

PROPOSED WESTERN SYDNEY ORBITAL

VOLUME 2

Director-General's Report

*Section 115C of the
Environmental Planning and Assessment Act 1979*

February 2002

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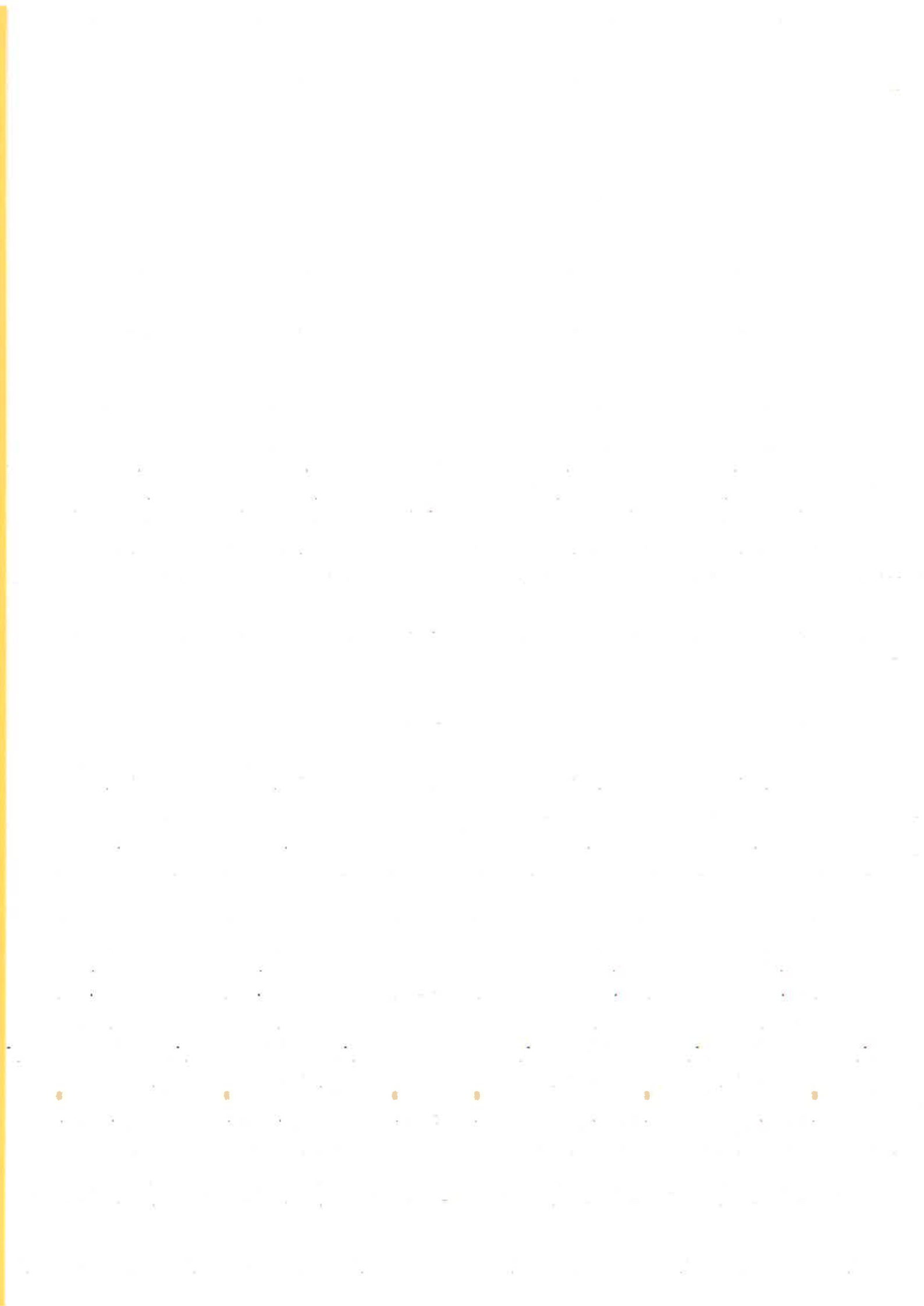
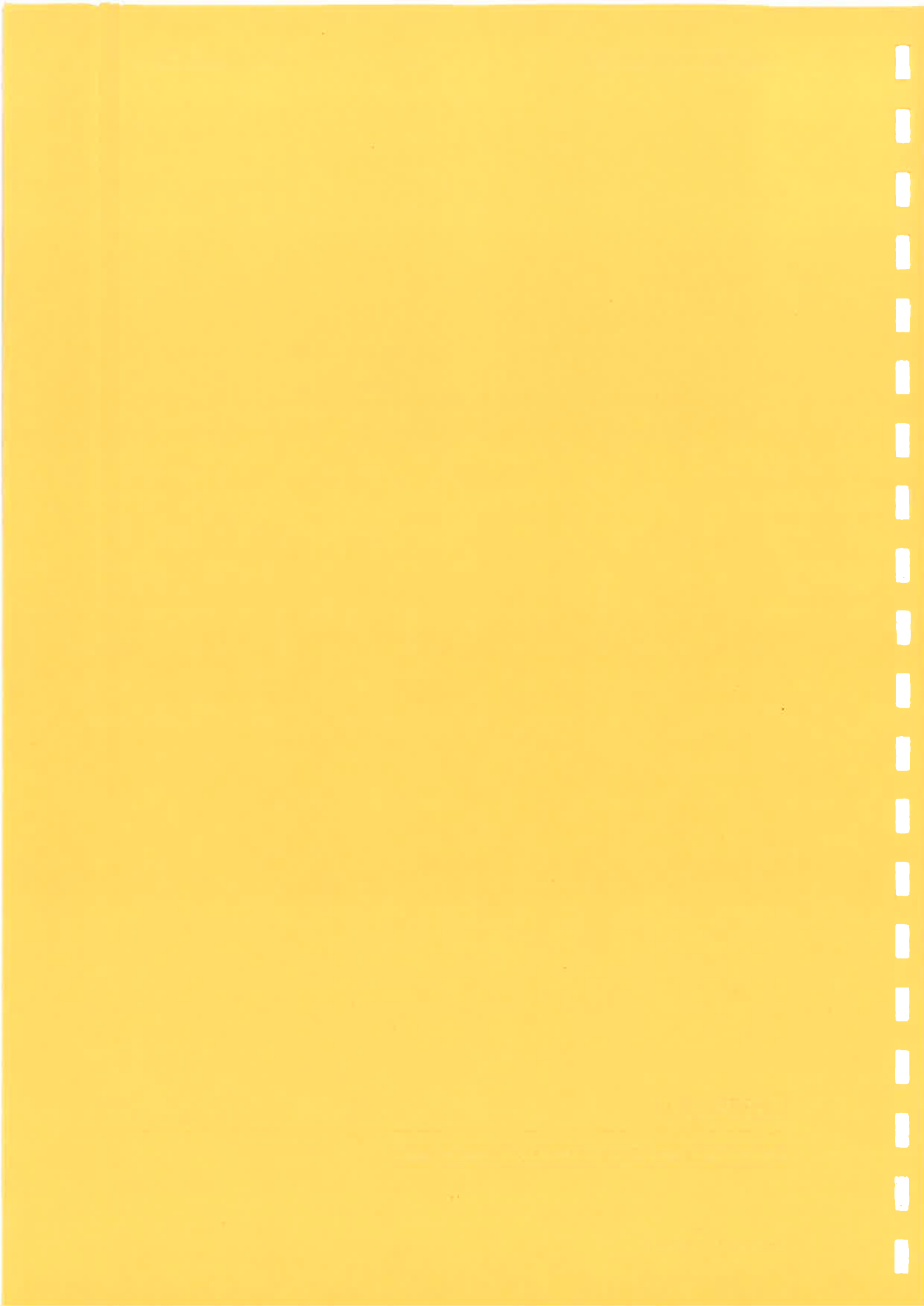
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APPENDIX A

National Parks and Wildlife Service's Concurrence Report





NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

ABN 30 841 387 271

Mr P Forward
Chief Executive
Roads and Traffic Authority of NSW
PO Box K198
HAYMARKET NSW 2000

Our Refs: C2001/2303 & CPPD/rlg/98/331

Att: Mr Malcolm Cross

Dear Mr Forward

**RE: WESTERN SYDNEY ORBITAL - REQUEST FOR CONCURRENCE OF
DIRECTOR-GENERAL OF NATIONAL PARKS AND WILDLIFE**

I refer to your letter of 15 August 2001 requesting concurrence for the proposal to construct the Western Sydney Orbital.

I have considered the application in accordance with Section 112D of the Environmental Planning and Assessment Act 1979. I have decided to grant concurrence to this activity for the reasons set out in Section 8 of the attached concurrence report and subject to the conditions outlined in Section 9 of that report.

Should you have any further enquiries regarding this issue, please contact Russell Couch, Manager, Conservation Programs and Planning Division, Central Directorate, on (02) 9585 6657 or e-mail russell.couch@npws.nsw.gov.au.

Yours sincerely

Bob Conroy 14/9/01
BOB CONROY
Director Central

14/9/01 ✓

43 Bridge Street
PO Box 1967
Hurstville NSW
2220 Australia
Tel: (02) 9585 6444
Fax: (02) 9585 6555
www.npws.nsw.gov.au



EXECUTIVE SUMMARY

On 20 August 2001, the Director-General of National Parks and Wildlife received a concurrence application pursuant to Section 112C(b) of the *Environmental Planning and Assessment Amendment Act 1997* (EP&A Act). Concurrence was sought for a decision by the Roads and Traffic Authority to construct the Western Sydney Orbital

I have considered the application in accordance with Section 112D of the EP&A Act. I have decided to grant concurrence to this activity for the reasons set out in Section 8 and subject to the proposed conditions of concurrence as stated in Section 9 of this report.

Bob Conroy
Director, Central

As delegate to the Director-General

Date: 14/9/01

1 DESCRIPTION OF THE PROPOSAL AND THE ENVIRONMENT

The description of the proposal in the SIS states the proposal consists of:

- A 39km road of motorway standard, from Prestons through Cecil Park and Eastern Creek to Dean Park, then east through Quakers Hill to West Baulkham Hills;
- Four 3.5m traffic lanes, with inner sealed shoulders of 1.0m, a depressed median of at least 15.0m, paved outer shoulders of 2.5m and 1.0m drains outside these shoulders; and,
- Associated drainage works, flood mitigation works, equipment and material storage, temporary roadways and other construction activities. The locations of these were not specified in any of the available documentation, so their impact has not been assessed.

The description of the environment of the study area in the SIS states that the study area consists of:

- Four local government areas;
- Land uses ranging from rural, urban/industrial, open space corridor and predominantly urban areas;
- A generally flat to undulating topography, with some hilly terrain;
- Five soil landscapes; and,
- Small remnants of the original vegetation, many subject to clearing, grazing, herbicide, weeds, rubbish dumping and slashing.

A general overview of the conservation status of the vegetation in the study area can be obtained from two sources:

“Since European settlement of the fertile land of the Cumberland Plain, the native vegetation has been extensively cleared...to such an extent that very little of the pre-European distribution remains and many of the plant communities are now considered under threat of extinction” (NSW NPWS 2000); and,

“Approximately 950 plant taxa, comprising c. 72% of the total number recorded for [western Sydney] are considered to be vulnerable and inadequately conserved... This outstanding level of vulnerability reflects the high degree of urbanisation within the region and the inadequacy of the present reserve system” (NSW NPWS 1997)

It should be noted that the situation in the WSO study area can be considered more dire than that painted by these two studies. The study areas for NSW NPWS (1997 & 2000) included the far north west and south west of the Cumberland Plain, which are less urbanised than the WSO study area.

2 CONSIDERATION OF THE SPECIES IMPACT STATEMENT AND ASSESSMENT REPORT PREPARED BY THE RTA

Section 112D(a) of the EP&A Act requires that the Director-General consider any SIS which accompanied the development application. Section 112D(b) requires that the Director-General consider any assessment report prepared by or on behalf of the proponent. This section addresses those provisions.

Documentation provided by the RTA includes:

- An SIS, EIS and accompanying documentation were publicly exhibited from 8 January 2001 to 5 March 2001.
- A draft RTA response to issues raised by the NPWS regarding the SIS was received on 17 July 2001.
- A Representations Report was received with the concurrence application on 20 August 2001 (which included the information provided in the draft response received on 17 July).
- A facsimile from Malcom Cross, RTA Senior Project Development Manager, giving site by site areas of endangered ecological communities directly cleared by the proposal, was received on 24 August 2001. A number of minor corrections to these figures were also received during the period of the concurrence assessment. Final figures have been presented in Table 1 of this report (in the "Recalculated Impact" column).
- A report titled "Assessment of impact of the proposed WSO off-ramp at Rooty Hill Road North" – an addendum to the SIS. Received on 5 September 2001.

2.1 Species Considered by the Species Impact Statement and Representations Report

The species impact statement assessed the following threatened species and ecological communities:

- Cumberland Plain Woodland (CPW);
- Shale Sandstone Transition Forest (SSTF);
- Sydney Coastal River Flat Forest (SCRFF);
- Castlereagh Swamp Woodland (CSW);
- Western Sydney Dry Rainforest (WSDR);
- *Grevillea parviflora* ssp. *parviflora*;
- *Pultenaea parviflora*;
- *Pimelea spicata*;
- *Pultenaea pedunculata*;
- *Acacia pubescens*;
- *Dillwynia tenuifolia*;
- *Grevillea juniperina* ssp. *juniperina*; and,
- *Meridolum corneovirens*.

The Diamond Firetail (*Stagonopleura guttata*), Speckled Warbler (*Pyrrholaemus sagittata*), Hooded Robin (*Melanodryas cucullata cucullata*), Brown Treecreeper (*Climacteris picumnus victoriae*) and Black-chinned Honeyeater (eastern subspecies - *Melithreptus gularis gularis*) were given preliminary listings by the Scientific

Committee on 18 May 2001. As an assessment of the impacts on these species would be required should they receive final determinations for listing before the project is approved, it was deemed prudent by the NPWS for the RTA to carry out the assessment prior to final listing occurring.

Three additional communities (Moist Shale Woodland (MSW), Cooks River Castlereagh Ironbark Forest (CRCIF) and Shale Gravel Transition Forest (SGTF)) are understood to be under consideration of the Scientific Committee and, again, it was deemed prudent to carry out assessment prior to any listing occurring. If these assessments were not carried out, and final determinations were made before final approval, then the approval would be delayed until assessment could be completed.

Also, the Grey-headed Flying Fox (*Pteropus poliocephalus*) was given a final determination for listing in 2001 and this species was also considered in the representations report.

Finally, a number of species and ecological communities were considered in the representations report at the request of the Department of Urban Affairs and Planning:

- Barking Owl (*Ninox connivens*);
- Glossy Black-cockatoo (*Calyptorhynchus lathami*);
- *Acacia bynoeana*;
- *Allocasuarina glareicola*;
- *Amperea xiphoclada* var. *papillata*;
- *Amperea xiphoclada* var. *pedicellata*;
- *Cynanchum elegans*;
- *Epacris purpurascens*;
- *Hypsela sessiliflora*;
- *Micromyrtus minutiflora*;
- *Persoonia hirsuta* ssp. *hirsuta*;
- *Persoonia nutans*;
- *Pimelea curviflora* var. *curviflora*;
- *Pterostylis saxicola*; and
- *Thesium australe*.

2.2 Impact Assessment

2.2.1 Species and ecological communities unlikely to be significantly effected by the proposal (as assessed by the SIS or representations report)

Grevillea parviflora ssp. parviflora

The surveys conducted for the SIS did not find this species within or adjacent to the alignment of the WSO, concluding that the proposal would not have a significant effect on it. Thus these species will not be considered further in this report.

Cooks River Castlereagh Ironbark Forest; *Acacia bynoeana*; *Allocasuarina glareicola*; *Amperea xiphoclada* var. *papillata*; *Amperea xiphoclada* var. *pedicellata*; *Cynanchum elegans*; *Epacris purpurascens*; *Hypsela sessiliflora*; *Micromyrtus minutiflora*; *Persoonia hirsuta* ssp. *hirsuta*; *Persoonia nutans*; *Pimelea curviflora* var. *curviflora*; *Pterostylis saxicola*; *Thesium australe*; Diamond Firetail (*Stagonopleura guttata*); Speckled Warbler (*Pyrrholaemus sagittata*); Hooded Robin (*Melanodryas cucullata cucullata*); Brown Treecreeper (*Climacteris picumnus victoriae*); Black-chinned Honeyeater (eastern subspecies - *Melithreptus gularis gularis*); Grey-headed Flying Fox (*Pteropus poliocephalus*); Barking Owl (*Ninox connivens*); Glossy Black-cockatoo (*Calyptorhynchus lathami*)

The representations report found that the proposal would not have a significant effect on these species or the ecological community as only minor impacts might be expected or no impact at all was expected.. Thus these will not be considered further in this report.

2.2.2 Species and ecological communities likely to be significantly affected by the proposal (as assessed by the SIS or representations report)

Table 1 gives a site by site summary of the impacts of the proposal on threatened species and ecological communities. This includes the impacts calculated in the SIS, those subsequently recalculated by the RTA following alignment and design modifications and clearing occurring since the drafting of the SIS and an assessment of the likely indirect impacts of the proposal.

Species Community Site#	SIS Impact	NPWS Comment	Recalculated Impact	Indirect Impacts
<i>Meridolum corneovirens</i>				
Site 1 ¹	Entire pop'n (>25) lost	Cannot determine from information presented	No significant change	Cannot determine from information presented
Site 2	Partial loss of pop'n and habitat	Cannot determine from information presented	No significant change	Cannot determine from information presented
Site 3	Partial loss of pop'n and habitat	Cannot determine from information presented	No significant change	Cannot determine from information presented
Site 4	Partial loss of pop'n and habitat	Cannot determine from information presented	No significant change	Cannot determine from information presented
Site 5	Partial loss of pop'n and habitat	Cannot determine from information presented	No significant change	Cannot determine from information presented
Site 6	Partial loss of pop'n and habitat	Cannot determine from information presented	No significant change	Cannot determine from information presented
Site 7	Partial loss of pop'n and habitat	Cannot determine from information presented	No significant change	Cannot determine from information presented
Cumberland Plain Woodland				
Site 1	70-80% of 0.88Ha (degraded, weedy & regrowth) lost directly..	Likely to have been unviable without intervention even without impacts from proposal	0.60Ha	Remaining 0.2Ha unviable.
Site 2	20% of 1Ha (3 remnants weedy & regrowth) lost directly..	Likely to have been unviable without intervention even without impacts from proposal	0.14Ha	Remaining 3 remnants (0.85Ha total) unviable without intervention.
Site 3	50% of 7Ha (disturbed & weedy, grazing) lost directly		2.32Ha	Remaining 2 remnants (approx. 2.25Ha each) have low viability without intervention.
Site 4	30% of 3.8Ha (very weedy) lost directly		0.66Ha	
Site 5	50% of 0.72Ha (heavily degraded)	Likely to have been unviable without intervention even without impacts from proposal	0.11Ha	Remaining 0.61Ha unviable.
Site 6	Unquantified linear band (varying levels of disturbance)		0.65Ha	Possible flooding or flood mitigation impacts
Site 7	Unquantified area of regenerating woodland (heavily degraded)		0.29Ha	Possible flooding or flood mitigation impacts
Site 8	Unquantified area of degraded woodland		0.0Ha (SGTF)	N/A
Site 10	80% of 3Ha (weeds and grazing)		0.75Ha	50% (1.15Ha) of remainder isolated to E of WSO – unlikely to be viable.
Site 11	33% of 8Ha (frequent slashing, some weeds)		1.05Ha	
Site 13	90% of 1.5Ha (regularly mown)	Likely to have been unviable without intervention even without impacts from proposal	0.85Ha	Remaining 0.65Ha in two fragments, separated by WSO - unviable
Site 14	50% of 2.5Ha (good condition – 3 remnants)	1 remnant under alignment likely to have been unviable without intervention even without impacts of proposal	0.75Ha	Small fragment from unviable remnant now completely unviable

¹ Site numbering for *M. corneovirens* is not related to other site numbers

Species Community Site#	SIS Impact	NPWS Comment	Recalculated Impact	Indirect Impacts
Site 35	Unquantified proportion (~50%?) of 3.5Ha lost (variable condition)		0.91Ha	Fragment (approx 0.5Ha) to E of WSO unviable
Site 36	2.5Ha lost (some weedy – N.B. confusion about amount lost here)		0.71Ha & 0.07Ha <i>Themeda</i> grassland	Linear fragment (approx 0.5Ha) N of Florence St unviable
Site 36b ³	Not assessed in SIS		0.12Ha	
Site 37	Unquantified proportion (<10%?) of 60Ha lost (good condition)		1.42Ha	
Site 38&39	1.75Ha of 3.5Ha lost (disturbed but diverse)		1.87Ha	Remainder (1.63Ha) unviable fragments
Site 40	1.6Ha of 1.75Ha lost (heavily modified)		1.16Ha	Remainder unviable (0.6Ha)
Site 41	0.55Ha of 0.6Ha lost (heavily disturbed)	Likely to have been unviable without intervention even without impacts from proposal	0.38Ha	Remainder unviable (0.2Ha)
Site 42	6.4Ha of 7.5Ha lost (good condition)		4.62Ha	Remainder (3Ha) in two linear strips has very low viability without intervention
Site 43	4.4Ha of 5.5Ha lost (good condition)		3.40Ha	Remainder (2Ha) in fragments either side of WSO – unviable without intervention
Site 44	3.3Ha of 5Ha lost (grazing, weeds, rubbish)		2.61Ha	Remainder (2.5Ha) in fragments – unviable without intervention
Shale Sandstone Transition Forest				
Site 46	Unquantified proportion of 9.5ha lost (heavily degraded)		0.60Ha	
Sydney Coastal River Flat Forest				
Site 1	Unquantified loss (degraded)		0.06Ha	Approx 0.1Ha left as unviable fragment
Site 3	1.5Ha of 3Ha lost (heavily disturbed)		0.94Ha	Remainder (2.1Ha) low viability without intervention
Site 6	Small proportion (10%?) of 5Ha lost (heavily degraded)		0.27Ha	
Site 9	Unquantified amount lost (heavily degraded)		0.65Ha	
Site 10	Very small, unquantified, amount lost (heavy weed infestation)		0.06Ha	
Site 12	Unquantified amount lost (heavy weed infestation)		0.91Ha	
Site 16	Very narrow linear band lost (0.5Ha? – disturbed)		0.02Ha	
Site 17	Unquantified amount lost (good condition)		0.10Ha	
Site 24	Not assessed/quantified in SIS		0.36Ha	Approx. 0.5Ha unviable fragments remaining
Site 28	Unquantified amount lost (weeds)		1.30Ha	Approx. 1.0Ha unviable fragments remaining
Site 31	Unquantified riparian strip lost (degraded)		Unknown	Undetermined as unmapped
Site 32	Not assessed/quantified in SIS		0.60Ha	
Site 33	Not assessed/quantified in SIS		0.25Ha	Undetermined as unmapped
Site 38	Unquantified riparian strip lost (degraded)		1.65Ha	Approx. 2.5Ha N of WSO in three fragments – unviable

³ Northbound off-ramp to Rooty Hill Road near Richmond Road. Impacts not assessed in SIS for reasons unknown.

Species Community Site#	SIS Impact	NPWS Comment	Recalculated Impact	Indirect Impacts
<i>Acacia pubescens</i>				
Site 6	1 plant, disjunct from main area of population, lost.		No significant change	None expected
<i>Dillwynia tenuifolia</i>				
Site 37	342 plants lost. Out of c. 400 in immediate area, & >5000 to the north.		No significant change	Isolation of areas 1 & 2c. Resultant small pop'n much less viable without active management.
<i>Pimelea spicata</i>				
Site 21	53 out of 69 plants lost.		No significant change	Remaining small pop'n very low viability
Site 22	Loss of potential habitat.		No significant change	Not expected to be substantial given existing environment
Site 39	No direct impact.		No significant change	Remaining remnant habitat low viability without intervention
Site 42	1 of 3 meta-populations entirely lost (4 plants out of c. 470).		No significant change	Remaining remnant habitat low viability without intervention
<i>Pultenaea parviflora</i>				
Site 37	No direct impacts		No significant change	Not expected to be substantial given existing environment
<i>Grevillea juniperina ssp. juniperina</i>				
Site 35	Entire pop'n (2 plants) lost, as well as potential habitat	Likely to have had low viability without intervention even without impacts from proposal	No significant change	N/A as entire pop'n already lost
Site 36	Entire pop'n (166 plants) and large areas (X?) of potential habitat lost.		No significant change	N/A as entire pop'n already lost
Site 37	1500 individuals lost (out of c.>10000) directly. Area of potential habitat (highly disturbed)		No significant change	Isolation of area to south of alignment – undetermined pop'n size.
Site 39	Entire pop'n (65 plants – 0.3Ha) lost		No significant change	N/A as entire pop'n already lost
Site 40	Entire pop'n (11 plants) lost		No significant change	N/A as entire pop'n already lost
Site 42	Entire pop'n (3 plants) lost	Likely to have been unviable without intervention even without impacts from proposal	No significant change	N/A as entire pop'n already lost
Site 43	Entire pop'n (c.3 plants) lost	Likely to have been unviable without intervention even without impacts from proposal	No significant change	N/A as entire pop'n already lost
<i>Pultenaea pedunculata</i>				
Site 6	Entire pop'n (6 plants) lost	Likely to have been unviable without intervention even without impacts from proposal	Now no direct impact	Possible indirect impacts.

The figures in Table 1 have been derived by the following means:

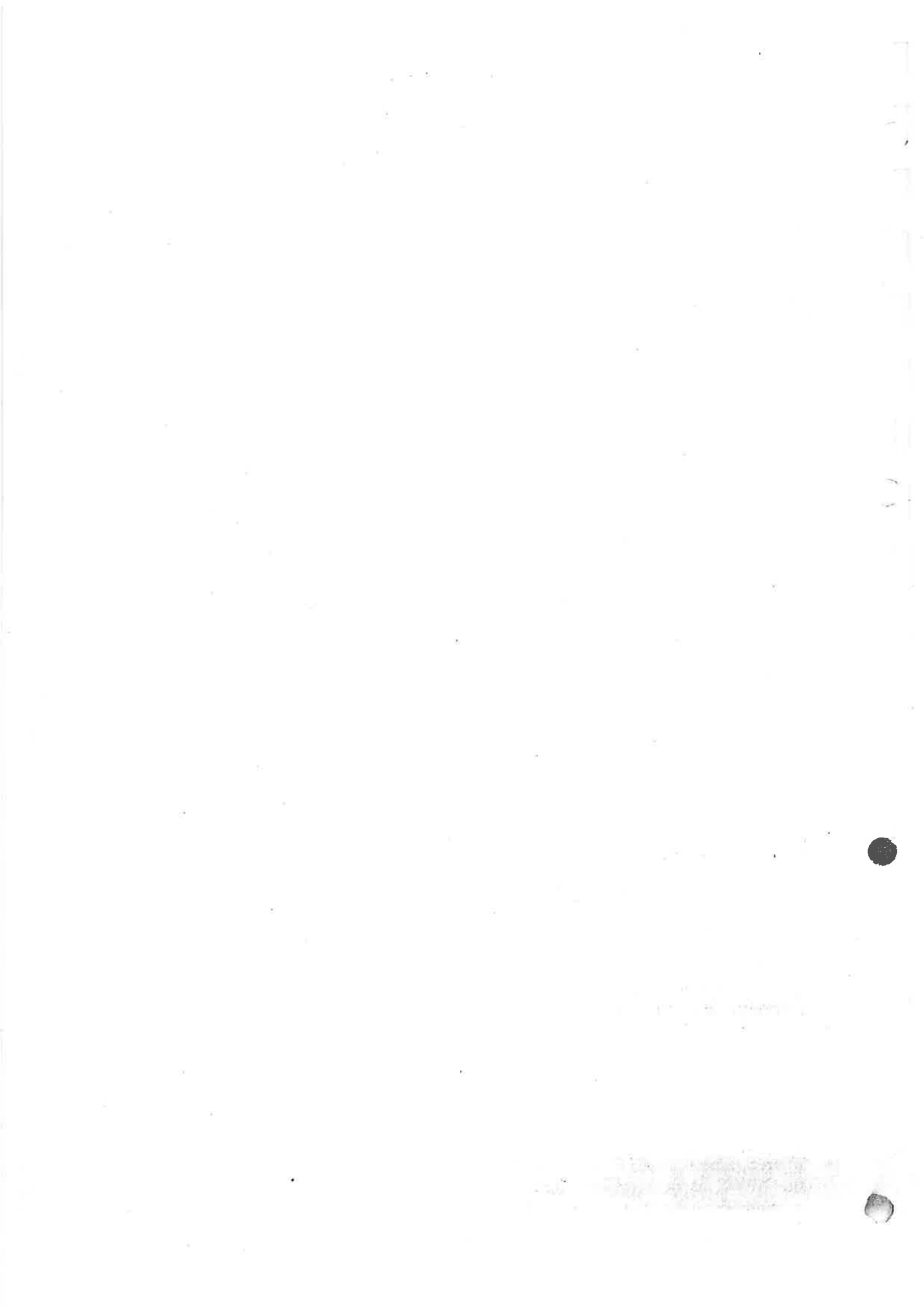
- The "SIS Impact" figures are those as stated in the species impact statement. Some sites were not assessed in the SIS (eg site 36b, the northbound off ramp to Rooty Hill Road North) and these are marked as such. Also, ecological communities, such as SGTF, were not assessed in the SIS. These areas were assessed in the SIS as other communities.
- The "NPWS Comment" column is for sites where the NPWS considered the likely impacts to vary significantly from those stated in the SIS (though there were no sites where this was the case) or where the NPWS considered that the remnant(s) to be impacted were of a condition that they were unlikely to have been viable even without the impacts of the proposal.
- The "Recalculated Impact" figures are those provided by the RTA following the alterations to the proposal after exhibition of the SIS and EIS. For threatened species no detailed figures were provided but, instead, a discussion of the magnitude and significance of the change in impact was provided. For the ecological communities the RTA provided figures on impacts to the nearest square metre.
- The "Indirect Impacts" column was derived by the NPWS assessing the viability of the remaining remnant(s). This was done using the criteria of remnant size and condition.

There are many differences in the areas of ecological communities to be affected by the project as calculated in the SIS, compared to those calculated following the alignment modifications. Explanations for these are as follows:

- Some areas previously assessed as CPW were subsequently assessed as SGTF, WSDR or MSW.
- Modifications to the alignment altered the impacts of the proposal.
- The RTA has stated that significant reductions in the direct impact on ecological communities, particularly in the southern half of the proposal (sites 1-20), are due to initial over-estimates of impact, based on an inaccurate method of calculation. The impacts were initially calculated from boundary to boundary of the WSO corridor, not from the footprint of the proposal.

The calculation of these figures had the following constraints:

- The NPWS was not able to carry out its own accurate analysis of direct impacts as it was not given access to digital data layers of the distributions of threatened species or ecological communities, as presented in the SIS. This data was initially requested during the exhibition of the SIS and EIS and was again requested in June 2001, but has not been forthcoming. The assessments of direct impacts are thus based entirely on figures provided by the RTA.
- Similarly, without this digital data indirect impacts have only been able to be estimated using the diagrams in the SIS and representations report.
- Indirect impacts on SGTF, MSW and WSDR were not able to be assessed by the NPWS as no mapping, digital or hardcopy, of the extent of these communities was received as part of the representations report.



- The NPWS was also unable to assess indirect impacts on *Meridolum corneovirens* due to the extremely small scale and lack of detail in the maps of the habitat in this species provided in the SIS. At late notice (on 31 August 2001) the NPWS requested (by e-mail) more detailed maps of habitat and population distributions or, at least, a more detailed consideration of the issue. The RTA replied on 3 September 2001 that it would supply "some info/comment" but none has been provided.
- As stated elsewhere in this report, no impacts resulting from associated infrastructure was able to be calculated as the RTA has not provided accurate information regarding locations, size or extent of that infrastructure.

Finally, no assessment has been possible for some indirect impacts resulting from the project such as flooding effects or erosion and sedimentation. Of particular concern are:

- Flooding or water retardation in the Prestons area. The fill batter construction of the proposal has the potential to cause localised flooding or, at least water retention, that could impact on the threatened species and ecological communities present in the area (sites 6&7). As the RTA has not provided details of the mitigation measures designed to prevent these effects, the NPWS could not assess their ability to mitigate, nor could the NPWS assess the possible impacts of constructing the mitigation measures (eg detention basins). The RTA has, instead, preferred to address these issues at the "detailed design stage".
- Downslope erosion, sedimentation and pollution at SIS site 20. The WSO here traverses a ridgeline with a steep slope leading into WSDR and MSW ecological communities. As the RTA has not provided details of the mitigation measures designed to prevent these effects, the NPWS could not assess their ability to mitigate, nor could the NPWS assess the possible impacts of constructing the mitigation measures (eg sedimentation and erosion control basins).

Summary of Impacts

Reviewing Table 1 the NPWS has assessed the total likely impacts of the proposal, excluding those indirect impacts it was unable to assess. The impacts can be summarised as follows:

- *Acacia pubescens*: Loss of a single individual directly (SIS site 6).
- *Dillwynia tenuifolia*: Loss of entire meta population of approx. 400 individuals (SIS site 37).
- *Pimelea spicata*: Loss of one population (SIS site 21) directly two other populations (SIS sites 29 & 42) indirectly through loss of viability of remnant habitat.
- *Grevillea juniperina* ssp. *juniperina*: Loss of six populations (SIS sites 35, 36, 39, 40, 42 & 43) and loss of approximately 15% of population at SIS site 37.
- *Pultenaea pedunculata*: Potential indirect loss of one population (SIS site 6).

- *Meridolum corneovirens*: Loss of one population (snail site 1) and partial loss of 6 other populations and habitat (snail sites 2-7).
- Cumberland Plain Woodland: Loss of 56.3Ha from 27 sites. A number of other areas would also be lost but they were assessed as already being unviable.
- Shale Sandstone Transition Forest: Loss of 0.6Ha from one site.
- Sydney Coastal River Flat Forest: Loss of 14.4Ha from 15 sites. SCRFF would also be lost from two other sites but these were assessed as already being unviable.
- Shale Gravel Transition Forest: Loss of 3.8Ha from 5 sites.
- Western Sydney Dry Rainforest and Moist Shale Woodland: Loss of 0.4Ha from one site.

Indirect impacts that were unable to be assessed include:

- Fragmentation effects on *Meridolum corneovirens* habitat. As habitat for this species was not mapped in detail, the NPWS was unable to assess whether remaining habitat fragments would be viable.
- Flooding impacts on CPW, CSW or SGTF in the Prestons area.
- Downslope impacts (sedimentation, etc) on WSDR, MWS and CPW at Site 20.
- Indirect impacts, due to fragmentation, on SCRFF at sites 31 & 33 as this community was not mapped at these sites by the RTA.

2.3 Ameliorative Strategies

2.3.1 Design of Interchanges and Intersections

Several of the intersections and interchanges impact (directly and/or indirectly) on threatened species or ecological communities. These include the M5 and M4 interchanges and the Quakers Hill Parkway, Bernera Road, Old Wallgove Road and Sunnyholt Road intersections.

The NPWS considers that there may be some scope for reduction of impacts at these sites, but has not had access to independent professional advice regarding the assessment of alternatives. The RTA documentation has stated that these designs have the least impact possible for meeting the design criteria, such as design speed of interchange ramps. Again, the NPWS has not had access to independent professional advice regarding whether this is correct or that these design criteria are appropriate or necessary.

2.3.2 Alignment Modifications

At various sites along the motorway, such as SIS site 37, the horizontal alignment could potentially be modified to reduce impacts on threatened species or ecological communities.

The RTA has stated, in the documentation and at meetings, that the proposed alignment has the least impact possible for meeting the design criteria, such as

design speed. Also, horizontal alignment changes may have additional noise impacts on adjacent residences.

Again, the NPWS has not had access to independent professional advice regarding whether this is correct, that these design criteria are appropriate or necessary, or assessment of the possible noise impacts of horizontal alignment adjustments.

2.3.3 Reduction in Width of Median

The WSO is designed with a 15 metre median, with the intention that this be used for future public transport facilities such as a dedicated bus way or rail line. The removal of this median could potentially reduce the impact of the proposal on threatened species or ecological communities by reducing the footprint of the proposal.

It is noted that, in section 3.11.1 of the Representations Report, the RTA presents several points which indicate that demand for such a public transport link may not be high. For example, the WSO parallels existing or planned public transport links and the demand for cross-regional bus services between large centres is relatively small (Rep's Report pp.217-219).

The NPWS has not had access to independent professional advice regarding whether the provision of the wide median in anticipation of these facilities being constructed at some unknown date in the future is necessary. As such, it cannot assess whether the impact of this median is appropriate.

2.3.4 Reduction in Design Speed

As mentioned above, a reduction in design speed could potentially reduce impacts at some sites, through altered alignment or interchange design. It could also result in a smaller footprint, and subsequent reduced impacts, by reducing the necessary width of the carriageways.

The RTA has stated that the current design speed is appropriate for a number of reasons and that the difference in footprint resulting from a reduced design speed would be "minimal" (Rep's Report p.136).

Again, the NPWS has not had access to independent professional advice regarding whether this is correct or that the design speed is appropriate or necessary.

2.3.5 Provision of Vertical Walls

There are a number of sites along the WSO where cut or fill batters are proposed over threatened species populations or areas of ecological communities. Impacts could be reduced by the replacement of the batters with vertical walls at these sites.

The NPWS submission on the exhibited EIS & SIS requested that vertical walls be considered as a measure to reduce impacts. The RTA response (Rep's Report p. 137) states that:

"Vertical walls would be considered where the Proposal would impact on threatened species and ecological communities. The height of these walls would be determined at the detailed design stage of the Proposal, and where justified walls greater than 2m in height would be considered. Vertical walls would be considered at Site 21 to minimise the impacts on the CPW and *Pimelea spicata* plants in the area"

On 29 August 2001 the NPWS requested (by e-mail) that the RTA use its digital data to calculate, on a site by site basis, the areas of endangered ecological community and threatened species habitat that vertical walls would prevent being lost. A reply received the same day stated that:

"walls over 2 metres high apart from being very costly also are not desirable owing to visual/urban design considerations. Providing 2 metre high walls reduce the area of impact by up to 8 square metres per lineal metre assuming both sides are impacting on threatened/endangered flora. Hence a kilometre of walls may reduce impacts by only 0.8 Ha. The benefit is only slight".

The NPWS pursued the matter and received a further clarification on 30 August 2001:

"High walls are expensive and construction requires room at the base for equipment such as cranes, concrete trucks, etc. After construction there is a need to ensure that access is available to the wall and running along the wall to monitor its condition, clear weep holes and other maintenance activities. Taking into account a 3 metre strip cleared at the bottom of the wall, a 4 metre high wall then may only achieve a net gain of 5 metres. If we provide 4m high walls on both sides there would be a 1 Ha saving for a kilometre of wall. The cost of 8000 square metres of wall (4 metres X 1000metres X 2) is about \$3.2M according to our estimators. There is saving in earthworks of perhaps \$1M. So net cost increase is say \$2M. Therefore to save 1 Ha of land costs around \$2M. We were going to buy 75 Ha for maybe \$12M (\$160,000/ha). So walls do not appear to be attractive or cost effective considering we can provide compensatory habitat. Shading would be an issue for any plantings close to the wall as well as the visual impact for nearby residents. Considering the provision of compensatory habitat, I would have thought walls should only be necessary to prevent the loss of threatened species, especially where compensatory areas do not contain these."

This apparent rejection of vertical walls appears to be at odds with the advice in the Representations Report, which stated that vertical walls would be considered. At no stage has the RTA provided the NPWS with the requested site by site indication of the benefits of this amelioration measure.

As noted in section 2.2.2 the NPWS does not have digital data on the extent of threatened species and ecological communities (as mapped in the SIS). Consequently, the NPWS was not able to undertake its own assessments of the benefits of providing vertical walls at particular sites along the alignment.

2.3.6 Provision of Viaduct/Bridging (to alleviate flooding)

Section 10.1.13 of the SIS discusses the issue of flooding in the Maxwells Creek area (Prestons) resulting from the proposal and indicates a detention basin could be constructed to alleviate this problem. Both the location of the basin and the location of the placement of fill (greater than 5.3Ha of fill likely) resulting from the basin could have an impact on vegetation in the area. Alternatively, increased flooding could impact on this vegetation.

The submission to the EIS and SIS by the Department of Land and Water Conservation recommended that the WSO should "be bridged" from south of Kurrajong Rd to after it crosses Maxwells Ck, alleviating the need for a detention basin.

) Again, the NPWS does not have the digital data to assess the benefits this would provide. Nor has it the costing data to assess whether it is an appropriate or cost effective ameliorative measure.

2.3.7 Compensatory Habitat

Compensatory habitat is a measure that can be implemented to offset the impacts of a proposal that cannot be ameliorated. Components of a compensatory habitat package can range from purchase of intact habitat to revegetation of cleared environments.

A range of impacts which cannot be ameliorated are discussed above. Given this, the NPWS has agreed to the provision of compensatory habitat based on the following criteria:

1. Compensatory habitat requirements shall be calculated at a ratio of at least 2:1 for purchase of existing habitat. That is, at least two hectares of existing habitat shall be purchased for each hectare of habitat that is cleared. The relative amounts of each community so purchased shall, as closely as is practicable, mirror the relative areas of each community or species habitat that is to be cleared.
2. Compensatory habitat shall, where possible, include habitat and/or populations of the threatened species that are to be impacted by the proposal, as discussed above.
3. The NPWS preliminary estimate of endangered ecological community to be lost, directly and indirectly, as a result of this proposal is 75.5Ha. As discussed elsewhere in this report, it is noted that the NPWS has been unable to estimate the indirect effects of flooding or flood mitigation measures in the Prestons area (SIS sites 6 and 7). Nor has it been able to estimate the indirect impacts, due to sedimentation, erosion, etc, downslope from SIS site 20. Similarly, if further assessments under the *Environmental Planning and Assessment Act 1979* allow for ancillary infrastructure to impact on threatened species or ecological communities, these impacts should be ameliorated through this compensatory habitat package. Therefore, the final total of endangered ecological community to be lost (on which the final compensatory package shall be based) may be higher.

4. Priorities for compensatory habitat purchase shall be as follows:
 - Properties identified in the representations report as compensatory habitat;
 - Habitat within 10km of the route of the WSO;
 - Habitat adjacent to existing conservation or other public reserves;
 - Habitat identified in the NPWS conservation significance assessment (conducted for the Cumberland plain endangered ecological communities recovery plan) as 'core habitat' or 'support for core habitat';
 - Habitat under imminent and significant threat.
5. Where it is not possible to purchase existing habitat at a ratio of 2:1, a minimum ratio of 1:1 shall be purchased and the balance of compensation be revegetation of areas at a ratio of up to 20:1. It is expected that the budget for this revegetation will be in the order of \$5000 per hectare over 3 years, based on costs for revegetation work conducted by Greening Australia in the Hoxton Park Corridor. Ongoing management will need to be negotiated by the RTA with the relevant land manager.
6. Priorities for revegetation shall be as follows:
 - Land within 10km of the route of the WSO;
 - Habitat adjacent to existing conservation or other public reserves;
 - Land identified in the NPWS conservation significance assessment as 'candidate corridor paths';
 - In order of priority - Private land (this will require negotiation of a conservation measurement such as a covenant or a conservation agreement); Land owned by Council or Government agency other than DUAP or the NPWS; Land owned by DUAP or the NPWS.
7. Establishment and management costs for lands transferred to NPWS shall be provided in the compensation package negotiated. It is expected that these costs shall be in the order of \$8000 per hectare of reserve (based on the financial impact statement for Kemps Creek Nature Reserve).
8. Establishment and management costs for lands transferred to other agencies shall be provided in the compensation package negotiated.

2.3.8 Translocation of Threatened Species

Translocation of threatened species is similarly a measure that can be implemented when the impacts of a proposal cannot be ameliorated. In the case of translocation, however, the measure is experimental and likely success is unknown. For this reason translocation is not, strictly, an ameliorative measure.

Translocation is only implemented once all other ameliorative measures have been exhausted and the impacts cannot be avoided. If this is the case, and the proposal is still to be given approval, then translocation can be trialed.

In the case of the WSO, threatened species are to be impacted by the proposal and no amelioration has been identified as possible. Condition 7 of this concurrence, therefore, provides for the RTA to assess and implement translocation proposals for these species.

2.3.9 Ameliorative Measures Overview

As noted above, a number of ameliorative measures remain to be fully assessed for their effectiveness or feasibility. While this is not an ideal situation, the time frames imposed on the assessment process by the RTA (by requesting concurrence before the various agencies had reached consensus on a number of issues and without supplying the NPWS with all requested information) requires that the concurrence assessment be completed before these measures can be addressed.

It is noted, however, that the approval of the Minister for Urban Affairs and Planning is still required for the project and that the DUAP, having greater access to expertise in motorway engineering and design, may be in a better situation to assess these issues.

Modifications that further reduce the impacts of the proposal on threatened species or ecological communities, which arise from the Minister for Urban Affairs and Planning's approval, would not be inconsistent with this concurrence report. The NPWS has previously discussed these issues with the DUAP and will continue to do so during that agency's assessment of the proposal.

Where amelioration has not been assessed as possible, compensatory habitat is to be purchased or revegetated and translocation proposals are to be assessed and implemented.

3 THE PUBLIC SUBMISSIONS

Section 112D(c) of the EP&A Act requires that the Director-General considers any submissions or objections received concerning the development application. This section addresses that provision.

A total of 85 submissions that dealt with threatened species or endangered ecological communities issues were received. Of these, 40 were from residents or landowners in the Cecil Hills area who stated they would be affected by the proximity of the WSO and who stated that an alignment further from their properties would have less impact on endangered ecological communities or threatened species.

Of the remainder of the submissions, the following comments were received:

- Objections were made to the compulsory acquisition of submitters properties, or adjacent properties, for compensatory habitat purposes;
- Habitat acquisition would not compensate for loss;
- The ratio of habitat acquired to habitat lost should be greater, suggesting ratios up to 10:1;
- Indirect impacts needed to be assessed, with some stating they also needed to be compensated for;
- Comments about the impacts at specific sites;
- Non-specific concerns regarding loss of threatened species or endangered ecological communities;
- Clearing of endangered ecological communities or threatened species should not be allowed at any site;

- Specific concerns about the adequacy of the assessment documents;
- Further consideration of ameliorative measures, such as vertical walls, is required;
- Agreement with some measures proposed, such as the need for environmental bonds, vegetation management plans or specific measures for particular sites or species;
- Disagreement with some measures proposed, such as relocation of affected species;
- Comments regarding improvement or reinforcement of proposed measures, such as extension of period for regeneration of EECs, securing funding for management, extending monitoring periods, etc;
- Comments about appropriate compensatory habitat sites;
- Ameliorative measures proposed were suitable; and,
- Other, general, comments.

The issues raised by these submissions are dealt with throughout this concurrence report.

4 RELEVANT RECOVERY OR THREAT ABATEMENT PLANS

Section 112D(d) of the EP&A Act requires that the Director-General considers any relevant recovery or threat abatement plans. This section addresses that provision.

There are no existing threat abatement plans that are relevant to this proposal. There are also no final approved recovery plans relevant. However, a draft recovery plan for *Acacia pubescens* was exhibited in April 2001. This plan did not specifically make recommendations for the population affected by this proposal (Prestons – site 6), but the population counts given in the plan indicate it to be one of the largest on private property.

Additionally, a draft recovery plan for the endangered ecological communities on the Cumberland Plain (including CPW, CSW, MSW, SCRFF, SSTF, SGTF and WSDR) is currently being prepared. As part of this recovery planning process the NPWS has conducted a conservation significance assessment of the vegetation on the Cumberland Plain. That assessment placed the vegetation of the Cumberland Plain into categories, one of which was the category of “Critically endangered and core habitat”. This category (“core vegetation”) contained those areas of ecological communities at imminent risk of extinction or those constituting the backbone of a viable conservation network.

The proposal impacts on core vegetation at 22 of the sites described in the SIS. At nine of these sites, the core vegetation will be lost altogether and a total of approximately 51Ha of core vegetation will be lost.

Due to the proposal resulting in the loss of core vegetation, as identified by the preliminary draft recovery plan, the NPWS considers that this vegetation should be compensated for at a ratio of at least 2:1. It is considered that this is a minimum requirement for the loss of this important habitat. When the recovery plan is

approved, it is likely that this requirement will be greatly increased for later proposals, so that the ratio of compensation to area lost is much higher than 2:1.

5 REGIONAL VIABILITY & RISK OF EXTINCTION

Section 112D(e) of the EP&A Act requires that the Director-General consider whether the proposal is likely to reduce the long-term viability of the threatened species, population or ecological community in the region (the Sydney Basin Biogeographical Region). Section 112D(f) of the EP&A Act requires that the Director-General consider whether the development is likely to accelerate extinction of the species, population or ecological community or place it at risk of extinction. This section seeks to address those provisions.

Acacia pubescens

This species occurs at 124 sites in 15 LGAs within the region. It does not occur elsewhere. As the proposal is unlikely to result in the loss of any of these populations, or substantially reduce their viability, it is unlikely to reduce the long-term viability of the species in the region. Neither will it accelerate the extinction of the species.

Pultenaea parviflora

Recent surveys conducted for the NPWS found this species at 34 sites within the region, with an additional 26 known sites not visited. Known population size varies from a few individuals to several thousand. It is known from three existing and one proposed conservation reserve. It does not occur outside the Sydney Basin Biogeographical Region.

As the proposal does not impact directly on the species at all, and as the NPWS has assessed indirect impacts as unlikely to be substantial, it is unlikely to reduce the long-term viability of the species in the region. Nor will it accelerate the extinction of the species.

Dillwynia tenuifolia

Recent surveys conducted for the NPWS found this species at 31 sites within western Sydney, with an additional 19 known sites not visited. Also, approximately 5 populations are known from outside western Sydney but within the region. The species is not known from outside the region. The species can become locally abundant when habitat conditions are favourable and a number of populations had greater than 100 individuals, with some having in excess of 1000. The species is recorded from seven existing and one proposed conservation reserve.

The proposal is likely to result in the loss of the majority of the population of this species immediately adjacent to the alignment (SIS site 37), with the remainder exhibiting a reduced viability. There is, however, a large population and area of habitat to the north of the proposal that is partially within the compensatory habitat proposed in the representations report and partially within DUAP-owned properties.

The loss of the existing population will result in a reduction in the viability of the species within the region, although not a substantial one. Similarly, the loss must accelerate the extinction of the species but, again, it is not considered that this acceleration will be substantial.

Pimelea spicata

This species occurs at 42 sites within the region. It does not occur elsewhere. The proposal will result in the probable loss of one population and a substantial reduction in the viability of two others.

The proposal is therefore considered likely to cause some reduction in the viability of the species in the region. It is also likely cause some acceleration of the extinction of the species, but will not place it at risk of immediate extinction.

Grevillea juniperina ssp. juniperina

Recent surveys and reviews conducted for the NPWS found this taxon at 32 sites within the region. Ten of these have populations in excess of 100 individuals, with only one small population occurring within a conservation reserve.

The proposal will result in the loss of six populations from direct and indirect impacts. Four of these populations are small and possibly unviable (2-11 individuals), with one population of 65 and one of 166 individuals. Additionally, the proposal will result in the loss of approximately 1500 out of the estimated greater than 10000 individuals of this taxon at SIS site 37.

The compensatory habitat proposed in the representations report includes a proportion of the population at SIS site 37 and a substantial proportion of it is in adjacent DUAP-owned properties. It is unlikely that this population will be lost as a result of the proposal.

Clearly, however, the loss of six populations (out of 32 known) means that the proposal will result in a reduction in the viability of the taxon in the region and will accelerate its extinction.

Pultenaea pedunculata

This species is only known to occur at three sites within the region – SIS site 5, at Villawood (a small populations in a fragmented remnant) and near the Nepean River north of Appin (a substantial population in a large area of habitat). Elsewhere, it occurs on the South Coast between Bournda National Park and Bermagui, on the Southern Tablelands to the south and south-east of Goulburn (and especially in the Windellama area) and in Victoria, Tasmania and South Australia. Within NSW, but outside the region, there are approximately 20 known populations with population sizes ranging from (mostly) a few individuals to several southern highlands populations having greater than 100 individuals.

The proposal has been modified to prevent direct impacts but indirect impacts are still possible, particularly through the possible flooding effects of the proposal on

the Maxwells Creek flood plain, or through the impacts of flood mitigation measures. Even without the proposal, however, the likelihood of survival of the population at site 5 is low, given the description of the surrounding environment presented in the SIS.

It is not considered, therefore, that the proposal will reduce the long-term viability of the species in the region. Nor is it likely to cause acceleration of the extinction of the species, or place it at risk of immediate extinction.

Meridolum corneovirens

This species is known from over 100 locations in the region. It is not known from elsewhere. The locations are scattered throughout the Cumberland Plain and are often small and isolated. The species is known from 5 conservation reserves.

The proposal will completely remove one population of a significant size, and partially remove six other populations and potential habitat. It is considered that these impacts mean that the proposal will result in a reduction in the viability of the taxon in the region and will accelerate its extinction.

Cumberland Plain Woodland

There is approximately 10832Ha of CPW in the region (NSW NPWS 2000) in over 1400 separate remnants. It is not known to occur elsewhere. The proposal will directly and indirectly result in the loss of approximately 56 hectares of CPW, from a total of 27 sites, that would not have otherwise been lost in the medium term (ie that which is not assessed as already unviable in Table 1). Cumberland Plain Woodland will cease to exist at nine of these 27 sites.

This will obviously have a detrimental affect on the community, and must be considered as likely to accelerate its extinction, although the magnitude of this acceleration will be small due to the relatively large area of the community still in existence. Similarly, the impact on the viability of the community will be small in comparison to the extent still existing.

Sydney Coastal River Flat Forest

There is approximately 4170Ha of SCRFF in the region (NSW NPWS 2000) in over 550 separate remnants. It is not known to occur elsewhere. The proposal will (directly and indirectly) remove approximately 15.5 hectares of SCRFF, from a total of 15 sites, that would not have otherwise been lost in the medium term. Sydney Coastal River Flat Forest will cease to exist at two of these sites.

This will obviously have a detrimental affect on the community, and must be considered as likely to accelerate its extinction, although the magnitude of this acceleration will be small due to the relatively large area of the community still in existence. Similarly, the impact on the viability of the community will be small in comparison to the extent still existing.

Shale Sandstone Transition Forest

There is approximately 7900Ha of this endangered ecological community in the region (NSW NPWS 2000) in over 1100 remnants. It is not known to occur elsewhere. The proposal will (directly and indirectly) remove approximately 0.6 hectares of SSTF, from one site, that would not have otherwise been lost in the medium term.

This will have a unsubstantial detrimental affect on the community, and must be considered as likely to accelerate its extinction only marginally. The relatively large area of the community still in existence, in comparison to that area to be lost would indicate that the impact will not be significant.

Western Sydney Dry Rainforest

There is approximately 262Ha of WSDR in the region (NSW NPWS 2000) in only 27 separate remnants. It is not known to occur elsewhere. The proposal will directly remove 0.42Ha of this community and has the potential to impact further downslope at SIS site 20, although the NPWS has not been able to assess the extent of the indirect impacts. This is because the area of WSDR at the site has not been mapped by the RTA and the RTA has not provided details of the ameliorative measures to be implemented to minimise downslope impacts at this site (preferring to leave this latter issue to the detailed design stage of the project).

This will obviously have a detrimental affect on the community, and must be considered as likely to accelerate its extinction, with the magnitude of the impact possibly substantial given the relatively small amount of the community extant, and its limited distribution. Similarly, the impact on the viability of the community in the region has the potential to be substantial.

Amelioration of this impact will require considerable resources in avoiding indirect impacts adjacent to SIS site 20. Compensatory habitat and revegetation measures will need to target this community.

Moist Shale Woodland

There is approximately 480Ha of MSW in the region (NSW NPWS 2000) in only 11 separate remnants. It is not known to occur elsewhere. The proposal will (directly remove an unknown quantity MSW, and has the potential to impact further downslope at site 20. The RTA has included the direct impacts on this ecological community in the corresponding figure for WSDR, as it did not separate these communities on the ground. The NPWS has not been able to assess the extent of the indirect impacts because the area of MSW at the site has not been mapped by the RTA and the RTA has not provided details of the ameliorative measures to be implemented to minimise downslope impacts at this site (preferring to leave this latter issue to the detailed design stage of the project).

The proposal is likely to have a detrimental affect on the community, and must be considered as likely to accelerate its extinction, with the magnitude of the impact possibly substantial given the relatively small amount of the community extant, and

its limited distribution. Similarly, the impact on the viability of the community in the region has the potential to be substantial.

Amelioration of this impact will require considerable resources in avoiding indirect impacts adjacent to SIS site 20. Compensatory habitat and revegetation measures will need to target this community.

Shale Gravel Transition Forest

There is approximately 2620Ha of SGTF in the region (NSW NPWS 2000) in nearly 300 separate remnants. It is not known to occur elsewhere. The proposal will directly remove approximately four hectares of SGTF, with a further, undetermined amount possibly being indirectly lost at SIS site 7 due to the possible flooding and water retardant effects of the proposal on the Maxwells Creek floodplain.

This will obviously have a detrimental affect on the community, and must be considered as likely to accelerate its extinction, although the magnitude of this acceleration will be small due to the relatively large area of the community still in existence. Similarly, the impact on the viability of the community will be small in comparison to the extent still existing.

Furthermore, the ameliorative measures proposed in the SIS, as well as those imposed by the conditions of this concurrence report (see sections 2.6 and 9 of this report) are such that the proposal should not substantially accelerate the extinction of SCRFF nor reduce its long-term viability in the region.

Castlereagh Swamp Woodland

There is approximately 220Ha of CSW in the region (NSW NPWS 2000), in only 11 separate remnants. It is not known to occur elsewhere. The proposal will not directly impact on CSW. Indirect impacts could not be assessed, but flooding or flood mitigation measures at Prestons may impact.

It is not considered, therefore, that the proposal will reduce the long-term viability of the endangered ecological community in the region. Nor is it likely to cause acceleration of the extinction of CSW; or place it at risk of immediate extinction

6 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

Section 112D(g) of the EP&A Act requires that the Director-General consider the principles of ecologically sustainable development as defined by the *Protection of the Environment Administration Act 1991*. The relevant provisions are defined below.

The principles of ecologically sustainable development, and how these principles have been applied in the assessment of this proposal, are as follows:

- a) *The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*

Using the precautionary principle, and given the apparent benefits of the proposal to society, the best means to protect the threatened species and ecological communities affected by the proposal is to minimise the vegetation clearance caused by the proposal. Accordingly the WSO has been located for maximum vegetation retention and a commitment had been to ensure it is protected during the construction period and managed accordingly to prevent environmental degradation. Additionally, the RTA has committed to purchase of habitat that is under threat from other impacts, possible revegetation of large areas of endangered ecological communities and to investigating the translocation of threatened species impacted by the proposal.

- b) *Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.*

The compensatory habitat program proposed by the RTA should ensure the protection of insecure sites that would otherwise be lost through development or mis-management. Additionally, the program may provide for the revegetation of large areas of woodland in the vicinity of the orbital.

- c) *Conservation of biological diversity and ecological integrity.*

The compensatory habitat program should ensure the protection of sites that would otherwise be lost through development or mis-management. Additionally, the program may provide for the revegetation of large areas of woodland in the vicinity of the orbital

- d) *Improved valuation and pricing on environmental resources."*

The principle of improved valuation and pricing of resources seeks to overcome the inefficient allocation of environmental resources that occurs due to market and Government failure, by ensuring that the appropriate value of these resources is recognised and considered in decision making.

In this respect, it should be recognised that environmental resources have economic values and that, in the case of the proposal, the trade-off between the economic benefits associated with construction and the economic benefits provided by the natural environment that will be foregone are not considered to be justified.

The economic benefits associated with the natural environment include use values, together with non-use values such as option values, bequest values and existence values.

This has been assessed in section 7 of this concurrence report.

7 SOCIAL AND ECONOMIC CONSEQUENCES

Section 112D(h) of the EP&A Act requires the Director-General of National Parks and Wildlife to consider the likely social and economic consequences of granting or not granting concurrence.

To facilitate the assessment of the social and economic consequences of granting or of not granting concurrence, it is necessary to clearly identify the distinction between the social and economic impacts of particular activities, policies, programs, etc.

The EIS documentation has indicated a number of economic and social benefits of the proposal:

- Support desirable economic activity and employment, as well as population growth;
- The identified need for an efficient transport link between Liverpool and Hornsby;
- Catering for the future increased demand for freight and other movements;
- Good transport links encouraging employers to situate in western Sydney;
- Improvement to public transport and cyclist opportunities;
- Reduction of road congestion with improved traffic flow (all EIS Vol. 1, s.1.5);
- A net present value of between \$425 and \$2305M, depending on discount rate (EIS Vol. 1 s.7.6.1).

The NPWS has not had access to independent professional advice regarding these issues, making it difficult to determine whether the conclusions reached in the EIS are justified.

8 REASONS FOR THE DIRECTOR-GENERAL'S DECISION

The NPWS has assessed the proposal as per the heads of consideration set out in section 112D of the *Environmental Planning and Assessment Act 1979*.

As can best be determined based on the information presented by the RTA, the impacts of the proposed Western Sydney Orbital are not avoidable. Some of these impacts, in particular those on *Grevillea juniperina* ssp. *juniperina*, *Pimelea spicata*, Western Sydney Dry Rainforest and Moist Shale Woodland, potentially compromise the recovery of species and ecological communities listed under the *Threatened Species Conservation Act 1995*.

Taking the economic justification presented by the RTA at face value, however, the conclusion reached has been that the benefits of the proposal justify the impacts that will occur.

Notwithstanding this, the conditions of concurrence presented below are imposed in order to minimise and, where possible 'compensate' for the loss of threatened species and ecological community habitat.

9 CONDITIONS OF CONCURRENCE

1. The proposal shall be constructed as shown in the Concept Design (sheets 1-16), as presented in the document "The Western Sydney Orbital Representations Report Volume 1 (August 2001)," as received by the NPWS on 20 August 2001, with the following exceptions:
 - As modified by the replacement of sheet 8 on 30 August 2001;
 - That part of the alignment between Richmond Road and Symonds Road shall be constructed as shown in the SIS; and,
 - As modified by these conditions of concurrence.

2. All measures for the amelioration of impacts on threatened species and ecological communities proposed in the SIS, EIS and Representations Report shall be implemented.

Reasons: To ensure that the activity is undertaken as described in the SIS or as partly amended by the subsequent reports, and incorporates amelioration measures for threatened species as agreed to by the Director-General of National Parks and Wildlife in this Concurrence Report.

3. No ancillary infrastructure or other works, including permanent or temporary detention basins, materials stores, access roads, clearing, utility corridors, works areas, depots or any other activity or development (as defined by the *Environmental Planning and Assessment Act 1979*) shall be carried out, or be allowed to be carried out, within areas shown as habitat for endangered ecological communities or threatened species in any of the documents received by the NPWS in assessing the concurrence proposal (as listed in section 2 of this concurrence report).

Reason: The location of this infrastructure was not identified, nor were the impacts assessed, in the EIS, SIS or any of the documentation received by the NPWS. This concurrence cannot, therefore, give approval for this infrastructure to clear any threatened species or ecological community habitat. This will require further assessment under Part 5 of the Environmental Planning and Assessment Act 1979, possibly including s.5A of that Act and the production of further SISs.

4. The RTA must negotiate a habitat compensation package with the Manager CPPD, Central Directorate. The compensation package is to include the acquisition and transfer of lands and/or funds for rehabilitation and management to the NPWS, and may also include funds for revegetation of cleared land where sufficient intact habitat cannot be purchased to meet the requirements of the compensation package. The principles of this habitat package are detailed in section 2.3.7 of this concurrence report. The compensation package must be formally agreed to by the Manager CPPD, Central Directorate, prior to the commencement of clearing for construction of the proposal.

Reason: To provide adequate habitat compensation and/or financial compensation for initial management of compensatory habitat, the direct and

indirect impacts of the activity on threatened flora and fauna, which cannot be fully mitigated by other ameliorative measures

5. The design and alignment of the proposal may be modified to result in no increased impact, or in a reduced impact (direct and/or indirect impact) on threatened species or endangered ecological communities. Such modifications could possibly include the redesign of interchanges, the provision of vertical walls to replace batters, changes in alignment allowable following a reduction in design speed, tunnelling or other, similar modifications.

Reason: The NPWS was not able to independently assess the feasibilities of modifying the design of the proposal, such as interchange and intersection design or the provision of vertical walls, to reduce the footprint of the proposal.

6. Where the proposal is to traverse areas shown as habitat for endangered ecological communities or threatened species in any of the documents received by the NPWS in assessing the concurrence proposal (as listed in section 2 of this concurrence report), the boundary of the footprint of the proposal shall be surveyed and fenced so as to prevent construction activities from entering sites intended for protection.

Additionally, when ancillary infrastructure are to be constructed within 50m of the habitat for endangered ecological communities or threatened species in any of the documents received by the NPWS in assessing the concurrence proposal (as listed in section 2 of this concurrence report), the boundary of the habitat shall be surveyed and fenced so as to prevent construction activities from entering sites intended for protection.

Reason: Areas of habitat of threatened species or ecological communities identified for protection require physical separation from construction activities to ensure that protection.

7. The RTA must undertake assessments on the feasibility of translocation of any individuals of the species:

- *Pimelea spicata*, which would otherwise be destroyed by road construction activities at sites 21, 39 and 42.
- *Dillwynia tenuifolia*, which would otherwise be destroyed by road construction activities at site 37;
- *Pultenaea pedunculata*, which would be otherwise affected indirectly at SIS site 6;
- *Grevillea juniperina* ssp. *juniperina*, which would otherwise be destroyed by road construction activities at sites 35, 36, 36b, 37 and 40 ; and,
- *Meridolum corneovirens*, which would otherwise be destroyed by road construction activities at snail sites 1 to 7.

A report detailing the findings of this assessment and any proposed actions is to be provided to the Manager, CPPD, Central Directorate, prior to any translocation. Translocation must be undertaken in consultation with the Manager, CPPD, Central Directorate.

Reason: Despite the provision of compensatory habitat, there will still be a net loss of individuals and populations of these species. Translocation should be attempted to see if these populations can be conserved at alternative sites..

8. The RTA will contribute \$100,000 (in 2001 dollars) towards the costs incurred by the NPWS in the development of recovery plans and the implementation of recovery actions for the threatened species and ecological communities significantly affected by this proposal.

Reason: The proposal impacts on the recovery potential of a number of threatened species and ecological communities.

9. Those parts of the Environmental Management Plan (EMP) that address threatened species and ecological community issues shall be provided to the Manager, CPPD, Central Directorate, for review and comment before the commencement of clearing of threatened species or ecological communities.

Reason: To ensure compliance with the measures outlined in the documentation, to minimise potential impacts on threatened species and to maximise the effectiveness of mitigation measures.

APPENDIX B

Summary of Representations to the EIS

No.	Name/Organisation	Type	Object/Support	Key Issues	Sub-Categories	Summary
1	Ian Tice	Individual	N	Flora and Fauna Stormwater	Cumberland Plain Woodland	Concerned over impacts to remnant Cumberland Plain Woodland in Eastern Creek, Doonside, Prospect, M4 interchange area. Concerned about storm water runoff during construction.
2	John Wilkes	Individual	S	Link to F3/Pennant Hills Road More lanes required on WSO		Concerned over F3 to WSO link. Believes that the WSO should be three lanes each way initially.
3	Peter Zipkis	Individual	N	Public Transport		Believes that provision of a dual track railway line should be included as part of WSO.
4	Roger Stuart-Smith	Individual	S	More lanes required on WSO Design considerations Toll	Interchange	The median is insufficient and the road should be designed for 4 lanes in each direction. The design of M5 Interchange slip lanes needs to be carefully considered due to high traffic volumes and required high speeds. No provision for Castlereagh extension. Need north facing on and off ramps at Elizabeth Drive. Need west facing on and off ramps at Quakers Hill Parkway. Shouldn't be a toll.
5	Clint Wilde	Individual	S	Commencement of Project		Believes that the project should start ASAP.
6	James Simmons	Individual	N	Link to F3/Pennant Hills Road		Concerned over impacts on Pennant Hills Road.
7	Jeff Cook	Individual	N	Link to F3/Pennant Hills Road		Concerned that WSO is being proposed without consideration given to F3 link.
8	Trevor Challacombe	Individual	N	More lanes required on WSO		Believes that the WSO should be constructed as a minimum 3 lanes each way.
9	Peter Hall	Individual	S	More lanes required on WSO Toll		Believes that the WSO should be a minimum of 6 lanes initially. Objects to a toll.
10	Keith Crews	Individual	N	Toll Design considerations		Supports the toll but believes it should have a finite life. Wants west facing ramps constructed at Windsor Road.
11	Tom Sammons	Individual	N	Design considerations		Wants the WSO to be an underpass at Blacktown to <i>Richmond Railway Line to minimise impacts on surrounding areas.</i>
12	Brian Noad	Individual	S	Environmental Impacts		Supports concept but wants EIS to demonstrate that

				(General)		environmental issues can be dealt with satisfactorily.
13	Dr Francis Khoo	Individual	S			Supports the WSO as it would lead to easier travel, less pollution and reduced accidents. Essential from a socio-economic point of view.
14	Chris Watkins	Individual	O	Public Transport Cycleway/Cyclists Urban Development	Car Dependency	Concerned that the WSO would promote further car dependency, reduce money for public transport/bikeways, will lead to greater residential and commercial sprawl perpetuating car dependency.
15	Paul Jacks	Individual	N	Toll		Objects to the lack of Federal Govt commitment to fund the complete project.
16	George Tillett	Individual	S	Link to F3/Pennant Hills Road		Is concerned that no study has been undertaken re the link from WSO to F3.
17	Andrew Tink MP (Member for Epping)	MP	N	Link to F3/Pennant Hills Road		Concerned about the impact of the WSO on Pennant Hills Road and that no link to F3 has been investigated. Both projects should proceed in tandem.
18	Chris Schwartz	Individual	S	Design Considerations Toll Link to F3/Pennat Hills Road	Interchange	Thinks there should be an interchange provided at Eastern Road or Woodstock Avenue. Electronic tolling must be compatible with other motorways. Needs to be connected to F3. Believes a clover leaf approach to M4 interchange would be a less expensive and more sensible option. Suggested that clover leaf interchanges are a more sensible alternative for other interchanges with planned traffic lights. Wonders why the RTA aren't considering city extension of M4 or fixing Windsor Road in short term. Also concerned over how E-tag lanes are being managed on M4 and M5.
19	Suzanne Jones (Rail Infrastructure Corporation)	State	N	Public Transport	Rail	Supports the provision on WSO of median for public transport but is concerned that the width and geometry may not permit the provision of heavy rail. Wants all care to be taken during construction of overbridges to minimise disturbance to operations on Main Western Line and Richmond line. Believes that RTA should be mindful of interactions with potential North West Rail Link particularly re Norwest Boulevard.
20	Peter Kerr	Individual	N	Public Transport	Rail	Wants a railway line constructed in middle of WSO from Rooty Hill to Gelnfield. This line could serve both commuters and freight trains.

21	Richard Johanson	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is concerned that residents in Cecil Hills have not been informed about proposal. Believes that the eastern option is the worst available to residents and environmentally.
22	Frank Amononce	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Wants the western alignment in vicinity of Cecil Hills.
23	Malcolm Holden	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Concerned over the lack of information of the eastern alignments impacts. Wants the RTA to reconsider there option.
24	Glen Amanonce	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Wants the western alignment in vicinity of Cecil Hills.
25	Brad Hall	Individual	N	Consider Alternative Alignment/Option		Concerned that the WSO would be of a scale much greater than that envisaged by landowners in close proximity of Phillip Parkway corridor at Oakhurst. Wants alternative alignments to be considered.
26	Keith Mitchell	Individual	S	Toll Link to F3/Pennant Hills Road Public Transport Upgrade Roads Design Considerations Urban Development Employment	Rail Bus	Supports the use of a toll. Is worried that inner city components of 'orbital' will reach congestion in near future. A link between WSO and F3 must be considered now. A better north-south rail link as part of the proposal should have been considered. Wants the M5 upgraded to three lanes in each direction near 'Crossroads'. Additional bus access and facilities needs to be included such as the extension of bus only lanes from the M2 to Sunnyholt Road. Wants west-facing ramps at Windsor Road. Have full grade separation at WSO/Old Windsor Road/Seven Hills Road. Delay urban development in Rouse Hill in preference to 500m either side of proposed orbital (except for western side of WSO in vicinity of Cecil Hills). Make Quakers Hill into major commercial centre. Develop additional employment zones near Orbital.
27	Saraj Mughal	Individual	N	Surrounding Road Network		Concerned over traffic and environmental implications of additional exit from M5 at Beech Road.
28	Tom Sanderson	Individual	S	Link to F3/Pennant Hills Road		Concerned that the F3 connection has not been considered as part of the project. Concerned that 2 lanes

				More lanes required on WSO		each way on WSO may not be sufficient.
29	Anne and Simon Canli	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Concerned that they were not informed of Eastern Option at Cecil Hills and supports Western Option.
30	Mr and Mrs Kilic	Individual	S	Objects to Eastern Alignment near Cecil Hills.		Concerned over the impacts on them of the Eastern Alignment. Support the original plan through Badgerys Ck.
31	Peter Kelly	Individual		Design Considerations Access		Believes the WSO should include the construction of west facing ramps at Windsor Road. There should be more access to the WSO/M2 in the Seven Hills / Baulkham Hills area.
32	Mr and Mrs Falconetti	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Wants the western alignment in vicinity of Cecil Hills.
33	F and K Suyderhoud	Individual	N	Noise and Vibration		Noise barriers in the vicinity of houses south of the proposed WSO in the Richmond Railway – Sunnyholt strip should be designed to reduce noise to 45dBA.
34	Alan Zammit (Norwest)	Business	S	Design Considerations		Concerned that extension to Norwest Boulevard does not include east facing ramps to the M2. Also concerned about right turn movements onto Old Windsor Road. Believes that west facing ramps at Windsor Road are required.
35	Ben Taylor	Individual	N	Surrounding Road Network Planning and Land Use Flooding and Hydrology Noise and Vibration Overshadowing impact		Concerned that residents in Erin Place Casula have not been informed of the impacts of the M5 junction with the WSO and Beech Road. Believes vacant land in Prestons would be more suitable. Concerned about flooding, noise and sunlight impacts.
36	Kim Ellis (Hoxton Park Airport Limited)	Business	N	Land Acquisition Access Geology and Soils Heritage	Erosion and Sediment Non-Indigenous	Concerned over required acquisition of Airport land and that the WSO and access to Airport could infringe on OLS. The submission also requests that the RTA provide more details on erosion and sediment controls and the implications of the recent listing of the Airport on the RNE.
37	Graham Boyd	Individual	O	Public transport	Rail	The money spent on WSO would be more sensibly

				Air quality Flora and Fauna Water quality Urban Development Environmental Impacts (General)	Cumberland Plain Woodland	channelled to more sustainable transport solutions (such as a rail line). The proposal perpetuates car dependency and the pollution and health problems that result. The WSO would lead to the decline in goods and services at a local level. The WSO would lead to greater dislocation and increases the disadvantages of the less mobile. The EIS deals with environmental impacts superficially such as regional air quality, impacts on Cumberland Plain Woodland, cumulative impacts on water quality in the Hawkesbury Nepean basin and the pressures of urban development on the WSO corridor. Believes the EIS failed to identify the real costs of the proposal whilst overstating the benefits.
38	Lindsay Salt	Individual	N	Consider Alternative Alignment/Option Noise and Vibration		Concerned that the scale of the WSO along the Phillip Parkway corridor in Oakhurst will have larger than expected impacts. Wants sufficient noise controls implemented to minimise impacts.
39	Aram Sarafian	Individual	N	More lanes required on WSO		Concerned that the construction of the WSO as 2 lanes in each direction will be insufficient to meet future demand.
40	Jonathan Orban	Individual	N	Consider Alternative Alignment/Option		Concerned that the alignment of the WSO is not a 'bypass' of Sydney as it should be. Believes an alternative alignment around the greater metropolitan area would be more sensible.
41	Sonja Hudaly	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Objects to the Eastern Alignment in Cecil Hills as it would impact on their privacy, cause pollution and lead to unacceptable noise. Requests that consideration be given to repositioning freeway.
42	Peter Hrastnik	Individual	S	Link to F3/Pennant Hills Road Surrounding Road Network Consider Alternative Alignment/Option		Supports proposal but believes that Lane Cove tunnel and F3 extension is now required. Believes that Browns Waterhole alignment is most sensible.
43	Athol Mullen (Mullen Automotive Engineering)	Business		Link to F3/Pennant Hills Road Design Considerations		Concerned that existing Cumberland Hwy users were not consulted about the proposal. Believes that link to F3 should be considered from WSO in vicinity of Kings Langley through the Galston Gorge. Believes that link

						should be provided to Richmond Road using Castlereagh freeway corridor as an alternative to Windsor Rd and the Northern Road.
44	John and Nevina Vacopoulus	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Wants the western alignment in vicinity of Cecil Hills.
45	Robert Sutka	Individual	N	Consider Alternative Alignment/Option Noise and Vibration		Concerned that with the completion of the Sydney International Equestrian Centre that the WSO may be diverted to impact upon there property on the opposite side of Wallgrove Road. Wonders if noise barriers will be erected on WSO or Wallgrove Road in vicinity of his property.
46	Peter Millgate	Individual	S	Toll More lanes required on WSO Design Considerations Link to F3/Pennant Hills Road Timeframe		Believes that the WSO should be toll free. The WSO should be a minimum of 3 lanes in each direction. Need to look at more direct route between Eastern Creek and M2 rather than Richmond Road 'kink'. The M2 to F3 link needs to be completed as part of this proposal. Why can't the road be completed in a shorter timeframe.
47	Dr Phil McManus (Australian Conservation Foundation)	Community Group	O	Public Transport Greenhouse Gases Heritage Pedestrians Cycleway/Cyclists	Car Dependency Indigenous Non-indigenous	The WSO will only exacerbate the problems of car dependency, greenhouse gas emissions and the inability to make more sustainable forms of transport more viable. Car oriented landscapes are uninviting for pedestrians, cyclists and public transport. The WSO will affect Australia's ability to meet Kyoto protocol requirements. \$1.2 billion to be spent on the WSO could be better spent on more sustainable options. The EIS poorly addresses indigenous and non-indigenous heritage.
48	Andrew Docking (NSW Agriculture)	State	N	Flora and Fauna		Concerned that the construction of the WSO may aid the distribution of noxious weeds. This should be specifically addressed in the EMP.
49	K H Pearce	Individual	N	Heritage	Non-indigenous	As trustee of Pearce Cemetery on Seven Hills road the person is concerned with regard to the proximity of proposed WSO and potential impacts on cemetery.
50	R A James	Individual	N	Surrounding Road Network Property value		Concerned that residents in Erin Place Casula have not been informed of the impacts of the M5 junction with the WSO and Beech Road. Concerned about property value,

				Noise and Vibration Overshadowing impact Consider Alternative Alignment/Option		noise and overshadowing impacts. Believes alternative options need to be considered.
51	J Feilivene	Individual	O	Air Quality Noise and Vibration Traffic		Are concerned that the WSO would further impact on their environment by increase air pollution and noise and increasing traffic on Ferrers Road.
52	John Burkhardt (NSW Dept. of Education)	State	N	Noise and Vibration		The Department requires that the RTA address the criteria levels for internal (Leq 1hr 45dBA existing schools, Leq 1hr 40dBA at new schools) and external noise (Leq 1hr 55dBA) at all schools that have been agreed to. Concerns are raised that the noise assessment hasn't considered noise impacts on Seven Hills North, Hoxton Park High, Hinchinbrook and Prestons Public Schools.
53	D Trezise (Holroyd City Council)	Local	S	Toll Public transport Traffic Noise and Vibration Surrounding Road Network	Rail Modelling	Council supports the proposal but considers that a Prospect Arterial is still critical, opposes a toll and supports the inclusion of a rail corridor as part of proposal. Is unclear why certain sections of the Cumberland Hwy would experience increases in traffic after WSO. Wants noise walls along Cumberland Hwy frontage of Central Gardens.
54	Tripodina family	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills and believes that Western Alignment is best.
55	Catillo and Joanna Cognetti	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Believes the Eastern Alignment near Cecil Hills is the worst of the three considered. The Eastern Alignment would have the highest environmental impacts. Believe that the Western Alignment should be reinstated.
56	Keith Mottram	Individual	S	Open Space Land Acquisition		Concerned about the loss of part of Troubadour Park backing onto his property. The acquisition boundary should be moved closer to where the actual works are to take place. Representatives of residents should be involved in future decision making on the WSO.
57	Kim Riley	Individual	N	Access Toll		Objects to the fact that the WSO would not have direct access to and from Great Western Hwy affecting surrounding industrial areas. Is also concerned over the

						lack of access to and from WSO from Wallgrove Road and Reservoir Rd. Objects to be forced to pay a toll to access certain sections of road.
58	Brian Gore	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports the Western Alignment.
59	Antonio and Emma Fortus	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports the Western Alignment.
60	Nina Saliba	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports the Western Alignment.
61	John Inshaw	Individual	O	Consider Alternative Alignment/Options Air quality		Options other than road transport need to be considered for this corridor. The widened study should include an assessment of the environmental costs of various transport alternatives for both people and freight. Believes that the WSO would lead to continuing unsatisfactory air pollution problems in western Sydney.
62	Beverley Hobbs	Individual	O	Consider Alternative Alignment/Options Air quality		Options other than road transport need to be considered for this corridor. The widened study should include an assessment of the environmental costs of various transport alternatives for both people and freight. Believes that the WSO would lead to continuing unsatisfactory air pollution problems in western Sydney.
63	John and Daniela Cardile	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports the Western Alignment. Wants to know what compensation would be offered.
64	Nikola and Stefica Markovic	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports the Western Alignment.
65	Damien Garner	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports the Western Alignment.
66	Michael and Houda Dakhoul	Individual	N	Objects to Eastern Alignment near Cecil		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental

				Hills.		impact. Supports the Western Alignment.
67	Gerry Morvell (Environment Australia)	Federal	N	Consider Alternative Alignment/Option Flora and Fauna Heritage	Threatened/endanger ed Species Compensatory Habitat Indigenous Non-indigenous	Believes that mitigating measures such as proposal realignment and minimising the footprint be considered where considerable impact is anticipated on threatened species. Raises issue that impacts on threatened flora and fauna on Federal land may trigger need for permit under Section 201 of EPBC Act. Support the proposal for acquisition of compensatory habitat in adjoining areas to the WSO. Indicates that the WSO would not directly impact upon any natural or indigenous heritage items as part of RNE. Is concerned that the archaeological sites identified have not been given relative significance or weighted and that the assessment is deficient in areas. Is concerned that the five items of non-indigenous heritage on the RNE in close proximity to the proposal have not been sufficiently assessed including Hoxton Park Airport under consideration for inclusion on the RNE.
68	Kevin Crnkovic	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports the Western Alignment.
69	M A Menna	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact.
70	Elisabeth Hawkins	Individual	N	Link to F3/Pennant Hills Road		Objects to Pennant Hills Road taking more traffic as a result of the proposal.
71	Dominic Sidoti (Landcom)	State	N	Consider Alternative Alignment/Option Planning and Land Use Noise and Vibration Visual and Urban Design Air quality Services/Utilities Compensation		Prefers the central or western alignments near the future release area of the Aerodrome and Cecil Hills. Concerned over severance of Aerodrome release area affecting future planning for site. Landcom would strongly object to any severed portions of their land being offered as compensatory habitat. Landcom is concerned over the noise, visual, air quality, drainage and future servicing impacts of the proposal on their land holdings. Concerned over Benzene exposure at nearby schools. Want to negotiate appropriate compensation.
72	T and G Lanciano	Individual	N	Objects to Eastern		Is opposed to Eastern Alignment near Cecil Hills as he

				Alignment near Cecil Hills.		believes it would have the greatest environmental impact. Supports Western Alignment.
73	Suzanne Caccamo	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports Western Alignment.
74	E and J Claxton	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact.
75	Year 9, Patrician Brothers College	Community	S	Employment Traffic Toll Flora and fauna	Threatened/endangered species	Support the proposal for the jobs it will create and the benefits to traffic. Object to the toll and are concerned with regard to the impacts on endangered flora and fauna.
76	Gary Hendrikson (Valspar)	Business	N	Land Acquisition Services/Utilities Noise and Vibration		Is concerned over land take at their factory for Power Street interchange, particularly with regard to the substantial investments that they have made, and the safe access to Power Street. Concerned that the encroachment onto their property would effect fire protection buffer and utilities corridors. Wants to negotiate over construction of entry/exit points for the site. Concerned over noise impacts to administration building.
77	Chris and Karen Short	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Wants the western alignment in vicinity of Cecil Hills.
78	LSK Suyderhoud	Individual	N	Noise and Vibration		Noise barriers in the vicinity of houses south of the proposed WSO in the Richmond Railway – Sunnyholt strip should be designed to reduce noise to 35dBA.
79	Darinka Lalic	Individual	N	Access Services/Utilities		Is concerned over the implications of the WSO on their land holding in Hoxton Park including access and services to remaining parcels.
80	Mr and Mrs Tsoukalas	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports Western Alignment.
81	Michael Sultana	Individual	S	Objects to Eastern Alignment near Cecil		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental

				Hills.		impact. Supports Western Alignment.
82	Faith Hanzic	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports Western Alignment.
83	Usatti Family	Individual	O	Land Acquisition Environmental Impacts (General) Consider Alternative Alignment/Option		Is concerned that the WSO would have a detrimental effect to their rural lifestyle. Concerned over the possible purchase of part of their landholdings in Cecil Park and the environmental impacts of the WSO. Wonders why the WSO does not utilise the Wallgrove Road corridor.
84	Esturninos Family	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports Western Alignment.
85	Ron Dowd (Townscape Technologies)	Business	S	Employment Traffic		Supports the proposal as he believes it will foster growth in employment and reduce traffic on local roads and traffic congestion.
86	Robert and Fanny Morandarte	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports Western Alignment.
89*	S Bestwick	Individual	N	Traffic Access Pedestrians		Concerned over the increase in traffic on Norwest Boulevard as a result of proposal. Also concerned with regard to access to Norwest Boulevard and pedestrian safety for crossing the road.
90	Bill Craig (Campbelltown and Districts Commuter Ass)	Community Group		Public transport Air quality Design considerations Environmental Impacts (General) Traffic Upgrade Roads	Rail Car Dependency Interchange	The WSO perpetuates car dependency. Alternative transport solutions need to be found. The proposal would lead to a continued deterioration in air quality. Western Sydney should be given the same public transport opportunities as Eastern Sydney. Car dependency increases sprawl, social inequity and the costs of accidents. Believes we need to diversify our types of fuel and transport systems to cope with predicted oil shortages. The intersections should be redesigned to reduce land take. The EIS does not accurately indicate actual land development close to the WSO. The EIS does not address the extent of environmental impacts of the WSO or alternatives to the proposal. Induced traffic has not been assessed

						adequately. A freight rail line along the WSO median should be considered. Upgrading of the Cumberland Highway as an alternative should have been considered.
91	Charmaine Blundell	Individual	N	Land Acquisition	Compensatory Habitat	Object to the potential purchase of their land for compensatory habitat. Believe that they shouldn't be penalised for keeping trees on their property.
92	Rita Galea	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Objects to the alignment of the WSO in proximity to Cecil Hills.
93	Pennant Hills District Civic Trust	Community Group	N	Link to F3/Pennant Hills Road Public Transport	Rail	Supports the WSO as long as the link between M2 and F3 is investigated to relieve pressure on Pennant Hills Road. Wants urgent investigations into alternative transport including the removal of freight from road to rail. Wants Pennant Hills deleted as designated National Highway Route.
94	Michael Richardson, MP Member for The Hills	MP	N	Heritage Noise and Vibration	Non-indigenous	Submission on behalf of Ken Pearce, trustee of Pearce Cemetery regarding concerns about impacts during construction on cemetery. Submission on behalf of the Excelsior Park Bushland Society regarding noise concerns.
95	Tigone Minh	Individual	N	Cycleway/Cyclists		Suggests that wide roads are constructed that specifically accommodate bicycles.
96	Martin Olmos	Individual	O	Public transport Cycleway/Cyclists Toll		Public transport should be built in western Sydney in preference to WSO. If WSO is built facilities for cyclists including a grade separated track should be provided. No toll should be charged to cyclists.
97	David Delic	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as he believes it would have the greatest environmental impact. Supports Western Alignment.
98	Tony Giusti (Maraya Holdings)	Business		Land Acquisition Property value Access	Compensatory habitat	Are concerned that an earmarked area for potential compensatory habitat is adjacent to their land on Jedda Road, recently approved by Liverpool Council for industrial subdivision. Believe this will reduce value of their land and affect proposed shared road.
99	Mark Hather (DUAP)	State	N	Public transport Traffic	Freight	Refer to submission on file

				Economic Design Considerations Currency of documents Noise and Vibration Staging Western Sydney Regional Parklands Flora and Fauna Badgery's Creek Airport Consider Alternative Alignment/Option Toll Access Pedestrian Cycleway/Cyclists Open space Flooding and hydrology Visual and urban design Heritage Air quality Planning and land use Geology and soils	Interchange Habitat Threatened/endanger ed species Compensatory habitat Indigenous Non-indigenous	
100	Mark Pearce	Individual	N	Heritage Access Visual and Urban design	Non-indigenous	Concerned about impacts of the proposed WSO on Pearce family cemetery. Wants access to cemetery maintained during construction. How will the visual impacts on the cemetery be mitigated?
101	Susana Perez	Individual	N	Consultation Consider Alternative Alignment/Option Overshadowing Impact		Lives at Erin Place and is concerned with the impacts on their area and the lack of consultation with residents. Alignment should be further to the west. Believes noise barriers will reduce sunlight to property.
102	Adrian Perez.	Individual	N	Noise and Vibration		Concerned over noise of trucks from WSO in vicinity of Erin Place property.
103	Gordon Cameron,	State	N	Services/Utilities		Concerned that the WSO would have significant impacts

	Sydney Water			Heritage Urban development		on SWC's infrastructure that have not been addressed sufficiently in the EIS. Wants commercial agreement between proponent and SWC established so that cost and relocation requirements are addressed. The WSO will need a Section 73 certificate. Need to better assess SWC heritage items. Concerned that the WSO will lead to additional urban development in the area and that no analysis has been undertaken in the EIS as to what implications such development would have on SWC water and sewerage infrastructure.
104	Vladimir Hristov	Individual	N	Environmental Impact (General) Greenhouse gases Design considerations	Interchange	Concerned that the WSO would have a devastating environmental impact and contribute towards global warming. Believes that WSO interchanges should be constructed as four leaf clovers to minimise stopping and emissions.
105	Shirphine Loh	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports Western Alignment.
106	Jack de Vries	Individual	S	Link to F3/Pennant Hills Road		Concerned that in promoting the WSO forward planning has not been given to a link to the F3. Pushing traffic onto the already crowded Pennant Hills Road and M2 is not effective.
107	Les Derwent (Scott's Refrigerated Freightways)	Business	N	Design considerations	Interchange	Wants to ensure that the design and construction of interchange at Benara Road caters for B-Triples entering Prestons Industrial Precinct.
108	Brian Peck	Individual	N	Link to F3/Pennant Hills Road		The F3 link must be built at the same time as WSO. Pennant Hills road is already too unsafe.
109	Chris Gardner	Individual	N	More lanes required on WSO Link to F3/ Pennant Hills Road		The WSO should have at least four lanes in each direction. Four lanes in each direction would allow for a dedicated car pooling/bus lane. Concerned that link to F3 has not been considered at the same time.
110	John Cichacz, GHD (on behalf of Sydney Wonderland Park)	Business	S	Access		Supports the WSO but is concerned that southbound traffic would have to travel all the way to Old Wallgrove Road exit to access Wallgrove Road to Sydney Wonderland. This concern is further amplified by additional vehicle movements that would be generated by SEPP 59 developments.

111	Peter Lee (Baulkham Hills Shire Council)	Local	S	Public transport Design considerations Link to F3/ Pennant Hills Road Cycleway/Cyclists	Bus	Believes the WSO should consider the provision of bus services and stops in the design including the need for any carparking in close proximity to the bus stops. Proposal should be considered in conjunction with Epping to Mungerie Park Railway Line. Want west facing ramps at Windsor Road and east facing ramps on Norwest Boulevard extension. Early consideration must be given to link between WSO and F3 congestion on Pennant Hills Road is unacceptable. Monitoring of heavy vehicles should occur on Norwest Boulevard, Showground Road and Castle Hills Road. Consideration should be given to an underpass in vicinity of roundabout at intersection of Old Windsor Road and Seven Hills Road. Need to consider cycleways.
112	R J Ball (Hornsby Shire Council)	Local	S	Link to F3/ Pennant Hills Road Traffic Toll	Modelling	In conjunction with the WSO an alternative to Pennant Hills Road between M2 and F3 must be found. Consideration should not only be given to impacts on Pennant Hills Road from the WSO but also the surrounding road network. Questions the validity of the traffic modelling particularly with regard to Pennant Hills Road. The impacts of the toll on motorist behaviour such as use of 'rat runs' should be considered. Are concerned over toll.
113	Fairfield City Council	Local	S	Toll Badgery's Creek Airport Traffic Road closure Noise and Vibration Air quality Heritage Landscaping Visual and Urban Design Land Use and Planning Flooding and Hydrology Flora and fauna	Non-indigenous Compensatory habitat	Object to a toll. Removing the toll would result in the maximum benefits of diversion of traffic from local roads. Such a toll is likely to need exclusivity clauses within the contract reducing the likelihood of PT provision as part of the WSO corridor. The WSO should be seen as an integrated transport corridor and consideration should be given to the contract requiring such arrangements. The WSO should be assessed as a stand alone project without consideration of a Badgerys Ck Airport. Critical of the traffic and transport sections of the EIS in that they don't sufficiently identify the need for the proposal, fail to show substantial relief on Cumberland Hwy, fail to indicate the diversion of freight traffic to the proposal. Concerned that the WSO would

						cause the closure of Redmayne Road and potential anti-social behaviour, impact on Elizabeth Drive and The Horsley Drive. Wallgrove Road should be downgraded to a local access road. The noise impacts on new residential areas should be considered. The regional noise impacts of the WSO need to be considered as well as the impacts if tolls were removed. Question the height of noise measurements undertaken and several other noise issues. A detailed analysis of sleep disturbance should be included. The EIS needs to present a clearer picture as to the impacts of the WSO during operations on regional air quality. An air quality monitoring program should be included as part of the proposal. Impacts on the heritage items of the Timber Barn (Redmayne Road), Melville Reservoir (Villiers Road) and Abbotsbury House need to be considered. Additional landscaping and visual treatments are required along the proposed corridor. Visual impacts of noise barriers should be considered. Greater consideration is required as to the pressures for landuse change as a result of the WSO. Greater consideration to cumulative impacts particularly with regard to landuse need to be considered. Impacts on community facilities such as schools near to the WSO have not been assessed in appropriate detail. Existing flood data should be used for design. Insufficient space would seem to exist within the road corridor for detention basins. Further clarification is required with regard to f & f impacts and compensatory habitat.
114	Clr Robert Watkins (Mayor of Fairfield)	Local	S	Toll Badgery's Creek Airport Traffic Road closure Noise and Vibration Air quality Heritage Landscaping	Non-indigenous	Reiterates the main issues raised in Councils submission (113).

				Visual and Urban Design Land Use and Planning Flooding and Hydrology Flora and fauna	Compensatory habitat	
115	Jack Floehl	Individual	S	Water quality Air quality Flora and fauna	Threatened/endanger ed species	Supports the proposal and the concept of an orbital road. Recognises that potential impacts may occur to water quality, air quality and threatened flora and fauna but believes these can be easily resolved through good engineering and environmental practice.
116	Janice Crosio, Member for Prospect	MP	S	Traffic Toll		Concerned that the WSO would not relieve traffic pressure on the Cumberland Hwy, The Horsley Drive and Elizabeth Drive. Impacts of traffic on Smithfield should be considered. Concerned that the high toll would lead to more people using local road alternatives.
117	Tania and Vincenzo Pacenza	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports Western Alignment.
118	Trevor Jennings (Busways)	Business	N	Public transport More lanes required on WSO	Bus	Concerned that the WSO would further disadvantage the potential use of PT. The funds could be channelled into PT projects. Believes that the WSO should include three lanes in each direction from the outset with a dedicated bus or transit lane. The WSO would also cause inconveniences to some of the Busway services.
119	Mr and Mrs H Forsythe	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports Western Alignment.
120	David Hartmann (Camden Council)	Local	S	Toll Surrounding Road Network Public transport Staging		Object to a toll. Concerned that the toll would reduce the benefits of the proposal upon the surrounding local road network. The EIS should more closely look at connecting roads such as Camden Valley Way, Narellan Road and M5 including PT access. More consideration to PT provision should be considered. Concerned that the southern sections of the WSO may be delayed in the proposed staging.
121	D & M Mileto	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports Western Alignment.

122	Mike Belfield	Individual	S	Design considerations Link to F3/Pennant Hills Road Toll Commencement of project	Interchange	Believes that all of the interchanges should allow for access to and from the WSO from all directions. Is concerned that link between M2 and F3 has not been considered. Slipways should be of sufficient length to allow merging vehicles to attain freeway speeds. Concerned over the toll and any future increases or contractual arrangements that make government responsible for any losses. Wants the cheapest and easiest to construct sections started ASAP.
123	John Cunico	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports Western Alignment.
124	Ian Reynolds (Blacktown City Council)	Local	S	Access Safety Air quality Public transport Design considerations Upgrade Roads Traffic Pedestrian Cycleway/Cyclists Toll Staging Surrounding Road Network Link to F3/Pennant Hills Road Noise and Vibration Heritage Landscaping Land use and Planning Groundwater Salinity Water quality Flora and fauna Social	Bus Interchange Modelling Non-indigenous Compensatory habitat	Support the concept of the WSO in improving accessibility within Western Sydney which should lead to economic and employment growth. Believe that the WSO should lead to improved road safety, air quality due to reduced congestion and has the potential to improve PT. Believes that an interchange of the WSO should be provided at Eastern Road both for access to and from surrounding residential areas and also to Aquilina Reserve. The impact of the intersection at Power Street (a local road) have not been discussed. Want an interchange between M4 and Wallgrove Road maintained so that residents of Mount Druitt and Rooty Hill are not forced to pay a WSO toll to access the M4. Want Rooty Hill Road North upgraded. The Quakers Hill Parkway and Old Windsor Road interchanges with the WSO should provide for all movements. Raise concerns over the accuracy of traffic data used in modelling. PT should be provided for within the WSO corridor such as bus priority lanes for cross regional trips at the proposals inception. Consideration should be given to pedestrian access to any PT service along the WSO. Some refinements to the off-road cycleway alignment are required. Object to the toll particularly on equity grounds. Tolls will not lead to the improvements to the local road network that otherwise would have

						occurred. Tolls should not be levied on those using the WSO for local access. Staging process should involve Councils and more closely relate to traffic benefits. The EIS should address the relationship of the WSO to the Prospect Arterial. Connections between the WSO and F3 should be considered in tandem with the WSO. The EMP prepared for the project must closely look at potential noise and air quality impacts of the WSO. Noise barriers should be constructed early in the construction phase. The use of open space areas as noise buffer zones around residential areas is not encouraged as an appropriate mitigation and attenuation should be investigated. The Native Institution has not been sufficiently assessed and some non-indigenous heritage items need to be more closely examined. Support the concept of a comprehensive landscape strategy as part of WSO. Deficiencies with the EIS Land Use assessment are identified such as not identifying some residential areas. Concerned over the extent of landtake for the M4/WSO interchange. Strategies for severed and residual lands should be put in place. The EIS should more closely investigate impacts of the WSO on groundwater levels and salinity. The design and monitoring regime for proposed water quality devices should be revisited. Concerned that the WSO does not identify the appropriate commonwealth legislation for f & f ie. EPBC Act. As the majority of CPW to be removed is in Blacktown LGA compensatory habitat should also be focussed within this area. Compensatory habitat at Wonderland Sydney site is not appropriate as this is being dealt with through precinct planning mechanisms. A comprehensive social impact assessment should be undertaken prior to determination of the EIS.
125	Neil Gillard	Individual	N	Public transport Consider Alternative Alignment/Options Social	Rail	The potential for light or heavy rail along the centre of the proposal should be removed from plans as he believes it would not be possible. Concerned that the alignment of the WSO along the Phillip Parkway is a big

						change from 2 lane arterial originally proposed and wants the RTA to consider alternative alignments such as to the east closer to industrial areas. Should consider impacts on people ahead of impacts on f & f.
126	Amanda Spalding (Parramatta City Council)	Local	S	Toll Land use and planning Public transport Flora and fauna	Threatened/endangered species	Opposes the toll on WSO and concerned that the EIS does not provide details of impacts of WSO with or without toll. The EIS does not address landuse pressures that will be created by WSO. Concerned that the EIS does not identify substantial benefits for surrounding road network, nor examine potential PT role of WSO in any detail. Concerned that the toll will exclude from the use of the road those unable to afford the cost reducing benefits of the road. The integration of this toll road with others needs to be considered. Concerned over potential local impacts on threatened flora and fauna.
127	S & A Canli & M & S Canli	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as they believe it would have the greatest environmental impact. Supports Western Alignment. Concerned over lack of consultation with residents.
128	Clr Mark Pigram (Western Sydney Alliance)	Community Group	S	Badgery's Creek Airport		The WSO is needed as a stand alone project without any reliance on a Badgerys Ck airport.
129	Stephen Lees (Upper Parramatta River Catchment Trust)	State	N	Stormwater Flooding and hydrology Geology and soils	Erosion and sediment	Believes that the proposed on-site stormwater controls in the EIS generally meet their requirements. The WSO must not lead to impacts of flooding and erosion of Lalor and Toongabbie Creeks. Main concern is potential loss of Sierra Place flood retarding basin which may require the raising of the bridge and abutments and reduction of bridge piers at Toongabbie Ck. Concerned over impact on Model Farms Ck.
130	Paul Tosi (Campbelltown City Council)	Local	N	Surrounding Road Network Design considerations Link to F3/Pennat Hills Road More lanes required for WSO		Concerned that roads such as M5, Camden Valley Way and Campbelltown Rd will experience increased traffic as a result of WSO. Believe improvements to these roads should occur prior to opening of WSO. Request that the RTA review the link between Glenfield and East Hills via Holsworthy to address congestion concerns on the M5. The WSO project should include an extension

				Public transport		to F3. The WSO should be constructed with 3 lanes in each direction and public transport facilities should be included.
131	Graeme Jarman	Individual	N	More lanes required for WSO		WSO should be at least 3 lanes in each direction to avoid future congestion.
132	Ron Bergin (StateWide Roads - M4 Leaser)	Business	S	Design Considerations Staging		Concerned that proposed roundabout junction between M4 and WSO could cause queuing onto these roads at peak times. Queuing may also lead to problems at Reservoir, Roper and/or Mamre Roads. Construction of interchange with M4 should involve the minimum of disturbance to traffic flows. Believe that the project should be let as a number of stages rather than one package to contractors.
133	David Martin (Roads and Traffic Advisory Council)	State	S	Traffic	Freight	The WSO should consider the inclusion of appropriately located rest areas and variable message signs addressing travel times to help facilitate freight movements.
134	Giselle Howard (DLWC)	State	N	Design considerations Flooding and hydrology Geology and Soils Salinity Groundwater Flora and fauna Stormwater	Erosion and sediment Compensatory habitat Revegetation	Supports EIS principle to construct bridges rather than culverts where crossing watercourse and to set back abutments to enable wildlife flow, however is concerned that concept design indicates the inclusion of culverts at some drainage crossing points. All watercourse crossings should be in the form of a bridge. Oppose the construction of an on-line detention basin close to Maxwells Ck due to impacts on the Creeks health. Believe that the section of the road from the Kurrajong Road overpass to Maxwells Ck should be bridged. Erosion and sediment control plan should be prepared in accordance with Blue Book. Salinity impacts of the WSO should be addressed such as the construction of embankments or impeding groundwater flow. Support the need for compensatory habitat for the loss of Cumberland Plain Woodland. Revegetation where possible should be fully continuous on both sides of the proposal. Oppose the use of non-indigenous plantings for gateways. Support the stormwater treatments proposed as long as they are included as off line from any watercourses.

135	Paul Jasper	Individual	N	Economic Design considerations Link to F3/Pennant Hills Road		Believes that whilst the WSO is a commendable proposal it is being put forward for political reasons ahead of other vital road proposals such as the F6. A comparative economic assessment between the two projects should be conducted. The WSO should be designed to the standards set on other road projects such as the Gold Coast to Brisbane and Citylink freeways. To maximise the benefits of the WSO the M2 to F3 link is needed. The Hume Highway at Prestons and grade separated interchange at Moorebank Rd is needed. A motorway standard road between the Hume Hwy and Mt Ousley Rd should be constructed as an alternative to Appin Rd.
136	Kathryn Ridge (Nature Conservation Council)	Community Organisation	O	Environmental impacts (General) Consider Alternative Alignment/Options Flora and fauna Currency of Documents Upgrade roads Traffic Air quality Public transport	Revegetation Compensatory habitat Threatened/endanger ed species Freight	The impacts on the natural environment are not assessed with sufficient weight. Alternative options to the WSO are not assessed with sufficient detail. Edge effects have not been addressed. Replanting proposals do not list a sufficient number of plants. Believe that any compensatory habitat provided should be at least 10 times the size of the areas to be destroyed. The flora and fauna studies are out of date. Concerned that the ameliorative measures for threatened species are not sufficient. Alternative alignments to reduce impacts should be considered or sites protected in some other way such as not constructing the WSO and upgrading existing roads. The WSO is an ill-conceived answer to Western Sydney's transport problems and will further entrench car ownership. The benefit to freight of the WSO has not been established. The WSO reduces the likelihood of meeting requirements in 'Action for Air' to reduce vkts. Public transport can be successful with low densities as is shown by the Toronto example.
137	John Gardiner (Interlink Roads – Owner of M5)	Business	S	Surrounding Road Network Design considerations Access Cycleway/Cyclists		Support the concept of 6 lanes on the M5 north of Camden Valley Way prior to WSO. Are concerned that WSO traffic may cause pavement deterioration on M5. The location of potential service centres on M5 may be in conflict with WSO/M5 interchange. The EIS does not consider the impact of the additional northbound lane on

						the Camden Valley Way to accommodate for the northbound on ramp at the Hume Highway. Believe that a travel speed of 110km/h should be maintained on M5 during construction and operation. Access to construction sites should not be from the M5. Concerned over the impacts to the M5 of construction of the interchange. Believe that construction of the interchange within Interlink leasehold land may be best conducted by Interlink. Access to the M5 needs to be maintained from Camden Valley Way during construction. Should not affect cyclist access on the M5. Believe the footprint in the area (to allow for safe merging) would be greater than that shown in the EIS.
138	Raj Karthigeyan (Telstra)	Business	N	Services/Utilities		Concerned over the impact to Telstra services and the costs of required relocations.
139	Jean and Joseph Israfil	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as they believe it would have the greatest environmental impact. Supports Western Alignment.
140	Liliana Araboghlian	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as they believe it would have the greatest environmental impact. Supports Western Alignment.
141	Sam Araboghlian	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as they believe it would have the greatest environmental impact. Supports Western Alignment.
142	Nabil Gazal (Gazcorp)	Business	N	Land acquisition Access		Object to the use of their property to allow the relocation of access to Austral Bricks removing their frontage and some access to Wallgrove Rd. Access should be modified to Wallgrove Rd such as a T junction or roundabout.
143	Erin Lewington	Individual	N	Flora and fauna Link to F3/Pennant Hills Road Consider Alternative Alignment/Option Toll	Cumberland Plain Woodland	Concerned over the loss of Cumberland Plain Woodland as a result of proposal. A connection to F3 should be part of proposal. The WSO encroaches on existing residential areas and should be further west to constitute a true orbital road. Objects to toll.
144	Brenda Clifton	Individual	N	Design Considerations		Concerned over the Norwest Boulevard/WSO

						interchange. The broad curve of the west bound on-load ramp is too close to residents in Sporing Ave Kings Langley and should be flatter and lower to minimise environmental impacts such as noise, visual etc. A full interchange at Old Windsor Road should be considered as an alternative to <u>proposed interchange</u> .
145	Jan Deighton (Excelsior Park Bushland Society)	Community Group		Noise and Vibration Traffic		Object to the lack of noise walls on the M2 Darling Ck Bridge. Concerned over greater traffic and greater noise at this location as a result of WSO. 6m high noise walls should be constructed. Concerned that the EIS underestimates the noise impacts of the proposal on this area.
146	Olimpia Miceli	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as they believe it would have the greatest environmental impact. <u>Supports Western Alignment.</u>
147	Joe Woodward (EPA)	State	N	Staging Public transport Air quality Traffic Noise and Vibration Contamination Geology and soils Groundwater Stormwater Economic		Believes the RTA should hold the EPL for the construction of the project to ensure consistency. The RTA should commit to independent monitoring or environmental performance during construction. The splitting of the proposal into two sections leads to inconsistencies in the assessment. Concerned that the project will promote car dependency and effect commitments made to PT provision and objectives in 'Action for Air'. The estimates of impacts on air quality does not seem to include induced traffic. PT provision on the WSO should be considered as an environmental offset for air quality impacts. Additional noise impact assessment is required to address potential construction noise. Acute noise impacts or work outside of normal construction hours should be negotiated between the proponent and those to be directly affected including the need for respite times. Regenerated noise and vibration should be included in any management plan. A number of inconsistencies between the traffic noise assessments in the southern and northern sections are cited. More details are required of proposed noise barriers and other <u>mitigation measures</u> . An assessment of potentially

						contaminated land and remediation required needs to be included in accordance with SEPP 55. Contingencies in case ASSs are encountered are required. Effective dust suppression is required during construction. Greater assessment on impacts on groundwater should be undertaken. Stormwater reuse should be considered. Stormwater collected must be treated prior to discharge. A contingency plan should be established for contaminated water and collection ponds for operation should be designed to accommodate wash down waters of largest tanker spillage. The economic analysis does not comply with guidelines. The economic analysis did not include the impacts of induced traffic nor the negative environmental externalities of the project or address ESD principles.
148	Richard Powis (Integral Energy)	Business	N	Services/Utilities		Concerned that the EIS only deals superficially with electrical infrastructure. A number of Integral assets are within the vicinity of the WSO. Future provision of infrastructure should also be considered. Undergrounding some assets may be extremely difficult. Overpasses or underpasses should make sufficient space available to potential future assets particularly in future urban release areas.
Un	Danny Hannan (CAMWEST)	Community Group	N	Cycleway/Cyclists Air quality Public transport		The WSO should contain a grade separated high speed cycleway as an alternative to using breakdown lanes for commuting cyclists. The WSO will exacerbate car dependency and problems with air pollution. PT options should be considered as alternatives to the WSO.
149	Evelina Flores (Dean Park Community Development Committee)	Community Group	N	Noise and Vibration Air quality Flora and fauna	Revegetation	Concerned that Dean Park will be 'surrounded' by proposed WSO. Mitigative measures for noise, air quality and tree plantings are of critical importance to Dean Park residents.
150	Kerry Brew (Hawkesbury Nepean Catchment Management Trust)	State	N	Geology and Soils Design considerations Stormwater Flora and fauna	Erosion and sediment Revegetation Compensatory habitat	Concerned that the EIS lacks the required detail. The proposal needs to be considered in relation to the surrounding regional catchment. Do not agree that treatment measures other than grass are not required where the road is in cut. Measures to reduce sediment

				Landscaping Heritage		entering sedimentation basins need to be considered prior to adding chemical flocculants. Where the construction cross-section is steep different levels for the carriageways should be considered. Monitoring should be undertaken by an independent person or body. Monitoring and management plans need to be flexible and transparent. Run-off control structures should be off-stream. More detail is required regarding stormwater interceptors and discharge structures. Ponds should be set further back from creeks. Believes that impacts on CPW have been underestimated and 'seral' regrowth areas must be included. The impact of the WSO on the NPWS Recovery Plan should be considered. Vertical walls or tunnels should be considered to minimise impacts on CPW. Revegetation should not occur in areas which would naturally regenerate. Feature landscaping should include endemic species. Site management must include weed control and should be for 5-10 years after construction not the 24 months suggested. Compensatory habitat should aim to increase habitat values within an ecosystem and management plans for compensatory habitat should be in place prior to any clearing. The compensatory habitat proposal in the EIS is insufficient. The package should aim to purchase degraded CPW or cleared areas that could be rehabilitated into CPW. The EIS should consider realignments or bridging of cultural heritage areas.
151	Rachel Krstic	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports Western Alignment.
152	Steven and Maria Cunico	Individual	N	Objects to Eastern Alignment near Cecil Hills.		Is opposed to Eastern Alignment near Cecil Hills as they believe it would have the greatest environmental impact. Supports Western Alignment.
153	K Riley	Individual	N	Public transport	Rail	Objects to the lack of provision for rail access in corridor. It seems obvious that serious consideration has not been given to future PT usage.
154	Peter Griffin	Individual	O	Surrounding Road		Believes the tollway is misconceived and will not work.

				Network Link to F3/Pennant Hills Road		The WSO is too far west Prospect Highway would be a far more likely route to use for those travelling to the north or south of Sydney. Other 'rat runs' would be much more attractive than WSO. The proposed motorway should incorporate the Prospect Highway reducing costs and impacts. The M2 to F3 corridor should be taken into account now.
155	Jonathon Falk (Jonathon Falk Planning Consultants)	Business	O	Public transport Land Use and Planning Land acquisition Toll Air quality		Objects to the fact that PT has not been catered for. Believes the WSO does not relate to planning strategies for GMR in Sydney. The WSO proposal should be reviewed in light of more important PT projects. Consideration should be given to reducing width of proposal to minimise landtake from parkland. The justification for the project without the SSA is unclear. It is unclear whether motorists would pay the large proposed toll. The WSO will lead to a deterioration in air quality and encourage more industry into this area leading to further deterioration. There should be a special Commission to investigate need for WSO.
156	Neil Tonkin (Bicycle NSW)	Community Organisation	N	Cycleway/Cyclists Safety		Wish to applaud the RTA for proposed provision for cyclists on WSO. Happy with concept to use shoulders on Freeway but concerned with potential conflicts at entry and exit ramps. Grade separation for cyclists should be constructed at all of these interchanges.
157	Denis Juelicher (Bankstown Transport Coalition)	Community Organisation		Public transport Employment Toll		Main concern is that the WSO does not include PT provision. If PT provision is not included from the outset then an alternative to car travel will be lost forever. The WSO is an ideal opportunity to provide integrated transport provision. Access by PT to businesses and employment which will be attracted into the area by the WSO should be provided. Any PT on the WSO should not have to pay the toll.
158	Craig Ross (Penrith City Council)	Local	S	Traffic Surrounding road network Toll		Main concern is traffic flow on the arterial road network in the Penrith LGA. Direct arterial road links to the Erskine Park Employment Area and the northern residential areas of the LGA would be desirable. Requests the RTA to advance the planning for such

						links. Also only National Highway to attract a toll. Would not oppose a shadow toll but objects to the proposed direct toll on road users.
159	Gary and Yolinda de Bruyn	Individual	N	Social Flora and Fauna Currency of Documents Noise and Vibration Lighting		Potential movement of termites from reserve to properties during construction. Flora data be updated (done in 1996) and bushfires since then. If endangered flora not an issue, would like road realigned back into the centre of the corridor to equally distribute noise. Will there be no street lighting except at interchanges?
160	Brendan Mills	Individual	S	Road closure		Main concern is the closure or cutting off of certain smaller roads. Link the WSO to new bus transitway and the a new Sydney West Second Airport
161	Caterina Chiefari	Individual	N	Objects to Eastern Alignment near Cecil Hills		Main concern is closeness to home. Produce noise and air pollution and damage natural flora. Re-look at the proposed western alignment.
162	Sylvia Nuttgens (Blacktown and District Environment Group)	Community Organisation	N	Flora and fauna Consider Alternative Alignment/Option Heritage Water quality Toll	Compensatory habitat Threatened/endanger ed species Indigenous Non-indigenous	Major concern is impact on ecological values in western Sydney. Avoid important stand of native vegetation, especially threatened ecological communities. Maintain buffer zone around waterways. Reconsider alternative routes. Concern about impact on fauna species including displacement and endangered species. Object to removal/damage to Aboriginal sites. Retain as much non-indigenous heritage as possible. Do not support compensatory habitat buyback although list bushland suitable for compensatory habitat. Soil and plant translocation is a last resort. List sites of particular concern. Other concern are no reference made to obligations to international conventions and treaties, lowering of water quality, toll to assist in promoting ecological values and construction timed so nesting/rearing of birds and fauna is taken into account.
163	Ross A Rapmund	Individual	N	Flora and fauna Landscaping	Compensatory habitat Revegetation	Amount of vegetation earmarked for destruction. Actual size of the road corridor/footprint is unclear, amount of extra vegetation impacted. Fragmented strips of vegetation should be included in compensatory habitat. Believes more than 73ha of significant vegetation will be damaged. Vertical walls rather than road batters. EISs

						for upgrades on entry and exit points to the WSO? Will the EMP go on display for public comment prior to construction? Compensatory habitat: what happens if land not designated? Will threatened species be used for landscaping? Landscape Strategy Plan displayed? Plant species list is not comprehensive. Seed collecting period too short for volume of landscaping/revegetation. Use of exotic grasses opposed. Maintenance of landscaped and vegetated areas.
164	Paul Lynch (Member for Liverpool)	MP	N	Objects to Eastern Alignment near Cecil Hills		Concern of proposed route which will go to the west of Cecil Hills. Impacts include visual, noise, air. Support proposal just not route option. Want the eastern alignment.
165	Anna Van der Helm	Individual	O	Objects to Eastern Alignment near Cecil Hills		Against the eastern alignment as so close to the Cecil Hills Estate.
166	Dennis Morgan	Individual	N	Link to F3/Pennant Hills Road Traffic Surrounding Road Network		Increased impacts of WSO on the M2 link to the F3 have not been addressed. Traffic volumes for night not addressed, the time when most heavy interstate transport operates. Impacts need to be assessed. Concern over impact of the proposal on the M2 and it's surrounding environment. All impacts of the WSO freight route need to be addressed for this section of the M2.
167	Malcolm Hughes (Sydney Catchment Authority)	State	N	Services/Utilities Pedestrian Cycleway/Cyclists		Warragamba Pipeline. Integrity of pipeline not undermined by construction of the WSO. Prevent structural damage to pipeline and auxiliary works. Through access must remain available. Pipelines remain serviceable with minimum clearance of 2m. Security concerns of pedestrian/cyclist access along the pipeline, area must be fenced.
168	George, Irena, Rikard and Natalie Smit	Individual/Family	N	Objects to Eastern Alignment near Cecil Hills		Protect against the construction of the eastern alignment. Not against WSO in general. Alarmed at damage to environment, heritage and quality of life. Should go ahead with the western alignment.
169	Bob Sims	Individual	N	Toll		Suggests that electronic tolling is set at a sliding scale that fits the demand.
170	Paul and Carolyn Bennett	Individual	N	Objects to Eastern Alignment near Cecil Hills		Oppose the eastern alignment. Support the WSO. Want the western alignment.

171	Tony Polvere (Planning and Development Solutions Pty Ltd)	Business	N	Urban Development Employment Public Transport Air Quality Access		Issues raised in relation to the future development of the Marsden Park Area. Most UDP release areas have little or no remaining development potential. Impact of urbanisation of the RHDA should be expanded to include the Marsden Park area. Employment Growth. Fails to adequately address the potential environmental benefits of providing public transport along the WSO. Air quality assessment does not include reference to the positive impact of providing public transport. Address public transport more. Adequacy of access arrangements. Use the WSO as an infrastructure corridor for future growth.
172	Ray Schembri	Individual	N	Objects to Eastern Alignment near Cecil Hills		Protests the eastern alignment. Highest visual and sensitivity impact, hydrology of the area transformed, highest noise impact, landslip issues, highest air quality impact, direct impact on the wetlands area, threatened species, endangered ecological communities, indigenous heritage. Supports the western alignment.
173	Margaret Schembri	Individual	N	Objects to Eastern Alignment near Cecil Hills		Protests against the eastern alignment. Agrees with concept of WSO. Impacts of eastern alignment include visual, noise pollution, air quality, water pollution, , landslip, Cumberland plain woodlands, threatened species of fauna and aboriginal sites. Use the western alignment.
174	Denis Bainbridge	Individual	N	Link to F3/Pennant Hills Road		Concerned about proposal to use Pennant Hills Road as the link between the M2 and F3. Pennant Hills Road currently a grid-locked mess. Impact on this road neglected.
175	David Delic	Individual	N	Objects to Eastern Alignment near Cecil Hills		Against the eastern alignment. Agree with WSO but want the western alignment.
176	Glen Hunter	Individual	O	Public transport Traffic	Rail Freight	Oppose the construction of the WSO. Prefer increased public transport, particularly high speed electric rail systems. For freight, upgrade rail systems drawing heavy trucks off the road. Both recommendations more environmentally friendly. Invest money into more efficient mass transit solutions.
177	Mojmir Damjanovic	Individual	O	Objects to Eastern		Protest WSO over their property. Destroy family home,

				Alignment near Cecil Hills		poultry farming facilities and access.
178	James, Jenny and Joshua Sheddon	Individual/Family	N	Objects to Eastern Alignment near Cecil Hills		Protest against the eastern alignment. Agree with WSO but want the western alignment. Noise, pollution and devaluation of home. Eastern alignment fails in the following areas: noise, flora/fauna, birds from Japan, water run-off, night time noise, landslip, Aboriginal sites, local traffic. Has the highest visual impact, noise impact, air quality impact on Cecil Hills, devaluation to property impacts on Cecil Hills, impact on endangered ecological communities and threatened species.
179	Gloria Smith	Individual	N	Objects to Eastern Alignment near Cecil Hills		Protest against the eastern alignment. Agree with WSO but want the western alignment. Eastern alignment has negligible costs savings. Reject eastern alignment as impacts include noise, natural flora and fauna, destruction of dam, water run-off, landslip, Aboriginal sites, increased traffic and air quality.
180	Miranda Podrez	Individual	N	Objects to Eastern Alignment near Cecil Hills		Against the eastern alignment. Western alignment is the best. Eastern alignment will affect noise, trees and native shrubs, birds from Japan, Aboriginal sites, landslides, air quality and night time traffic. Why no noise barriers?
181	Margaret Ainsworth	Individual	N	Objects to Eastern Alignment near Cecil Hills		Protest against eastern alignment. Not against WSO in general, want western alignment. Eastern alignment fails in visual, , air quality, noise, flora, birds from Japan, water run-off and Aboriginal sites.
182	Paul Smith	Individual	N	Objects to Eastern Alignment near Cecil Hills		Protest eastern alignment. Agree with WSO though. Want western alignment. Eastern has highest impact on Cecil Hills residents in air quality, noise, flora and fauna, visual, Aboriginal sites and landslide. Concern over endangered ecological communities and threatened species, property values, local traffic and community.
183	Pina Marvello	Individual	N	Objects to Eastern Alignment near Cecil Hills		Protest against eastern and central alignments. Choose the western alignment. Choice of eastern alignment was a financial one. More noise, local traffic, destroy Aboriginal sites, landslide areas, drainage, endanger flora and fauna.
184	Jane and Tony Curcio	Individual	N	Objects to Eastern		Protest against the eastern alignment. Agree with WSO

				Alignment near Cecil Hills		but want the western alignment.
185	Branko Suric	Individual	O	Objects to Eastern Alignment near Cecil Hills		Protest against the WSO, in particular the Eastern Alignment.
186	Carol May Bradley	Individual	N	Objects to Eastern Alignment near Cecil Hills		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports the Western Alignment.
187	M Botfield	Individual	N	Objects to Eastern Alignment near Cecil Hills		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports the Western Alignment. Based on monetary motivation.
188	Julio Boff and Sarah Marsh	Individual	O	Noise and Vibration Air quality Social Property value Flora and fauna	Threatened/endangered species	Two major concerns are noise and air pollution. Social impact on families in the area. Financial impact due to devaluation of property. Threatened species.
189	Lillian Buttie	Individual	N	Objects to Eastern Alignment near Cecil Hills		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports the Western Alignment.
190	Sydney Buttie	Individual	N	Objects to Eastern Alignment near Cecil Hills		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports the Western Alignment.
191	Allan and Wendy Benson	Individual	N	Objects to Eastern Alignment near Cecil Hills		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports the Western Alignment and the Central Alignment.
192	Luisa Zanella	Individual	N	Objects to Eastern Alignment near Cecil Hills		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports the Western Alignment.
193	Lorenzo Zanella	Individual	N	Objects to Eastern Alignment near Cecil Hills		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports the Western Alignment.
194	Anna Zanella	Individual	N	Objects to Eastern Alignment near Cecil Hills		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports the Western Alignment.
195	Franco Zanella	Individual	N	Objects to Eastern		Is opposed to Eastern Alignment near Cecil Hills as she

				Alignment near Cecil Hills		believes it would have the greatest environmental impact. Supports the Western Alignment.
196	Benedetto & Concetta Sanzone	Individual	N	Objects to Eastern Alignment near Cecil Hills		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports the Western Alignment.
197	Dino and Rosella Mazzolini	Individual	N	Objects to Eastern Alignment near Cecil Hills		Is opposed to Eastern Alignment near Cecil Hills as she believes it would have the greatest environmental impact. Supports the Western Alignment.
198	David Newton	Individual	O	Social		Strongly object to the proposed WSO. Community was not informed of the proposed route.
199	EO Iafeta and PL Iafeta	Individual	O	Social		Strongly object to the proposed WSO. Community was not informed of the proposed route.
200	Lina Perez	Individual	O	Social		Strongly object to the proposed WSO. Community was not informed of the proposed route.
201	David Hughes (Olympic Co-ordination Authority)	Federal	N	Access Land acquisition Noise and Vibration Overshadowing impact Air quality		Supports the views that the WSO will provide an essential missing link for transport planning for Sydney. Aim to restrict additional capital cost to the Blacktown Olympic Centre, ensure long-term viability and minimise impact to amenity and environment. Effects of WSO are loss of entry of Phillip Parkway and loss of land and buffer zone to minimise noise, light and air quality impact. Provides recommendations for improvement.
201	David Hughes (Olympic Co-ordination Authority)	Federal	N			No impact on the shooting centre.
201	David Hughes (Olympic Co-ordination Authority)	Federal	N	Land acquisition Flora and fauna Consider Alternative Alignment/Option		Supports the views that the WSO will provide an essential missing link for transport planning for Sydney. Aim to restrict additional capital cost, ensure long-term viability and minimise impact to amenity and environment. Effects of WSO are loss of arenas, entry and gates, parking areas, roads and paths, vegetation, land and buffer zone. Road alignment shifted east and has a severe impact on the core operating areas of the venue. Provides recommendations for improvement. Second letter attached on how the proposal will affect all 3 OCA centres. Western alignment not good for shooting centre. Prefer eastern alignment. Need

						alignment as far west as possible for equestrian centre. No realignment of Horsley Drive for the equestrian centre.
202	Bernard Blackley (Department of Defence)	Federal	S	Access Urban development		The WSO will provide valuable connections for the growing residential and employment areas in South Western Sydney and encourage new industries to these areas. The improved accessibility will support increased development in surrounding areas, including on those Defence lands identified for disposal.
203	Bruce Poon	Individual	N	Noise and Vibration Flora and Fauna		WSO close to crossing of Toongabbie Creek and joining of M2 motorway. Concern include impacts during the construction period (namely noise), impacts by the construction of road and bridge over Toongabbie Creek (namely noise) and impact on native animals and plants.
204	Rob and Evelyn Baluyot	Individual	N	Objects to Eastern Alignment near Cecil Hills		Objects to the eastern alignment of the WSO. Not against the WSO in general. Supports the Western alignment.
205	Aleksandar Kurcubic	Individual	O	Objects to the WSO		Objects to the WSO.
206	Angelina Moral	Individual	N	Objects to Eastern Alignment near Cecil Hills		Objects to the eastern alignment of the WSO. Not against the WSO in general. Supports the Western alignment.
207	Rocco Pellgrino	Individual	N	Objects to Eastern Alignment near Cecil Hills		Object to the eastern alignment of the WSO. Not against the WSO in general. Supports the Western alignment.
208	Paul Trevakis (Blue Mountains Commuter and Transport Users Association)	Community Organisation	S	Public transport	Rail	Agree that Orbital should be built but with the provision that the Design should take into account consideration of the grades of the Route so that the Route can be used with Light Rail Systems.
209	Philip Laird (School of Mathematics and Applied Statistics University of Wollongong)	Individual	O	Public transport Toll	Rail	Introduce vehicle demand management in Sydney. Increase public transport usage. Need more funding for rail projects rather than roads, including Sydney rail freight bypass. Advance Sydney rail projects. Approval should not be given until the NSW Government has released the NSW strategy foreshadowed in Action for Transport 2010. Supports tolls. Road transport more energy intensive than rail and urban public transport, should reduce dependence on imported oil. Does not agree with approval process. Present proposal should

						not proceed and firm plans should be drawn up for a Sydney Freight Bypass together with Campbelltown-Mittagong and Hornsby-Newcastle track straightening and an agreed strategy has been developed for vehicle demand management. Complete the Parramatta-Chatswood rail link. Proposal not to be determined by the RTA.
210	Mr KJ Burke	Individual	N	Design considerations		EIS for the proposed WSO should include investigation of provision of west facing ramps onto the M2 Tollway at Windsor Road.
211	William Morris (For the Estate of H&W Morris)	Individual	N	Land Acquisition:	Compensatory habitat	Protest about proposed acquisition of land on Horsley Drive for the purpose of a compensatory habitat. Land been in the family for 60 years.
212	Steven Klinger (For Mr and Mrs G and R Ghignone)	Individual	N	Land Acquisition:	Compensatory habitat	Make representations as to why the land is totally inappropriate for acquisition. Purpose is for habitat compensation. Problems include costs of acquisition, zoning of land, use of land, environment defect. Will not willingly sell their land, it will have to be compulsorily acquired.
213	Richard Martyr (For the Valspar Corporation Pty Ltd)	Business	N	Land Acquisition Property value		Expressed concern about the impact of the interchange at Power Street upon the safe accessibility of the site from the street. Want total impact quantified. Looking to negotiate a global settlement in regard to the impact of the WSO on the site and operations. Do not object to the WSO but object to being left in the air in regards to the detriment caused by the Power Street interchange being so close to the existing main entry/exit point. Do not agree with the valuation of land.
214	Emmanuel Magee	Individual	N	Water quality Flora and Fauna Heritage Noise and Vibration Consider Alternative Alignment/Option	Revegetation Indigenous Non-indigenous	Lives where proposed WSO crosses Toongabbie Creek and joins the M2. Concerns over Toongabbie Creek: water quality, damage to ecosystems, fauna survey, keep native species, eliminate foreign species, maintain local resident access to the area, Aboriginal sites and convict steps and convict landing in the area. Construction Impacts: weekend work, noise barriers, state of properties and regular inspection to ensure no damage. Road Corridor Alignment: realign the corridor where it

						passes over Toongabbie Creek, height of bridge, noise barriers.
215	Jim Bosnjak (Greater Western Sydney Economic Development Board)	Business	S	Staging Commencement of Project Link to F3/Pennant Hills Road Employment Design considerations Public Transport Traffic Flora and Fauna	Bus Freight Cumberland Plain Woodland	Supports the project and the timeline for construction. Commence ASAP, as soon as planning and land acquisition activities completed. Consider tunnel link from M2 to F3. Review funding options for the WSO. Review to determine ways that major employment lands have direct access to the WSO. Additional construction of ramps. Expand the M2 busway along the Orbital, make public transport option available. Add public car parks near Orbital to promote park and ride. Have a dedicated freight lane. Endorse the WSO as Australia's most environmentally credible highway. Concern over loss of Cumberland Woodland, need to have new area to plant the trees.
216	Ms Lesley Diver (NSW Fisheries)	State	N	Design Considerations Flora and Fauna Geology and Soils Stormwater	Sediment and Erosion	Best practice document for waterway crossings: Policy and Guidelines for Bridges, Roads, Causeways, Culverts and Similar Structures 1999. Should be followed. Use single-span bridges for crossings less than 30m. Maintain fish passage. Assess threatened aquatic species. Sediment and erosion controls. Wetlands and detention basins for stormwater should be offline. Large Farm Dam near Hinchinbrook Creek and associated aquatic flora and fauna be preserved. Rehabilitation of bridge crossing work. Crossing over Toongabbie Creek involve the removal of the existing causeway. Consult with NSW Fisheries during EMP preparation.
217	Mark Quinlan (Property Council of Australia)	State	S	Land Use and Planning Employment Toll		Strong support for the WSO. Efficient transport infrastructure is vital to competitive business performance on which a successful property industry relies. Land use management to attract new employment and businesses to the region. Develop a land use strategy. Support the toll system. Consider offering the project as a build, own, operate and transfer system.
218	Beverly Orell	Individual	N	Consider Alternative Alignment/Option		Need an orbital but not in their backyard. Other options and routes need to be considered.
219	Robert Humphries	State		Western Sydney Regional		Issues raised in previous correspondence have not been

	(NSW National Parks and Wildlife Service)			Park Open space Flora and Fauna Heritage Services/Utilities Land Acquisition Design considerations Western Sydney Regional Park Link to F3/Pennant Hills Road	Threatened/endangered species Compensatory habitat Habitat Indigenous	adequately addressed. Further information essential before NPWS can undertake statutory responsibilities in relation to the proposal. Under 3 areas. Role of the NPWS in planning and determination process requires clarification. Significant issues is the potential impact on Western Sydney Regional Park. Prefer an alternate route which does not traverse the park, changes may need to be made to legislation. If option pursued NPWS will seek compensation for loss of public open space and endangered ecological communities. Major issues is the identification of 'off-site' conservation mechanisms to compensate for the loss of native vegetation. Significant for the NPWS as a concurrence authority. Also outstanding Aboriginal heritage issues. Flora, Fauna and Threatened Species: Concerned that potential impacts have not been adequately identified and addressed. Following issues must be addressed before granting concurrence to the proposed activity. RTA must consider the impact of the WSO on the Shale Gravel Transition Forest, Moist Shale Woodland and Cooks River/Castlereagh Ironbark Forest. RTA provide an assessment of the proposal in regards to Key Threateneing Processes. Loss of biodiversity as a result of loss and/or degradation of habitat following clearing and fragmentation of native vegetation and high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition. Need location of any auxiliary infrastructure. Location, nature and extent of habitat removal and modification needs to be further addressed. SIS assessment of the relative significance of the impacts threatened species populations and endangered ecological community habitat within the locality needs to be further defined, discuss other locations of the impacted threatened species and ecological communities in the locality, compensatory strategy land managers need to be consulted and their
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					support demonstrated. Further investigation of compensatory habitat is required. Confirmation required of RTA's compulsory acquisition powers. Area purchased as compensatory habitat should be at least twice the size of the area to be impacted (directly and indirectly) by the proposal. RTA should prepare a comprehensive compensation package for comment by the NPWS for loss of threatened species and endangered ecological communities. Would prefer acquisition negotiations to be completed prior to concurrence being granted. Otherwise performance criteria will need to be developed which the RTA will be required to meet. Alternatives to the proposal have also been suggested including reducing the speed limit, construction of more vertical walls, structures at creek/river crossings, weed programs, justification of design. CEMP is not the appropriate vehicle for detailing mitigative strategies. Scientific Committee is not the NPWS Scientific Committee, references should be rectified. Cultural Heritage: Aboriginal heritage assessment not sufficient to adequately assess the impacts of the proposal. RTA should identify and consider the impact of the proposal in terms of the number of sites to be impacted over the entire length, the proportion of sites in the region which will be impacted and the significance of the sites remaining compared to the significance of the sites to be destroyed. Statement of significance must be supplied for each site. Extent of impact needed on each site. Demonstrate that recommendations of all Aboriginal groups considered and incorporated. RTA should meet with NPWS to discuss the Section 90 Consent to Destroy. Impacts to NPWS estate and potential NPWS estate. Western Sydney Regional Park: impact not adequately addressed. Concerns include loss of public open space and infrastructure (not addressed SREP 31), access (to Sydney International Equestrian Centre), noise and
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						visual amenity (landscape management plan), weed invasion, drainage and erosion. Certain areas may be managed by NPWS in the future because of their open space, native flora and fauna and/or Aboriginal heritage values, including Dean Park, Shanes Park, Hoxton Park, Wonderland and Prospect Reservoir. Impact of the WSO on these areas not adequately addressed. If route goes west may impact on the Shale Plain Woodland at Hoxton Park. NPWS want assurances that the future routes for the M2 to F3 extension will not travers Lane Cover National Park, the proposed area of compensatory habitat at Dean Park or other areas of NPWS estate.
220	Danny Hannan (Cyclist Action Movement West)	Local	N	Cycleway/Cyclists Pedestrian Public transport Toll	Rail	Sydney Orbital should contain as part of the road corridor and paralleling the road alignment a grade separated high-speed cycleway. Supports a shared pedestrian/cycling facility parallel to the Orbital but does not support this as an alternative option to on road facilities. Rail and people powered transport are the only long-term viable solutions to transport needs. Costs to the public not raised: toll and future price of fuel.
221	Mr Kel Dillon	Individual	N	Link to F3/Pennant Hills Road Public transport		Fantastic initiative and long overdue. Should link directly with the F3. Ownership and management structure should not be like M2. Public transport needs to be incorporated.
222	Alex Tucker	Individual	N	Flora and fauna Western Sydney Regional Park Consider Alternative Alignment/Option Traffic	Compensatory habitat Threatened/endanger ed species	Supports the consultants recommendations provided that the EMP are made available for public scrutiny and audit. Does not consider SREP31. Detail all impacts on lands managed by DUAP and NPWS. Compensatory habitats should be approved by either DUAP or NPWS. Western Sydney Regional Park. Proposed corridor through area of endangered ecological communities, suggest re-routing. Traffic congestion.
223	Richard Jones	MP	O	Land use and planning Flora and fauna Public transport	Threatened/endanger ed species	Opposed to the WSO. Reduction in green belts, open space and planning corridor. Affect 43 separate sites if endangered ecological communities and threatened species. Does not provide the answers to transport

						needs. No road but better public transport. EIS is inadequate. Need to protect the ecological communities. Provides a list of actions to be taken.
224	Gordana Perceviski	Individual	N	Objects to Eastern Alignment near Cecil Hills		Objects to the eastern alignment of the WSO. Not against the WSO in general.
225	Tony Reed and Anthony Lau (Ryde City Council)	Local	N	Link to F3/Pennant Hills Road Toll		Acknowledges need to address problem of heavy vehicles using Pennant Hills Road (PHR) but opposed to any link of the F3 to M2 on the eastern side of PHR. RTA should consult with Council on the F3 to M2 link and undertake an origin destination study of heavy vehicles. Matter should be referred to NSROC. Hornsby and Ku-ring-gai Council should be advised of the decision. Council only concerned with the conceptual aspect and the delivery of an orbital network of motorway standard roads in Sydney. Concern over rat running of traffic to avoid tolls. Suggest possibilities for M2 to F3 link.
226	Giselle Howard (DLWC Sydney/South Coast Region)	State	N	Flooding and Hydrology		Development's should be in accordance with the <i>State Government's Flood Policy (1984)</i> as outlined in the <i>NSW Government Floodplain Development Manual (1986)</i> . Develop with regards to potential flooding effects including impacts on the WSO, the impact of the WSO on flood behaviour both upstream and downstream of the site, impacts of flooding on residents and other users of the floodplain. The full range of potential flood events, up to the probably maximum flood (PMF) should be included in any assessment of flooding effects. Need a floodplain management study to assess the cumulative impacts. Consent authority needs to check that all considerations in the Floodplain Management Manual are adequately addressed in making decisions. The proposed WSO may significantly reduce capacity of the proposed flood mitigation basins recommended within the catchments as a flood mitigation measure. Additionally a number of houses may experience flooding as a consequence. There is not sufficient information in the EIS documents to establish if such

						adverse impact have, or will be, adequately addressed. It appears that detention basins recommended in WP10 are not included in the EIS document, nor have their impacts been determined. Small bridge structures should be considered rather than culverts where possible as there is a high risk of debris causing blockages during flood events.
227	Mark Greenhill (Western Sydney Regional Organisation of Councils Limited)	Local	S	Toll Public transport Urban Development Badgery's Creek Airport Design considerations Air quality Western Sydney Regional Park Flora and fauna Salinity	Habitat Threatened species	Supports the WSO. Recommends that the proposal be modified. Primary concern is the proposed partial funding of the project through a direct toll on road users. Opposes the toll and wants Government to fully fund this project. Remove direct toll on road users. Modify so represents environmental best practice in regard to construction and operation and incorporates effective public transport as an integral component in the transport corridor. Other issues include implement a regional road system, public transport strategy, manage urban growth, remove consideration of Second Sydney Airport, regional transport linkages, integration with transitways, modification of interchange access, air quality, compensate for Western Sydney Regional Park, limit loss of habitat and preserve threatened species, consider impact of salinity and adopt environmental best practice. Provide public transport as an integral element of the operation of the Orbital.
228	Andrew Wilson (NSW Health)	State	N	Traffic Public transport Air quality Noise and Vibration Social Link to F3/ Pennant Hills Road Cycleway/Cyclists Pedestrian Consultation	Freight	Supports in principle the WSO. Have strong recommendations: WSO be the primary freight route for the western sector, at least a 50 metre buffer zone from the roadside to the nearest dwelling or school be provided, project should not proceed until significant public transport initiatives are in place and air quality assessments be redone with longer data collection and more stations. Carbon monoxide predictions should be reassessed. Increases in traffic from local roads should be included in the assessment of regional air quality. Extend assessment to impacts on the roads forming the connections from the WSO to the F3. Noise levels at the

						nearest residential or sensitive are be assessed. Further assessment should be made in relation to noise using worst case scenario for traffic volumes. Determined noise levels at schools. Welcomes the proposal for cycle paths. Additional pedestrian access points be provided where local roads have been severed. No assessment made of the social implications of dividing communities or access to areas divided by the WSO. Areas for further consideration include impacts on community identity and cohesion, disruption to the community and loss of amenity. Put in place construction phase mitigation measures for air and noise. Establish community consultation processes.
230	Warrick Irvine (Transport Workers Union of Australia)	Federal	N	Design considerations		Need to consider parking areas for heavy vehicles, Bdouble access from the 13 exit ramps into the local road network and future consideration of roadtrain movements.
231	G&K Alit	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
232	R&J McClarence	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
233	E&S Borbajo	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
234	Robert Thompson	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
235	Lance Roycroft and H Rene-Roycott	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
236	A, J, T&S Rekes	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
237	L Brown and L Hitcheson	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
238	D Newtown	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
239	D Proctor & A Steel	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
240	Kristy Newell	Individual	O	Opposed to the Proposed		Opposed to the Proposed Western Sydney Orbital

				Western Sydney Orbital		
241	P Gaston	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
242	Dayna Cheffins	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
243	F Labous	Individual	O	Opposed to the Proposed Western Sydney Orbital		Opposed to the Proposed Western Sydney Orbital
244	Liverpool City Council	Local	N	Urban development Consider Alternative Alignment/Option Toll Public transport Upgrade Roads Currency of Documents Compensation Pedestrian Cycleway/Cyclists Staging Flooding and hydrology Consultation Flora and fauna Air quality	Compensatory habitat	EIS understates the projected growth in Liverpool. Interchange at Cowpasture Road does not consider future development of the Hoxton Park Aerodrome Precinct. Provides "in-principle" support but objects to the building of the Orbital on the Eastern alignment and to any proposed toll on the use of the road. Supports the inclusion of enhanced public transport at the earliest possible stage. Existing Council roads that will have direct connection to the WSO will require maintenance during construction and upgrading. Concerned that aerial mapping used which is not up to date. Cecil Hills and Casula areas to be reviewed with current photos. Council will seek compensation for loss of Section 94 Contributions, loss of areas for construction of flood detention basins and costs for LCC to process their involvement in the various stages of approval and construction of the WSO. Supports increase in public transport, provision for pedestrian and bicycle movements (with alterations to proposed design) and road improvements. Would prefer that the section of WSO between Elizabeth Drive and the M5 be constructed as a single stage. For a community consultative group. The importance of flooding issues has not been fully addressed in the EIS. Loss of floodplain storage. Need further information on flooding issues. Consideration must be given to ecological considerations. Provision of secure compensatory habitat should address broader conservation and ecological values rather than limiting land area to EEC's directly affected. Air quality, found to be lacking

						specifics of the local area.
245	Craig Ross (Penrith City Council)	Local	N	Flora and fauna	Cumberland Plain Woodland	Request the RTA to consider the acquisition of the endangered Cumberland Plain Woodlands on the ADI Site at St Mary's. Listed on the Register of the National Estate by the Australian Heritage Commission.
246	Mark Hather (Department of Urban Affairs and Planning)	State	N	Design Considerations Consider Alternative Alignment/Options Visual and Urban Design Access Noise and Vibration Land Use and Planning Pedestrian Cycleway/Cyclists Western Sydney Regional Parkland Flora and fauna		Additional Pedestrian, cyclist and vehicular access point across all sections of the proposed WSO need to be considered in relation to impact on potential future use. Potential tunnel or alternative alignments should be considered in the Cecil Park-Cecil Park North section to minimise the potentially severe impacts that the WSO would have on the character of these areas. In areas of likely high visual impacts, such as proposed embankments close to creek lines and the M4 intersection, consideration should be given to alternatives to reduce the scale of the proposal. This would also improve accessibility across the corridor. Further information, including scale and location of other built structures as part of the proposal including electronic ticketing gantries, noise walls and any administration and ancillary buildings. Details are provided covering specific localities. Main impacts are impacts on the future use, amenity, and pedestrian and cycle links to the Western Sydney Regional Parklands, severance of existing and desired pedestrian and cycle links between established and future urban areas, visual and physical impacts of built elements such as interchanges as well as road cuttings and earth embankments and loss of existing remnant trees and vegetation.
247	Sam Haddad (Department of Urban Affairs and Planning)	State	N	Currency of documents Staging Public transport Traffic Western Sydney Regional Parklands Noise and Vibration	Freight	Number of major concerns relating to the EIS: currency of technical reports used in the EIS, inconsistency of assessment (different methodologies and assessments for 2 sections), staging of proposal (not discussed in enough detail), only cursory consideration to the provision of public transport, very limited assessment of freight transport, Western Sydney Regional Parklands (a large

				Flora and Fauna		part of the route through this area but EIS only deals with it superficially) and noise, flora and fauna and traffic (all require substantial supplementary information).
248	Anjus and Gaye Dickson	Individual	N	Oppose the Eastern Alignment		Object to the WSO Eastern Alignment,
249	Raymond Harb (Liverpool Area Action Group Concerning the WSO)	Community	N	Design considerations		Have provided an alternate concept for the Hume Highway/M5/WSO Interchange with the Gateway to Sydney.
250	Marzi DeSanti (NRMA)	Business	S	Toll Environmental Impacts (General) Access Design considerations Social Upgrade Roads Public Transport Economic	Interchange Rail	Tolling: should be a toll-free National Highway from federal government funds. Environmental Considerations/Ecological Impact: Constructed to ensure a positive impact on the environment. Creek crossings. Manage excess road space. Off-carriageway paths be constructed four metres wide. Alignment options that require relocation of rare and endangered species should be avoided if possible. Compensatory habitat. No assessment of the level of risk associated with habitat recreation. Access to and from the orbital: take every opportunity to maximise access. Rationalise traffic controls at the interchanges. Make specific comments on interchanges. Cross-Section Issues: all shoulders should provide a full 3 metre traversable width. The proposed 15m width of the median is insufficient for Heavy Rail. Corridor width should be increased to accommodate future public transport facilities in the median for its full length. Residential impacts: need to update and investigate the rapidly evolving access requirements. Upgrading Adjacent Traffic Routes: incorporate attenuation measures to ensure compliance with target noise levels. Upgrade routes feeding the Orbital. Construction: ensure full completion of the project. All stages should be dual carriageway sections. Public Transport: new public transport systems should

						provide connections to local communities. Future provision of public space be legally reserved. Modelling Issues: Commission modelling studies to identify the economic benefit.
251	Max Pahlow (Sydney West Orbital Taskforce)	State	S	Commencement of Project Economic Toll Public Transport Traffic Social Upgrade roads Access Design Considerations Staging Air quality Noise and Vibration Western Sydney Regional Park Flora and fauna Salinity Waste	Freight Interchange Threatened/endangered species Habitat	Orbital should be an essential part of the National Highway network. Wants construction expedited. Supports Economic Benefits. National Highway and Tolls: no toll should be imposed as a National Highway. Public Transport Strategy: the integrated public transport strategy should include the linkage of the corridor to the other transport provision in the region. Promote sustainable forms of transport. Freight Transport: freight task will be handled more efficiently, deliver improved traffic flow. Does not adequately address the diversion of freight transport and heavy vehicles from the existing road system. Impact on Residential Areas and Traffic Diversion: should investigate strategies to improve the efficiency and reduce the impacts of the surrounding regional road system. Management of increase of traffic levels on other roads not addressed. Access arrangements on surrounding roads and residential areas should be further investigated. Increased travel will mean impacts on air quality. Proposal should promote alternate transport options. Upgrading of Adjacent Roads: modelling shows that travel on alternative routes will decrease, but on other roads feeding the Orbital traffic will increase. Upgrade certain roads prior to completion of the Orbital. Mentions changes to adjacent roads. Access to Employment Areas: supports the improved access and efficiency for freight and the potential for decrease on surrounding local/regional road system. Interchange Design: traffic volumes requiring access to the road will be significant and interchanges will be required at frequent intervals with full access in all

						directions. New route means accessibility and equity for all potential users. Introduce all access points during construction. Rationalise traffic control at the interchanges. Provides specific comments on interchanges and suggests some changes. Construction Issues: tenderer should be able to demonstrate a capability to provide the high level of detail design associated with traffic switching and signposting to provide for safe travel during construction. Deterioration of adjacent surface streets. Staging: funding should be secured to ensure the full completion of the project. Environmental Best Practice Design: air quality, address operational impact. Noise: increase in traffic on existing roads not fully addressed. Regional park: the loss of area should be compensated, noise impact on the park. Flora and Fauna: affects 6 vulnerable or endangered species, 70 hectares of communities, habitat loss. Salinity: salinity hazard in Western Sydney, impacts structural integrity of construction. Waste reused and recycled if possible.
252	Leba and Rita Harb	Individual	N	Design considerations	Interchange	Concerned over the Norwest Boulevard/WSO interchange. The broad curve of the west bound on-load ramp is too close to residents in Sporing Ave Kings Langley and should be flatter and lower to minimise environmental impacts such as noise, visual etc. A full interchange at Old Windsor Road should be considered as an alternative to proposed interchange.
253	M&D Egan-Lee	Individual	N	Design considerations	Interchange	Concerned over the Norwest Boulevard/WSO interchange. The broad curve of the west bound on-load ramp is too close to residents in Sporing Ave Kings Langley and should be flatter and lower to minimise environmental impacts such as noise, visual etc. A full interchange at Old Windsor Road should be considered as an alternative to proposed interchange.
254	R&S Mischkonigg	Individual	N	Design considerations	Interchange	Concerned over the Norwest Boulevard/WSO interchange. The broad curve of the west bound on-load

						ramp is too close to residents in Sporing Ave Kings Langley and should be flatter and lower to minimise environmental impacts such as noise, visual etc. A full interchange at Old Windsor Road should be considered as an alternative to <u>proposed interchange</u> .
255	Bernadette and Vincent Stafrace	Individual	N	Design considerations	Interchange	Concerned over the Norwest Boulevard/WSO interchange. The broad curve of the west bound on-load ramp is too close to residents in Sporing Ave Kings Langley and should be flatter and lower to minimise environmental impacts such as noise, visual etc. A full interchange at Old Windsor Road should be considered as an alternative to <u>proposed interchange</u> .
256	David Richter and Maree Puckles	Individual	N	Design considerations	Interchange	Concerned over the Norwest Boulevard/WSO interchange. The broad curve of the west bound on-load ramp is too close to residents in Sporing Ave Kings Langley and should be flatter and lower to minimise environmental impacts such as noise, visual etc. A full interchange at Old Windsor Road should be considered as an alternative to <u>proposed interchange</u> .
257	Lee and Paul Sedgwick	Individual	N	Design considerations	Interchange	Concerned over the Norwest Boulevard/WSO interchange. The broad curve of the west bound on-load ramp is too close to residents in Sporing Ave Kings Langley and should be flatter and lower to minimise environmental impacts such as noise, visual etc. A full interchange at Old Windsor Road should be considered as an alternative to <u>proposed interchange</u> .
258	Gerald and Linda Denyer	Individual	N	Design considerations	Interchange	Concerned over the Norwest Boulevard/WSO interchange. The broad curve of the west bound on-load ramp is too close to residents in Sporing Ave Kings Langley and should be flatter and lower to minimise environmental impacts such as noise, visual etc. A full interchange at Old Windsor Road should be considered as an alternative to <u>proposed interchange</u> .
259	Dan Reeve	Individual	S	Surrounding Road Network Consider Alternative Alignment/Option		Concerned about the capacity of the F5 south of Camden Valley Way: traffic increase not addressed. The choice of the current route selected is not well explained.

260	Joe Masciotra	Individual	N	Objects to Eastern Alignment near Cecil Hills		Objects to Eastern Alignment near Cecil Hills. Wants a forum held in Cecil Hills to discuss matters.
261	Nick Juradowitch (Royal Australian Planning Institute)	State	N	Traffic Link to F3/Pennant Hills Road Public Transport	Bus Rail	Insufficient analysis of traffic impacts on roads connecting to the Orbital. Including Pennant Hills Road and the F3. Much needed public transport projects are not proceeding according to plan. Need supporting alternative public transport infrastructure. Orbital should incorporate a busway or bus lanes as part of the construction. Design should facilitate upgrading to light or heavy rail.
263	Reece McDougall (NSW Heritage Office)	State		Heritage Currency of Documents	Non-indigenous	Heritage impact assessment seems to be incomplete. No non-indigenous heritage assessment of the Prestons Park to Cecil Park section of the proposed route. Conclusions in summary table relating to non-indigenous heritage are not based on a heritage assessment and are therefore of doubtful veracity. Assessment done in 1996, has the proposed route changed? Currency of the information needs to be updated. Needs substantiation of the levels of significance. Need to consider assessment of the former OTC holdings at Doonside. Bungarribee House Archaeological Site recently listed on State Heritage Register but not assessed. Meurant's cottage needs a detailed management plan. Hoxton Park Airport: submission made to list airfield and adjacent WWII revetments on the Register of the National Estate. Main indigenous heritage issue is the Blacktown Native Institute Site, Plumpton: need to consider the Environment Protection and Biodiversity Conservation Act 2000 and the Environmental Protection Impact of Proposals Act 1974. Listed on State Heritage Register in Feb 2001. No management recommendation in the EIS.
264	John and Sam Mir (Mir Bros Group of Companies)	Business	N	Land Use and Planning Land Acquisition		Land affected by the current proposed concept design. Current concept design is flawed. Affects greater number of properties. Affects more land. Affect the industrial complex. Opposed to the current proposal. Earlier design preferred. Link Road Corridor is the issue.

265	Peter Szewcow	Individual	N	Access		Access be made available to and from the WSO, M4, Great Western Highway, Eastern Rd, Woodstock Ave, Power Street and Rooty Hill.
266	Hon. Kevin Rozzoli	MP	N	Link to F3/Pennant Hills Road		Would like information on what plans are in hand for joining the WSO Link to the National Highways network at Hornsby.
267	Mr MG Steer	Individual	N	More lanes required for WSO Toll Design considerations		WSO be built with 6 lanes rather than 4. That the road be built toll-free. Provision be made for emergency cross-overs.
269	Mrs Hinearau Pene-Roycroft	Individual	O	Noise and Vibration Property value		Strongly object to the current proposal for the WSO. Noise pollution is another issues. Land values affected.
270	Margaret Bryant (Campbelltown Community Action Group)	Community Organisation	N	Badgery's Creek Airport Toll Access Traffic		All references to the Second Sydney Airport at Badgery's Creek should be removed from the EIS. Section of the National Highway so don't understand the imposition of a toll. Need to make allowances for appropriate access adjustments at either end of the project. Commuter access to and from the WSO via the Hume Highway is the particular concern. Access and traffic flow through Campbelltown must be addressed in conjunction with the Orbital to avoid major traffic congestion in the future.
273	Peter Cork (Fairfield City Council)	Local	N	Badgery's Creek Airport Road Closure Pedestrian Access Western Sydney Regional Park Toll Compensation Air quality Public transport	Rail	The WSO should not be used as a lever to promote the construction of an airport at Badgery's Creek nor to allow further untrammelled urban and industrial sprawl in western Sydney. Complaint against the method of delivery (during the Christmas break). Closure of Redmayne Road will create a crime area and impact on the future operation of the fire brigade. Keep Redmayne Road open!!! Loss of pedestrian access. Impact on development proposal. Access to Elizabeth Drive. No information on the associated development from the project. Does not address the lack of public transport. Should not allow the Badgery's Creek Airport to go ahead. Concern over impact on the greenbelt, Regional Park, Equestrian Centre. Concern over cost to community, genuine viability of the Orbital due to

						tollways. Generous compensation provided. Other issues include air quality, public transport, reports indicating no more tar roads should be built due to pollution levels. No public transport easement planning, operation or allowance. Want a rail based public transport construction within the WSO Road route as a priority.
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*There are no submissions 87, 88, 229, 262, 268, 271 or 272.

APPENDIX C

Whole of Government Integrated Action Agreement

- ♦ Whole of Government Integrated Action Agreement

In addition to existing government policy documents, a Whole Of Government Integrated Action Agreement was developed specifically addressing issues of air quality, road and land use planning to be fully integrated in the planning and development of the WSO. A resultant "Action Package" was prepared out of concern that insufficient emphasis had been placed on integrated urban planning principles in the content and presentation of WSO plans to that time. It was considered that this may lead to a general perception that the Government was not pursuing a consistent strategic direction in the development of western Sydney. The Action Package outlined a series of actions and commitments of the involved parties (the Department of Planning (then DUAP), RTA, EPA and DoT) in relation to planning for the development of western Sydney and how this could be integrated with the development of the WSO.

Fundamental to the Action Package prepared was the focus on the potential uses of the WSO. The actions and commitments outlined are aimed at ensuring the WSO is used by a wide range of transport modes and not solely as a private vehicle route. This is shown in the key commitments of the RTA specifically for the WSO which emphasise strategies for public and freight transport. These are stated below addressing how each is fulfilled within the context of the proposal.

- ♦ ensure WSO planning and corridor acquisition includes provision for lanes, lay-bys and interchanges for buses linked with M2 Motorway busway planning

The WSO road corridor as proposed in the EIS includes a 15 metre wide median retained for future provision of public transport. A feasibility study into bus services along the WSO indicated that there is potential demand for bus services along the Richmond Road to M2 section from opening of the proposal to traffic. The RTA has committed to providing bus facilities on the motorway, east from Richmond Road to the M2 (though not necessarily within the median) from opening of the proposal to traffic which provide opportunities to link services further eastwards on the M2 though specific bus interchange locations have yet to be determined.

- ♦ identify interchanges suitable for development between WSO and CityRail network, at locations such as Glenfield, Rooty Hill, Quakers Hill (with DoT)

Specific consideration of interchanges with the CityRail network were not addressed in the EIS. In the southern section, Glenfield and Casula stations are located approximately 3.25 km south east and 2.5 km east respectively. The nearest access points for these stations to the WSO would be via the M5 Motorway. No specific access has been provided for between the WSO and Rooty Hills Station. The nearest road access points to Rooty Hill Station are at the M4 interchange approximately 2.5 km south or Richmond Road approximate 5 km to the north. Pedestrian links in the proximity of Rooty Hill station are provided over Angus Creek to the south or Woodstock Avenue in the north. An interchange has been provided between the proposal and Quakers Hill Parkway which could connect indirectly with Quakers Hill railway station. A pedestrian overpass would be provided at Eastern Road, though vehicular access would be closed off.

Whilst there is potential for some links between existing rail stations and the proposal, it would appear that the interchanges included have not been specifically addressed access to these facilities. The Department has recommended an access strategy be prepared which considers

BRIEFING NOTE

WESTERN SYDNEY ORBITAL

PURPOSE

To present for ministerial endorsement a whole-of-government action package which addresses the need for air quality, road and land use planning to be fully integrated during the development of the Western Sydney Orbital (WSO).

BACKGROUND

Over the past five years there has been significant integration of the planning functions of NSW Government agencies responsible for strategic metropolitan investment and management. Examples of this integration include:

- close liaison in developing and releasing the set of strategic planning documents that comprises Cities for the 21st Century, the Integrated Transport Strategy, the State Road Network Strategy and the CityRail Strategic Plan;
- close co-ordination in implementing the Metropolitan Air Quality Study and developing the forthcoming Air Quality Management Plan; and
- co-operation in the preparation of strategic studies leading to the current state of development of the WSO (full details of the project are provided below), including the National Highway Strategy Study, the Western Sydney Orbital and Elizabeth Drive Overview Report and the Elizabeth Drive EIS (to Sydney West Airport).

All of these initiatives have also required significant community participation.

While the WSO is a Commonwealth initiative and will form part of the National Highway through Sydney, the project will also have considerable effects on future urban development, strategic transport networks and the environment in Western Sydney. The Commonwealth Department of Transport has therefore accepted that planning for the WSO should be conducted within the bounds of the NSW Government's Metropolitan Strategy.

Nonetheless, following the exhibition of the Elizabeth Drive EIS and the WSO Overview Report, key government agencies have been concerned that insufficient emphasis in the content and presentation of WSO plans on integrated urban planning principles, and on ecologically sustainable development principles agreed between governments, may lead to a general perception that the Government is not pursuing a consistent strategic direction in the development of Western Sydney. This risk will be increased if a number of new strategic planning documents or proposals of relevance to Western Sydney, scheduled for release over the coming months, come to be seen by the community as not being integrated across the Government. These projects or initiatives are listed at Appendix 1.

It should be noted that the four agencies (DUAP, RTA, EPA and DoT) involved in the preparation of this Briefing Note are all in agreement that the WSO should proceed, but consider that an associated range of initiatives to be carried out by these agencies will be critical to minimising potential impacts of the proposals and achieving key integrated urban management outcomes. This paper therefore seeks to present a total package of planning actions, spanning all relevant agencies, that will ensure such outcomes are attained.

THE PROJECT

The WSO (map at Appendix 2) represents about 41.5km of new motorway-standard road in Western Sydney which will ultimately link the M5 at Prestons with the M2 at West Baulkham Hills. The WSO is Commonwealth - funded and will form a new segment of the National Highway between Liverpool and Hornsby.

The interim National Highway route, which the WSO will replace, runs via the Cumberland Highway. This route is not up to the National Highway standard with extensive frontage development and 62 sets of traffic signals which impede traffic flow and road safety.

The WSO will provide the only major north-south road route of motor way standard in the general area, and more specifically will provide a major freight and commercial vehicle route consistent with the State Road Network Strategy. It will link a series of developing industrial centres, from Seven Hills and Norwest through to Quakers Hill, Glendenning, Huntingwood, Wetherill Park, Prestons and Ingleburn. The ADI site, Sydney West Airport and Erskine Park are nearby, and the Western Sydney Regional Park will be immediately adjacent to the route. Residential areas from Rouse Hill to Campbelltown will enjoy improved access to employment and recreation opportunities through use of the road. It is intended that to the greatest practical extent such access be gained by way of public transport committed at the outset of the road's operation. A key aspect of the project will be to manage demand for use of the new road so that it does not induce traffic beyond its intended transport task.

The southern section of the WSO between the M5 at Prestons and Cecil Park, together with the upgrade of the western section of Elizabeth Drive, represent not only elements of a new north-south link through Sydney but also vital links in the road connection between Sydney (Kingsford Smith) Airport and the new Sydney West Airport. The road and proposed new rail line will share the task of linking the two airports. The new airport is expected to be capable of serving all but the very heaviest of the international aircraft currently in operation and will be able to handle 1,000,000 passengers per year (compared with Sydney Airport's current load of about 15,000,000 passengers per year). It is expected to be in service during 2000/01.

A study into the industry benefits of the WSO and Elizabeth Drive has shown a benefit-to-cost ratio of 2.71, finding that the combined project will result in the creation of 2,400 jobs in the region and will increase the value added by industry by \$264 million per annum over the next three decades. Traditional analysis of transport benefits indicates a benefit-to-cost ratio of 1.81 for a "medium" travel scenario and a 7% discount rate. (These two BCRs are not additive). However, there has not been a full cost-benefit

analysis which takes into account potential environmental costs. Further work needs to be undertaken by agencies to develop this approach for application to future road and other infrastructure projects.

Liverpool City Council strongly supports in principle the development of both Sydney West Airport and the WSO connection to it. Fairfield City Council and Penrith City Council also support the proposed developments. Blacktown City Council supports the WSO, but wishes to see the section from the M4 to West Baulkham Hills via Dean Park constructed at an earlier date than is currently programmed to pre-empt traffic diverting through Blacktown to link between the WSO constructed to the M4 junction and the M2.

These Western Sydney Councils are understood to recognise the economic and employment opportunities expected to arise from the Airport and related development, and from the stimulus to existing industrial areas that would be generated by the WSO. As a matter of enquiry, it is noted that Western Sydney has only 601 jobs per 1,000 workers, compared with 1,201 in eastern Sydney, and that Western Sydney is still growing rapidly (eg Penrith LGA population grew 37.8% between 1981 and 1991).

At the same time, WSROC has developed a substantial response to the State Road Network Strategy and CityRail Strategic Plan, indicating support for the development of public transport and bicycle strategies for the Region, rather than simply a focus on infrastructure development.

The completion of the Metropolitan Air Quality Study (MAQS) has confirmed the concerns with deterioration of air quality, particularly in Western Sydney, through the projected increase in vehicle kilometres travelled (VKT). The current projections related to Sydney's expected future population show that a reduction by one-third in the growth of VKT is needed to meet the current NHMRC air quality goals, which are less stringent than the Government's goals expressed in the 1995 election platforms. MAQS also highlighted an increasingly disproportional impact of diesel vehicles on air quality.

Therefore it is critical in considering the WSO that measures are put in place to ensure effective travel demand management for private motor vehicles and to focus the WSO on commercial and freight movement.

OBJECTIVES OF THE WESTERN SYDNEY ORBITAL

The objectives formulated for the WSO are:

- to provide a National Highway link between the M5 Motorway at Prestons and the future M2 Motorway at West Baulkham Hills, and one link of the road connection between Sydney (Kingsford Smith) Airport and Sydney West Airport, in an environmentally and socially sensitive manner;
- to support the NSW Government's overall Metropolitan Strategy for land use, transport and the environment;

- to form part of the integrated strategic transport network for Sydney; and
- to support economic development.

POTENTIAL IMPACTS OF THE WSO

Potential impacts of the WSO which need to be mitigated through a range of actions include the following:

- without some mitigating measures, the WSO may tend to encourage further single-occupant vehicle travel;
- any growth in air emissions in Western Sydney, particularly NOx, needs to be mitigated;
- in the absence of land use controls, pressures could arise from developers for relatively intense urban and rural residential development to be permitted at strategically undesirable locations, including areas between Hoxton Park and Rooty Hill, that are supposedly "opened up" by the new road;
- without carefully targeted land use controls, pressures may arise to allow new commercial (including industrial and retail) development, which may undermine the viability of existing such areas, in undesirable locations; and
- action will be required to ensure that the use of existing and programmed public transport services is encouraged, and network expansion opportunities explored, in the face of potential competition from the new road for passenger transport.

OPPORTUNITIES FOR ACTION

It is proposed that the Government support the development of the WSO within an integrated, whole-of-government planning framework that is informed by the underlying principles of the Metropolitan Strategy. Supporting the primary Strategy principles of more compact cities and an ecologically sustainable region, the key stated principles relevant to the WSO include:-

- to develop the Greater Metropolitan Region as four strong economic units - Sydney, Central Coast, Newcastle and Wollongong - linked by efficient inter-regional transport systems to enhance their individual and combined strengths in national and international trade;
- to control the location, scale and character of urban expansion and urban support activities so that impacts on the environmental quality of the Region are minimised;
- to minimise travel demand by encouraging the concentration of retail and commercial activity in selected existing centres;

- to contain urban expansion within linear corridors along major transport routes, principally the rail network, to maximise the efficiencies of development and to reduce individual dependency on the motor car;
- to relate the development of areas of significant job concentration to major public transport infrastructure, to enable best use of public transport for employee and client travel and of arterial roads for freight and commercial goods transport.

Given this strategic framework and the supporting principles, and particular opportunities presented by the imminent commencement of construction of the WSO, a multi-agency action package has been developed to optimise environmental, social and economic outcomes for Western Sydney.

Specifically,

- particular features can be incorporated into the design and management of the road itself;
- appropriate strategic urban planning policies and land use controls can be developed and enforced;
- public transport opportunities can be identified and exploited; and
- various Government policy and management initiatives can be developed and / or adapted for application to the WSO.

In general terms, such actions can be grouped under the three headings of Policy and Planning, Infrastructure, and Management, and can seek to achieve three important outcomes for Western Sydney which can be expressed quite simply as:

- Wider Transport Choice
- Managed Traffic Impacts
- Moderated Travel Demand

An action package for implementation in association with the development of the WSO, structured in this way, is at Appendix 3.

FUNDING

The actions set out in Appendix 3 are initiatives that are already committed, or can be carried out, within the existing budgets of the relevant agencies. No additional funding is therefore required to implement the actions.

RECOMMENDATION

It is recommended that the attached package of actions and commitments in relation to the WSO:

- a) be endorsed by the Ministers for Urban Affairs and Planning, Transport, Roads and the Environment;

- b) be referred to Cabinet for information; and
- c) be referred to by the Minister for Urban Affairs and Planning in considering the determination of project approvals for future sections of the WSO following exhibition of EIS's.

APPENDIX 1**INITIATIVES PLANNED OVER THE NEXT YEAR**

Initiative	Action	Proposed Timing
Project Approval following EIS for Elizabeth Drive, WSO to Sydney West Airport	Assessment by Minister for Urban Affairs and Planning of RTA Determination	February 1996
EIS for WSO section from M5 at Prestons to Elizabeth Drive at Cecil Park	Release of EIS by RTA for public comment	March 1996
Air Quality Management Plan Discussion Paper	Release by EPA for public comment	March 1996*
Draft Sydney West Airport Sub-Region Strategy	Release by DUAP for public comment	Late March 1996?
Air and Health Conference	Joint convening by EPA and Department of Health	April 1996
Update of Metropolitan Strategy	Release of short document by DUAP	May 1996
Update of Integrated Transport Strategy	Release of short document by DOT	May 1996
EIS for WSO section from Elizabeth Drive at Cecil Park to West Baulkham Hills	Release of EIS by RTA for public comment	July 1996
Draft Smog Management Plan	Release by EPA for public comment	September 1996
Sydney West Airport EIS	Release of new EIS prepared for Commonwealth for public comment	early 1997

* Date subject to Cabinet approval. Minute circulated January.

APPENDIX 3

INTEGRATED ACTION PACKAGE

OUTCOME A: WIDER TRANSPORT CHOICE

	ACTION	LEAD AGENCY	TIMING
Policy And Planning	A1. Ensure WSO planning and corridor acquisition includes provision for lanes, lay-bys and interchanges for buses ^{linked} consistent with M2 Motorway busway planning.	RTA	July 1996
	A2. Develop <i>Western Sydney Public Transport Strategy</i> to ensure consistency between policy frameworks and capital expenditure	DoT	Draft released by June 1996
	A3. Complete <i>Improving Modal Choice in Low Density Employment Areas Study</i> (case study area: Wetherill Park) aimed at improving workers' transport options	DoT	Study complete by July 1996
	A4. Complete <i>Buses as Mass Transit</i> Study of innovative and conceptual approaches	DoT	Study complete by March 1996
	A5. Develop <i>Sydney Region Road-Based Public Transport Strategy</i> to guide investment in bus priority facilities and related measures	RTA	Strategy complete by ? 1996
	A6. Finalise <i>Greenfields Bus Servicing Policy</i> encouraging private operators to compete for right to serve new urban areas	DoT	Policy agreed by June 1996
Infrastructure	A7. Provide bicycle facilities along WSO ensuring integration with local and regional bicycle planning, including cycling lanes and provision for bicycle storage at public transport interchanges	RTA	As required given WSO timetable
	A8. Identify interchanges suitable for development between WSO and CityRail network, at locations such as Glenfield, Roory Hill, Quakers Hill	RTA / DoT	Review complete by June 1996

	A9. Develop upgraded Liverpool Interchange / Station, and associated bus priority facilities, to improve public transport access between Liverpool CBD and residential areas	DoT	Construction started by December 1996
	A10. Provide adequate entry/exit facilities for buses along WSO, including bus lay-bys with safe pedestrian access and waiting areas	RTA	As required given WSO timetable
	A11. Complete construction of "Y" link between Main Southern and Main Western Lines, for direct trains between south-western and western Sydney	SRA	Open by November 1996
	A12. Liaise with the Commonwealth in development of plans for Sydney West Airport rail links	DoT	1996 and continuing as required
Management	A13. Establish an Area Bus Servicing Working Party to bring together public and private agencies to implement actions below	DOT	Active by June 1996
	A14. Schedule provision of Bus Lanes, Transit Lanes and specific freight facilities or lanes as required	RTA	1996 onwards
	A15. Review scope for integrated ticketing of private bus and CityRail services, e.g. through introduction of periodical pass between Hoxton Park and major centres via Liverpool	DoT	Completed by December 1996
	A16. Develop proposals for integrated marketing of private bus services, addressing bus stop and fleet design, timetabling and passenger information	DoT	Formulated by December 1996
	A17. Promote design of new residential subdivisions that supports bus, pedestrian and bicycle travel	RTA/ DUAP/ DoT	1996 onwards
	A18. Investigate opportunities to facilitate provision of public transport in new urban areas through minibus schemes or section 94 contributions.	DUAP/ Councils	March 1997

OUTCOME B: MANAGED TRAFFIC IMPACTS

	ACTION	LEAD AGENCY	TIMING
Policy and Planning	B1. Pursue more stringent emission standards for vehicles through NEPC/NRTC at Commonwealth level	EPA	Agreement by December 1997

	B2. Apply new MAQS model to assessing air quality impacts from transport and urban development scenarios in Western Sydney	EPA	March 1996 onwards
	B3. Develop Air Quality Management Plan for GMR and Smog Action Plan	EPA	Finalised by December 1996
	B4. Recognise integrity of Regional Open Space Corridor and access needs for Western Sydney Regional Park	RTA	In WSO designs completed by July 1996
Infrastructure	B5. Develop plans for pedestrian and bicycle crossings of WSO which mitigate local community severance impacts	RTA	In WSO designs completed by July 1996
	B6. Where projected noise levels at nearby buildings are excessive, provide noise amelioration	RTA	At time of construction
Management	B7. Set WSO speed limits that balance road safety, economic efficiency of road travel and vehicle emissions	RTA and NSW Police	1996 onwards
	B8. Develop and implement in-service vehicle maintenance program	EPA/RTA	During 1996-97
	B9. Implement smoky vehicle enforcement campaigns including Western Sydney	EPA/RTA/ NSW Police	1996-2000
	B10. Continue collaborative education program as part of <i>Clean Air Initiative</i>	EPA/RTA	1996 onwards
	B11. Further develop MAQS monitoring program and model validation	EPA	1996-1999
	B12. Implement Roadside Air Quality Monitoring Program for sections of WSO	RTA	12 months after road opens
	B13. Implement RTA air monitoring plan to improve understanding of dispersion of pollutants and to validate predictive models	RTA	Commence June 1996

OUTCOME C: MODERATED TRAVEL DEMAND

	Action	LEAD AGENCY	TIMING
Policy and Planning	C1. Apply land use and access management strategies adopted for WSO in Sydney West Airport Sub-Region Strategy	DUAP	Draft Strategy released in March 1996
	C2. Consolidate and reinforce existing commercial and industrial areas in Western Sydney before allowing new areas, related to transport networks, to be zoned	DUAP, Councils	Principle stated in Metro Update, released in May 1996.
	C3. Rank proximity to public transport and accessibility to employment and services highly in assessing Residential Development Strategies in preparation by Councils, including advantage taken of opportunities to intensify development at WSO interchanges with rail network (see A8)	DUAP	Assessments completed in September 1996
	C4. Develop a Road Freight Strategy for NSW and metropolitan Sydney	RTA	Completed by December 1996
	C5. Develop guidelines for Local Government on provision of parking in industrial areas to support measures to encourage use of alternate modes	DUAP, DoT	Completed by March 1997
	C6. Consider the possibility of innovative tolling regimes for the National Highway Link north of M4 that (relative to private car use) encourage use of the Link by high occupancy and freight and commercial vehicles	RTA/Fed. DoT	As required by project timetable
Infrastructure	C7. Locate interchanges with WSO to give preference to needs of industrial estates (e.g. Prestons, Wetherill Park, Glendenning), major freight routes and existing major arterial roads	RTA	Locations finalised by July 1996
	Wherever practicable prohibit access across WSO boundaries	RTA	Measures finalised by July 1996

	C8. In considering staged construction of WSO, recognise the following priorities: * Need for road access between Sydney Airport and Sydney West Airport * Need for road access between Sydney West Airport and commercial centres of Central Sydney and lower North Shore * Need to extend Phillip Parkway to Great Western Highway for improved access to Glendenning Industrial Area * Need to provide specifically for freight and commercial traffic * Need to improve traffic conditions around western terminus of M2 at Seven Hills * Need for continuous roadway along whole route of WSO between M5 at Prestons and M2 at West Baulkham Hills	RTA	1996 onwards
Management	C9. Identify opportunities for traffic calming on alternative routes to WSO	RTA	1996 onwards
	C10. Prevent urban development leapfrogging WSO by containing expansion within Urban Development Program areas and longer-term areas identified in Metropolitan Strategy	WSO DUAP	Principle stated in Metro Update, released in May 1996
	C11. In assessing rezonings maintain subdivision limits and controls on types of development in adjoining rural areas to prevent increasing intensification of development in response to WSO.	DUAP	Principle stated in Metro Update, released in May 1996
	C12. In assessing rezonings restrict development which would lead to new access points on roads within and adjacent to WSO route (eg Wallgrove Road)	DUAP/ Councils	Guidance issued to Councils by July 1996.

APPENDIX D

Arup Design Review Report

planningNSW

**Proposed Western
Sydney Orbital**

Road and Interchange
Design Review

Final Report

Department of Planning
Proposed Western Sydney Orbital
Road and Interchange Design Review

February 2002

Arup
Level 10, 201 Kent Street, Sydney Australia, PO Box 76, Millers Point NSW 2000
Tel +61 2 9320 9320 Fax +61 2 9320 9321
www.arup.com

Job number 81471/700

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Ove Arup Pty Ltd ABN 18 000 966 165



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		Name	John Hamilton	Alistair Kerle	Alistair Kerle		
		Signature					
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			Prepared by	Checked by	Approved by		
		Name	John Hamilton	Alistair Kerle	Alistair Kerle		
		Signature					
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		Description	Incorporates planningNSW comments dated 6/2/02				
			Prepared by	Checked by	Approved by		
		Name	John Hamilton	Alistair Kerle	Alistair Kerle		
		Signature					
		Filename					
		Description					
			Prepared by	Checked by	Approved by		
		Name					
		Signature					

Issue Document Verification with Document



This report takes into account the particular instructions and requirements of our Client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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QA Rev 1/01 1 November 2001

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APPENDICES

Appendix A – Data Acquisition Schedule

1. INTRODUCTION AND BACKGROUND

The Environmental Impact Statement for the proposed Western Sydney Orbital (WSO) was exhibited from January 2001 to 5 March 2001.

The WSO is a proposed motorway approximately 39 kilometres long from the Hume Highway/M5 Motorway at Prestons in the south to the M2 Motorway at West Baulkham Hills in the north. Initially, the motorway would have four traffic lanes (two lanes in each direction) and a wide central median to allow for additional traffic lanes or public transport facilities such as a bus transitway, light or heavy rail if considered appropriate in the future.

Much of the proposed motorway would be through road reservation or an existing open space corridor. The section of the WSO between Richmond Road and the M2 has a proposed design speed of 100km/h and between Prestons and Richmond Road 110km/h. The WSO would include 15 grade-separated interchanges. The interchanges with the M5, M4 and M2 all involve total grade separation for all traffic movements including on and off ramps. On and off ramp design speeds allow for up to 90km/hr traffic movements at these interchanges. All other intersections include on and off ramps designed to at least 80km/hr with 60km/hr speed environments at the intersections.

2. STUDY OBJECTIVES AND SCOPE

The Minister for Urban Affairs and Planning has a formal approval role for this project under Division 4 Part 5 of the Environmental Planning and Assessment Act 1979. In deciding whether or not to recommend approval, the Minister is required to take into account an independent environmental impact assessment report by the Director General of the Department of Urban Affairs.

The primary objective of the commission is to provide the Department with an independent assessment of the road and interchange design of the proposal in the context of the most appropriate balance between traffic performance requirements and environmental impact.

Arup has been engaged by planningNSW (pNSW) to review the appropriateness of the vertical and horizontal design of the WSO and interchanges proposed by the RTA generally within the proposed road acquisition corridor. Specific tasks to be undertaken include:

- *Assess the suitability and consistency of the design principles and concept plan in the EIS and Representations Report including design speeds. This assessment should include a level of benchmarking against intra and interstate and overseas practice.*
- *Review the adequacy of the concept design assessment undertaken in the EIS and Representations Report in the context of the impacts on the surrounding environment (note that at the inception meeting the Department will identify the key environmental constraints), particularly in relation to the following intersections (including on and off ramps):*
 - *M5/Hume Highway;*
 - *Elizabeth Drive;*
 - *M4;*
 - *Richmond Road;*
 - *Norwest Boulevard;*
 - *M2.*

- *Review the engineering assumptions regarding lack of suitability of using Wallgrove Road as the WSO route due to horizontal and vertical geometry and the need for access to properties.*
- *Suggest alternative concepts where appropriate that would reduce the bulk and scale of the interchanges but still fulfil traffic requirements to an acceptable level.*

3. INFORMATION PROVIDED

The EIS (including Working Paper 3 – Road Concept Design) and the relevant sections of the Representations Report were provided by pNSW and used as the primary reference material. A number of design changes to the WSO and interchanges have been made since the EIS exhibition and extracts from the Representations Report which described these changes were provided.

A briefing meeting was held with RTA and DUAP on 12/10/01. Profiles for the Orbital were subsequently requested from RTA and provided. A full list of information provided is included in Appendix A – Data Acquisition Schedule.

A discussion to review the preliminary findings of the draft report was held with RTA and pNSW on 13/12/01.

4. METHODOLOGY

The review was carried out on the information provided as described above. In addition, information was obtained on typical design standards for urban motorways and interchanges adopted by National and State road agencies in Australia, the UK Highway Agency, two US State agencies and the Poland road agency.

5. REVIEW OF DESIGN

5.1 Design Speed of WSO (Through Route)

The section of the WSO between Richmond Road and the M2 has a design speed of 100km/h and between Prestons and Richmond Road 110km/h. RTA suggest in the Representations Report that the WSO may be signposted at between 90 and 110 km/h and that operating speeds would be expected to be in the range 100 to 110 km/h regardless of the posted speed limit. RTA subsequently advised by fax on 12/12/01 that the likely posted speed limit for both sections would be 100 km/h.

The proposed design speed has been reviewed considering the road function and typical practice in Australia and elsewhere.

It is noted that the WSO has been designated as a National Highway, invoking design requirements that are not necessarily applicable to other roads. Normal minimum National Highway design speed in Australia is 100 km/h, 110 km/h desirable where additional cost or environmental consequences of the increase are not significant

For urban motorways, which may or may not be part of the National Highway network reference has been made to National and State road agencies in Australia, the UK Highway Agency and two US State agencies. These agencies typically provide guidelines for design speeds as well as the relationship between design speeds, speed environment and posted speed limits for urban motorways. Speed environment/operating speed is commonly defined as the speed at or below which 85% of drivers would travel in a free flow situation.

The findings for Freeways/Motorways in Urban Areas may be summarised as follows:

- The Victorian VicRoads' Road Design Guidelines and the Western Australian Main Roads' Guide to the Geometric Design of Roadways adopt a common approach. It is suggested that typical operating speed in outer urban freeways is 110 km/h and that the minimum design speed in urban areas should be equal to or greater than the operating speed (ie 110 km/h). Both guidelines also advise that the desirable design speed would be 10 km/h above the posted speed limit. It is also noted that the recent Western Ring Road in Melbourne is signposted at 100 km/h in some sections and 110 km/h in others.
- In Queensland, the Department of Main Roads sets out design guidelines in its Road Planning and Design Manual. The minimum speed environment for an outer urban motorway is 100 km/h. The guidelines also note that the speed limit and roadside environment are the primary factors affecting the speed environment in urban areas and that higher values of speed environment should be adopted where there are little savings in using a lower value. Where vehicle speeds are largely unaffected by the horizontal alignment (as would be the case for the WSO) the guidelines advise that the speed environment can be 10 to 20 km/h above the speed limit.
- The RTA Road Design Guide does not specify design speeds for urban freeways or motorways but notes that in Sydney the operating speeds for arterials can be in the range 70-110 km/h.
- There is no Austroads document with design guidelines for motorways or freeways – the old NAASRA "Guide Policy for Geometric Design of Freeways and Expressways" suggests a minimum design speed of 100 km/h for a suburban freeway or expressway
- In the UK the design speed for a freeway in an urban area is 85-100 km/h
- In the US the design speed is typically 90-130 km/h

Considering the above and RTA's advice that the signposted speed for both sections is likely to be 100 km/h, the design speeds proposed by RTA for the two sections are considered reasonable:

- The minimum design speed of 100 km/h is consistent with the minimum requirement for National Highways:
- Depending on the level of police enforcement of the 100 km/h speed limit, the likely operating speed on both sections would be in the range 100-110 km/h, with operating speeds on the M5 to Richmond Road section expected to be slightly higher because of the more open nature of the terrain. In these circumstances the proposed design speeds are considered appropriate
- In Victoria, Queensland and Western Australia the state road agencies all recommend that the design speed should desirably be at least 10 km/h above the posted speed limit
- In both sections the nominated design speeds are easily achieved by the horizontal and vertical geometry in the RTA designs and, considering the relatively open topography, there would appear to be little savings to be gained by lowering the design speed. In these circumstances good design practice would be to adopt the minimum design speeds as suggested by RTA.

At the same time, the RTA vertical design is generally quite generous for 100 km/h or 110 km/h and some reduction in earthworks savings might be possible when tenderers prepare tender designs and seek to optimise earthworks to reduce costs.

5.2 Interchange Layouts

5.2.1 General

The WSO proposal includes 15 grade-separated interchanges. The interchanges with the M5, M4 and M2 all involve total grade separation for all traffic movements including on and off ramps. On and off ramp design speeds allow for up to 90km/h traffic movements at these interchanges. All other intersections include on and off ramps designed to at least 80km/hr with 60km/hr speed environments at the intersections.

The proposed layouts and ramp design speeds have been reviewed considering the interchange functions and typical practice in Australia and elsewhere.

Most interchanges adopt diamond or half diamond layouts. These are appropriate and efficient in terms of cost and land take where traffic volumes entering or leaving the motorway and on the crossing road are low. Attention has therefore been focused on interchanges where a higher standard layout has been proposed.

5.2.2 Design Standards for Motorway to Motorway Interchanges

For the motorway to motorway connections a summary of typical design standards adopted by National and State road agencies in Australia, the UK Highway Agency and two US State agencies has been prepared. Key findings are as follows:

- Normal practice in most agencies is to limit the speed differential between the through route and the connecting ramps, with allowable speed differentials varying depending on whether the connecting ramp is a loop or not.
- The only Australian State with specific guidelines for motorway to motorway connections is Queensland. Where two motorways intersect (such as at the WSO/M4) a minimum connection design speed of 70-90 km/h is required for indirect ramps (diverging and merging on the left) or 80-100 km/h minimum for direct ramps (diverging and merging on the right). At a Y interchange the connections between the three legs would be treated as direct ramps with a minimum design speed of 80-100 km/h. All cases assume a design speed of 100-120 km/h for the through route.
The guidelines also recommend that the maximum difference in speed environment between the through route and the ramps should not exceed 20 km/h, which is to some extent inconsistent with the minimum design speeds quoted elsewhere in the document.
- NAASRA's 1984 "Grade Separated Interchanges – A Design Guide" suggests a design speed of at least 80 km/h for direct ramps (leaving from the right lane) but acknowledges that design speeds above about 50 km/h are generally not practicable for semi-direct connections (leaving from the left lane). Design speeds below 80 km/h are permitted provided that adequate deceleration length is available from the freeway exit taper to the start of the horizontal curve. This publication largely supersedes the 1976 NAASRA "Guide Policy for Geometric Design of Freeways and Expressways" which suggested a minimum design speed of 70 km/h for turning roadways.
- In the UK the minimum design speed for a freeway to freeway connection in an urban area is 70 km/h (based on their recommended through route design speed of 85-100 km/h).
- In the US the recommended minimum design speed for freeway to freeway connections is typically 80 km/h (for CALTRANS which adopts 90-130 km/h for the through movement) or 15-45 km/h below the through movement design speed (New York Highways Department).
- Polish standards for motorway to motorway connections (system interchange) are low in comparison to other standards, requiring a connection design speed of 60-80 km/h for

right turns (left turns in Australia) or 50-70 km/h for left turns (right turns in Australia).

In conclusion, and assuming a sign posted speed limit of 100 km/h would be adopted for the WSO throughout, then the suggested minimum ramp design speeds are set out in the following table:

Motorway to Motorway - Ramp Design Speeds

Interchange/ Ramp	Minimum Radius in RTA Design	Design Speed adopted by RTA	Suggested Design Speed
<i>WSO/M5/F5</i>			
F5 to WSO (National Highway)	R720m	100	100
WSO to F5 (National Highway)	R600m	100	100
M5 to WSO	R400m	95	80
WSO to M5	R340m	90	80
<i>WSO/M4</i>			
All ramps	R240m	80	75

At the WSO/M5/F5 interchange the design speed as suggested above for the WSO/M5 connections is 80 km/h. The expected speed environment would be 80 –85 km/h. The maximum reduction in speed environment would be for the link from the WSO to the M5; a speed environment reduction of about 20-25km/h assuming a speed environment of 100-110 km/h for the WSO. The speed environment reduction for the reverse movement would be less. While the speed differential exceeds the maximum of 15 km/h suggested by RTA for the WSO, the 80 km/h design speed is reasonable considering guidelines in Australia and overseas provided that measures are taken to advise of the change. These might include advance warning signs, pavement markings, lighting and reinforcement of the lower speed environment by reducing the cross-section, planting nearer the roadway, etc.

At the WSO/M4 interchange it is suggested that the ramp design speeds could be slightly lower with a corresponding increase in the change in speed environment. With ramp design speeds of 75 km/h the anticipated speed environment would be 75-80 km/h, corresponding to a reduction in speed environment of 25-30 km/h for vehicles leaving the WSO. Provided that measures are taken to advise of the change as described above, the reduction is considered appropriate for the following reasons:

- The minimum radius could be reduced from R240 to R200m, with a possible reduction in footprint and cost, subject to achieving the necessary vertical separation on the connections.
- after leaving the motorway drivers have at least 460m from the exit nose before the start of the curve. This length provides adequate deceleration length from motorway speeds in accordance with guidelines and is on an uphill grade for both WSO exits.
- the one lane diverge at the motorway exit will emphasise to motorists that there is a change in the speed environment as they leave the motorway.

- Curves with a radius of R200 and 7% superelevation would have a maximum curve approach speed of about 93 km/h, and should not be unsafe considering the 2 points above.
- A design speed of 75 km/h would generally be consistent with Queensland and UK guidelines but would be lower than US guidelines.

Application of the suggested design standards is further discussed under the specific interchanges below.

5.2.3 M5/Hume Highway

At this interchange the connection between the F5 (Hume Highway to the south) and the WSO is designated as part of the National Highway network. The northbound and southbound through movements appear to achieve a design speed of 110 km/h, exceeding the 100 km/h nominated by RTA, but this is achieved without significant increases in land take, footprint or cost.

The connection between the WSO and the M5 provides a design speed on the controlling movement from WSO southbound to M5 eastbound of 90 km/h (R340m). The reverse movement from M5 westbound to WSO northbound is on the outside and provides a design speed of 95 km/h (R400m).

The design speeds achieved in the current RTA layout exceeds their earlier nominated minimum design speed of 80 km/h (RTA WSO Interchange Report, July 2001) and it is also noted that the radii are within the R300 to R440 band which RTA guidelines advise should only be used in exceptional circumstances for design speeds greater than 70 km/h. Accident records show that curves with radii within this band are deceptive to drivers on higher speed roads, as it appears they can be safely travelled at higher speeds than is actually possible. It is recommended that consideration should be given to reducing the design speed of these movements to 80 km/h (R240m) as discussed in 5.2.2 above.

If a reduction in design speed is considered appropriate, it may also be feasible for the M5 to WSO connection to exit from the right lanes after passing under Beech Road, potentially reducing the length and cost of this ramp.

5.2.4 Bernera Road

This is a diamond interchange with the WSO passing above Bernera Road. Bernera Road also appears to be raised in the RTA design to bring it above the 20 year ARI flood level. Comments on the layout:

- Consider bringing the roundabouts closer to the WSO to reduce the footprint; with Yarrawa Road connecting as a separate intersection to the west
- Given the shortage of material, consider passing Bernera Road above rather than under the WSO – this would allow the WSO to be lowered over a distance of about 800m. The reduction in fill requirements should be at least 100,000m³ after allowing for the extra fill required for Bernera Road.

As a further exercise, the reduction in fill requirements assuming 1.9 km of viaducts across the flood plain has also been assessed. Assuming viaducts extended from Ch 1700-2300 and from Ch 3200-4500, the net reduction would be of the order of 600,000 m³.

5.2.5 Elizabeth Drive

It is noted that the proposed layout of this interchange has been modified to reduce the footprint and the environmental impact. As a concept, the current layout looks reasonable.

The southbound off-ramp is separated from the through route by a retaining wall and vehicles using this ramp would find sight distance to the west severely restricted as they approach Elizabeth Drive. Care would be required in the detail design to ensure that minimum sight distance requirements are provided for a vehicle stopped at the approach or traffic signals may be required.

5.2.6 Old Wallgrove Road/Waste Management Services, Eastern Creek

It is noted that this is the only interchange with tight loops on the exit radii. The recommended practice of most road agencies is that for a given section of road there should be consistency in the layout of intersections and interchanges for ease of use and safety.

A reduction in the scale of the M4 interchange as discussed below may create enough separation between the two junctions to allow the opportunity to convert the Old Wallgrove Road interchange to the diamond type interchange which has been proposed at most interchange locations. It is recommended that this should be considered as part of the review of the M4 interchange.

5.2.7 M4

Background

At this interchange turning movements are not particularly high compared to the traffic volumes on the M4. The highest hourly volume for a turning movement in the AM peak in 2016 is forecast at 693 vph, less than half the capacity of one lane.

The layout presented in the EIS was a grade separated roundabout. This was later rejected by RTA on safety grounds. In a preliminary review of the roundabout options in the EIS it was noted that the design speed achieved with the EIS option was 60 km/h, considerably less than the 75 km/h design speed suggested for motorway to motorway connections in 5.2.2 above. An enlarged version of the roundabout option was also presented in the WSO Concept Design Report (Figure 7F). This option increased the design speed to 70 km/h, still lower than desirable.

RTA now proposes replacing the roundabout with a 4 level directional interchange. This form of interchange, while universally preferred in terms of capacity and safety, is not often adopted because of the high cost of the 4 level structures required. It has the advantage in this instance of maintaining Wallgrove Road as a separate through route as well as maintaining the connections between Wallgrove Road and the M4.

RTA documents provided indicate that a simpler and cheaper alternative with three rather than four levels was also considered. With this arrangement the M4 would be at its existing level and the WSO would pass above it while the third level would comprise the four right turn ramps with an at-grade intersection at their junction. The third level ramps could potentially all be underneath the M4 in tunnels or could all be on elevated ramps at the same level as the highest level of the current proposal. The three level layout has the potential to reduce the cost and the overall height but not the footprint. A single set of 2-phase signals would be required at the ramp junctions and the viability of this layout is a function of safety and capacity of the signalised intersection. Preliminary calculations suggest that sufficient capacity would be available until about 2026 with a single through lane at the signals for each of the four approaches. However, traffic management in the event of accidents would be difficult and widening at a later date to increase capacity would be costly. For these reasons a three level layout is not recommended.

The do not appear to be any other options which achieve the design speed requirements and still maintain full access to Wallgrove Road, but which would have a lower cost or footprint.

Comments on the layout of the proposed 4 level interchange

The layout achieves a design speed of 80 km/h (R240m) for all connections except for the M4 westbound to WSO northbound connection which has a design speed of 90 km/h (R320m).

Recommendations are as follows:

- Consider reducing the connecting ramp design speeds from 80 km/h (R240m) to 75 km/h (R200). The change would allow a reduction in current footprint subject to achieving the required level differences.
- Consider moving the existing ramps of the half diamond interchange at M4/Wallgrove Road closer to the M4. There would be additional costs of reconstruction of the ramps but these costs should be less than the savings in structure costs for the 6 structures which span over the width of the existing half diamond.
- The M4 westbound off-ramp seems excessively long, especially when compared to the length of the M4 eastbound off-ramp.
- The design shows the M4 eastbound to WSO northbound crossing under the M4 westbound to WSO northbound connection before the two ramps merge and connect to WSO northbound. Consider merging these two ramps before rather than after they cross, reducing structure costs and shortening the length of both ramps before they connect to the WSO.

5.2.8 Richmond Road

Basic layout seems appropriate but consider the following adjustments to reduce the footprint and cost:

- The WSO eastbound on-ramp seems very long and has a large overall footprint compared to other ramps.
- Consider moving the WSO eastbound on-ramp and westbound off-ramp closer to the WSO to reduce the footprint, subject to provision of adequate vehicle storage on Richmond Road between the signalised ramp junctions.

5.2.9 Norwest Boulevard

It is noted that both ramps at this location appear to have a radius of about R200, corresponding to a design speed of about 75 km/h. A lower design speed of say 60 km/h (R160m) may be acceptable for the on-ramp considering the adjacent junctions on Norwest Boulevard at Greenhill Drive and Old Windsor Road. A lower design speed for the on-ramp would reduce the footprint and might also reduce the structure length. The acceleration lengths would need to be checked.

5.2.10 M2

The through movement between the WSO and the M2 is effectively a motorway to motorway connection but is achieved seamlessly. The design speed of the connections to Abbot Road are 95 km/h (R400) for the off-ramp to Abbott Road southbound and 90 km/h for the on-ramp from Abbott Road northbound. The design speeds are in excess of requirements but are existing ramps.

5.3 Wallgrove Road

The key issue with using Wallgrove Road as the alignment for the WSO would not seem to be restrictions related to the horizontal or vertical alignment of Wallgrove Road but rather the need to provide local access – Wallgrove Road, or at least another road which would duplicate

its current function, would have to be relocated elsewhere if the WSO was located on Wallgrove Road's present alignment. Additional costs, disturbance and traffic management issues would probably exceed any benefits to be gained.

5.4 Earthworks

RTA has advised that a significant shortfall, in excess of 2 million m³, would result with the current RTA design (as advised 13 Dec 2001). It is understood that this figure is based on cut and fill slopes of 2H:1V throughout.

There may be a tendency for the shortfall to increase in the detail design when better geotechnical information is available. A likely result would be for fill batter slopes on lower fills to be made flatter while cut batter slopes on deeper cuts may be steepened in the deeper shales. The result would tend to reduce the volume of cut and increase the volume of fill, adding to the significant shortfall. Other requirements, eg for noise mounds or landscaping may also be considerable, further adding to the shortfall.

The cost and programme implications of obtaining the required material could be considerable, notwithstanding RTA expectations that spoil material will be available from the major infrastructure works in Sydney such as the Cross City Tunnel and the Parramatta Rail Link.

It is recommended that the design be critically reviewed with a view to:

- Identifying areas where adding or extending viaducts could reduce the shortage and have other benefits in terms of environmental impacts, effects on flooding, etc.
- Identifying areas where the motorway could be lowered, particularly where the WSO has been shown as passing above crossing roads. Local roads are much narrower and can have sharper vertical curvature, allowing an overall reduction in fill requirements where the local road passes above the WSO. Examples might include:
 - Passing Bernera Road (Ch 3000) above rather than under the WSO.
 - Passing The Horsley Drive (Ch 14700) over rather than under the WSO, although the proximity of Wallgrove Road and the drainage structure to the north may make this difficult.
 - Consider alternative access arrangements for Austral Bricks, the Sydney Water Pipeline and the Chicken Farm at Ch 17000. Provision of adequate cover above the access road raises the WSO over a considerable length.
 - Passing Woodstock Avenue (Ch 24250) above the WSO.

5.5 Environmental Issues

Issues arising from a limited review of the design with respect to environmental impacts are identified as follows:

- At the F5/M5/WSO interchange the remnant vegetation appears to be of limited value and any benefits to be gained by realigning any of the connections or ramps would appear to be marginal.
- At the Hinchinbrook Creek crossing there would appear to be advantages in extending the bridge on the north side of the creek to keep the abutment and wingwalls out of the channel and reduce the impact on vegetation.
- At the M4 the woodland is degraded, disturbed and fragmented – urban design, safety and cost considerations would appear to be more important at this location.

- North of Richmond Road the vegetation mapping does not suggest any significant gains if the east-west alignment of the WSO was to be moved further to the south.
- It would be usual for the EIS to identify likely requirements for temporary land for a range of construction-related activities such as site compounds for offices and storage of plant and equipment, batch plants and stockpile sites. While actual requirements would depend on factors such as the contractor, the final design and work methods adopted, the usual approach would be to identify sufficient suitable areas for each possible ancillary construction activity, to assess likely impacts and to describe appropriate mitigation measures in the EIS. The proposed sites and mitigation measures would normally be discussed and agreed with the relevant agencies as part of the EIS process. In this instance it appears that suitable sites have not yet been identified, neither likely impacts or their mitigation. The risk with this approach is that obtaining the necessary approvals (including an appropriate level of environmental assessment such as a REF) REF may cause delays and/or increases in design/construction costs.

6. SUMMARY OF FINDINGS

Key findings from the review are summarised in the following table:

No	Item	Description
1	M5/WSO Interchange: M5 to WSO ramp WSO to M5 ramp	Consider reducing design speed of these ramps to 80 km/h (R240)
2	Old Wallgrove Road	Inconsistent treatment of exits. Consider revising layout to avoid loops depending on outcome of WSO/M4 interchange review (see 4 below)
3	Bernera Road	Consider passing Bernera Road above rather than under the bypass to reduce overall fill volume Review ramp layout on west side with view to reducing the footprint
4	M4 Interchange	Consider reducing design speed of ramps to 75 km/h. Consider reconstructing Wallgrove Rd diamond interchange as a closed diamond with ramps close to the M4 Consider other minor revisions to ramps as noted in 5.2.7
5	Richmond Road	Review ramp layout to reduce length and footprint
6	Norwest Boulevard	Consider reducing on-ramp design speed to 60 km/h
7	Earthworks shortage in excess of 2 million m ³	Reconsider opportunities for extending viaducts, eg in the vicinity of Ch 1700-4500. Review profile, particularly where the WSO passes above local roads (eg Bernera Rd, The Horsley Drive, Austral Bricks access, and Woodstock avenue)

APPENDIX A

Data Acquisition Schedule

APPENDIX 1.

DATA ACQUISITION SCHEDULE

Item No. 81471/-	Description of Data (including drawing and report references)	Source	Date Received	Comments	Document Type	Filing Location
0001	Project Brief (Request for Proposals)	RTA	Sept 01		Document	Correspondence File
0002	Review of Western Sydney Orbital - Arup Proposal	Arup	Sept 01		Document	Correspondence File
0003	Revised RTA plans of WSO. Sheet 1 of 16 to Sheet 16 of 16	DUAP			Foldouts	In-Document Folder with JHH
0004	Extract from Representations Report dated 17/9/01 - Section 3 "Consideration of representations"	DUAP			A4	In-Document Folder with JHH
0005	Extract from Representations Report dated 17/9/01 - Section ?? Correspondence from DUAP including letter responding to DUAP queries and RTA Report of Proposed 4 level directional interchange at the M4	DUAP			A4	In-Document Folder with JHH
0006	Extract from Representations Report dated 17/9/01 - Section 5 Additional Investigations since the EIS Exhibition	DUAP			A4	In-Document Folder with JHH
0007	Extract from Representations Report dated 17/9/01 - Section ?? Summary of Modifications to the EIS Proposal including Table 7.2 - Design Specifications for the Preferred Activity	DUAP			A4	In-Document Folder with JHH
0008	Extracts from EIS with details on maps of threatened species and endangered ecological communities	DUAP	18/10/2001		21 x A4 colour copies	In-Document Folder with JHH
0009	A3 colour photocopy of proposed F3/Braxton interchange with the Newcastle Link Road and the existing F3	DUAP	18/10/2001		1 x A3 colour photocopy	In-Document Folder with JHH
0010	WSO EIS - Summary, Working Paper 3 Road Concept design	DUAP				With JHH
0011	WSO EIS - Volume 2 Prestons to Cecil Park, Volume 3 Cecil Park to West Baulkham Hills	Arup				Arup Library

Item No. 81471/-	Description of Data (including drawing and report references)	Source	Date Received	Comments	Document Type	Filing Location
0012	Dublin Ring Road - N4 Interchange Layout	Arup	17/10/2010			In-Document Folder with JHH
0013	Long Sections for Western Sydney Orbital - Sheets 1,2,3, Sheets 4,5,6, Sheets 7,8,10, Sheets 11,12,13, Sheets 14,15,16	DUAP	19/10/2001		5 x rolls	With JHH
0014	Schedule of Design Speeds and Posted Speed limits	pNSW	13/12/2001		1 x A4 sheet	Correspondence file
0015	Schedule of Cut/Fill Areas/Volumes	RTA	20/12/2001		1 x A4 sheet	Correspondence file
0016	Revised Traffic Figures - Tables 4.4 to 4.7 from Mason/Wilson/Twiney dated 11/12/01	pNSW	18/12/2002		5 x A4 pages	Correspondence file

APPENDIX E

Masson Wilson Twiney's Traffic Report

**FINAL TRAFFIC REPORT – INCORPORATING
RESULTS OF A HEAVY VEHICLE MOVEMENT
SURVEY IN WESTERN SYDNEY**

**Prepared for
Western Sydney Orbital**

February 2002

**Roads and Traffic Authority
Client Services Branch
Blacktown**

MASSON | WILSON | TWINEY
TRAFFIC AND TRANSPORT CONSULTANTS

Suite 47, “Chatswood Village”
47 Neridah Street
Chatswood NSW 2067
Telephone (02) 9415 2844
Fax (02) 9415 2944
Email info@mwtttraffic.com
Web www.mwtttraffic.com

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1. Introduction

The RTA engaged Masson Wilson Twiney (MWT) to review the Western Sydney Orbital EIS's Working Paper 2 – Transportation, Traffic and Access. The proposed Western Sydney Orbital would form the western closure of the emerging Sydney orbital road by linking the M5 Motorway at Prestons with the M2 Motorway at West Baulkham Hills. It would comprise approximately 40 kilometres of four-lane divided carriageway at motorway standard with access control and grade-separated interchanges. Other sections of the Sydney orbital are the recently opened M5 East and the section between the Gore Hill Freeway and M2 Motorway, which currently in the planning phase. Importantly, the proposed WSO is to provide the designated National Highway link through Sydney replacing parts of the existing link along the Cumberland Highway and Pennant Hills Road.

In July 2001, MWT submitted a review report to the RTA that identified the following concerns with the work undertaken for the EIS:

- Potential problems with assumptions underlying the landuse scenarios used as the basis of forecasting future traffic flows;
- Lack of corridor analysis to explore the nature and scale of transport demands in the proposed WSO's corridor – especially with regard to longer distance traffic and freight;
- The application of factoring from morning peak models to derive daily and annual estimates of traffic volumes and network performance;
- Assumptions regarding the development of the base road network that appear to be inappropriate under current conditions.

MWT were commissioned by the RTA to then address these concerns. To this end, the following activities were completed:

- Investigation of the movements of heavy vehicles in Western Sydney, with a focus on longer distance movements;
- Modelling of the road system, with and without the proposed WSO, using the Netanal network modelling package, with the latest landuse scenarios and base network improvements and multiple time slice modelling.

This report describes the method used to investigate heavy vehicle movement patterns in Chapter 2 and the results of the survey in Chapter 3. The traffic modelling approach and results are discussed in Chapter 4. Chapter 5 compares the most recent modelling results with those in the EIS and examines differences in input assumptions that have led to different forecasts. The role of the proposed WSO is discussed in the context of the project's objectives, its contribution to the development of the road network in Western Sydney and the function that the modelling indicates it would provide. Conclusions are drawn in Chapter 7.

A series of appendices contain more detailed information about the survey of heavy vehicles and the modelling process.

2. Outline of Heavy Vehicle Data Collection

2.1 Objectives

The objectives of this part of MWT's brief were to:

- Identify the volumes of heavy vehicles that currently travel in and around the corridor of the proposed WSO;
- Identify the patterns of these movements in terms of their origins and destinations;
- Characterise the current use of the Cumberland Highway, a link which the proposed WSO seeks to replace in functional terms;
- Estimate likely diversions to the proposed WSO for future years.

Due to the timescale and likely function that would be provided by the proposed WSO the study does not seek to analyse all heavy vehicle movement patterns within Sydney. It focuses on traffic on those routes close to the proposed WSO alignment that may have some scope to consider the use of that facility.

2.2 Tasks

The study comprises five elements:

- Review of existing information
- Survey planning and fieldwork;
- Data processing;
- Survey reporting;
- Modelling.

2.3 Review of Existing Information

Two main sources of existing information considered for this study were:

- External Cordon Survey (ECS) from 1993;
- Commercial Vehicle Survey (CVS) from 1992.

The ECS was undertaken at a series of sites around the periphery of Sydney and provides information on movements into, out of and through Sydney. It employed intercept surveys using self-completion postcard surveys at traffic signals, sampling all vehicle classifications.

The CVS used travel diaries for a sample of vehicles registered at addresses within the Sydney region. As such it did not capture all inter-regional movements. Its real value lay in its picture of local distribution; although in the intervening years a number of developments have eroded its applicability. These developments include:

- Developments in vehicle technology, leading to changes in fleet structure, with larger vehicles carrying more of the long distance task, whilst there has been an increase in frequency of local deliveries.

-
- Land use patterns have altered with a shift in industrial land uses from the Central Industrial Area (located between the CBD and Airport) to the west, increasing the amount of heavy vehicle traffic within the reach of the WSO corridor.
 - Changes in economic structure and work practises. These have reduced the relative importance of industrial activity (a major generator of heavy vehicle movements) within the Australian economy, although micro-economic reform has led to particular manufacturers emerging with an export focus. At the same time there has been an increase in the complexity of supply chains with more movements of goods occurring during the manufacturing and distribution processes.
 - National competition policy has exposed sub-sectors of the economy to competitive forces, which they did not previously face. Illustrations of this include the Sydney ports that now compete with Newcastle and Port Kembla for trade and the emergence of private operators in the rail sector.

All these changes, among others, were only emerging at the time of the CVS. These trends, whilst their transition period is not complete, are now well established and data on heavy vehicle movements collected in 2001 is more likely to be representative than data from a decade ago.

The nature of the above two sources of data suggested fresh data was required.

A further possible source of existing data considered was a set of freight trip tables that are currently under development by the Transport Data Centre within the NSW Department of Transport. These are due for release later in the year.

2.4 Survey Planning and Fieldwork

After consideration of alternative methods, an intercept survey using postcard questionnaires was designed. This provided advantages over number plate surveys by identifying the true origins and destinations of heavy vehicle movements, it also provided advantages in terms of lead time over interview or travel diary surveys.

The initial intention of the survey was to sample heavy vehicle movements using the northern and south-western entry points to the Sydney road network, this would capture movements into and out of the Sydney road network and as well as through movements. However, this was extended to include a series of survey stations within the area around the proposed alignment of the WSO. These would provide information on the assignment of longer distance trips within the road network and identify movement patterns that are wholly within the Sydney road network, as well as collecting detailed data on heavy vehicle volumes.

Appendix A contains the survey specification. Vehicles sampled were goods carrying vehicles over 5 tonnes. This did not include light commercial vans, as are used by couriers and trades.

Fieldwork was undertaken on Thursday 9 and Friday 10 August 2001. A fieldwork report is in Appendix B. The salient features of the fieldwork were:

- Relatively low contact rates were experienced at a series of stations, primarily due to the signal timings. At the Pacific Highway station this resulted in relocation from Ada Avenue to Bobbin Head Road.

- A total of 5,289 postcards were distributed and the control counts recorded a total of 22,480 rigid heavy vehicles and 11,536 articulated heavy vehicles at the survey stations.
- The Prospect Highway and Mamre Road sites were surveyed on the following day Friday 10 August 2001. Counts were undertaken at these stations on the day.
- A generally positive response was received from drivers of heavy vehicles during the survey.
- No weather or traffic incident interruptions to survey.
- The Tri-Star dispute, involving the closure of this Marrickville-based automotive parts manufacturer had yet to be resolved. Three out of four car assembly plants were closed in South Australia and Victoria during the survey.

2.5 Data Processing

A total of 733 postcards were returned to the survey firm within two weeks of the conduct of the fieldwork. Returns after this date were not processed. This represents a return rate of 14%, which is at the lower end of expectations. A degree of survey fatigue may have affected drivers during the survey week as Tuesday 7 August 2001 was Census Day.

The survey firm was responsible for the entry of data into computer format from the survey postcards. MWT processed the raw database to produce a database for analysis and modelling. The process steps were:

- Clean address coding;
- Test records for logic and validity;
- Attach additional fields, including supplementary origin and destination information, such as the TDC travel zone numbers and SLA names; and
- Expansion of the survey records to reflect the volumes of vehicles at the relevant station.

The data processing report is in Appendix C.

A total of 697 records with valid origins, destinations and vehicle types were available for analysis after initial processing was completed.

2.6 Survey Reporting

The survey results are summarised in Chapter 3. This includes:

- volumes and profiles of truck movements at each survey site;
- the general patterns of movement for each of the key sites; and
- analysis of load status and commodity.

2.7 Modelling

The purpose of the data collection was to provide an improved understanding of heavy vehicle movement patterns in Western Sydney. Chapter 4 describes how the information is used to strengthen the existing network modelling and provides results of the forecasting process.

3. Heavy Vehicle Survey Results

3.1 Heavy Vehicle Control Counts

Volumes of heavy vehicles at each of the survey stations are summarised in Table 3.1 with analysis by hour by direction for each station, while graphs showing the profiles of heavy vehicle volumes (Charts 3.1 to 3.21) are located immediately behind the tables at the end of this chapter. Table 3.2 reports the split of heavy vehicles by type for morning and afternoon periods.

Features of this analysis, for sites ranked by the level of recorded demand, are:

Pennant Hills Road, at Comenarra Parkway, experiences the largest volumes of heavy vehicles of all survey stations, with a little under 5,000 recorded during the survey period (6:30am to 5:30pm). These movements are balanced in each direction, and approximately 42 per cent of trucks are articulated. The profile of demand (refer to Chart 3.1) shows a large increase in northbound numbers from 8:00 am to 9:00 am which stays high to 11:00 am and then declines through the afternoon. Northbound rigid vehicles are skewed to the afternoon. Articulated vehicle have a less volatile profile through the day. Southbound articulated vehicles are high early in the day (refer to Chart 3.2) and then decline faster than numbers of northbound articulated vehicles.

Cumberland Highway at Old Prospect Road, just south of the M4, is the next busiest station. During the survey period it had about 10 per cent more northbound heavy vehicles than southbound ones. Approximately 42 per cent of the heavy vehicles were articulated. The profile of vehicle (refer to Charts 3.3 and 3.4) volumes is relatively flat in both directions except for a peak from noon to 2:00 pm. Articulated numbers are higher than rigid numbers at 3:00 pm and 5:00 pm only. In both directions the number of trucks falls heavily to 5:00 pm.

Wallgrove Road carried about 5 per cent fewer trucks than the Cumberland Highway at Old Prospect Road. Of interest is that Wallgrove Road carried 25 per cent more trucks than the Cumberland Highway at Brennan Street, south of The Horsley Drive. It carried about 10 per cent more heavy vehicles southbound than northbound; if the flows on Cumberland Highway at Old Prospect Road are combined with the Wallgrove Road flows, then 4,131 vehicles were recorded northbound and 4,166 were recorded southbound, indicating directional balance and possibly some preference by drivers to avoid the west-to-south movement through the M4 / Cumberland Highway interchange, opting to use the M4 / Wallgrove Road interchange. The profile through the day (refer to Charts 3.5 and 3.6) is fairly similar in both directions. About 22 per cent of heavy vehicles on Wallgrove Road are articulated. Articulated vehicle numbers are relatively flat through the day and then decline from 3:00 pm onwards. Rigid vehicle numbers start high and increase to a peak at 11:00 am before declining sharply from 1:00 pm onward.

Approximately 4,029 heavy vehicles were counted at the M5 station. This does not include the 836 vehicles counted at Moorebank Avenue, which, if combined with the M5 flows indicate that the M5 carries about 100 heavy vehicles less than the Cumberland

Highway at Old Prospect Road over the 11-hour survey period. Articulated vehicles make up about 35 per cent of the heavy vehicles at this site. The profile of demand for articulated vehicles eastbound (refer to Chart 3.7) shows a slow, steady decline through the day. Westbound (refer to Charts 3.8 and 3.9), it experiences the reverse, a slow steady rise through the day to a spike at 4:00 pm, before sharp drop to 5:00 pm. Rigid heavy vehicles travelling eastbound show a similar pattern of decline through the day, although there is a spike at 10:00 am and another between 2:00 pm and 3:00 pm. Numbers of rigid vehicles travelling westbound increase strongly through the morning to 11:00 am before stabilising to 4:00 pm, after this their numbers decline sharply to 5:00 pm.

Prospect Highway carried 3,779 heavy vehicles with these roughly balanced by direction. Of its heavy vehicles, 22 per cent were articulated, which is relatively low for survey stations. The profile of demand (refer to Chart 3.10 and 3.11) on this road was very similar in each direction: articulated heavy vehicle numbers build gradually through the day. Rigid vehicle numbers increase sharply after 9:00 am and stay relatively high until 3:00 pm, before declining steadily to 5:00 pm. It is the variation in demand by rigid heavy vehicles that drives the overall profile of demand.

Hume Highway carried the same volume of heavy vehicles as Prospect Highway with about 7 per cent more in the northbound direction than southbound over the survey period. About 39 per cent of the heavy vehicles were articulated, which is the fourth highest proportion of all stations. Northbound demand climbs (refer to Chart 3.12) to a peak at 9:00 am, then declines during the rest of the morning before rising to another peak at 1:00 to 2:00 pm. This is in contrast to the southbound direction, which shows (refer to Chart 3.13) a steady increase to 4:00 pm and then declines sharply. Articulated vehicle numbers only exceeded rigid vehicle numbers at 8:00 am northbound and did not exceed southbound volumes during the survey period.

Cumberland Highway at Brennan Street had 3,240 heavy vehicles over the course of the survey period. Of these, the northbound direction carried approximately 15 per cent more than the southbound. Articulated vehicles comprised 52 per cent of total heavy vehicles, making this station the only one where articulated numbers exceeded rigid vehicle numbers over the course of the whole survey period. Both northbound and southbound directions show a general decline (refer to Charts 3.14 and 3.15) from mid-morning and then a sharp fall to 5:00 pm.

Pacific Highway ranks as the next most busy site with 2,614 heavy vehicles counted. Articulated vehicles only accounted for 15 per cent of this demand, the lowest of any site by a considerable margin. Northbound demand was about 5 per cent heavier than southbound. In the northbound direction articulated vehicle numbers experience a slight increase throughout the day (refer to Chart 3.16). Northbound numbers do not fall until a sharp drop at 5:00 pm. Southbound demand falls to a low level at 2:00 pm (refer to Chart 3.17) and then declines further to almost nothing at 5:00 pm.

Rooty Hill Road carried 1,911 heavy vehicles during the survey period, of which 24 per cent were articulated vehicles. Northbound demand was slightly higher than southbound but the numerical difference was small at 55 vehicles over the 11-hour survey period. The profile of demand was similar in both directions (refer to Charts 3.18 and 3.19). Articulated vehicle numbers build gradually whilst rigid vehicle numbers jump to a peak at 8:00 and 9:00 am and then stay high to 2:00 pm, when they start their fall through the rest

of the afternoon. Northbound articulated vehicle numbers are always higher than the southbound flows.

Mamre Road carried 903 heavy vehicles, with about 10 per cent more in the southbound direction than the northbound direction. Approximately 23 per cent of the heavy vehicles were articulated. In the northbound direction (refer to Chart 3.20) peaks were experienced at 8:00 am, 1:00 pm and 3:00 pm; these were driven by changes in the numbers of rigid heavy vehicles. Articulated vehicles' demand profile was flat over the course of the survey period. Southbound, there was a peak at 8:00 am (refer to Chart 3.21) and then sustained levels of demand to 4:00 pm when a sharp decline was experienced.

The proportion of survey period heavy vehicle demand carried during the peak hour for each station is reported in Table 3.3.

The proportion of the total traffic stream comprising heavy vehicles during the survey period is summarised in Table 3.4. The values in this table indicate changes from previous counts of heavy vehicle volumes recorded in 1995, during the preparation of the initial WSO's EIS's Traffic and Transport Working Papers. Three sites from the present study are in broadly comparable locations to sites used in 1995. A comparison of 1995 and 2001 heavy vehicle volumes is provided in Table 3.5 at the three sites.

This limited comparison shows:

- The site on the Cumberland Highway (south of the M4 Motorway) has experienced a fall in both rigid and articulated heavy vehicle volumes between the 1995 and 2001 counts.
- The Prospect Highway has experienced a substantial increase in the number of rigid heavy vehicles in both directions between the two count dates, whilst articulated vehicle numbers have remained static.
- The Rooty Hill Road site has experienced a substantial increase in the number of rigid vehicles using the road whilst the number of articulated vehicles has fallen. Overall, the total number of heavy vehicles has remained about the same.

Explanations for the change include changes to the road network, such as the opening of the M2 Motorway in 1997 and the more recently completed widening of the M4 Motorway. There has also been a large increase in total traffic on the Cumberland Highway, which may have resulted in heavy vehicles, other than those making longer distance trips, seeking to avoid that road, if possible. It is beyond the scope of the available data, to provide a detailed explanation of the reasons for the changes in volumes shown in Table 3.5.

3.2 Characteristics of Heavy Vehicle Movements

Movement Patterns

In order to summarise the survey information, a coarse reporting zone system was adopted. The coarseness means that it is relatively easy to comprehend the patterns of movement at a strategic level and also improves the statistical confidence attached to the understanding of heavy vehicle movement patterns. The reporting zone system comprises four zones:

- West – the area around the proposed WSO and areas with the WSO’s corridor between them and the bulk of Sydney and Sydney’s northern and southern approaches:
 - Baulkham Hills;
 - Blacktown;
 - Blue Mountains;
 - Fairfield;
 - Hawkesbury;
 - Holroyd;
 - Liverpool;
 - Penrith; and
 - Western NSW.
- North:
 - Ku-ring-gai
 - Hornsby; and
 - Areas to their north.
- South:
 - Camden;
 - Campbelltown; and
 - Areas to their south.
- Sydney Balance:
 - All the remaining Sydney SLA’s contained within the area bounded by the other three zones.

A formal definition of this reporting zone system is in Appendix C.

An analysis of the distribution of heavy vehicle trip ends within the Sydney road network for traffic surveyed at the northern (Pennant Hills Road and Pacific Highway) and southern (Hume Highway, M5 and Moorebank Avenue) stations is presented in Table 3.6. In the first half of this table, the destination of inbound heavy vehicles as a proportion of the expanded survey sample is shown at each station. The second half of the table shows the origin of outbound heavy vehicles through the same stations.

The northern survey stations are the main northern exits from and approaches to Sydney. The southern survey stations cover Sydney’s main south-western approach and exit. The main southern exit, via the Princes Highway was not surveyed as it was too far from the alignment of the proposed WSO, although conceivably, some of this traffic may consider use of the new facility, e.g., traffic from Wollongong to Rooty Hill.

The main destination of the inbound heavy vehicle traffic was the West zone which accounted for 41 per cent of such traffic. Whilst the Sydney Balance zone accounted for 40 per cent of inbound heavy vehicle traffic. The North and South zones together accounted for 20 per cent, some of which was through-Sydney traffic.

Of the outbound traffic, 56 per cent was generated by Sydney Balance zone and 31 per cent by West zone. The North and South zones generated 16 per cent of heavy vehicle

traffic through the stations. Again, some of this traffic between North and South zones was through-Sydney traffic.

Combining inbound and outbound records, the Sydney Balance zone contains the most trip ends within Sydney for heavy vehicle travel through the external stations with just under half (48 per cent) of all heavy vehicle traffic. West zone is the next most important zone with 36 per cent of external trip ends. South zone accounts for 5 per cent of trip ends, whilst North zone accounts for 11 per cent.

Of note is the absence of traffic to or from West or South zones using the Pacific Highway. This confirms the perception that Pennant Hills Road is the main heavy vehicle route for through-Sydney traffic and for traffic associated with Western Sydney.

Table 3.7 reports the results of the application of the proportions from Table 3.6 to control counts at relevant stations. There were approximately 5,800 heavy vehicles that passed through the survey's external stations during the 11-hour survey period with a trip end in West zone. This comprised approximately 3,100 inbound vehicles and 2,700 outbound vehicles. The most important routes for carrying this traffic from West zone were the Hume Highway or Pennant Hills Road, which accounted for 4,700 of these heavy vehicle movements, or about 80 per cent of heavy vehicles through the external stations.

Through-Sydney heavy vehicle movements were estimated from the survey at these external stations, yielding two estimates (i.e., one for northern stations and one for southern stations), and a third estimate from internal stations. These estimates are summarised in Table 3.8, which averages the estimates from the external stations and compares these with the estimates from the internal stations. The variations in the estimates are due to the sampling process. The level of through-Sydney movement during the survey period was:

- Southbound – 115 heavy vehicles from the external stations and 168 from the internal stations; and
- Northbound – 143 heavy vehicles from the external stations and 167 from the internal stations.

It must be stressed that the number of survey records supporting this analysis of through movements is a relatively small proportion of the number of survey records at the relevant survey stations (a total of 39 out of 600 records underlie these estimates) and therefore the precision of the estimates is modest. It would be reasonable to say that during the survey period there were between 200 and 400 heavy vehicles travelling through Sydney, two-way.

Trip Lengths

The average trip length for the expanded survey sample was estimated using easting and northing co-ordinates attached to origins and destinations for each record. Where applicable, these used TDC travel zone-level information. The distances calculated are straight-line (crow-fly), which is an approximation of actual distance (refer to Table 3.9).

Articulated vehicles had an average trip length of 195 kilometres, well in excess of rigid vehicles, which had an average of 38 kilometres. The average trip length for all heavy

vehicle classes was 79 kilometres. Several long distance trips by articulated heavy vehicles are represented in the database, including trips from Western Australia, South Australia and the Northern Territory. These have had a small upward effect on the average calculated trip length.

The survey strategy sampled routes that were likely to have a higher than the Sydney average proportion of longer-distance heavy vehicle trips and, as such, these average trip lengths should not correspond with other estimates of average heavy vehicle trip lengths for Sydney as a whole. If they do, then it is by coincidence only. It was not the intention of the study to derive such a Sydney-wide estimate.

Load Status

The load status of surveyed heavy vehicles is reported in Table 3.10. Articulated heavy vehicles are more likely to be fully loaded than rigid vehicles. This finding is consistent with expectations: the operating cost of articulated heavy vehicles is relatively high and operators would seek to maximise full running. More rigid vehicles are involved in local trips (note the lower average trip distance in previous sub-section) and, therefore, are less likely to be able to arrange effective backloads. The higher proportion of part loads for rigid vehicles tends to indicate that, consistent with local distribution patterns, these vehicles are more likely to be making delivery runs, in which a larger proportion of the load sizes are likely based on end-user requirements, rather than vehicle load capacity.

Table 3.1: Heavy Vehicle Volumes by Station, by Direction, by Hour

Site	Direction	Hour Commencing												Total
		6	7	8	9	10	11	12	13	14	15	16	17	
Cumberland Hwy	NB	104	168	174	197	165	196	136	150	135	160	115	34	1,734
	SB	50	91	112	157	178	164	154	147	139	168	108	38	1,506
Cumberland Hwy Total		154	259	286	354	343	360	290	297	274	328	223	72	3,240
Cumberland Hwy OPR	NB	116	182	179	221	238	195	202	293	194	157	211	67	2,255
	SB	94	155	173	187	161	155	217	223	217	174	184	63	2,003
Cumberland Hwy OPR Total		210	337	352	408	399	350	419	516	411	331	395	130	4,258
Hume Hwy	NB	67	148	191	300	177	149	140	256	200	140	119	69	1,956
	SB	70	127	111	163	170	180	188	204	193	172	187	57	1,822
Hume Hwy Total		137	275	302	463	347	329	328	460	393	312	306	126	3,778
M5	EB	161	270	215	224	256	141	148	164	184	89	123	37	2,012
	WB	71	122	162	139	171	212	194	220	224	203	229	68	2,015
M5 Total		232	392	377	363	427	353	342	384	408	292	352	105	4,027
Mamre Rd	NB	26	28	49	34	36	39	30	52	33	53	34	17	431
	SB	19	38	46	48	41	41	38	48	42	42	53	16	472
Mamre Rd Total		45	66	95	82	77	80	68	100	75	95	87	33	903
Moorebank Ave Nth	WB	25	75	74	78	64	93	82	84	100	67	62	32	836
Pacific Hwy	NB	29	43	79	111	141	146	152	175	162	131	149	20	1,338
	SB	59	97	114	114	143	167	133	168	126	82	62	11	1,276
Pacific Hwy Total		88	140	193	225	284	313	285	343	288	213	211	31	2,614
Pennant Hills Rd	NB	49	183	182	289	312	312	281	220	268	184	217	78	2,575
	SB	36	151	171	222	267	265	271	225	295	179	257	77	2,416
Pennant Hills Rd Total		85	334	353	511	579	577	552	445	563	363	474	155	4,991
Prospect Hwy	NB	15	71	97	111	198	219	189	239	243	206	182	84	1,854
	SB	47	68	112	103	185	226	250	243	216	216	180	79	1,925
Prospect Hwy Total		62	139	209	214	383	445	439	482	459	422	362	163	3,779
Rooty Hill Rd	NB	26	84	75	107	95	92	112	115	108	82	68	19	983
	SB	26	111	70	90	79	80	109	99	99	79	60	26	928
Rooty Hill Rd Total		52	195	145	197	174	172	221	214	207	161	128	45	1,911
Wallgrove Rd	NB	101	188	175	175	184	210	183	200	163	148	104	45	1,876
	SB	93	205	187	211	228	230	179	234	196	202	135	63	2,163
Wallgrove Rd Total		194	393	362	386	412	440	362	434	359	350	239	108	4,039
Total		1,284	2,605	2,748	3,281	3,489	3,512	3,388	3,759	3,537	2,934	2,839	1,000	34,376

Note: 6:00 am is survey count from 6:30 am to 7:00 am factored; a similar adjustment was applied to the count from 5:00 pm to 5:30 pm.

Table 3.2: Proportions of Heavy Vehicle Types by Station by Direction

Site	Direction	Period*	Heavy Vehicle Type					
			Rigid	Rigid with Trailer	Artic. Vehicle	Large Combin. Vehicle	Other	Total
Cumberland Hwy	NB	Morning	46%	1%	46%	6%	0%	100%
		Afternoon	48%	1%	46%	5%	0%	100%
	NB Total		47%	1%	46%	6%	0%	100%
	SB	Morning	45%	1%	50%	4%	0%	100%
		Afternoon	51%	0%	44%	5%	0%	100%
SB Total		48%	1%	47%	5%	0%	100%	
Cumberland Hwy Total			47%	1%	46%	5%	0%	100%
Cumberland Hwy OPR	NB	Morning	57%	4%	34%	3%	1%	100%
		Afternoon	52%	2%	43%	3%	0%	100%
	NB Total		55%	3%	39%	3%	0%	100%
	SB	Morning	56%	2%	39%	3%	0%	100%
		Afternoon	54%	2%	41%	3%	0%	100%
SB Total		55%	2%	40%	3%	0%	100%	
Cumberland Hwy OPR Total			55%	3%	39%	3%	0%	100%
Hume Hwy	NB	Morning	42%	8%	44%	5%	2%	100%
		Afternoon	51%	7%	39%	3%	1%	100%
	NB Total		46%	7%	42%	4%	1%	100%
	SB	Morning	68%	3%	26%	2%	1%	100%
		Afternoon	62%	2%	31%	3%	2%	100%
SB Total		65%	3%	29%	2%	1%	100%	
Hume Hwy Total			55%	5%	35%	3%	1%	100%
M5	EB	Morning	59%	7%	33%	1%	0%	100%
		Afternoon	51%	5%	44%	0%	0%	100%
	EB Total		56%	6%	37%	1%	0%	100%
	WB	Morning	57%	10%	30%	3%	0%	100%
		Afternoon	62%	8%	29%	1%	0%	100%
WB Total		60%	9%	29%	2%	0%	100%	
M5 Total			58%	7%	33%	1%	0%	100%
Mamre Rd	NB	Morning	66%	11%	20%	2%	0%	100%
		Afternoon	74%	10%	16%	0%	0%	100%
	NB Total		70%	10%	18%	1%	0%	100%
	SB	Morning	63%	10%	24%	2%	0%	100%
		Afternoon	64%	11%	23%	2%	0%	100%
SB Total		64%	11%	24%	2%	0%	100%	
Mamre Rd Total			67%	11%	21%	2%	0%	100%
Moorebank Ave Nth	WB	Morning	59%	4%	32%	5%	1%	100%
		Afternoon	53%	5%	35%	7%	0%	100%
	WB Total		56%	4%	34%	6%	0%	100%
Moorebank Ave Nth Total			56%	4%	34%	6%	0%	100%
Pacific Hwy	NB	Morning	78%	6%	13%	2%	1%	100%
		Afternoon	78%	6%	14%	1%	1%	100%
	NB Total		78%	6%	14%	1%	1%	100%
	SB	Morning	77%	8%	12%	2%	1%	100%
		Afternoon	78%	6%	15%	1%	0%	100%
SB Total		78%	7%	14%	1%	0%	100%	
Pacific Hwy Total			78%	6%	14%	1%	1%	100%
Pennant Hills Rd	NB	Morning	56%	7%	34%	2%	0%	100%
		Afternoon	44%	10%	46%	0%	0%	100%
	NB Total		50%	9%	40%	1%	0%	100%
	SB	Morning	47%	7%	40%	5%	0%	100%
		Afternoon	51%	6%	41%	1%	0%	100%
SB Total		50%	7%	41%	3%	0%	100%	

Site	Direction	Period*	Heavy Vehicle Type					
			Rigid	Rigid with Trailer	Artic. Vehicle	Large Combin. Vehicle	Other	Total
Pennant Hills Rd Total			50%	8%	40%	2%	0%	100%
Prospect Hwy	NB	Morning	69%	10%	19%	2%	0%	100%
		Afternoon	70%	6%	21%	2%	0%	100%
	NB Total		70%	8%	20%	2%	0%	100%
	SB	Morning	69%	8%	20%	3%	0%	100%
		Afternoon	71%	7%	20%	2%	0%	100%
	SB Total		70%	8%	20%	2%	0%	100%
Prospect Hwy Total			70%	8%	20%	2%	0%	100%
Rooty Hill Rd	NB	Morning	75%	4%	19%	2%	1%	100%
		Afternoon	73%	6%	18%	2%	1%	100%
	NB Total		74%	5%	18%	2%	1%	100%
	SB	Morning	66%	4%	29%	0%	0%	100%
		Afternoon	65%	7%	26%	1%	0%	100%
	SB Total		66%	6%	28%	1%	0%	100%
Rooty Hill Rd Total			70%	6%	23%	1%	0%	100%
Wallgrove Rd	NB	Morning	70%	10%	18%	1%	0%	100%
		Afternoon	67%	10%	22%	1%	0%	100%
	NB Total		68%	10%	20%	1%	0%	100%
	SB	Morning	69%	9%	21%	1%	0%	100%
		Afternoon	65%	11%	22%	1%	0%	100%
	SB Total		67%	10%	21%	1%	0%	100%
Wallgrove Rd Total			68%	10%	21%	1%	0%	100%
Average			60%	6%	31%	2%	0%	100%

Note: * periods are morning: 6:00am to noon; and afternoon: noon to 6:00pm.

Table 3.3: Peak Hour Heavy Vehicle Volumes by Station, by Direction

Station	Direction	Morning Peak		Evening Peak	
		Volume	%	Volume	%
Cumberland Hwy	NB	174	10.0%	115	6.6%
	SB	112	7.4%	108	7.2%
Cumberland Hwy OPR	NB	179	7.9%	211	9.4%
	SB	173	8.6%	184	9.2%
Hume Hwy	NB	191	9.8%	119	6.1%
	SB	111	6.1%	187	10.3%
M5	EB	215	10.7%	123	6.1%
	WB	162	8.0%	229	11.4%
Mamre Rd	NB	49	11.4%	34	7.9%
	SB	46	9.7%	53	11.2%
Moorebank Ave Nth	WB	74	8.9%	62	7.4%
Pacific Hwy	NB	79	5.9%	149	11.1%
	SB	114	8.9%	62	4.9%
Pennant Hills Rd	NB	182	7.1%	217	8.4%
	SB	171	7.1%	257	10.6%
Prospect Hwy	NB	97	5.2%	182	9.8%
	SB	112	5.8%	180	9.4%
Rooty Hill RD	NB	75	7.6%	68	6.9%
	SB	70	7.5%	60	6.5%
Wallgrove Rd	NB	175	9.3%	104	5.5%
	SB	187	8.6%	135	6.2%
Total		2,748	8.0%	2,839	8.3%

Note: Percentages represent the proportion of survey period heavy vehicle travel counted during the peak periods.

Table 3.4: Proportion of Total Traffic Stream Composed of Heavy Vehicles, by Heavy Vehicle Type during Survey Period

Road	Direction	Proportion of Traffic by Heavy Vehicle Type		
		Rigid	Articulated	Total Heavy Vehicles
Cumberland Hwy	NB	3.5%	3.7%	7.2%
	SB	3.1%	3.3%	6.4%
	Total	3.3%	3.5%	6.8%
Hume Hwy	NB	4.0%	3.3%	7.4%
	SB	4.8%	2.2%	6.9%
	Total	4.5%	2.8%	7.1%
M5	EB	3.6%	2.2%	5.7%
	WB	4.4%	2.0%	6.4%
	Total	4.0%	2.1%	6.0%
Pacific Hwy	NB	5.5%	1.0%	6.5%
	SB	4.2%	0.7%	4.9%
	Total	4.8%	0.8%	5.7%
Pennant Hills Rd	NB	6.7%	4.6%	11.3%
	SB	7.4%	2.1%	9.4%
	Total	6.3%	4.5%	10.8%
Prospect Hwy	NB	7.6%	2.2%	9.7%
	SB	7.4%	2.1%	9.4%
	Total	7.3%	2.1%	9.4%
Wallgrove Rd	NB	12.2%	3.3%	15.5%
	SB	13.1%	3.8%	16.9%
	Total	12.7%	3.6%	16.3%
<i>Average of sites combined direction</i>		6.0%	3.0%	8.9%

Note: Based on survey control counts and adjacent RTA stations for total traffic volumes.

Table 3.5: Comparison of Heavy Vehicle Volumes - 1995 & 2001

Road	Direction	1995			2001		
		Rigid	Artic.	Total	Rigid	Artic.	Total
Cumberland Highway OPR	NB	1,702	1,438	3,140	1,339	963	2,302
	SB	1,711	1,281	2,992	1,165	878	2,043
	Total	3,413	2,719	6,132	2,504	1,841	4,345
Prospect Highway N of Lucas	NB	724	447	1,171	1,458	417	1,875
	SB	797	443	1,240	1,529	427	1,956
	Total	1,521	890	2,411	2,987	844	3,831
Rooty Hill Rd	NB	498	404	902	794	197	991
	SB	507	440	947	674	265	939
	Total	1,005	844	1,849	1,468	462	1,930

Table 3.6: Analysis of Trip Ends within Sydney for Heavy Vehicles at Northern and Southern Survey Stations (%)

Station	Direction	North	South	Sydney Balance	West	Total
<i>Destination of Inbound Traffic</i>						
Pacific Hwy	SB	29%	0%	71%	0%	100%
Pennant Hills Rd	SB	14%	7%	28%	52%	100%
Hume Hwy	NB	12%	4%	11%	73%	100%
M5	EB	0%	17%	62%	21%	100%
Total		12%	8%	40%	41%	100%
<i>Origin of Outbound Traffic</i>						
Pacific Hwy	NB	28%	0%	72%	0%	100%
Pennant Hills Rd	NB	12%	2%	48%	39%	100%
Hume Hwy	SB	3%	3%	37%	57%	100%
M5	SB	1%	8%	78%	12%	100%
Moorebank Ave	WB	3%	3%	45%	49%	100%
Total		9%	4%	56%	31%	100%
Total Combined In and Out		11%	5%	48%	36%	100%

Note: During survey period; based on coarse zonal system, see Appendix C for definition.

Table 3.7: Analysis of Trip Ends within Sydney for Heavy Vehicles at Northern and Southern Survey Stations (vehicles)

Station	Direction	North	South	Sydney Balance	West	Total
<i>Destination of Inbound Traffic</i>						
Pacific Hwy	SB	375	-	901	-	1,276
Pennant Hills Rd	SB	333	159	673	1,251	2,416
Hume Hwy	NB	232	74	219	1,432	1,956
M5	EB	-	344	1,243	425	2,012
Total		939	576	3,036	3,108	7,660
<i>Origin of Outbound Traffic</i>						
Pacific Hwy	NB	373	-	965	-	1,338
Pennant Hills Rd	NB	303	53	1,227	993	2,575
Hume Hwy	SB	46	56	680	1,040	1,822
M5	SB	24	171	1,575	244	2,015
Moorebank Ave	WB	24	26	368	400	818
Total		770	305	4,816	2,677	8,568
Total Combined In and Out		1,709	882	7,852	5,785	16,228

Note: During survey period; based on coarse zonal system, see Appendix C for definition.

Table 3.8: Comparison of Estimates of North-South Through-Sydney Movements

Origin	Station	Direction	Destination	
			North	South
<i>External Station Estimate</i>				
North	Pacific Hwy	SB		0
	Pennant Hills Rd	SB		159
	Hume Hwy	SB		46
	M5	WB		24
	Moorebank Ave	WB		0
<i>Average of Southbound External Estimates</i>				115
South	Pennant Hills Rd	NB	53	
	Hume Hwy	NB	232	
	M5	EB	0	
	Pacific Highway	NB	0	
<i>Average of Northbound External Estimates</i>			143	
<i>Internal Station Estimate</i>				
North	Cumberland Highway OPR	SB		168
	Wallgrove Rd	SB		0
South	Cumberland Highway OPR	NB	93	
	Wallgrove Rd	NB	74	
<i>Northbound Internal Estimate</i>			167	

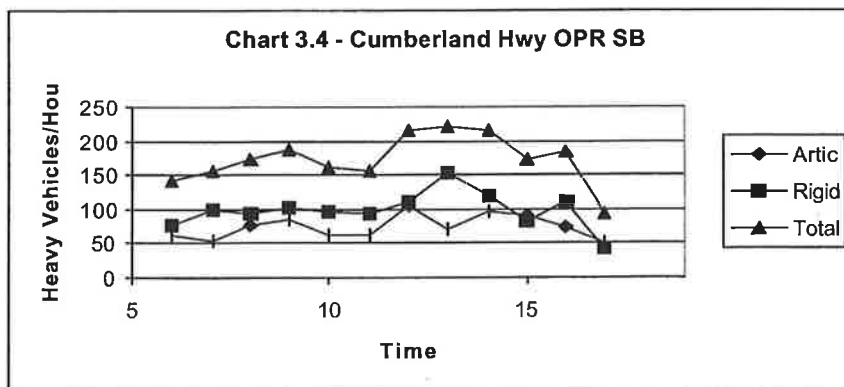
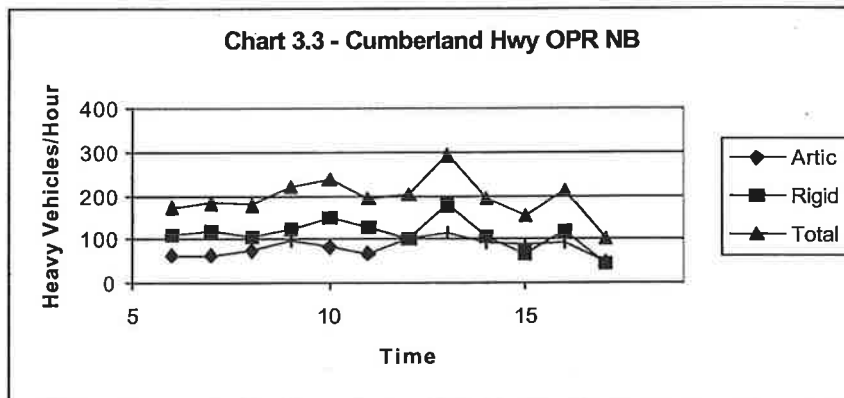
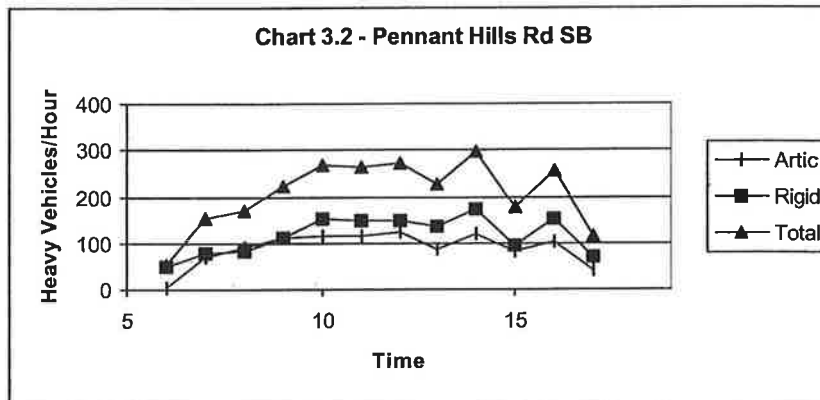
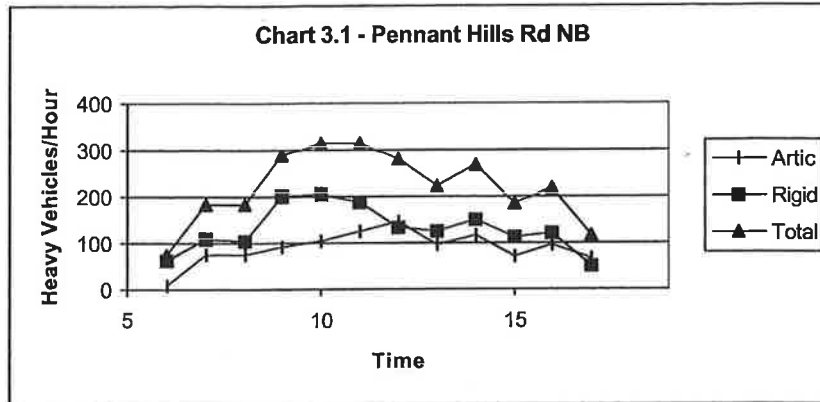
Table 3.9: Average Trip Length by Heavy Vehicle Type

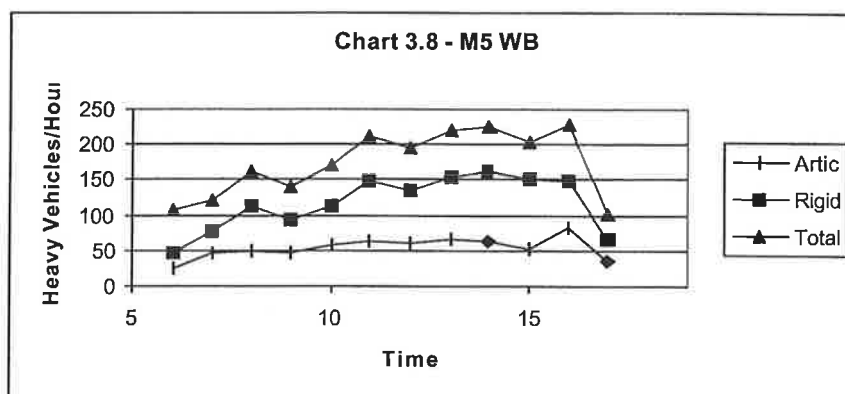
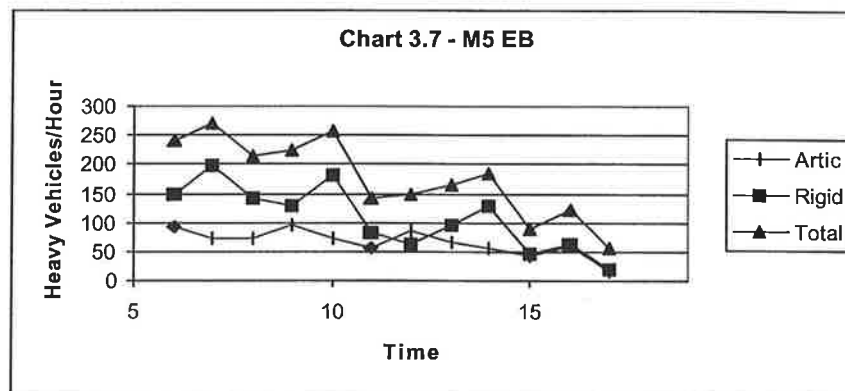
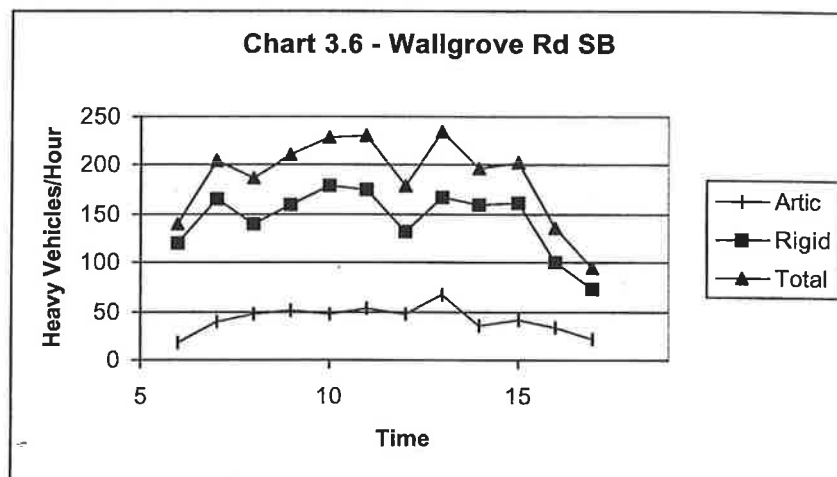
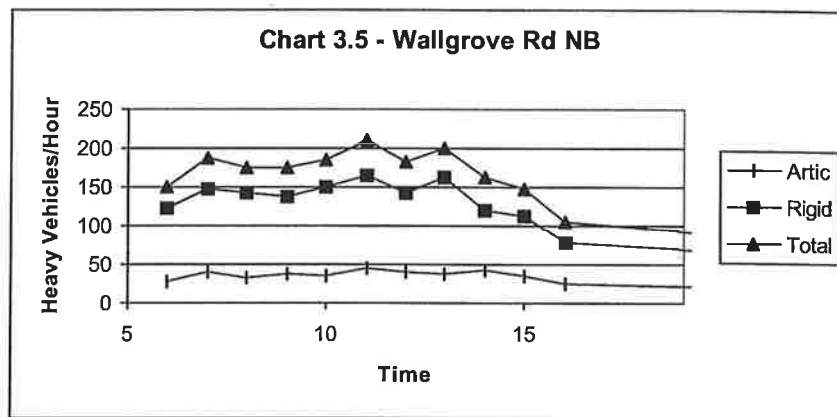
Vehicle Type	Average Trip Length km
Articulated	195
Rigid	38
<i>Average</i>	<i>79</i>

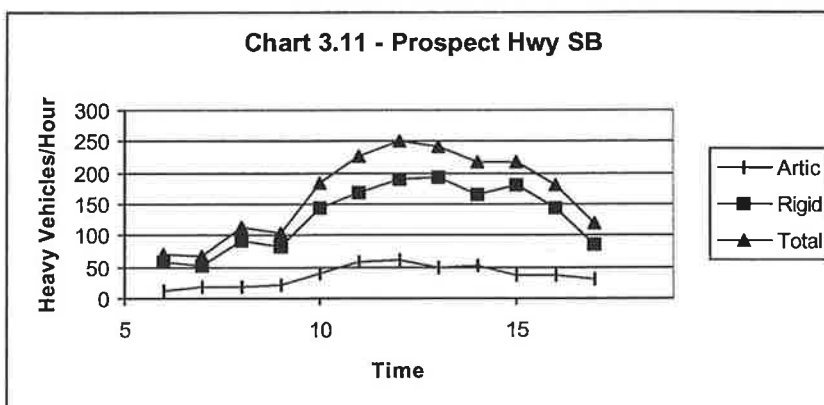
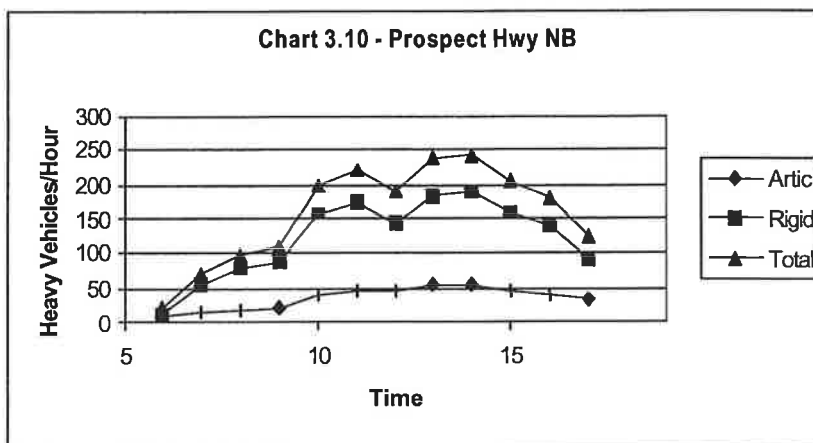
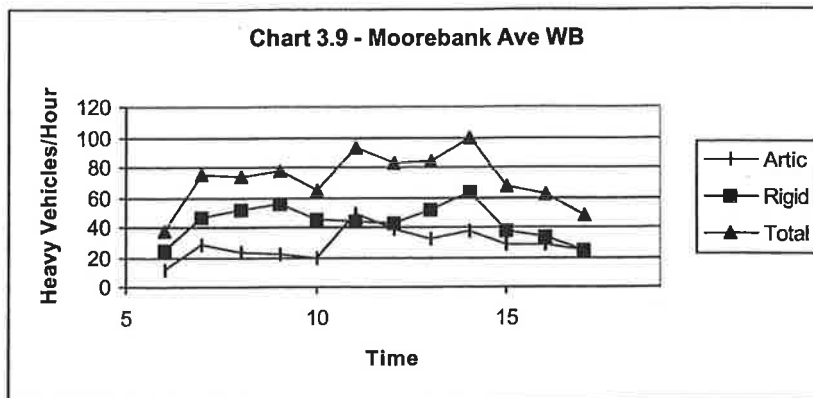
Note: Straight-line distances.

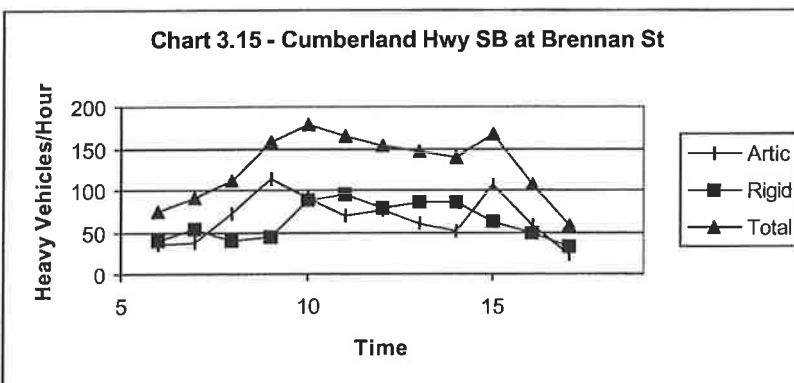
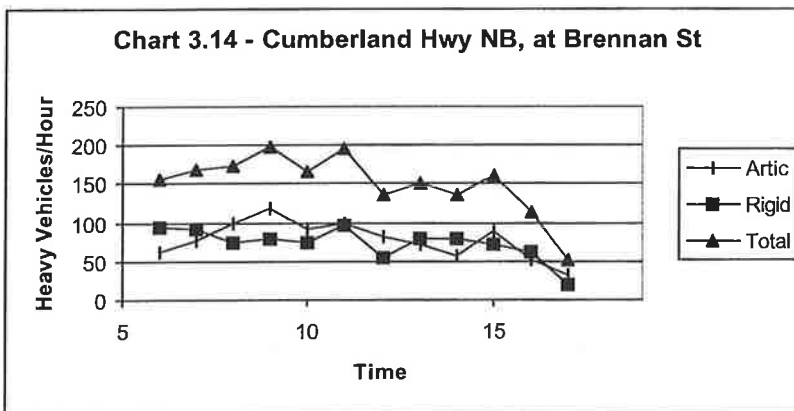
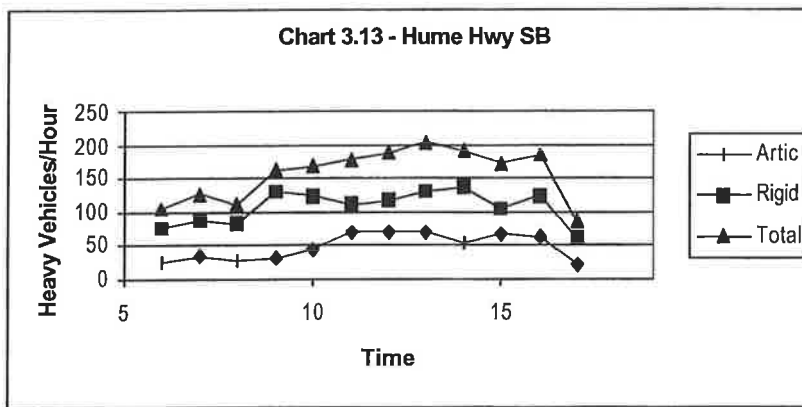
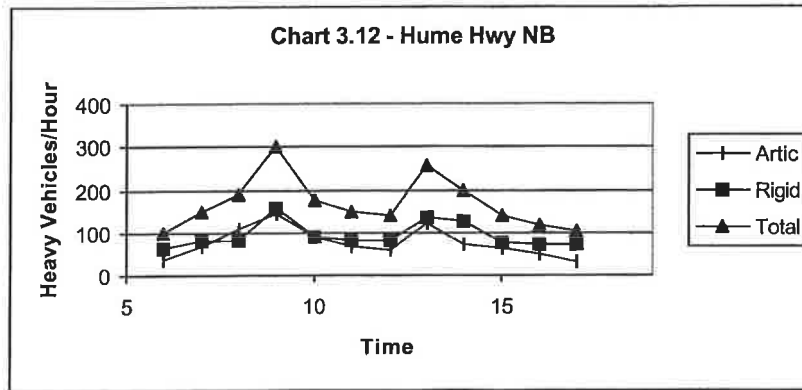
Table 3.10: Load Status by Vehicle Type

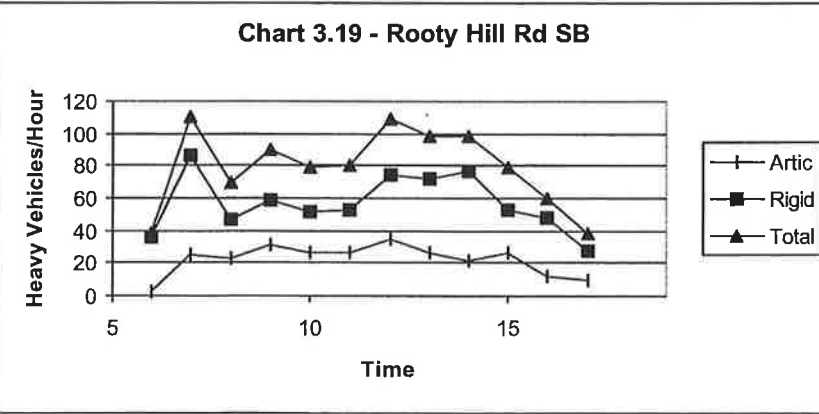
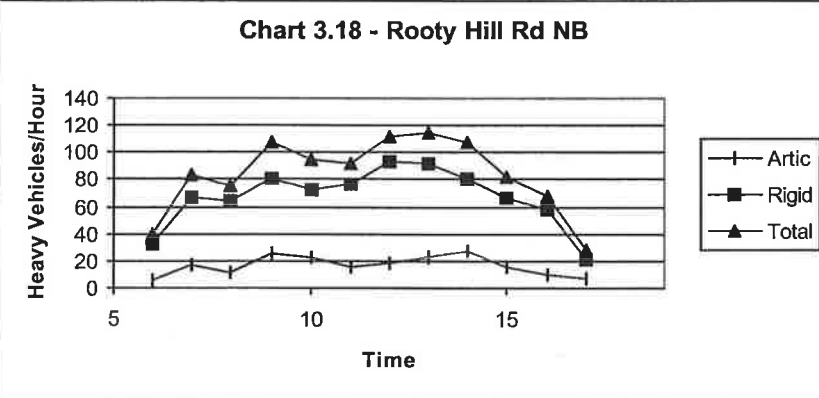
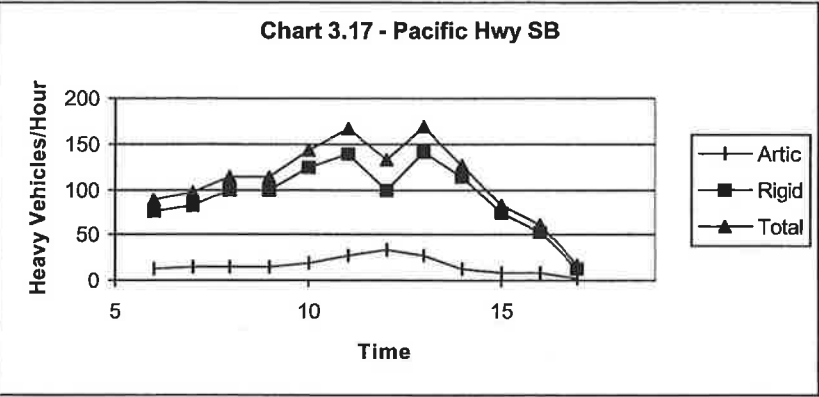
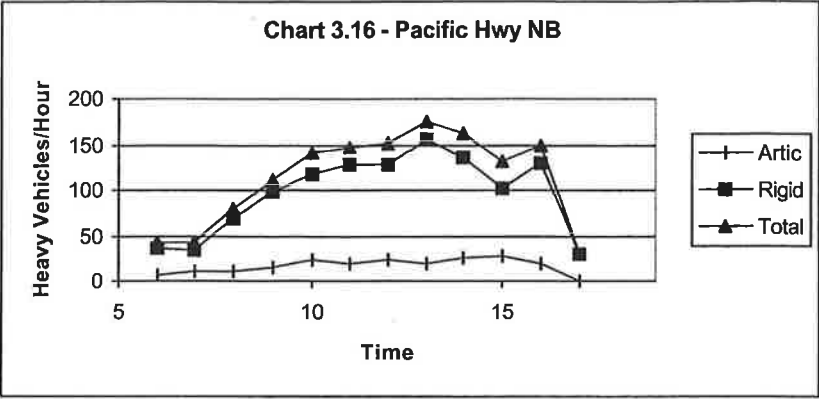
Vehicle Type	Load Status				Total
	Full Load	Part Load	Empty	Not Specified	
Artic	59%	14%	26%	1%	100%
Rigid	33%	43%	24%	1%	100%
<i>Average all Heavy Vehicle</i>	<i>40%</i>	<i>35%</i>	<i>24%</i>	<i>1%</i>	<i>100%</i>

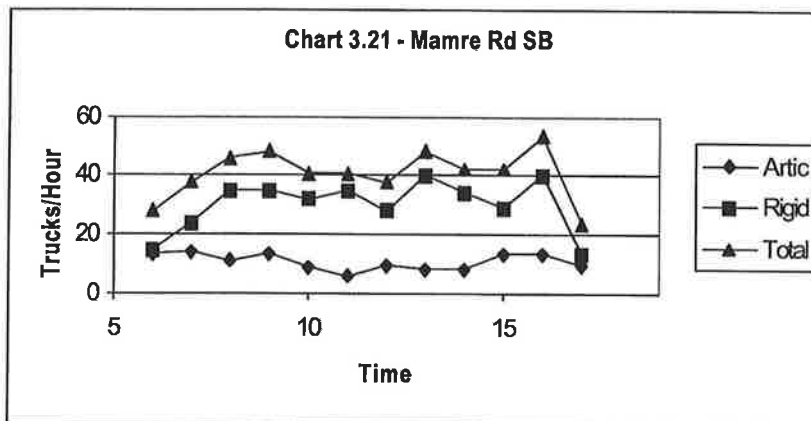
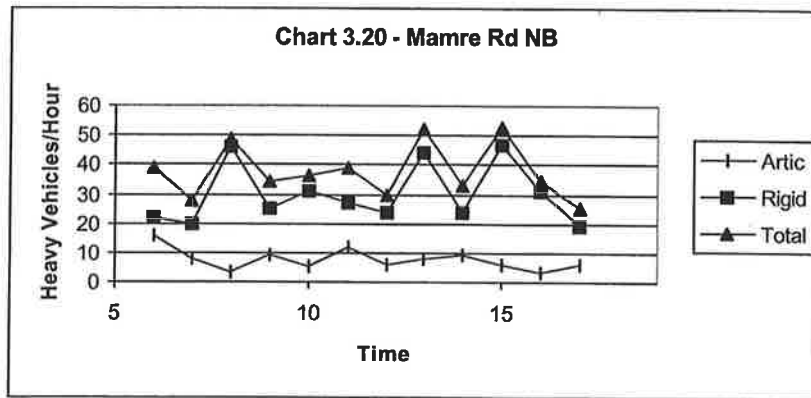












4. Modelling

The focus of the information underlying traffic models for Sydney, such as Netanal, is person travel, most of which occurs within Sydney. This relative strength of the data is appropriate for person movement, given Sydney's very large population relative to surrounding localities and relative isolation from centres of comparable size, such as Melbourne. However, for freight movement there is a higher relative importance of travel from and to other centres.

The data gathered by the intercept survey undertaken by this study is used to strengthen the existing heavy vehicle data within the Netanal traffic model. It does this for the specific origin-destination pairs on key links identified by the survey and through the use of up-to-date heavy vehicle control counts to review and improve the assignment of heavy vehicles to the road network by Netanal.

4.1 Process

4.1.1 Travel Demand Data

The travel demand data used in Netanal comprises two types of matrices:

- Car travel;
- Heavy vehicle travel.

The car travel matrix is based on journey to work information from the census and household interview data. A travel demand model is used to produce estimates of vehicle flows and these are then adjusted to allow for estimates of future year changes in population and employment levels and distributions within Sydney.

The matrices are assigned to the road network (in conjunction with the heavy vehicle demand data) by the Netanal network model based on the costs (in terms of travel time and tolls) of competing routes between origins and destinations. The base year assignment is checked against known traffic volumes to ensure that it provides a reasonable representation of traffic movements.

Heavy vehicle demand data is based on some rules of thumb that have derived from previous surveys. Netanal converts the heavy vehicle matrix to passenger car equivalent units (pcus) to better represent how an individual heavy vehicle effects traffic flow. A factor of 2.5 is currently applied by the model. This means that each heavy vehicle is converted to two and half cars and then assigned to the road network.

After assignment of cars and heavy vehicles is complete, the model is able to report traffic volumes by these vehicle classifications.

Matrices used in the model are for various time periods through the day, although it is the peak hour travel demands in the morning and evening that are critical for assessing the performance of the road network.

average toll of approximately 12.5 cents per kilometre. This is positive for the proposed facility in the sense that there is a financial incentive provided for longer distance movements to use the road. This aligns with the objectives of the proposal.

- For short distance trips there is no fixed cost associated with the use of the facility. Their use of the proposed road, however short it may be, is predicted if the value of the travel time savings from use of the WSO exceeds the toll. This might lead to relatively high volumes of short distance trips on the facility that would not necessarily be beneficial for the operation of the proposed facility as it might lead to relatively heavy use of pairs of adjacent interchanges. This has the potential to interfere with the smooth operation of the motorway.

4.1.7 Road Network

The future year road networks comprise:

- The standard base network (without the WSO), which is the existing road network plus potential road improvement projects which are detailed in Appendix G; and
- The October 2001 configuration of the proposed WSO.

4.2 Results

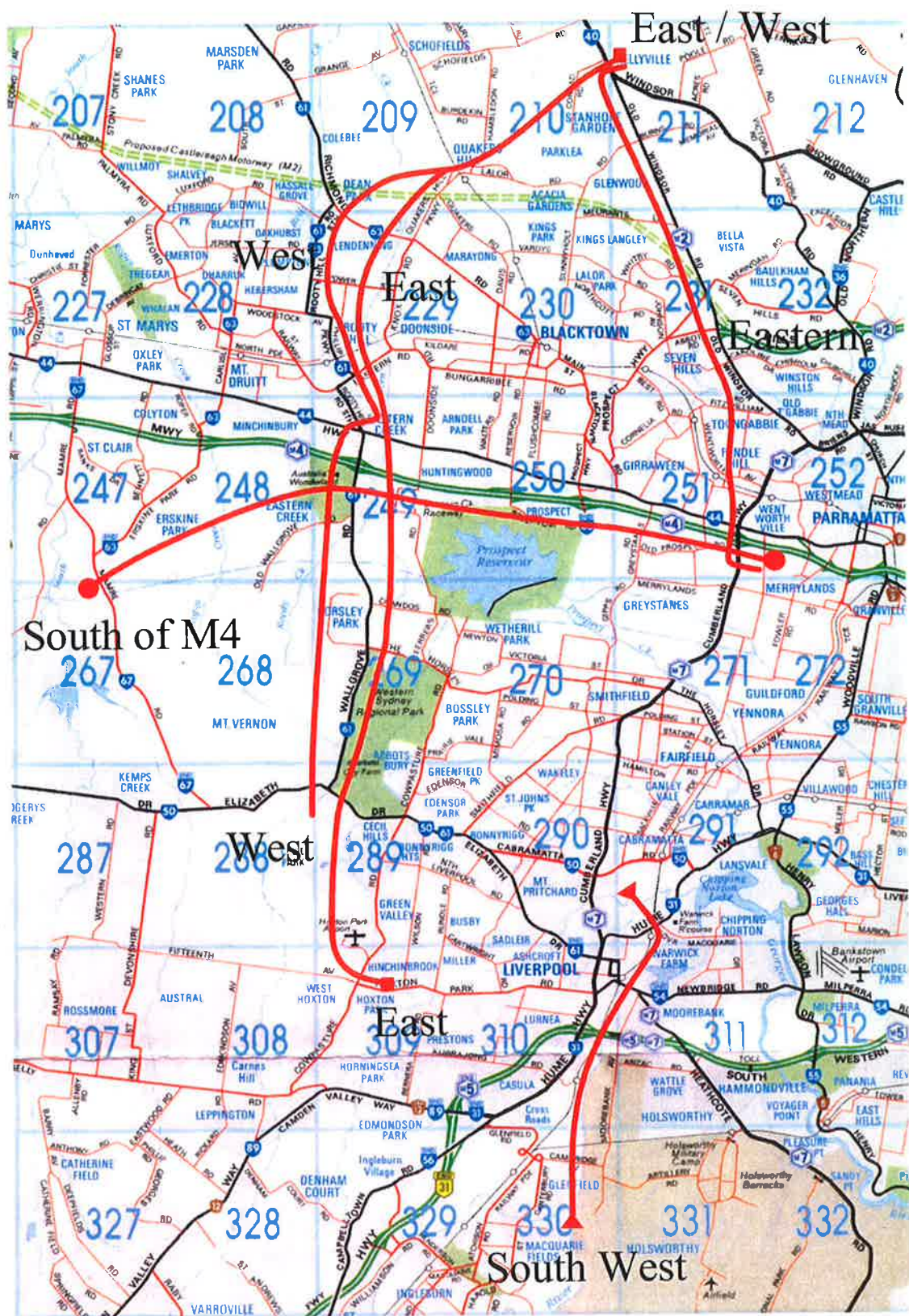
The following sub-sections report the results of the modelling for:

- Traffic growth rates across a series of large screenlines in the base case to review the levels of traffic growth projected by the Netanal traffic model.
- Traffic volumes on selected road sections, with and without the proposed WSO. This provides the reader with a view of the effect of the proposal on traffic volumes on existing routes in the immediate environs of the project.
- Volumes on the WSO itself, to provide an indication of the attractiveness of the use of the proposal to heavy vehicles.
- Toll diversions for the WSO during the morning peak hour in 2016, to provide an indication of the sensitivity of traffic volumes to toll costs.
- Total vehicle travel (vehicle kilometres of travel - VKT) and vehicle hours of travel to provide an indication of the effect of the proposal on overall network performance.
- The distribution of heavy vehicles at key locations in the WSO's corridor, to identify changes to patterns of assignment as a result of the proposal.
- Travel times for selected origins and destinations to provide an indication of the likely changes to travel times resulting from the proposed WSO for heavy vehicles.

4.2.1 Traffic Growth Rates

Large screenlines were established in Western Sydney in order to review the rates of traffic growth projected by the modelling process over the analysis period. Figure 4.1 indicates the locations of the screenlines. The projected growth rates are reported in the Table 4.1 for the morning peak hour.

In general the growth rates are stronger in the period to 2006 than for the subsequent ten-year period. As well, the southbound and westbound directions tend to have stronger



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Figure 4.1
Screenlines in Western Sydney

growth rates. These directions are generally the counter-peak, although this does vary along some of the screenlines.

Table 4.2 shows the projected population and employment growth rates for Sydney as a whole and for DUAP regions along the WSO's corridor.

The estimated level of growth in landuse within the proposed WSO's corridor is in excess of the Sydney Region's average. The traffic growth rates are at, or just above, the rates of population growth. The projected level of traffic growth is considered to be reasonable.

4.2.2 Traffic Volumes on Selected Links

Morning Peak Hour

Table 4.3 shows the predicted total traffic volumes on a selection of roads around the WSO in the morning peak for 2016. It compares the northbound/eastbound volumes in columns 3 and 4, providing a difference in column 5 and a percentage change in column 6. The same format is provided for southbound/westbound traffic volumes on the right hand side of the table.

In general, most of the roads, especially those running parallel to the proposed WSO, would experience a reduction in traffic volumes in both directions during the morning peak hour. Examples of roads parallel to the alignment of the proposed WSO that would experience large percentage declines in traffic volumes include:

- Doonside Road;
- Brabham Drive;
- Abbott Road;
- Cowpasture Road;
- Knox Road;
- Rooty Hill Road South; and
- Wallgrove Road.

In the north-south corridor from the Hume Highway to the M4 Motorway, the proposed WSO would draw varying amounts of traffic from:

- Wallgrove Road;
- Mamre Road;
- Brabham Drive;
- Prospect Arterial; and
- Greystanes Road.

The proposed WSO would draw-in traffic that would otherwise use more congested routes – this would free-up some capacity on those roads and, in turn further traffic would be drawn to them. Therefore, while the southern section of the Cumberland Highway (north of the Hume Highway and at Prospect Creek) is forecast to experience a very marginal decline in traffic volumes, a larger proportion of its base traffic would be expected to transfer to the WSO (and other roads in the corridor). This traffic would then be replaced by other traffic, drawn from roads further from the WSO, such as Woodville Road, as well as lower order roads.

Of particular note is the level of projected decline in traffic volumes using the Prospect Arterial due to the WSO. Peak hour volumes would decline to about 600 to 700 vehicles per hour one-way. This suggests that the WSO may allow the Prospect Arterial to be constructed to a lower standard, possibly with smaller intersections.

Roads in the vicinity of proposed interchanges are projected to experience a more mixed picture with regard to changes in traffic volumes, with road sections that feed traffic into the Sydney network and that are intercepted by the proposed WSO's interchanges expected to experience some increased volumes. For example, Richmond Road west of Rooty Hill Road North, Elizabeth Drive west of Wallgrove Road, Woodstock Avenue east of Rooty Hill Road North and Sunnyholt Road south of Quakers Hill Parkway.

The proposed extension of Norwest Boulevard from Old Windsor Road to the WSO interchange is forecast to carry high volumes of traffic, which is almost directionally balanced in the morning peak hour.

Traffic volumes on roads on the 'inside' (i.e., on the CBD side) of the WSO that connect to proposed interchanges are forecast to experience relatively large falls. Examples include: Cowpasture Road west of the Hume Highway, Elizabeth Drive west of Wallgrove Road, Great Western Highway east of the WSO, M4 Motorway west of Cumberland Highway, Sunnyholt Road north of Vardys Road and Richmond Road east of Symonds Road.

An exception to this is The Horsley Drive east of Wallgrove Road, which is forecast to experience an increase in traffic in both directions during the morning peak hour.

Heavy vehicle volumes are summarised in Table 4.4 using the same format as for total traffic. This shows projected changes in heavy vehicle movements that are reasonably consistent with changes to total traffic in terms of percentage changes.

The modelling indicates that the proposed section of Norwest Boulevard to the west of Old Windsor Road would be an important route for heavy vehicles. It also indicates that the existing eastern section of Norwest Boulevard would be expected to experience a large increase in heavy vehicle traffic. This is of roughly the same proportional increase as is forecast for total traffic.

Evening Peak Hour

Table 4.5 shows the predicted traffic volumes on the same selected roads and using the same format as Table 4.3, discussed above.

The proposed WSO would provide a relatively high amount of traffic relief within its corridor. Parallel roads would be expected to experience substantial falls in two-way traffic volumes. Roads that intersect with the proposed WSO and have interchanges with the motorway exhibit the same pattern of behaviour as in the morning peak hour, with roads on the 'outside' (i.e., with the WSO between them and the CBD) of the WSO experiencing higher traffic volumes, whilst those on the 'inside' experience reductions.

The proposed westward extension of Norwest Boulevard would be heavily used, with a two-way flow of about 3,500 vehicles per hour. Whilst this is a similar level of two-way traffic as the morning peak hour, it is relatively unbalanced; about 60 per cent of the evening peak hour traffic is westbound.

Projected heavy vehicle volumes are compared in Table 4.6 using the same layout. These exhibit similar changes to those of total traffic.

Annual Average Daily Traffic

Estimates of AADTs for the selected road links summarised above are presented in Table 4.7, using the same format.

The daily volumes provide a better indicator of the nature of the traffic function provided by a particular road and the likely change in function as a result of the proposed WSO. The following roads are forecast to experience a substantial fall in daily traffic volumes as a result of the proposed WSO:

- Abbott Road west of Old Windsor Road would be expected to experience a fall from just under 45,000 vehicles per day to around 31,000 vehicles per day. It would, therefore, remain a busy arterial road, however traffic impacts would be lower.
- Cowpasture Road north of North Liverpool Road is projected to experience a decline in daily traffic volumes from about 44,000 vehicles to about 29,000 vehicles. Again, it would still be a busy arterial road, although there would be lower traffic impacts.
- Traffic volumes on Doonside Road north of Great Western Highway are forecast to decline from about 21,000 vehicles per day to just under 12,000 vehicles per day. This would see a downgrading in function from an arterial road to a sub-arterial/collector road.
- Eastern Road east of Rooty Hill Road South would experience declines in traffic volumes from 30,000 vehicles per day to 21,000 vehicles per day.
- Richmond Road east of Symonds Road would be expected to experience a fall in traffic volumes from 49,500 vehicles per day to 30,000 vehicles per day. It would still be providing an arterial road function, although it would have improved amenity.
- Rooty Hill Road South north of The Great Western Highway would enjoy substantial reductions in traffic volumes: from about 34,000 vehicles per day to 13,600. This would see its function fall from an arterial to sub-arterial road, with considerable improvements in amenity. There may also be scope to reduce the carriageway to two travel lanes in each direction at mid-block.
- Sunnyholt Road east of Old Windsor Road is projected to experience large declines in traffic volumes, but it would remain a heavily used arterial road carrying approximately 55,000 vehicles per day.
- Wallgrove Road would experience a downgrading of function from a busy arterial road carrying nearly 40,000 vehicles per day to a sub-arterial road carrying about 16,500 vehicles per day.

Several roads would be expected to experience a substantial increase in traffic volumes as a result of the construction of the WSO. These include:

- Norwest Boulevard east of Old Windsor Road, which would go from carrying about 41,000 vehicles per day to about 73,000 vehicles per day. This is a very large increase and reflects the additional traffic drawn to it by its proposed westward extension to the WSO. In combination with the WSO, Norwest Boulevard provides an east-west route from Richmond Road at Rooty Hill Road North, through to Castle Hill. This provides a more direct link than some of the alternatives without the WSO (such as Sunnyholt Road, Memorial Avenue and Windsor Road).
- Woodstock Avenue east of Rooty Hill Road North is forecast to experience an increase from 7,500 vehicles per day to just under 20,000 vehicles per day. Its function would change from a collector road to a sub-arterial/arterial road, providing a link to the proposed WSO from the Rooty Hill/Glendenning area.

Annual average daily heavy vehicle volumes are summarised in Table 4.8. As with total traffic, most road links reported in Table 4.8 are expected to experience a decline in heavy vehicle volumes over the course of the day.

Impacts of WSO-related Traffic Volume Changes on Road Network

For road sections where traffic volumes are forecast to increase by a reasonable amount as a consequence of the construction of the proposed WSO, analysis of the impacts were calculated. These are presented in Table 4.9 and Table 4.10 for the morning and evening peak hours, respectively. The volume to capacity ratio is calculated and where the road section is motorway standard, the level of service is included.

For the surface roads, the capacity used in the calculations is based on theory and practice. Actual throughput is dependent on the nature of interruptions and the capacity achieved at upstream and downstream intersections. As such the ratio should be treated with caution. However, it does provide a useful indicator of changes in expected performance as a consequence of a network changes, such as the proposed WSO. It also is a useful indicator of likely capacity constraints (i.e., a value greater than 1.0 indicates there is likely to be some queuing and delay). The level of service designators for motorway sections also have limitations, for example there are sections of motorway in Sydney carrying in excess of 2,000 vehicles per lane per hour and providing a level of service consistent with E rather than F.

Bearing in mind the limitations of the approach, Table 4.9 indicates that in the morning peak hour:

- The M4 Motorway west of Wallgrove Road in the eastbound direction would experience a decline in LOS from E to F with the construction of the proposed WSO and intermittent traffic delays would be experienced. It is also likely to be effected by merging traffic at the downstream interchange ramps.
- The M5 Motorway at Georges River Bridge in the eastbound direction would experience an increase in its volume to capacity ratio, although it would remain at LOS D, with the introduction of the WSO. In the westbound direction it would remain at LOS B.
- Norwest Boulevard east of Old Windsor Road would experience a substantial increase in its volume to capacity ratio in both directions, with the proposed WSO and its associated extension of Norwest Boulevard to the WSO (west of Old

Windsor Road). While these would remain under 1.0, flow conditions would deteriorate noticeably.

- The proposed WSO would have a limited impact on Pennant Hills Road north and south of the M2 Motorway.
- The Horsley Drive east of Wallgrove Road is projected to have its volume to capacity ratio increase to around 0.9. This indicates additional delays as a result of the proposed WSO.

Table 4.10 indicates that during the evening peak:

- The M4 Motorway west of Wallgrove Road is projected to experience a decline in LOS from D to E in the eastbound direction (counter-peak). It would remain above LOS F.
- The M5 Motorway at the Georges River Bridge would experience an increase in its volume to capacity ratio but its LOS would not change in either direction.
- Sunnyholt Road south of Quakers Hill Parkway is projected to experience an increase in its volume to capacity ratio for the northbound direction to just under 0.9. This would be a noticeable deterioration in performance.
- The Horsley Drive east of Wallgrove Road is projected to experience a marked increase in its volume to capacity ratio from 0.79 to 1.18 – well above 1.0 and likely to cause delays and queuing. This would require additional capacity to be provided – through upgrading to a four-lane divided cross section.

In order to provide for smooth traffic flow on the above road sections, apart from the Horsley Drive east of Wallgrove Road, the most critical road elements will be the at-grade intersections. If the intention is to provide sufficient road capacity to meet the projected demand, intersections will need to be sized to match the upstream/downstream capacity.

It is important to note that the impact on Pennant Hills Road is minor as the proposed WSO is forecast to have little impact on traffic volumes. This is because this is the only realistic route into Western Sydney from the north, regardless of whether the proposed WSO is constructed or not – at least as far south as Thompsons Corner (Castle Hill Road).

4.2.3 Traffic Volumes on the WSO

Morning Peak Hour

Table 4.11 summarises projected traffic volumes on the WSO during the morning peak hour in 2006. Northbound/eastbound the sections around Sunnyholt Road would carry the highest volumes of around 3,300 vehicles per hour. This level of demand is within the capacity of the proposed facility. The next highest traffic volume in that direction is just under 2,500 vehicles per hour on section south of Woodstock Avenue.

Southbound/eastbound one section is forecast to carry in excess of 3,000 vehicles per hour – south of Woodstock Avenue (3,150 vehicles per hour). In this direction the sections around Old Windsor Road are expected to be very lightly trafficked during the peak.

In 2016, about ten years after opening, the projected traffic volumes are shown in Table 4.12. The table includes both total traffic and heavy vehicles. Five sections of the proposed motorway are projected to carry in excess of 3,000 vehicles per hour in one direction, with the section south of Woodstock Avenue projected to carry 3,660 vehicles

per hour southbound. This is within the WSO's capacity of approximately 4,000 vehicles per hour.

A large amount of traffic is accessing the motorway at Woodstock Avenue and some of this is exiting the motorway at M4, along with other traffic. The separation of interchange roads is approximately 3 kilometres, although, when ramp configurations are taken into account, the separation is somewhat less. The operation of the ramp merge and demerge areas should be checked to ensure that they are of sufficient capacity to accommodate this movement safely.

The substantial fall in volumes east of the Norwest Boulevard extension link (i.e., between east of Sunnyholt Road and west of Old Windsor Road) accounts for the high volumes of traffic projected to use that extension of Norwest Boulevard discussed above.

The relatively low volume on the section west of Old Windsor Road indicates that the east-west road alignment created by the section of the proposed WSO from Richmond Road/Rooty Hill Road North through to Norwest Boulevard to Windsor Road/Showground Road is relatively attractive for a large proportion of traffic when compared with linking through to the M2.

The proportion of heavy vehicles that are projected to use the WSO is higher at the southern end, indicating the importance of the proposal to provide access to the industrial areas of western Sydney from the south.

Evening Peak Hour

In 2006, the traffic volumes projected to be carried by the proposed WSO are summarised in Table 4.13. The volumes for both directions are above the projected demand during the morning peak hour by varying degrees. One section, south of Woodstock Avenue, is projected to carry in excess of 3,000 vehicles per hour northbound/eastbound. The sections with the next highest projected traffic volumes at just under 2,900 vehicles per hour each are further to the south, north of The Horsley Drive and north of Camden Valley Way.

Southbound/westbound traffic volumes are highest around Sunnyholt Road, with the section of the WSO east of Sunnyholt Road projected to carry around 3,500 vehicles per hour.

Traffic volumes on selected planning sections of the WSO during the evening peak hour in 2016 are summarised in Table 4.14.

On the whole traffic volumes are projected to be higher during the evening peak hour than the morning peak hour, with nine sections forecast to carry in excess of 3,000 vehicles per hour.

The westbound section east of Sunnyholt Road is forecast to carry in excess of 4,100 vehicles per hour. This is in excess of the theoretical capacity of the proposed motorway, and would be expected to lead to intermittent queuing on the motorway and possibly on the approach ramps at Norwest Boulevard and at the demerge area at the Sunnyholt Road interchange. Although, as noted earlier, there are sections of motorway carrying in excess

of this volume at present with a level of service of E. These areas should be reviewed and checked to ensure that they can safely accommodate the projected levels of traffic.

The section west of Old Windsor Road is forecast to be the most lightly trafficked section in the evening peak hour, although it would be about 20 per cent busier than during the morning peak hour.

The proportion of heavy vehicle traffic is lower during the evening peak than the morning, partly due to the higher projected volumes of cars on the road.

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Table 4.15 shows the projected annual average daily traffic volumes for 2006. The most heavily trafficked section would be the most southerly, north of Camden Valley Way, with about 60,000 vehicles per day. The sections south of Woodstock Avenue and east of Sunnyholt Road are also projected to carry similar volumes.

The sections either side of Old Windsor Road are projected to carry the lowest volumes – of around 20,000 vehicles per day.

The projected traffic volumes for 2016 are summarised in Table 4.16. As with peak hourly traffic, there is considerable variation in the levels of projected daily traffic on the proposed WSO from one section to another. The section east of Sunnyholt Road is heavily used, feeding Norwest Boulevard to the east. Norwest Boulevard is projected to carry about 63,000 vehicles per day, which is somewhat in excess of traffic volumes on most planning sections of the proposed WSO. This reinforces the importance of Norwest Boulevard as a strategic road link in western Sydney.

The proportion of heavy vehicles also varies considerably by planning section, although the volume of projected heavy vehicle traffic is not as volatile as total traffic. The projected heavy vehicle proportions are relatively high when compared with some existing roads within Sydney, however the longer distance nature of many heavy vehicle trips makes the motorway a more attractive proposition for them. In addition, the location of the WSO, with interchanges that provide direct access to freight generating areas at Hoxton Park, Wetherill Park, Rooty Hill/Glendenning, Blacktown and Baulkham Hills, would act to attract a relatively high proportion of heavy vehicle traffic.

Level of Service on the WSO

Table 4.17 and Table 4.18 show the projected levels of service on the proposed WSO in the morning and evening peak hour in 2016. The purpose of this analysis is to further flag sections of the proposed WSO that would be expected to be operating close to or at capacity.

During the morning peak hour, all sections are expected to be operating above LOS F. The sections operating at LOS E would obviously experience an improvement in their LOS if a third lane were to be provided. However, planning for the WSO has been based on the adoption of LOS D as the design criteria. This and the proposed toll of the facility are designed to provide a degree of demand management (refer to page 74 of EIS Working Paper 2). Therefore, where the projected volume of traffic is less than 3,400 vehicles per

hour, then the provision of a third lane would result in the provision of a higher LOS – generally LOS C. This would run counter to the intention to moderate travel demand.

On this basis consideration might be given to the provision of an additional lane eastbound between Quakers Hill Parkway and Norwest Boulevard Extension. However, MWT are of the view that work should be undertaken to check the interchange capacities to ensure that all elements of the interchanges do not result in interruptions to traffic flow on the proposed WSO.

In the evening peak hour more of the links are expected to be operating beyond the designated LOS D. Again a case could be made for a third lane on the following sections:

- south of Woodstock Avenue northbound the LOS is expected to be F.
- westbound between Norwest Boulevard and Quakers Hill Parkway.

4.2.4 WSO Toll Diversions

An estimate of the level of diversion caused by the imposition of a toll is summarised in for the morning peak hour in 2016 in Table 4.19. The negative percentages indicate the proportion of traffic that would divert from the motorway when a toll is imposed. Note that all analysis presented in this report, apart from Table 4.19, is based the proposed WSO being tolled.

The effect of the toll is to reduce traffic volumes using the proposed WSO. On some sections, this reduction is considerable. Without the toll, there would be an additional five sections with eastbound volumes in excess of 3,000 vehicles per hour and an additional three sections with volumes in excess of 3,000 vehicles per hour.

The section of the WSO east of Sunnyholt Road would be expected to carry volumes in excess of 4,000 vehicles per hour in the morning peak hour.

Without the toll it is likely that several sections of the motorway would need to be constructed to three lanes in each direction.

In general toll diversions, as a percentage, are higher on sections of the proposed WSO where volumes are lower. This reflects the fact that there is less congestion in the network surrounding the WSO in these locations, which results in less traffic being assigned to the motorway in the first instance. An exception to this relationship is the section of the WSO to the east of Norwest Boulevard's extension.

Traffic volumes are modest on this section of the WSO and the percentage diversion is also relatively low. Part of the explanation for this is that Norwest Boulevard's Extension is the last exit for eastbound traffic before Pennant Hills Road. This results in fewer short distance trips using the WSO along this section and hence an increased proportion of vehicles that are likely to have reached their 'free' toll cap. The imposition of a toll is therefore less likely to discourage their use of the facility.

4.2.5 Network Performance

Table 4.20 summarises annual aggregate network statistics to provide an indication of the level of impact of the proposed WSO on overall performance.

The amount of travel (vehicle kilometres of travel) is projected to increase by 0.21 per cent. This represents additional travel undertaken by vehicles in the base model for 2016 that make longer journeys in order to derive travel time savings from the proposed WSO. This effect is typical of orbital routes and results from out-around-and-back and in-around-and-back-out movements. That is, some vehicles would travel out to the WSO, along the WSO and then back in to their destination. Similarly other vehicles might travel into the WSO, along the WSO and then back out to their destination.

Given that the proposed WSO is such a large proposal in terms of its length, it is surprising that the increase in VKT is not more substantial. However, its configuration fills in some missing links in the Sydney road network, which currently require circuitous movements to negotiate. Examples of these are:

- Across the north of Blacktown from Richmond Road to Sunnyholt Road and then to Old Windsor Road;
- From the Great Western Highway to Phillip Parkway;
- From the Hume Highway to Wallgrove Road.

By filling in the missing links and introducing a more permeable and regular road network structure, the travel distance savings accruing to many movements would outweigh a significant proportion of the expected increase in travel from other vehicles travelling further to access the route.

A further consideration is that the relationship of Sydney to its hinterland and the nature of the hinterland is such that there are likely to be few if any trips that are likely to make in-around-and-back-out movements. That is, there is relatively little traffic that would travel into Sydney to use the proposed WSO to gain an advantage. This results from the very large physical barriers around the Sydney Basin and the lack of redundancy in the rural road network in NSW.

Essentially a large proportion of external traffic is fixed on its current assignment because differences in length and standard of competing routes are so significant that the proposed WSO would make no difference to the overall attractiveness of alternatives. In addition, the sizes of many rural travel segments are very small (due to relatively tiny rural populations) in comparison with the volume of traffic in Sydney.

For example:

Movements between Melbourne and Brisbane, which currently use the Newell Highway, are unlikely to switch to the Hume and Pacific Highways as a result of travel time savings through Sydney.

The effect of the proposed WSO on vehicle hours of travel is relatively large – a projected reduction of 3.15 per cent. This is substantially in excess of the increase in travel distance and, together, results in an improvement in average speed in the network of just under 3.5 per cent.

Part of this travel time saving would be due to the completion of missing links in the road network, which would make for shorter (and hence quicker) trips as well as from congestion relief.

The proposed WSO would result in a substantial increase (61 per cent) in the amount of travel undertaken in Sydney on tollways. This travel is drawn mainly from arterial roads, which are projected to experience a decline of 6.2 per cent in their overall use. There would also be some travel drawn from highways (2 per cent reduction), sub-arterial roads (3.1 per cent reduction) and collector/local roads (-0.8 per cent). This has positive implications for road safety.

4.2.6 Distribution of Heavy Vehicles

The effect of the WSO on the distribution of heavy vehicle origins and destinations during the morning peak hour is considered at:

- Hume Highway northbound off-ramp at Camden Valley Way and southbound at Campbelltown Road;
- Pennant Hills Road at Comenarra Parkway.

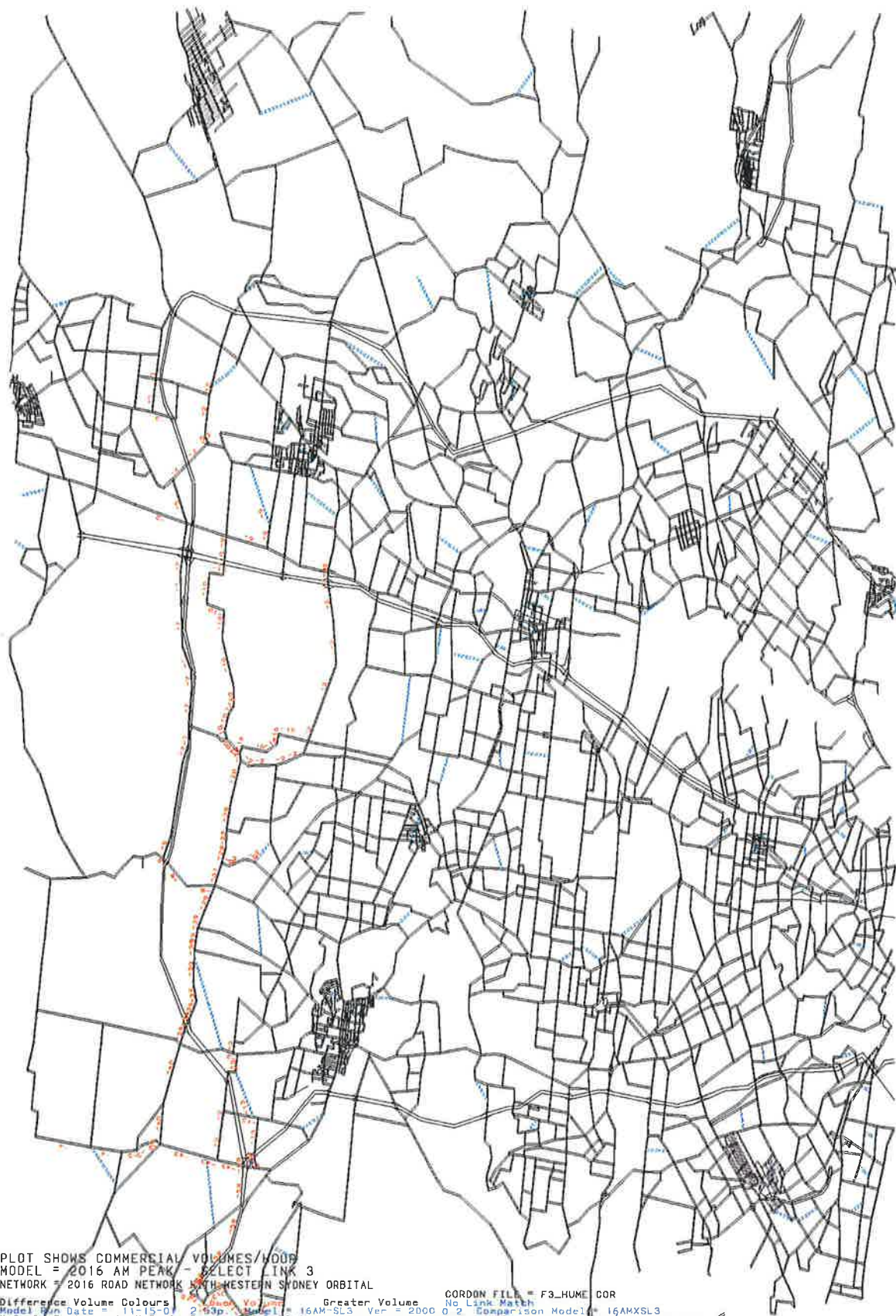
Table 4.21 compares the origin and destination patterns for these locations. The first block in the table presents the destinations within the Sydney area of inbound traffic using the reporting zone system described in Chapter 3 and defined in Appendix C.

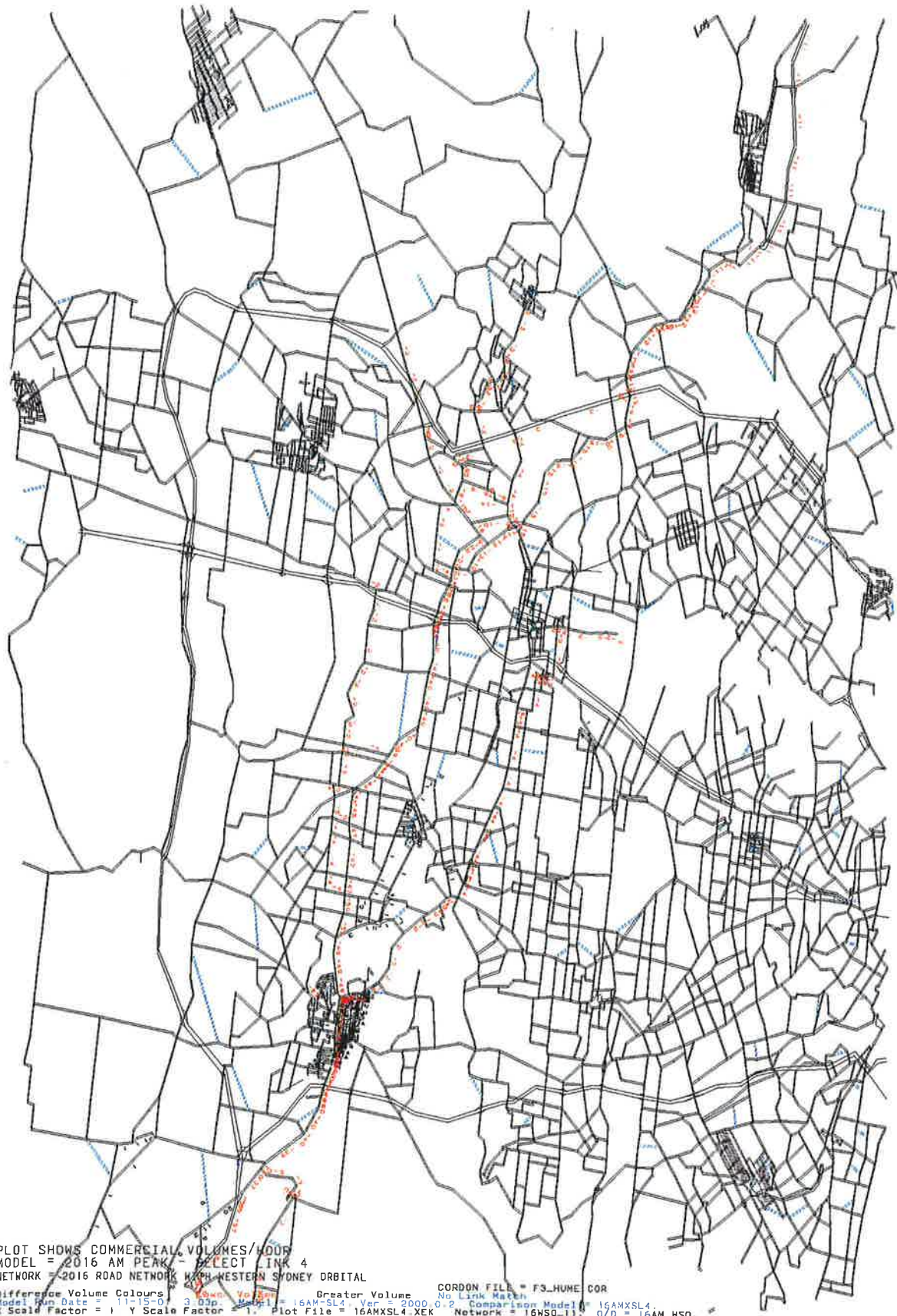
The WSO has no discernible impact on the distribution of traffic in Pennant Hills Road. This is not surprising as there is no effective alternative for access to western Sydney. The effect on the distribution of traffic using the northbound off-ramp from the Hume Highway at Camden Valley Way is far more dramatic. The introduction of the proposed WSO would result in most heavy vehicle traffic destined for western Sydney staying on the Hume Highway and feeding through to the WSO, rather than exiting via the existing Off-ramp to Camden Valley Way. This leaves the heavy vehicles that are headed to Sydney Balance as a far larger proportion of a much smaller number of heavy vehicles on the ramp.

The origins of outbound traffic from Sydney through the Pennant Hills Road site does not change with the proposed WSO, for the same reason as discussed above for inbound traffic. The distribution of heavy vehicle traffic on the southbound on-ramp to the Hume Highway does not alter much, although the volume of heavy vehicles does reduce by about 15 per cent. The reduction is roughly equal for Sydney Balance and West and therefore, results in the heavy vehicle traffic distribution remaining roughly the same.

The change in assignment of traffic at these two locations is illustrated in Figures 4.2 to 4.5. The figures show the difference between traffic assignment of heavy vehicles using either the Hume Highway off or on-ramp (Figures 4.2 and 4.3) or Pennant Hills Road at Comenarra Parkway (Figures 4.4 and 4.5) during the morning peak hour. A negative number indicates that heavy vehicles are no longer using a particular road after the introduction of the WSO; conversely, a positive number indicates an increase in the number of heavy vehicles through the particular select link site that use the road.

Figure 4.2 shows that the heavy vehicle traffic no longer using the Hume Highway Off-ramp as a result of the proposed WSO would be drawn off Camden Valley Way, Cowpasture Road, Wallgrove Road/Rooty Hill Road South/Eastern Road/Knox Road, Brabham Drive and Prospect Arterial. Most of the base heavy vehicle traffic would no





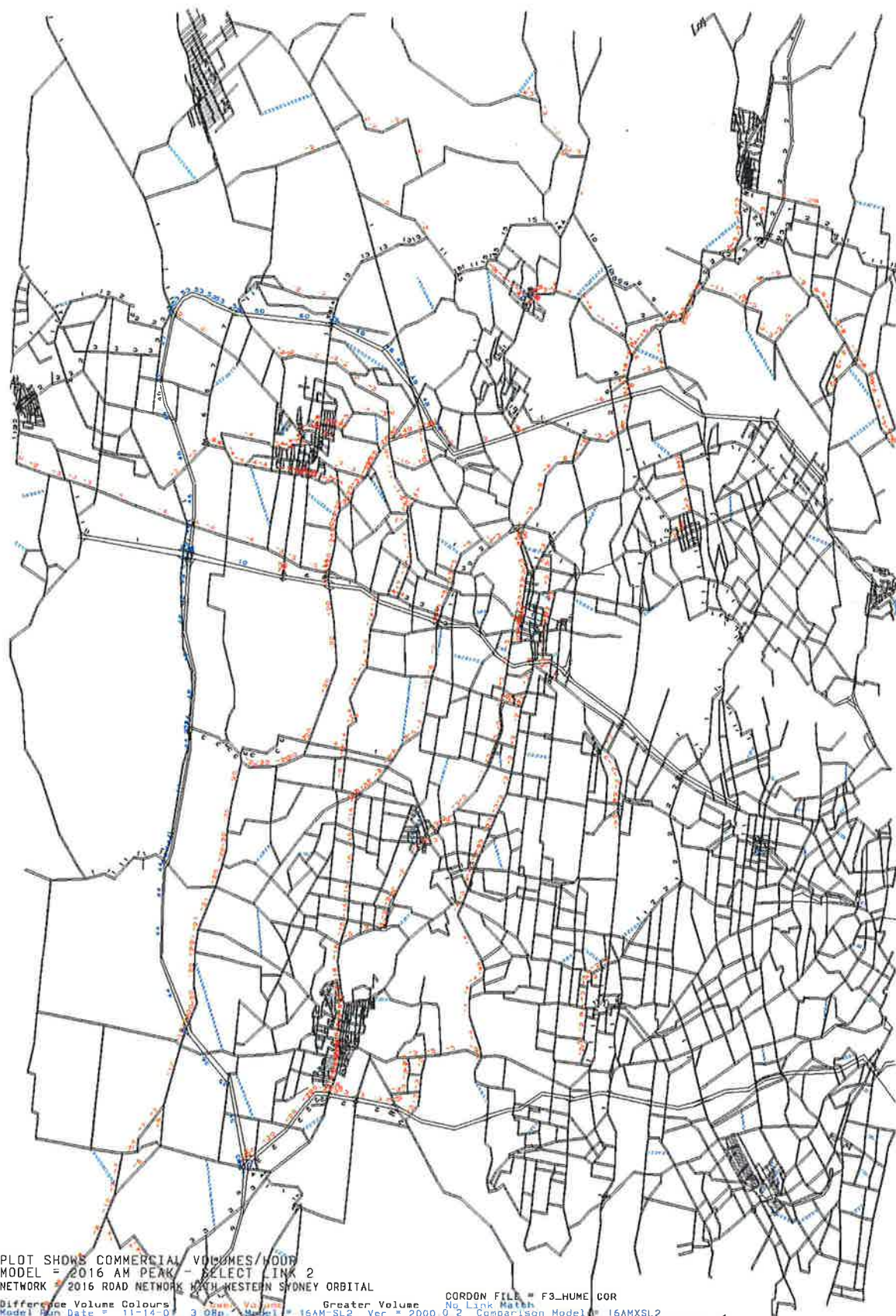
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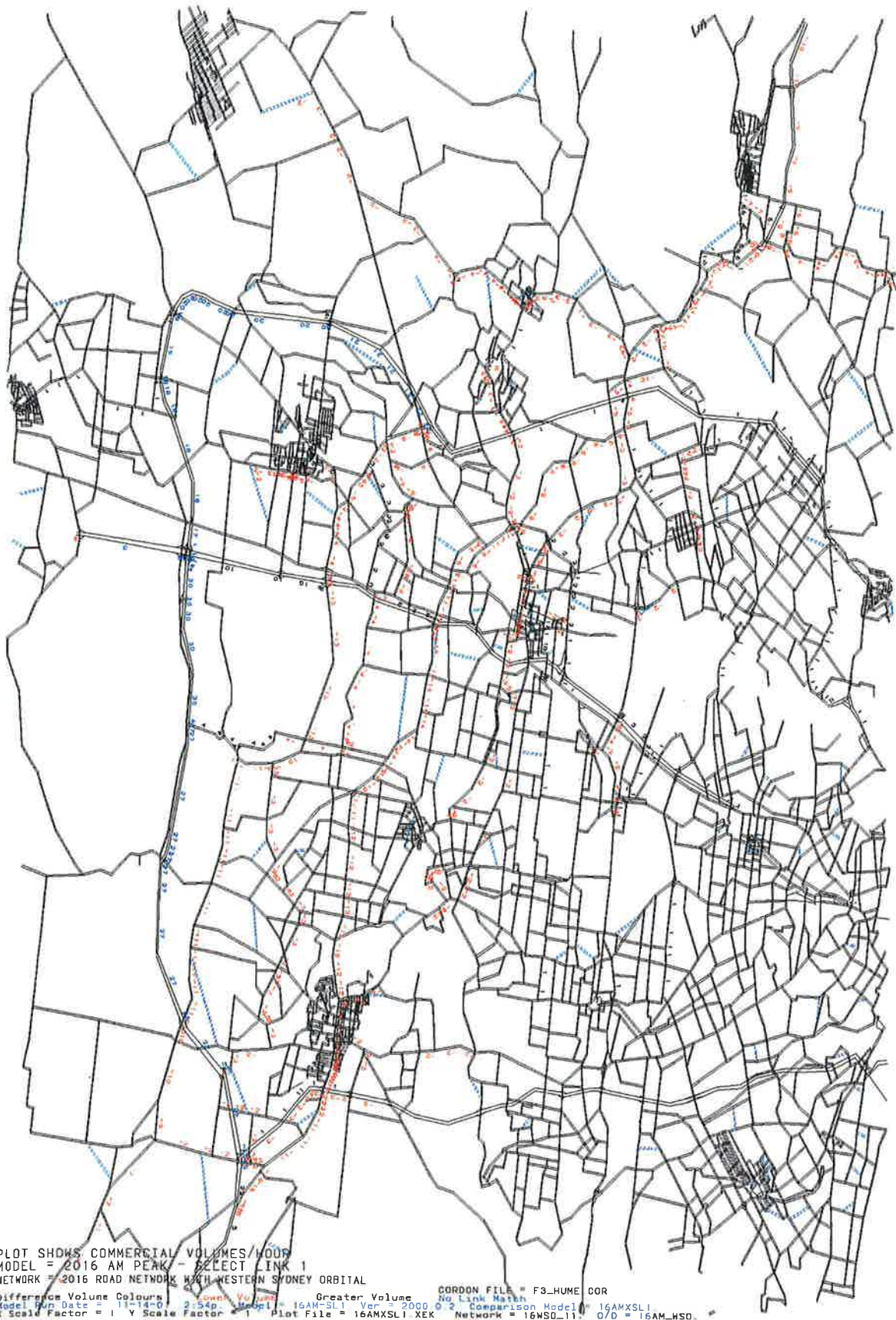
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Figure 4.3





longer use the ramp, and would use the proposed WSO to access freight generating areas in Sydney's west.

Figure 4.3 shows that the proposed WSO would draw heavy vehicles from Woodville Road, Hume Highway, Cumberland Highway and Greystanes Road. It would also draw some of the traffic out of the Parramatta/Seven Hills area. The negative 11 shown on Pennant Hills Road indicates that 11 heavy vehicles that, in the base case, travelled from Pennant Hills Road through to the Hume Highway southbound On-ramp would divert to the proposed WSO. It would lead to some heavy vehicle traffic that, in the base, would use Cumberland Highway, Woodville Road and Greystanes Road to transfer to the WSO.

Figure 4.4 shows the projected change in assignment for northbound heavy vehicle traffic on Pennant Hills Road. Because the trips in the base case are generally also in the WSO case, this figure (and the next one) provide a better indication of how heavy vehicles through Sydney would change their route choice (assignment). The WSO would attract northbound heavy vehicles from Wallgrove Road, Prospect Arterial/Seven Hills Road/Abbott Road alignment, Greystanes Road, Cumberland Highway and a few from Woodville Road. Much of the heavy vehicle traffic that would divert to the proposed WSO would stay on the WSO to the M2 and then access Pennant Hills Road. However, the modelling is indicating that some of the heavy vehicles would leave the WSO at Sunnyholt Road and travel north via Burns Road, Memorial Avenue and Windsor Road to Showground Road. This indicates that there is a relatively high level of congestion expected on the M2 and Pennant Hills Road, to make such a circuitous route attractive. There may also be some sensitivity to the M2 toll costs incurred when travelling as far as Pennant Hills Road.

It is interesting to note that the re-assignment of traffic as a result of the WSO may lead to a very minor switching of heavy vehicles from Stacey Street/Silverwater Road to Hume Highway and Homebush Bay Drive.

The projected changes to heavy vehicle assignment at Pennant Hills Road in the southbound direction are shown in Figure 4.5. Again, a considerable number of these heavy vehicles transfer to the proposed WSO. Some of them appear to feed directly on from the western end of the M2 and travel around the WSO, whilst others choose to remain on the Abbott Road/Prospect Highway through as far as the M4 and use this to travel to the west to then join the WSO at Wallgrove Road. Roads that would see some of the heavy vehicle traffic that they carry from Pennant Hills Road divert include:

- Abbott Road/Prospect Highway/Prospect Arterial;
- Greystanes Road; and
- Cumberland Highway.

This analysis indicates that the WSO would indeed provide a traffic function that aligns with a project need – *to provide a national highway link through Sydney*. From a freight perspective the WSO provides an efficient link for the longer distance movement of freight through Sydney, as well as reducing the conflicts between access requirements of heavy vehicles that currently use the Cumberland Highway and longer distance movements.

4.2.7 Travel Times

The effect of the proposed WSO on heavy vehicle travel times is to reduce them. Travel times between Campbelltown and Hornsby are projected to reduce from around 87

minutes to 70 minutes during the morning peak period in 2016 for heavy vehicles. This estimate is based on a weighted average of travel times on all competing routes between these two locations. This represents a reduction of about 20 per cent. The trips involved would transfer from the existing route via the Cumberland Highway to the WSO to derive the saving. This diversion resulted in an increase in individual vehicle's travel distance from 60 kilometres to 70 kilometres.

For direct travel times between Prestons and West Pennant Hills,

Table 4.22 shows the changes in travel times via the WSO and Cumberland Highway for the morning peak period in 2016.

Table 4.1: Annual Average Projected Traffic Growth Rates Across Screenlines – Morning Peak Hour

Screenline	2000 to 2006		2006 to 2016	
	NB/EB	SB/WB	NB/EB	SB/WB
West Screenline	2.5%	3.4%	1.2%	1.5%
East Screenline	1.6%	3.2%	1.9%	1.5%
South of M4 Screenline	1.2%	2.4%	0.6%	2.5%
South West Screenline	1.1%	2.2%	1.6%	1.0%
Eastern Screenline	1.8%	4.4%	1.0%	1.4%

Table 4.2: Annual Average Population and Employment Growth Rates, WSO Corridor and Sydney Region (1996 to 2016)

DUAP Region	Population		Employment	
	96 to 06	06 to 16	96 to 06	06 to 16
Blacktown-Baulkham Hills	1.8%	1.1%	2.3%	1.1%
Central Western	1.2%	1.1%	1.0%	0.7%
Fairfield-Liverpool	1.4%	0.6%	1.8%	0.7%
Outer South Western	1.2%	0.5%	2.1%	1.5%
Outer Western	1.2%	0.8%	1.7%	0.6%
Total WSO Corridor	1.4%	0.9%	1.7%	0.8%
Sydney Region	0.96%	0.73%	0.93%	0.83%

Note: Central Western comprises SLAs of Auburn Holroyd and Parramatta; Outer South Western comprises SLAs of and Outer Western comprises SLAs of

Table 4.3: Morning Peak Total Traffic Volumes - 2016

Road Section	Northbound/Eastbound				Southbound/Westbound			
	Base	WSO	Change #	%	Base	WSO	Change #	%
Abbott Rd W of Old Windsor Rd	2,251	1,173	-1,078	-48%	1,966	1,426	-540	-27%
Brabham Dr S of M4	496	308	-188	-38%	344	189	-155	-45%
Cambridge Av W of Moorebank Ave	1,369	1,275	-94	-7%	420	390	-30	-7%
Camden V Way W of Hume Hwy	1,906	1,578	-328	-17%	892	328	-564	-63%
Campbelltown Rd N Denham Ct	631	862	231	37%	498	472	-26	-5%
Cowpasture Rd N Nth Liverpool Rd	2,021	1,225	-796	-39%	809	489	-320	-40%
Cumberland Hwy N Hume Hwy	1,646	1,529	-117	-7%	2,277	1,889	-388	-17%
Cumberland Hwy S of Old Windsor	1,210	1,407	197	16%	1,376	1,328	-48	-3%
Cumberland Hwy S of Prospect Ck	2,827	2,820	-7	0%	2,853	2,628	-225	-8%
Doonside Rd N of Gt Western Hwy	470	117	-353	-75%	1,110	851	-259	-23%
Dunmore E of Goodall St	873	860	-13	-1%	174	188	14	8%
Eastern Rd E of Rooty Hill Sth	1,537	1,167	-370	-24%	1,081	664	-417	-39%
Eastern Rd W of Knox Rd	1,458	1,167	-291	-20%	853	664	-189	-22%
Elizabeth Dr W of Cowpasture Rd	1,768	1,059	-709	-40%	892	534	-358	-40%
Elizabeth Dr W of Wallgrove Rd	1,504	1,619	115	8%	253	266	13	5%
Fitzwilliam Rd W of OWR	1,389	1,286	-103	-7%	1,373	1,176	-197	-14%
Greystanes Rd N of Old Prospect Rd	816	703	-113	-14%	1,879	1,816	-63	-3%
Greystanes Rd S of Old Prospect Rd	740	624	-116	-16%	1,302	1,236	-66	-5%
Gt Western Hy E of WSO	3,478	2,730	-748	-22%	641	668	27	4%
GWH W of Cumberland Hwy	2,597	2,572	-25	-1%	684	674	-10	-1%
GWH W of Rooty Hill Sth	3,478	2,462	-1,016	-29%	641	758	117	18%
Hambeldon Rd N of QH Pkwy	745	760	15	2%	2,156	2,197	41	2%
Hume Hwy at Georges Rv	4,455	4,341	-114	-3%	2,058	1,984	-74	-4%
Knox Rd N of Eastern Rd	992	553	-439	-44%	2,116	1,490	-626	-30%
M4 W of Cumberland Hwy	6,454	6,322	-132	-2%	4,102	3,866	-236	-6%
M4 W of Wallgrove Rd	5,716	6,275	559	10%	4,608	4,427	-181	-4%
M5 at Georges Rv Bridge	5,027	5,787	760	15%	3,376	3,651	275	8%
Macquarie Dr at Georges Rv	1,628	1,407	-221	-14%	1,032	936	-96	-9%
Mamre Rd at Pipeline	287	212	-75	-26%	835	765	-70	-8%
Newbridge Rd at Georges Rv	3,066	2,558	-508	-17%	1,521	1,362	-159	-10%
Norwest Bd E of OWR	1,552	2,650	1,098	71%	1,391	2,500	1,109	80%
Norwest Bd Extension W of OWR	0	1,897	1,897	100%	0	1,657	1,657	100%
Old Prospect W of Cumberland Hwy	602	571	-31	-5%	336	338	2	1%
Old Windsor Rd S of Sunnyholt Rd	775	833	58	7%	2,496	2,026	-470	-19%
PHR N of M2	2,173	2,110	-63	-3%	3,488	3,538	50	1%
PHR S of M2	1,787	1,888	101	6%	2,309	2,314	5	0%
Power St W of Knox Rd	830	987	157	19%	1,229	1,150	-79	-6%
Powers Rd E of Rooty Hill Nth	2,254	1,651	-603	-27%	586	924	338	58%
Powers Rd W of OWR	479	304	-175	-37%	1,701	1,593	-108	-6%
Prospect Arterial S of M4	1,046	620	-426	-41%	609	350	-259	-43%
Richmond Rd E of Symonds Rd	2,374	772	-1,602	-67%	934	767	-167	-18%
Richmond Rd W of Rooty Hill Nth	1,685	1,911	226	13%	868	737	-131	-15%
Rooty Hill Nth S of Richmond Rd	1,785	1,782	-3	0%	1,163	721	-442	-38%
Rooty Hill Sth N of GWH	874	270	-604	-69%	1,974	744	-1,230	-62%
Seven Hills Rd W of OWR	1,890	1,505	-385	-20%	1,801	1,465	-336	-19%
Sunnyholt Rd N of Vardys Rd	1,076	964	-112	-10%	3,106	2,907	-199	-6%
Sunnyholt Rd S of QH Pkwy	954	1,318	364	38%	1,751	1,783	32	2%
Sunnyholt Rd W of OWR	2,975	2,215	-760	-26%	2,032	1,562	-470	-23%
The Horsley Dr E of Wallgrove Rd	1,746	2,123	377	22%	329	512	183	56%
Wallgrove Rd N of Elizabeth Drv	907	565	-342	-38%	531	198	-333	-63%
Wallgrove Rd N of The Horsley Drv	1,273	651	-622	-49%	1,854	568	-1,286	-69%
Wentworth Av W of Binalong	1,069	1,011	-58	-5%	247	222	-25	-10%
Windsor Rd N of OWR	1,948	1,963	15	1%	2,554	2,335	-219	-9%
Woodstock Av E of Rooty Hill Rd N	509	1,264	755	148%	360	338	-22	-6%

Table 4.4: Morning Peak Hour Heavy Vehicle Volumes, 2016

Road Section	Northbound/Eastbound				Southbound/Westbound			
	Base	WSO	Change	%	Base	WSO	Change	%
			#				#	
Abbott Rd W of OWR	259	135	-124	-48%	223	171	-52	-23%
Brabham Dr S of M4	65	39	-26	-40%	36	18	-18	-50%
Cambridge Av W of Moorebank Ave	131	120	-11	-8%	43	40	-3	-7%
Camden V Way W of Hume Hwy	147	111	-36	-24%	94	27	-67	-71%
Campbelltown Rd N Denham Ct	53	69	16	30%	57	55	-2	-4%
Cowpasture Rd N Nth Liverpool Rd	254	135	-119	-47%	118	56	-62	-53%
Cumberland Hwy N Hume Hwy	227	184	-43	-19%	327	251	-76	-23%
Cumberland Hwy S of Old Windsor	183	198	15	8%	193	180	-13	-7%
Cumberland Hwy S of Prospect Ck	320	307	-13	-4%	434	375	-59	-14%
Doonside Rd N of Gt Western Hwy	50	14	-36	-72%	105	80	-25	-24%
Dunmore E of Goodall St	90	90	0	0%	19	21	2	11%
Eastern Rd E of Rooty Hill Rd Sth	164	122	-42	-26%	98	51	-47	-48%
Eastern Rd W of Knox Rd	151	122	-29	-19%	65	51	-14	-22%
Elizabeth Dr W of Cowpasture Rd	170	103	-67	-39%	96	58	-38	-40%
Elizabeth Dr W of Wallgrove Rd	137	148	11	8%	28	25	-3	-11%
Fitzwilliam Rd W of OWR	155	145	-10	-6%	173	157	-16	-9%
Greystanes Rd N of Old Prospect Rd	150	115	-35	-23%	248	240	-8	-3%
Greystanes Rd S of Old Prospect Rd	144	109	-35	-24%	197	190	-7	-4%
Gt Western Hwy E of WSO	329	260	-69	-21%	63	67	4	6%
GWH W of Cumberland Hwy	270	271	1	0%	63	64	1	2%
GWH W of Rooty Hill Rd Sth	329	246	-83	-25%	63	75	12	19%
Hambeldon Rd N of QH Pkwy	77	78	1	1%	209	213	4	2%
Hume Hwy at Georges Rv	426	418	-8	-2%	215	194	-21	-10%
Knox Rd N of Eastern Rd	105	63	-42	-40%	181	128	-53	-29%
M4 W of Cumberland Hwy	620	609	-11	-2%	437	431	-6	-1%
M5 at Georges Rv Bridge	286	359	73	26%	272	279	7	3%
Macquarie Dr at Georges Rv	176	154	-22	-13%	104	95	-9	-9%
Mamre Rd at Pipeline	18	12	-6	-33%	67	62	-5	-7%
Newbridge Rd at Georges Rv	259	199	-60	-23%	147	133	-14	-10%
Norwest Bd E of OWR	153	259	106	69%	127	240	113	89%
Norwest Bd Extension W of OWR	0	186	186	100%	0	158	158	100%
Old Prospect W of Cumberland Hwy	62	52	-10	-16%	32	32	0	0%
Old Windsor Rd S of Sunnyholt Rd	84	90	6	7%	255	211	-44	-17%
PHR N of M2	383	360	-23	-6%	491	481	-10	-2%
PHR S of M2	257	266	9	4%	312	300	-12	-4%
Power St W of Knox Rd	77	102	25	32%	120	109	-11	-9%
Powers Rd E of Rooty Hill Rd Nth	221	162	-59	-27%	58	89	31	53%
Powers Rd W of OWR	58	31	-27	-47%	174	158	-16	-9%
Prospect Arterial S of M4	123	56	-67	-54%	85	42	-43	-51%
Richmond Rd E of Symonds Rd	225	79	-146	-65%	98	81	-17	-17%
Richmond Rd W of Rooty Hill Rd N	168	191	23	14%	97	82	-15	-15%
Rooty Hill Nth S of Richmond Rd	181	176	-5	-3%	125	73	-52	-42%
Rooty Hill Sth N of GWH	102	32	-70	-69%	172	57	-115	-67%
Seven Hills Rd W of OWR	174	139	-35	-20%	165	140	-25	-15%
Sunnyholt Rd N of Vardys Rd	108	98	-10	-9%	321	296	-25	-8%
Sunnyholt Rd S of QH Pkwy	96	149	53	55%	183	185	2	1%
Sunnyholt Rd W of OWR	294	239	-55	-19%	209	162	-47	-22%
The Horsley Dr E of Wallgrove Rd	235	291	56	24%	56	91	35	63%
Wallgrove Rd N of Elizabeth Drv	102	64	-38	-37%	67	22	-45	-67%
Wallgrove Rd N of The Horsley Drv	175	89	-86	-49%	262	82	-180	-69%
Wentworth Av W of Binalong	120	115	-5	-4%	35	26	-9	-26%
Windsor Rd N of OWR	204	206	2	1%	275	253	-22	-8%
Woodstock Av E of Rooty Hill Rd N	62	115	53	85%	41	36	-5	-12%

Table 4.5: Evening Peak Hour Total Traffic Volumes, 2016

Road Section	Northbound/Eastbound				Southbound/Westbound			
	Base	WSO	Change		Base	WSO	Change	
			#	%			#	%
Abbott Rd W of Old Windsor Rd	1,447	1,375	-72	-5%	2,256	1,641	-615	-27%
Brabham Dr S of M4	672	283	-389	-58%	488	279	-209	-43%
Cambridge Av W of Moorebank Ave	501	489	-12	-2%	1,135	1,106	-29	-3%
Camden V Way W of Hume Hwy	1,792	1,311	-481	-27%	1,739	846	-893	-51%
Campbelltown Rd N Denham Ct	491	442	-49	-10%	829	1,194	365	44%
Cowpasture Rd N Nth Liverpool Rd	945	574	-371	-39%	2,064	1,160	-904	-44%
Cumberland Hwy N Hume Hwy	2,890	2,540	-350	-12%	1,931	1,592	-339	-18%
Cumberland Hwy S of Old Windsor	1,814	1,854	40	2%	2,047	1,884	-163	-8%
Cumberland Hwy S of Prospect Ck	2,737	2,622	-115	-4%	2,962	2,890	-72	-2%
Doonside Rd N of Gt Western Hwy	1,571	1,040	-531	-34%	395	103	-292	-74%
Dunmore E of Goodall St	153	154	1	1%	1,062	986	-76	-7%
Eastern Rd E of Rooty Hill Sth	1,212	725	-487	-40%	1,606	1,364	-242	-15%
Eastern Rd W of Knox Rd	996	725	-271	-27%	1,700	1,364	-336	-20%
Elizabeth Dr W of Cowpasture Rd	1,150	672	-478	-42%	2,099	1,097	-1,002	-48%
Elizabeth Dr W of Wallgrove Rd	464	336	-128	-28%	1,772	2,096	324	18%
Fitzwilliam Rd W of OWR	1,299	1,111	-188	-14%	1,185	908	-277	-23%
Greystanes Rd N of Old Prospect Rd	1,849	1,789	-60	-3%	856	827	-29	-3%
Greystanes Rd S of Old Prospect Rd	1,630	1,543	-87	-5%	630	613	-17	-3%
Gt Western Hy E of WSO	2,284	905	-1,379	-60%	3,267	3,225	-42	-1%
GWH W of Cumberland Hwy	694	626	-68	-10%	2,492	2,448	-44	-2%
GWH W of Rooty Hill Sth	2,284	998	-1,286	-56%	3,267	2,829	-438	-13%
Hambeldon Rd N of QH Pkwy	2,058	2,132	74	4%	861	803	-58	-7%
Hume Hwy at Georges Rv	2,641	2,520	-121	-5%	3,481	3,415	-66	-2%
Knox Rd N of Eastern Rd	1,876	1,379	-497	-26%	1,205	790	-415	-34%
M4 W of Cumberland Hwy	3,941	3,800	-141	-4%	6,495	6,167	-328	-5%
M4 W of Wallgrove Rd	3,799	4,945	1,146	30%	7,004	6,952	-52	-1%
M5 at Georges Rv Bridge	3,285	3,668	383	12%	5,684	6,389	705	12%
Macquarie Dr at Georges Rv	851	787	-64	-8%	1,807	1,503	-304	-17%
Mamre Rd at Pipeline	1,066	1,087	21	2%	489	242	-247	-51%
Newbridge Rd at Georges Rv	1,795	1,302	-493	-27%	2,420	1,979	-441	-18%
Norwest Bd E of OWR	810	1,761	951	117%	1,893	3,071	1,178	62%
Norwest Bd Extension W of OWR	0	1,406	1,406	100%	0	2,120	2,120	100%
Old Prospect W of Cumberland Hwy	286	292	6	2%	653	659	6	1%
Old Windsor Rd S of Sunnyholt Rd	2,214	2,194	-20	-1%	927	649	-278	-30%
PHR N of M2	3,473	3,507	34	1%	1,927	2,237	310	16%
PHR S of M2	2,305	2,580	275	12%	1,545	1,496	-49	-3%
Power St W of Knox Rd	1,333	1,778	445	33%	678	661	-17	-3%
Powers Rd E of Rooty Hill Nth	699	488	-211	-30%	2,163	2,189	26	1%
Powers Rd W of OWR	1,623	1,411	-212	-13%	491	259	-232	-47%
Prospect Arterial S of M4	1,003	530	-473	-47%	1,007	644	-363	-36%
Richmond Rd E of Symonds Rd	1,844	809	-1,035	-56%	2,484	1,486	-998	-40%
Richmond Rd W of Rooty Hill Nth	1,092	1,276	184	17%	1,350	1,344	-6	0%
Rooty Hill Nth S of Richmond Rd	1,806	1,563	-243	-13%	2,186	2,664	478	22%
Rooty Hill Sth N of GWH	2,344	904	-1,440	-61%	905	251	-654	-72%
Seven Hills Rd W of OWR	1,565	1,196	-369	-24%	2,671	1,662	-1,009	-38%
Sunnyholt Rd N of Vardys Rd	3,308	3,069	-239	-7%	1,234	1,423	189	15%
Sunnyholt Rd S of QH Pkwy	1,825	2,467	642	35%	1,162	1,392	230	20%
Sunnyholt Rd W of OWR	2,407	1,846	-561	-23%	3,031	2,423	-608	-20%
The Horsley Dr E of Wallgrove Rd	425	383	-42	-10%	1,886	2,821	935	50%
Wallgrove Rd N of Elizabeth Drv	687	455	-232	-34%	1,046	446	-600	-57%
Wallgrove Rd N of The Horsley Drv	2,107	1,044	-1,063	-50%	1,360	568	-792	-58%
Wentworth Av W of Binalong	528	428	-100	-19%	1,051	865	-186	-18%
Windsor Rd N of OWR	2,726	2,566	-160	-6%	2,181	1,969	-212	-10%
Woodstock Av E of Rooty Hill Rd N	229	620	391	171%	539	1,055	516	96%

Table 4.6: Evening Peak Hour Heavy Vehicle Traffic Volumes, 2016

Road Section	Northbound/Eastbound				Southbound/Westbound			
	Base	WSO	Change	#	Base	WSO	Change	#
				%				%
Abbott Rd W of OWR	213	192	-21	-10%	249	164	-85	-34%
Brabham Dr S of M4	63	26	-37	-59%	48	28	-20	-42%
Cambridge Av W of Moorebank Ave	50	47	-3	-6%	116	108	-8	-7%
Camden V Way W of Hume Hwy	120	74	-46	-38%	139	42	-97	-70%
Campbelltown Rd N Denham Ct	48	43	-5	-10%	71	95	24	34%
Cowpasture Rd N Nth Liverpool Rd	112	73	-39	-35%	195	105	-90	-46%
Cumberland Hwy N Hume Hwy	318	259	-59	-19%	208	160	-48	-23%
Cumberland Hwy S of Old Windsor	220	225	5	2%	237	212	-25	-11%
Cumberland Hwy S of Prospect Ck	320	310	-10	-3%	276	254	-22	-8%
Doonside Rd N of Gt Western Hwy	135	91	-44	-33%	35	10	-25	-71%
Dunmore E of Goodall St	17	17	0	0%	108	101	-7	-6%
Eastern Rd E of Rooty Hill Rd Sth	73	50	-23	-32%	147	130	-17	-12%
Eastern Rd W of Knox Rd	62	50	-12	-19%	153	130	-23	-15%
Elizabeth Dr W of Cowpasture Rd	110	61	-49	-45%	159	95	-64	-40%
Elizabeth Dr W of Wallgrove Rd	38	28	-10	-26%	154	170	16	10%
Fitzwilliam Rd W of OWR	143	120	-23	-16%	118	93	-25	-21%
Greystanes Rd N of Old Prospect Rd	244	224	-20	-8%	110	103	-7	-6%
Greystanes Rd S of Old Prospect Rd	224	202	-22	-10%	91	85	-6	-7%
Gt Western Hwy E of WSO	210	84	-126	-60%	283	284	1	0%
GWH W of Cumberland Hwy	73	66	-7	-10%	247	244	-3	-1%
GWH W of Rooty Hill Rd Sth	210	90	-120	-57%	283	268	-15	-5%
Hambeldon Rd N of QH Pkwy	189	199	10	5%	82	75	-7	-9%
Hume Hwy at Georges Rv	243	233	-10	-4%	322	309	-13	-4%
Knox Rd N of Eastern Rd	119	93	-26	-22%	100	79	-21	-21%
M4 W of Cumberland Hwy	360	336	-24	-7%	561	534	-27	-5%
M5 at Georges Rv Bridge	114	156	42	37%	294	350	56	19%
Macquarie Dr at Georges Rv	84	78	-6	-7%	176	153	-23	-13%
Mamre Rd at Pipeline	70	72	2	3%	31	13	-18	-58%
Newbridge Rd at Georges Rv	164	120	-44	-27%	219	183	-36	-16%
Norwest Bd E of OWR	80	171	91	114%	141	263	122	87%
Norwest Bd Extension W of OWR	0	135	135	100%	0	192	192	100%
Old Prospect W of Cumberland Hwy	27	27	0	0%	63	67	4	6%
Old Windsor Rd S of Sunnyholt Rd	270	270	0	0%	84	58	-26	-31%
PHR N of M2	493	498	5	1%	284	312	28	10%
PHR S of M2	287	311	24	8%	200	187	-13	-7%
Power St W of Knox Rd	122	152	30	25%	55	54	-1	-2%
Powers Rd E of Rooty Hill Rd Nth	63	48	-15	-24%	208	205	-3	-1%
Powers Rd W of OWR	169	143	-26	-15%	46	27	-19	-41%
Prospect Arterial S of M4	121	60	-61	-50%	86	54	-32	-37%
Richmond Rd E of Symonds Rd	193	86	-107	-55%	233	134	-99	-42%
Richmond Rd W of Rooty Hill Rd N	118	136	18	15%	123	129	6	5%
Rooty Hill Nth S of Richmond Rd	173	165	-8	-5%	208	251	43	21%
Rooty Hill Sth N of GWH	100	31	-69	-69%	64	19	-45	-70%
Seven Hills Rd W of OWR	151	116	-35	-23%	211	132	-79	-37%
Sunnyholt Rd N of Vardys Rd	320	303	-17	-5%	115	132	17	15%
Sunnyholt Rd S of QH Pkwy	177	238	61	34%	109	135	26	24%
Sunnyholt Rd W of OWR	238	177	-61	-26%	298	242	-56	-19%
The Horsley Dr E of Wallgrove Rd	36	50	14	39%	150	236	86	57%
Wallgrove Rd N of Elizabeth Drv	45	34	-11	-24%	112	48	-64	-57%
Wallgrove Rd N of The Horsley Drv	137	72	-65	-47%	133	57	-76	-57%
Wentworth Av W of Binalong	63	49	-14	-22%	109	92	-17	-16%
Windsor Rd N of OWR	345	323	-22	-6%	207	188	-19	-9%
Woodstock Av E of Rooty Hill Rd N	17	47	30	176%	35	55	20	57%

Table 4.7: Annual Average Daily Total Traffic Volumes, 2016

Road Section	Northbound/Eastbound				Southbound/Westbound			
	Base	WSO	Change	#	Base	WSO	Change	#
				%				%
Abbott Rd W of Old Windsor Rd	20,942	14,564	-6,378	-30%	23,852	16,073	-7,779	-33%
Brabham Dr S of M4	5,915	3,198	-2,717	-46%	4,404	2,595	-1,809	-41%
Cambridge Av W of Moorebank Ave	9,360	9,080	-280	-3%	8,945	8,727	-218	-2%
Camden V Way W of Hume Hwy	25,443	20,159	-5,284	-21%	15,963	6,873	-9,090	-57%
Campbelltown Rd N Denham Ct	5,113	5,228	115	2%	5,166	5,926	760	15%
Cowpasture Rd N Nth Liverpool Rd	21,970	14,717	-7,253	-33%	22,020	13,737	-8,283	-38%
Cumberland Hwy N Hume Hwy	28,446	26,026	-2,420	-9%	29,567	25,795	-3,772	-13%
Cumberland Hwy S of Old Windsor	24,850	25,915	1,065	4%	25,643	24,120	-1,523	-6%
Cumberland Hwy S of Prospect Ck	36,409	35,348	-1,061	-3%	37,240	35,799	-1,441	-4%
Doonside Rd N of Gt Western Hwy	11,719	6,582	-5,137	-44%	8,990	5,210	-3,780	-42%
Dunmore E of Goodall St	5,939	5,867	-72	-1%	6,244	5,910	-334	-5%
Eastern Rd E of Rooty Hill Sth	15,212	10,406	-4,806	-32%	14,308	11,175	-3,133	-22%
Eastern Rd W of Knox Rd	13,275	10,406	-2,869	-22%	13,336	11,175	-2,161	-16%
Elizabeth Dr W of Cowpasture Rd	16,033	10,742	-5,291	-33%	15,489	9,591	-5,898	-38%
Elizabeth Dr W of Wallgrove Rd	10,315	9,157	-1,158	-11%	9,177	10,030	853	9%
Fitzwilliam Rd W of OWR	14,925	13,467	-1,458	-10%	12,393	11,379	-1,014	-8%
Greystanes Rd N of Old Prospect Rd	19,460	18,298	-1,162	-6%	19,665	19,062	-603	-3%
Greystanes Rd S of Old Prospect Rd	18,015	16,823	-1,192	-7%	14,989	14,526	-463	-3%
Gt Western Hy E of WSO	35,309	17,289	-18,020	-51%	16,708	18,047	1,339	8%
GWH W of Cumberland Hwy	20,106	18,409	-1,697	-8%	17,500	17,315	-185	-1%
GWH W of Rooty Hill Sth	35,309	16,557	-18,752	-53%	16,708	17,197	489	3%
Hambeldon Rd N of QH Pkwy	18,219	18,220	1	0%	19,715	19,591	-124	-1%
Hume Hwy at Georges Rv	38,894	38,166	-728	-2%	35,617	34,873	-744	-2%
Knox Rd N of Eastern Rd	17,993	12,054	-5,939	-33%	19,647	13,171	-6,476	-33%
M4 W of Cumberland Hwy	56,454	58,754	2,300	4%	69,115	67,451	-1,664	-2%
M4 W of Wallgrove Rd	49,133	62,430	13,297	27%	70,871	66,501	-4,370	-6%
M5 at Georges Rv Bridge	49,369	54,435	5,066	10%	55,201	59,385	4,184	8%
Macquarie Dr at Georges Rv	15,136	13,724	-1,412	-9%	16,005	14,540	-1,465	-9%
Mamre Rd at Pipeline	5,402	4,748	-654	-12%	6,287	4,229	-2,058	-33%
Newbridge Rd at Georges Rv	32,412	27,338	-5,074	-16%	24,988	21,774	-3,214	-13%
Norwest Bd E of OWR	19,615	33,343	13,728	70%	21,695	39,910	18,215	84%
Norwest Bd Extension W of OWR	0	25,302	25,302	100%	0	28,167	28,167	100%
Old Prospect W of Cumberland Hwy	3,825	3,756	-69	-2%	4,369	4,410	41	1%
Old Windsor Rd S of Sunnyholt Rd	18,319	20,829	2,510	14%	24,500	18,750	-5,750	-23%
PHR N of M2	38,249	38,392	143	0%	37,044	40,258	3,214	9%
PHR S of M2	27,990	30,625	2,635	9%	28,422	28,105	-317	-1%
Power St W of Knox Rd	13,790	17,418	3,628	26%	11,891	11,387	-504	-4%
Powers Rd E of Rooty Hill Nth	19,799	13,952	-5,847	-30%	17,667	18,956	1,289	7%
Powers Rd W of OWR	12,753	11,994	-759	-6%	12,657	12,625	-32	0%
Prospect Arterial S of M4	10,102	6,036	-4,066	-40%	7,646	5,307	-2,339	-31%
Richmond Rd E of Symonds Rd	26,723	12,833	-13,890	-52%	22,860	17,997	-4,863	-21%
Richmond Rd W of Rooty Hill Nth	16,510	18,379	1,869	11%	15,017	14,242	-775	-5%
Rooty Hill Nth S of Richmond Rd	26,856	24,754	-2,102	-8%	24,484	23,863	-621	-3%
Rooty Hill Sth N of GWH	17,709	7,149	-10,560	-60%	16,437	6,577	-9,860	-60%
Seven Hills Rd W of OWR	23,448	19,536	-3,912	-17%	28,081	18,762	-9,319	-33%
Sunnyholt Rd N of Vardys Rd	29,083	26,771	-2,312	-8%	31,985	33,441	1,456	5%
Sunnyholt Rd S of QH Pkwy	19,947	23,974	4,027	20%	22,819	22,269	-550	-2%
Sunnyholt Rd W of OWR	38,319	26,771	-11,548	-30%	37,144	28,374	-8,770	-24%
The Horsley Dr E of Wallgrove Rd	12,523	14,582	2,059	16%	11,483	18,113	6,630	58%
Wallgrove Rd N of Elizabeth Drv	9,238	5,973	-3,265	-35%	8,643	3,855	-4,788	-55%
Wallgrove Rd N of The Horsley Drv	18,692	8,792	-9,900	-53%	19,166	7,615	-11,551	-60%
Wentworth Av W of Binalong	6,637	5,754	-883	-13%	5,255	4,653	-602	-11%
Windsor Rd N of OWR	35,170	35,081	-89	0%	36,012	33,640	-2,372	-7%
Woodstock Av E of Rooty Hill Rd N	3,219	11,020	7,801	242%	4,179	8,254	4,075	98%

Table 4.8: Annual Average Daily Heavy Vehicle Traffic Volumes, 2016

Road Section	Northbound/Eastbound				Southbound/Westbound			
	Base	WSO	Change	%	Base	WSO	Change	%
			#				#	
Abbott Rd W of OWR	4,268	3,040	-1,228	-29%	4,333	2,950	-1,383	-32%
Brabham Dr S of M4	864	419	-445	-52%	569	325	-244	-43%
Cambridge Av W of Moorebank Ave	1,315	1,274	-41	-3%	1,307	1,275	-32	-2%
Camden V Way W of Hume Hwy	2,637	1,771	-866	-33%	1,815	491	-1,324	-73%
Campbelltown Rd N Denham Ct	584	556	-28	-5%	643	701	58	9%
Cowpasture Rd N Nth Liverpool Rd	2,776	1,609	-1,167	-42%	2,626	1,327	-1,299	-49%
Cumberland Hwy N Hume Hwy	4,485	3,502	-983	-22%	4,210	3,246	-964	-23%
Cumberland Hwy S of Old Windsor	4,381	4,394	13	0%	4,036	3,567	-469	-12%
Cumberland Hwy S of Prospect Ck	5,097	4,718	-379	-7%	5,073	4,438	-635	-13%
Doonside Rd N of Gt Western Hwy	1,345	797	-548	-41%	1,111	652	-459	-41%
Dunmore E of Goodall St	744	741	-3	0%	768	728	-40	-5%
Eastern Rd E of Rooty Hill Rd Sth	1,852	1,196	-656	-35%	1,827	1,297	-530	-29%
Eastern Rd W of Knox Rd	1,499	1,196	-303	-20%	1,560	1,297	-263	-17%
Elizabeth Dr W of Cowpasture Rd	2,077	1,211	-866	-42%	1,634	1,047	-587	-36%
Elizabeth Dr W of Wallgrove Rd	1,142	1,049	-93	-8%	932	1,035	103	11%
Fitzwilliam Rd W of OWR	1,984	1,830	-154	-8%	1,680	1,605	-75	-4%
Greystanes Rd N of Old Prospect Rd	3,826	3,146	-680	-18%	3,374	3,259	-115	-3%
Greystanes Rd S of Old Prospect Rd	3,650	2,970	-680	-19%	2,896	2,792	-104	-4%
Gt Western Hwy E of WSO	4,253	1,856	-2,397	-56%	1,528	1,628	100	7%
GWH W of Cumberland Hwy	2,666	2,475	-191	-7%	2,222	2,225	3	0%
GWH W of Rooty Hill Rd Sth	4,253	1,844	-2,409	-57%	1,528	1,695	167	11%
Hambeldon Rd N of QH Pkwy	2,201	2,209	8	0%	2,343	2,314	-29	-1%
Hume Hwy at Georges Rv	5,255	5,125	-130	-2%	3,915	3,772	-143	-4%
Knox Rd N of Eastern Rd	1,747	1,229	-518	-30%	2,282	1,575	-707	-31%
M4 W of Cumberland Hwy	9,280	9,167	-113	-1%	10,399	9,889	-510	-5%
M5 at Georges Rv Bridge	3,797	4,679	882	23%	4,581	5,300	719	16%
Macquarie Dr at Georges Rv	1,920	1,731	-189	-10%	2,018	1,854	-164	-8%
Mamre Rd at Pipeline	320	296	-24	-8%	580	325	-255	-44%
Newbridge Rd at Georges Rv	3,183	2,602	-581	-18%	2,875	2,524	-351	-12%
Norwest Bd E of OWR	2,396	4,023	1,627	68%	2,502	4,486	1,984	79%
Norwest Bd Extension W of OWR	0	3,033	3,033	100%	0	3,198	3,198	100%
Old Prospect W of Cumberland Hwy	359	328	-31	-9%	561	569	8	1%
Old Windsor Rd S of Sunnyholt Rd	3,467	3,398	-69	-2%	3,488	2,496	-992	-28%
PHR N of M2	8,243	8,416	173	2%	6,773	7,192	419	6%
PHR S of M2	5,002	5,405	403	8%	4,391	4,187	-204	-5%
Power St W of Knox Rd	1,644	2,109	465	28%	1,325	1,318	-7	-1%
Powers Rd E of Rooty Hill Rd Nth	2,374	1,716	-658	-28%	2,118	2,233	115	5%
Powers Rd W of OWR	1,624	1,488	-136	-8%	1,651	1,668	17	1%
Prospect Arterial S of M4	1,380	670	-710	-51%	999	609	-390	-39%
Richmond Rd E of Symonds Rd	3,457	1,502	-1,955	-57%	2,517	2,060	-457	-18%
Richmond Rd W of Rooty Hill Rd N	2,330	2,914	584	25%	1,782	1,910	128	7%
Rooty Hill Nth S of Richmond Rd	2,904	2,814	-90	-3%	2,516	2,558	42	2%
Rooty Hill Sth N of GWH	1,428	455	-973	-68%	1,732	632	-1,100	-64%
Seven Hills Rd W of OWR	2,754	2,254	-500	-18%	3,032	2,007	-1,025	-34%
Sunnyholt Rd N of Vardys Rd	3,273	2,881	-392	-12%	3,491	3,431	-60	-2%
Sunnyholt Rd S of QH Pkwy	2,136	2,780	644	30%	2,380	2,353	-27	-1%
Sunnyholt Rd W of OWR	4,355	2,993	-1,362	-31%	4,184	3,121	-1,063	-25%
The Horsley Dr E of Wallgrove Rd	2,006	2,437	431	21%	1,505	2,434	929	62%
Wallgrove Rd N of Elizabeth Drv	1,263	852	-411	-33%	1,486	578	-908	-61%
Wallgrove Rd N of The Horsley Drv	2,617	1,279	-1,338	-51%	3,216	1,255	-1,961	-61%
Wentworth Av W of Binalong	794	687	-107	-13%	595	505	-90	-15%
Windsor Rd N of OWR	4,685	4,483	-202	-4%	4,103	3,589	-514	-13%
Woodstock Av E of Rooty Hill Rd N	485	1,124	639	132%	575	790	215	37%

Table 4.9: Mid-block Capacity Analysis - Selected Road Sections, Morning Peak Hour

Road Section			Volume to Capacity Ratio**			
			Base		WSO	
			Base	WSO	Base	WSO
	Standard	Capacity*	NB/EB	NB/EB	SB/WB	SB/WB
M4 W of Cumberland Hwy	6LDMW	6,000	1.08 (F)	1.05 (F)	0.68 (D)	0.64 (D)
M4 W of Wallgrove Rd	6LDMW	6,000	0.95 (E)	1.05 (F)	0.77 (D)	0.74 (C)
M5 at Georges Rv Bridge	8LDMW	6,000	0.63 (D)	0.72 (D)	0.42 (B)	0.46 (B)
Norwest Bd E of OWR	4LDA	3,300	0.47	0.80	0.42	0.76
PHR N of M2	6LDA	3,300	0.44	0.43	0.70	0.71
PHR S of M2	6LDA	3,300	0.36	0.38	0.47	0.47
Power St W of Knox Rd	4LD	2,400	0.35	0.41	0.51	0.48
Richmond Rd W of Rooty Hill Nth	4LDA	2,800	0.60	0.68	0.31	0.26
Sunnyholt Rd S of QH Pkwy	4LDA	2,800	0.34	0.47	0.63	0.64
The Horsley Dr E of Wallgrove Rd	4L	2,400	0.73	0.88	0.14	0.21
Woodstock Av E of Rooty Hill Rd N	4L	2,400	0.21	0.53	0.15	0.14

Note: * throughput of road sections will depend on upstream/downstream constrictions and other sources of interruption; ** volume to capacity ratio used to determine motorway LOS which is shown in brackets.

Source: Based on AustRoads and City of Blacktown Section 94 Contribution Plan

Table 4.10: Mid-block Capacity Analysis - Selected Road Sections, Evening Peak Hour

Road Section			Volume to Capacity Ratio**			
			Base		WSO	
			Base	WSO	Base	WSO
	Standard	Capacity*	NB/EB	NB/EB	SB/WB	SB/WB
M4 W of Cumberland Hwy	6LDMW	6,000	0.66 (D)	0.63 (D)	1.08 (F)	1.03 (F)
M4 W of Wallgrove Rd	6LDMW	6,000	0.63 (D)	0.82 (E)	1.17 (F)	1.16 (F)
M5 at Georges Rv Bridge	8LDMW	6,000	0.41 (B)	0.46 (B)	0.71 (D)	0.80 (D)
Norwest Bd E of OWR	4LDA	3,300	0.25	0.53	0.57	0.93
PHR N of M2	6LDA	3,300	0.70	0.71	0.39	0.45
PHR S of M2	6LDA	3,300	0.47	0.52	0.31	0.30
Power St W of Knox Rd	4LD	2,400	0.56	0.74	0.28	0.28
Richmond Rd W of Rooty Hill Nth	4LDA	2,800	0.39	0.46	0.48	0.48
Sunnyholt Rd S of QH Pkwy	4LDA	2,800	0.65	0.88	0.42	0.50
The Horsley Dr E of Wallgrove Rd	4L	2,400	0.18	0.16	0.79	1.18
Woodstock Av E of Rooty Hill Rd N	4L	2,400	0.10	0.26	0.22	0.44

Note: * throughput of road sections will depend on upstream/downstream constrictions and other sources of interruption; ** volume to capacity ratio used to determine motorway LOS which is shown in brackets.

Source: Based on AustRoads and City of Blacktown Section 94 Contribution Plan

Table 4.11: Traffic Volumes on the WSO, Morning Peak Hour - 2006

Section of WSO	Northbound/Eastbound			Southbound/Westbound			Combined		
	Total	HV	%	Total	HV	%	Total	HV	%
N of Camden Valley Way	2,610	308	12%	2,563	277	11%	5,173	585	11%
N of Bernera Rd	2,246	293	13%	2,086	244	12%	4,332	537	12%
N of Cowpasture Rd	2,350	304	13%	1,949	243	12%	4,299	547	13%
N of Elizabeth Drv	2,257	298	13%	1,676	228	14%	3,933	526	13%
N of The Horsley Drv	2,450	332	14%	2,503	333	13%	4,953	665	13%
S of Great Western Hwy	2,305	273	12%	2,523	268	11%	4,828	541	11%
S of Woodstock Ave	2,495	293	12%	3,153	317	10%	5,648	610	11%
S of Richmond Rd	1,447	179	12%	2,293	245	11%	3,740	424	11%
E of Richmond Rd	2,582	284	11%	1,600	176	11%	4,182	460	11%
W of Sunnyholt Rd	3,317	357	11%	1,807	196	11%	5,124	553	11%
E of Sunnyholt Rd	3,271	349	11%	2,010	211	10%	5,281	560	11%
W of Old Windsor Rd	1,829	207	11%	667	82	12%	2,496	289	12%
E of Old Windsor Rd	2,227	241	11%	907	111	12%	3,134	352	11%

Table 4.12: Traffic Volumes on the WSO, Morning Peak Hour - 2016

Section of WSO	Northbound/Eastbound			Southbound/Westbound			Combined		
	Total	HV	%	Total	HV	%	Total	HV	%
N of Camden Valley Way	2,721	321	12%	3,125	367	12%	5,846	688	12%
N of Bernera Rd	2,261	298	13%	2,731	338	12%	4,992	636	13%
N of Cowpasture Rd	2,332	303	13%	2,453	327	13%	4,785	630	13%
N of Elizabeth Drv	2,355	311	13%	2,016	298	15%	4,371	609	14%
N of The Horsley Drv	2,444	331	14%	2,971	427	14%	5,415	758	14%
S of Great Western Hwy	2,278	268	12%	3,061	325	11%	5,339	593	11%
S of Woodstock Ave	2,523	293	12%	3,663	373	10%	6,186	666	11%
S of Richmond Rd	1,346	165	12%	2,737	293	11%	4,083	458	11%
E of Richmond Rd	2,722	293	11%	1,884	207	11%	4,606	500	11%
W of Sunnyholt Rd	3,525	373	11%	2,126	230	11%	5,651	603	11%
E of Sunnyholt Rd	3,660	367	10%	2,462	258	10%	6,122	625	10%
W of Old Windsor Rd	1,763	181	10%	805	100	12%	2,568	281	11%
E of Old Windsor Rd	2,210	218	10%	1,116	134	12%	3,326	352	11%

Table 4.13: Traffic Volumes on the WSO, Evening Peak Hour - 2006

Section of WSO	Northbound/Eastbound			Southbound/Westbound			Combined		
	Total	HV	%	Total	HV	%	Total	HV	%
N of Camden Valley Way	2,858	282	10%	2,991	279	9%	5,849	561	10%
N of Bernera Rd	2,642	272	10%	2,284	243	11%	4,926	515	10%
N of Cowpasture Rd	2,335	222	10%	2,475	257	10%	4,810	479	10%
N of Elizabeth Drv	1,461	164	11%	2,697	277	10%	4,158	441	11%
N of The Horsley Drv	2,868	254	9%	2,529	255	10%	5,397	509	9%
S of Great Western Hwy	2,771	206	7%	2,623	233	9%	5,394	439	8%
S of Woodstock Ave	3,340	240	7%	2,788	253	9%	6,128	493	8%
S of Richmond Rd	1,656	151	9%	2,224	214	10%	3,880	365	9%
E of Richmond Rd	2,185	222	10%	2,797	277	10%	4,982	499	10%
W of Sunnyholt Rd	2,642	267	10%	3,203	324	10%	5,845	591	10%
E of Sunnyholt Rd	2,206	232	11%	3,484	356	10%	5,690	588	10%
W of Old Windsor Rd	827	100	12%	1,896	211	11%	2,723	311	11%
E of Old Windsor Road	976	113	12%	2,357	270	11%	3,333	383	11%

Table 4.14: Traffic Volumes on the WSO, Evening Peak Hour - 2016

Section of WSO	Northbound/Eastbound			Southbound/Westbound			Combined		
	Total	HV	%	Total	HV	%	Total	HV	%
N of Camden Valley Way	3,554	334	9%	3,118	290	9%	6,672	624	9%
N of Bernera Rd	3,297	322	10%	2,523	264	10%	5,820	586	10%
N of Cowpasture Rd	2,916	261	9%	2,566	265	10%	5,482	526	10%
N of Elizabeth Drv	1,833	190	10%	2,827	288	10%	4,660	478	10%
N of The Horsley Drv	3,207	275	9%	2,584	259	10%	5,791	534	9%
S of Great Western Hwy	3,302	245	7%	2,787	245	9%	6,089	490	8%
S of Woodstock Ave	3,965	287	7%	2,961	265	9%	6,926	552	8%
S of Richmond Rd	2,135	188	9%	2,266	217	10%	4,401	405	9%
E of Richmond Rd	2,499	245	10%	3,123	305	10%	5,622	550	10%
W of Sunnyholt Rd	2,995	293	10%	3,538	354	10%	6,533	647	10%
E of Sunnyholt Rd	2,414	253	10%	4,183	422	10%	6,597	675	10%
W of Old Windsor Rd	1,008	118	12%	2,063	230	11%	3,071	348	11%
E of Old Windsor Road	1,270	141	11%	2,533	291	11%	3,803	432	11%

Table 4.15: Traffic Volumes on the WSO, Annual Daily Traffic - 2006

Section of WSO	Northbound/Eastbound			Southbound/Westbound			Combined		
	Total	HV	%	Total	HV	%	Total	HV	%
N of Camden Valley Way	29,628	4,755	16%	31,078	4,680	15%	60,706	9,435	16%
N of Bernera Rd	24,696	4,468	18%	22,127	3,881	18%	46,823	8,349	18%
N of Cowpasture Rd	21,091	4,098	19%	20,773	3,916	19%	41,864	8,014	19%
N of Elizabeth Drv	17,848	3,841	22%	21,018	4,036	19%	38,866	7,877	20%
N of The Horsley Drv	25,197	4,678	19%	23,496	4,454	19%	48,693	9,132	19%
S of Great Western Hwy	26,695	3,739	14%	26,252	4,143	16%	52,947	7,882	15%
S of Woodstock Ave	30,117	4,015	13%	29,747	4,506	15%	59,864	8,521	14%
S of Richmond Rd	12,497	2,171	17%	20,407	3,560	17%	32,904	5,731	17%
E of Richmond Rd	21,458	3,495	16%	20,173	3,245	16%	41,631	6,740	16%
W of Sunnyholt Rd	28,794	4,568	16%	23,534	3,805	16%	52,328	8,373	16%
E of Sunnyholt Rd	28,118	4,442	16%	30,714	4,695	15%	58,832	9,137	16%
W of Old Windsor Rd	8,516	2,079	24%	8,150	2,110	26%	16,666	4,189	25%
E of Old Windsor Rd	11,136	2,530	23%	11,343	3,031	27%	22,479	5,561	25%

Table 4.16: Traffic Volumes on the WSO, Annual Daily Traffic - 2016

Section of WSO	Northbound/Eastbound			Southbound/Westbound			Combined		
	Total	HV	%	Total	HV	%	Total	HV	%
N of Camden Valley Way	35,472	5,550	16%	36,236	5,688	16%	71,708	11,238	16%
N of Bernera Rd	29,671	5,212	18%	27,522	4,861	18%	57,193	10,073	18%
N of Cowpasture Rd	24,089	4,690	19%	23,328	4,676	20%	47,417	9,366	20%
N of Elizabeth Drv	20,401	4,426	22%	23,788	4,842	20%	44,189	9,268	21%
N of The Horsley Drv	27,421	5,249	19%	26,380	5,300	20%	53,801	10,549	20%
S of Great Western Hwy	30,093	4,306	14%	30,205	4,772	16%	60,298	9,078	15%
S of Woodstock Ave	34,109	4,632	14%	34,102	5,176	15%	68,211	9,808	14%
S of Richmond Rd	15,089	2,535	17%	23,585	3,987	17%	38,674	6,522	17%
E of Richmond Rd	25,753	4,083	16%	24,064	3,717	15%	49,817	7,800	16%
W of Sunnyholt Rd	33,600	5,198	15%	27,762	4,318	16%	61,362	9,516	16%
E of Sunnyholt Rd	34,571	5,313	15%	37,436	5,564	15%	72,007	10,877	15%
W of Old Windsor Rd	9,279	2,280	25%	9,271	2,370	26%	18,550	4,650	25%
E of Old Windsor Rd	12,978	2,932	23%	13,198	3,519	27%	26,176	6,451	25%

Table 4.17: WSO Level of Service Analysis Morning Peak Hour 2016

Section of WSO	Northbound/Eastbound		Southbound/Westbound	
	Total	LOS	Total	LOS
N of Camden Valley Way	2,721	D	3,125	E
N of Bernera Rd	2,261	D	2,731	D
N of Cowpasture Rd	2,332	D	2,453	D
N of Elizabeth Drv	2,355	D	2,016	C
N of The Horsley Drv	2,444	D	2,971	D
S of Great Western Hwy	2,278	D	3,061	E
S of Woodstock Ave	2,523	D	3,663	E
S of Richmond Rd	1,346	B	2,737	D
E of Richmond Rd	2,722	D	1,884	C
W of Sunnyholt Rd	3,525	E	2,126	C
E of Sunnyholt Rd	3,660	E	2,462	D
W of Old Windsor Rd	1,763	B	805	A
E of Old Windsor Rd	2,210	C	1,116	A

Table 4.18: WSO Level of Service Analysis Evening Peak Hour 2016

Section of WSO	Northbound/Eastbound		Southbound/Westbound	
	Total	LOS	Total	LOS
N of Camden Valley Way	3,554	E	3,118	E
N of Bernera Rd	3,297	E	2,523	D
N of Cowpasture Rd	2,916	D	2,566	D
N of Elizabeth Drv	1,833	B	2,827	D
N of The Horsley Drv	3,207	E	2,584	D
S of Great Western Hwy	3,302	E	2,787	D
S of Woodstock Ave	3,965	F	2,961	D
S of Richmond Rd	2,135	C	2,266	D
E of Richmond Rd	2,499	D	3,123	E
W of Sunnyholt Rd	2,995	D	3,538	E
E of Sunnyholt Rd	2,414	D	4,183	F
W of Old Windsor Rd	1,008	A	2,063	C
E of Old Windsor Rd	1,270	A	2,533	D

Table 4.19: Toll Diversions Morning Peak Hour 2016

Section of WSO	Northbound/Eastbound				Southbound/Westbound				Combined			
	Toll	No Toll	Toll Div	Toll Div %	Toll	No Toll	Toll Div	Toll Div %	Toll	No Toll	Toll Div	Toll Div %
N of Camden Valley Way	2,721	3,498	-777	-22%	3,125	3,435	-310	-9%	5,846	6,933	-1,087	-16%
N of Bernera Rd	2,261	2,931	-670	-23%	2,731	3,112	-381	-12%	4,992	6,043	-1,051	-17%
N of Cowpasture Rd	2,332	3,073	-741	-24%	2,453	2,934	-481	-16%	4,785	6,007	-1,222	-20%
N of Elizabeth Drv	2,355	2,996	-641	-21%	2,016	2,656	-640	-24%	4,371	5,652	-1,281	-23%
N of The Horsley Drv	2,444	3,143	-699	-22%	2,971	3,113	-142	-5%	5,415	6,256	-841	-13%
S of Great Western Hwy	2,278	2,827	-549	-19%	3,061	3,372	-311	-9%	5,339	6,199	-860	-14%
S of Woodstock Ave	2,523	3,104	-581	-19%	3,663	3,905	-242	-6%	6,186	7,009	-823	-12%
S of Richmond Rd	1,346	1,704	-358	-21%	2,737	3,283	-546	-17%	4,083	4,987	-904	-18%
E of Richmond Rd	2,722	3,155	-433	-14%	1,884	2,232	-348	-16%	4,606	5,387	-781	-14%
W of Sunnyholt Rd	3,525	3,904	-379	-10%	2,126	2,989	-863	-29%	5,651	6,893	-1,242	-18%
E of Sunnyholt Rd	3,660	4,042	-382	-9%	2,462	2,907	-445	-15%	6,122	6,949	-827	-12%
W of Old Windsor Rd	1,763	2,009	-246	-12%	805	963	-158	-16%	2,568	2,972	-404	-14%
E of Old Windsor Rd	2,210	2,504	-294	-12%	1,116	1,262	-146	-12%	3,326	3,766	-440	-12%

Table 4.20: Aggregate Network Performance, Annual - 2016

Parameter	Base	WSO	Change %	
Vehicle Kilometres of Travel (millions)	28,789	28,848	59	0.21%
Freeway	4,396	4,460	64	1.46%
Tollway	1,326	2,135	809	61.01%
Tollway/Freeway Ramp	302	339	37	12.25%
Highway	7,290	7,140	-150	-2.06%
Arterial	7,707	7,227	-480	-6.23%
Sub-Arterial	6,849	6,636	-213	-3.11%
Other	919	911	-8	-0.83%
Vehicle Hours of Travel (millions)	962	932	-30	-3.15%
Average Speed (km/hr)	29.92	30.95	1.04	3.46%

Table 4.21: Comparison of Heavy Vehicle Traffic Distribution at Selected Entry Points - Morning Peak, 2016

Station	Direction	Base Network				WSO Network			
		North	South	Sydney Balance	West	North	South	Sydney Balance	West
Destination of Inbound Traffic									
Pennant Hills Rd	SB	1%	7%	15%	78%	1%	7%	14%	78%
Hume Hwy	NB	4%	3%	34%	59%	1%	1%	92%	6%
Total		1%	6%	18%	75%	1%	7%	16%	76%
Origin of Outbound Traffic									
Pennant Hills Rd	NB	1%	5%	14%	81%	1%	5%	14%	80%
Hume Hwy	SB	0%	13%	12%	75%	0%	17%	10%	73%
Total		0%	8%	13%	78%	0%	9%	13%	78%

Table 4.22: Travel Times and Savings, Morning Peak Hour 2016 (minutes)

From	To	Via	Base Travel Time Saving	WSO Travel Time Saving	Saving
Prestons	West Pennant Hills	Cumberland Highway	105	95	10
		WSO	na	38	67

5. Relationship with Previous Modelling

5.1 General

The traffic estimates presented in this report vary from the forecasts presented in the EIS's Working Paper 2. This reflects a number of different input assumptions and revised and updated base information. There have also been developments in the modelling software that seek to better reflect traffic behaviour. This section examines the differences.

5.2 Comparison with EIS Modelling

Forecasts for traffic demand on the proposed WSO in the morning peak hour in 2016 are compared in Table 5.1. In the northbound and eastbound direction (clockwise) there are differences of up to 46 per cent in the traffic volumes between the EIS and current forecasts. A number of sections are forecast to have broadly similar levels of traffic and, indeed, the EIS indicates that the section south of Richmond Road would carry more vehicles than the MWT review volumes.

The southbound and westbound directions (counter-clockwise) have very large differences with the MWT review volumes up to two and a half times higher than the EIS forecasts. On many sections of the proposed WSO the predicted peak direction of travel reverses as a result of these differences.

5.3 Sources of Differences

Traffic modelling forecasts largely reflect input assumptions and input data. There are a number of substantial differences between the EIS and MWT review forecast inputs. These can be broadly classified as:

- Year of analysis;
- Landuse;
- Network assumptions;
- Improved modelling software.

Each of these is discussed below.

5.3.1 Year of Analysis

The modelling work for the EIS was undertaken over a period of several years reflecting change in circumstances, including strategic landuse planning directions, such as the proposed location and need for a second major airport to serve Sydney. The initial landuse modelling work was undertaken in 1995 and produced trip tables referred to in the EIS Working Paper as S010 (March 1995). It is understood that the traffic modelling was updated and re-calibrated to reflect traffic patterns in 1997.

This means that the landuse forecasts were prepared using data available from the 1991 Census. This would not be expected to capture new development patterns found in a number of areas served by the WSO's corridor, which have experienced rapid growth

since the early 1990s, as accurately as data prepared using the 1996 Census and reviewed with analysis of trends since that time. For example, at the time of the 1991 Census the major release area of the Norwest Sector (Blacktown/Baulkham Hills) was only starting at a detailed planning stage, with limited amounts of new occupation. By the 1996 Census occupation of the release area had commenced. Similarly, employment areas such as Huntingwood were still filling up, whilst Glendenning was largely un-developed in 1991. By the 1996 Census, Huntingwood was nearing capacity and Glendenning had more, and a greater range of, employers present. The same general situation applies to Norwest Business Park.

This meant that future forecasts using the 1996 Census information at least had real data of how population and employment changes in these two growth areas would influence future trends. Hence this forecasting has substantial advantages over work based on 1991 Census information.

The implications of this difference in analysis years also affect the journey to work travel patterns, which are an important element when converting landuse to travel. This information is collected by the Census.

The 1997 traffic counts used in the re-calibration of the network model for the EIS Working Paper may have embodied some of this information. However, the use of more recent counts still (2000 and 2001) would be expected to have an even more beneficial effect on the veracity of the modelling.

5.3.2 Landuse Comparison

A comparison of the landuse scenarios S010 and 99V1_1 is presented in Table 5.2. Overall the differences appear relatively minor, the more recent forecasts have 1.7 per cent more population and 1.3 per cent more employment in the Sydney region. However, the distribution of population and employment is a more substantial difference – the S010 forecasts were predicated on more growth occurring in peripheral areas, such as Gosford/Wyong, Blue Mountains and External areas. Drawing this growth back inside the Hawkesbury/Nepean Rivers (as is shown in 99V1_1) makes for a more substantial difference in overall levels of development within this part of Sydney.

Within the rivers, the distribution of population and employment is also different for the two scenarios. The EIS process called for consultation with local authorities within the WSO's corridor to establish what their projections were for population and employment growth. This is a sensible step to take in the preparation of landuse forecasts for any traffic modelling project of the nature of the WSO. It is usual for these forecasts at local government level to be optimistic, and indeed, if all local government forecasts were aggregated for the Sydney region they would be likely to exceed the DUAP forecasts by a large margin.

This higher level of population and employment along the WSO corridor would be expected to result in a greater degree of trip containment and less traffic on the proposed WSO. The more recent projections have substantially more development located in the Central Western DUAP Region (comprising Auburn, Holroyd and Parramatta). This area is near the WSO's corridor and would be expected to provide employment for some of the

population growth areas on the 'other' side of the WSO. This would lead to additional use of the WSO.

5.3.3 Network Assumptions

The networks that were modelled in the EIS and by MWT had the following key differences:

- M5 Motorway and Moorebank Avenue were not grade separated in the EIS network;
- M5 was not widened north of the Crossroads in the EIS network;
- Extension of the M2/WSO from Richmond Road to Stoney Creek Road (two-lanes) was in the EIS network but not MWT's; and
- WSO interchanges were slightly different in several locations.

MWT anticipate that the first two road upgrades are likely to be implemented by 2016. This is the consultant's view and does not represent a commitment by the RTA. The effect of these two improvements is to improve access to and from the proposed WSO and therefore to increase use of the facility.

The third upgrade is unlikely to be constructed by 2016. This has implications for the balance of traffic using the M4/Great Western Highway corridor and Rooty Hill Road North/Richmond Road corridor.

Different interchange configurations, for example at Woodstock Avenue and Power Street, have had some effect on the use of the facility. The arrangement in the EIS had a diamond interchange at Power Street, which results in a concentration of traffic on Power Street. This configuration would act to increase access times to the motorway and hence discourage the use of the facility.

The configuration modelled by MWT has south facing ramps at Woodstock Avenue and north facing ramps at Power Street. This disperses the access activity and would result in lower access times. The modelling indicates very heavy flows of traffic access the WSO at Woodstock Avenue from areas west of Rooty Hill Road North, such as Mount Druitt and Hebersham. Access from this direction via Woodstock Avenue is far superior than via Power Street: Woodstock Avenue feeds directly from the west, via traffic signals and divided carriageway, to the proposed interchange with the WSO; Power Street would require access to Rooty Hill Road North and then right hand turns onto Power Street, to then encounter the concentration of traffic associated with the single diamond interchange.

5.3.4 Improved Modelling Software

The Netanal modelling software package undergoes revisions and improvements in response to developments in general practice and user requirements. Key changes between the EIS and MWT review software versions are:

- The pcu equivalence factor was adjusted from an integer value of 3 to a real value of 2.5. This better reflects the impacts of heavy vehicles on the general performance of the road network, and has been partly brought about by improved computer hardware capacity to deal with the greater computational requirements of reals rather than integers. The implication of this for forecasts of traffic on a

facility, apart from better reflecting conditions, is that the assignment process can fit more traffic within the same road configuration.

- Explicit modelling of distance-based tolls. All tolls in Sydney currently operate as discrete charges levied at toll plazas. The tolls are based on passing a particular point and do not relate to the distance travelled on a particular facility. Netanal had evolved to reflect this situation. The proposed WSO's tolling regime is distance-based, with no toll plaza(s). The newer release of software used by MWT is apparently better able to reflect this situation.

5.4 Effect of Differences in Methodology and Data on EIS Forecasts

A detailed analysis of the effect of each of the above differences on the forecasts has not been undertaken. However, in order to illustrate the ramifications of the EIS approach on forecasts, a limited comparison was made between EIS forecasts for 2006 and traffic levels in 2000 and 2001. This approach is limited in that only locations for which the EIS reported forecasts happen to have an RTA station with available data (or from other sources of existing data) can be compared.

The comparison is presented in Table 5.3. Bearing in mind the limitations of the comparison, it does indicate that a large number of sites have traffic volumes in 2001 in excess of the EIS's projections for 2006.

Table 5.1: Comparison of Forecasts for WSO - 2016 Morning Peak Period

Section of WSO	Northbound/Eastbound			Southbound/Westbound		
	MWT	EIS	MWT Diff	MWT	EIS	MWT Diff
N of Camden Valley Way	2,721	2,079	31%	3,125	989	216%
N of Bernera Rd	2,261	1,799	26%	2,731	888	208%
N of Cowpasture Rd	2,332	1,932	21%	2,453	706	247%
N of Elizabeth Drv	2,355	1,844	28%	2,016	635	217%
N of The Horsley Drv	2,444	2,267	8%	2,971	1,700	75%
S of Great Western Hwy	2,278	1,640	39%	3,061	1,430	114%
S of Woodstock Ave	2,523	1,731	46%	3,663	1,802	103%
S of Richmond Rd	1,346	1,514	-11%	2,737	1,598	71%
E of Richmond Rd	2,722	2,222	23%	1,884	1,058	78%
W of Sunnyholt Rd	3,525	2,707	30%	2,126	1,111	91%
E of Sunnyholt Rd	3,660	2,724	34%	2,462	873	182%
W of Old Windsor Rd	1,763	1,641	7%	805	447	80%
E of Old Windsor Rd	2,210	1,959	13%	1,116	631	77%

Source – EIS forecasts from WSO EIS Workign Paper No 2 – October 2000

Table 5.2: Comparison of S010 and 1999V1_1 Landuse Scenarios - 2006

DUAP Region	Difference (1999V1_1 less S010)			
	Population		Employment	
	#	%	#	%
Inner Sydney	9970	3.3%	2544	0.5%
Lower Northern	25266	9.1%	6570	3.2%
Eastern Suburbs	8843	4.9%	1326	2.6%
Inner Western	13511	8.7%	-191	-0.3%
Canterbury-Bankstown	19866	6.5%	183	0.2%
St George-Sutherland	20272	4.7%	2943	2.4%
Central Western	26605	9.2%	11247	6.2%
Fairfield-Liverpool	-2110	-0.6%	2677	2.2%
Outer South Western	-9471	-4.4%	-1142	-2.0%
Outer Western	3015	1.2%	2742	3.4%
Blacktown-Baulkham Hills	-6426	-1.5%	505	0.4%
Hornsby-Ku-ring-gai	-312	-0.1%	-315	-0.4%
Manly-Warringah	-934	-0.4%	-665	-0.8%
Gosford / Wyong	-15837	-9.3%	525	1.0%
Blue Mountains	-9511	-10.8%	-1398	-6.3%
External	-10912	-4.6%	-2582	-3.6%
Grand Total	71835	1.7%	24969	1.3%

Table 5.3: Comparison of EIS Forecasts, morning peak hour 2006 with 2001 counts

Road		Location	NB/EB 2001 RTA	NB/EB 2006 SKM	NB/EB Difference	SB/WB 2001 RTA	SB/WB 2006 SKM	SB/WB Difference
Abbott Rd	west	Old Windsor Rd	2,346	1,841	00 or 01>06	-505	1,755	00 or 01>06
Blacktown Rd	south	Wall Park Ave	1,746	1,033	00 or 01>06	-713	1,321	00 or 01>06
Carlisle Av	north	GWH	1,395	1,340	00 or 01>06	-55	1,207	
Cumberland Hwy	at	Kenyons Bridge	2,689	3,712		1,023	-	
	north	GWH	1,402	1,861		459	1,693	
	west	Old Windsor Rd	380	1,370		990	1,450	
Davis Rd	north	Richmond Rd	450	171	00 or 01>06	-279	511	
Francis Rd	west	Rooty Hill Road Sth	1,096	1,241		145	1,052	00 or 01>06
Great Western Hwy	east	Cumberland Hwy	2,042	3,728		1,686	723	
James Cook Drv	east	Sunnyholt Rd	616	191	00 or 01>06	-425	599	
Knox Rd	north	Eastern Rd	956	622	00 or 01>06	-334	1,370	00 or 01>06
Lalor Rd (Quakers Hill Pkwy)	west	Sunnyholt Rd	1,406	1,002	00 or 01>06	-404	618	
Lytton St	south	Richmond Rd	491	122	00 or 01>06	-369	452	00 or 01>06
M2 (Abbot Rd Ramps)	east	Old Windsor Rd	2,701	2,557	00 or 01>06	-144	1,542	
Norwest Blvd	east	Old Windsor Rd	1,299	-	00 or 01>06	-1,299	448	00 or 01>06
Old Northern Rd	north	Windsor Rd	891	88	00 or 01>06	-803	1,005	00 or 01>06
Old Windsor Rd	north	Cumberland Hwy	3,364	1,530	00 or 01>06	-1,834	3,753	00 or 01>06
	south	M2 & Abbott Rd	1,909	1,022	00 or 01>06	-887	2,608	
		Norwest Blvd	1,103	905	00 or 01>06	-198	2,258	
		Seven Hills Rd	876	870	00 or 01>06	-6	2,314	
		Sunnyholt Rd	589	730		141	1,170	
		Windsor Rd	484	1,070		586	673	
Pennant Hills Rd	north	Carlingford Rd	1,490	968	00 or 01>06	-522	2,436	
		M2	2,099	2,551		452	3,471	
Quakers Hill Pkwy	east	Hambledon Rd	872	671	00 or 01>06	-201	962	00 or 01>06
Richmond Rd	east	Knox Rd	697	1,262		565	712	
		Rooty Hill Road Nth	1,238	1,619		381	1,136	00 or 01>06
Rooty Hill Rd Nth	north	Luxford Rd	804	1,190		386	1,099	00 or 01>06
Sackville Rd	east	Sunnyholt Rd	536	231	00 or 01>06	-305	550	00 or 01>06

Road		Location	NB/EB 2001 RTA	NB/EB 2006 SKM	NB/EB Difference	NB/EB 2001 RTA	NB/EB 2006 SKM	SB/WB 2001 RTA	SB/WB 2006 SKM	SB/WB Difference
Seven Hills Rd	east	Old Windsor Rd	606	786		180	1,013	1,043		30
	west	Old Windsor Rd	901	1,395		494	861	921		60
Sunnyholt Rd	north	Lalor Rd (Quakers Hill Pkwy)	1,902	1,552	00 or 01>06	-350	1,200	1,603		403
		Sackville Rd	1,771	650	00 or 01>06	-1,121	1,671	1,452	00 or 01>06	-219
		Third Ave	1,974	881	00 or 01>06	-1,093	1,956	1,921	00 or 01>06	-35
		Turner St	1,061	814	00 or 01>06	-247	1,752	1,548	00 or 01>06	-204
		Vardys Rd	1,287	948	00 or 01>06	-339	1,758	2,078		320
Vardys Rd	east	Sunnyholt Rd	800	717	00 or 01>06	-83	827	87	00 or 01>06	-740
Wallgrove Rd	north	The Horsley Drv	1,128	1,403		275	1,440	1,257	00 or 01>06	-183
Windsor Rd	south	M2	1,689	896	00 or 01>06	-793	3,487	2,316	00 or 01>06	-1,171
Summary			51,086	45,540	25 66%	-5,546	54,853	64,296	18 47%	9,443

6. The Role of Proposed WSO: Implications of Analysis

The transport functions provided by the proposed facility would be to:

- Support access movements of freight and people into and out of Sydney;
- Support movement of freight and people through Sydney;
- Support movement of people and freight within Sydney.

Connecting to the Hume Highway at Casula, the proposed WSO would provide a significantly improved access function to Sydney for interstate corridors of Victoria-Sydney/Newcastle via the Hume Highway and F3 Freeway; and ACT – Sydney/Newcastle via the Federal Highway/Hume Highway and F3 Freeway.

Looking to the north, the proposal would improve access conditions into Western Sydney for the corridors of Queensland – Sydney and Newcastle – Sydney.

The improved access function provided by the proposal has two important facets. Firstly, it provides a direct link of high standard, with safety, travel time and environmental benefits. Secondly, it would result in transfer of traffic off alternative routes that would facilitate movement on those links by vehicles that do not choose to use the proposed WSO and some traffic, which in the absence of the WSO, would use lower order roads.

Movements through Sydney are relatively small in number. However, the proposed facility would provide a route far superior to the existing National Highway link through Sydney, the Cumberland Highway and Pennant Hills Road. It would provide a safe and efficient link for interstate and inter-regional movements and would reduce conflicts between segments of heavy vehicle movement. These conflicts currently manifest themselves in the form of fifty-three sets of traffic signals between the Hume Highway at Camden Valley Way and Pennant Hills Road at the M2 Motorway.

A large part of the function of the proposed WSO, as is currently the case with the Cumberland Highway, is to support movements within Sydney. The proposed WSO would do this in a more efficient and a safer manner than the existing route. It would provide high standard, direct links to support corridors that are currently served by low standard and indirect routes.

Between the Hume Highway and key industrial areas of Rooty Hill (with its steel mini-mill), Glendenning, Huntingwood, Hoxton Park, Wetherill Park and Arndell Park there is currently no direct link. Rather, vehicles must negotiate routes of varying standard, with numerous at-grade intersections and which run past sensitive landuses. The proposed WSO would provide a high standard transport spine through these areas, with well-place interchanges to connect into these important freight-generating employment areas.

Around the north of Blacktown there is currently no direct east-west link. Rather a series of radial roads (Richmond Road, Sunnyholt and Old Windsor Road) are connected by an irregular and circuitous series of cross routes. The proposed WSO would provide a direct link across the north of Blacktown, connecting the key roads (Richmond Road, Quakers Hill Parkway, Sunnyholt Road and Old Windsor Road) to support a range of longer

distance movements. This would provide for an improved access/circulation function for shorter distance traffic on the surface road system – they would no longer need to compete with longer distance traffic segments (who would use the WSO).

Forming part of, and in conjunction with, the emerging Sydney Orbital, the proposed WSO would provide high levels of access between the rapidly growing Western Sydney region and key elements of national infrastructure. The movement of people and freight to and from Sydney's Airport would be improved. Similarly, access to Port Botany would be improved for freight. These improvements are directly related to the interstate and international movement of people and goods.

This type of function aligns directly with the first objective of the National Highway Program, which is:

"To facilitate trade and commerce between the States and Territories by the provision of a network of connecting roads, known as National Highways, which link major centres of economic activity."

(refer to page 1.1 of the WSO EIS)

Indeed, in terms of the volume of interstate movement of people and the commerce that it represents, the air corridors carry far more passengers than the road corridors (as would be expected with Australia's geography) – hence improving access to Sydney Airport from Western Sydney would better achieve this objective for person travel than, for example, further upgrading the Hume Highway. The benefits of such improved access to the Airport would accrue nationally and not be restricted to Sydney or New South Wales.

In terms of assessing the proposal in planning terms the key question should be:

"Would the proposed WSO provide its functions better than the alternative?"

The alternative to the WSO for access to Sydney and through-Sydney movement is the Cumberland Highway. The comparative performance can be considered in the following areas:

- Travel times and costs – accessibility and efficiency
- Road safety
- Environmental amenity – better air quality performance and mitigation of noise

Clearly, a modern, high standard access controlled motorway would better provide these functions than a surface arterial, which has sections of steep grade, fifty-three sets of traffic signals and substantial amounts of direct property access. The traffic modelling allows comparison of the effect of the proposal on a network-wide basis and demonstrates the substantial benefits of the proposal over the Do Nothing case.

7. Conclusions

Traffic Effects of the Proposal

The effect of the WSO is to provide traffic relief for roads along the corridor and to attract a substantial number of longer distance heavy vehicle trips. Areas of particular interest are:

- A number of roads are projected to experience considerable falls in traffic volumes in 2016. However, many of these would still be functioning as arterial roads.
- Rooty Hills Road South would experience a decline in function from arterial to collector, while Doonside Road would decline in function (based on daily volumes) from arterial to sub-arterial.
- Woodstock Avenue is projected experience a large increase in traffic volumes that see it function as an arterial road rather than a collector road.
- The need for the Prospect Arterial to provide a through route function from Cowpasture Road across the M4 and then along the Prospect Highway to Abbott Road may be diminished by the introduction of the WSO. The use of this route should be considered in further detail and there may be scope to reduce investment in the Prospect Arterial directly as a result of the proposed WSO.
- Norwest Boulevard is a heavily used road with the introduction of the proposed WSO. This is largely as a result of the concentration of traffic accessing the very large traffic zone centred on the Norwest Business Park, onto the link between the WSO and the Business Park. Whilst the model indicates it provides relief for Windsor Road and Sunnyholt Road, it is likely to place very substantial pressure on the intersection of Old Windsor Road and Norwest Boulevard.
- The proposed WSO is projected to carry substantial volumes of traffic, to varying degree along its alignment. The sections between the Great Western Highway and Woodstock Avenue and between Norwest Boulevard and Sunnyholt Road are expected to carry high volumes with heavy use of their interchanges. These should be checked to ensure that the proposed road elements would safely accommodate the projected levels of traffic.
- The use of the proposed WSO is expected to be higher in the evening peak hour than the morning. One section (Sunnyholt Road and Norwest Boulevard) is projected to carry in excess of 4,100 vehicles per hour, suggesting there may be some queuing.
- Toll diversions vary along the length of the proposed WSO. Clearly, the toll keeps volumes on the WSO down and would act to improve the efficiency of the route. There may be a need to adjust the toll structure to include a small flag fall element to discourage short distance trips.

- The amount of vehicle travel (VKT) is projected to rise marginally as a result of the WSO. Indeed, the projected increase is modest when one considers the scale of the proposal. The proposed WSO would directly support many journeys that, in the base, would need to take circuitous routes. As such the proposal would actually reduce the amount of vehicle travel for some origin destination combinations.
- This analysis indicates that the WSO would indeed provide a traffic function that aligns with a project need – *to provide a national highway link through Sydney*. From a freight perspective the WSO provides an efficient link for the longer distance movement of freight through Sydney, as well as reducing the conflicts between access requirements of heavy vehicles that currently use the Cumberland Highway and longer distance movements. The modelling indicates there would be transfer of a proportion of this heavy vehicle movement to the WSO.

Comparison with Previous Modelling

The traffic volumes estimated in this report for use of the proposed WSO are substantially higher in this report than in the EIS. The differences are due to:

- The more contemporary nature of the analysis, with additional and more up-to-date information built into the modelling process.
- Landuse forecasts that better reflect likely development and feed through to different traffic distributions within Sydney.
- Network assumptions that better reflect likely outcomes in road development in Sydney, and indeed, better access arrangements to the facility. The proposed WSO has a slightly different interchange arrangement.
- Improved modelling software that better reflects the effect of heavy vehicles on the road network and distance-based tolling.

Most of the differences are due to modelling being undertaken in 2001 as compared with previous traffic modelling undertaken four years ago and landuse forecasts prepared six years ago.

A limited comparison between EIS forecasts for 2006 and traffic counts for 2000/2001 suggests that traffic growth in Western Sydney has out-stripped EIS forecasts.

Function of the Proposal

The proposed WSO would provide numerous transport functions. Its stated objective of providing the National Highway link through Sydney has two components:

- Access into and out of Sydney for longer distance movements;
- Through-Sydney movements.

It would provide a far superior link for these two functions than the alternative provided by the Cumberland Highway. As with the Cumberland Highway, the WSO would predominantly support movements that are within Sydney. It would support these movements in a far more efficient and safer manner than the existing road network. This is due to its high standard and well-placed interchanges.

A number of these apparently within-Sydney movements are actually interstate or international in nature, as they are access trips to and from Sydney Airport.

The proposal would also complete a number of missing links in the Western Sydney Road network. This would facilitate direct travel for many journeys that must currently negotiate circuitous routes.

Appendix A - Survey Specification

FREIGHT MOVEMENTS IN WESTERN SYDNEY

SURVEY SPECIFICATION – 001338s02.doc

It is proposed to undertake a postcard survey to identify freight movement patterns in western Sydney. This specification describes the survey requirements.

Postcard Distribution Locations

Postcards will be distributed to heavy vehicles stopped at traffic signals in western Sydney. The following movements are to be sampled:

Core Stations

Road	Intersection with	Direction	Movement
Hume Hwy	Camden Valley Rd	NB	RHT
Hume Hwy	Camden Valley Rd	NB	LHT
Hume Hwy	Campbelltown Rd	SB	LHT
Hume Hwy	Campbelltown Rd	SB	Thru
Pennant Hills Road	F3	NB	RHT
Pacific Hwy	Ada Ave	NB	Thru
F3	Pennant Hills Rd	SB	LHT
Pacific Hwy	Ada Ave	SB	Thru

The above Core Stations will provide data on:

- movements of heavy vehicles through Sydney;
- movements of heavy vehicles from the study corridor (and some other parts of western Sydney) to the north and south of Sydney.

Corridor Stations

Road	Intersection with	Direction	Movement
Mamre Rd	Bakers Lane	NB	Thru
Mamre Rd	Bakers Lane	SB	Thru
Wallgrove Rd	Australia's Wonderland access	NB	Thru
Wallgrove Rd	Australia's Wonderland access	SB	Thru
Rooty Hill Rd	Evans Rd	NB	Thru
Rooty Hill Rd	Evans Rd	SB	Thru
Prospect Hwy	Lucas Rd	NB	Thru
Prospect Hwy	Lucas Rd	SB	Thru
Cumberland Hwy	Brennan St	NB	Thru
Cumberland Hwy	Brennan St	SB	Thru
Cumberland Hwy	Old Prospect Rd	NB	Thru
Cumberland Hwy	Old Prospect Rd	SB	Thru

The above Corridor Stations will provide information on the movement of heavy vehicles through and around the study area.

Option Stations

Road	Intersection with	Direction	Movement
M5	Moorebank Ave	EB	LHT – if signalised
M5	Moorebank Ave	EB	Thru
M5	Moorebank Ave	WB	Thru
M5	Moorebank Ave	WB	RHT from Moorebank Ave north
M5	Moorebank Ave	WB	LHT from Moorebank Ave south

The above Option Stations will increase the coverage of heavy vehicle movements between the south western approach to Sydney and the balance of the Sydney's main freight generators. This data may assist to identify the relative 'catchments' of this approach to Sydney.

Sample

It is proposed that postcards would be distributed to all heavy vehicles (i.e., goods carrying vehicles over 5 tonnes – not courier or trades vans) stopped at the signals for the relevant movement.

The classifications would be consistent with the TDC's current standard, although this may be aggregated to:

- B-Doubles

-
- Articulated
 - Rigid

The survey firm should allow for 5 classifications.

Survey Control

A manual count of each of the sampled movements would be undertaken. The count would be classified according to the classification system used on the postcards. Non-sampled vehicles, such as cars, motorbikes, etc; would not be counted.

The control counts would be to 15 minute totals. This data is to be provided to MWT in electronic format (by e-mail and on diskette/CD-Rom). The field sheets should be retained to enable checking in the event of an anomaly.

A record will be required of when individual postcards are distributed and to which movement. This will be to 15 minute periods. This will require sufficient extra survey forms to be available to allow consecutively numbered postcards to be distributed to each movement. A field inventory sheet will be required for each survey station (possibly one inventory sheet for each direction/approach at some stations) – the sheet should identify the station location, the movement(s) surveyed, the serial numbers of postcards distributed for each movement by 15 minute period. This information should be provided electronically to MWT and the field sheets should be retained to enable checking in the event of an anomaly.

It is proposed to undertake the survey at all stations on the same day.

Hours of Survey

The survey would be undertaken during the hours of daylight, which currently are from approximately 6.30 am to 5.30 pm.

Ideally the survey day should be dry – prior to final confirmation of the day the survey firm and MWT should discuss the weather forecasts. There may be a need to delay the survey should poor weather eventuate.

Questionnaire

The questionnaire is attached at the back of this specification.

The postcards will require an unique serial number which will be punched into the database along with the data.

Postcards are to be self completion mail back to a free post address. The survey firm would be responsible for the printing of the questionnaires, the provision of a freepost address and the collection of postcards from the freepost box.

Ideally the questionnaire would take the form of a small card to post office approved size, with questions on one side and return address on the other (i.e., to avoid separate envelopes or the need for the respondent to paste the questionnaire together, etc;).

Data Coding

The postcards will need to be punched into an electronic format by the survey firm, with some error checking. An electronic database is to be provided to MWT - with preliminary databases to be e-mailed at the close of each working day when data entry has occurred.

A final complete database will be required on floppy disk/CD-Rom to meet our record keeping requirements.

MWT will undertake the cleaning, coding and logic testing of the database, prior to analysis and reporting.

Occupational Health and Safety

It is the responsibility of the survey firm to prepare and have approved a relevant occupational health and safety plan for the survey, covering each of the survey locations. Surveyors should wear appropriate clothing and be instructed in the conduct of the survey, and appropriate safety procedures. It is the responsibility of the survey firm to ensure that this is complied with.

The RTA is studying truck movements in and through the Sydney area to assess how many trucks would use the proposed Western Sydney Orbital Motorway. Please take a few minutes to complete the following questions about the journey you were making when you received this card. When completed, please post back as soon as possible. No stamp or envelope is needed. Your response is anonymous and untraceable.

Q1. Where were you travelling FROM (your origin) when you received this card?

- a. Street name
- b. Suburb/Town
- c. Postcode (if known).....

Q2. What did you do at that location? (please circle response)

- a. Picked up goods
- b. Delivered goods
- c. Picked up and delivered goods
- d. Other

Q3. Where were you travelling TO (your destination) when you received this card?

- a. Street name
- b. Suburb/Town
- c. Postcode (if known).....

Q4. What did you do at that location? (please circle response)

- a. Picked up goods
- b. Delivered goods
- c. Picked up and delivered goods
- d. Other

Q5. What type of vehicle were you driving when you received this card?

(please circle response)

- a. Rigid truck - no trailer
- b. Rigid truck - with trailer
- c. Articulated truck
- d. Large combination vehicle (B-Double, etc;)
- e. Other

Q6. How many axles on that vehicle (including trailers)?

Q7. Was your vehicle... (please circle response)

- a. Fully loaded
- b. Partly loaded
- c. Empty

Q8. If carrying a load, please indicate the type of goods being carried (please circle more than one if appropriate)

- a. Food & live animals
- b. Beverages & tobacco
- c. Crude material, inedible (not fuels)
- d. Fuels, lubricants & related materials
- e. Chemical & related products
- f. Manufactured goods
- g. Machinery & transport equipment
- h. Mail & other packets not classified by commodity

SN:XXXXXXX

Appendix B - Fieldwork Report

Survey Conditions

Weather conditions on the day were good with sun and little or no cloud for most of the day. No rain was reported during the course of the survey.

Distribution of Postcards

Distribution of postcards by station is summarised in the following table.

Table B1: Distribution of Postcards by Survey Site by Direction by Hour

Sum of Num_Cards		Agg_Hr													
Station	Dir	6	7	8	9	10	11	12	13	14	15	16	17	Total	
Cumberland Hwy	NB	19	31	35	30	70	55	75	35	35	45	47	33	510	
	SB		2	1	1	1		1	2	4	3	4	2	21	
Cumberland Hwy OPR	NB	22	74	48	57	69	79	41	75	103	51	62	56	737	
	SB	13	60	70	50	42	38	37	59	37	49	28	24	507	
Hume Hwy	NB	10	57	79	89	38	54	63	57	56	43	54	26	626	
	SB	20	43	36	35	60	70	63	73	73	43	27	15	558	
M5	EB	9	25	19	37	40	31	23	30	19	16	4	8	261	
	WB	7	16	20	27	31	40	40	47	27	18	29	10	312	
Mamre Rd	NB		5	9	5	3	3	2	3	2	9	6	3	50	
	SB		3	12	5	2	4	2	2	9	6		4	49	
Moorebank Ave	WB	1	16	23	23	5	41	25	34	39	13	14	15	249	
Pacific Hwy	NB	2	5	4	10	7	8	2	6	4	3	6	3	60	
	SB	3	6	6	5	5	7	2	6	5	8	5	2	60	
Pennant Hills Rd	NB	1	19	19	31	30	30	22	25	22	20	32	8	259	
	SB	15	23	20	22	21	21	19	29	51	23	31	16	291	
Prospect Hwy	NB	1	5	19	15	13	14	15	12	7	22	18	15	156	
	SB	3	11	6	1	14	13	2	4	6	3	7	6	76	
Rooty Hill Rd	NB	4	9	16	23	8	11	22	10	9	7	10	2	131	
	SB	3	4	18	16	5	5	3	4	8	7	10	3	86	
Wallgrove Rd	NB	3	15	23	18	18	15	8	15	22	21	13	5	176	
	SB			6	21	23	11	8	11	10	13	5	6	114	
Total		136	429	489	521	505	550	475	539	548	423	412	262	5289	

*Note: Cumberland Hwy OPR – is Cumberland Highway station at Old Prospect Road;
Hours starting 0600 hrs and 1700 hrs contain only half an hour of distribution.*

Variations from Survey Specification

Changes from the survey specification were:

- Pennant Hills Road site was re-located to the intersection with The Comenarra Parkway after review of traffic signal timings, prior to the survey day;
- Pacific Highway station at Ada Avenue moved south to Bobbin Head Road and Beechworth Road intersection at 11.00 am;
- Mamre Road and Prospect Highway stations surveyed on Friday 10 August 2001;
- Left hand turn movement from Moorebank Avenue south to M5 westbound not surveyed.

Appendix C - Data Processing Report

Process

The raw database received from the survey firm was processed using the following steps:

- Attachment of survey control information (survey station, direction and time of distribution);
- Address cleaning;
- Zonal information;
- Additional information (SLAs, aggregations of vehicle type, commodity type, time of postcard distribution, etc.);
- Validity tests;
- Minimum data content test;
- Logic test; and
- Expansion.

Survey Control Information

Information relating the returned postcards to their point, direction and time of distribution was received from the survey firm and attached to the relevant records in the survey database. Table C.1 summarises this information for the returned records.

Address Cleaning

Records were reviewed for correct spelling of street names and suburbs. Where street names were omitted from the postcard, then this could not be added. When suburb names were not provided but a postcode was provided, then a suburb/locality name was added.

A total of 8 records had indeterminate origin or destination information (some had indeterminate origins and destinations).

Zonal Information

The clean suburb/locality name allowed the attachment of TDC standard 1991 traffic zone numbers to the records. Several records with address information for new suburbs (i.e., those not included in the 1991 zone system's coding) were coded to adjoining suburbs. A number of records were from outside the area covered by the TDC's zonal system for Sydney. These were coded to:

- Northern NSW – NNSW
- Southern NSW – SNSW
- Western NSW – WNSW
- Victoria – VIC

- Western Australia - WA
- Queensland – QLD
- South Australia – SA
- Australian Capital Territory – ACT
- Northern Territory – NT

In addition, SLA information was attached to records within the TDC's zonal system for Sydney, and a reporting zone system was also attached. This coarse system is summarised in the following table.

Table C.2 – Reporting Zone System

SLA	C_Zone
CESSNOCK	North
GOSFORD	North
HORNSBY	North
KU-RING-GAI	North
LAKE MACQUARIE	North
MAITLAND	North
NEWCASTLE (INNER)	North
NEWCASTLE (REMAINDER)	North
NNSW	North
NSW DUMP	North
NT	North
PORT STEPHENS	North
QLD	North
WYONG	North
ACT	South
CAMDEN	South
CAMPBELLTOWN	South
KIAMA	South
SA	South
SHELLHARBOUR	South
SHOALHAVEN	South
SNSW	South
VIC	South
WA	South
WINGECARRIBEE	South
WOLLONDILLY	South
WOLLONGONG	South
ASHFIELD	Sydney_Balance
AUBURN	Sydney_Balance
BANKSTOWN	Sydney_Balance
BOTANY	Sydney_Balance
BURWOOD	Sydney_Balance
CANTERBURY	Sydney_Balance
CONCORD	Sydney_Balance
DRUMMOYNE	Sydney_Balance
HUNTERS HILL	Sydney_Balance
HURSTVILLE	Sydney_Balance
KOGARAH	Sydney_Balance
LANE COVE	Sydney_Balance
LEICHHARDT	Sydney_Balance
MANLY	Sydney_Balance
MARRICKVILLE	Sydney_Balance

SLA	C_Zone
MOSMAN	Sydney_Balance
NORTH SYDNEY	Sydney_Balance
PARRAMATTA	Sydney_Balance
RANDWICK	Sydney_Balance
ROCKDALE	Sydney_Balance
RYDE	Sydney_Balance
SOUTH SYDNEY	Sydney_Balance
STRATHFIELD	Sydney_Balance
SUTHERLAND	Sydney_Balance
SYDNEY (INNER)	Sydney_Balance
SYDNEY (REMAINDER)	Sydney_Balance
WARRINGAH	Sydney_Balance
WAVERLEY	Sydney_Balance
WILLOUGHBY	Sydney_Balance
WOOLLAHRA	Sydney_Balance
BAULKHAM HILLS	West
BLACKTOWN	West
BLUE MOUNTAINS	West
FAIRFIELD	West
HAWKESBURY	West
HOLROYD	West
LIVERPOOL	West
PENRITH	West
WNSW	West

Additional Information

A series of additional fields were attached to each record within the database. These allowed for the following aggregations:

- Time of postcard distribution;
- Vehicle type; and
- Commodity carried.

Time of distribution

This was aggregated to half-hour, one-hour, peak (AM, PM and Business Hours) and half-day (morning and afternoon); and

Vehicle type

The survey coding was converted to the following aggregation:

RTWNT	Rigid_No_Trailer	-	Rigid
RTWT	Rigid_Trailer	-	Rigid
AT	Articulated	-	Artic
LCV	Large_Comb_Veh	-	Artic
OP&E	Other_Plant	-	Rigid

Commodity Carried

A number of records contained multiple types of commodity carried and on some records the respondent wrote on the load by hand. These were coded to appropriate class(es).

Validity Tests

To be accepted records, had to have valid address information and a valid vehicle type.

Table C-3 summarises the distribution of records with invalid origin, destination or vehicle type.

Minimum Data Content Test

To be accepted a record required a valid origin, a valid destination and a valid vehicle type. The records identified in Table C-3 are those that failed this test.

Logic Test

The general overall direction of travel of a vehicle, as determined by their origin and destination information, was compared with the survey station and direction of the postcard when it was distributed. This decision is generally clear-cut, although a number of records had apparent exceptions that were left in the database.

Table C-4 summarises the distribution of records with illogical general overall direction of travel.

Table C-5 summarise the distribution of accepted records.

Expansion

The approach to expansion was to take the sites' valid records and expand them to represent the control count of records through the particular site. Various time periods were tested. The time period selected for expansion was half day (i.e., morning - 6:30 am to 11:59 am; afternoon - 12:00 noon to 5:30 pm).

Database Summary

A frequency count of the responses to each question is reported in Table C-6.

Table C-1: Postcard Returns by Station by Direction by Hour

Count of Hour		Hour													
Station	Direction	6	7	8	9	10	11	12	13	14	15	16	17	Grand Total	
Cumberland Hwy	NB	2	13	5	6	14	3							43	
	SB					1					1	1			
Cumberland Hwy OPR	NB	6	10	10	18	7	9	8	9	1			27	105	
	SB	2	11	10	4	3	9	1	6	10	5	6	2		
Hume Hwy	NB	1	11	8	12	6	6	5	5	6	5	10		75	
	SB	4	2	10	9	12	10	6	9	9	6	6	2		
M5	EB	3	4	4	8	2	2	2	4	3			6	38	
	WB	4	3	6	2	9	12	9	8	6	4	4	2		
Mamre Rd	NB			2							1		1	4	
	SB			4							2				
Moorebank Ave	WB		4	1	1	3	7	4	5	3	3		2	33	
Pacific Hwy	NB			1	1	2	1	1	2	1	2	1		12	
	SB	1	1	1		1	1		1	1	2	1	2		
Pennant Hills Rd	NB	1	3	4	7	3	7	1	1		1	4		32	
	SB		4	2	2	4	2	2	5	4	1	4			
Prospect Hwy	NB	1	1	4		2	4	2	1		7	3	2	27	
	SB	1	1			3	4				3				
Rooty Hill Rd	NB	1		6	2	1	2	2	2	1	2	4		23	
	SB	2	2	3	3				1		2	2			
Wallgrove Rd	NB	2	3	4	2	1	3	1	1		6	4		27	
	SB			2	2	1	1	1			3	3			
Grand Total		31	73	87	79	75	83	45	60	45	56	53	46	733	

Table C-3: Records with Invalid Origin, Destination or Vehicle Type

Sum of Valid_OD_Veh_Dir		Hour												
Station	Direction	6	7	8	9	10	11	12	13	14	15	16	17	Grand Total
Cumberland Hwy	NB	0	0	1	0	1	0	0	0	0	0	0	0	2
	SB	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumberland Hwy OPR	NB	0	0	0	0	0	0	0	0	0	0	0	1	1
	SB	0	0	0	0	0	0	0	0	0	0	0	0	0
Hume Hwy	NB	0	0	0	0	0	0	0	0	0	1	0	0	1
	SB	0	0	0	0	0	0	1	0	0	0	0	0	1
M5	EB	0	1	0	0	0	0	0	1	0	0	0	0	2
	WB	0	0	0	0	0	0	1	0	0	0	0	0	1
Mamre Rd	NB	0	0	0	0	0	0	0	0	0	0	0	0	0
	SB	0	0	0	0	0	0	0	0	0	0	0	0	0
Moorebank Ave	WB	0	0	0	0	0	0	0	0	0	0	0	0	0
Pacific Hwy	NB	0	0	0	0	0	0	0	1	0	0	0	0	1
	SB	0	0	0	0	0	0	0	0	0	0	0	0	0
Pennant Hills Rd	NB	0	0	0	0	0	0	0	1	0	0	0	0	1
	SB	0	0	0	0	0	0	0	0	0	0	0	0	0
Prospect Hwy	NB	0	0	1	0	0	0	0	0	0	0	0	0	1
	SB	0	0	0	0	0	0	0	0	0	0	0	0	0
Rooty Hill Rd	NB	0	0	0	0	0	0	0	0	0	0	0	0	0
	SB	0	0	0	0	0	0	0	0	0	0	0	0	0
Wallgrove Rd	NB	0	0	0	0	0	1	0	0	0	0	0	0	1
	SB	0	0	0	0	0	0	0	0	0	0	1	0	1
Grand Total		0	1	2	0	1	1	2	3	0	1	1	1	13

Table C-4: Records with Invalid Overall Direction

Sum of Valid_OD_Veh_Dir		Hour													
Station	Direction	6	7	8	9	10	11	12	13	14	15	16	17	Grand Total	
Cumberland Hwy	NB	0	0	0	0	0	0	0	0	0	0	0	0	0	
	SB	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cumberland Hwy OPR	NB	0	0	1	1	0	0	2	0	0	0	0	0	4	
	SB	0	0	0	1	0	0	0	0	0	0	0	0	1	
Hume Hwy	NB	0	0	1	0	1	0	2	0	0	1	1	0	6	
	SB	0	0	0	1	0	1	0	0	0	0	0	1	3	
M5	EB	0	0	0	0	0	2	0	0	1	0	0	0	3	
	WB	0	0	0	0	0	0	0	0	0	1	0	0	1	
Mamre Rd	NB	0	0	0	0	0	0	0	0	0	0	0	0	0	
	SB	0	0	1	0	0	0	0	0	0	0	0	0	1	
Moorebank Ave	WB	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pacific Hwy	NB	0	0	0	0	0	0	0	0	0	0	0	0	0	
	SB	0	0	0	0	0	0	0	0	0	0	0	1	1	
Pennant Hills Rd	NB	0	0	0	0	0	0	0	0	0	1	0	0	1	
	SB	0	0	0	0	0	0	0	0	0	0	1	0	1	
Prospect Hwy	NB	0	0	0	0	0	0	0	0	0	0	0	0	0	
	SB	0	0	0	0	0	0	0	0	0	0	0	0	0	
Rooty Hill Rd	NB	0	0	0	0	0	0	0	0	0	0	0	0	0	
	SB	0	0	0	0	0	0	0	0	0	0	0	0	0	
Wallgrove Rd	NB	0	0	0	0	0	0	0	0	0	1	0	0	1	
	SB	0	0	0	0	0	0	0	0	0	0	0	0	0	
Grand Total		0	0	3	3	1	3	4	0	1	4	2	2	23	

Table C-5: Survey Records with Valid Origin, Destination, Vehicle Type and Overall Direction

Sum of Valid_OD_Veh_Dir		Hour												
Station	Direction	6	7	8	9	10	11	12	13	14	15	16	17	Grand Total
Cumberland Hwy	NB	2	13	4	6	13	3							41
	SB					1					1	1		
Cumberland Hwy OPR	NB	6	10	9	17	7	9	6	9	1			26	100
	SB	2	11	10	3	3	9	1	6	10	5	6	2	
Hume Hwy	NB	1	11	7	12	5	6	3	5	6	3	9		68
	SB	4	2	10	8	12	9	5	9	9	6	6	1	
M5	EB	3	3	4	8	2	0	2	3	2			6	33
	WB	4	3	6	2	9	12	8	8	6	3	4	2	
Mamre Rd	NB			2							1		1	4
	SB			3							2			
Moorebank Ave	WB		4	1	1	3	7	4	5	3	3		2	33
Pacific Hwy	NB			1	1	2	1	1	1	1	2	1		11
	SB	1	1	1		1	1		1	1	2	1	1	
Pennant Hills Rd	NB	1	3	4	7	3	7	1	0		0	4		30
	SB		4	2	2	4	2	2	5	4	1	3		
Prospect Hwy	NB	1	1	3		2	4	2	1		7	3	2	26
	SB	1	1			3	4				3			
Rooty Hill Rd	NB	1		6	2	1	2	2	2	1	2	4		23
	SB	2	2	3	3				1		2	2		
Wallgrove Rd	NB	2	3	4	2	1	2	1	1		5	4		25
	SB			2	2	1	1	1			3	2		
Grand Total		31	72	82	76	73	79	39	57	44	51	50	43	697

Table C-6: Frequency Count by Question

Q1. Where were you travelling from?

ACT	6	0.8%
AUBURN	27	3.7%
BANKSTOWN	48	6.5%
BAULKHAM HILLS	11	1.5%
BLACKTOWN	74	10.1%
BLUE MOUNTAINS	2	0.3%
BOTANY	21	2.9%
CAMDEN	7	1.0%
CAMPBELLTOWN	48	6.5%
CANTERBURY	4	0.5%
CONCORD	4	0.5%
DRUMMOYNE	2	0.3%
FAIRFIELD	103	14.1%
GOSFORD	7	1.0%
HAWKESBURY	2	0.3%
HOLROYD	36	4.9%
HORNSBY	21	2.9%
HURSTVILLE	10	1.4%
KIAMA	1	0.1%
KU-RING-GAI	5	0.7%
LAKE MACQUARIE	3	0.4%
LANE COVE	2	0.3%
LEICHHARDT	2	0.3%
LIVERPOOL	97	13.2%
MARRICKVILLE	2	0.3%
NEWCASTLE (INNER)	6	0.8%
NEWCASTLE (REMAINDER)	2	0.3%
NNSW	8	1.1%
PARRAMATTA	27	3.7%
PENRITH	20	2.7%
PORT STEPHENS	1	0.1%
QLD	4	0.5%
RANDWICK	3	0.4%
RYDE	3	0.4%
SA	2	0.3%
SHELLHARBOUR	3	0.4%
SHOALHAVEN	2	0.3%
SNSW	18	2.5%
SOUTH SYDNEY	5	0.7%
STRATHFIELD	14	1.9%
SUTHERLAND	10	1.4%
SYDNEY (REMAINDER)	1	0.1%
VIC	12	1.6%
WA	1	0.1%
WARRINGAH	4	0.5%
WILLOUGHBY	2	0.3%
WINGECARRIBEE	7	1.0%
WNSW	3	0.4%
WOLLONDILLY	5	0.7%
WOLLONGONG	17	2.3%

WYONG	8	1.1%
Total	733	100.0%

Q2. What did you do at that location?

Deliver	208	28.4%
Pickup	334	45.6%
Pickup&Deliver	56	7.6%
Other	128	17.5%
Not Spec	7	1.0%
Grand Total	733	100.0%

Q3. Where were you travelling to when you received this card?

Blank	8	1.1%
ACT	8	1.1%
AUBURN	18	2.5%
BANKSTOWN	16	2.2%
BAULKHAM HILLS	21	2.9%
BLACKTOWN	96	13.1%
BLUE MOUNTAINS	1	0.1%
BOTANY	4	0.5%
BURWOOD	1	0.1%
CAMDEN	24	3.3%
CAMPBELLTOWN	97	13.2%
CANTERBURY	2	0.3%
CONCORD	1	0.1%
FAIRFIELD	95	13.0%
GOSFORD	14	1.9%
HAWKESBURY	5	0.7%
HOLROYD	31	4.2%
HORNSBY	23	3.1%
HUNTERS HILL	2	0.3%
HURSTVILLE	2	0.3%
KU-RING-GAI	11	1.5%
LAKE MACQUARIE	5	0.7%
LEICHHARDT	4	0.5%
LIVERPOOL	57	7.8%
MAITLAND	2	0.3%
MARRICKVILLE	2	0.3%
NEWCASTLE (INNER)	11	1.5%
NEWCASTLE (REMAINDER)	1	0.1%
NNSW	6	0.8%
NT	1	0.1%
PARRAMATTA	26	3.5%
PENRITH	35	4.8%
QLD	7	1.0%
RANDWICK	1	0.1%
ROCKDALE	1	0.1%
RYDE	4	0.5%
SA	2	0.3%
SHELLHARBOUR	1	0.1%

SHOALHAVEN	1	0.1%
SNSW	12	1.6%
SOUTH SYDNEY	5	0.7%
STRATHFIELD	7	1.0%
SUTHERLAND	2	0.3%
SYDNEY (REMAINDER)	6	0.8%
VIC	14	1.9%
WARRINGAH	8	1.1%
WILLOUGHBY	2	0.3%
WINGECARRIBEE	5	0.7%
WNSW	1	0.1%
WOLLONDILLY	7	1.0%
WOLLONGONG	3	0.4%
WOOLLAHRA	2	0.3%
WYONG	12	1.6%
Grand Total	733	100.0%

Q4. What did you do at that location?

Deliver	386	52.7%
Pickup	144	19.6%
Pickup&Deliver	60	8.2%
Other	130	17.7%
Not Spec	13	1.8%
Grand Total	733	100.0%

Q5. What type of vehicle were you driving when you received this card?

Rigid_No_Trailer	429	58.5%
Rigid_Trailer	51	7.0%
Articulated	196	26.7%
Large_Comb_Veh	30	4.1%
Other_Plant	22	3.0%
NVT	5	0.7%
Grand Total	733	100.0%

Q6. How many axles on that vehicle?

	1	69	9.4%
	2	271	37.0%
	3	97	13.2%
	4	49	6.7%
	5	33	4.5%
	6	157	21.4%
	7	11	1.5%
	8	5	0.7%
	9	18	2.5%
	10	3	0.4%
(blank)		20	2.7%
Grand Total		733	100.0%

Q7. Was your vehicle...

Full Load	291	39.7%
Part Load	259	35.3%
Empty	175	23.9%
Not Spec	8	1.1%
Grand Total	733	100.0%

Q8. If carrying a load, please indicate the type of goods being carried

Food	53	7.2%
Beverages	16	2.2%
Crude Materials	100	13.6%
Fuel	21	2.9%
Chem	24	3.3%
Manuf	218	29.7%
Machinery	59	8.0%
Assorted	25	3.4%
Chem & Manuf	3	0.4%
Crude	44	6.0%
Crude & Chem	2	0.3%
Crude & Fuel	1	0.1%
Crude & Manuf	7	1.0%
Food & Bev	10	1.4%
Food & Crude	1	0.1%
Food & Manuf	10	1.4%
Fuel & Chem	1	0.1%
Fuel & Manuf	1	0.1%
Manuf & Mach	5	0.7%
Manuf & Mail	1	0.1%
No Commod Spec	130	17.7%
Tools	1	0.1%
Grand Total	733	100.0%

Appendix D - Review of Survey Period's Representativeness

The period of survey is considered against general traffic over annual and weekly periods to identify variations from average values. Three sources of data are used:

- Weekly RTA traffic count totals for 1999 to considered seasonal patterns;
- Hourly RTA traffic counts for a week in 1999 to consider day of week variations;
- Safe-T-Cam data for a four week period around the survey day in 2001, to consider changes in the number of vehicles matched between Bargo and Wyong Safe-T-Cam sites.

Seasonal Patterns

The proportion of year's travel recorded during the survey week for 1999 is compared with the weekly average in the following table. The second last column on the right indicates the difference from average flows by deducting the survey week from 1.923% (1/52). The last column on the right calculates the proportional difference between the weekly total and 1.923%.

Table D1: Seasonal Patterns of Traffic, Selected Roads

Station No	Station Name	Direction	Balance of Year	Survey Week	Total	Difference from Average	
						Absolute	Proportional
53.209	Pacific Highway	NB	98.105%	1.895%	100%	-0.028%	-1.480%
		SB	98.108%	1.892%	100%	-0.031%	-1.634%
	Pacific Highway Total		98.107%	1.893%	100%	-0.030%	-1.554%
60.002	M5 Motorway	NB	97.965%	2.035%	100%	0.112%	5.844%
		SB	98.054%	1.946%	100%	0.023%	1.212%
	M5 Motorway Total		98.008%	1.992%	100%	0.069%	3.581%
62.001	Hume Highway	NB	98.065%	1.935%	100%	0.011%	0.596%
		SB	98.037%	1.963%	100%	0.040%	2.089%
	Hume Highway Total		98.050%	1.950%	100%	0.027%	1.379%
66.248	Cumberland Hwy	NB	98.082%	1.918%	100%	-0.005%	-0.263%
		SB	98.042%	1.958%	100%	0.035%	1.799%
	Cumberland Hwy Total		98.062%	1.938%	100%	0.015%	0.759%
69.087	Prospect Highway	NB	98.034%	1.966%	100%	0.043%	2.257%
		SB	98.023%	1.977%	100%	0.054%	2.796%
	Prospect Highway Total		98.028%	1.972%	100%	0.049%	2.536%
71.035	Wallgrove Rd	NB	98.030%	1.970%	100%	0.047%	2.427%
		SB	98.046%	1.954%	100%	0.031%	1.633%
	Wallgrove Rd Total		98.038%	1.962%	100%	0.039%	2.020%
74.200	F3 Freeway	NB	98.147%	1.853%	100%	-0.070%	-3.636%
		SB	98.160%	1.840%	100%	-0.083%	-4.325%
	F3 Freeway Total		98.153%	1.847%	100%	-0.076%	-3.975%
74.218	Pennant Hills Rd	NB	98.155%	1.845%	100%	-0.078%	-4.038%
		SB	98.139%	1.861%	100%	-0.062%	-3.210%
	Pennant Hills Rd Total		98.147%	1.853%	100%	-0.070%	-3.626%
Total			98.078%	1.922%	100%	-0.001%	-0.060%

Source: RTA Blue Book 1999

Overall the week of survey is representative of total traffic movements in the area of the survey. At the critical stations the situation is more mixed. At the Cumberland Highway and Hume Highway the week is slightly busier than average, whilst at Pennant Hills Road it is slightly quieter than average. Similar data for heavy vehicles alone is not available.

Hourly Patterns

The following table compares traffic volumes during the period of survey for five weekdays.

Table D2: Analysis of Survey Period Flows

Station	Road	Direction	Day						Difference from Average	
			Mon	Tue	Wed	Thur	Fri	Total	Absolute	Proportion
53.209	Pacific Highway	NB	19.75%	19.76%	19.73%	20.11%	20.65%	100.00%	0.11%	0.56%
		SB	19.24%	19.33%	19.50%	20.16%	21.78%	100.00%	0.16%	0.81%
	Pacific Highway Total		19.52%	19.57%	19.63%	20.13%	21.15%	100.00%	0.13%	0.67%
60.002	M5 Motorway	NB	19.58%	19.69%	19.95%	20.14%	20.64%	100.00%	0.14%	0.69%
		SB	19.93%	18.02%	20.21%	20.39%	21.45%	100.00%	0.39%	1.96%
	M5 Motorway Total		19.74%	18.90%	20.07%	20.26%	21.02%	100.00%	0.26%	1.29%
62.001	Hume Hwy	NB	19.76%	18.78%	20.15%	20.38%	20.92%	100.00%	0.38%	1.91%
		SB	19.81%	19.55%	20.05%	19.79%	20.80%	100.00%	-0.21%	-1.05%
	Hume Hwy Total		19.79%	19.18%	20.10%	20.08%	20.86%	100.00%	0.08%	0.39%
66.248	Cumberland Hwy	NB	19.42%	19.80%	19.91%	20.16%	20.70%	100.00%	0.16%	0.81%
		SB	19.32%	19.46%	19.88%	19.76%	21.59%	100.00%	-0.24%	-1.21%
	Cumberland Hwy Total		19.37%	19.63%	19.90%	19.96%	21.14%	100.00%	-0.04%	-0.19%
69.087	Prospect Hwy	NB	19.41%	19.64%	19.69%	20.20%	21.06%	100.00%	0.20%	1.01%
		SB	19.31%	19.33%	19.54%	20.57%	21.25%	100.00%	0.57%	2.85%
	Prospect Hwy Total		19.35%	19.48%	19.61%	20.40%	21.16%	100.00%	0.40%	1.98%
71.035	Wallgrove Rd	NB	19.63%	20.00%	20.01%	20.13%	20.23%	100.00%	0.13%	0.66%
		SB	19.82%	20.34%	20.18%	18.99%	20.66%	100.00%	-1.01%	-5.03%
	Wallgrove Rd Total		19.73%	20.17%	20.10%	19.55%	20.45%	100.00%	-0.45%	-2.25%
74.200	F3 Freeway	NB	19.01%	19.07%	19.31%	19.68%	22.92%	100.00%	-0.32%	-1.58%
		SB	19.52%	19.06%	19.47%	19.98%	21.95%	100.00%	-0.02%	-0.08%
	F3 Freeway Total		19.28%	19.07%	19.40%	19.84%	22.42%	100.00%	-0.16%	-0.81%
74.218	Pennant Hills Rd	NB	19.71%	19.44%	19.55%	19.74%	21.56%	100.00%	-0.26%	-1.30%
		SB	19.52%	20.53%	19.37%	19.90%	20.69%	100.00%	-0.10%	-0.49%
	Pennant Hills Rd Total		19.61%	19.99%	19.46%	19.82%	21.12%	100.00%	-0.18%	-0.89%
Grand Total			19.54%	19.43%	19.77%	20.03%	21.23%	100.00%	0.03%	0.15%

Source: RTA Blue Book 1999

The survey period analysis indicates that there is general consistency between days for the hours of survey, with Thursday, the day of survey, being the closest to the average (20%) for the total of all stations and for about half the individual stations. This information is for total vehicles – similar information for heavy vehicles alone is not available.

Safe-T-Cam

The RTA provided information on the number of vehicles matched between the Bargo and Wyong Safe-T-Cam sites for the period of 23 July and 21 August 2001, including the survey day. The number of matches by direction for four match periods (in 2 hours, in 3 hours in 4 hours and in 5 hours) was provided by hour of day. The match period between the two stations is of the order of 1 ¾ hours, if speed limits are observed.

The number of matches over the four week period is compared with average values for each direction during the hours of survey for matches in three or less hours. For example, the first entry for northbound travel of 168% indicates that on that day the number of matches during the hours of postcard survey were 168% of the average over the four week period of Safe-T-Cam data.

Table D3: Comparison of Matches (3 hours or less) for period of Survey by Direction with Average (All Days)

Date	Day	North	South	Total
23-Jul-01	Monday	168%	65%	111%
24-Jul-01	Tuesday	141%	115%	127%
25-Jul-01	Wednesday	159%	87%	119%
26-Jul-01	Thursday	80%	22%	48%
27-Jul-01	Friday	106%	101%	103%
28-Jul-01	Saturday	9%	7%	8%
29-Jul-01	Sunday	124%	137%	131%
30-Jul-01	Monday	124%	173%	151%
31-Jul-01	Tuesday	141%	123%	131%
01-Aug-01	Wednesday	88%	115%	103%
02-Aug-01	Thursday	97%	137%	119%
03-Aug-01	Friday	88%	101%	95%
04-Aug-01	Saturday	80%	65%	72%
05-Aug-01	Sunday	35%	137%	91%
06-Aug-01	Monday	88%	108%	99%
07-Aug-01	Tuesday	124%	173%	151%
08-Aug-01	Wednesday	186%	43%	107%
09-Aug-01	Thursday	88%	65%	75%
10-Aug-01	Friday	97%	87%	91%
11-Aug-01	Saturday	97%	101%	99%
12-Aug-01	Sunday	80%	130%	107%
13-Aug-01	Monday	97%	159%	131%
14-Aug-01	Tuesday	133%	79%	103%
15-Aug-01	Wednesday	141%	159%	151%
16-Aug-01	Thursday	124%	151%	139%
18-Aug-01	Saturday	27%	43%	36%
19-Aug-01	Sunday	62%	173%	123%
20-Aug-01	Monday	80%	22%	48%
21-Aug-01	Tuesday	35%	22%	28%

The analysis indicates that for the day of survey the amount of through traffic was 88% of the average for northbound, 65% for southbound and 75% for total.

The following table repeats the analysis, for weekdays only.

Table D4: Comparison of Matches (3 hours or less) for period of Survey by Direction with Average (Weekdays)

Date	Day	North	South	Total
23-Jul-01	Monday	148%	65%	105%
24-Jul-01	Tuesday	124%	115%	120%
25-Jul-01	Wednesday	140%	86%	112%
26-Jul-01	Thursday	70%	22%	45%
27-Jul-01	Friday	93%	101%	97%
30-Jul-01	Monday	109%	173%	142%
31-Jul-01	Tuesday	124%	122%	123%
1-Aug-01	Wednesday	78%	115%	97%
2-Aug-01	Thursday	86%	137%	112%
3-Aug-01	Friday	78%	101%	90%
6-Aug-01	Monday	78%	108%	93%
7-Aug-01	Tuesday	109%	173%	142%
8-Aug-01	Wednesday	163%	43%	101%
9-Aug-01	Thursday	78%	65%	71%
10-Aug-01	Friday	86%	86%	86%
13-Aug-01	Monday	86%	158%	123%
14-Aug-01	Tuesday	117%	79%	97%
15-Aug-01	Wednesday	124%	158%	142%
16-Aug-01	Thursday	109%	151%	131%
20-Aug-01	Monday	70%	22%	45%
21-Aug-01	Tuesday	31%	22%	26%

The above table indicates, in the first part of the Safe-T-Cam data period, that Monday and Tuesday experience peaks in through movement activity. This pattern is not maintained during the survey period and there is a high degree of variability. The day of survey is relatively quiet in terms of through movement volumes, being less representative of weekdays than it is of all days (see Table D3).

Conclusion

Based on past trends the week of survey is reasonably representative for total traffic volumes; and the survey period is representative of total traffic. The volumes of through traffic during the survey period are lower than average.

Therefore, it is unlikely that the survey timing has led to an overstatement of truck volumes. If anything the Safe-T-Cam data, while volatile, does indicate that the volumes on the survey day were lower than for the month around the survey day. The rather confused pattern may be related to the Tri-Star strike.

Further analysis of Safe-T-Cam data for a longer period may assist in the understanding of survey representativeness.

Appendix E - Calibration

The following table presents the calibration of heavy vehicles in the Netanal traffic model.

Table E.1: Comparison of Modelled and Observed Heavy Vehicle Volumes – Morning Peak Hour

Location	Count	Model	Diff	Diff%
Cumberland Hwy SB N of Brennan St	102	118	16	16
Cumberland Hwy NB S of Brennan St	171	203	32	19
Cumberland Hwy SB N of Old Prospect Rd	164	185	21	13
Cumberland Hwy NB S of Old Prospect Rd	181	171	-10	-6
Hume NB Off Ramp at Camden Valley Way	170	155	-15	-9
Hume SB N of Box Rd	119	109	-10	-8
M5 EB at Georges River Bridge	215	247	32	15
M5 WB E of Moorebank Ave	162	182	20	12
Mamre Rd SB N of Bakers Ln	42	54	12	29
Mamre Rd NB S of Bakers Ln	39	44	5	13
Pacific SB E of F3	106	121	15	14
Pacific NB E of F3	61	65	4	7
Pennant Hills Rd SB N of Comenara Pkwy	161	159	-2	-1
Pennant Hills Rd NB S of Comenara Pkwy	183	210	27	15
Prospect SB N of Lucas Rd	112	196	84	75
Prospect NB S of Lucas Rd	97	150	53	55
Rooty Hill Rd South SB N of Evans Rd	91	133	42	46
Rooty Hill Rd South NB S of Evans Rd	80	99	19	24
Wallgrove Rd SB S of M4	196	208	12	6
Wallgrove Rd NB S of Old Wallgrove Rd	182	177	-5	-3
Windsor Rd NB S of Memorial Ave	194	251	57	29
Windsor Rd SB S of Memorial Ave	128	150	22	17
Windsor Rd NB N of Old Windsor Rd	104	114	10	10
Windsor Rd SB N of Old Windsor Rd	101	158	57	56
Sunnyholt Rd NB N of Quakers Hill Pkwy	148	136	-12	-8
Sunnyholt Rd SB N of Quakers Hill Pkwy	80	138	58	73
Richmond Rd EB W of Quakers Hill Pkwy	44	140	96	218
Richmond Rd WB W of Quakers Hill Pkwy	77	91	14	18

A comparison of modelled and observed total vehicle volumes is presented in the following table.

Table E.2: Calibration of Total Vehicles – Morning Peak Hour

Note: Citybound is assumed to be northbound on Cumberland Hwy and at Western Rail Line.

		Citybound				Outbound			
Northern		Observed	Modelled	Difference	% Diff	Observed	Modelled	Difference	% Diff
Richmond Rd	N of Rooty Hill Rd	1270	1197	-73	-6%	750	770	20	3%
Windsor Rd	N of Old Windsor Rd	1400	1453	53	4%	1080	1050	-30	-3%
South West									
M5 East Bound	At Georges Rr, Moorebank	4400	4534	134	3%				
M5 West Bound	At Georges Rr, Moorebank	2350	2388	38	2%				
Newbridge Road	At Georges Rr, Moorebank	2000	1874	-126	-6%	1700	1753	53	3%
Elizabeth Dr	At Cabramatta Ck	2120	2042	-78	-4%	1130	1032	-98	-9%
Cumberland Hwy	At Cabramatta Ck	1700	1644	-56	-3%	1650	1567	-83	-5%
		10220	10094	-126	-1%	6830	6740	-90	-1%
Hume Hwy	At Prospect Ck	3000	3835	835	28%	1650	1506	-144	-9%
Cumberland Hwy	At Prospect Ck	2430	2544	114	5%	1950	1738	-212	-11%
Gipps St	At Prospect Ck	1065	656	-409	-38%	1125	1130	5	0%
Wallgrove Rd	At Water Supply Pipeline	1110	1286	176	16%	1450	1435	-15	-1%
		7605	8321	716	9%	6175	5809	-366	-6%
Western Rail Line									
Cumberland Hwy	At Western Rail Line	1875	2038	163	9%	2100	2104	4	0%
Prospect Hwy	At Western Rail Line	1865	1756	-109	-6%	2000	2029	29	1%
Sunnyholt Rd	At Western Rail Line	1160	1138	-22	-2%	1530	1452	-78	-5%
Third Ave	At Western Rail Line	820	754	-66	-8%	1150	1153	3	0%
Lytton St	At Western Rail Line	300	290	-10	-3%	790	847	57	7%
Knox Rd	At Western Rail Line	680	678	-2	0%	1155	1109	-46	-4%
Phillip Pkwy	At Western Rail Line	400	418	18	5%	700	683	-17	-2%
Francis Rd	At Western Rail Line	740	724	-16	-2%	980	972	-8	-1%
Carlisle Ave	At Western Rail Line	1300	1296	-4	0%	1160	1139	-21	-2%
		9140	9092	-48	-1%	11565	11488	-77	-1%

** North bound adjusted due to queuing over loop detectors.

Appendix F - Adjustments to Landuse Forecasts

Landuse forecasts are prepared by the Transport Data Centre (TDC), a section of the NSW Department of Transport. A detailed forecasting tool has been developed which allocates growth in population and employment to travel zones within the Sydney Region. The allocation process is based on a predetermined likelihood of land being developed or redeveloped within the Sydney statistical Division. The model is called the "Sydney Landuse Model" (SLM). Outputs from the model are forecasts at 5 yearly increments for over 800 zones in Sydney SD of:

- Estimated Resident Population.
- Estimated Population between 5 and 18 years of age.
- Occupied Private Dwellings.
- Employment – Manufacturing and Non-Manufacturing.
- Workforce – Manufacturing and Non-Manufacturing.

The forecasts cover 45 local government areas within the Sydney Region including the Blue Mountains, Wollondilly, Gosford, and Wyong.

The SLM is the most detailed and comprehensive tool currently available for forecasting landuse patterns in Sydney. It relies on past trends in landuse patterns as well as expert input on likely future trends.

TDC produced a set of landuse forecasts in 1999 which have been used as the starting point for the Lane Cove Tunnel analysis. This dataset is known as the 1999V1 forecasts.

The landuse forecasting process is extremely complex and data intensive. It requires a proving process before application to transport planning. In this regard, Masson Wilson Twiney completed a review of the 1999V1 forecasts in relation to the Lane Cove Corridor.

The review involved taking the landuse forecasts from the SLM and estimating strategic travel forecasts for the Sydney metropolitan area using a separate model known as the Sydney "Grand Model". This model produces a vehicle trip table which contains estimates of vehicle trips between origin and destination zones in Sydney. The trip table is then assigned through a separate modelling program called NETANAL which determines likely route choices and resultant traffic volumes on individual roads.

The traffic flows forecast from the NETANAL model were then reviewed and compared against typical trends that would be expected in the corridor. It was found that the trip patterns forecast for the contra peak direction grew at a considerably higher rate than the peak direction growth. This was found to link back to the relationship between the workforce and employment landuse forecasts. The 1999V1 workforce population and forecasts allowed for a significantly higher rate of growth in the Inner areas of Sydney compared to the employment forecasts where more growth was estimated for the Outer areas of Sydney. The Inner areas comprise an arc which encloses Manly, Willoughby, Lane Cove, Auburn, Bankstown, Hurstville and Rockdale SLAs. Whilst the magnitude of

the differences was small compared to the Sydney region, it resulted in forecasts of travel patterns in the Lane Cove Tunnel corridor being skewed slightly to contra peak directions.

In general terms, it was found that the 1999V1 forecasts were not unreasonable in terms of population and workforce. However, it was also found that the 1999V1 forecasts contained a relatively low amount of employment growth in the Inner Areas of Sydney in comparison to forecast increases in population in the same areas.

It was concluded that there was a need to allow for a greater degree of self containment of growth in jobs and population within the Inner areas of Sydney Statistical Division (SD). The Inner areas comprise an arc which encloses Manly, Willoughby, Lane Cove, Auburn, Bankstown, Hurstville and Rockdale SLAs.

In 1996, there were around 1.45 million people living and 0.98 million people working in the Inner area. These numbers have remained virtually unchanged over the past twenty-five years, with the strong population and employment growth directed to the Outer areas of the Sydney SD. However, in recent years the population in the Inner area has started to increase as a result of the government's commitment to urban consolidation, where higher proportions of dwellings are accommodated in the established parts of Sydney rather than the urban release areas.

The 1999V1 landuse forecasts reflect the current trends with population in the Inner area forecast to increase by around 250,000 persons by 2016. This increase represents around 35 per cent of the total population increase for the Sydney SD over this period. However, the 99V1 forecasts allow for only a modest increase in employment of around 65,000 persons in the Inner area by 2016.

Masson Wilson Twiney developed a revised set of landuse forecasts based on the same data used in the 1999V1 forecasts (Called the 1999V1_1 forecasts). They allow for an increase in employment of around 150,000 persons in the Inner area by 2016. The population growth forecasts in the Inner areas remain unchanged at 250,000 persons by 2016.

Table H.1 below summarises the difference between the 1999V1 and 1999V1_1 forecasts.

Table H.1 – Comparison of Landuse Forecasts (Sydney Statistical Division)

Year	Dataset	Sydney SD			Growth (1996 to 2016)		
		Inner	Outer	% Inner	Inner	Outer	% Inner
Population (ERP)							
1996	Same for Both	1,452,644	2,428,373	37.4%			
2016	1999V1	1,702,422	2,892,027	37.1%	249,778	463,654	35.0%
2016	1999V1_1	1,702,422	2,892,027	37.1%	249,778	463,654	35.0%
Workforce							
1996	Same for Both	689,197	1,095,172	38.6%			
2016	1999V1	807,556	1,317,034	38.0%	118,359	221,862	34.8%
2016	1999V1_1	807,556	1,317,034	38.0%	118,359	221,862	34.8%
Employment							
1996	Same for Both	975,253	809,089	54.7%			
2016	1999V1	1,040,657	1,084,070	49.0%	65,404	274,981	19.2%
2016	1999V1_1	1,125,361	999,365	53.0%	150,108	190,276	44.1%

From Table H.1 it can be seen that the revised 1999V1_1 forecasts allow for 44.1 per cent of the growth in employment to occur in the Inner areas whereas the previous 1999V1 forecasts allowed for only 19.2 per cent of the growth in employment to occur here. The growth in population in the Inner areas was maintained at 35.0 per cent of the total growth.

The revised 1999V1_1 forecasts represent a conservative assessment of growth that could affect the Lane Cove Tunnel route. Hence, it provides a more robust basis for assessment of this project.

Table H.2 summarises the net differences in employment by region between the TDC 1999V12 forecasts and the Masson Wilson Twiney 1999V1_1 forecasts.

Table H.2 – Comparison of Employment Differences

Lane Cove Tunnel Region	Year 2006			Year 2016		
	1999V1	1999V1_1	Difference	1999V1	1999V1_1	Difference
Lane Cove	19,275	19,271	-4	19,705	21,931	2,226
Willoughby	59,043	59,043	0	61,588	65,773	4,185
North Sydney	67,918	67,918	0	68,131	68,931	800
Mosman	8,941	8,941	0	8,669	9,308	639
Hunters Hill	3,424	3,424	0	3,356	3,831	475
Ryde	55,709	55,709	0	58,151	55,028	-3,123
Hornsby / Ku-ring-gai	83,917	83,916	-1	95,581	87,492	-8,089
Manly / Warringah	82,244	82,242	-2	90,589	86,027	-4,562
Inner Sydney / Eastern Suburbs	560,255	560,215	-40	580,662	623,892	43,230
Inner Western	68,569	68,564	-5	69,034	75,950	6,916
South Western Sydney	416,663	416,672	9	463,474	460,252	-3,222
North Western Sydney	416,774	416,809	35	479,567	450,826	-28,741
Gosford / Wyong	93,544	93,542	-2	102,837	93,949	-8,888
Blue Mountains	20,744	20,744	0	23,385	21,571	-1,814
Total	1,957,020	1,957,010	-10	2,124,729	2,124,761	32

Notes: 1. 1999V1 employment forecasts were prepared by the Transport Data Centre.
 2. 1999V1_1 employment forecasts were adapted from the 1999V1 forecasts by Masson Wilson Twiney. These forecasts have been used in the Lane Cove Tunnel analysis.

From Table H.2 it can be seen that the 2006 employment forecasts used in the Lane Cove Tunnel analysis are effectively the same as the forecasts originally produced by TDC.

The 2016 employment forecasts used in the Lane Cove Tunnel analysis are:

- 11, 7, 7, and 14 per cent higher in Lane Cove, Willoughby, Mosman, and Hunters Hill respectively. This reflects the potential for the Lane Cove Tunnel project to induce additional employment opportunities in these municipalities.
- Only 1 per cent higher in North Sydney. The potential for additional employment growth in North Sydney is constrained by the existing development in this municipality.
- 10 per cent higher in the inner western area of Sydney which is consistent with the 19 per cent population growth forecast for this area.

The effect of adopting the revised employment forecasts for the Lane Cove Tunnel analysis is that peak direction traffic estimates will be slightly higher than if the original

TDC 1999V1 forecasts were used. This presents a conservative basis on which to assess the system capacity and traffic impacts.

Appendix G - Road Network Improvements

The following table outlines the likely base case road network improvements used in the modelling. These are not a list of RTA commitments and many of the projects do not have secured funding. The projects are those that MWT believe are reasonable to be included in modelling of the future road network.

Project Description	Completion Date
Sunnyholt Rd (4 lanes throughout)	by 2006
Cumberland Hwy (3 lanes from Hume Hwy to Old Windsor Rd)	by 2006
Cross City Tunnel	by 2006
Extension of Motorway south of Menai Rd to near Barden Rd, Lucas Heights (4 lanes)	by 2006
Several climbing lanes on Mona Vale Rd, Ingleside	by 2006
One way pair O'Riordon St southbound, Bourke Rd northbound - between Green Square and Robey St (6 lanes from 4 lanes)	by 2006
Widening of King Georges Rd to 6 lanes between Stoney Creek Rd and Forest Rd	by 2006
Old Windsor Rd - M2 to Windsor Rd (4 lanes)	by 2006
Upgrading of the Sydenham Rd route (Parramatta Rd to Princes Hwy)	by 2006
Pennant Hills Rd - Mahers Rd to Marsden Rd (6 lanes)	by 2006
Widening of Frederick St, Ashfield (one unobstructed through lane in each direction from Thomas Street to Parramatta Rd (4 lanes)	by 2006
Northern Rd, Penrith (Wentworth Rd to Smith St) (4 lanes)	by 2006
Marsden Rd widened Stewart St to Terry Rd (provide turn lanes in addition to 2 lanes in each direction)	by 2006
Warringah Fwy - Falcon Street ramps (2 lanes)	by 2006
Bourke Rd extension, Coward St to Gardeners Rd, Mascot (4 lanes)	by 2006
Hawkesbury Nepean Flood Plain Management Strategy Road projects	by 2006
Horsley Dr (Hume Hwy to Ferrers Rd) (4 lanes)	by 2006
Cowpasture Rd (Horsley Dr to North Liverpool Rd (4 lanes)	by 2006
Widening of M5 (Camden Valley Way to Hume Hwy) to 6 lanes	by 2006
Moorebank Avenue Interchange and associated M5 widening (to Heathcote Rd)	by 2006
Eastbound off ramp from M5 to Hume Hwy Liverpool	by 2006
Lane Cove Tunnel	by 2006
Eastwood County Rd (Blaxland to Epping) (4 lanes)	by 2016
Widening of King Georges Rd to 6 lanes and grade separation at King Georges Rd / Hillcrest Ave intersection, Hurstville	by 2016
Windsor Rd Roxborough Park Rd at Merindah Rd (4 lanes)	by 2016
Alfords Point Bridge duplicated, Alfords Point Rd widened north of Georges River to 4 lanes	by 2016
Sydenham Rd route 4 lanes and turn bays (Parramatta Rd to Princes Hwy)	by 2016
Windsor Rd - Merindah to Showground Rd (4 lanes)	by 2016
Delhi Rd and Fullers Rd to Pacific Hwy (4 lanes)	by 2016
Bangor Bypass (2 lanes)	by 2016
Smiths Creek Bypass, Leumeah	by 2016
Quakers Hill Bypass widen to 4 lanes	by 2016
Cowpasture Rd (Horsley Dr to Bringelly Rd) (4 lanes)	by 2016
Church Ln, M4 Blacktown Rd (4 lanes)	by 2016
Prospect Arterial (2 lanes) - GWH to Horsley Dr	by 2016

Project Description	Completion Date
Prospect Link (4 lanes) - Wall Park Ave to Blacktown Rd	by 2016
Hoxton Park Rd (4 lanes) Hume Hwy to Cowpasture Rd	by 2016
Werrington Arterial (4 lanes) M2 to M4	by 2016
M4 Kent St - East facing ramps to University of Western Sydney (1 lane each way)	by 2016
Mona Vale Road 4 lanes Pittwater - Terrey Hills	by 2016
Boundary St, Roseville intersection upgraded (3 lanes each way, with dual turn bays)	by 2016
Pacific Hwy, Chatswood - grade separation at key intersections	by 2016

APPENDIX F

Masson Wilson Twiney's Estimates for Traffic Volumes

Table F.1 Traffic Volumes on the WSO, Morning Peak Hour – 2016

Section of WSO	Northbound/Eastbound		Southbound/Westbound		Combined	
	Total	HV%	Total	HV%	Total	HV%
N of Camden Valley Way	2,721	12%	3,125	12%	5,846	12%
N of Bernera Rd	2,261	13%	2,731	12%	4,992	13%
N of Cowpasture Rd	2,332	13%	2,453	13%	4,785	13%
N of Elizabeth Dr	2,355	13%	2,016	15%	4,371	14%
N of The Horsley Dr	2,444	14%	2,971	14%	5,415	14%
S of Great Western Hwy	2,278	12%	3,061	11%	5,339	11%
S of Woodstock Ave	2,523	12%	3,663	10%	6,186	11%
S of Richmond Rd	1,346	12%	2,737	11%	4,083	11%
E of Richmond Rd	2,722	11%	1,884	11%	4,606	11%
W of Sunnyholt Rd	3,525	11%	2,126	11%	5,651	11%
E of Sunnyholt Rd	3,660	10%	2,462	10%	6,122	10%
W of Old Windsor Rd	1,763	10%	805	12%	2,568	11%
E of Old Windsor Rd	2,210	10%	1,116	12%	3,326	11%

Table F.2 Traffic Volumes on the WSO, AADT – 2016

Section of WSO	Northbound/Eastbound		Southbound/Westbound		Combined	
	Total	HV%	Total	HV%	Total	HV%
N of Camden Valley Way	35,472	16%	36,236	16%	71,708	16%
N of Bernera Rd	29,671	18%	27,522	18%	57,193	18%
N of Cowpasture Rd	24,089	19%	23,328	20%	47,417	20%
N of Elizabeth Dr	20,401	22%	23,788	20%	44,189	21%
N of The Horsley Dr	27,421	19%	26,380	20%	53,801	20%
S of Great Western Hwy	30,093	14%	30,205	16%	60,298	15%
S of Woodstock Ave	34,109	14%	34,102	15%	68,211	14%
S of Richmond Rd	15,089	17%	23,585	17%	38,674	17%
E of Richmond Rd	25,753	16%	24,064	15%	49,817	16%
W of Sunnyholt Rd	33,600	15%	27,762	16%	61,362	16%
E of Sunnyholt Rd	34,571	15%	37,436	15%	72,007	15%
W of Old Windsor Rd	9,279	25%	9,271	26%	18,550	25%
E of Old Windsor Rd	12,978	23%	13,198	27%	26,176	25%

Table F.3 Morning Peak Total Traffic Volumes - 2016

Road Section	Northbound/Eastbound			Southbound/Westbound		
	Without WSO	With WSO	Change %	Without WSO	With WSO	Change %
Abbott Rd W of Old Windsor Rd	2,251	1,173	-48%	1,966	1,426	-27%
Cowpasture Rd N Nth of Liverpool Rd	2,021	1,225	-39%	809	489	-40%
Cumberland Hwy N of Hume Hwy	1,646	1,529	-7%	2,277	1,889	-17%
Cumberland Hwy S of Old Windsor Rd	1,210	1,407	+16%	1,376	1,328	-3%
Elizabeth Dr W of Cowpasture Rd	1,768	1,059	-40%	892	534	-40%
Gt Western Hwy E of WSO	3,478	2,730	-22%	641	668	+4%
M4 W of Cumberland Hwy	6,454	6,322	-2%	4,102	3,866	-6%
M4 W of Wallgrove Rd	5,716	6,275	+10%	4,608	4,427	-4%
M5 at Georges River Bridge	5,027	5,787	+15%	3,376	3,651	+8%
Norwest Bd E of Old Windsor Rd	1,552	2,650	+71%	1,391	2,500	+80%
Pennant Hills Rd N of M2	2,173	2,110	-3%	3,488	3,538	+1%
Pennant Hills Rd S of M2	1,787	1,888	+6%	2,309	2,314	0%
Prospect Arterial S of M4	1,046	620	-41%	609	350	-43%
Richmond Rd E of Symonds Rd	2,374	772	-61%	934	767	-18%
Sunnyholt Rd W of Old Windsor Rd	2,975	2,215	-26%	2,032	1,562	-23%
Wallgrove Rd N of The Horsley Dr	1,273	651	-49%	1,854	568	-69%

Table F.4 Evening Peak Total Traffic Volumes - 2016

Road Section	Northbound/Eastbound			Southbound/Westbound		
	Without WSO	With WSO	Change %	Without WSO	With WSO	Change %
Abbott Rd W of Old Windsor Rd	1,447	1,375	-5%	2,256	1,641	-27%
Cowpasture Rd N Nth of Liverpool Rd	945	574	-39%	2,064	1,160	-44%
Cumberland Hwy N of Hume Hwy	2,890	2,540	-12%	1,931	1,592	-18%
Cumberland Hwy S of Old Windsor Rd	1,814	1,854	+2%	2,047	1,884	-8%
Elizabeth Dr W of Cowpasture Rd	1,150	672	-42%	2,099	1,097	-48%
Gt Western Hwy E of WSO	2,284	905	-60%	3,267	3,225	-1%
M4 W of Cumberland Hwy	3,941	3,800	-4%	6,495	6,167	-5%
M4 W of Wallgrove Rd	3,799	4,945	+30%	7,004	6,952	-1%
M5 at Georges River Bridge	3,285	3,668	+12%	5,684	6,389	+12%
Norwest Bd E of Old Windsor Rd	810	1,761	+117%	1,893	3,071	+62%
Pennant Hills Rd N of M2	3,473	3,507	+1%	1,927	2,237	+16%
Pennant Hills Rd S of M2	2,305	2,580	+12%	1,545	1,496	-3%
Prospect Arterial S of M4	1,003	530	-47%	1,007	644	-36%
Richmond Rd E of Symonds Rd	1,844	809	-56%	2,484	1,486	-40%
Sunnyholt Rd W of Old Windsor Rd	2,407	1,846	-23%	3,031	2,423	-20%
Wallgrove Rd N of The Horsley Dr	2,107	1,044	-50%	1,360	568	-58%

APPENDIX G

Renzo Tonin and Associates' Noise Barrier Assessment

Table G-1 – Predicted Noise Levels at Nearest Affected Residence (NAR) for Year 2016 and Required Barrier Heights to Achieve ECRTN Criteria

NCA	Predicted Traffic Noise Levels at NAR dB(A)		Barrier Height to achieve ECRTN 'Base' Criteria with WSO, m		
	Leq, 15hr	Leq, 9hr	WSO	Ramp	Adj Rd
<i>Southern Section – Camden Valley Way to Elizabeth Drive</i>					
E1	64	59	-	1 - 2	6
E2	67	62	-	2	8.5
E3	61	56	-	1.5 - 3	-
E4	58	54	2	-	-
E5	66	60	7	4	4
E6	57	52	1.2	-	-
E7	64	59	4.2	-	-
E8	60	54	2.4	-	-
E9	46	41	-	-	-
E10	57	52	-	-	1
E11	64	59	-	-	3.3
E12	57	51	1.5	-	-
E13	52	46	-	-	-
E14	55	49	1	-	-
E15	54	48	1	-	-
E16	55	50	1	-	-
E17	59	54	3	-	1.5
E18	56	51	1	-	1
W1	52	47	-	-	-
W2	54	48	-	-	-
W3	62	55	4	2	3
W4	61	55	1.5	-	2.1
W5	61	55	1.5	-	2
W6	51	46	-	-	-
W7	54	49	0.4	-	-
W8	55	49	0.8	-	-
W9	60	54	4	-	2
W10	61	55	-	-	2.8
W11	64	59	2	-	3.2
W12	58	54	1.2	1.2	1.5
W13	60	55	3	-	-
<i>Northern Section between Elizabeth Drive and M2</i>					
1E	57	51	2.5	-	-
1W	62	57	2.5	-	2.5
2E	60	55	7	2	-
2W	62	57	4	-	3
4	58	61	2	1	-
5	61	56	3.5	1.5	1 – 2
6	61	57	2.5	-	-
7E	62	58	3	-	-
7W	64	59	3.5	-	-
8	64	59	3	-	-
9	68	63	5	-	-
10E*	59	54	3	-	-
10W*	64	59	5	-	-
11*	54	50	2	-	-
12*	62	57	4	-	-
13*	65	60	3.5	-	-
14*	63	58	2.5	-	-
15N*	55	49	-	-	-
15S*	56	50	1	-	-

16*	64	50	4	1.5 - 4	-
17*	60	54	6	-	-
18*	63	57	4	-	-
19*	65	59	4	-	-
20*	62	57	4.5	-	-
21*	60	54	3	-	-
22*	56	50	2	-	-
23W*	60	54	5.5	-	-
23E*	66	60	5.5	-	2
24*	61	55	6	-	-

* These estimates have been based on a 90km/hr speed limit on this section of the proposal. The Proponent has indicated that a speed limit of 110km/hr would generally lead to an increase in barrier heights of 0.5m.

Table G-2 – Predicted Number of Dwellings Exposed to Noise Levels Exceeding ECRTN ‘Base’ Criteria in 2016 and Proposed Noise Mitigation

NCA	Number of Affected Residences Existing and (Potential Future)		Proposed Noise Mitigation
	Day (Leq, 15hr)	Night (Leq, 9hr)	
E1	60 (160)	60 (160)	Roadside Barriers
E2	27 (220)	27 (220)	Roadside Barriers
E3	20 (140)	20 (140)	Roadside Barriers
E4	12 (60)	12 (60)	Roadside Barriers
E5	2	2	Building Treatment
E6	2 (30)	2 (30)	Building Treatment
E7	1 (25)	1 (25)	Building Treatment
E8	0 (30)	0 (30)	No Treatment
E9	0	0	No Treatment
E10	30	30	Roadside Barriers
E11	73	73	Roadside Barriers
E12A	0 (280)	0 (280)	No Treatment
E12	0	0	No Treatment
E13	0	0	No Treatment
E14	0	0	No Treatment
E15	0	0	No Treatment
E16	0	0	No Treatment
E17	10	10	Roadside Barriers
E18	23	32	Roadside Barriers
W1	0 (50)	0 (50)	Roadside Barriers
W2	0 (70)	0 (70)	Roadside Barriers
W3	3	3	Building Treatment
W4	3	3	Building Treatment
W5	5	5	Building Treatment
W6	0	0	No Treatment
W7	0	0	No Treatment
W8	0 (30)	0 (30)	No Treatment
W9	36 (46)	36 (46)	Roadside Barriers
W10	29	29	Roadside Barriers
W11	3 (50)	3 (50)	Building Treatment
W12	3 (50)	3 (50)	Building Treatment
W13	1 (50)	1 (50)	Building Treatment
W14	0 (420)	0 (420)	No Treatment
1E	3	3	Building Treatment
1W	29	29	Building Treatment
2E	8	5	Building Treatment
2W	16	13	Building Treatment
3	0	0	Building Treatment
4	11	11	Building Treatment
5	4	4	Building Treatment
6	0	0	No Treatment
7E	0	0	No Treatment
7W	20	17	Building Treatment
8	86	80	Roadside Barriers
9	84	62	Roadside Barriers
10E*	1	1	Building Treatment
10W*	43	55	Roadside Barriers
11*	25	22	Roadside Barriers
12*	25	28	Roadside Barriers
13*	120	110	Roadside Barriers
14*	140	147	Roadside Barriers
15N*	2	2	Building Treatment

15S*	150	139	Roadside Barriers
16*	58	58	Roadside Barriers
17*	190	181	Roadside Barriers
18*	218	210	Roadside Barriers
19*	270	270	Roadside Barriers
20*	368	368	Roadside Barriers
21*	840	840	Roadside Barriers
22*	315	304	Roadside Barriers
23W*	30	30	Roadside Barriers
23E*	32	28	Roadside Barriers
24*	320	320	Roadside Barriers

Table G-3 – Summary of Cost Effective Barrier Heights for 12 Critical NCAs

NCA		Cost Effective Barrier Height, m			Comment
		WSO	Ramp	Existing	
E1		-	-	3	Assessed Barrier preferred in combination with architectural treatment of potentially affected residences.
E2	A	-	2.5	6.5	Target Barrier is preferred. Existing refers to M5 Motorway.
	B	-	3.5	5.5	Target Barrier is preferred. Existing refers to Beech Road.
	C	-	-	-	<3 houses. No further treatment required.
E5		-	-	-	<3 houses. Architectural treatment preferred.
E7		-	-	-	<3 houses. Architectural treatment preferred.
2E	A	-	-	-	<3 houses. Architectural treatment preferred.
	B	4	-	-	Target Barrier is preferred.
9	A	2	-	3.5	Target Barrier is preferred.
	B	5	-	-	Target Barrier is preferred.
10W	A	-	-	2	Assessed Barrier preferred. Existing refers to Power St.
	B	2.5	-	-	Assessed Barrier preferred in combination with architectural treatments.
17	A	5.5	-	3	Target Barrier is preferred. Existing refers to Quakers Rd.
	B	6	-	-	Target Barrier is preferred.
20	A	4	-	-	Target Barrier is preferred.
	B	-	-	2.5	Assessed Barrier preferred. Existing refers to Sunnyholt Rd.
23W		-	-	-	Barriers and architectural treatment not cost effective.
23E		5.5	-	-	Target Barrier is preferred.
24	A	2.5	-	-	Assessed Barrier preferred in combination with architectural treatments.
	B	-	-	-	Noise levels are predicted to be below existing noise levels.

APPENDIX H

Urban Design Advisory Service's Urban Design Review Report



Proposed Western Sydney Orbital Urban Design Review

Final Report

**Prepared by the Urban Design Advisory Service
for the Development and Infrastructure
Assessment Branch of PlanningNSW**

February 2002

CONTENTS

Introduction

- 1 Summary of UDAS Issues**
- 2 Review of RTA Responses to UDAS Issues**
- 3 Outstanding Issues and Recommendations**

Introduction

The Urban Design Advisory Service (UDAS) was engaged by the Development and Infrastructure Assessment Branch of PlanningNSW (DoP) in February 2001 to provide the Department with an independent assessment of the urban design component of the Western Sydney Orbital (WSO) EIS (Phase 1). UDAS was consequently engaged in November 2001 to provide the Department with an independent assessment of the urban design component of the Western Sydney Orbital Representations Report (Phase 2).

The primary objective of the review is to provide the Department with an independent assessment of the **urban design** component of the WSO proposal to assist in PlanningNSW assessment process and to ensure that cost effective environmental standards are adopted for the project.

The PlanningNSW's project brief identifies two project phases to meet the objectives:

- Phase 1 is a *review* of the relevant parts of the EIS and Working Papers and the *identification of key issues* for discussion with DoP and the RTA.
- Phase 2 is an *assessment and reporting* of the key issues raised in phase 1, and an assessment of the RTA's response from phase 1, and assisting with the preparation of urban design conditions.

This report brings together both review phases into a final report.

The report is divided into three parts as follows:

- Part 1** Summary of the key issues from the UDAS Phase 1 report;
- Part 2** Review of the RTA response to the UDAS issues in the RTA Representations Report; and
- Part 3** Summary of key outstanding issues and recommended actions for the RTA.

The recommended actions form the basis for urban design conditions for the WSO.

1.0 Summary of UDAS Issues

The Following is a summary of the issues raised by UDAS in the Phase 1 WSO Urban Design Review of the Western Sydney Orbital Environmental Impact Statement. The discussion identifies the key issues and provides the justification and reasoning for the recommendations in part 3 of this report.

1.1 Prestons

(a) Issue: the proposal does not allow adequate access across the motorway for pedestrians in the Prestons area

Explanation

The EIS proposal is for the road to be on embankment through this area. The proposal would limit access routes across the WSO to Kurrajong Road and Bernera Road between Camden Valley Way and Hoxton Park Road - a distance of 4km. Kurrajong Road would be an elevated overpass (which is less accessible for pedestrians than an at-grade crossing or underpass) and Bernera Road underpass would provide very poor pedestrian accessibility due to the proposed dual roundabouts.

The EIS proposal would also close the existing Ash and Illaroo Road reservations.

Summary

The proposal would divide and create a barrier within the Prestons Urban Development Program area (also identified in *Liverpool City Council Smart-Growth Strategy* as the Yarrunga commercial and retail area) and thereby impact on accessibility and permeability (severance) in relation to future land uses.

(b) Issue: the proposal would provide no open space connection or pedestrian access under the motorway at Maxwells Creek.

Explanation

The proposal would run parallel with Maxwells Creek from the intersection with the M5 to Liverpool Showground. At that point the motorway would cross the creek on a road embankment. The EIS shows no proposal for a bridge or pedestrian connection at Maxwells Creek. The proposal would thereby sever the potential to develop a regional open space link north along Maxwells Creek from Casula, via Liverpool Showground, to Eloura Nature Reserve in the suburb of Cartwright. This key link is identified in the *Liverpool City Council Smart-Growth Strategy*.

In addition, the motorway on embankment would physically alienate the western portion of the Liverpool Showground open space area from the eastern portion causing alienation of open space.

Summary

The proposal would sever potential regional open space connections as well as have significant physical impacts on open space in the area.

1.2 Cabramatta Creek

(a) Issue: The proposal would impact on access to community facilities and open space

Explanation

In the suburbs of Hinchinbrook and Hoxton Park immediately around where the motorway would be located there is a high concentration of existing and proposed community facilities including public schools, high schools, a TAFE, a community health centre and various community centres and clubs, as well as recreation facilities. The proposal would maintain Hoxton Park Road as the only link between the areas.

The impacts of the motorway on local pedestrian accessibility and permeability would be exacerbated by the proposed closure of local roads:

- Wilsons and Government Roads would be closed near the intersection with Hoxton Park Road thereby reducing local access to and from the Hinchinbrook residential area;
- Illaroo Road reservation would be closed thereby limiting the potential for a local north south link from Hoxton Park Road to Prestons.

Summary

The potential for high quality pedestrian and cycle access in the area would be significantly impacted (severance) by the EIS proposal.

1.3 Hoxton Park Airport

(a) Issue: the proposal would impact on Hoxton Park Airport

Explanation

The cultural significance of the Hoxton Park Airport site has been recently acknowledged through a listing on the Register of the National Estate.

The proposed alignment of the motorway runs along the western edge of Hoxton Park Aerodrome with an interchange at Cowpasture Road. The result is that the existing airport vehicular access, off Cowpasture Road via McIver Avenue (McIver Avenue is proposed to be a cul-de-sac), would be severed by the proposed interchange. The proposed new access road is circuitous and indirect. The height and scale of the proposed interchange and the proposed alignment of the motorway on the western edge of the airport would have visual impacts on the cultural significance of the place.

Summary

- The EIS proposal would isolate Hoxton Park Airport from its surroundings and visually impact on a culturally significant site.

1.4 Cecil Park

(a) *Issue: the motorway is located in the regional open space corridor land*

Explanation

North of Hoxton Park Aerodrome the EIS alignment would cut through the eastern fringe of the regional open space corridor land skirting the western edge of Cecil Hills. Through this area the motorway would climb to Elizabeth Drive through steeply undulating landforms and across a number of creeks creating a series of large road cuttings and fill embankments. Just to the north of Elizabeth Drive the proposal would cut through the top of prominent hill creating a significant road cutting. The proposed EIS alignment would have significant impacts on the open space area including:

- sever impacts on the amenity and character of the regional open space corridor due to the scale and number of cuttings and embankments and other impacts of the road such as noise;
- limit pedestrian access through the proposed regional open space corridor north to the Western Sydney Regional Park on the other side of Elizabeth Drive;
- alienate a portion of open space to the east of the motorway and thereby reduce the overall area of the park;
- impact on the amenity of the upper reaches of Hinchinbrook Creek including the farm dam;
- restrict pedestrian and cycle movement and access within the park generally particularly east west movement; and in addition
- the alignment would have significant impacts on the residential amenity of the Cecil Hills area due to the high visibility and visual impacts of the proposed cuttings and embankments.

The proposal would incorporate a number of features to mitigate the impacts including a bridge over the farm dam, a land bridge, a pedestrian underpass and a pedestrian bridge. However these are not considered adequate to address the impacts fully.

The EIS considers a number of alternative alignments through this area namely the western alignments, the central alignment and the eastern alignment. It is understood through discussions with DUAP Sydney Region West Branch that the DUAP preferred alignment is the western alignment as it maximises the main body of the park, minimises visual impacts and minimises impacts on north south pedestrian/cycle links across Elizabeth Drive. It appears that the western alignment was not preferred due to the economic costs related to a longer route.

Summary:

Even though some mitigating elements are included the proposal would have severe impacts on open space amenity and character, regional open space connections and residential amenity. This section of the WSO is one of the most difficult sections of the entire route because:

- the motorway would not be located within an existing road corridor;
- the motorway would traverse scenic and steep topography;
- the motorway would impact on pedestrian and cycle access in the park;
- the motorway would cut through a long established regional open space corridor; and
- the proposal would be in close proximity to an established residential area with high expectations of rural views/outlook to the west.

1.5 Cecil Park North

(a) Issue: The proposed motorway cutting would impact on open space amenity, sever regional open space links, and have high visual impacts

Explanation

At the south-western corner of the WSRP, between Elizabeth Drive and Villiers Road, the motorway would cut through a hill top and create a road cutting in excess of 25m. The hill is a significant visual element in the landscape as it is one of the highest points in the vicinity being on the ridge that forms the headwaters of a number of major catchments including: Ropes Creek, Eastern Creek, Prospect Creek Orphan School Creek and Cabramatta Creek.

The hilltop offers a significant recreational experience including views of the surrounding area. The motorway would impact significantly on the parks amenity and character. In addition the cutting would be visible from a long distance and may have regional visual impacts that have not been assessed in the EIS.

The road alignment would also alienate a portion of the WSRP to the west of the motorway around the headwaters of Ropes Creek. This would also sever the potential regional open space link along Ropes Creek connecting to the WSRP. The motorway proposal makes no provision for a link to the west from the main body of the WSRP nor for the reduction of the visual impact of the cutting.

Summary

The visual impacts of the road proposal in this area have not been assessed adequately in the EIS.

(b) Issue: motorway would create a barrier between the Western Sydney Regional Park (WSRP) and future development along the western edge of the park

Explanation

The EIS proposal would be located on the eastern side of Wallgrove Road within the WSRP. The topography of the area is undulating and as a result the motorway would be on fill embankments and in road cuttings. The motorway would provide vehicle entry points from Wallgrove Road to the Regional Park at distances of between 1 and 1.5km at existing roads - Villiers Road, Saxony Road, the Horsley Drive and Chandos Road. Other local roads that currently enter the WSRP would be closed such as Redmayne Street and Cobham Street (unformed). While the EIS proposal would be satisfactory for vehicular traffic access the intervals are not adequate for pedestrian and cycle access to a regional open space area.

Summary

The proposal would impact on the future pedestrian and cycle accessibility in relation to the Western Sydney Regional Park. In order to improve potential access it is desirable to achieve access points to the WSRP for pedestrians and cyclists at approximately 500m – 1000m intervals.

1.6 Horsley Park

(a) Issue: impact of M4 interchange

Explanation

The intersection of the WSO with the M4 would be located in gently undulating open rural land. It is proposed to accommodate all movements between the two motorways using a typical interchange

arrangement with the addition of a large "roundabout" in the centre. This, it is assumed, is to avoid traffic lights and allow traffic to maintain higher speeds. The result is that the interchange is designed with three layers of vehicular movements. Where the WSO crosses the M4 the bridge height would therefore be twice the height of a typical interchange. The photomontage in the EIS does not correctly convey the scale and character of the interchange. This is most notable at the bridge where the WSO crosses the M4 because the shadows do not indicate the true bridge height.

In addition the EIS proposes considerable earthworks (fill) to create the necessary levels. The alignment also impacts on a significant stand of vegetation to the north of the M4.

The impacts of the interchange further exacerbated by the proposal to maintain Wallgrove Road as a separate corridor to the west.

Summary

The EIS proposal would have significant impacts on views and the visual character of the locality as well as impacts on significant vegetation. The EIS does not properly assess these impacts. Examples of significant views include:

- Views from the Western Sydney Regional Parklands;
- The view west driving along the M4 to the treed hill top where Wonderland is located; and
- The view west to the Blue Mountains from the M4.

(b) *Issue: impact on the amenity of open space link along Reedy Creek*

Explanation

The motorway is proposed to cross Reedy Creek (near the intersection of Old Wallgrove Road with Wallgrove Road) at a low level with a short bridge. Reedy Creek is a major tributary of Eastern Creek and forms a potential future open space link from the western Sydney open space corridor to Horsley Park.

Summary

While the proposal would potentially allow access at Reedy Creek the amenity of that access is of concern. The preferred approach would be to provide a longer bridge at a higher level to increase the amenity of the future open space link along Reedy Creek.

1.7 Eastern Creek to Glendenning

(a) *Issue: the proposal would divide and create a barrier in the area*

Explanation

The proposal would limit east west access across the motorway in the Rooty Hill, Plumpton and Glendenning residential areas. The proposal provides for five crossings over a distance of approximately 6 kilometres (between the Great Western Highway and Richmond Road), the proposal would also close a number of local roads such as Mavis Street, Dunsmore Street, Plumpton Street, and Simms Road. In addition, the quality and nature of the proposed crossings would vary widely in terms of pedestrian accessibility and permeability, notably:

- Woodstock Avenue would be an elevated overpass reducing pedestrian permeability;
- Power Street would be a major interchange reducing pedestrian accessibility;
- Florence Street is closed and replaced with an elevated pedestrian bridge offering good access; and

- Lamb Street and Eastern Road are at grade overpasses (motorway in cut) offering good pedestrian access

The net result is three adequate or good quality pedestrian crossings over a distance of six kilometres two of which are within 400 metres of each other at the northern end of the area.

Summary

The proposal would impact significantly on existing and future pedestrian access and permeability in the area as the distances proposed between pedestrian crossing points would be too great. The area is a developing residential area with large tracts of open space as well as business and industrial uses, and the motorway would form a barrier to pedestrian movement. In addition the proposed crossings would not all provide high quality pedestrian crossings.

(b) *Issue: the proposal would alienate a portion of open space from the Eastern Creek corridor*

Explanation

The motorway alignment south of Eastern Road would run along the eastern edge of the Rooty Hill Reserve and Morreau Reserve, cross the alignment of Telegraph Road and follow approximately Belmore/Beggs Roads to connect with the Great Western Highway. The result is that a large parcel of land between Rooty Hill Road and the WSO, which is identified as part of the Western Sydney Regional Parklands corridor, is separated from the main part of the corridor to the east of the alignment. In this area a number of existing local roads would be closed including Church Street, Beggs Road and Belmore Road. The EIS does not propose any pedestrian connections across the motorway to mitigate the impact. The only link across the Motorway is at Eastern Road.

Summary

The WSO would isolate a large portion of land from the western Sydney regional open space corridor impacting on open space links.

1.8 Dean Park to Eastern Creek Corridor

(a) *Issue: impacts on potential local and regional open space connections and character and amenity of open space*

Explanation

The motorway would pass under the Symonds Road overpass across the Breakfast/Eastern Creeks floodplain and under the Quakers Hill Parkway interchange. The proposal would pass across the floodplain at a low level and in part on-grade (it is not clear from the EIS at what level). Impacts would therefore be significant, particularly in terms of:

- reduction in the amenity and possible partial severance of the potential north south open space links along the creek lines; and
- the degradation of the landscape and visual quality, including loss of views and existing trees, within the Breakfast Creek/Eastern Creek floodplain generally.

1.9 Quakers Hill to Kings Langley

(a) Issue: impacts on informal pedestrian routes across motorway corridor

Explanation

The proposal would limit north south access between Quakers Hill Parkway, Quakers Hill and - Seven Hills Road, Baulkham Hills - a distance of approximately 8km - to two road crossings, one at Railway Parade, Quakers Hill the other at Sunnyholt Road, Glenwood, and three pedestrian underpasses. While it is acknowledged that few formal links exist connecting across the road reservation there is evidence, from air photographs, of informal pedestrian access across the reservation that would be severed by the motorway.

The following impacts on pedestrian accessibility would result from the motorway proposal in this area:

- The Quakers Road overpass would result in some loss of pedestrian accessibility when compared with the existing situation;
- the proposed closure of Eastern Road would impact on local accessibility;
- The proposed interchange at Sunnyholt Road would impact on pedestrian/cyclist accessibility when compared to the existing situation; and
- The proposed culverts at Caddies Creek/Lady Penrhyn Park, Pearce Reserve and Troubadour Park/Toongabbie Creek would have significant implications for pedestrian amenity and safety.

Summary

The proposed pedestrian and cycle links in this area are either inadequate in terms of safety and amenity or are insufficient in number to cater for links between suburbs. Of particular concern is the:

- Proposed closure of Eastern Road;
- The area between Richmond Road and Sunnyholt Road where there are no proposed pedestrian crossings - a distance of 2-3kms;
- The area between Sunnyholt Road and Seven Hills Road where the motorway would cross a number of creeks on fill embankment and where drainage culverts are to be used for pedestrian links.

1.10 West Baulkham Hills

(a) Issue: impacts on the landscape quality of Toongabbie Creek

Explanation

The EIS motorway proposal would pass under Seven Hills Road and descend to Toongabbie Creek crossing at a low elevation passing under the Abbott Road Link and then joining the M2. The road would cross the creek approximately 10m above ground level (although difficult to determine accurately from EIS) and at this level the road would impact on the existing environment and result in the loss of existing trees and native vegetation. These impacts are further exacerbated by the cumulative impacts on Toongabbie Creek as a result of the M2 and the WSO.

Summary

The motorway proposal would impact on the environmental quality of the Toongabbie Creek open space corridor and on existing vegetation.

1.11 Overall Route

(a) Issue: *The EIS document does not provide concept details relating to the built elements of the proposal*

The EIS does not address in any detail the built and landscape elements of the proposal. The main areas of concern include the proposed noise walls, road and pedestrian bridges, embankments and road cuttings and the electronic ticketing gantry structures.

2.0 Review of RTA Responses to UDAS Issues

The following discussion summarises the RTA's response to the UDAS issues presented in Part 1 of this report. The RTA provide response to a wide range of public representations in their Representations Report which follows on from the EIS and makes modifications to the EIS based on representations and other design considerations.

2.1 Prestons

RTA responds to the issue of *severance in the Prestons area* in the Representations Report under *Section 3.11.3 Pedestrians - B Issue additional pedestrian access points*.

The RTA response to the UDAS issue is that there are crossings proposed for Maxwells Creek (which were not shown in the EIS), Bernera Road and Cabramatta Creek.

RTA also responds to the issue of *no provision for pedestrian access under the motorway at Maxwells Creek* in the Representations Report under *Section 3.3.2 Impacts on current land uses – D Issue of open space and Section 3.5.5 Aquatic and Riparian ecosystems – A Issue creek and river crossings*.

The Representations Report now shows the road on a bridge over Maxwells Creek and the issue is considered partially addressed. The size and type of bridge requires further resolution.

The RTA do not respond to the UDAS comments regarding the closure of Illaroo Road and Ash Road reservations nor to the comments noting the poor pedestrian conditions of the Bernera Road and Kurajong Road crossings. This issue is outstanding.

2.2 Cabramatta Creek

The RTA responds to the issue of *access to community facilities and open space* in the Representation Report under *Section 3.3.2 Impacts on current land uses - Issue A Schools and other community facilities*.

The RTA do not respond to the UDAS concerns regarding:

- the closure of Illaroo Road, Wilson Road and Government Road; nor
- minimising road on embankment and maximising road on viaduct/structure in the area to enhance permeability

This issue is outstanding.

2.3 Hoxton Park Airport

The RTA responds to the UDAS issue of *impacts on Hoxton Park Airport* in the Representations Report under *Section 3.4.1 Public Property - B Issue Hoxton Park Aerodrome and Section 3.6.6 Non Indigenous Heritage – C Issue Hoxton Park Aerodrome*.

The RTA has responded to concerns regarding access to Hoxton Park Aerodrome by redesigning Cowpasture Road as an underpass to the WSO thereby improving access to the airport as well as pedestrian/cycle access in the area.

This issue is adequately addressed.

2.4 Cecil Park

(a) The RTA has responded to issues concerning the *impacts of the motorway on the regional open space corridor land* under *Sections 3.4.1 Public Property - A Issue Western Sydney Regional Park, 3.1.1 Suggested changes to route alignment- A Issue Change route alignment to avoid property and 3.3.2 Impacts on current land uses – D Issue of open space of the Representations Report*.

The RTA provide responses to concerns raised in this area in relation to *visual impacts* in the Representations Report under *Section 3.4.1 Public Property - A Issue Western Sydney Regional Park and 3.5.7 Design Issues – D Issue Elizabeth Drive Interchange*.

The RTA has responded to concerns in this area particularly from residents of Cecil Hills by proposing to realign the road to be approximately 400 metres to the west of the EIS alignment. While the new alignment may reduce the perceived impacts on the residential area it increases the open space impacts by running closer to the middle of the open space corridor.

The RTA has indicated in the Representations Report that the option for a road tunnel through this area was not viable. The main reasons the RTA give for not adopting a tunnel relate to the cost of a tunnel, the perceived social and environmental impacts of a stack and some design implications near Elizabeth Drive.

The RTA comments are not considered adequate. As noted in the UDAS Stage 1 report the tunnel option must be compared with the EIS western alignment as these are the only two options that have the potential to adequately resolve the conflicting issues in this area. And both are the more expensive options therefore the main reason for the current option is to minimise costs.

Subsequent discussions with the RTA regarding the alignment in this area have concentrated on what measures could be used to mitigate the impacts of the road. The discussions have concentrated on the visual impacts of the road embankments and cuttings. PlanningNSW engaged an independent consultant to prepare detail sections through Cecil Hills and the WSO to assist with the review. The sections confirm that the road will have an embankment between 15 and 20 metres high within about 300 metres of houses in Cecil Hills.

A meeting was held with the RTA to discuss the concerns. The results of the meeting are as follows:

- general agreement that the route shown in the Representations Report is the best without incurring major extra costs to the project.
- The impacts of the WSO on the open space and residential areas were acknowledged and that the RTA will be required to prepare an Urban Design and Landscape Strategy to address the impacts and to also consider some community offsets.
- The RTA agreed to address concerns regarding pedestrian access across the WSO.

2.5 Cecil Park North

The RTA respond to UDAS concerns regarding *access to the Western Sydney Regional Park (WSRP)* in the Representations Report under *Section 3.4.1 Public Property - A Issue Western Sydney Regional Park* and *4.11.3 Pedestrians – A Issue general comments*.

The Representations Report indicates that pedestrian access would be made available at Redmayne Road. However close inspection of the drawings shows the proposal is to combine a drainage structure within a pedestrian underpass in the vicinity of Redmayne Road. The proposal is not adequate and requires reconfiguration so that the pedestrian access is on the alignment of Redmayne Road.

In addition the following issues have not been addressed:

- The RTA does not respond to UDAS concerns regarding the closure of Cobham Street reservation.
- The RTA does not respond to the concerns regarding the location of the Villiers Road and Saxony Road underpasses.

2.6 Horsley Park

The RTA address the UDAS issues regarding *impacts of M4 interchange design* in the Representations Report under *Section 3.1.3 Design of Specific Interchanges – D Issue design of M4 Interchange*.

In the Representations Report the RTA propose to modify the design of the interchange:

- the new design incorporates the use of tunnels and fly overs;
- it appears to reduce the bulk of the interchange through a significant reduction in the amount and height of fill embankments; and
- Wallgrove Road is integrated within the intersection.

Overall it is a more elegant resolution than the EIS proposal and the issue is addressed adequately.

The RTA respond to the UDAS issue of impacts on the *amenity of open space link along Reedy Creek* in the Representations Report under *3.3.2 Impacts on current land uses – D Issue of open space*.

The response is not considered adequate. The redesign of the Old Wallgrove Road/Wallgrove Road intersection proposed in the Representations Report has increased the impacts along Reedy Creek. The EIS proposed one road bridge the current proposal is for four road bridges.

2.7 Eastern Creek to Glendenning

The RTA do not respond directly to the issues raised by UDAS concerning *severance and the alienation of a portion of open space* from the Eastern Creek corridor. Some indirect reference is made to the issues in the Representation Report under *Section 3.11.3 Pedestrians – B Issue additional pedestrian access points*. As a result the RTA do not address UDAS concerns regarding the severance of local street access at Mavis Street, Dunsmore Street, Plumpton Street and Simms Road.

The RTA propose minor improvements to east-west connectivity in the area:

- Woodstock Avenue is proposed to be an underpass; and
- Power Street is proposed to be a half interchange.

- The RTA provides no response to the issues regarding *open space links* across the Motorway in the area between The Great Western Highway and Eastern Road. Particularly concerns regarding the closure of Church Street, Beggs Road and Belmore Road.

A number of issues remain outstanding.

2.8 Dean Park to Eastern Creek Corridor

The RTA do not address the issues raised by UDAS regarding *impacts on potential local and regional open space connections and character and amenity of open space* in the Representations Report. A response was given by the RTA under *Section 3.3.2 Impacts on Current Land Uses – D Issue Open Space* however the response misinterpreted the issue.

Subsequent discussions with the RTA have indicated that raising the height of the WSO over Eastern Creek would require the WSO to go over Quakers Hill Parkway and Symonds Road. The RTA has indicated such a change would significantly increase the amount of fill required (creating a fill imbalance) and would also have impacts on a number of endangered ecological communities.

The issue is partially addressed. Further consideration required for minimising fill embankments within the flood plain for views and access.

2.9 Quakers Hill to Kings Langley

The RTA addresses the issue of impacts on *pedestrian routes across motorway corridor* in the area under *Section 3.11.3 Pedestrians – B Issue additional pedestrian access points*.

The main reason given by the RTA for not providing a greater number of crossings along the length of the motorway in this area is that the road is within an existing road reserve and that the adjoining suburbs have been designed with the future road in mind. Discussions with the RTA and site inspection by UDAS of subdivision pattern shows there is in fact very limited opportunities for safe pedestrian links across the motorway because of the dominance of back fences along the road reserve.

The RTA have also responded to the UDAS recommendations by modifying the EIS proposal to retain the Eastern Road crossing in Quakers Hill

Both issues have been adequately addressed.

The RTA have not responded to the UDAS concerns regarding the open space links at Lady Penrhyn Park and Pearce Reserve Kings Langley. These crossings require longer separated bridges for access, views and safety. This issue is outstanding.

2.10 West Baulkham Hills

The RTA do not respond directly to the UDAS issue *concerning impacts on the landscape quality of Toongabbie Creek*. However, other respondents raised similar issues which are addressed by the RTA

in the Representations Report under *Section 3.5.2 Further Assessment required – B issue areas that require additional assessment*.

The RTA response is generally adequate with regard the UDAS issues.

2.11 Overall Route

In response to the UDAS issue regarding design proposals for built elements of the WSO the RTA provided further information. The document provided by the RTA is *Appendix 22 – Urban Design and Landscape Specification for the Western Sydney Orbital*. The document was prepared by Jackson, Teece, Chesterman, Willis (JTCW) in Association with Bruce Mackenzie Design and Richard Goodwin.

UDAS reviewed the document and found the proposals to be of a very high quality. Of particular note:

- The noise wall concept is designed by a well-known Sydney-based artist. The proposal is highly innovative
- The landscape design proposal is thorough and responds to the changing environments that the WSO passes through
- The proposed bridges are of a high architectural quality. The bridge design is careful to integrate all elements of the bridge including abutments, screen elements, guard rails, noise walls among others.

This is addressed. However it will be important to ensure that all components of the Urban Design and Landscape Specification are carried through from concept to the final built outcome and that the built outcome is consistent in detail and intent with the concept proposals.

3.0 Outstanding Issues and Recommendations

The following is a summary of the UDAS issues that have not been addressed in the RTA Representations Report or in subsequent discussions with the RTA. Recommendations are provided which may form the basis of Urban Design Conditions.

Issue A

The WSO proposal does not have a strategic approach to pedestrian access. Pedestrian crossings are ad hoc with no detailed analysis to determine pedestrian access requirements for the project.

Recommendations

Prepare Pedestrian Access Strategy identifying key pedestrian origins and destinations adjacent to the route of the Project such as:

- residential and commercial/industrial development ;
- public facilities such as educational, community and recreational facilities;
- public transport nodes;
- the appropriateness of existing pedestrian access points across the WSO to cater for demand;
- the need for additional access points across the WSO;
- appropriate urban design of access points, pathways, landscaping, lighting and signage; and
- safety and security issues.

Issue B

The proposed road alignment through the Cecil Hills area has severe impacts on the regional open space corridor as well as visual impacts for the Cecil Hills' residents and pedestrian access impacts related to the Regional Parklands.

Recommendation

The RTA required to prepare an urban design and landscape strategy for the affected area. The Strategy shall include:

- measures to minimise the visual impacts of the WSO to residents of Cecil Hills including tree planting or other landscape measures;
- consideration of noise barriers;
- appropriate access across the WSO including the consideration of width, length and treatment for any overpasses or underpasses;
- the consideration of Cecil Hills community offsets including compensatory purchase of land and the provision of community or recreation facilities; and
- consideration given to an overall strategies for the Regional Parklands.

Issue C

Severance caused by elevated road on embankment and closure of local roads in the area between Kurrajong Road and Cowpasture Road.

Recommendation

The road should be designed to be as open and permeable as possible in this area to enhance future development. The road is currently a wall dividing the Prestons area into two parts. To this end the road should be designed to:

- minimise road embankment and maximise road on viaduct/structure in the area;
- Retain existing local streets links including Illaroo Road, Wilson Road, Government Road and Ash Road reservations and allow for future local roads;
- Retain visual connections under the road; and
- Improve pedestrian conditions at proposed interchanges at Bernera Road and Kurrajong Road crossings.

Issue D

Severance caused by closure of local streets in the Glendenning area

Recommendation

Retain all local street crossings including Mavis Street, Dunsmore Street, Plumpton Street and Simms Road.

Issue E

Location, design and quality of access points to Western Sydney Regional Parklands

Recommendations

- Relocate Saxony Road/Wallgrove Road intersection to align with Abbotsbury Road;
- Realign Villiers Road, away from Ropes Creek, to intersect with Wallgrove Road at Alaine Place as an overpass. Maintain bridge at Ropes Creek for future pedestrian access;
- Redesign of intersection at Old Wallgrove Road to reduce impacts and improve open space linkage along Reedy Creek; and
- Retain local street links including Redmayne Road, Cobham Street, and either Church Street or Beggs/Belmore Road.

Issue F

Inadequate open space links at major creek crossings

Recommendation

Improve the open space links in the following locations:

- Lady Penrhyn Park and Pearce Reserve, Kings Langley;
- Troubadour Park/Toongabbie Creek;
- Maxwells Creek, Prestons; and
- Reedy Creek, Eastern Creek

These crossings require longer bridges (a minimum of 20 metres wide) with separated carriageways for access, views and pedestrian safety.

Issue G

The impacts of fill embankment within the Breakfast Creek/Eastern Creek corridor between Quakers Hill Parkway and Symonds Road.

Recommendation

Construct bridge across the area avoiding fill embankments.

APPENDIX I

Development Control Plan No. 1 (SREP 31)

Development control plan No. 1

– Interim regional parklands management

1. Introduction

Where does this plan apply?

This Development Control Plan applies to land shown edged heavy black and coloured green on sheet 1 of the map. This land is referred to in this plan as the Regional Parklands. It is in Blacktown, Fairfield and Liverpool local government areas.

What environmental planning instrument does this plan relate to?

This plan relates to Sydney Regional Environmental Plan No.31 — Regional Parklands.

What is the purpose of this plan?

This plan provides further details on the matters covered in Sydney Regional Environmental Plan No. 31 — Regional Parklands — clauses 7(2), 12 and 13.

2. Principles and strategies

What will the consent authority consider under clause 12 — matters to be taken into consideration?

This section will help you to satisfy the matters to be considered under clause 12. These matters are stated here as principles with accompanying strategies. The consideration of the consent authority under clause 12 cannot, however, be assumed to be limited to these strategies;

PRINCIPLE 1. Protect and enhance the natural systems of the parkland.

PRINCIPLE 2. Conserve and enhance remnant bushland to ensure protection of biodiversity, threatened species, populations and ecological communities and areas of environmental importance.

PRINCIPLE 3. Conserve and enhance watercourses and riparian areas.

STRATEGIES

- Locate all development in areas that are already cleared
- Ensure that the proposal is consistent with any adopted Recovery Plan for threatened species, populations or ecological communities
- Conserve bushland and habitat, giving priority in design, development and management to retention of bushland
- Maximise the use of locally indigenous native species propagated from local plant and seed stock in all revegetation and landscaping
- Ensure planting mix mirrors local species mix and supports revegetation of the naturally occurring ecological communities of the site.

- Retain and/or revegetate a continuous 100 metres width of vegetated riverine corridor along all watercourses
- Ensure bushland areas contribute to the conservation of compact, continuous bushland areas rather than smaller, thin areas, and connect fragmented bushland areas to create larger and more compact habitat areas
- Incorporate buffer areas free of disturbance or degrading influences, such as increased/ altered soil nutrient or run-off levels, between the development and any bushland
- Incorporate a bushland buffer on all sites in the Regional Parklands adjoining Kemps Creek Nature Reserve and the proposed Prospect Nature Reserve.

PRINCIPLE 4. The diversity and quality of recreation uses in the Regional Parklands reflects the changing and diverse needs of existing and potential users.

STRATEGIES

- Ensure recreational and community facilities add to the range of facilities available within the region and do not duplicate facilities already available within the Regional Parklands or adjoining areas
- Design facilities to be flexible and able to be used by different groups within the community for different purposes
- Design and operate community uses to support use by multiple groups within the community and not for the exclusive use of one group
- Accompany all proposals for new and expanded recreational facilities with Access Plans indicating access to, and within, the site by vehicles, pedestrians, cyclists and public transport, and indicating how the accessibility of the site to all sectors of the community will be maximised
- Consider the needs of the local community regarding access to facilities from the surrounding areas, and reflect these needs in all proposals.

PRINCIPLE 5. Develop a high degree of visual quality, continuity and identity throughout the Regional Parklands, and reinforce the visual break the Regional Parklands provides within the urban area.

STRATEGIES

- Landscape and manage land in visually significant and prominent locations, including land adjoining arterial and sub-arterial roads and elevated land, in a way which supports the presentation of a landscape free of structures
- Ensure that all structures are lower than the height of the tree canopy
- Ensure that the ridgeline is free of large structures and the treeline is maintained
- Revegetate moderate to steep slopes.

PRINCIPLE 6. Establish a biodiversity and pedestrian or cyclist movement corridor linking recreational areas and areas of environmental importance.

STRATEGIES

- Site management plans, which must be considered for all development in the Regional Parklands under clause 13 of SREP No. 31, should include strategies to support and maintain ecological and recreational linkages through the Regional Parklands
- All developments should seek to link to pedestrian and bicycle paths that are either within the Regional Parklands or adjacent urban areas, especially where they link to adjoining residential areas and recreational facilities with the Regional Parklands
- Pedestrian and bicycle paths should reflect the routes indicated in the NSW Government's *Action for Bikes Bikeplan 2010* and any relevant council recreational or bicycle plans. Wherever possible, these routes should be implemented.

PRINCIPLE 7. Improve long-term Regional Parklands management and establish appropriate management systems.

STRATEGIES

- Revegetate creeklines to create good ecological status, control erosion, filter nutrient run-off and re-establish biodiversity links
- Maintain and reinforce cultural plantings of native or exotic vegetation only where it is necessary to reinforce the visual character of the setting or exclude potentially invasive species
- Protect habitat and remnant vegetation from degradation caused by inappropriate use, encroachment of invasive plants, predation by feral animals, inappropriate fire regimes and grazing.

PRINCIPLE 8. Ensure all development has minimal adverse impact.

STRATEGIES

- Consider and ameliorate the impacts of activities in the park on surrounding residential areas, particularly by infrequent but large-scale events
Note: A scheduling strategy will be required for uses that incorporate large-scale, occasional events to ensure that schedules reflect the ability of the site to recover from the impact of these events
- Protect uses in the Regional Parklands from the potential noise, visual and traffic impacts of the proposed Western Sydney Orbital
- Ensure traffic generated by uses within the Regional Parklands has minimal impact on the surrounding residential areas, and where impacts cannot be avoided, take steps to reduce its impact
- Construct adequate soil erosion control structures on-site before other work begins. Maintain these structures throughout all stages of development
- Phase development to minimise the disturbed area exposed at any time
- Minimise the use of hard surfaces. Ensure car parking areas use surfaces that allow for penetration of water and minimise run-off.

PRINCIPLE 9. Limit vehicle access points.

STRATEGIES

- Create no new through traffic routes
- Locate parking areas on the edge of the Regional Parklands and link them to activity centres with pedestrian and cycleways
- Encourage links over main roads and design them to support pedestrian movement and flora and fauna corridors.

PRINCIPLE 10. Consider the maintenance of existing utilities within the Regional Parklands.

STRATEGIES

- Ongoing liaison is required with utility providers
- Routine operations on electricity infrastructure to be carried out in accordance with *Procedures for power line maintenance in lands administered by the NPWS*, Electricity Association of NSW, 1994.

PRINCIPLE 11. Protect the quality of water in bulk supply infrastructure.

STRATEGIES

- Surface water management of proposals adjacent to the upper canal must ensure that run-off does not enter the canal easement.

3. **Site management plans submitted in accordance with clause 13**

When is a site management plan required?

The consent authority must consider, under clause 13, a site management plan which details how the development will contribute to the management, conservation and restoration of the land on which it is proposed to be carried out, before granting development consent.

Requirements for a site management plan to be considered under clause 13.

The aim of this site management plan is to demonstrate how the proposal will support the maintenance, management, conservation and restoration of the site. Each development located within the Regional Parklands must aim to retain all bushland and undertake management which will conserve and augment existing bushland, ensuring that each part of the Parklands contributes to the development of the Parklands as a biodiversity corridor. The site management plan must also detail ongoing management to maintain the natural land systems to the satisfaction of the consent authority.

What is the process for considering a site management plan required under clause 13?

A site management plan is submitted with the development application. No additional fee is involved in consideration of this management plan.

The site management plan should include:

- 1) A comprehensive survey and mapping of all vegetation** on the site including an assessment of the condition and identification of relevant location characteristics such as soil character, upstream or downstream location, level of inundation. This survey will help develop measures aimed at maintaining and restoring all areas of bushland on the site.
- 2) An assessment of site condition** prior to the proposal, including photographic documentation of the condition of the bushland and areas requiring restoration and special attention.
- 3) Details of ongoing site management** which will maintain the natural ecological systems, conserve existing bushland and increase the area revegetated. Conservation of natural systems will reduce future maintenance requirements.

4.2 Management unit B — between main western railway and M4 motorway

Constraints

- extensive areas within the Probable Maximum Flood level
- known high archaeological significance
- construction of Philip Parkway and/or the Western Sydney Orbital will divide the Regional Parklands separating Morreau Reserve from John Acquilina Reserve
- much of the eastern side is isolated from residential areas and adjoins industrial areas
- ability to service area is limited, particularly provision of reticulated sewerage
- remediation of contaminated lands may be required.

Opportunities

- flat land with potential to accommodate structured recreation facilities, for example Olympic softball facility
- landscape buffer and visual edge to urban areas
- potential Regional Park site on former Telstra/OTC land
- cultural significance of the Rooty Hill in Morreau Reserve.

Management objectives

- provide a mix of recreational opportunities
- act as landscape buffer
- protect and restore riparian areas
- conserve areas of known high archaeological significance
- conserve landscape values of Telstra/OTC land.

Suitable uses

- recreation uses attracting users from a wide area travelling either by rail or road
- low-scale structures and low to moderate noise impact
- limited hard surfaces
- uses compatible with flood affected areas.

4.3 Management unit C — between M4 motorway (west of Prospect Reservoir) and Chandos Road

Constraints

- much of the area around Eastern and Reedy creeks is within the Probable Maximum Flood level
- limited access from Wallgrove Road
- existing long-term uses including waste management facility and extractive industry
- potential contamination of sites from former and continuing uses may require remediation
- narrow riparian area
- limited opportunities to provide pedestrian/cycle link because of width of Regional Parklands
- further reduction in width of Regional Parklands possible with construction of the proposed Orbital Road and access ramps

- extensive areas with known or potential archaeological significance
- area north of Eastern Creek Waste Management Centre — includes locally rare and sensitive landscape.

Opportunities

- high accessibility with access from Horsley Road
- potential pedestrian link under M4 Motorway
- separation from residential areas.

Management objectives

- group and limit noisy and higher impact uses
- develop a visual buffer
- protect and restore riparian areas
- develop pedestrian and vegetative link along creekline and under/over M4 Motorway and Great Western Highway
- protect sensitive landscape north of Eastern Creek Waste Management Centre.

Suitable uses

- recreation uses with limited structures
- consideration of higher profile uses with parking.

4.4 Management unit D — north of Prospect Reservoir

Constraints

- limited pedestrian access
- motorway along northern boundary with no access
- proximity to Prospect Reservoir and Cumberland Plain Woodland remnant
- European cultural heritage significance of old highway alignment and Royal Cricketers Arms.

Opportunities

- vehicle access from Reservoir Road
- links to Prospect Reservoir for vegetation and pedestrian movement
- improve visual contribution to buffer from M4 Motorway.

Management objectives

- conserve remnant bushland
- reinforce bushland buffer around remnant Cumberland Plain Woodland in catchment of Prospect Reservoir
- strengthen role as a visual buffer.

Suitable uses

- recreation and community uses requiring small, low scale buildings sited outside of the catchment of Prospect Reservoir
- limited hard surfaces.

Suitable uses

- recreational and community uses of small scale requiring minimal built structures and earthworks
- pedestrian and cycle links to adjoining residential areas
- recreation and community uses that attract users from adjoining residential areas
- market gardening and rural residential uses

4.9 Management unit I — south of Fifteenth Ave

Constraints

- limited flat areas
- limited access points from east through residential areas and from west over water supply canal
- remediation may be required for some sites e.g. sites used as market gardens.

Opportunities

- proximity to developing residential areas
- good views and elevated sites
- some significant remnant vegetation
- heritage value of canal and some landscape features
- close to Camden Valley Way and Cowpasture Road.

Management objectives

- maintain vegetated ridgeline and slopes to support role as a visual buffer
- provide regional recreational opportunities to developing residential area
- retain and conserve remnant bushland.

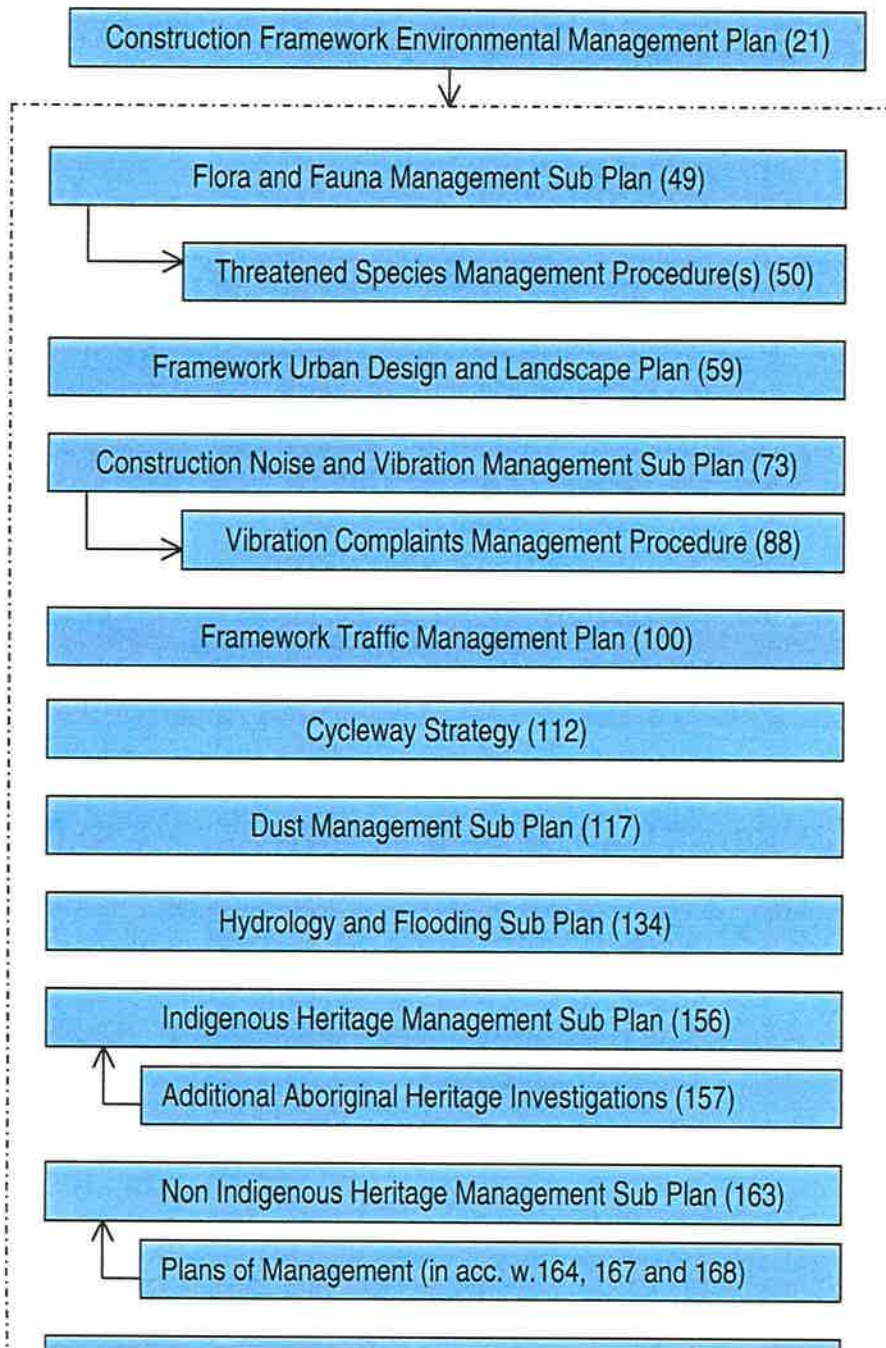
Suitable uses

- recreational and community uses of small scale requiring minimal built structures and earthworks
- uses that have a local catchment, attracting users from adjoining areas
- unstructured recreational areas, picnic facilities and walking trails.

APPENDIX J

Environmental Management Planning Structure

Construction Stage Environmental Management Planning

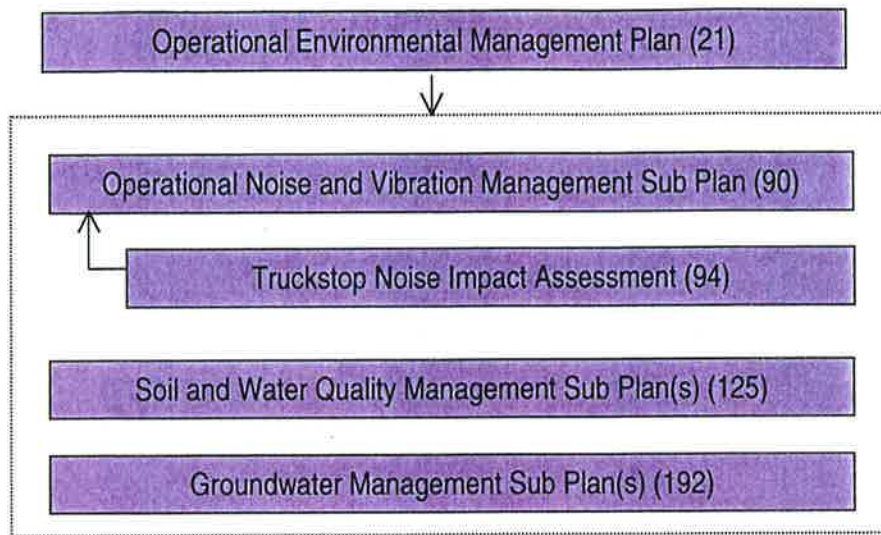


Construction Stage Environmental Management Planning (Cont)

Individual Planning and Reporting Requirements

Ancillary Infrastructure Impact Assessment (20)	→	12 months prior to construction
Pedestrian Access Strategy (109)		1 months prior to construction
Pre-Construction Compliance Report (4)	→	Prior to commencement of construction
Community Involvement Plan (12)	→	Prior to commencement of construction
Report on Preferred Southern Floodplain Design (32)	→	Prior to commencement of construction
Road Dilapidation Report (105)	→	Prior to commencement of construction and once construction is complete
Contamination Investigation Report (184)	→	Prior to commencement of construction

Operational Environmental Management Planning



Individual Planning and Reporting Requirements

