mark places of mythological or social importance, relatively few stone arrangements have been recorded. They are easily disturbed, and minimal disturbance can render them unrecognisable. They tend to occur on ridges or upper slopes, possibly because their survival rate is better there.

3.3 Archaeological Surveys Carried out in the Prestons - Cecil Park Area

The road corridor for the Prestons to Cecil Park component of the Western Sydney Orbital [WSO], which forms the western extent of the present study area, extends from the F5 Casula link in a north westerly direction to Elizabeth Drive, meeting it east of the intersection with Wallgrove Road. Alternative alignments surveyed were to the north west of the final route, and crossed the Sydney water supply aqueduct before turning north east towards Elizabeth Drive. The archaeological survey of this section of the WSO, carried out by Brayshaw and White [1999] identified nineteen open sites, in the form of surface scatters of stone artefacts, eleven isolated artefact finds and six areas of PAD [potential archaeological deposit]. Most of the identified sites had been disturbed and their potential to provide further scientific information was thereby reduced. Within the Cecil Park section of the corridor, at the junction of several tributaries with Hinchinbrook Creek, sites P-CP7 and P-CP12, together with PADs 3 and 4, appeared to form an archaeological complex.

The survey located several open sites and isolated finds on elevated land in the vicinity of Elizabeth Drive. Eleven artefacts [seven of silcrete and four of quartz] were recorded at a maximum density of 4/m² at site P-CP 8 located on a narrow crest about 50-80 metres south of Elizabeth Drive and 1.5 kilometres west of the study area. At P-CP 9, a little further to the west, on the southern slope of a ridge crest south of Elizabeth Drive, seven artefacts were recorded, two each of silcrete, mudstone and igneous, one of quartz and two pieces of quartz and quartzite which were not clearly either artefactual or road base. Three of the definite artefacts were bipolar cores, and the remainder debitage. At another site, P-CP 14, identified at the confluence of two first-order gullies, about 200m south of the intersection of Elizabeth Drive and Wallgrove Road, four artefacts were seen in three locations along discontinuous erosion scars totalling about 100 metres long by 1-5 metres wide with visibility overall of about 60-80%. About

230 metres north-east of the Elizabeth Drive - Wallgrove Road roundabout isolated find IF10, a red silcrete core-tool, 6-7cm in size and with evidence of heat treatment, was identified. A small bipolar core of heat treated silcrete, IF11, was found on the end of the dam wall 420 metres north-east of Elizabeth Drive and three metres east of the Wallgrove Road reserve fenceline.

Mills [1996] recorded an open site with about eight artefacts, and associated areas of PAD, and a scarred tree, during her survey of an early alignment option of the Western Sydney Orbital north of Elizabeth Drive and west of Wallgrove Road.

Prior to the WSO project a number of other surveys had been carried out in the nearby area. Navin and Dallas [1991] surveyed a 1.55km² area bounded on the east by Cowpasture Road and on the north by Elizabeth Drive, where the Cecil Hills subdivision is now located. Their study area comprised two major topographic units, ridgeline spurs and saddles to the north and west, and undulating plains to the south. One open campsite, CP1, comprising five artefacts, was identified on the banks of a small stream flowing through an erosion channel. The site was severely eroded and considered to be of low significance; application for consent to destroy the site was recommended.

In 1995 the Daruk [now Deerubbin] Local Aboriginal Land Council surveyed an area between Elizabeth Drive and Wallgrove Road for the proposed Olympic mountain bike facility / Fairfield City Farm. Site FCF1 with 17 artefacts was found on a first-order tributary of Hinchinbrook Creek [NPWS site record for 45-5-2354].

The upper slopes and ridge of the Hinchinbrook/Kemps Creek watershed, through which the Sydney water supply channel passes, and which extend north to Elizabeth Drive, were subject to spot checks in the late 1970s along the route of the natural gas pipeline west of the ridge. More recent archaeological survey was carried out for the Olympic shooting venue [Navin 1997, 1998]. Three low-density sites and eight isolated finds were found on hill tops and slopes, as well as along drainage lines. Navin emphasised the disturbed nature of the landscape and considered it unlikely that *in situ* cultural materials occurred in her survey area [Navin 1997:12].

3.4 Potential Archaeological Constraints

Certain conclusions can be drawn from what is already known of the archaeology of the area.

While Aboriginal occupation sites are most likely to occur on flat locations in elevated areas above creeks and creek junctions, they could be found on any landform - major creek, minor creek, slope or ridge. More complex sites could be expected in the vicinity of major creeks and creek junctions. Temporary and minor gullies are more likely to have low density sites representing one-off or occasionally repeated Aboriginal visits in pre-European times.

Ground visibility is likely to be limited, and cultural material identifiable by surface survey may represent only a small part of what is likely to be present. Subsurface testing may be required at locations considered likely to be occupation sites but

where there is poor surface visibility. Most of the likely locations so tested will be found to contain cultural material even if none is visible on the surface.

The extent to which Aboriginal archaeology represents a constraint will be greatly influenced by the degree of ground disturbance resulting from previous land use practices. Disturbed areas will potentially represent less of a constraint than undisturbed areas.

Within the Elizabeth Drive corridor sparsely distributed stone artefacts could be expected to occur on the slope and also on flat areas adjacent to Hinchinbrook Creek. Because of the degree of disturbance which has already occurred along the corridor, as outlined in Section 2.5 above, any artefacts present are unlikely to be *in situ*.

4 ABORIGINAL INVOLVEMENT

It is the policy of the NSW National Parks & Wildlife Service and of the Australian Association of Consulting Archaeologists that local Aboriginal community representatives participate in archaeological work and are involved in management decisions affecting archaeological sites in their area.

Elizabeth Drive forms the boundary between the Gandangara Local Aboriginal Land Council to the south and the Deerubbin Local Aboriginal Land Council to the north. In addition, the Daruk Tribal Aboriginal Corporation has an interest in the area. Prior to the commencement of fieldwork contact was made with Mr Fred Malone of the Gandangara LALC, Kevin Cavanagh of the Deerubbin LALC and Colin Gale of the DTAC. Details of the project and a map were faxed to all three.

In the field Peter Gale represented the DTAC and Steve Randall the Deerubbin LALC. It was not possible to arrange field inspection with the Gandangara LALC within the available time. The RTA therefore determined that this would be undertaken by the RTA Aboriginal Liaison Officer at a later stage.

Reports regarding the Aboriginal significance of the cultural remains identified were commissioned from the two stakeholder groups whose representatives inspected the road corridor [Appendix A]. The statement from the Derrubbin Local Aboriginal Land Council is to be sent direct to the RTA.

5 FIELD SURVEY

5.1 Background Review

As indicated in Section 3, prior to the field investigations a range of archaeological documents and survey reports relevant to the study area had been examined. The known archaeological context provided a basis for the assessment of sites located by the survey and determination of appropriate management procedures. Site types and locations are often seen as being closely linked to environmental factors such as water, stone, animal and plant resources and climate and topography. Environmental data and information on the known archaeological resource within the study area and over the wider region were used to predict site type and location. Aerial photographs were used to determine areas likely to have been disturbed.

5.2 Survey Methodology

Prior to the field survey reports on previous studies conducted in the area were checked, and information obtained from the NSW National Parks and Wildlife Service [NPWS] regarding sites previously recorded in the vicinity. There was no indication that any sites had previously been recorded within the subject section of road corridor.

Site inspections were carried out on June 17th and 20th, 2002. Both days were clear and sunny, and visibility was good.

The Cecil Park U8245 1:10,000 orthophotomap was used in the field together with the Liverpool 9030-II-S 1:25,000 map.

Both sides of the road corridor were traversed on foot. All ground exposures were searched. Ground surfaces were assessed for unevenness and the presence of shale and exotic materials near the surface noted as indicative of disturbance resulting from past land use practices. Estimates of ground visibility from which survey efficiency can be deduced are outlined in Section 2.6.

5.3 Results

Artefacts were found along the southern side of Elizabeth Drive corridor, over a distance of about 100 metres. Artefact details were recorded on NPWS site forms [Appendix B]. Locations were recorded with a Magellan 315 GPS and by reference to the Liverpool 1:25,000 map. Figure 2 indicates the area over which the artefacts were distributed.

HC/ED1 Open Site

Map Ref: Liverpool 1:25,000 30087 624886 [AGD 1966]

Location: On the southern side of Elizabeth Drive, four to nine metres from the road, 550-650 metres south east of the Western Sydney Orbital centreline.

Landform: On a spurline sloping south east towards upper tributary drainage lines of Hinchinbrook Creek, 180-280 metres from the creekline.

Description: In addition to the artefacts listed below, three fragments of red silcrete [<50mm] were found.

1. Grey chert core fragment, maximum dimension 37mm
2. Grey silcrete, fine grained, fragment of a core, maximum dimension 24mm
3. Red silcrete flaked piece, maximum dimension 18mm
4. Grey silcrete fragment, possibly part of a broken flake, 15mm.
5. Quartz bipolar flake, maximum dimension 15mm.

Maximum exposure on the slope where the artefacts were found was 60-85%, and exposure extended beyond the artefacts. The minimum distance between artefacts was three metres, but it is unlikely that they were *in situ*, such has been the disturbance in the area. The southern side of the road corridor in this area has been bulldozed and cleared of all but a few large trees. In some areas there is a veneer of A unit, but this may be redeposited, and elsewhere underlying clay is exposed. Pipe and brick fragments are present, as well as road gravel. The area is therefore severely disturbed and any further investigation of the site is unwarranted.

The Prestons to Cecil Park archaeological component of the WSO EIS [Brayshaw and White 1999] found silcrete to be the predominant raw material [80%] at open sites, followed by indurated mudstone/chert [10%] and quartz [9%]. Most of the assemblage consisted of debitage [83%], with cores and tools making up a minority component [17%]. The recorded artefacts were small, with most being in the 1-2cm size range; the few complete artefacts tended to be only slightly larger with most still being 1-3cm in size. Nearly half of the quartz artefacts were bipolar, and bipolar flaking was more frequent in the Cecil Park area than in the southern part of the route. The use of silcrete was more frequent in the south. Artefact numbers on elevated land in the vicinity of Elizabeth Drive were generally low, 4 - 11 on sites, and there were several isolated finds.

Site HC/ED1 is consistent with findings of that project in the low number of artefacts, the raw materials and artefact types present, and the disturbed condition of the location.

6 HISTORIC HERITAGE

6.1 Background

The subject section of Elizabeth Drive is within the former boundary of the Cecil Hills Farm grant. This grant was made in 1817 and taken up in 1818 by Judge Advocate John Wylde. The family ran cattle on the property and sold beef to the government stores.

6.2 Methodology

The Heritage Office and Register of the National Estate databases were searched for items in the vicinity of the section of Elizabeth Drive. Relevant aerial photographs and historic plans in *Modifications Report, Non-indigenous Heritage, Western Sydney Orbital* [Casey & Lowe, 2001] were reviewed. The roadway was inspected on foot by Tony Lowe, with particular attention being paid to the southern side of the road reserve and the locations of culverts on the northern side of the roadway. These procedures were reviewed by Mary Casey of Casey & Lowe.

6.3 Results

The register search showed two items in the vicinity of the proposed works. The Cecil Hills Farm group (LEP #0252) is to the south of Elizabeth Drive. Another site containing 'relics of early homestead and exotic vegetation' in Abbotsbury is to the north of Elizabeth Drive. Neither of these sites will be affected by the proposed road widening.

The 1947 aerial photograph, contained in the report referenced above, does not show any structures within or adjacent to the existing road reserve.

No historic structural remains or artefacts were sighted.

7 CONSTRAINTS - ABORIGINAL HERITAGE

Management of Aboriginal sites is carried out within a legislative framework and management policy is based upon the assessed or potential significance of the sites.

7.1 Legislative Constraints

Development in New South Wales is regulated by state legislation some of which plays a direct and specific role in managing Aboriginal heritage, and there is also some Commonwealth Government legislation of relevance.

The state legislation of most direct relevance is the *National Parks & Wildlife Act 1974* [as amended]. Under section 90[1] this act provides, inter alia, a person is guilty of an offence if they, without the written consent of the Director, knowingly damage, deface or destroy an Aboriginal relic or place. Any person aware of the location of a relic is required to report its existence to the Director. Relics may be portable [ie stone artefacts] or fixed ie rock art sites, archaeological deposits in shelters or in the open and grinding grooves [occurring on sandstone outcrops]. Most Aboriginal sites are real property and thus belong to whoever owns the land on which they occur. They may not, however, be disturbed or destroyed.

If sites, PADs or other areas of site potential are identified some form of sub-surface testing will be recommended unless the sites/material is very disturbed and/or insignificant. It is necessary to obtain a *Preliminary Research Permit* [PRP] from the National Parks & Wildlife Service before this testing can be carried out. If testing confirms a negative surface survey finding then there is no archaeological constraint upon proposed development. If testing detects sites then these and any previously identified sites will be subject to determination as to whether they will be impacted by the proposed development. If impact is likely then *Consent to Destroy* must be sought from the National Parks & Wildlife Service. PRP and Consent applications must be accompanied by supportive documentation from relevant Aboriginal community organisations. In the case of Consent to Destroy appropriate salvage may be required. For open sites judged to be of low significance this might simply take the form of collection of visible artefacts, in other cases salvage would be in the form of an archaeological excavation and analysis of excavation results.

The provisions of the National Parks & Wildlife Act enables the Minister to acquire land containing significant relics: these may be dedicated as Aboriginal Areas or Historic Sites. The NPWS may also enter into Conservation Agreements with landowners for the protection of relics and/or, with the consent of owners, may declare particular places to be Protected Aboriginal Areas while remaining in private ownership. Where a site exists which is, in the opinion of the Minister, significant to Aboriginal people but is unmarked by the existence of physical relics, the Minister may declare the area an Aboriginal Place, thus conferring on it the same protection as a relic.

Under the terms of the Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*, the Minister of Aboriginal Affairs may, upon application by Aborigines, intervene to protect objects deemed to be of traditional significance to Aborigines and which are under threat.

The *Heritage Commission Act 1975* establishes the Australian Heritage Commission which maintains a Register of the National Estate. The Register includes many Aboriginal sites which are covered by provisions of relevant state legislation. The Commission offers advice on the conservation of listed sites. The Act constrains Federal Ministers in relation to matters which might affect sites.

The *Native Title Act 1983* [as amended] focuses on continuity of links with an area [Butt 1993]. Where this can be demonstrated Aborigines of local derivation and ancestry will have a case for making claims for land interests arising from it.

7.2 Significance of Sites

The assessed Aboriginal, scientific and public significance of sites identified provide the basis for their management [Sullivan & Bowdler 1984].

Scientific or archaeological significance relates to the potential of a site to answer timely and future research questions, and is based on condition/integrity, structure, content and representativeness, the latter being partially defined by its rarity or commonness. Rock shelter sites have considerable potential to provide information about early occupation of the area because their deposits are stable and can preserve cultural and organic materials for long periods of time in chronologically stratified and datable contexts. Open sites have the potential to provide complementary material allowing study of a fuller range of cultural elements. However, the scientific significance of all sites identified along the route corridor has been reduced by disturbance.

Site HC/ED1 has been considerably disturbed by past land use, and it appears to consist of only a few artefacts which would be able to contribute little new archaeological information. Its scientific significance is therefore assessed as low.

Aboriginal significance involves the cultural and archaeological elements which form links with the past for Aboriginal groups. These elements may or may not accord with interpretations made by archaeologists and must be assessed by the Aboriginal people themselves. In this case assessment was provided by the Gandangara and Deerubbin Local Land Aboriginal Councils and the Darug Aboriginal Tribal Corporation [see Section 4 and Appendix A].

8 MANAGEMENT RECOMMENDATIONS

8.1 Aboriginal Heritage

These recommendations are made on the basis of:

- the *National Parks & Wildlife Act of 1974* [as amended], whereby it is illegal to damage, deface or destroy an Aboriginal relic without written permission of the Director;
- a comprehensive survey of those areas which might be affected by the development proposal;
- consultation with the Darug Aboriginal Tribal Corporation and with the Deerubbin Local Aboriginal Land Council;; and
- the nature of the proposed development.

The recommendations are based on the assessed archaeological significance of the study area. This assessment does not pre-empt any Aboriginal value attributed to the area.

It is recommended that:

1. The RTA Aboriginal Liaison Officer should contact the Gandangara Local Aboriginal Land Council and arrange a site visit.
2. Application should be sought for Consent to Destroy site HC/ED1 without further archaeological work being required.
3. In accordance with a policy of many years' duration, the Aboriginal stakeholder groups may have an interest in monitoring certain ground surface disturbance during construction within the Elizabeth Drive road corridor. The purpose of the monitoring would be to retrieve any artefacts exposed during this process.
4. Arrangements should be made with these groups for representatives to be present at the appropriate time should they wish it.
5. If any Aboriginal cultural relics are uncovered during the course of development, the Aboriginal stakeholder groups and the National Parks & Wildlife Service should be notified immediately.
6. A copy of this report should be forwarded to each of the following:

Mr Colin Gale
Darug Tribal Aboriginal Corporation
PO Box 441
Blacktown 2148.

Mr Frank Vincent
Chairperson
Deerubbin Local Aboriginal Land Council
PO Box V184, Mt Druitt Village, NSW, 2770.

The Secretary
Gandangara Local Aboriginal Land Council
Shop 2, 103 Moore St
LIVERPOOL 2170.

7. Two copies of this report should be forwarded to

The Acting Site Registrar
Aboriginal Heritage Unit
National Parks and Wildlife Service
PO Box 1967, Hurstville, NSW, 2220.

8.2 European Heritage

No items of historic heritage were identified along the length of Elizabeth Drive defined above. Therefore the proposed works should not impact on any items of heritage significance.

No further action is recommended.

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FIGURES

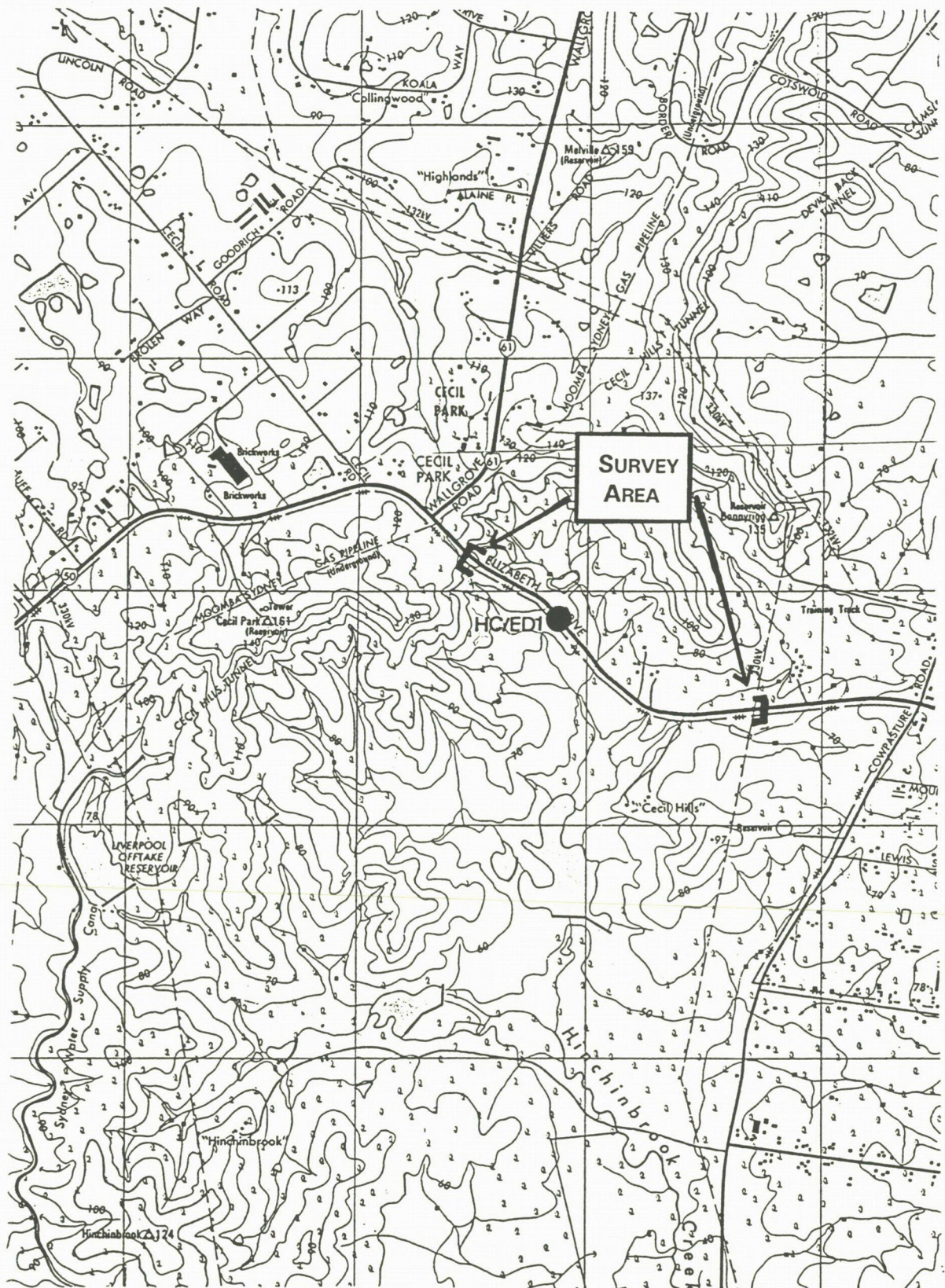


Figure 1: Location Map

Prospect/Liverpool 1:25,000

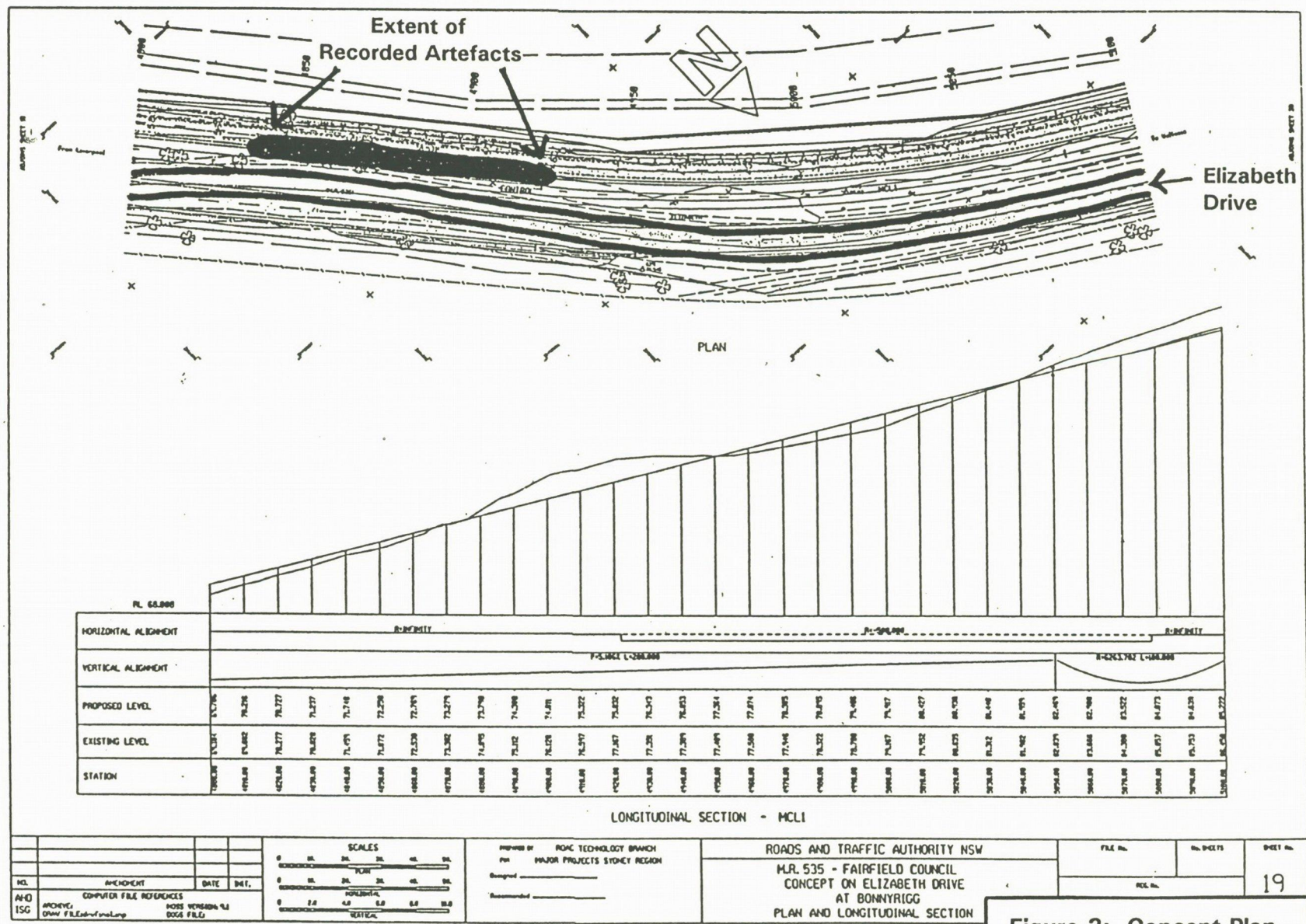


Figure 2: Concept Plan Showing Location of Site HC/ED1

PLATES



Plate 1: Site HC/ED1, southern side of Elizabeth Drive, camera facing north west. Artefacts were found on the rise and as far as the smallish tree centre background.



Plate 2: One of the artefacts identified at Site HC/ED1.

APPENDIX A
ABORIGINAL COMMUNITY STATEMENT

DARUG TRIBAL ABORIGINAL CORPORATION
[Incorporating Darug Link Associating Inc.]
P.O BOX 441
BLACKTOWN
2148
ABN -GST no. 77 184 151 969

20-6-02
Helen Brayshaw
51 Thompson St.
Drummoyne 2047

Re; Aboriginal Cultural Heritage Assessment Elizabeth Dr. near Wallgrove Rd.

Peter Gale attended with you on Monday 17th June 02 and reported the following , both sides of the road highly disturbed along the entire length of the designated survey . Found a total of 4 pieces of Silcrete , 2 of which are artifacts , on the western side of the road, but due to the disturbed area that they were found in , would recommend consent to destroy .

Yours Sincerely
Colin Gale
Chairman



APPENDIX B
NPWS SITE FORM



Aboriginal Sites Register of NSW

NPWS, PO Box 1967, Hurstville NSW 2220

Standard Site Recording Form

New Recording ☒ Additional

information ☐

SITE IDENTIFICATION

Site name	HC/ED1	NPWS Site Number	
Owner/manager	RTA		
Owner Address	81 Fluscombe Road, Blacktown 2148		
LOCATION			
Location	Cecil Hills.		
How to get to the site	Turn east from Wallgrove Road, site is on the southern side of Elizabeth Drive, four to nine metres from the road, 550-600 metres south east of the Western Sydney Orbital centreline.		
1:250,000 map name	Sydney	NPWS map code	45
AMG Zone	56	AMG Easting	300870
		AMG Northing	6248860
Method for grid reference	Hand-held GPS	Map scale (if method = map)	1:25,000
		Map name	Liverpool
NPWS District Name (see map)		NPWS Zone (see map)	Sydney Zone
Portion no.		Parish	

SITE DESCRIPTION

Site type(s)	Open site	Site type code (NPWS use only)	
Description of site and contents CHECKLIST: eg. length, width, depth, height of site, shelter, deposit, structure, element eg. tree scar, grooves in rock. DEPOSIT: colour, texture, estimated depth, stratigraphy, contents-shell, bone, stone, charcoal, density & distribution of these, stone types, artefact types ART: area of decorated surface, motifs, colours, wet/dry pigment, engraving technique, no. of figures, sizes, patination. BURIALS: number & condition of bone, position, age, sex, associated artefacts TREES: number, alive, dead, likely age, scar shape, position, size, patterns, axe marks, regrowth. QUARRIES: rock type, debris, recognisable artefacts, percentage quarried	<p>Landform: On a spurline sloping south east towards upper tributary drainage lines of Hinchinbrook Creek, 180-280 metres from the creekline.</p> <p>Description: In addition to the artefacts three fragments of red silcrete [$<50\text{mm}$] were found.</p> <ol style="list-style-type: none">1. Grey chert core fragment, maximum dimension 37mm2. Grey silcrete, fine grained, fragment of a core, maximum dimension 24mm3. Red silcrete flaked piece, maximum dimension 18mm4. Grey silcrete fragment, possibly part of a broken flake, 15mm.5. Quartz bipolar flake, maximum dimension 15mm. <p>Maximum exposure on the slope where the artefacts were found was 60-85%, and exposure extended beyond the artefacts. The minimum distance between artefacts was three metres, but it is unlikely that they were in situ, such has been the disturbance in the area. The southern side of the road corridor in this area has been bulldozed and cleared of all but a few large trees. In some areas there is a veneer of A unit, but this may be redeposited, and elsewhere underlying clay is exposed. Pipe and brick fragments are present, as well as road gravel.</p> <p>Attach photographs and sketches, eg. plan & section of shelter. Do NOT dig, disturb or damage site or contents.</p>		



Aboriginal Sites Register of NSW

NPWS, PO Box 1967, Hurstville NSW 2220

Standard Site Recording Form

SITE ENVIRONMENT					
Land form	crest/spur	Aspect	east	Slope	
Mark position of the site					
Local rock type	Wianamatta shale	Land use/effect	Disturbed road corridor		
Distance from drinking water	180m	Source	Hinchinbrook Creek tributary		
Resource zone (eg. estuarine, river, forest)	Cumberland Plain Woodland	Vegetation	Eucalypts, privet, grass		
Edible plants		Faunal resources (include shellfish)			
Other exploitable resources (eg. ochre)					
Are there other sites in the locality	Yes	Are they in the Sites Register	Yes	Other site types include	open sites
SITE MANAGEMENT					
Site condition	Very disturbed				
Management recommendations	Consent to Destroy without further investigation				
Have artefacts been removed from site	No	When			
By whom		Deposited at			
Consent applied for	<input type="checkbox"/>	Consent issued	<input type="checkbox"/>		
Date of issue		Consent number			
SITE INSPECTION AND RECORDING					
Reason for investigation	REF				
Were local Aborigines contacted or present for the recording	<input type="checkbox"/> Not contacted <input checked="" type="checkbox"/> Contacted and present <input checked="" type="checkbox"/> Contacted but not present	Names and addresses	Peter Gale Darug Tribal Aboriginal Corporation PO Box 441 Blacktown 2148 Fred Malone Gandangara Local Aboriginal Land Council Shop 2, 103 Moore St LIVERPOOL 2170.		
Is the site important to local Aborigines	Yes, but Consent to Destroy not opposed				
Verbal/written reference sources	Elizabeth Drive Addendum REF Western Sydney Orbital to Windsor Road Cecil Hills Heritage Assessment Helen Brayshaw June 2002		ASR report number(s) (or title)	C- C-	
Photographs taken	Yes		No. of Photos attached	See report	
Site recorded by	Helen Brayshaw		Date of recording	17 June, 2002	
Address/institution	51 Thompson St Drummoyne 2047				

5465



www.rta.nsw.gov.au

**Addendum REF for the Proposed
reconstruction and widening of Elizabeth
Drive (Windsor Road to Wallgrove Road)
MR 535 – Elizabeth Drive
Cecil Hills
Liverpool Council, Fairfield Council**

REVIEW OF ENVIRONMENTAL FACTORS

DECISION REPORT

REF DECISION REPORT Sydney REGION

Addendum REF for Proposed Reconstruction and Widening of Elizabeth Drive (Windsor Road to Wallgrove Road) MR 535 – Elizabeth Drive, Cecil Hills Liverpool Council and Fairfield Council

INTRODUCTION

An Addendum Review of Environmental Factors (REF) has been prepared to assess the potential environmental impacts of the Proposal as described below. The REF has been prepared by Macoun Environmental Consulting and forwarded for assessment by Project Management Services. This Decision Report has been prepared to consider the REF in relation to requirements under the NSW *Environmental Planning and Assessment Act 1979* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The objectives of this Decision Report are to:

- Assess the likely environmental impacts detailed in the REF,
- Determine the significance of those impacts,
- Propose conditions of approval to apply should the Proposal proceed, and
- Address the position under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

PROJECT DESCRIPTION

Elizabeth Drive has been subject to an upgrade program between Cabramatta Road and Cowpasture Road. Between 1996 and 2000 this upgrade program included the construction of two lanes in each direction with facilities for pedestrians and cyclists and the upgrade of major intersections. Works also included the landscaping of the median and roadside verge and installation of noise attenuation walls along critical sections of the road. These works were subject to an REF prepared in 1996.

The Proposal outlined in the Addendum REF is the upgrade of a section of Elizabeth Drive between the existing roundabout intersections with Windsor Road and Wallgrove Road. The works involve reconstruction and widening from an existing two lane undivided road to a four lane divided road (two carriageways each of two through lanes plus turn bays) for a distance of 1700m. It should be noted that the western end of this work is the interchange between the Western Sydney Orbital and Elizabeth Drive. This Proposal consists of a number of modifications to the original REF. These have been summarised in "Modifications to the Proposal".

The objectives of the Proposal are to:

- Improve environmental amenity for the local community by reducing congestion and other impacts associated with high volumes of traffic in urban areas
- Improve through and local access for road users
- Improve pedestrian and bicycle safety for the local community
- Reduce potential accidents, traffic congestion, travel times and operation costs
- Improve public transport facilities for bus service providers and passengers

JUSTIFICATION OF THE PROPOSAL

Elizabeth Drive has been upgraded over time as traffic demand has warranted. The proposed works are necessary to provide a satisfactory level of service and safety to road users by reconstructing and widening the section of road between the existing intersections with Windsor Road and Wallgrove Road. The Proposal is required to provide an east-west link to connect Liverpool and Fairfield with the Western Sydney Orbital (WSO).

The modifications detailed in the Addendum REF are due to changes in local requirements since 1996. These include the decision not to proceed with the Sydney West Airport, the decision not to provide an additional entrance into the Western Sydney Regional Park, and other minor changes that have come through the modification of design standards over time.

CONSIDERATION OF REVIEW OF ENVIRONMENTAL FACTORS

The Addendum REF has been examined and considered. The REF addresses the requirements of Section 111 of the *Environmental Planning and Assessment Act, 1979*.

In considering the activity this assessment has examined and taken into account, all matters affecting or likely to affect the environment by reason of that activity as addressed in the Addendum REF and associated information. This assessment was considered in accordance with the Department of Planning's best practice guideline *Is an EIS Required*.

This assessment has considered the potential impacts of the activity on critical habitat and on threatened species, populations or ecological communities or their habitats for both terrestrial and aquatic species.

As part of the consideration of the activity this assessment has also addressed matters of National Environmental Significance (NES matters) and any impacts on Commonwealth land. In relation to NES matters, this evaluation has been undertaken in accordance with Government Administrative Guidelines on determining whether an action has, will have, or is likely to have a significant impact.

COMMUNITY CONSULTATION and CONSIDERATION OF REPRESENTATIONS

An extensive community consultation program was undertaken for the preparation of the 1996 REF. A total of 235 individual submissions were received and a number of changes to the design were made as a result of the feedback.

The concept design for the Proposal has not substantially changed from the 1996 REF, therefore no additional community consultation was undertaken for the Supplementary REF.

ADDITIONAL STUDIES AND NEW INFORMATION

Six specialist reports were carried out for the original REF, these included:

- MR 515 – Elizabeth Drive Upgrade Strategic Route Analysis (RTA, 25 October 1995)
- Traffic Reports (various) (RTA and Rust PPK)
- Elizabeth Drive Economic Appraisal (SKM, January 1996)
- Flora and Fauna Assessment (LesryK, January 1996)
- Landscape Assessment and Concept Elizabeth Drive: Bonnyrigg to Wallgrove Road, Cecil Hills (RTA, undated)
- Noise Assessment (Koikas Pty Ltd, 30 October 1995; 20 Nov 1995)

Three specialist reports were undertaken for this Addendum REF including:

- (i) Traffic Noise Assessment of Elizabeth Drive Between Windsor Road and Wallgrove Road Cecil Hills (Koikas Acoustics Pty Ltd, June 2002)

Key conclusions arising from this study that had a bearing on this section of the Proposal were:

- It was recommended that noise mitigation measures be evaluated for the ten properties that are predicted to be exposed to high noise levels.
- Further noise impact assessment studies are recommended to assess locations where additional noise attenuation is required.

- (ii) Flora and Fauna Assessment (Lesryk Environmental Consultants, June 2002)

Key conclusions arising from this study that had a bearing on this section of the Proposal were:

- No plants of national or State conservation significance listed as a rare or threatened Australian plant or on the Schedules of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1995* were located with the proposed road works area.
- No species currently being considered for listing under either State or Commonwealth legislation were identified within the proposed roadworks area.
- The Cumberland Plain Woodland vegetation community is located along the proposed roadworks area. This community is listed under the *Threatened Species Conservation Act, 1995* as an endangered ecological community. An eight part test was carried out to determine whether the proposed works would have a significant impact on the woodland community. This Proposal is not expected to have a significant impact on any species, populations or ecological communities listed on the *Threatened Species Conservation Act*.
- No threatened animals or their habitats were recorded within the study area, and it is therefore not considered that the works would have a significant impact on any threatened species or their habitats.

- (iii) Heritage Assessment (Helen Brayshaw Heritage Consultants Pty Ltd and Casey & Lowe Associates, June 2002)

- Artefacts were found along the southern side of the Elizabeth Drive road reservation, which appeared to have been considerably disturbed. It was recommended that an application be sought for Consent to Destroy for the site, without further investigations being required.
- The proposed works would not impact on any items of non-indigenous heritage significance.

MODIFICATIONS TO THE PROPOSAL

A number of modifications have been made to the original proposal detailed in the REF for *Proposed Upgrading of Elizabeth Drive between Cabramatta Road, Bonnyrigg and Wallgrove Road, Cecil Park*. The changes include:

- Median width reduced to 6m, and be a raised median in lieu of a depressed median.
- A combined pedestrian path/off-road cycleway on the southern side of the corridor. The path would be 4 metres wide and would have a concrete surface. It would connect with the proposed off-road cycleway on Cowpasture Road and the WSO Motorway.

- Deletion of an entrance/exit to the Western Sydney Regional Park at the Windsor Road roundabout

The WSO design is yet to be finalised. Once the WSO design has been finalised, the design of this proposal can be finalised.

CONCLUSION

The activity described in the Addendum REF for the proposed upgrading of Elizabeth Drive (Windsor Road to Wallgrove Road) will have some environmental impacts, which can be ameliorated satisfactorily. Having regard to the safeguard measures proposed and to the Conditions of Approval set out below, this assessment has considered that these impacts are unlikely to be significant and therefore an Environmental Impact Statement is not required.

The activity described in the Addendum REF for the proposed upgrading of Elizabeth Drive (Windsor Road to Wallgrove Road) will not affect declared critical habitat. The activity described in the Addendum REF will not significantly affect threatened species, populations or ecological communities or their habitats. Therefore a Species Impact Statement is not required.

The activity described in the Addendum REF will not affect Commonwealth land. It will have no impact on matters of National Environmental Significance.

CONDITIONS OF APPROVAL

The activities described in the Addendum REF for the upgrade of Elizabeth Drive are a component of the WSO and therefore would be subject to the following:

- Department of Planning's Conditions of Approval;
- Contract specifications;
- Community involvement plan/s;
- Environmental management plan/s and related documents; and
- Audits and inspections undertaken by the contractor, RTA and the independent environmental management representative.

SECTION A - DETAILED DESIGN

1. Environmental Impact Assessment

- 1.1 Ancillary infrastructure such as compound sites, stockpiles and sedimentation basins have not been assessed in the initial REF, Addendum REF or in the WSO EIS and Representations Report. Additional environmental impact assessment shall be undertaken for the location and establishment of any proposed permanent or temporary ancillary infrastructure in the area and would be subject to the Department of Planning's Conditions of Approval for the WSO.

2. Design and Contract Specification Issues

- 2.1 All Conditions of Approval within this Decision Report, safeguard measures from the REF and any additional mitigation measures required to meet appropriate environmental legislation shall be incorporated within the detailed design, the contract specifications for the Proposal and the Contractor EMP.
- 2.2 A Detailed Design Report shall be prepared for the Proposal prior to construction and forwarded to the RTA Environmental Adviser, David Ledlin. This shall include further details of the proposed design once they are available.

- 2.3 Any changes to the concept design as included in the REF shall not be undertaken without additional environmental assessment.

SECTION B - CONSTRUCTION STAGE

3. REF Safeguard Measures

- 3.1 All safeguard measures stated in the initial REF and Addendum shall be applied to the Proposal. These Conditions of Approval prevail where there is any inconsistency with the safeguard measures.

4. Notification

- 4.1 The RTA Project Manager shall notify the nominated RTA Environmental Adviser (David Ledlin) or the WSO RTA Environmental Representative, Ian Burke, prior to work commencing.

5. Compound and Stockpile sites

- 5.1 Prior to the establishment of a compound or stockpile site, consultation is to be undertaken with the nominated Environmental Adviser (David Ledlin).

6. Erosion and Sediment Control

- 6.1 Prior to the commencement of work, an Erosion and Sedimentation Control Plan is to be attached to the CEMP and provided to the nominated Environmental Adviser (David Ledlin). The plan shall include control measures to be maintained and inspected regularly, particularly after storm or rain events to ensure that they are structurally and functionally sound.

7. Construction and Operational Noise and Vibration

- 7.1 Construction work shall be restricted to normal working hours (7am to 6pm Monday to Friday and 8am to 1pm on Saturdays).
- 7.2 Construction works that are to be outside normal working hours should conform to the RTA's Consultation Procedure for Road Works Undertaken Outside Normal Working Hours guidelines and RTA's Environmental Noise Management Manual.
- 7.3 The contractor as part of the CEMP shall prepare a Noise and Vibration Management Plan (NVMP). The Plan shall address monitoring and mitigation measures to reduce the impact of noise and vibration from construction works.
- 7.4 Noise and vibration levels are to be monitored on a regular basis during the construction phase. Where noise levels exceed EPA guideline levels, appropriate and practical action is to be implemented to minimise noise impacts.
- 7.5 Noise attenuation, at locations specified in the REF, is to be implemented in accordance with Practice Note IV of the RTA Environmental Noise Management Manual.

8. Vegetation Management

- 8.1 The boundaries of vegetation clearing are to be clearly identified by the Contractor and marked in the field prior to the commencement of works. All personnel taking part in construction activities shall be instructed and made aware of clearing limits and areas of vegetation to be retained including individual trees.
- 8.2 Prior to any development remaining trees are to be identified and clearly marked and labelled on the Contractor's EMP. Protective fencing with a radius of 2-3 metres is to be erected around remaining trees to prevent physical damage to the trunk of the trees and to root zone areas.

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8.3 An inspection of mitigation measures to assess their adequacy is to be undertaken prior to the clearing works.

9. Aboriginal Heritage

9.1 A Consent to Destroy permit shall be sought from National Parks and Wildlife Services for the site identified in the REF as HC/ED1.

RECOMMENDATION

It is recommended that the works detailed in the Proposed Upgrading of Elizabeth Drive (Windsor Road to Wallgrove Road) Addendum REF proceed subject to implementation of all environmental safeguard measures identified in the Addendum REF and Decision Report, and the above Conditions of Approval.

The REF approval shall remain current for five years from the date of approval, at which time it shall lapse if construction works have not begun.

Approval recommended by:


Geoff Cahill
Manager, Environmental Services
Date

21/10/02

Approved by:


Garry Humphrey
General Manager, Motorway Services Branch
Date

21/10/02