## NATIONAL CAPITAL AUTHORITY

**GUNGAHLIN DRIVE EXTENSION** 

EASTERN AND WESTERN ALIGNMENTS COMPARATIVE EVALUATION AND IMPACT ASSESSMENT REPORT AUSTRALIAN INSTITUTE OF SPORT PRECINCT

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### **GLOSSARY OF TERMS AND ABBREVIATIONS**

AIS	Australian Institute of Sport
ASC	Australian Sports Commission
DB(A)	Sound pressure level in decibels with an A weighting filter which has a similar frequency response as the human ear
EPA	Environmental Protection Authority
GDE	Gungahlin Drive Extension
GETS	Gungahlin External Travel Study
L <sub>A10</sub>	Noise level exceeded for 10% of the time period and is measured in terms of dB(A)
L <sub>A10(18hr)</sub>	Average of the hourly values for LA10 over the 18 hour period from 0600 to 2400 hrs
L <sub>Aeq</sub>	Equivalent sound pressure level – a steady sound level that over a period of time would produce the same energy equivalence as the fluctuating sound level actually occurring. LAeq is not directly comparable to $L_{A10}$ .
NCA	National Capital Authority
NCDC	National Capital Development Commission
NCPA	National Capital Planning Authority (now NCA)
PA	Preliminary Assessment as defined in Appendix 11 of the Territory Plan and Part IV of the Land (Planning and Environment) Act.

#### 1.0 EXECUTIVE SUMMARY

The National Capital Authority (NCA) commissioned Young Consulting Engineers Pty Ltd to carry out a comparative evaluation and impact assessment report of the Western and Eastern alignment options for the proposed Gungahlin Drive Extension (GDE) at the Bruce (AIS) Precinct.

The comparative evaluation and impact assessment considered all relevant work carried out to date on the project. All previous work was assessed for relevance and adequacy.

The extent of the GDE alignment assessed at the AIS Precinct is between the point of divergence of the Eastern and Western Alignments, approximately 700m north of Ginninderra Drive and the point of convergence on Bruce Ridge.

The lengths of the Western and Eastern alignment over this section of GDE are 2580m and 2800m respectively, ie, the Eastern Alignment is 220m or about 8% longer than the Western Alignment.

The alignments were evaluated using the following criteria:

- AIS Masterplan impacts
- AIS Precinct access and through traffic
- AIS Services impacts
- Parking at the AIS
- Noise at the AIS
- Air Quality at the AIS
- Horizontal Geometry of the GDE at the AIS
- Vertical Geometry of the GDE at the AIS
- Cross Section of the GDE at the AIS
- Earthworks associated with the construction of GDE at the AIS
- Construction time and staging impact on the AIS
- Construction costs for GDE associated with the AIS
- Fauna and Flora near the AIS
- Cultural Heritage near the AIS
- Visual Assessment of GDE near the AIS

The results of the evaluation are summarised in the following table.

The comparative assessment showed that the Eastern Alignment of GDE has significantly less impact on the operations and further planning of the AIS. These impacts would be important for the continuing success of the AIS as an internationally renowned sporting facility. The Eastern Alignment is also is preferred as it has less overall environmental impact.

#### **GUNGAHLIN DRIVE EXTENSION**

AIS PRECINCT IMPACTS					
	Comparative Assessment of corridor options				
1. AIS Masterplan impacts	<ul> <li>Changes to Territory and National Capital Plans will impact on opportunities and flexibility for the AIS Masterplan.</li> <li>Implementation of the AIS Masterplan will be delayed.</li> <li>The adverse impact on future planning may result in reduced viability for the AIS.</li> </ul>	<ul> <li>No variation to Territory Plan required.</li> <li>There are significant opportunities for growth and flexibility in the AIS Masterplan in the future.</li> <li>An early start on Masterplan implementation is possible.</li> <li>AIS investment in new facilities at the site can continue unimpeded.</li> </ul>	Eastern alignment preferred, as there are minimal impacts on the AIS Masterplan.		
2. AIS Precinct access and through traffic	<ul> <li>Reduced potential to connect to the East Bruce precinct.</li> <li>Through traffic within AIS precinct remains a problem.</li> <li>3 new road bridges and 1 new pedestrian / cycleway across GDE required.</li> </ul>	<ul> <li>Access maintained to the East Bruce precinct with through traffic within the AIS precinct eliminated.</li> <li>1 new road bridge and 1 new pedestrian / cycleway underpass required.</li> </ul>	Eastern alignment preferred.		

ELEMENT	WESTERN ALIGNMENT	EASTERN ALIGNMENT	COMMENT
3. AIS Services impacts (water supply, telecommunications & power)	<ul> <li>High impact on services.</li> </ul>	<ul> <li>Low impact on services.</li> </ul>	Eastern alignment preferred.
4. Parking at the AIS	<ul> <li>Significant impact on existing parking with 2200 spaces lost requiring relocation to east of the AIS with significantly increased walking distances and reduced safety with pedestrian / cyclist conflict.</li> </ul>	No impacts	Eastern alignment preferred.
5. Noise at the AIS	<ul> <li>Climbing traffic lane will create more noise once constructed.</li> <li>Predominant winds will carry noise towards the AIS and their residences.</li> <li>Significantly longer exposure to noise in construction phase.</li> </ul>	<ul> <li>Lower noise impacts at AIS (and Kaleen residences).</li> <li>More noise at the AIS playing fields.</li> <li>AIS is upwind of noise source reducing its impact.</li> <li>Impact on O'Connor and Bruce Ridge Nature reserves which can be partially mitigated with design.</li> </ul>	Eastern alignment preferred.

ELEMENT	WESTERN ALIGNMENT	EASTERN ALIGNMENT	COMMENT
6. Air Quality at the AIS	<ul> <li>Vehicle emissions within guidelines.</li> <li>GDE will slightly increase emission intensities compared to present levels.</li> <li>Emission levels are a fraction of those in Civic.</li> <li>Predominant winds will concentrate some vehicle emissions at the AIS.</li> <li>Climbing lane south of Battye Street will increase emission levels at the AIS.</li> <li>Note: Australian Sports Commission has concerns relating to health of athletes.</li> </ul>	<ul> <li>Vehicle emissions within guidelines.</li> <li>GDE will slightly increase emission intensities compared to present levels.</li> <li>Emission levels are a fraction of those in Civic.</li> <li>Predominant winds will disperse vehicle emissions away from the AIS. Note: Australian Sports Commission is carrying out independent studies on impact of emissions on Athletes however results not yet available.</li> </ul>	Little difference between either alignment with respect to vehicle emissions, however the AIS is upwind of predominant winds and the impact will be less for the Eastern alignment.
7. Horizontal Geometry of GDE at the AIS	<ul> <li>Meets AUSTROAD design guidelines.</li> </ul>	<ul> <li>Meets AUSTROADS design guidelines.</li> <li>220m (8%) longer than Western alignment.</li> </ul>	Little difference in either route.

ELEMENT	WESTERN ALIGNMENT	EASTERN ALIGNMENT	COMMENT
8. Vertical Geometry of the GDE at the AIS	<ul> <li>Steep gradient (7%) requiring a 700m long climbing lane and widened formation.</li> <li>1.8km long cutting with impacts on drainage and AIS access.</li> <li>Deficiencies in sight distances at several locations.</li> </ul>	<ul> <li>Moderate gradients, no greater than 4%.</li> </ul>	Eastern alignment preferred.
9. Cross Section of the GDE at the AIS	<ul> <li>Cutting depth up to 12.6m near Battye Street (average approx 7m) with steep batters retained within concrete retaining walls and concrete stabilised batters.</li> <li>8.5m deep cutting at Bruce Ridge.</li> </ul>	<ul> <li>Cutting depth up to 5.5m north of Bruce Ridge (average approx 3m) with flat batters and no retaining walls in hard finishes.</li> <li>9.2m deep cutting at Bruce Ridge</li> <li>Maximum fill depth 7m at Ginninderra Drive overpass and up to 5m elsewhere.</li> </ul>	Eastern alignment preferred.

ELEMENT	WESTERN ALIGNMENT	EASTERN ALIGNMENT	COMMENT
10. Earthworks associated with the construction of the GDE at the AIS	<ul> <li>Approx 500,000m<sup>3</sup> of excavation, 450,000m<sup>3</sup> exported to other sections of GDE.</li> <li>Significantly longer construction time</li> <li>Greater vehicle emissions and noise during construction.</li> </ul>	<ul> <li>Approx 300,000m<sup>3</sup> of excavation, 100,000m<sup>3</sup> exported to other sections of GDE.</li> <li>Reduced construction time, vehicle emissions and noise.</li> </ul>	Eastern alignment preferred.
11. GDE Construction time and staging impact on the AIS	<ul> <li>Little opportunity for staging of road works and disruption at AIS for a significantly longer time.</li> </ul>	<ul> <li>Opportunity to stage construct major bridges and reduced disruption to AIS.</li> </ul>	Eastern Alignment preferred.
12. Construction Costs for the GDE associated with the AIS	<ul> <li>Significantly higher cost due to greater excavation and finishes to batters, service relocations, additional bridge structures, car park relocations and storm water drainage works.</li> </ul>	<ul> <li>Lower cost due to better topography and minimal services requiring adjustment.</li> </ul>	Eastern alignment preferred (\$10m lower construction cost for this option).

ELEMENT	WESTERN ALIGNMENT	EASTERN ALIGNMENT	COMMENT
13. Fauna & Flora near the AIS	<ul> <li>High impact on endangered grasslands.</li> <li>High impact on remnant woodland south of Battye Street.</li> <li>No endangered fauna species.</li> </ul>	<ul> <li>Low impact on endangered grassland.</li> <li>High impact on lower slopes of Bruce Ridge open forest but this area is already disturbed by a cycle path, several access tracks and power line clearings.</li> <li>No endangered fauna species.</li> </ul>	Eastern alignment preferred.
14. Cultural Heritage near AIS	<ul> <li>Minimal impact.</li> </ul>	<ul> <li>Minimal impact.</li> </ul>	Little difference in either route.

ELEMENT	WESTERN ALIGNMENT	EASTERN ALIGNMENT	COMMENT
15. Visual Assessment of GDE near the AIS	<ul> <li>Due to road being located in a cutting past the AIS the road would not be visually intrusive from the AIS and East Bruce.</li> <li>GDE would be very visible from Ginninderra Drive and the Link road and Battye Street overpasses.</li> <li>Driver experience would be of a semi-enclosed space formed by the cutting.</li> <li>Retaining walls forming lower 3m of cutting relieved by artwork on the walls and concrete faced upper batters relieved by planting on the bench separating the walls and batters</li> <li>Impacts of cutting at Bruce Ridge mitigated by confining construction, retaining trees and new planting.</li> </ul>	<ul> <li>Embankment at Ginninderra Drive overpass will dominate the view from Ginninderra Drive.</li> <li>Extensive views to south towards AIS with Black Mountain and Tower dominating the skyline.</li> <li>Extensive views over Kaleen grasslands and the treed suburbs of Kaleen towards north from Ginninderra Drive overpass.</li> <li>GDE will be screened against backdrop of O'Connor Ridge and will create an abrupt junction between the natural vegetation and the degraded and developed valley floor.</li> <li>South of the AIS GDE will have a major impact on this area due to its stark contrast with the open forest vegetation.</li> </ul>	As the two alignments have totally different characteristics and traverse differing landscape forms it is not possible to make a comparable assessment.

ELEMENT	WESTERN ALIGNMENT	EASTERN ALIGNMENT	COMMENT
15. Visual Assessment of		<ul> <li>Impacts of cutting at</li> </ul>	
GDE near the AIS		Bruce Ridge mitigated by	
(continued from previous		confining construction,	
page)		retaining trees and new	
		planting.	

#### 2.0 BACKGROUND

#### 2.1 The Brief

In late October 2002, the National Capital Authority (NCA) commissioned Young Consulting Engineers Pty Ltd to undertake a comparative evaluation and an impact assessment on the Gungahlin Drive Extension (GDE) between the Barton Highway and the Glenloch Interchange.

The GDE is a proposed arterial road, as defined in the National Capital Plan, that the ACT Government is currently proposing to construct as part of the Canberra metropolitan road network. This road is to meet the needs of road transport movements between the northern part of Canberra, primarily from the Gungahlin District, and the southern and central districts of Canberra.

The arterial road is shown partly as existing and partly as proposed in the General Policy Plan – Metropolitan Canberra (Figure 1) of National Capital Plan.

Part of the new arterial passes by the Australian Institute of Sport (AIS) at Bruce. A Preliminary Assessment (PA) carried out by Maunsell Pty Ltd for the previous ACT Government formed the basis of Variation 138 to the Territory Plan which proposed an eastern alignment being adopted by the Government at the time. A change in the ACT Government has resulted in the exploration of a western alignment for which design and impact studies have recently been carried out.

A PA for the Western Alignment was released by Roads ACT in late November 2002 for public comment.

The Brief identified a need to provide a comparative analysis of the two options with particular assessment of the relative impacts of the both options on the health and well being of athletes at the AIS as well as assessing the effect of each option on the future planning and development of the AIS through its Masterplanning.

### 2.2 Historical Context

The GDE has appeared on the 'Y-Plan' since 1970 as a western peripheral parkway linking the satellite towns of Canberra.

The parkway requirement has been reaffirmed by several studies since including:

- 1984 Metropolitan Canberra Policy Plan and Development Plan. Proponent: National Capital Development Commission (NCDC)
- 1988 89: Gungahlin External Traffic Study (GETS). Proponent: NCDC/National Capital Planning Authority (NCPA)
- 1991: Parliamentary Joint Committee (PJC) recommending two routes be assessed, one east and other west of the AIS.
- 1997: Preliminary Assessment (PA) by ACT Government/Maunsell McIntyre Pty Ltd which considered at a strategic level several options for linking Gungahlin to the City, but favoured the road east of the AIS and linking to Barry Drive, but also indicated an option to link the road to Caswell Drive at Aranda.
- 2000: The ACT Government's decision to abandon the connection to Barry Drive and adopt the route east of the AIS and connect the road to an upgraded Caswell Drive following an inquiry by the Legislative Assembly's Standing Committee on Planning and Urban Services.
- 2001: The present Government reversed the decision of the previous Government by proposing that the road be built on the western alignment at the AIS subject to studies.
- 2002: A PA was produced by Roads ACT on behalf of the ACT Government for the total road link from the Barton Highway to Glenloch Interchange with the route being the western alignment at the AIS. The total length assessed is 8.8km.

## 3.0 COMPARATIVE EVALUATION AND IMPACT ASSESSMENT OF WESTERN AND EASTERN ALIGNMENT OPTIONS

#### 3.1 Introduction

The comparative assessment of the Western and Eastern Alignments of GDE at the AIS is based on the following background information:

- i) Western Alignment
- a) Preliminary Assessment by Roads ACT, dated 30 November 2002
- b) Engineering Feasibility Study of the Western Corridor, June 2002 by Roads ACT.
- ii) Eastern Alignment
- a) A Preliminary Assessment prepared in 1997 on behalf of the ACT Government by Maunsell McIntyre Pty Ltd which showed the alignment of a eastern route with a linkage to Caswell Drive at Belconnen Way via the southern boundary of the AIS and Bruce Ridge.
- b) Revisions to the 1997 Maunsell McIntyre alignment undertaken by Young Consulting Engineers to address some deficiencies relating to the scale of GDE on this alignment and impacts on present AIS infrastructure. These revisions generally lifted the road to a standard which could be directly compared with similar elements on the western alignment.

The revisions were:

- Upgrading the scale of the road between the AIS and Caswell Drive following the deletion of the link to Barry Drive.
- Provision of a grade-separated diamond interchange at Ginninderra Drive, the PA proposal being an at-grade junction.
- Moving the alignment slightly eastward adjacent to the ActewAGL Switching Yard and the east Canberra Stadium carpark to alleviate impacts on these two assets.

• Relocating Masterman Street to abut GDE on its western flank to provide the service road for AIS back-of-house activities as well as accessing carparks, sports fields, the ActewAGL Switching Yards etc.

The previous location of this road was proposed on an alignment which now passes through the new AIS Archery Centre presently under construction.

iii) Discussions with the Australian Sports Commission (ASC) to verbalise their issues with any road abutting the AIS Precinct.

The comparative assessment was carried out on the section of GDE between the point of divergence of the 2 alignments about 700m north of Ginninderra Drive (ch2800) and Bruce Ridge (ch 5600), the point of convergence. The following elements were addressed:

- i) Engineering Elements
- ii) Municipal Services
- iii) Noise
- iv) Air Quality Peak Hour Traffic Emissions
- v) Flora and Fauna
- vi) Cultural Heritage
- vii) External Access Onto and Across GDE
- viii) AIS Precinct
- ix) Parking
- x) Visual Assessment
- xi) AIS Masterplan
- xii) Construction Staging
- xiii) Construction Costs

## 3.2 Engineering Elements

#### 3.2.1 Horizontal Geometry

The horizontal geometry of both alignments meets the AUSTROADS curvature required for the speed environment in which the alignments are placed. Refer Figure 1.

The Western Alignment passes through the site recognizing the constraints such as maximising the separation to the AIS, Kaleen and Bruce CIT and the narrow neck of land between the Bruce CIT and the AIS Athletic Track as the only approach to Bruce Ridge.

The Eastern Alignment parallels the 132kV transmission line in the vicinity of Ginninderra Drive, avoids impacting on the Canberra Stadium east carpark and minimises impacts on the open forest, forming the lower slopes of Bruce Ridge, the Canberra Stadium and the AIS Athletic Track.

The cutting on the Eastern Alignment through Bruce Ridge is on an horizontal curve which avoids highlighting of the cutting on the skyline as occurs with virtual straight Western Alignment. Aesthetics and visual clues to the terrain are also better provided for with cutting encompassed by the horizontal curve.

The Eastern Alignment is approximately 220m (8%) longer than the Western Alignment which equates to 10 seconds of travel time at a speed of 80km/h.

#### 3.2.2 Vertical Geometry

The primary difference between the vertical geometry of the Western and Eastern Alignments at the AIS is the need to introduce a 7% gradient on the Western alignment south of Battye Street to climb out of the cutting formed past the AIS and up onto Bruce Ridge. Refer Figure 1.

This gradient results in:

- the need for a 700m long auxiliary (climbing) lane.
- widening the formation in the deepest cutting on this portion of the alignment to provide the auxiliary lane.
- Additional cost
- Additional noise and emissions from slow moving vehicles.

The PA for the Western Alignment indicates that GDE will only be provided with lighting at interchanges. If this is correct then there is a serious deficiency in the design of the vertical geometry south of Battye Street where sight distance is limited to a 65km/h design speed which is inconsistent with the stated design speed of 100km/h.

Similar problems exist at the Ginninderra Drive underpass and Barton Highway overpass with the vertical geometry not matching the quoted design speed of the road. These deficiencies may be ameliorated with streetlighting as the 2 locations are connected to the interchanges which are stated to be provided with lighting.

South of Aranda there are other deficiencies.

As the cutting on the Western Alignment is 1.8km long and varies in depth between 2m at Ginninderra Drive to 12.6m south of Battye Street (average depth about 7m) there is no opportunity to relieve stormwater collecting within the cutting from both the roadway and batters and hence the runoff needs to be conveyed for a distance of 1.3km before it can be discharged in the Kaleen stormwater channel at Ginninderra Drive. This results in a larger and more extensive stormwater drainage pipe network than is required for the Eastern Alignment where the maximum cutting length is 550m.

Due to the incised nature of the Western Alignment there is unlikely to be any opportunity to form above ground stilling basins or pollutant traps for the collection of contaminated runoff from the road. Hence relatively expensive below ground traps would be required with inherent maintenance issues.

The maximum gradient on the Eastern Alignment is 4% which does not require an auxiliary (climbing lane) as truck speeds do not fall below 40km/h, the normal warrant for the introduction of climbing lanes.

On the Eastern Alignment the cuttings are generally no more than 5.5m in depth. However, due to the natural gradient of the topography on approach to Bruce Ridge being steeper than on the Western Alignment, the resultant cut at Bruce Ridge is 9.2m compared to 8.2m on the Western Alignment.

## 3.2.3 Cross Sections

## i) Western Alignment

The Western Alignment has a cross section which carries 4 lanes of traffic, flanking shoulders for emergency usage and on-road cycling.

South of Battye Street an auxiliary climbing lane has been introduced for southbound traffic.

The transport and traffic study carried out as part of this project (refer Scott Wilson Nairn; Traffic and Transport Planning Assessment report) also supports the need for 4 traffic lanes.

The formation width is 30m while the width at the top of the excavation is generally about 50m north of Battye Street. South of Battye Street the formation widens to 34m to accommodate the climbing lane. The width of the cutting in this area extends to 65m at the point of maximum cut.

The geotechnical investigation along the Western Alignment indicates that the cut batter slopes not be constructed greater than 1(V):2(H) in the zone between Ginninderra Drive and Battye Street.

However, the batters shown in the PA are significantly steeper, 1(V): 0.16 (H) in the bottom 3m of the cutting and 1(V): 1(H) in top portion which , while not specially identified in PA require retaining by use of precast elements in the lower 3m section (Refer Figure 2) and soil nailing (shotcrete over a grid of reinforcing bars) on the upper, flatter section, producing a hard finish to all faces in the vertical planes.

The advantages of this cross sectional treatment are:

- Reduced width of the cutting and hence land take
- Assistance in ameliorating noise impacts
- Minimisation of excavation volumes

The disadvantages of this cross sectional treatment are:

- The visual impact of the steep batters which do not allow planting (concrete surfaces). This negative has been softened to some extent by planting on the benches constructed above the retained section of the cutting. (Refer Figure 2).
- Substantial increases in cost and construction time.
- The potential for entrapment of wildlife within the cutting with no possible means of escape due to the steep, unscalable batters.

• A safety fence would be required along the top of the cutting to prevent pedestrians, wildlife, etc from accidentally stumbling into the excavation.

#### ii) Eastern Alignment

The cross section for the Eastern Alignment in terms of median traffic, standard traffic and bicycle lanes and the formation containing these elements matches that of the Western Alignment.

The separate aforementioned traffic and transport planning assessment report confirmed the need for 4 traffic lanes.

No auxiliary lanes are required.

None of the disadvantages eg, steep, hard surface finished batters on the Western Alignment are an issue for the Eastern Alignment.

While there has not been any geotechnical investigations along the Eastern Alignment, the angle of repose of batters has been set at 1 (V): 3(H) which does not require any special finishes and planting is only restricted by the required safety clear zones and the need to discourage wildlife eg, kangaroos from grazing and sheltering close to the roadway. Refer Figure 3.

#### 3.2.4 Earthworks

As there is no requirement on the Eastern Alignment to depress the road to allow bridging of the GDE to link the AIS with East Bruce as occurs on the Western Alignment, the vertical alignment of the road is developed through a series of cuttings and embankments as dictated by the topography traversed; the need to maintain minimum road gradelines; provide an overpass over Ginninderra Drive, and; the need to minimise the gradient ascending into the crossing of Bruce Ridge to avoid the need for an auxiliary slow lane. Refer Figure 1.

As a consequence the Eastern Alignment has less cut, approximately 200,000m<sup>3</sup>, than the Western Alignment over the comparative section (ch 2800 to ch 5600).

While it is understood the cut of about 500,000m<sup>3</sup> on the Western Alignment will be used within the project, the reduced amount of cut on the Eastern Alignment has significant advantages with respect to reduced construction time and hence less cost, noise and emissions, especially Particulate Matter (PM) in the smaller 2.5 micron range (produced by construction dust and emissions from plant and equipment) which is of concern to the ASC, in the vicinity of the AIS.

The reduction in earthworks on the Eastern Alignment within the AIS Precinct will require the lowering of the gradeline of the Kaleen precinct of the GDE between ch 1600 and ch 2800 (the latter chainage representing the common northerly point for the east and alignment comparisons) to that shown in the PA, to reduce the requirement for fill, primarily for the Ellenborough Street overpass approaches, which is to be provided from the AIS Precinct section of the project.

For the Eastern Alignment option it is envisaged that filling for the northern approaches to the Belconnen Way overpass will be won from the cuttings immediately south of Belconnen Way in the Aranda Precinct section of the roadway.

While there has not been any Geotechnical Investigation on the Eastern Alignment, the depth of cuts over the majority of the road are such that the batters of cuttings and fill embankment slopes can have an angle of repose of 1 (V): 3 (H) which will enhance the driving experience along the road.

This assumption with respect to batter slopes would need to be confirmed in a detail design phase.

In the Bruce Ridge cutting, the cut batter slopes on the Eastern Alignment would match the 1(V): 1(H) as adopted for the Western Alignment.

While it appears that all of the excess excavated material generated from the Western Alignment at the AIS will be used on the project (we understand that filling old inactive scour gullies at Glenloch Interchange is proposed), the material is not required to produce a sustainable outcome for the project. The gradeline can be adjusted over the whole project length to produce a balanced earthwork with a consequential reduction in construction duration and costs.

#### 3.3 Municipal Services Impacts

#### i) Western Alignment

The AIS is provided with major telecommunications, water and gas services from the west. The Western Alignment of GDE will sever these services and relocations will be required. Refer Figure 5.

Given the depth and steepness of batters forming the trench containing GDE it would be an unacceptable arrangement to maintain these services should they be lowered from their present location to cross the depressed roadway.

Hence it would be a requirement that the telecommunications cables, gas main and water main (375mm diameter) in Battye Street be relocated onto the new GDE overbridge. Similarly the 375mm diameter watermain located near the proposed Link Road bridge would also need to be relocated onto this structure.

The bridges would need to be built before the services could be relocated. As the AIS depends on both water services to meet the fire protection requirements, each water service would not be able to be out of commission for other than short periods while cut-ins were made.

At Ginninderra Drive there are substantial impacts on the stormwater and sewer outfalls from the AIS precinct as GDE is coincident with these services as it passes beneath Ginninderra Drive, about 2m below the existing ground levels abutting the Ginninderra Drive embankment.

While the 375mm diameter sewer is at a sufficient depth as it passes beneath Ginninderra Drive, adjustments will be required to the main and manholes upstream of Ginninderra Drive. The existing twin 2 x 1500mm diameter stormwater pipes are proposed to be replaced by low profile box culverts.

Immediately upstream of Ginninderra Drive, two stormwater retarding basins are proposed each side of GDE to reduce the stormwater conduit sizes beneath Ginninderra Drive and GDE.

The outfall stormwater channel leading into Kaleen is proposed to be lowered over a length of about 200m to account for the lower GDE and associated stormwater drainage conduits. In this alignment assessment, no investigative work has been carried out to determine the viability of this proposal.

There are several power lines both overhead and underground impacted by the works; a high voltage (132kV) and 3 low voltage (11kV/22kV) all of which will require adjustment. The AIS is serviced by power from one of the low voltage lines requiring adjustment and hence power supply disruption to the AIS will require careful management.

North of Ginninderra Drive a major Optus cable is impacted as the road is cut hence relocation is required. This cable is also cut at Ginninderra Drive and hence will require relocation on the new overbridge. The impact on clearances to overhead poles and catenaries of low and high powerlines where GDE passes beneath them about 500m north of Ginninderra Drive is also possible.

None of the services cut by GDE in the portion of the road between Ginninderra Drive and Battye Street is identified in the PA. All of this work will have significant cost implications.

Refer Figure 5 for further details.

#### ii) Eastern Alignment

The services impacted by the Eastern Alignment are:

- The minor telecommunications cable along Masterman Street servicing the ActewAGL Switching Yard and other users to the south. This cable will require relocation along the proposed new alignment of Masterman Street.
- A small diameter sewer servicing the ActewAGL Switching Yard. This sewer will require relocation along the alignment of the northbound off-ramp of GDE.
- Two overhead low voltage power lines crossing Tucker Street at Ginninderra Drive will require undergrounding.
- An overhead low voltage power line located along Masterman Street which services the AIS substation at the Canberra Stadium substation will require undergrounding across GDE.
- An overhead low voltage power line from O'Connor to Bruce CIT will require undergrounding across GDE adjacent to the Canberra Stadium east carpark.

Refer Figure No 5 for further details.

#### 3.4 Noise

#### 3.4.1 Introduction

This assessment reviewed the two previous noise assessment reports prepared by Marion Burgess. The first report was part of the John Dedman Parkway Preliminary Assessment prepared by Maunsell McIntyre Pty Ltd in 1997. The second report was part of the Gungahlin Drive Extension Western Alignment Preliminary Assessment in 2002.

## 3.4.2 Statutory Requirements

Both reports have cited the Draft Noise Management Guidelines produced by the ACT Planning Authority 1996 as being the relevant criteria for the project. The target levels listed in both reports were  $L_{A10 (18hr)} 63dB(A)$  for Residential and Community Facilities and  $L_{A10 (18hr)} 58 dB(A)$  for Private Open Space. The 2002 Report also mentioned the criterion of  $L_{A10 (18hr)} 75dB(A)$  for commercial facilities.

 $L_{A10 (18hr)}$  is the noise average of each hourly noise level between 0600 and 2400hrs that is exceeded for 10% of each time period. Both the Residential and Commercial requirements measured 1m from building facades. The private open space requirements is exterior 1m inside the nearest fence to the noise source.

## 3.4.3 Existing Noise Levels

The 1997 report seven day monitoring of existing noise levels at 10 locations was undertaken. Three of these locations namely, Gairdner Circuit Kaleen, the northern open area of the AIS and open area adjacent to Fernyhough Crescent were within the area being considered in this assessment. The measured range of noise levels were  $L_{A10 (18hr)} 46-51 dB(A)$  for at Gairdner Street,  $L_{A10 (18hr)} 51-54 dB(A)$  at the AIS and  $L_{A10 (18hr)} 42-47 dB(A)$  at Fernyhough Crescent over the 7 day period of noise measurement.

The 2002 report undertook seven day monitoring of existing noise levels at 9 locations. Four of these locations namely, Skarden Street, Kaleen; Shannon Circuit, Kaleen; AIS Residences and CIT Eastern boundary were within the area being considered in this assessment. The Skarden Street and the AIS Residences locations were similar to two of the locations where measurements were taken in the 1997 Report (Gairdner Street and Northern open area of AIS). The measured range of noise levels were L<sub>A10 (18hr)</sub> 43 – 50 dB(A) at Skarden Street, L<sub>A10 (18hr)</sub> 46 – 56 dB9(A) at Shannon Circuit, L<sub>A10 (18hr)</sub>, L<sub>A10 (18hr)</sub> 50 – 56 dB(A) at the AIS Residences and L<sub>A10 (18hr)</sub> 45 – 53 dB(A) at the CIT over the 7 day period of noise measurements.

A comparison between the existing measurements at Gairdner Street/Skarden Street and the two AIS locations indicated that there was less than 3dB(A) difference between the 1997 and 2002 measurements. According to the 2002 report 3dB(A) is just noticeable under normal listening conditions.

### 3.4.4 Estimated Traffic Noise Levels Provided in Previous Reports

No mention is made in the 1997 report of the predicted traffic volumes or percentage of heavy vehicles that were used to calculate the traffic noise levels.

As the 1997 Eastern Alignment had a link to Barry Drive there would have been a split in the traffic volumes giving a different traffic volume for south of Ginninderra Drive to north of Belconnen Way.

This differs from the traffic flow characteristics for the western alignment that has the same traffic volume south of Ginninderra Drive to north of Belconnen Way. This means that it is not possible to make a direct comparison between the two options as only a true comparison could be made if the traffic volumes, traffic speed and percentage of heavy vehicles were identical.

Notwithstanding this the predicted external  $L_{A10 (18hr)}$  noise levels for the two options based on the 1997 and 2002 reports were:-

	West (2002)	East (1997)
Skarden St, Kaleen	51	-
Fernyhough Cr, Lyneham	-	53
Shannon Circ, Kaleen	52	-
Northern open area of AIS	-	<631
AIS Residences	46 <sub>3</sub>	-
CIT	58	<63 <sub>1</sub>
Gairdner Circ, Kaleen	50 (562)	54

- 1. No exact figure given in the report only a statement that noise levels would be less than the relevant criteria.
- 2. Level without noise walls or mounds
- 3. Level with 2m high noise mound

The  $L_{A10 (18hr)}$  58dB(A) contour was indicated in the 2002 report but no contours were provided in the 1997 report to enable a direct comparison to be made.

Hence, to enable a direct comparison to be made between the two optional alignments new estimates of the future traffic noise levels have been calculated. The estimated noise levels are indicated in Figure 6. These levels were calculated assuming that there is no mitigation measures on either alignment to allow a fair comparison to be made, but allows for the effects of cuttings and embankments along the route. The  $L_{A10 (18hr)} 58dB(A)$  contour is also indicated for comparison.

	West	East
Skarden St, Kaleen	51	51
AIS Residences	51.7	47.7
CIT	63.8	52.0

The predicted traffic noise levels calculated as part of this report were:

These calculated noise levels are based on a 3% of heavy vehicles in the traffic stream, a traffic speed of 80km/h and traffic volumes of 44,850 vehicles per day (VPD) on Western Alignment and 45,338 VPD on the Eastern Alignment.

#### 3.4.5 Noise levels at the AIS Residences

The 1997 Report states that the relevant criterion for the buildings on the AIS would be 63dB(A). This report then goes on to state that the estimated traffic noise levels at the closest building façade would be less than 63dB(A). No exact figure is given.

In September 2002 Fitch was engaged by Roads ACT and the Australian Sports Commission (ASC) to assess the potential environmental health issues, effects and impacts that the proposed Western Alignment would have on high performance athletes training at the AIS. Fitch also inspected the eastern alignment but no specific conclusions were made as to its impacts.

Fitch stated that intensively training athletes require more rest and sleep than the general population otherwise their performance could be reduced. It is indicated that some of these athletes require an early afternoon recovery sleep and some are in bed by 9pm. He expresses concerns that pulse noises generated by trucks or emergency vehicles are likely to have the potential to wake athletes. In particular, concerns were expressed regarding the potential effects that these pulse noises would have on visiting athletes.

Fitch highlighted concerns that Dr Stephen Samuels, (another noise expert) had with the work undertaken by Marion Burgess. In particular concerns were raised about adopting the  $L_{A10 (18hr)}$  method as this does not address night time noise. It is stated that Dr Samuels' preference would be to use the NSW EPA  $L_{Aeq (15hr)}$  daytime and  $L_{Aeq (9hr)}$  (2200 to 0700 hrs) night time criterion. It is suggested that the latter would be more acceptable when considering night time noise than considering night time noise from midnight to 6.00am as proposed in the June 2002 report by Marion Burgess.

The Fitch report implies that the NSW EPA night time criteria of  $L_{Aeq(9hr)}$  35dB(A) for inside a hospital ward would be a more appropriate criteria than the current ACT Planning Authority Noise Management Guidelines. It is stated that this equates to  $L_{Aeq}$  (9hr) 47.5 dB(A) one metre from a hospital window that is 20% open. It was concluded that Dr Samuels believed that the  $L_{Aeq}$  (9hr) 47.5dB(A) criterion would be exceeded when the effects of different pavement surface treatments were also considered.

The 2002 Report by Marion Burgess addresses the  $L_{Aeq (9hr)}$  47.5 dB(A) criteria suggested in the Fitch Report. It indicated that the  $L_{Aeq}$  would not exceed a level of 47.5dB(A) between the hours of 2200 and 0700. Furthermore, it is also suggested that the  $L_{Aeq}$  would only exceed the 47.5 dB(A) level during the am and pm peak hours. This predicted noise level meets the hospital criteria recommended in the Fitch report.

In order to enable a comparison to be made between the eastern and western alignments the  $L_{Aeq (1hr)}$ , the NSW EPA (1999) criteria of 35dB(A) for inside a hospital ward, levels were calculated for each alignment at 1m from the façade of the AIS residences during the peak night time hour. This was done to independently check whether or not either alignment without mitigation measures would meet the criteria put forward by Fitch.

Based on the traffic volumes calculated as part of this assessment it was calculated that the  $L_{Aeq (1hr)}$  max night taken between the peak nighttime hours of 2100 – 2200 hrs, was 43.5 dB(A) for the Western Alignment (similar to the figure indicated in the 2002 Report) and 39.5dB(A) for the Eastern Alignment. Both are below the  $L_{Aeq}$  (9hr) 47.5dB(A) criteria suggested by Fitch.

## 3.4.6 ASC Concerns

The ASC has concerns about the effects that pulse noises eg, truck air brakes at intersections, sirens, etc, may have on the recovery sleep and rest of athletes. No work has been carried out by either PA to address these concerns. However, the ASC is presently undertaking independent studies on the issue.

## 3.4.7 Impacts of Eastern Alignment on O'Connor and Bruce Ridge Areas

The  $L_{A10 (18hr)} 58dB(A)$  noise contour line extends between 110m and 140m from the Eastern Alignment of GDE into the O'Connor and Bruce Ridge. The area of Open Forest recreational space affected is about 20 Ha over the length of Eastern Alignment being assessed.

The noise will impact on the recreational quality of the Open Forest.

At the AIS Athletic Track the  $L_{A10 (18hr)}$  58dB(A) noise contour extends into the AIS Athletic Track requiring noise attenuation measures to be implemented, eg. mounding.

#### 3.4.8 Impacts of Step Gradient on Western Alignment at Bruce Ridge

The climbing lane on the Western Alignment of GDE will generate higher noise levels due to the heavy vehicles using lower gears on the climb up onto Bruce Ridge.

In the downhill (northerly) direction, heavy vehicles will use air breaks to maintain speeds within legal limits, hence elevating noise levels at this location.

Developments directly affected by the increased noise levels in this area are Bruce CIT and the AIS Athletic Track.

#### 3.4.9 Effects of Wind

None of the reports done to date have addressed the effects that the predominant north-westerlies and westerlies would have on noise distribution. Whilst no detailed analysis of the effects of wind has been carried out as part of this assessment, it is suggested that it would be reasonable to assume the predominant winds would slightly increase expected noise levels to the east of either alignment and slightly reduce the levels to the west of either alignment.

Fitch concluded that with prevailing winds tending to minimise noise the Eastern Alignment is likely to have a less unfavourable impact on athletes in the AIS residences than the Western Alignment.

#### 3.4.10 Construction Noise

None of the reports to date have predicted the noise levels expected during the construction phase. Whilst no detailed analysis of the noise levels during construction has been part of this assessment report it is suggested that due to the fact that the western alignment requires over 200,000m<sup>3</sup> more excavation than the eastern alignment the noise would be of a higher level and longer time period than the eastern alignment.

### 3.4.11 Effects of Road Pavement Surfaces

Research by the Swedish National Road and Transport Research Institute provides the following comparisons for various surface finishes at truck speeds of 80km/h.

- Porous asphaltic concrete (12 to 16mm stone size and mean depth profile of 1mm): 95d(B)A.
- Dense asphalt concrete (12 to 16mm stone size and mean depth profile of 0.7mm): 99.8d(B)A.
- Stone mastic asphaltic concrete (12 to 16mm stone size and mean depth profile of 1.3mm): 100.6d(B)A.
- Seal (6 to 12mm stone size, mean depth profile of 1.2mm): 98.3d(B)A

While porous asphaltic concrete gives the lowest noise generation there is only 4.8d(B)A difference compared with dense asphaltic concrete. An increase of 3d(B)A in noise levels is generally considered to be indiscernible.

There are maintenance issues associated with porous asphaltic concrete which would need to be considered before this surfacing material was adopted as the surfacing material to reduce tyre/road noise.

## 3.4.12 Conclusion

Both the Eastern and Western Alignments of GDE create noise impacts which will require further investigation in the design phases to address the issues raised by Fitch and Samuels.

Not withstanding the outcomes of studies presently being undertaken by the ASC, the designs will need to ensure that all noise is ameliorated to an acceptable level.

#### 3.5 Air Pollution

#### 3.5.1 Introduction

This assessment reviewed the two previous Air Quality Studies undertaken by Holmes. The first report was part of the John Dedman Parkway Preliminary Assessment prepared by Maunsell McIntyre Pty Ltd in 1997. The second report was part of the Gungahlin Drive Extension – Western Alignment Preliminary Assessment in 2002.

## 3.5.2 Air Quality Criteria

The 1997 report detailed the Air Quality Goals adopted in the report derived from ACT Department of Health and Community Care quarterly reports, the World Health Organisation (WHO), the United States Environmental Protection Agency (US EPA) and the National Health and Medical Research Council of Australia (NHMRC). It was stated that the Air Quality goals were under review by the National Environmental Protection Council (NEPC) at the time of reporting and that the figures would be revised at a later date. Air quality goals were given for the ambient air quantities of Total Suspended particulate matter, Lead, Carbon Monoxide, Nitrogen Dioxide and Ozone.

The 2002 report detailed the revised Air Quality goals determined by the NEPC that have been adopted by the ACT. The Air Quality Goals as determined by the NEPC are shown in the following table.

Pollutant	Goal	Averaging Period	Agency
Carbon monoxide	25 ppm or 30mg/m <sup>3</sup>	1-hour maximum	WHO
	9ppm or 10 mg/ m <sup>3</sup>	8 hour maximum	NHMRC, NEPM
Nitrogen dioxide	0.12ppm or 246 μg/	1 hour maximum	NEPM
_	m <sup>3</sup>		
	0.03ppm or 60µg/ m <sup>3</sup>	Annual mean	NEPM
Total suspended	90µg/m <sup>3</sup>	Annual mean	NHMRC
Particulate matter			
(TSP)			
Particulate matter	50 µg/ m <sup>3</sup>	24-hour maximum	NEPM
<um (pm10)<="" td=""><td>30 µg/m<sup>3</sup></td><td>Annual mean</td><td>NSW EPA</td></um>	30 µg/m <sup>3</sup>	Annual mean	NSW EPA
Ozone	0.10 ppm or 200	1-hour maximum	NHMRC, NEPM
	μ <b>g/m<sup>3</sup></b>		
	0.08 ppm or 150	4-hour maximum	NEPM
	μ <b>g/m<sup>3</sup></b>		
Benzene	5ppb or 16 μg/m <sup>3</sup>	Annual average	UK

#### Terms

ppm – Parts per million  $\mu$ g/m<sup>3</sup> – micrograms per cubic metre mg/m<sup>3</sup> – milligrams per cubic metre

The 2002 report reiterated that the Air Quality Goals are general airshed standards and not "hot spot" standards. These standards are therefore more applicable to checking major airsheds than for checking the air quality of an individual road. It is for this reason that this report has split the air quality assessment into two parts:

- i) Zonal emissions and Impacts in a Metropolitan Context
  - The emissions from the GDE eastern and western alignments have been calculated independently of the 1997 and 2002 reports.
  - The impact that these predicted emissions have on the general airshed have been assessed and, more specifically the impact of these predicted emissions near the AIS and other residential and commercial areas.
- ii) Localised road emissions
  - Comparison of the predicted emissions in the 1997 and 2002 reports.
  - Consideration of the local effects of wind.
  - Effects of air pollution resulting from the excavation of large volumes of materials.

#### 3.5.3 Metropolitan Traffic Emissions and Zonal Impacts

Changes in the age structure of the vehicle fleet will decrease emissions. The implementation of GDE will result in the following changes to vehicle emissions.

- i) GDE will slightly increase emission intensities
- ii) GDE will increase emission intensities near the AIS but will decrease the intensity of emissions in other parts of Canberra.

- iii) Emissions near the AIS will only be a fraction of those in Civic.
- iv) There is little difference between emissions on the Eastern and Western Alignments at the AIS.

Notwithstanding these observations air quality in the vicinity of the AIS will be within accepted national and international standards. After the construction of GDE the emission intensities will still be only a fraction (between 4% and 37%) of those in Civic.

## 3.5.4 Localised Traffic Emissions

The table below shows a direct comparison between the traffic figures used in predicting the localised traffic emissions in the 1997 and 2002 reports

Roadway Section	Eastern		Western	
	Northbound	Southbound	Northbound	Southbound
Ellenborough Street to Ginninderra Drive	1085	3613	2762	3253
Ginninderra Dr to Caswell	943	1766	2556	3011

It can be seen from the above figures that it is not feasible to make a comparison between the two alignments as each has used different peak traffic volumes. This is mainly due to the fact that the Eastern Option 3 had a link to Barry Drive that has caused the traffic flow to be less than those in the Western option.

Given that the above figures are not comparable it has been deemed pointless to compare the emissions calculated for the two alignments.

Hence this assessment has not deemed it necessary to undertake a recalculation of the kg/km/hr emissions previously calculated in the 1997/2002 reports based on the current estimated traffic predictions. It established that the emissions in the immediate vicinity of the GDE are well within accepted requirements and there is little difference between the Western and Eastern Alignments.

## 3.5.5 ASC Concerns

The ASC raised concerns about the effects of Ozone on athlete performance. However, they did not have any qualitative information on the issue.

Similarly the ASC is concerned about the release of Particulate Matter (PM) and especially the 2.5 micron range. They argue that many athletes are asthmatics and particulate matter in this range has the potential to have a greater impact on the health of these athletes. Particulate Matter is an issue on both the construction (dust) and operational phases (vehicle emissions) of GDE.

As there is no detailed information on the Eastern Alignment with respect to emissions and the impact on athlete's health and performance, the ASC is presently undertaking independent studies on the Eastern Alignment to enable a direct comparison to be made with the Western Alignment.

A further concern is that there has been no discussion about exercising athletes in the PA and the misleading statement about endurance events stated in the PA.

#### 3.5.6 Effects of predominant prevailing winds

Without recalculating the kg/km/hr emissions it is reasonable to assume that the predominant westerly and north westerly winds will have an effect on the dispersion of traffic emissions immediately adjacent to the GDE. It would be expected that for most of the year the AIS Precinct would be less affected by traffic air pollution from the Eastern Alignment than the Western Alignment.

Fitch concluded that with prevailing winds tending to minimise adverse air quality, the Eastern Alignment is likely to have a less unfavourable impact at the AIS than the Western Alignment.

#### 3.5.7 Air Pollution from Construction Activities

Due to the fact that the Western Alignment requires more than twice the excavation of the Eastern Alignment it can be safely assumed that its construction would result in significantly more Particulate Matter being emitted into the surrounding air from dust. The use of water sprays would not totally eliminate dust emissions from earthworks considering the magnitude of the project.

#### 3.6 Flora & Fauna

#### i) North of Ginninderra Drive

North of Ginninderra Drive the Western Alignment of GDE traverses areas of both lower and higher quality (southern third of the site) endangered natural temperate grasslands. There will also be some impact on woodland classified as other than Yellow Box/Red Gum and Snowgum assessed as having a moderate conservation value.

The Eastern Alignment in this area passes through the upper peripheral areas of small compartments of lower quality endangered natural temperate grasslands and 2 blocks of woodland classified as other than Yellow Box/Red Gum and Snowgum assessed as having a moderate conservation value.

Refer Figure 8 for details.

There are no studies that indicate that endangered fauna species are affected by the alignments in this area. However Environment ACT noted that it may be possible for the Striped Legless Lizard to reinvade the grasslands under management aimed at retaining the tussock structure. The Western Alignment of GDE would have an impact on the viability of such a proposal.

#### ii) AIS Precinct

The Western Alignment passes through an area of Yellow Box/Red Gum woodland immediately south of Battye Street. Environment ACT has reported that this pocket of woodland, while it is a small pocket in regional terms, has the potential to be restored to a healthy remnant of the threatened community and it is the only representative area of this community on Bruce Ridge. Its classification could be stated as a Yellow Box-Red Gum grassy woodland endangered ecological community.

Beyond this area the alignment traverses the Open Forest of Bruce Ridge.

The Eastern Alignment skirts the O'Connor Ridge Open Forest with minimal impacts adjacent to end of Masterman Street.

As the Eastern Alignment swings to the west along the southern boundary of the AIS about 15 Ha of Open Forest on the lower slopes of Bruce Ridge is impacted upon. This area is presently traversed by a series of access tracks, the City/Bruce cycleway and a power line all of which have clearings associated with their presence, ie, the area presently is disturbed.

Given that the Eastern Alignment will only isolate the small pocket of land between the AIS and Bruce CIT it is unlikely that this severance will impact on Echidna habitats. The alignment along the southern side of the AIS removes rather than severs habitat areas and hence the impacts on fauna are minimal.

There are no studies, which indicate that endangered species of fauna are affected by either alignment within the AIS Precinct.

Refer Figure 8 for details.

#### 3.7 Cultural Heritage

#### i) Western Alignment

Impacts of the Western Alignment on Cultural heritage sites are limited to:

- A potential Aboriginal Archaeological Deposit (PAD1) located 200m to 300m north of Ginninderra Drive through which the alignment passes. The site requires sub-surface testing to determine its significance.
- An Aboriginal Isolated Find (IF3) on the trench line of the Optus cable adjacent to this site and is termed moderate potential for further artifacts to occur in this area.
- The remnant of Old Weetangera Road which passes between the southern end of the AIS and the Bruce CIT. This site was noted to be in poor condition and its significance rated as low.

Refer Figure 9 for details.

#### ii) Eastern Alignment

Impacts of the Eastern Alignment on cultural heritage sites is limited to:

- O'Connor Ridge Aboriginal Isolated Find (IF2). This site will be destroyed by the roadworks and hence will require recording and collection.
- The remnant of the Old Weetangera Road on which the City/Belconnen Cyclepath is constructed. While the GDE will be constructed over the

road its integrity will be retained through the construction of a new cyclepath/footpath/emergency services underpass.

Refer Figure 9 for details.

#### 3.8 External Access Onto and Across GDE

#### i) Western Alignment

Three new road overbridges and one Cyclepath/pedestrian path overpass are required along the alignment:

- Ginninderra Drive overpass
- Link Road overpass providing the connection between the AIS and East Bruce
- Battye Street overpass.
- City/Bruce Cyclepath/footpath overpass

The City/Kaleen Cyclepath and the Optus telecommunication cable will need to be relocated from their present at-grade locations abutting Ginninderra Drive to the proposed Ginninderra Drive overpass.

The Link Road overpass will need to incorporate the 375 mm diameter watermain connection between the 900mm diameter trunk watermain and the AIS.

The Battye Street overpass will need to incorporate the following services:

- high pressure gas main
- major telecommunications services
- 375 mm diameter watermain.

Between the AIS and Bruce CIT a pedestrian/cycleway overpass is nominated. This overpass is about 150m north of the present Cyclepath location and requires an extra 200m of travel and 10m of elevation to be traversed. This overpass will maintain pedestrian links between Bruce CIT and AIS as well as carry cyclists on the City/Bruce Cyclepath but with the disadvantage of making the route more difficult for cyclists and pedestrians.

Refer Figure 10 for details.

### ii) Eastern Alignment

A road overbridge at Ginninderra Drive is required and an overpass over the City/Belconnen cyclepath/footpath.

This latter structure will also be designed for use by emergency vehicles.

No services require incorporation into the bridges.

A 200m section of the City/Bruce cyclepath/footpath will require a slight relocation in a northerly direction where impacted on by GDE adjacent to Canberra Stadium.

The movement of pedestrian traffic between Bruce CIT and the AIS is not affected.

Refer Figure 10 for details.

#### 3.9 AIS Access

#### i) Western Alignment

The Western Alignment of GDE has significant impacts on the AIS Masterplan which requires a reassessment of the planned roads in the western sector and the development planned around these roads, namely Battye Street, Leverrier Crescent, Masterman Street and Braybrooke Street.

The GDE will limit access and the connectivity between the AIS and the East Bruce Precinct to two locations, Battye Street and the Link Road at mid-block. The Masterplan option to "square-up" the intersection of Leverrier Crescent and Masterman together with the construction of Braybrooke Street and the upgrade of its intersection with Ginninderra Drive, to provide an optimised layout for development blocks to the northwest of the main AIS complex is no longer feasible.

The extension of Braybrooke Street to a new relocated intersection will provide convenient access from East Bruce to Ginninderra Drive. However traffic heading to North Canberra from the Precinct will be encouraged to use Leverrier Crescent, which passes the front door of the AIS, and the upgraded Tucker Street to avoid the signalized intersection of GDE with Ginninderra Drive.

This arrangement will continue to cause concern to the AIS with respect to the safety of the day-to-day visitors, staff and athletes moving across Leverrier Crescent from the remnant carparks to the AIS facilities.

The GDE in this location will place a visual and physical barrier between the AIS and East Bruce thus isolating the facility from the Precinct to which it has been planned to connect.

Refer Figure 10 for details.

#### ii) Eastern Alignment

The Eastern Alignment of GDE requires the relocation of Masterman Street, which provides back-of-house access to AIS facilities, the Canberra Stadium east carpark and the ActewAGL Switching Yard, to abut the western edge of GDE.

Masterman Street (west), Leverrier Crescent and Braybrooke Street are constructed to complete the planned road access network to allow the blocks of land northwest of the AIS to be developed.

The present junction of Braybrooke Street with Ginninderra Drive is upgraded from its present "special event" use to compete the planned access network.

The Tucker Street intersection with Ginninderra Drive is closed to allow the GDE/Ginninderra Drive diamond interchange to be developed. This closure has a positive effect in reducing through traffic on Leverrier Crescent past the front door of the AIS and hence the inherent safety issues associated with visitors, staff and athletes crossing Leverrier Street from the western carparks is removed.

The use of the presently gazetted, but undeveloped Agar Street connection between Masterman Street and Ginninderra Drive, as a "special event" access (serving the same role as the existing Braybrooke Street connection to Ginninderra Drive) is available should it be required.

These road configurations within the AIS Precinct allow its continued development with convenient access, while eliminating through traffic, and continuing the connectivity to the East Bruce Precinct to which the AIS is inextricably linked.

Refer Figure 10 for details.

#### iii) ASC Concerns

The AIS considers that there is a greater impact on parking than identified in the Western Alignment PA with respect to numbers of car and bus parking spaces impacted on and lost.

The use of the Pool will be significantly impacted upon which has about 1,000 patrons daily of which 500 – 600 children attend the AIS Swim School.

Traffic on Leverrier Crescent past residences and facilities is also an ASC concern with respect to the safety of the 30,000 patrons who attend the AIS each month and require to cross Leverrier Crescent.

#### 3.10 Parking

#### i) Western Alignment

The GDE alignment passes through the AIS and Canberra Stadium carparks. About 2800 spaces are impacted upon and around 2200 lost.

It is proposed to relocate these "lost" spaces to the north-east corner of the AIS Precinct on presently undeveloped land and easements beneath the 132kV transmission lines.

The impacts of this proposal are:

- Loss of parking at the front door of the AIS, the Pool, the AIS Indoor Arena and the Bruce Stadium main entry.
- Loss of land and the potential to develop this land for an expanded AIS.
- Greater walking distances for patrons attending functions and events at Canberra Stadium and the AIS Indoor Arena. Presently the majority of parking is within 600m of the main entry to Canberra Stadium. The proposed relocated carparks would extend walking distances up to 900m.
- Conflict between pedestrians using the Bruce/Kaleen cycleway as an access route to Bruce Stadium and the AIS Indoor Arena and cyclists who travel at relatively high speeds on this facility.
- Safety of users in a somewhat remote, less frequented, part of the AIS Precinct.

Refer Figure 11 for further information.

### ii) Eastern Alignment

There are no impacts on existing parking arrangements resulting from the development of GDE on the Eastern Alignment as shown in Figure 1.

## 3.11 Visual Assessment

## i) Western Alignment

As the Western Alignment of GDE through AIS precinct it cuts ranging in depth from 2 to 7m, the road would not be visually intrusive from most vantage points. This includes views from the AIS which would be screened with vegetation along the top of the cutting.

The GDE would be very visible from Ginninderra Drive, the AIS link Road overpass and Battye Street overpass.

The views from future developments in East Bruce would look across the cutting and be restricted due to the cutting and planting along the top of the cut.

The stormwater retention ponds at Ginninderra Drive would be a new element in the landscape.

Driver experience would reflect the semi-enclosed space formed by the cutting.

The engineering solutions to batter retaining and stabilisation would be relieved by artworks on the lower retaining walls and vegetation on the bench occurring 3m above road level.

The cutting through Bruce Ridge will separate the Eastern and Western sections resulting in fragmentation of the forest area, walking trails and wildlife movement and the general amenity of the area.

Impacts at Bruce Ridge have been mitigated by :

- Constricting construction to a narrow corridor
- Vegetating the edges of the GDE including batters where practical
- Retention of trees where practical close to the road works.

From a driver experience perspective the effects of the cutting at Bruce Ridge are similar to the cutting through the AIS however the forest vegetation would provide a high level of visual uniformity.

South of Battye Street where GDE is in a mixture of deep cuttings and shallow embankment sections of the road would be visible but not prominent through trees in views from the AIS Athletic Track.

#### ii) Eastern Alignment

A visual analysis of the Eastern Alignment was undertaken by Dorrough Britz and Associates (DBA) and their full report is attached in Appendix A.

The GDE will not adversely impact on view from Black Mountain Tower as most of the road is screened by trees.

A major visual intrusion of the roadway will be in the movement and reflection of vehicles across the landscape.

The embankments forming the bridge approaches at the Ginninderra Drive overpass will dominate the view from Ginninderra Drive and result in a discordant landscape. Existing power pylons and lines already impact visually on the views to and from this area.

The driver experience in the vicinity of Ginninderra Drive will include extensive views to the south towards the AIS and Canberra Stadium with Black Mountain and the Tower dominating the skyline.

To the north extensive views over the Kaleen grasslands and the treed suburb of Kaleen will dominate the driving experience. Near North Lyneham Ridge the existing woodland open/forest will provide an interesting and typical Canberra landscape experience.

At the AIS Precinct there is a discordant mix dominated by power pylons and lines, roads and the AIS facilities with a visual connection by rough grassland and scattered trees of O'Connor and Bruce Ridge.

Looking east the GDE will be seen against the backdrop of O'Connor Ridge and will be screened by cuttings. The existing and proposed planting will assist in blending the road into the landscape.

GDE will dominate the foreground at O'Connor Ridge and will create an abrupt junction between natural vegetation character of the Ridge and the degraded and developed valley floor. The scale and grading of embankments will appear

discordant against the gentle slopes of the surrounding landscape. Extensive screen planting will reduce visual impact.

South of the AIS the GDE will have a major adverse visual impact on this area due to its stark contrast with the scale and character to the natural vegetation and landscape.

There will be a variety of driver experiences from grasslands north of Ginninderra Drive to extensive views from the Ginninderra Drive overpass to restricted views due to cuttings and the open forest south of the AIS.

#### 3.12 AIS Masterplan

As shown on Figure 11, the Western Alignment has substantial impacts on the AIS Masterplan in that it:

- Removes land identified for potential development both within and outside its present lease boundaries.
- Delays any development as amendments are required to the Territory and National Capital Plans.
- Inflicts operational impacts.
- Limits growth potential and flexibility.
- Delays investment into additional facilities for which the AIS has funding.

The Eastern Alignment does not have any impacts on the Masterplanning and future development of the AIS.

#### 3.13 Construction Staging

The construction of the Eastern Alignment would be simpler to stage than the construction of the Western Alignment.

The major bridge at Ginninderra Drive could be built as 2 separate structures, one in the initial stage and the other in ultimate phase, thus saving cost and time for the Stage 1 works.

As all the structures on the Western Alignment are constructed over GDE they will need to be build in the Stage 1 works requiring a longer construction duration.

#### 3.14 Construction Costs

The Eastern Alignment requires significantly less funds to build due to:

- Less earthworks;
- Less bridges;
- No hard finishes to cuttings;
- Minimal service relocations;
- No carpark relocations; and,
- Less stormwater drainage infrastructure

The estimated cost savings in construction costs, including all adjustments at the AIS are in the order of \$10 million.

#### 4.0 CONCLUSION

The Eastern Alignment for GDE at the AIS is preferred over the Western Alignment as it has less overall environmental impacts.

There are no constraints on the development of AIS Masterplan as no variations to the Territory or National Capital Plans are required. Land identified for the development west of Leverrier Crescent is available for the growth thus providing the optimum flexibility in terms of access and leasing extra land without constraints.

#### **Report Reference Documents**

- 1. 1997 Preliminary Assessment John Dedman Parkway by Maunsell Pty Ltd for the ACT Government.
- 2. 30 November 2002 Preliminary Assessment, Gungahlin Drive Extension, Western Alignment
- 3. Gungahlin Drive Extension; Ecological Information for parts of the Proposed Route prepared by Environment ACT (Wildlife Research and Monitoring, March 2002)
- 4. Gungahlin Drive Extension; Traffic and Transport Planning Assessment report. Scott Wilson Nairn, 20 December 2002
- 5. Gungahlin Drive Extension; Eastern Alignment Visual Analysis. Dorrough Britz & Associates, 20 December 2002

#### APPENDIX A VISUAL ANALYSIS Dorrough Britz & Associates

# VISUAL ASSESSMENT OF PROPOSED EASTERN ALIGNMENT FOR THE GUNGAHLIN DRIVE EXTENSION

This report on the proposed eastern alignment of the Gungahlin Drive extension has been prepared to enable comparison with the proposed western alignment.

To aid comparison a similar methodology has been adopted to the report prepared for the western alignment by DSB Landscape Architects, November 02

This report deals only with the section of variance of the route namely from just north of Ginninderra Drive to the beginning of Bruce Ridge.

## VISUAL ASSESSMENT OF EXISTING CONDITIONS ALONG PROPOSED EASTERN ALIGNMENT

#### **General Landscape Description**

#### Kaleen South Precinct

The description of this area is covered in the DSB report.

#### Bruce Precinct

This is the main area of departure from the western alignment.

Bounded on the north by Ginninderra Drive, Bruce Ridge on the south, O'Connor Ridge on the east and the AIS, Bruce Stadium on the west.

#### Landform

This precinct is a wide valley opening to the north and west, enclosed and dominated by the western slopes of O'Connor Ridge and the more gentle northern slope of Bruce Ridge. To the south the valley narrows and flows out between O'Connor and Bruce Ridges.

#### Vegetation

The natural mature open forest vegetation of O'Connor Ridge and Bruce Ridge dominates the vegetation of this precinct to the east and south. The original valley, vegetation, probably grassland/woodland has been greatly disturbed but is still dominated by scattered groupings of Eucalypt trees in degraded grassland. All tall vegetation has been cleared to accommodate the power lines.

#### Built Form

This area is dominated by the twinned power pylons and power lines that follow the eastern edge of the valley and through the gap between O'Connor and Bruce Ridges,

and the electricity substation fenced compound and buildings. The asphalt access road to Bruce Stadium and the carpark follows the edge of O'Connor Ridge. The Bruce Stadium and the associated light towers are obvious to the west but the AIS buildings are not obvious, being generally screened by vegetation.

#### Views

From the valley views are enclosed on the east by the topography and forest vegetation of O'Connor Ridge and to the south by Bruce Ridge. Views to the south west and north west over the valley are restricted by the scattered tree planting. The power pylons and the electricity substation dominate the near views. Bruce Stadium roof and the light towers which appear over the horizon are the dominant architectural elements. Other buildings of the AIS are not clearly visible, being generally screened by the scattered groupings of trees. Black Mountain tower is only visible over Bruce Ridge due to the clearing of the vegetation from under the power lines.

#### Bruce Ridge

The description of this area is covered in the DSB report.

#### VISUAL IMPACT OF PROPOSED ROADWAY

This assessment considers the visual impact of the proposed eastern alignment in terms of

- the views of the road from adjacent public and private vantage points and surrounding areas and,
- the experience of the road users as seen from each direction of travel.

The following are key locations of potential impact

- views of the road from the urban edge of Kaleen
- views of the road from North Lyneham Ridge
- Views of the road overpass from Ginninderra Drive
- views of the road from O'Connor Ridge and Bruce Ridge
- locations along the road as viewed by the vehicle drivers and passengers

The visual impact at these locations depends on the nature of the existing landscape, the alignment and engineering of the road (width, batters and structures), and the proposed landscape treatment of the road corridor.

The proposed eastern alignment will not adversely impact on the view from the elevated viewing platform of Black Mountain. It is expected that much of the road will be screened by tree canopy.

The visual impact will obviously be greater during and immediately after construction. This condition has not been considered in this assessment and assumptions have been made as to the landscape treatment for such things as screening and verge treatment in line with the sensitivity of the site.

A major visual intrusion of the roadway will be the movement and reflection of the vehicles across the landscape.

#### **Kaleen South Precinct**

#### Kaleen South - Views toward GDE

The impact in this area is generally described in the Preliminary Assessment document.



View from Kaleen looking SW over grasslands toward North Lyneham Ridge with O'Connor Ridge in background. Ginninderra Drive overpass will dominate background. Note visual intrusion of power lines and pylons

The major additional adverse impact is the overpass of the GDE over Ginninderra Drive. The bridge, the on and off ramps and adjoining bank abutments will be visible from Kaleen and will dominate the view from Ginninderra Drive. The grading of the embankments and the dominance of the elevated roadway over the gentle slopes of the valley and North Lyneham Ridge will create a discordant landscape. The existing power pylons and lines, although not interrupting the views already impact visually on the views to and from this area. Extensive planting to the road verges and embankments will be required to create a link with the adjacent open forest of North Lyneham Ridge and O'Connor Ridge.



View south from North Lyneham Ridge along proposed alignment of overpass at Ginninderra Drive. Note power lines and pylons and distant view to Black Mountain

From the western slopes of North Lyneham Ridge the roadway, overpass and associated earthworks will dominate the views over the Kaleen grasslands. It will only be with extensive shrub and tree planting that the impact of the road and overpass will be reduced. This in turn will restrict the distant views to the west

#### Kaleen South - Driver Experience

The elevated roadway over Ginninderra Drive will provide extensive views to the south toward the AIS and Bruce Stadium (filtered and screened through the existing trees) with Black Mountain and the Tower dominating the horizon. To the north west extensive views over the Kaleen grassland areas and the treed suburb of Kaleen will dominate the driving experience. The proposed route for the GDE adjacent to the existing woodland/open forest of North Lyneham Ridge will provide an interesting and typical Canberra landscape experience for the driver - open grassland and natural forest woodlands.



View north from proposed location of Ginninderra Drive overpass over Kaleen grasslands

The road alignment generally parallels the major power lines, which with the associated twined power pylons are the dominants man made elements.

From Ginninderra Drive the GDE bridge overpass will dominate and interrupt the visual flow of that section of the road and restrict views of the natural landscape of North Lyneham Ridge and O'Connor Ridge. The scale and grading of the associated

embankments will appear discordant against the gentle slopes of the surrounding landscape.

#### **Bruce Precinct**

#### Views toward the GDE Project

This precinct

This precinct to the east of the AIS and Bruce Stadium is a discordant visual mix, dominated by the power pylons and lines, the electricity substation, Masterrman Street, Bruce Stadium and light towers, large car parking areas and AIS playing fields. These elements are visually connected by rough open grassland, scattered native trees and the dominant natural vegetation of O'Connor and Bruce Ridge that enclose the area



View SW from Masterrman Street toward AIS and Bruce Stadium. Scattered trees break up views of built elements. Note intrusion of power lines. Bruce Stadium roof and light towers dominate skyline

Looking to the east the GDE will be seen against the backdrop of the O'Connor Ridge. Additional planting of local tree and shrub species will assist in blending the road into this landscape.

The roadway will be in a cutting for approximately 400m as it passes to the east of the AIS and Bruce Stadium and not visible before emerging to cross the narrow valley and cycle path between O'Conner and Bruce Ridge.

The bridge over Ginninderra Drive, the on and off ramps and the associated embankments will be prominent in views to the north east from the AIS and Bruce Stadium, however, the current trees and further screen planting to the road verge will greatly screen the roadway and associated works.

From O'Connor Ridge the roadway and associate works will dominate the foreground and will create an abrupt juncture between the natural vegetation character of the Ridge and the degraded and developed valley floor. The scale and grading of the associated embankments will appear discordant against the gentle slopes of the surrounding landscape. Extensive screen planting with local native shrubs and trees will reduce the visual impact and assist in the blending to O'Connor Ridge. To the south of the precinct along Bruce Ridge the road passes over and parallels the Bruce cycle path and walking trail before joining the proposed western alignment. The road and associated earthworks will have a major adverse visual impact in this area, the road being in stark contrast in scale and character to the natural vegetation and landscape that dominates this area.



Typical Bruce Ridge open forest landscape character with views restricted by vegetation density. Detail variety important aspect. Note cycle path, walking path in right hand corner.

#### Driver Experience

For the motorist this precinct will provide a variety of experiences. For the southbound driver after passing through the open grassland area of Kaleen and the experiencing the extensive views from the Ginninderra Road overpass most of the roadway will be in cuttings which will restrict the views out, especially through the attractive open forest of Bruce Ridge. From the overpass and along the route to the south Black Mountain and the tower will dominate the horizon.

Occasional views will obtained when the road emerges at the cycle path overpass at the valley between Bruce Ridge and O'Connor Ridge with views in both directions down the valley under the power lines and toward Bruce Stadium.



View south ease down valley between O'Connor Ridge (left) and Bruce Ridge with Black Mountain and tower behind. Power lines and pylons intrude into and dominate the view. Note vegetation cleared beneath power lines

Verge and embankment planting will generally dominate the driving experience and restrict and enclose views.