Review of Environmental Factors

Olympic Park Development

NE30034

Prepared for
Muswellbrook Shire Council

4 January 2021

Cardno

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V1	20/08/2020	Draft for internal review	Nadine Caff	Tanja Mackenzie
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Executive Summary

Cardno (NSW/ACT) Pty Ltd (Cardno) has prepared this Review of Environmental Factors (REF) on behalf of Muswellbrook Shire Council (Council) under Division 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the proposed construction of Stage 1 of the Olympic Park Masterplan. Council is both the proponent and the determining authority for the proposal.

The purpose of this REF is to describe the proposed works, to document the potential environmental impacts of the works and to detail the protective measures to be implemented. In doing so, the REF helps fulfil the requirements of Part 5, Division 5.1 of the EP&A Act that the determining authority examine and consider to the fullest extent possible all matters affecting, or likely to affect, the environment by reason of the activity.

The environmental assessment indicates that the proposed works would not result in significant environmental impacts for the following reasons:

> Appropriate erosion and sediment controls would be implemented to ensure minimal impacts on the receiving environment throughout the construction phase;

> No threatened species, populations or ecologically endangered communities (EECs), including those which are matters of national environmental significance (MNES) are considered to be significantly impacted by the proposed works;

> Noise and traffic impacts during the construction and operational phases would be managed with appropriate controls; and

> Waste generation would be minimised and managed by the appointed Contractor through the application of waste management measures in accordance with Waste Management Hierarchy and the relevant statutory controls.

The proposed works are considered consistent with the statutory and non-statutory framework in NSW. It is expected the works would result in a net positive impact, with the principal benefit being improved recreational facilities for the local population and increased tourism potential. The REF concludes that the proposed works are unlikely to have any significant or long term negative environmental impacts providing the mitigation measures outlined in this REF are implemented during the works.

Glossary

Term/Acronym	Description
AEP	Annual Exceedance Probability
AHIMS	Aboriginal Heritage Information Management System
AOBV	Areas of Outstanding Biodiversity Value
ARI	Average Recurrence Interval
ASS	Acid Sulfate Soil
ASSMAC	Acid Sulfate Soil Manual, New South Wales
BC Act	NSW *Biodiversity Conservation Act 2016*
BOM	Bureau of Meteorology
CEMP	Construction Environmental Management Plan
CoE	Centre of Excellence
CSP	Community Strategic Plan
CTMP	Construction Traffic Management Plan
dBA	A-weighted Decibel
DoEE	Department of the Environment and Energy
DoI	Department of Industry
DoPIE	Department of Planning, Industry and Environment
DPI	Department of Primary Industries
EEC	Endangered Ecological Communities
EIA	Ecological Impact Assessment
EP&A Act	NSW *Environmental Planning and Assessment Act 1979 (NSW)*
EP&A Reg.	NSW *Environmental Planning & Assessment Regulation 2000*
EPA	Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FM Act	NSW *Fisheries Management Act 1994*
GIS	Geographical Information Systems
KTP	Key Threatening Processes
LEP	Muswellbrook Shire Local Environmental Plan 20
LGA	Local Government Area
LoS	Level of Service
MNES	Matters of National Environmental Significance
NSW	New South Wales
PA	Public Address
PMST	Protected Matters Search Tool
PNTL	Project Noise Trigger Levels
POEO Act	NSW *Protection of the Environment Operations Act 1997*
REF	Review of Environmental Factors
TfNSW	Transport for NSW
SEED	Sharing and Enabling Environmental Data
SWL	Sound Power Levels
TEC	Threatened Ecological Community
TIA	Traffic Impact Assessment

Table of Contents

Appendices

Tables

Figures

1 Introduction

This Review of Environmental Factors (REF) has been prepared by Cardno (NSW/ACT) Pty Ltd (Cardno) on behalf of Muswellbrook Shire Council (MSC) under Division 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to assess the potential environmental impacts of the proposed implementation of Stage 1 of the Olympic Park Masterplan (the Masterplan).

This REF describes the proposal, documents the potential impacts, and details management and mitigation measures to be implemented to protect the environment. This assessment has been prepared pursuant to Section 5.5 of the EP&A Act and Clause 228 of the Environmental Planning and Assessment Regulation (EP&A Reg.) 2000.

This REF fulfils the requirements of Section 5.5 of the EP&A Act, that the proponent examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

For this proposal, Council is the proponent and the determining authority in accordance with the provisions of Division 5.1 of the EP&A Act.

1.1 Background

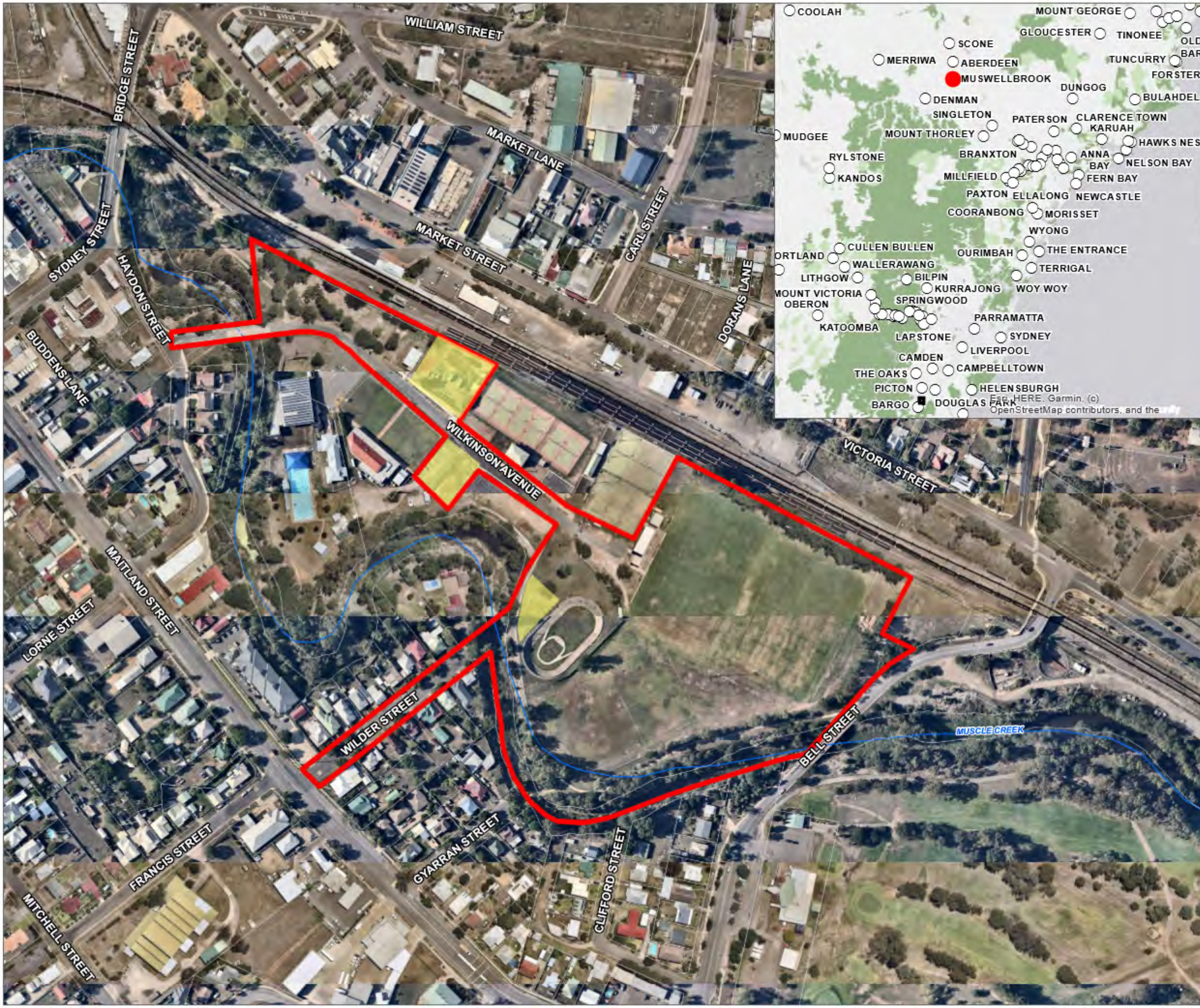
Olympic Park is a sports and entertainment precinct within the suburb of Muswellbrook, NSW (see **Figure 1-1**). Council developed the Masterplan (TDP 2018) for the proposed Olympic Park sporting precinct that incorporates the existing infrastructure with the proposed upgrades. Along with the golf course, Olympic Park forms the northern end of an almost 3.2 km long green space corridor running primarily east of the New England Highway from Wilkinson Avenue in the north and along the length of Bimbadeen Drive in the south. The main access to parking and the sporting facilities is via Wilkinson Avenue in the north. Additional parking and access is available via Bell Street in the south. The Park's main facilities include the rugby league fields, grandstand, toilets, canteen, tennis courts, velodrome and the aquatic centre.

MSC seeks to upgrade accessibility and improve amenity services at the Olympic Park Precinct (OPP) in accordance with the Masterplan prepared for the site. MSC will deliver the OPP upgrades in a staged approach, priority projects identified under the Stage 1 Structure Plan in the Masterplan.

1.2 Project Location

The subject site is bound by Haydon Street to the west, the New England Highway to the south, Bell Street to the east, and Australian Rail Track Corporation (ARTC) railway corridor to the north. The size of the site is constrained by these key transport corridors. The site is subject to the local planning controls of the Muswellbrook Local Environmental Plan (LEP) 2009 and Muswellbrook Shire Council Development Control Plan 2009 (DCP). Nearby land uses are predominantly Local Centres and Industrial, with the site itself zoned as RE1 – Public Recreation.

The site comprises Lot 7010 DP 93327 and the road reserve of Wilkinson Avenue and Wilder Street. Lot 7010 DP 93327 is Crown parcel that is currently managed by Council.



muswellbrook shire council

Study Area

OLYMPIC PARK DEVELOPMENT

Legend

- Potential Ancillary Area
- Study Area
- Cadastre (NSW SS, 2019)
- Watercourses (LPI)
- Railway (NSW SS)

FIGURE 1-1

1:3,000 Scale at A3

m
0 25 50 75 100

N

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (W&E)
Date: 2020-08-20 | Project: 8202021101
Coordinate System: GDA 1994 MGA Zone 56
Map: NE30034-GS-009-REF.mxd 01
Aerial imagery supplied by nearmap (April 2020)

2 Objectives, need and alternatives

2.1 Objectives

The objectives of the proposed works are:

1. To improve community amenity and upgrade community facilities;
2. To improve access to the precinct; and
3. To reduce environmental impacts.

2.2 Need for proposed works

The development of Olympic Park is closely aligned with the goals of the MSC Community Strategic Plan (CSP) (Muswellbrook Shire Council, 2015). Goal 4 of the CSP is to: Develop Muswellbrook as a Regional Centre. The precinct upgrade will allow for larger regional events to be hosted in Muswellbrook, including hosting National Rugby League (NRL) games.

Goal 5 of the CSP is to continue to improve the affordability, liveability and amenity of the Shire's communities. Implementation of the Masterplan will assist in achieving this goal by promoting and facilitating increased participation in active and passive recreational activities. This project is closely aligned with the priorities of the CSP, together with the Premier's Priorities in Action (NSW Government, 2020), Hunter Regional Plan 2036 (NSW Government, 2016) and other State Government plans (Muswellbrook Shire Council, 2019).

The construction of the Wilder Street bridge over Muscle Creek and the Wilkinson Avenue upgrades will improve connectivity between adjacent residential areas and the facilities in Olympic Park.

2.3 Alternative and options considered

In May 2017, Muswellbrook Shire Council engaged urban design consultancy The Design Partnership to prepare a Masterplan for Olympic Park (TDP, 2018). The development of the Masterplan included consultation with the community and stakeholders (refer **Section 5.3**). The development of the Masterplan included a use analysis and site analysis to identify key issues and priorities. Consideration was given to site uses and activities, movement around the facility and visual enhancement of the facility.

The Masterplan includes two Stages for development. This REF considers Stage 1 which includes:

> General precinct upgrades including upgrade of Wilkinson Avenue and a new bridge over Muscle Creek;

> Upgrades to the Rugby League Precinct including fencing and an amenities building; and

> Upgrades to the Ron King Velodrome including lighting and fencing.

Council are considering three options for the proposed new bridge over Muscle Creek.

> Two lane bridge with a pedestrian path / cycleway;

> One lane bridge with pedestrian path / cycleway; and

> One lane bridge.

2.3.1 Option Analysis

The options considered for this REF are:

1. New Masterplan works; and
2. Do nothing.

The new Masterplan works would provide improvements to the community facilities in the region. It will allow for larger regional events to be hosted in Muswellbrook, improving the local economy. The Masterplan works are aligned with the goals of the Muswellbrook CSP. The new bridge would improve access to the precinct. There is currently only one access point to the facility on Wilkinson Avenue off Haydon Street. The provision of a new bridge would improve access to the facility, and provide improvements to traffic flow particularly for larger regional events.

In terms of the bridge options, the concept design option for the physical bridge structure is the same for all options. The potential impacts to access, transport and traffic have been considered in **Section 6** of this REF. The detailed design for the proposed bridge will need to consider these potential impacts.

The do nothing option would not meet objectives of the proposed works and would not align with the goals of the Muswellbrook CSP. Community facilities would continue to deteriorate over time and result in a reduction in community amenity.

2.3.2 Preferred Option

The preferred option is to undertake the Masterplan works. This REF considers the Stage 1 works only. The design for the bridge will be considered further in the detailed design phase. The selection of the preferred bridge option will require careful consideration by Council with respect to:

> The available budget for the upgrade;

> The potential access, traffic and transport impacts during the construction and operation of the upgrade; and

> The demand for a pedestrian path or cycleway.

This REF has been written based on the concept options. The findings and conclusions made in this REF are applicable to all three options.

A detailed description of the proposed works is provided in **Section 3**.

3 Proposed Works

3.1 Objectives

The objectives of the proposed works are:

1. To improve community amenity and upgrade community facilities;
2. To improve access to the precinct; and
3. To reduce environmental impacts.

3.2 Description of the Proposal

The Stage 1 Structure Plan within the Masterplan provides for a range of upgrades to the existing sporting facilities, as well as provision of a new internal road connection and car park. The key elements from the Masterplan being implemented under Stage 1 are shown in **Figure 3-1**, and include:

> Wilkinson Avenue upgrade and new bridge over Muscle Creek to Wilder Street;

> Upgrades to the Rugby League Precinct; and

> Upgrades to the Ron King Velodrome.

3.2.1 Wilkinson Avenue upgrade and new bridge over Muscle Creek

The existing access off Hayden Street and Wilkinson Avenue would be retained with the addition of a roundabout at the location shown in **Figure 1-1**. A new internal road connection would be constructed between the new roundabout and Wilder Street, to include a new bridge over Muscle Creek (Refer **Appendix E**). Council are yet to determine whether the north-south arm of the internal road that joins the roundabout and Wilder Street would be one way or two way (as discussed in **Section 6.1**); however, it is proposed that the Maitland Street exit from Wilder Street would be restricted to left turns only. The upgrade of Wilkinson Avenue and new internal road would also include intelligent street lighting, a new pedestrian crossing, a shared path, and bus drop-off only zones.

Street trees and landscaping will be incorporated into the upgrade of Wilkinson Avenue. A new forecourt for the Rugby League Precinct will be constructed and the Keys Memorial Gates will be relocated to this area.

As part of the Stage 1 works, the new B1 carpark with 44 spaces would also be constructed at the site of the existing sustainability hub.

3.2.2 Rugby League Precinct

Works proposed in the Rugby League Precinct include:

> Field improvements and drainage to Fields 1 and 2;

> Irrigation and upgrades to Field 3. Field 3 is to be used for touch football and training, and is proposed as a public kick about space;

> 1,800 mm high palisade fence to enclose Fields 1 and 2; and

> New Amenities Building including:
  - Two change rooms,
  - Storage for the velodrome, and
  - Lift and stair access to multi-function room above.

3.2.3 Ron King Velodrome

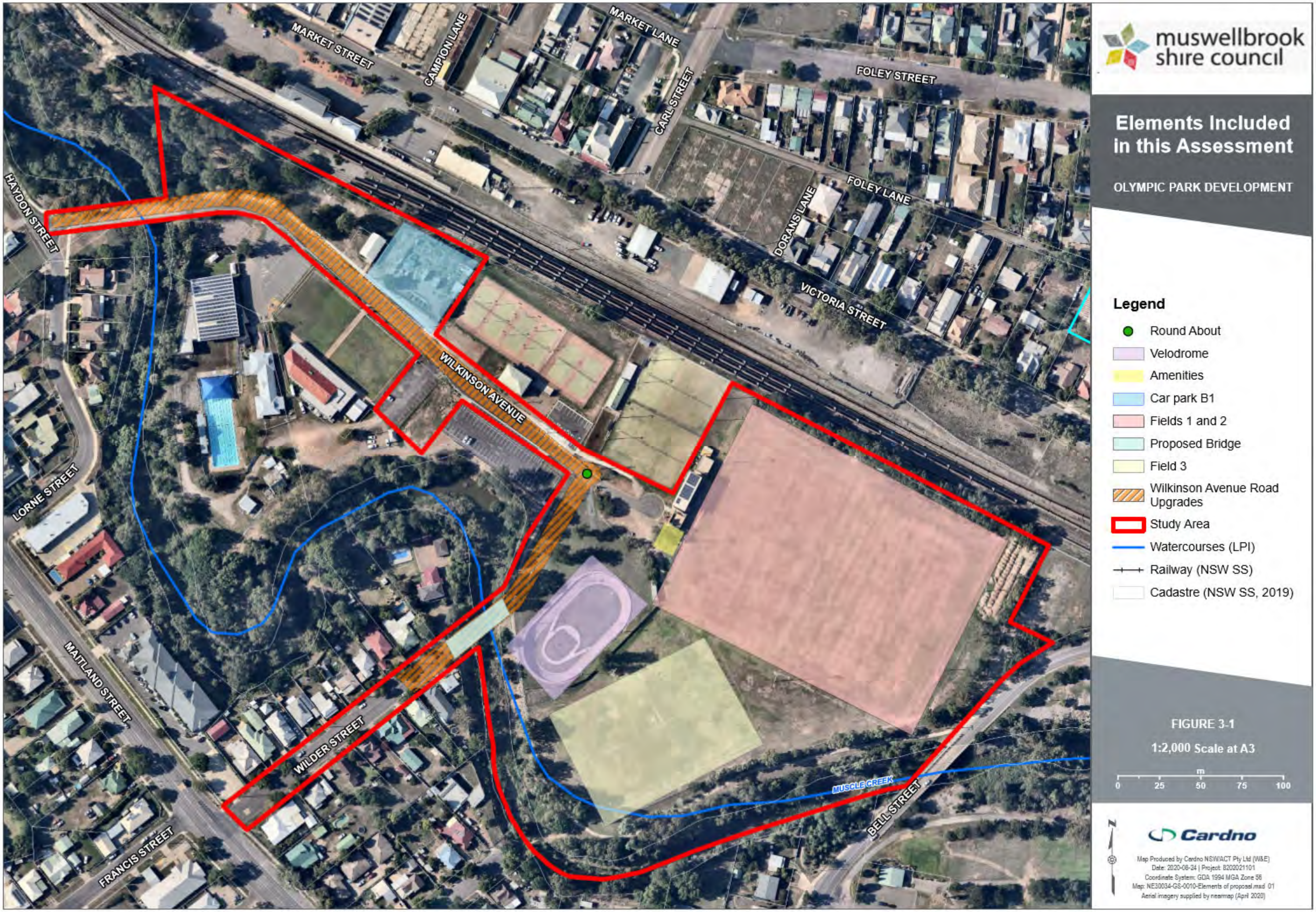
Upgrades to the velodrome include:

> New intelligent lighting to allow for night training and competition;

> New fencing to secure the track;

> Removal of storage facility and derelict brick structure; and

> New storage area for the Velodrome (to be incorporated into the new amenities building located within the Rugby League Precinct discussed above).


muswellbrook shire council
Elements Included in this Assessment
OLYMPIC PARK DEVELOPMENT
Legend
Round About
Velodrome
Amenities
Car park B1
Fields 1 and 2
Proposed Bridge
Field 3
Wilkinson Avenue Road Upgrades
Study Area
Watercourses (LPI)
Railway (NSW SS)
Cadastre (NSW SS, 2019)
FIGURE 3-1
1:2,000 Scale at A3
m
0 25 50 75 100
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (W&E)
Date: 2020-08-24 | Project: 8202021101
Coordinate System: GDA 1994 MGA Zone 56
Map: NE30034-GS-0010-Elements of proposal.mxd 01
Aerial imagery supplied by nearmap (April 2020)
MARKET STREET
CAMPION LANE
MARKET LANE
CARL STREET
FOLEY STREET
FOLEY LANE
DORANS LANE
VICTORIA STREET
HAYDON STREET
WILKINSON AVENUE
LORNE STREET
MAITLAND STREET
WILDER STREET
FRANCIS STREET
MUSCLE CREEK
BELL STREET

3.3 Construction Methodology

3.3.1 Work methodology

This construction methodology is indicative and has been developed based on previous projects of a similar nature. The final construction methodology is to be determined by the Contractor with works staged in accordance with the Masterplan staging and taking into account the availability of funding. Construction timing and duration is currently unknown and would be confirmed during detailed design.

Site Establishment

The following activities would be undertaken for each stage to establish the construction site:

> Establish the site ancillary area for all storage, waste management and parking areas for vehicles and machinery;
> Installation of temporary fencing around the perimeter of the site to prevent unauthorised access;
> Consultation with utility providers, if required;
> Delivery of equipment, machinery and materials to the site ancillary area;
> Implementing traffic management measures; and
> Installation of environmental controls.

Utilities

The following activities would be undertaken for each stage of works to minimise the risk of damage to utilities:

> Confirm location of both aerial and underground utility services (for safety reasons); and
> Establish exclusion zones around existing utility services to meet the requirements of the utility authorities.

Road Construction

> Clearing and vegetation removal;
> Minor earthworks and construction of new road sub-base, base and pavement;
> Construction of the roundabout;
> Line marking;
> Minor regrading works and pavement construction for the new pedestrian crossings, shared path, drop off zone and car park; and
> Install street furniture and signage.

Bridge Construction

For purposes of this REF, it has been assumed that the bridge design would incorporate piles, as this would be a greater impact than a span without the need for supporting piles. The construction methodology is assumed to involve:

> Undertake temporary works to prepare crane and piling pads for bridge construction;
> Clearing and vegetation removal;
> Excavate approaches;
> Excavate and construct bridge piers;
> Excavate and construct pile caps / abutments;
> Construct blade walls;
> Construct headstocks;
> Install prestressed reinforced concrete planks;
> Construct bridge decking slabs and approach slabs
> Install scour protection;

> Construct road sub-base;
> Construct safety barriers and asphalt road surfacing; and
> After construction of the new bridge the existing road would be tied into the new approaches.

Rugby League Precinct

> Earth works to improve drainage on fields 1 and 2;
> Installation of irrigation system for field three;
> Installation of fencing enclosing Fields 1 and 2; and
> Vegetation removal, earthworks, pavement and structural works to erect the New Amenities Building and the associated concrete pad.

Ron King Velodrome

> Demolition of existing storage structures; and
> Earthworks and installation of lighting and fencing.

Construction site de-commissioning

Following the completion of the construction works at each stage, the following activities would be undertaken:

> Decommission temporary facilities (such as ancillary area);
> Clean up the site and dispose of all surplus waste materials;
> Removal of erosion and sediment controls following adequate stabilisation of disturbed areas; and
> Removal of construction traffic management and opening of the proposal to traffic.

Site Rehabilitation

The work site would be progressively rehabilitated to minimise dust generation, erosion and sedimentation. The rehabilitation works would involve revegetation of any cleared areas with locally endemic native species (where not required for maintenance purposes). The revegetated areas would be maintained for a minimum of six months to ensure the survival of the vegetation.

3.3.2 Site Ancillary area

The location of a site ancillary area has not been confirmed at the time of this REF. However, suitable locations have been identified on **Figure 1-1**.

The ancillary area would likely include toilet facilities, bunded areas for the storage of materials/chemicals, and designated parking and waste management areas. A site office will be established if required. An ancillary site may be required for stockpiling construction materials. In addition, temporary stockpiling may be undertaken. Any construction compound or ancillary facilities would, where feasible, be located:

> Outside the floodplain, or if this is not possible, preferably above the 10-year ARI flood level;
> More than 50 m from a watercourse;
> More than 100 m from occupied residences;
> In previously disturbed areas that do not require the clearing of native vegetation;
> In plain view of the public to deter theft and illegal dumping; and
> On level ground.

3.3.3 Plant and equipment

Potential plant and equipment that is likely to be used during construction includes:

> Excavator;
> Bulldozer;
> Front end loader;
> Grader;
> Asphalt paver;

- Vibratory rollers;
- Concrete truck;
- Concrete pump;
- Cement mixer;
- Water cart;
- Light vehicles;
- Crane;
- Piling rig;
- Welding equipment;
- Generator;
- Concrete saw;
- Pneumatic jackhammer; and
- Chainsaw.

3.3.4 Construction hours and timeframe

The works would be undertaken during standard construction hours as follows:

- Monday to Friday: 7am to 6pm;
- Saturday: 7am to 1pm;
- Sunday and Public Holidays: no work.

Some works outside of standard hours may be required on occasion, for example, in order to minimise impacts on traffic, as required under a Road Occupancy Licence, or as required to minimise risk to the safety of construction staff or the public.

If required, out of hours work would occur in accordance with the project approval and notification requirements of any Environment Protection Licence for construction of the project. Any such, out of hours works would be limited in nature and would as a minimum require prior notification of the adjacent residents and businesses, any other affected stakeholders and approval from the Principals Authorised Person. Works to be constructed under the Olympic Park Masterplan will be delivered in a staged implementation as funding permits.

4 Statutory and Planning Framework

4.1 NSW Legislation and Policy

4.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act is the principal planning legislation for NSW. It provides a framework for the overall environmental planning and assessment of proposals.

Under Section 5.5 of the EP&A Act there is a duty for determining authority to consider the environmental impacts of proposed activities. The specific aspects of these environmental considerations are detailed in Clause 228 of the EP&A Regulation. All requirements of Clause 228 have been adequately addressed throughout this REF and are summarised in **Section 8**.

Development consent under Division 4.1 of the EP&A Act is not required due to the provisions of the ISEPP (refer **Section 4.1.2**).

4.1.2 State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)

The aim of this Policy is to facilitate the effective delivery of infrastructure across NSW by identifying whether certain types of infrastructure require consent, can be carried out without consent or are exempt development.

Clause 65 of the ISEPP permits development for the purpose of outdoor recreational facilities (including playing fields) to be carried out by a council on a public reserve under the control of or vested in the council without consent. As Council is the proponent, and the Site is land zoned RE1, it falls under the ISEPP and can be assessed under Part 5 of the EP&A Act. Development consent is not required.

Clause 101 of the ISEPP requires consideration of the potential impacts of traffic noise and vehicle emission on development adjacent to classified roads. The works satisfy the requirements of Clause 101 as the safety, efficiency and ongoing operation of the classified road will not be adversely affected by any of the following:

> The design of the vehicular access to the land;

> The emission of smoke or dust from the development; and

> The nature, volume or frequency of vehicles using the classified road to gain access to the land.

Where practicable and safe, vehicular access to the land is provided by a road other than the classified road. The works are appropriately located and designed and include measures, to ameliorate potential traffic noise or vehicle emissions.

Part 2 (Division 1) of ISEPP contains provisions for public authorities to consult with the local council and other authorities prior to the commencement of certain types of development. Consultation, including that required by the ISEPP, is discussed in **Section 5** of this REF.

4.2 Local Environmental Plans

Under the Muswellbrook LEP 2009 the proposal is located on land zoned RE1 Public Recreation.

The ISEPP overrides the provisions of the Muswellbrook LEP and development consent under Part 4 of the EP&A Act is not required. Further, the proposed works do not conflict the objectives of the land zoning objectives.

4.3 Other Legislation and Approvals

4.3.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act is the Australian Government's key piece of environmental legislation, focusing on MNES, with States and Territories having responsibility for matters of State and local significance.

Approval is required from the Commonwealth Minister for the Environment for any controlled action that may result in a significant impact on matters of MNES.

The results of Commonwealth EPBC Act Protected Matters Search Tool (PMST) indicated that a total of four MNES are identified as having potential to occur within the Study Area as listed in **Table 4-1**.

Table 4-1 PMST's predicted Matters of National Environmental Significance (MNES)

<table>
<tr><th>MNES</th><th>PMST predicted</th><th>Applicability to Study Area</th></tr>
<tr><td>World Heritage Places</td><td>None</td><td>NA</td></tr>
<tr><td>National Heritage Places</td><td>None</td><td>NA</td></tr>
<tr><td>Wetlands of International Importance</td><td>One wetland of international importance was predicted to occur:
▪ Hunter Estuary Wetlands</td><td>Hunter Estuary Wetlands are located in Kooragang, NSW, approximately 103 km south-east of the Study Area.
No further assessment is required.</td></tr>
<tr><td>Great Barrier Reef Marine Park</td><td>None</td><td>NA</td></tr>
<tr><td>Commonwealth Marine Area</td><td>None</td><td>NA</td></tr>
<tr><td>Threatened Ecological Communities (TECs)</td><td>Four TECs were predicted to occur:
▪ Central Hunter Valley Eucalypt Forest and Woodland Critically Endangered Ecological Community (CEEC);
▪ Hunter Valley Weeping Myall (Acacia pendula) Woodland (CEEC);
▪ Lowland Rainforest of Subtropical Australia (CEEC); and
▪ White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (CEEC).</td><td>Further assessment is presented in Section 6.5.</td></tr>
<tr><td>Threatened Species</td><td>A total of 31 threatened species were predicted to occur within the 10 km locality as per Table below.
<table>
<tr><th>Group</th><th colspan="3">Number of species predicted</th></tr>
<tr><th></th><th>Vulnerable</th><th>Endangered</th><th>Critically Endangered</th></tr>
<tr><td>Birds</td><td>3</td><td>2</td><td>4</td></tr>
<tr><td>Frogs</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Mammals</td><td>7</td><td>1</td><td></td></tr>
<tr><td>Plants</td><td>4</td><td>3</td><td>2</td></tr>
<tr><td>Reptiles</td><td>2</td><td></td><td></td></tr>
</table></td><td>Further assessment of threatened species was undertaken as shown in Section 6.5.</td></tr>
<tr><td>Migratory Species</td><td>Fourteen migratory species were predicted to occur within the 10 km locality.</td><td>Further assessment of migratory species was undertaken as shown in Section 6.5.</td></tr>
</table>

4.3.2 State Legislation

A summary of relevant State legislation and the permits and approvals that are required for the works is provided in **Table 4-2**.

Table 4-2 State Legislation

Instrument	Approval authority	Relevance to proposal	Required permits and approvals
Environmental Planning and Assessment Act 1979 (EP&A Act) *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation)	Council	Development in NSW falls under the provisions of the EP&A Act and subordinate legislation. Under Section 5.5 of the EP&A Act, there is a duty for determining authority to consider the environmental impacts of proposed activities. The specific aspects of these environmental considerations are detailed in Clause 228 of the EP&A Regulation.	The works will need to be determined by Council as the nominated determining authority under the Act.
Biodiversity Conservation Act 2016 (BC Act)	Department of Planning, Industry and Environment (DPIE)	The BC Act protects threatened species, populations and ecological communities and their habitat in NSW. If threatened species, populations, ecological communities or their habitat could be impacted by the proposal, an assessment of significance must be completed to determine the significance of the impact, in accordance with Section 7 of the BC Act.	None. Refer to Assessment of Significance in Appendix E of the Ecological Impact Assessment (**Appendix C**).
Biosecurity Act 2015	Department of Primary Industries (DPI)	Under the *Biosecurity Act 2015*, there is a general biosecurity duty to prevent, eliminate or minimise any biosecurity risks they encounter. Biosecurity includes weeds and pest animals.	None. If weeds are encountered, the proponent is obligated to remove and dispose of the weeds appropriately, as discussed in **Section 6.5**.
Contaminated Land Management Act 1997	Environment Protection Authority (EPA)	Must report to EPA if contaminated land is encountered during the works that meets the duty to report contamination requirements under Section 60 of this Act.	None. It is not anticipated that contaminated material would be encountered during the work. Refer to **Section 6.9**.
Fisheries Management Act 1994 (FM Act) Fisheries Management (General) Regulation 2002 (FM Regulation)	DPI (Fisheries)	Certain species are listed as vulnerable under the Act and protected under the Regulation. Permits are required under the following sections of the FM Act to undertake the activities specified: ▪ Section 200/201: Carrying out of dredging and reclamation works; and ▪ Section 219: Works that block the passage of fish.	Yes, the works associated with the bridge will trigger the need for a permit under the FM Act. Preliminary consultation has been undertaken with Fisheries to request their comments and requirements, this is detailed in **Section 5**.
Heritage Act 1977	DPIE	Relates to non-Aboriginal historic artefacts and/or sites (older than 50 years) if uncovered during the works.	None. There are no State heritage items to be impacted by the proposal. The management of locally significant item “Key’s Gates” is outlined in **Section 6.7**

Instrument	Approval authority	Relevance to proposal	Required permits and approvals
Local Government Act 1993	Council	Chapter 6, Section 59A 'Ownership of water supply, sewerage and stormwater drainage works' of the Act States that a Council: ▪ Is the owner of all works of water supply, sewerage and stormwater drainage installed in or on land by the council (whether or not the land is owned by the council), ▪ May operate, repair, replace, maintain, remove, extend, expand, connect, disconnect, improve or do any other things that are necessary or appropriate to any of its works to ensure that, in the opinion of the council, the works are used in an efficient manner for the purposes for which the works were installed. The provisions of this section have effect despite anything contained in Section 42 of the *Real Property Act 1900*.	None.
National Parks and Wildlife Act 1974	DPIE	Relates to disturbance or destruction of any Aboriginal objects or places and removal of identified native species, populations and ecological communities. The Proposal does not fall within a designated National Park, nor would it affect any National Parks or other areas of National Park Estate.	None. No Aboriginal cultural heritage sites or items were identified in close proximity to the proposed woks as part of the due diligence database search. Should any object or site of Aboriginal cultural heritage significance be encountered during construction, the works must cease near the find and DPIE contacted. Refer to **Section 6.6**.
Protection of the Environment Operations Act 1997 (POEO Act) *Protection of the Environment Operations (Waste) Regulation 2005* *Protection of the Environment Operations (Clean Air) Regulation 2010*	EPA	Relates to noise, air and water pollution and waste management for activities that may cause water pollution. 'Scheduled activities' as listed under Schedule 1 of the Act require an Environment Protection License (EPL) from the EPA, unless clauses in Schedule 1 specify otherwise.	None. Waste generated by the project which requires offsite disposal, must be classified in accordance with the NSW EPA *Waste Classification Guidelines* (EPA 2014). Refer to **Section 6.12**.
Roads Act 1993	TfNSW Council	Consent of the appropriate roads authority must be obtained in the event that there is a need to close, or conduct works on or over a public road.	Yes Consultation is currently ongoing with TfNSW regarding the potential to impact the New England Highway, the traffic assessment in **Appendix D** is informing this consultation.

Instrument	Approval authority	Relevance to proposal	Required permits and approvals
			Council would liaise internally with the appropriate departments in the case that works would impact Council managed Roads.
Coastal Management Act 2016	DPIE	The objects of this Act are to manage the coastal environment of NSW in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State.	None. The proposal is not in proximity to coastal environments managed under the Act.
State Environmental Planning Policy (Koala Habitat Protection) 2019	DPIE	The SEPP aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for *Phascolarctos cinereus* (Koala) to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline.	None. The proposal site is not located in the vicinity of Koala habitat according to the ecological impact assessment. Impacts to koalas have been considered in **Section 6.5** and, it is considered that Muscle Creek has some potential as corridor for movement of mobile fauna, including the koala. However, core koala habitat is not present within the Stage 1 works footprint within the Study Area.
Waste Avoidance and Resource Recovery Act 2001	DPIE	The works would use resources and generate waste, and as such needs to consider the Resource Management Hierarchy (Avoidance, Recovery and Disposal) in the Act.	None. However, as the works would generate waste it is required to consider the waste management hierarchy referred to in this Act.
Water Management Act 2000 *Water Management (General) Regulation 2004*	DPI (Water)	A controlled activity approval is required under the Act to undertake any controlled activities (which include the removal of material by way of extraction) in, on or under waterfront land. An Aquifer Interference Licence is required where the works involve use of groundwater.	Councils are exempt under Section 91E of the Act and do not require a controlled activity approval to carry out works in, on or under waterfront land. It is proposed to source irrigation from the potable water supply, therefore an Aquifer Interference Licence is not required.

5 Consultation

5.1 Stakeholder Consultation

Preliminary consultation was undertaken with DPI (Fisheries) on 12 August 2020 to invite their comment on the proposal and to confirm the permit requirements under the FM Act. A response was received on 20 August 2020 with Fisheries comments on the concept design and confirming the requirement for a permit to undertake any dredging and reclamation works. A copy of the consultation is contained in **Appendix F**.

Council are undertaking ongoing consultation with TfNSW regarding the impact of the proposed works on the New England Highway. The traffic assessment (**Appendix D**) is informing this consultation.

5.2 ISEPP Consultation

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development.

Clauses 13 to 16 of the ISEPP require public authorities to consult with local council where the development has impacts on Council related infrastructure or services, impacts on local heritage or impacts on flood liable land. As Council is the proponent for the proposed works, Clauses 13 to 15 are to be addressed via internal consultation with respect to the development.

In addition, Clause 15AA requires consultation with State Emergency Service (SES) for development on flood liable land that may be carried out without development consent under a relevant provision. The SES were contacted for their comments and requirements on 10 August 2020. A response was received on 25 September 2020. The SES reviewed the proposal, and determined that the proposed works appear to have minimal risk to NSW SES response operations (**Appendix F**).

5.3 Community Consultation

During the formulation of the Masterplan, Council undertook consultation with community groups. This involved approximately seven meetings with user groups and the design consultant, comprising individual and group meetings. The conceptual plan was then shown to clubs at user group meetings, resulting in alteration to the plan. Country Rugby League (CRL) have also been consulted during the planning process and have seen the concept. During the meetings clubs identified top priorities, these were traffic management, lighting, pedestrian safety, amenities for female participants and spectator viewing (grandstand and function centre) (P. Chandler, 2020).

6 Environmental Assessment

6.1 Traffic, Parking and Access

6.1.1 Existing Environment

A detailed account of the existing environment is explored in the Traffic assessment (**Appendix D**).

The road network surrounding the site comprises of the following:

> State classified roads:
  - The New England Highway: a single carriageway with four lanes (two lanes in each direction). The posted speed limit is 50 Km/h in the vicinity of the subject site;
  - Sydney Street: a single carriageway with two lanes (one lane in each direction). The posted speed limit is 50 Km/h.

> Local unclassified roads, all featuring unrestricted parking:
  - Haydon Street: a two-lane undivided carriageway (one lane in each direction). The posted speed limit is 50 Km/h;
  - Lorne Street: a two-lane carriageway (one lane in each direction). The posted speed limit is 50 Km/h;
  - Wilkinson Avenue: a two-lane undivided carriageway (one lane in each direction);
  - Wilder Street: a two-lane undivided carriageway (one lane in each direction). The posted speed limit is 50 Km/h with a 40 Km/h school zone restriction from 8- 9:30 AM and 2:30 – 4 PM during school days;
  - Bell Street: It has a two-lane carriageway (one lane in each direction). The posted speed limit is 50 Km/h with a 40 Km/h school zone restriction from 8am- 9.30am and 2.30pm – 4pm during school days.

TfNSW has two local traffic count stations (ID 6157 and ID 6154) nearby to the subject site. The most recent and complete dataset for the two locations is summarised in the following **Table 6-1.**

Table 6-1 Historical Traffic Flows

Station ID	Location on New England Highway	Average weekday traffic volumes			Traffic growth per year 2017 – 2019 (2 years)
		2017	**2018**	**2019**	
6154	1.64 km south of Muscle Creek Road	9,824	9,817	10,124	1.5%
6157	60 m north of Burtons Lane	10,336	10,324	10,299	-0.01%

The data in **Table 6-1** shows that the traffic volumes are on average in the order of 10,000 vehicles per day and that the volumes have increased by a maximum of 1.5% in the most recent two-year period.

Olympic Park currently contains a total of 172 formalised car parking spaces, with additional overflow parking available. Parking areas are currently utilised up to a maximum of 50% during weekday peaks and exceed capacity during weekend peak times, resulting in the use of overflow facilities.

The previous five years of crash data (2014-2018) report 22 crashes in proximity to Olympic Park, with the severity of crashes described below in **Table 6-2**, there were no fatal crashes within the vicinity of Olympic Park within this reporting period.

Table 6-2 Crash Summary by Severity

Crash severity	2014	2015	2016	2017	2018	Total
Non-casualty (tow-away)	5	3	3		1	**12**
Minor/other injury		1		2		**3**
Moderate injury	1			2	1	**4**
Serious injury			2		1	**3**
Total	**6**	**4**	**5**	**4**	**3**	**22**

Source: Crash and casualty statistics, TfNSW via https://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4, viewed 14/07/2020

The intersections surrounding Olympic Park currently perform as outlined in **Table 6-3**.

Table 6-3 Intersection performance

Scenario	PM Peak			SAT Peak		
	DoS	Delay (sec)	LoS	DoS	Delay (sec)	LoS
Sydney Street / Bridge Street / Haydon Street Intersection Performance	0.518	41.6	C	0.484	36.9	C
Haydon Street / Wilkinson Avenue Intersection Performance	0.072	4.8	A	0.169	5.2	A
New England Highway / Lorne Street Intersection Performance	0.214	37.4	C	0.285	58.2	E
New England Highway / Wilder Street/Francis Street Intersection Performance	0.223	45.6	D	0.188	45.7	D

The proposed location of the subject site is currently well served by public transport services as it is located within 1 km walk from Muswellbrook Station, which is served by NSW TrainLink Hunter Line services travelling between Newcastle and Scone. The train station is also served by NSW TrainLink Xplorer services from Sydney to Armadale and Moree.

A desktop review using nearmap and the TfNSW Cycle Way finder showed that the site is surrounded by footpaths and cycleways.

6.1.2 Potential Impact

A traffic assessment was undertaken that considered the indicative construction methodology outlined in **Section 3.3**, as well as the potential operational phase traffic impacts of the proposal (refer Cardno, 2020; **Appendix D**). The Traffic Impact Assessment included the following tasks:

> Review of background documentation including Muswellbrook Shire Council LEP, Development Control Plan (DCP), and TfNSW Guidelines;

> Review of the current transport context, including pedestrian, cycling and public transport networks and the integration of these transport modes with the wider transport network;

> Peak hour traffic surveys to establish the existing traffic movements in the area; and

> Consideration of potential traffic generation and the impact of the proposed development on the external road network following construction of the proposal and also following adoption of the Masterplan.

6.1.2.1 Construction

The Site would likely be accessed via Wilkinson Avenue during each stage of construction, with the potential for construction vehicles accessing the site via Wilder Street during the construction of the bridge. Construction traffic would comprise light vehicles used by personnel travelling to and from the Site daily. Heavy vehicles would deliver materials and haul fill material to the Site. The light and heavy vehicles accessing the Site would add additional traffic to the local road network and New England Highway, and in particular increase the volume of heavy vehicles on these roads. This increase would be temporary and short-term in nature and could be adequately managed by the implementation of a Construction Traffic Management Plan (CTMP).

There is not anticipated to be any road closures to complete construction; however, the works could cause minor, short-term traffic delays. These include:

> Some temporary increases in travel times for vehicles due to speed limit restrictions around construction areas;
> Possible delays to bus journeys due to temporary traffic control measures. It is expected that buses would be affected in a similar way to general traffic;
> Short-term delays associated with construction traffic entering and exiting the construction site;
> Changes to the safe operating profile of the road network given the addition of construction traffic, including heavy vehicles, as well as temporary traffic controls;
> Minor detours for pedestrians and cyclists; and
> Potential for temporary reduction of available kerbside parking.

6.1.2.2 Operation

As the works do not result in any changes in the intensity or timing of usage of the sports fields or other land-use changes, it is assumed that there would be no additional traffic generation due to the proposal. Traffic generation during special or atypical events is not proposed to be assessed as it is assumed that site-specific traffic management would be in place to manage these events.

The proposed Masterplan envisages increasing the quality and quantity of car parking up to 263 spaces by formalising the existing spaces.

The entry to Olympic Park via the intersection of Haydon Street and Wilkinson Avenue would be retained as it is. The Masterplan proposes a new access point to the precinct via Wilder Street. It is envisaged that Wilder Street would be predominantly used by vehicles travelling to/from the south of Muswellbrook.

According to the Masterplan, a shared path for pedestrians and cyclists is proposed along the Muscle Creek Riparian Corridor and Wilkinson Avenue. The path would be a 2.5m wide concrete path and would connect to the existing footpath network at the junction of Haydon Street and Wilkinson Avenue and the Bell Street overpass.

There would also be a pedestrian footpath would be integrated into the bridge. According to the Masterplan it is envisaged that Wilder Street would be used by vehicles heading south out of Muswellbrook. Buses would use Wilder Avenue to eliminate the need for buses to leave via Haydon Street, which would have required a minimum 25 m turning circle to undertake a U-turn within the site.

There are two locations proposed for bus parking. The first is on the northern side of Wilkinson Avenue opposite Park Tennis. The second is on the eastern side of Wilkinson Avenue opposite the Velodrome. Together, these locations provide space for approximately five buses. Egress of the buses would be via Wilder Street and left out onto the New England Highway.

The intersection of Haydon Street and Wilkinson Avenue would provide access to the buses travelling north. It is recommended that this intersection be upgraded to improve access for buses.

It is assumed that the portion of vehicles currently entering the site through Bridge Street / Haydon Street would continue to do so even when new access through Wilder Street is available. It is only the portion of vehicles that currently utilise the New England Highway / Lorne Street access that would see a redistribution of traffic due to the new access bridge at Wilder Street.

Redistribution of traffic likely to result from the construction of the bridge has been considered against the possibility of each of the following options:

> **Single Lane Bridge** which would predominantly be used as a cycle and footway linking the precinct to the south. However, the bridge would be opened to traffic during events to allow for improved egress from the site.
> **Single Lane Bridge** with additional pedestrian and cycle paths. Stop sign/give way sign at either end of the bridge would manage flows.
> **Two-Lane Bridge** with standard two-lane direction and additional pedestrian cycle path.

Under special events, it is expected that internal and external traffic management and temporary traffic control measures for the bridge would be in place, as described below.

Single Lane, Two-Way Bridge - All movement unrestricted.

A single-lane bridge with a “Stop” or “Give way” sign installed at either end of the bridge to manage flows. As a worst-case scenario, it was assumed that all (100%) of traffic that travels to/from the south on New England Highway would use the new bridge crossing. The resulting trip assignment is shown in **Figure 6-11** and **Figure 6-22**.

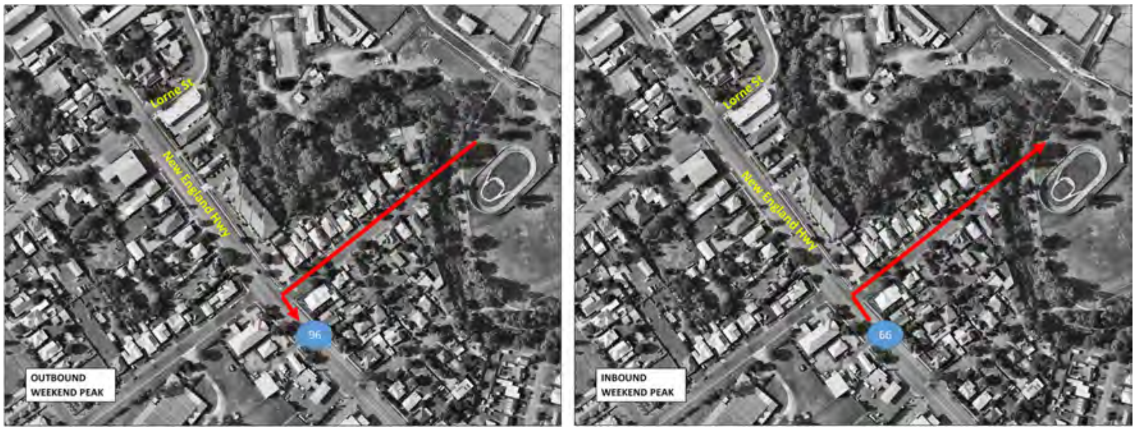


Figure 6-1 Weekend In/Out Trips Single Lane, Two-Way Bridge- Unrestricted Movements

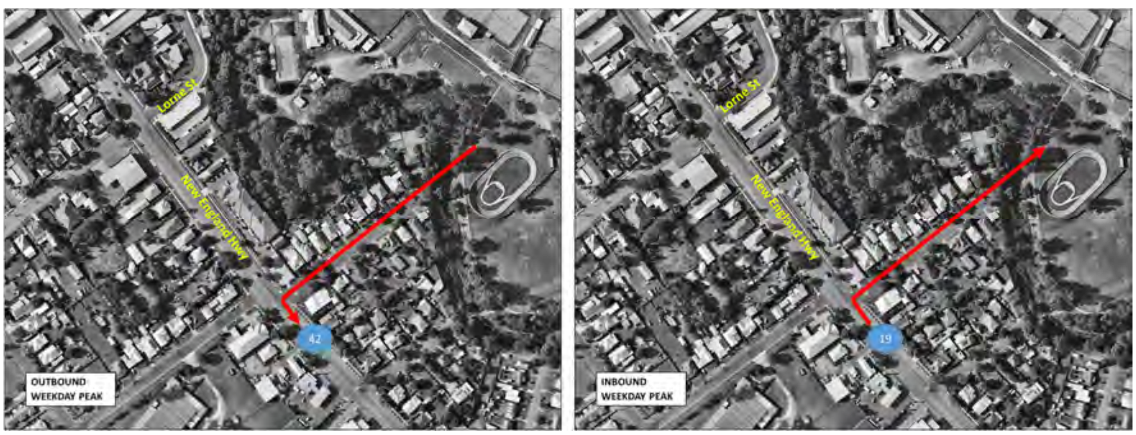


Figure 6-2 Weekday In/Out Trips Single Lane, Two-Way Bridge- Unrestricted Movements

Two-Lane, Two-Way Bridge - All Movement Unrestricted.

Standard two-lane two-way bridge. As a worst-case scenario, it is assumed that all (100%) of traffic that travels to/from the south on New England Highway would use the new bridge crossing.

Left in Left Out (LILO)

This scenario restricts the right turns in/out of Wilder Street at New England Highway. In this scenario, it is assumed the vehicles turning right into the precinct would use the Lorne Street intersection (no change from existing behaviour) however vehicles turning left out would use the Wilder Street access to go south.

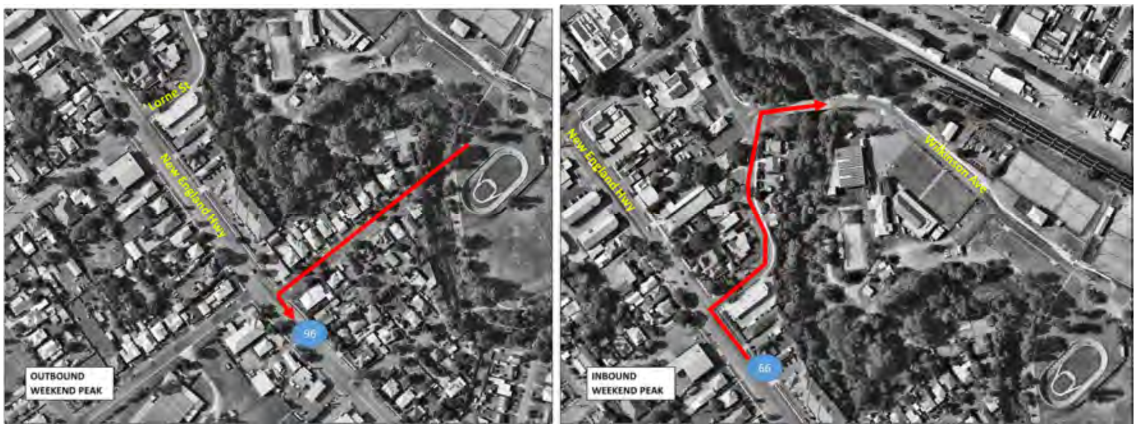


Figure 6-3 Weekend In/Out Trips Single Lane, Two-Way Bridge - LILO

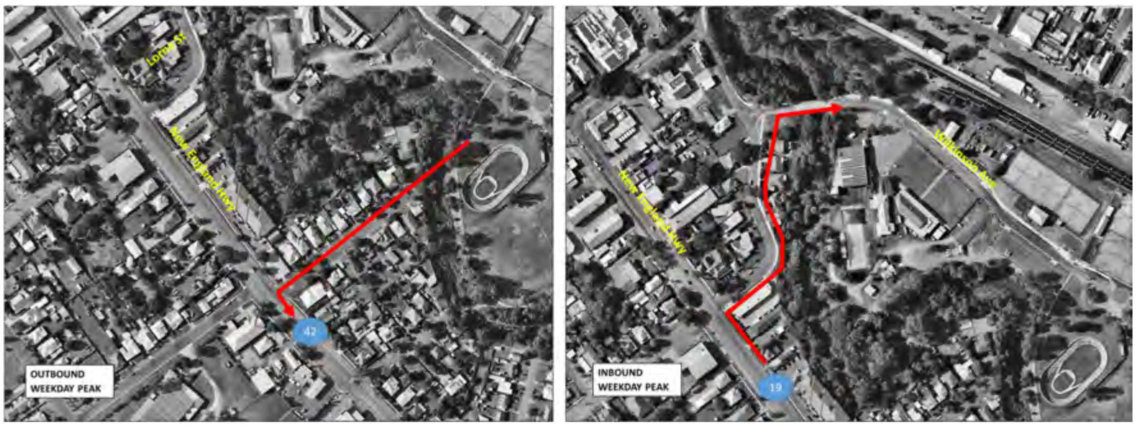


Figure 6-4 Weekday In/Out Trips Single Lane, Two-Way Bridge - LILO

<u>Two-Lane, Two-Way Bridge - LILO</u>

A two-lane two-way bridge for left in left out configuration at Wilder Street also assumes the same trip distribution as shown in **Figure 6-3** to **Figure 6-4**.

The performance of the surrounding intersections has been modelled against the scenarios considered for the bridge connecting Wilder Street with the results displayed in **Table 6-4**.

Table 6-4 Modelled future intersection performance

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2021 Future Base (no development)								
Sydney Street /Bridge Street/Haydon Street Intersection Performance	0.53	49.10	D	22.80	0.54	43.50	D	28.10
Haydon Street /Wilkinson Avenue Intersection Performance	0.07	4.80	A	1.90	0.17	5.20	A	4.90
New England Highway/ Lorne Street Intersection Performance	0.24	10.20	A	44.30	0.34	14.90	B	75.80
New England Highway /Wilder Street/Francis Street Intersection Performance	0.23	49.60	D	12.40	0.19	49.50	D	3.40
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2021 with Bridge - All Movements								

Sydney Street /Bridge Street/Haydon Street Intersection Performance	0.53	49.10	D	22.80	0.54	43.50	D	28.10
Haydon Street /Wilkinson Avenue Intersection Performance	0.05	4.80	A	1.10	0.10	4.90	A	2.50
New England Highway/ Lorne Street Intersection Performance	0.22	7.40	A	37.50	0.23	8.30	A	39.90
New England Highway /Wilder Street/Francis Street Intersection Performance	0.23	49.60	D	11.30	0.23	51.70	D	7.70

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2021 with Bridge - LILO								
Sydney Street /Bridge Street/Haydon Street Intersection Performance	0.53	49.10	D	22.80	0.54	43.50	D	28.10
Haydon Street /Wilkinson Avenue Intersection Performance	0.06	5.00	A	2.70	0.12	5.20	A	2.90
New England Highway/ Lorne Street Intersection Performance	0.28	8.00	A	50.00	0.29	8.80	A	50.80
New England Highway /Wilder Street/Francis Street Intersection Performance	0.19	48.10	D	3.90	0.19	50.50	D	3.20

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2031 Future Base (no development)								
Sydney Street /Bridge Street/Haydon Street Intersection Performance	1.14	291.10	F	69.60	1.10	228.80	F	73.80
Haydon Street /Wilkinson Avenue Intersection Performance	0.09	4.60	A	2.30	0.20	5.40	A	5.80
New England Highway/ Lorne Street Intersection Performance	0.28	10.40	A	53.20	0.40	15.30	B	92.10
New England Highway /Wilder Street/Francis Street Intersection Performance	0.33	81.20	F	18.60	0.29	84.50	F	6.20

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2031 with Bridge - All Movements								
Sydney Street /Bridge Street/Haydon Street Intersection Performance	1.14	291.10	F	69.60	1.10	228.80	F	73.80
Haydon Street /Wilkinson Avenue Intersection Performance	0.05	5.20	A	1.20	0.12	5.00	A	2.90
New England Highway/ Lorne Street Intersection Performance	0.26	7.60	A	45.80	0.26	8.60	A	47.60
New England Highway /Wilder Street/Francis Street Intersection Performance	0.34	81.60	F	16.30	0.35	85.10	F	10.60

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2031 with Bridge - LILO								
Sydney Street /Bridge Street/Haydon Street Intersection Performance	1.14	291.10	F	69.60	1.10	228.80	F	73.80
Haydon Street /Wilkinson Avenue Intersection Performance	0.07	5.40	A	3.20	0.14	5.40	A	3.40
New England Highway/ Lorne Street Intersection Performance	0.34	8.40	A	63.00	0.34	9.00	A	63.60

New England Highway /Wilder Street/Francis Street Intersection Performance	**0.31**	**75.10**	F	**7.50**	**0.27**	**80.40**	F	**6.00**

The future traffic assessment, based on the 2021 year of the bridge opening and 2031 design horizon year, shows that the intersection LoS is relatively unchanged by reassignment of traffic due to the proposed bridge. The single-lane bridge over muscle creek would continue to operate satisfactorily at LoS A which represents good performance.

This traffic assessment firstly assessed the New England Highway / Wilder Street intersection configuration as all movements to be permitted in the first instance. However, it should be noted that due to the forecast traffic volume increase on Wilder Street due to the proposed Masterplan the Wilder Street approach is forecast to operate at LoS E in the PM peak and LoS F in the SAT peak by 2031.

The intersection of Wilder Street / New England Highway is in a location that results in a staggered T-junction with Francis Street / New England Highway. The staggered junctions could attract safety concerns when the traffic intensifies at the Wilder Street approach, hence the proposal to ban the right in/out of Wilder Street as mitigation that reduces the safety issue due to the back to back right-turns at the staggered junction. Under the restriction of right turns in / out of Wilder Street the approach LoS improves to LoS A in both PM and SAT peak for the year 2031.

In conclusion, the proposed masterplan development is supported on traffic grounds. The potential traffic impact of the masterplan has been shown to have a negligible impact on the surrounding road network and can be accommodated accordingly.

6.1.3 Mitigation Measures

Mitigation measures to manage the identified impacts on traffic during construction will include:

> A CTMP would be prepared by the Contractor to be included in the CEMP and approved by Council prior to works commencing;

> The Contractor will comply with any Council requirements regarding traffic control and access;

> The number of construction vehicles accessing the site via Wilder Street will be kept to a minimum. The preferred access route would be via Wilkinson Avenue;

> Work vehicles will avoid obstructing vehicular or pedestrian traffic on roadways, or access to private driveways or public facilities, unless absolutely necessary and only if appropriate notification has been provided to potentially affected property owners / parties;

> No construction materials, equipment or vehicles would encroach onto private property without prior arrangement with the landowner;

> Appropriate signage will be erected to inform users of the disruption to pedestrian movements on local roads and any temporary area closures if required;

> All directly affected stakeholders shall be informed about the works, their timing, and expected impacts prior to the commencement of the works;

> Parking of vehicles and storage of plant/equipment is to occur on paved areas. Where this is not possible, vehicles and plant / equipment are to be kept away from environmentally sensitive areas and outside the dripline of trees;

> All vehicles transporting spoil would be covered and filled to maximum capacity to minimise vehicle movements;

> All roads, kerbs and footpaths damaged as a result of construction are to be restored to their preconstruction condition; and

> All sealed roads would be kept clean and free of dust and mud at all times. Where material is tracked onto sealed roads at any time, it would be removed immediately so that road pavements are kept safe and trafficable.

Recommendations to manage traffic impacts during the operation of the facility include:

> It is recommended to upgrade the intersection of Haydon Street and Wilkinson Avenue to improve access for buses;

> Site-specific traffic management plans will be implemented to manage increased traffic loads during events;

> Banning the right in/out of Wilder Street is recommended to reduce the safety issue of back to back right-turns at the staggered junction.

6.2 Noise and Vibration

6.2.1 Existing Environment

Sensitive land uses identified by the Interim Construction Noise Guideline (ICNG) (DECC 2009) include residences, classrooms, hospitals, places of worship, and passive and active recreation areas. A review of aerial imagery shows the Muswellbrook Seventh-day Adventist Church is approximately 100 m from the proposed works and that the nearest residential receiver would be approximately 15 m from the bridge construction on Wilder Street.

The ICNG (DECC, 2009) governs the assessment of noise from construction activities and advises best practice approaches to minimise noise impacts. Noise criteria for residential receivers are based on a rating background level (RBL), receivers are identified as 'noise affected' where construction noise is more than 10 dB higher than the RBL, and 'highly noise affected' where noise levels are 75 dB(A) or higher (DECC, 2009). RBLs for the existing environment around the Olympic Park have been estimated to be typical of residential area with traffic noise (RMS 2017).

Table 6-5 Assumed Noise Background and Management Level (Source: RMS, 2017)

Noise area category		
RBL or L_{A90} Background level (dB(A))	Day	45
	Evening	40
	Night	35
$L_{Aeq(15minute)}$ Noise management level (dB(A))	Day	55
	Evening	50
	Night	45

6.2.2 Potential Impact

6.2.2.1 Construction Phase

An assessment of potential noise impacts was undertaken using the Roads and Maritime Services construction noise estimator tool. Sound Pressure Levels are measured in dB(A) and represent the typical maximum noise level generated when the equipment is operating normally.

The construction of the bridge over Muscle Creek would be undertaken in close proximity to the residences in Wilder Street. Based on typical plant sound power levels, the works would result noise levels for nearby residents above the noise management level of the RBL +10 dB and may at times be highly noise affected for short period during construction.

The potential noise impacts have been calculated for the nearest residence (15 m distant) based on a conservative worst-case scenario assuming all machinery functioning in unison. This is unlikely to be a realistic scenario and it is expected the noise impacts would be less than anticipated. The measures outlined in **Section 6.2.3** are expected to appropriately manage the noise impacts experienced by nearby receivers as much as reasonable and feasible.

Table 6-6 Noise impact of indicative plant at nearest receiver (15 m)

Plant	Contribution SPL (dB(A)) at Receiver 15 m distance
Excavator	80
Bulldozer	89
Front end loader	81
Grader	78
Asphalt paver	88
Vibratory rollers	77

Plant	Contribution SPL (dB(A)) at Receiver 15 m distance
Concrete truck	77
Concrete pump	77
Cement mixer	77
Water cart	76
Light vehicles	71
Crane	76
Piling rig	84
Welding equipment	73
Generator	71
Concrete Saw	86
Pneumatic jackhammer	81
Chainsaw	80
Cumulative	**95**

6.2.2.2 Operational Phase

The operation of the proposed works is not anticipated to result in a significant impact to the existing noise environment. There is anticipated to be a minor increase in traffic noise on residential receivers in Wilder Street due to the redistribution of traffic, the severity of this impact is dependent on the selected option for the final bridge configuration but is expected to be minor.

The improved facilities aim to attract regional sporting events to the locality, during such events it is anticipated that there will be elevated levels of noise received that adjacent residences resulting from traffic, crowds, public address systems and whistles. It is not anticipated that this will be any change against the existing noise environment during events as there is no alteration to the capacity of the sporting fields, just an upgrade to the available facilities.

6.2.3 Mitigation Measures

6.2.3.1 Construction Phase

An updated noise assessment should be undertaken by the Contractor based on the final detailed design and the final construction methodology, schedule and list / number of plant and equipment to be used at each stage of construction. The updated assessment shall, as a minimum:

- Identify nearby residences and other sensitive land uses;
- Develop noise management levels consistent with the ICNG (DECC, 2009); and
- Assess the potential impact from the proposed construction methods.

The outcome of this updated assessment shall inform the development of reasonable and feasible construction noise and vibration management measures as part of the CEMP. The CEMP should consider the following as a minimum:

- Develop reactive and proactive strategies for dealing with any noise complaints;
- Identify a site contact person to follow up complaints;
- Source controls:
  - Maximising the offset distance between noisy plant and sensitive receivers,
  - Orienting equipment away from sensitive receivers where possible,
  - Using lower powered or reduced size equipment where noise benefits are available, where practical,
  - Using spotters, “smart” reversing alarms, or broadband reversing alarms in place of traditional beeper reversing alarms,

  - Operating machinery in a manner which reduces maximum noise level events including shaking excavator bucket, loading trucks, handling steel beams and frames and removing concrete sections,
  - Turning off machinery when not in use,
  - Ensuring plant and equipment is well maintained and not generating excessive noise,
  - Specific controls for concrete trucks and site trucks including scheduling activities to avoid numerous trucks operating on site simultaneously;
- Administrative controls:
  - Limiting work strictly to standard construction hours,
  - Minimising the number of noisy plant operating at once and schedule high noise generating activities to the middle of the day away from more sensitive early morning and late afternoon periods,
  - Site awareness training / environmental inductions that include a section on noise mitigation techniques / measures to be implemented throughout the project when on site and accessing the site; and
- Community management:
  - Notifying receivers potentially affected by the works at least five days prior to works starting,
  - Keeping the community informed in relation to noise intensive activities in the immediate area, and
  - Providing consultation where prolonged periods of construction works, or particularly noisy works, are planned.

6.2.3.2 Operational Phase

As it is not anticipated to be a significant change in the noise environment in the operation of the facility, there are minor noise impacts expected to be received by the residence on Wilder Street due to the redistribution of traffic to the facility to result from the operation of the bridge of Muscle Creek, this can be adequately managed by community notification prior to the occurrence of large sporting.

6.3 Hydrology and Water Quality

6.3.1 Existing Environment

The Site is located on gently to steeply sloping terrain, draining to the south into Muscle Creek.

The proposed bridge is to span Muscle Creek, a tributary of the Hunter River. It has a catchment area of approximately 92 km^2 that extends 14 km to the south-east of Muswellbrook. The upper and middle portions of the catchment comprise moderately steep forested terrain. The lower portion of the catchment is predominately forested but includes areas of mining and agricultural land uses as well as some urban areas. There are no major dams within the catchment (RHDHV, 2017).

The Muscle Creek channel is approximately 50 m wide (top of bank to top of bank) and 6 to 7 m deep (RHDHV, 2017). The channel banks are vegetated with moderately dense to dense vegetation, comprising a mixture of native and exotic species (RHDHV, 2018). Muscle Creek is mapped as a 5th order (Strahler) stream. There are currently bridges over Muscle Creek in Wilkinson Avenue and at Bell Street, which are upstream and downstream (respectively) of the location of the proposed new bridge over Muscle Creek.

Parts of the Site are located in the floodplain. Figure 6-5 shows inundation of Wilkinson Avenue and the southern portion of Olympic Park near Muscle Creek in the 0.2% Annual Exceedance Probability (AEP) event (or 1 in 500-year event) (RHDHV, 2018). RHDHV (2017, 2018) report that during flood events, inundation occurs within the Muswellbrook Golf Course, which is located downstream of the Site. Flood waters from the golf course area are known to overtop Bell Street and flow through residential areas located between Bell Street and Wilder Street before re-entering the channel. Surface levels suggest that some flood waters will also flow down the New England Highway (RHDHV, 2018).

The existing Wilkinson Avenue bridge is flood free up to the 0.2% AEP event, although its approaches are lower and are inundated in the 2% AEP (or 1 in 50 year) flood (RHDHV, 2018). It is understood that Wilder Street and Maitland Street / New England Highway can become inundated in the 5% AEP (1 in 20 year) event (RHDHV, 2018).

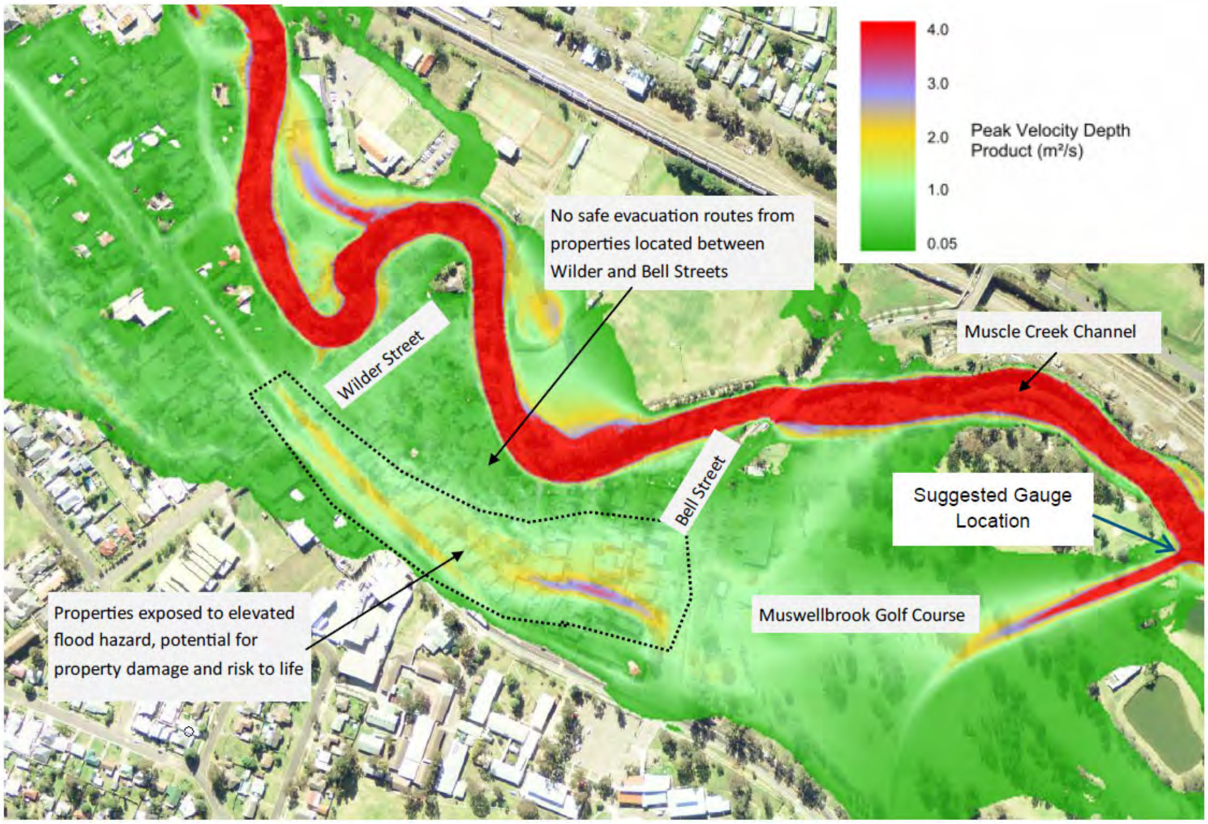


Figure 6-5 Flood hazard profile for 0.2% AEP event (source: RHDHV, 2018)

6.3.2 Potential Impact

6.3.2.1 Construction Phase

The clearing and excavation of land, transport of soils, earthworks and stockpiling of soil has potential to cause erosion and sedimentation, with resultant impact to receiving waterbodies. This risk is discussed further in **Section 6.9.2**, which proposes a range of mitigation measures to avoid and mitigate the potential for erosion and sedimentation. It is considered that, if the mitigation measures contained in **Section 6.9.3** are implemented, the risk can be appropriately managed.

The excavation works have potential to encounter groundwater, and result in localised groundwater drawdown. Where the groundwater cannot be reinjected, it would require disposal, which could represent a risk to surface water quality. It is considered that the potential impacts on groundwater levels and surface and ground water quality can be appropriately managed provided the measures recommended in **Section 6.9.3** are implemented.

The bridge works would result in excavation of the bed of Muscle Creek. Depending on the chosen construction method, some minor de-watering works may be required.

There is also the potential to have a flood event during the works. This may result in negative impacts on the environment due to erosion from exposed areas or if plant and equipment is damaged during the event. It may also result in changes to flood behaviour that negatively impact existing infrastructure or the safety of members of the public.

There is potential for accidental spills of chemical, fuel or other materials during construction, which may result in contamination of surface or ground waters. The potential for contamination to occur is considered low provided the safeguards and management measures outlined in **Section 6.9.3** are implemented.

6.3.2.2 Operational Phase

The proposed road works and sports field works would likely result in minor alterations to surface water flows. These changes are relatively minor in nature and are unlikely to result in significant impacts on surface or groundwaters. However, the proposed new bridge over Muscle Creek has potential to cause flood afflux with resultant increases in flood levels, extents and/or hazard for Olympic Park and neighbouring residential areas. There is also potential for instability of the creek bank or bed and scour around the bridge piers.

The proposed irrigation has the potential to strain the local potable water supply and should consider options to reduce reliance on water supplies as much as feasibly possible, in line with the recommendation made in **Section 6.3.3**.

6.3.3 Mitigation Measures

The following mitigation measures have been developed to manage the potential impacts identified in **Section 6.3.3**:

> The measures presented in **Section 6.9.3** to manage the risk of erosion and sedimentation should be implemented. This includes, but is not limited to, the preparation of Erosion and Sediment Control Plans and a Soil and Water Management Plan;

> The detailed design of the Muscle Creek bridge will be developed in consultation with DPIE's flooding team and DPI (Fisheries);

> The detailed design of the bridge will consider the requirement for fish passage and scour protection under the Policy and Guidelines for Fish Habitat Conservation and Management (NSW Department of Primary Industries, 2013) and the NSW Office of Water Guidelines for Controlled Activities. Appropriate scour protection measures will be incorporated into the design;

> The design of the new Muscle Creek bridge will consider potential flood impacts. Any identified impacts will be minimised through the detailed design process. In the event flood impacts cannot be avoided, Council would undertake consultation with the affected property owners. Appropriate mitigation measures will be developed in consultation with the affected property owners;

> The development of the detailed design will demonstrate consideration of options for the provision of water supply for sports field irrigation that meet the required water quality, reduce reliance on the potable water supply, and minimise or appropriately manage any potential impacts on other groundwater users;

> In developing the construction methodology for the new Muscle Creek bridge, the Contractor will demonstrate to the satisfaction of Council that they have sought to minimise the duration of the works, minimise impacts to the bed and banks of the creek, and that they can minimise obstruction of flows / fish passage. Should de-watering be required, it will consider appropriate means of disposal of the water and management of any fauna entrapped in the area to be de-watered, as well as the process of reinstating flows;

> The CEMP will include a flood emergency response plan that identifies which parts of the Site are located within the floodplain, the required monitoring of weather forecasts, and the measures to be undertaken in the event a flood is forecast for Muscle Creek;

> The CEMP will include procedures for managing the risk of accidental spills, to include, but not be limited to:

  - Refuelling of plant and equipment, or any other activity which may result in the spillage of a chemical, fuel or lubricant, would be undertaken away from any location with direct drainage to a waterway where possible/practical and within a designated re-fuelling area.
  - No maintenance of plant or equipment is to be undertaken within 30 m of the creek.
  - A spill kit would be kept on site and staff trained in its use. All spills would be cleaned up promptly. Absorbent materials and affected soil would be promptly collected and bagged for disposal to an appropriately licensed facility.

6.4 Visual Amenity

6.4.1 Existing Environment

The existing visual landscape at the site is dominated by open recreational areas and associated infrastructure. The land on the southern side of Muscle Creek is residential and is fully developed. The land to the north is occupied by the Great Northern Railway.

6.4.2 Potential Impact

The presence of a construction site and associated plant and equipment, fencing, cleared land, earthworks and stockpiles would result in a reduction in visual amenity for residents and road users in the locality. This will be a temporary, minor alteration to the existing visual amenity.

In the operational phase, there would be a minor change in the visual landscape due to the introduction of a new internal road and new bridge over Muscle Creek. Although these are new elements, they would be generally in keeping with the existing visual landscape.

6.4.3 Mitigation Measures

To reduce the visual impacts arising from construction, the following mitigation measures will be implemented as part of the CEMP:

> Works will be completed within the shortest possible timeframe;
> The site should be kept clean of general litter and tidy for the duration of works;
> All waste generated during the course of the works will be removed from the work areas as soon as practicable and disposed of in reasonable manner;
> All work equipment and materials will be contained within the designated boundaries of the work site. The spread of stockpiles, vehicle parking and waste storage will be minimised and contained to designated areas/site compounds;
> Disturbed areas would be re-instated and stabilised progressively, minimising the footprint of the works at any one time;
> On completion of the works, all vehicles, materials, and waste relating to the works will be removed from the work areas; and
> Ongoing consultation and communication with affected residents regarding the timing duration and likely impacts of construction works would be undertaken to manage impacts to local residents and the community.

6.5 Biodiversity

An Ecological Impact Assessment was undertaken to assess the potential impacts of the works on biodiversity (refer Cardno, 2020b in **Appendix C**).

6.5.1 Existing Environment

6.5.1.1 Vegetation

The project footprint is located in highly disturbed land consisting of cleared land with miscellaneous vegetation not consistent with endemic native vegetation communities. The only flora species present within the proposed project footprint are planted natives and exotics. Native vegetation was recorded within the Muscle Creek riparian corridor, consistent with Plant Community Type (PCT) 485 – River Oak Woodland.

PCT 485 was present in two overall conditions as follows:

> Low to moderate condition: This vegetation community was present along the Muscle Creek riparian corridor, mainly along the northern edge of the creek. It consists of remnant trees characteristic of PCT 485 with non-characteristic canopy, shrub and ground cover. Historical planting and current revegetation works are evident, which results in the vegetation having a structure and species composition different to those expected in the naturally occurring PCT. Erosion and sedimentation works were also evident in this vegetation zone, which in addition to revegetation works has resulted in a vegetation community with only the remnant trees being characteristic of PCT 485. Notwithstanding, this PCT has value with regards of native species biodiversity and structural complexity (e.g. strata). Although not meeting the expected structure of PCT 485, this vegetation zone is rated as having low to moderate condition due to its low cover of weeds and due to revegetation works increasing its overall ecological value in the riparian corridor.
> Very low condition: This vegetation was mainly present along the southern riparian corridor. The vegetation included remnant trees characteristic of the PCT mixed with planted and exotic species. High weed density was evident. There was evidence of erosion and sedimentation works in some sections.

Miscellaneous vegetated areas are areas which do not correspond to any known native vegetation community or PCT. Areas of miscellaneous vegetation identified onsite include:

> Mix of planted / remnant vegetation: includes vegetation that was a mix of remnant trees with planted non-endemic and/or exotic species. Species present included Silk Oak (*Grevillea robusta*), Forest Red Gum (*Eucalyptus tereticornis*), River Red Gum (*Eucalyptus camaldulensis*), Sydney Blue Gum (*E. saligna*), Callistemon spp. and Acacia spp. Overall, this vegetation type lacked a mid or ground layer.

> Planted natives: contains no remnant trees. This vegetation occurred across the Site near fences, walking tracks and in landscaped areas near buildings. This vegetation type included species such as Spotted Gum (*Corymbia maculata*), River Oak (*Casuarina cunninghamiana*), Prickly-leaved Tea Tree (*Melaleuca styphelioides),* Crimson Bottlebrush (*Callistemon citrinus*), Spotted Fuchsia (*Eremophila maculata*) and Lomandra (*Lomandra longifolia*).

> Planted exotics: located mainly along the northern boundary of the Site and included planted walls adjacent to the rail corridor, trees and vegetables gardens. Species included Jacaranda (*Jacaranda mimosifolia*), Pepper Tree (*Schimus mole*), Pine Tree (*Pinus sp*.), Common Olive (*Olea europea subsp. cuspidata*), Silk Oak (*G. robusta*), palms (*Chamaedorea sp.*), Orange (*Citrus sinensis*).

> Exotic grasslands: mainly Kikuyu Grass (*Pennisetum clandestinum*).

Cleared land within the Site included buildings, access roads, carparks, exposed soils (e.g. stockpiled soils, exposed soils with waste in riparian corridor and exposed soils in works areas), walking tracks and other infrastructure.

6.5.1.2 Fauna

Two threatened species were recorded during surveys of the Biodiversity Study Area, the Grey-headed Flying-fox (*Pteropus poliocephalus*; listed as a Vulnerable species under the BC Act and EPBC Act) and the River Red Gum (*Eucalyptus camaldulensis)* population in the Hunter Catchment (listed as Endangered under the BC Act). Also, seven microbat species were recorded within the Study Area in a previous study (Cardno, 2019): Eastern Bentwing-bat (*Minopterus schreibersii oceanensis*), Easter Cave Bat (*Vespadelus throughtoni*), Eastern Freetail-bat (*Mormopterus nofrolkensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Little Bentwing-bat (*Miniopterus australis*) and Southern Myotis (*Myotis macropus*).

A total of 14 threatened species were identified as having a moderate or known likelihood of occurrence within the Study Area.

6.5.1.3 Koala Habitat

Part of the Study Area, mainly along the riparian corridor, is mapped as assessment areas for koala habitat under the SEPP (Koala Habitat Protection) 2020. Two Koala feed tree species were recorded in the Biodiversity Study Area but no koala or potential core koala habitat is present within the proposed Stage 1 footprint.

6.5.1.4 Aquatic Environment

Muscle Creek is not mapped as habitat for threatened fish species. It is noted that the Hunter River, which is downstream of Muscle Creek, is mapped as habitat for one endangered fish species (Southern Purple-spotted Gudgeon (*Mogurnda adspersa*)) and one endangered population (Darling River Hardy Head Hunter River population). Aquatic fish surveys were previously undertaken by Cardno (2019) in Muscle Creek and no threatened fish were not recorded. Furthermore, large numbers of European Carp (*Cyprinus carpio*) were observed in ponds of Muscle Creek, which affects water quality and disrupts Southern Purple-spotted Gudgeon populations. Exposed soils, weeds and dumped waste was present in the section of Muscle Creek close to Wilder Street, at the location of the proposed bridge. It is considered that, in its current condition, this section of Muscle Creek does not appear to be suitable habitat for native fish. However, given that rehabilitation works are underway in other sections of Muscle Creek, and that there is connectivity between Muscle Creek and the Hunter River, the possibility of future occupation of the section of Muscle Creek near Wilder Street by native fish cannot be precluded.

A platypus was sighted in Muscle Creek by Landcare personnel undertaking works in the area (Scholes, K., 2020, pers. comm., 6 July 2020). No other records of this species have been identified in the area.

6.5.2 Potential Impact

6.5.2.1 Vegetation

The proposal would be located on highly disturbed land consisting of cleared land with miscellaneous vegetation not consistent with endemic native vegetation communities. The only flora species present in the proposed project footprint are planted natives and exotics, some of which would be cleared for the proposed works along the upgraded Wilkinson Avenue, within the grounds of the velodrome area, and at the site of the new amenities building (up to 2,000 m^2). Native vegetation was recorded within the Muscle Creek riparian corridor, including five River Red Gum (*Eucalyptus camaldulensis*) trees which are considered part of the listed endangered River Red Gum population in the Hunter. Although a bridge is proposed to be built over Muscle Creek the River Red Gums are not proposed to be affected as part of Stage 1 works for the Muswellbrook Olympic Park Precinct. The other vegetation removal in the riparian corridor is discussed in **Section 6.5.2.5**.

The proposed project is unlikely to result in impacts on TECs as none are present within the project footprint or within or adjacent to the Site.

6.5.2.2 Threatened Species

An assessment of significance on the 14 threatened species identified as having a moderate or known likelihood of occurrence concluded that the proposed Stage 1 works would not result in significant impacts on those threatened species (refer **Appendix C**).

6.5.2.3 Fauna Habitat and Wildlife Corridor

The proposal would not encroach into the riparian corridor where revegetation works are being undertaken. The proposed bridge works would involve direct impacts to the riparian corridor. Terrestrial fauna would still be able to transit along the riparian corridor beneath or above the bridge once constructed. Indirect impacts on riparian corridor will be further avoided and minimised by implementing erosion and sedimentation measures to manage runoff.

Based on the above, it is predicted that the proposed Stage 1 works of the Muswellbrook Olympic Park Precinct will not result on impacts on habitat and corridors in the riparian zones at or adjacent to the project's footprint.

6.5.2.4 Koala Habitat Protection

It is considered that the proposal is unlikely to result on any direct or indirect impacts on koalas or their habitat.

6.5.2.5 Aquatic Ecology

Disturbance of riparian vegetation and the creek bed during construction is likely to result in a short-term temporary increase in turbidity and suspended sediments downstream of the bridge site. Furthermore, there is potential for the banks to collapse during excavation if unmitigated. Erosion and sediment controls during excavation are particularly important at this site due to the high gradient of the banks and their potential susceptibility to collapse during earthworks.

Piling for the bridge is proposed to be located as far as practicable up the banks of the waterway but for the purposes of this assessment it has been conservatively assumed that part of the footprints of the piles, or the associated coffer dams (if required for their construction), may impinge upon the instream habitat of Muscle Creek. If instream construction activity is likely then a part 7 permit is required for dredging (Section 200 of the FM Act) and the potential obstruction of fish passage (Section 219 of the FM Act) prior to the commencement of works. This will require consultation with DPI (Fisheries).

Given piling rigs and other plant would need to be placed on the banks of Muscle Creek to construct and install the piles, management measures will need to be incorporated according to Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update) so that direct or indirect effects on riparian habitat would be minimised. The Guidelines recommend that developments should ensure that existing native riparian vegetation is retained to the greatest extent possible in an undamaged and unaltered condition. A small amount of riparian vegetation would be permanently removed by the pile footprint (up to 1,500 m^2) and from shading by the bridge but the area lost is considered in poor condition and a relatively small proportion of the full extent retained in the Study Area. A further area of riparian vegetation would be damaged during construction. Banks would also be at risk of scour without adequate stabilisation.

If the piles are constructed so that they are above the waterline of Muscle Creek for normal flow and do not constrict the channel substantially then water levels and fish passage are expected to be maintained through this reach in the future. Along with scour protection around the piles, revegetation of disturbed areas with local native riparian species should also be considered if damage to riparian vegetation is unavoidable during construction.

Provided specific safeguards and recommendations are implemented (see **Section 6.2.4**), it is considered that the proposed project is unlikely to result on any direct or indirect impacts on the aquatic and riparian environment that would substantially threaten the ecosystem services provides by these habitats. In the longer term, however, the bridge upgrade is likely to stabilise actively eroding banks.

6.5.3 Mitigation Measures

6.5.3.1 Construction Phase

The following mitigation measures are recommended to mitigate construction phase impacts to biodiversity:

> Where possible, limit disturbance within the project footprint to previously cleared and miscellaneous vegetated area (e.g. for the laydown areas) during construction phase;

> The detailed design of the proposal will demonstrate it has considered opportunities to minimise the footprint of the works, particularly in the riparian corridor. The works will avoid the Red River Gums;

> All works are to be restricted to the project footprint;

> Apart from the construction area required necessary to build the bridge, riparian corridors to be fenced off and labelled as No-Go areas to prevent accidental impacts and introduction of pathogens, such as *Batrachonchtrium dendrobatidis*, a pathogen that caused chytridiomycosis, an infection disease on amphibians;

> All machinery should be cleaned of foreign soil and vegetative matter to avoid the spread of Phytophthora cinnamomi, Exotic Rust Fungi of the order Pucciniales pathogenic (Myrtle Rust) and dispersal of seeds of non-native plants;

> Strict weed management, monitoring and control practices should be implemented as part of the CEMP to minimise the spread of exotic species into natural areas within and outside of the Study Area. In particular, priority weed and high threat exotic species should be targeted in accordance with the NSW DPI WeedWise recommended control measures (DPI 2020);

> Strict erosion and sediment control measures should be implemented as part of the CEMP, as discussed in **Section 6.9**;

> Implement dust and erosion and sediment control measures where necessary to protect adjacent retained vegetation and water quality in Muscle Creek, as per **Section 6.8.3**;

> Stockpiling of materials should occur within previously disturbed areas and not within driplines or retained vegetation;

> Stop-work procedure on the chance encounter of any dispersing wildlife during works should be implemented to avoid death or injury;

> A suitably qualified ecologist will be present during the removal of all trees to act as a spotter catcher that can relocate any captured wildlife;

> Any captured animals are relocated into the nearest suitable native vegetation;

> Any injured animals are taken to a local wildlife carer for treatment; and

> Disturbance to instream areas (from the top of banks to the creek bed) will be avoided as far as practicable;

> Consider timing of the works during favourable weather conditions to prevent erosion and sedimentation during construction;

> Following the completion of the works, riparian areas should be revegetated with native species. Species selection is to consider locally endemic species in the riparian areas of Muscle Creek; and

> A part 7 permit is required for dredging (Section 200 of the FM Act) and the potential obstruction of fish passage (Section 219 of the FM Act) prior to the commencement of works. This will require consultation with DPI (Fisheries).

6.5.3.2 Operational Phase

Due to the outcome of the impact assessment determining that the operation of the project is not likely to result in ecological impacts, no mitigation measures have been provided.

6.6 Aboriginal Heritage

6.6.1 Existing Environment

A search of the Aboriginal Heritage Information Management System (AHIMS) database adopting a 200 m search radius returned no known items of Aboriginal significance within the site.

It is understood that the Site forms part of a broader landscape that would be have been well resourced and attractive to Aboriginal people to move through the area (and potentially establish camp sites) due to the proximity of major watercourses (Umwelt, 2019).

The Site has been subject to historical disturbance to establish the sporting complex, residential areas, roads and rail corridor. The banks of Muscle Creek are steep and would likely have been subject to modification during flood events over time.

6.6.2 Potential Impact

A desktop assessment of the potential for the site to feature Aboriginal significance, in line with the generic procedure from the Due Diligence Code of Practice (DECCW 2010) was undertaken to determine the potential to impact items of Aboriginal significance.

1. Will the activity disturb the ground surface or any culturally modified trees?

Yes, the activity includes ground disturbance. There are no AHIMS records of culturally modified trees on the Site.

2. Are there any:

a) relevant confirmed site records or other associated landscape feature information on AHIMS? and/or b) any other sources of information of which a person is already aware? and/or

c) landscape features that are likely to indicate presence of Aboriginal objects?

No, there are no recorded sites or available information confirming the presences of Aboriginal items within the Site. Muscle Creek does provide a suitable resource for Aboriginal use, however it is thought that historical activities have resulted in extensive ground disturbance across the Site. This in conjunction with the site being located on a flood plain, likely to have been repeatedly scoured by flood events reduces the potential for artefacts to be presence and intact.

Despite the lack of AHIMS records for the Site (refer **Appendix B**) and history of modification of the Site, the potential still remains for unexpected finds to occur and the measures outlined in Despite the lack of AHIMS records for the Site should be implemented in the event of unexpected finds.

6.6.3 Mitigation Measures

The following mitigation measures will be included in the CEMP to manage the potential impacts of the project on Aboriginal heritage:

> All construction personnel will be made aware of their responsibilities in relation to Aboriginal heritage under the relevant legislation;

> An unexpected finds protocol to manage the risk of unexpected finds will be developed and included in the CEMP. If the works uncover any items of suspected heritage significance, all activity in the immediate area must cease and the area be cordoned off. Council, the DPIE and the Local Aboriginal Land Council will be developed and included in the CEMP. The protocol will manage so that the Aboriginal object can be appropriately assessed and managed. Where the find comprises human remains, NSW Police must be contacted in the first instance.

6.7 Non-Aboriginal Heritage

6.7.1 Existing Environment

A review of the State Heritage Register and Muswellbrook LEP was undertaken on 17 July 2020; the results are provided in **Appendix C**. No records of Commonwealth or State listed heritage items or places were identified for the Site. The Fitzgerald / Olympic Park Gates, Wilkinson Avenue, (**Figure 6-2**) (also known as the Keys Memorial Gates) are listed as having local heritage significance under Muswellbrook LEP. The gates have historical and social significance for recording the relative status of an eminent local person from the early 20th century and for being significant to all descendants of the locally-famous Keys family.

The Keys Memorial Gates commemorate the public services provided by Richard Thom Keys to the Muswellbrook and Upper Hunter District. Mr Keys was a pastoralist who was president of the Upper Hunter P and A Association for many years. The gates were erected in April 1914 and officially dedicated on the 10th June 1914 (monumentaustralia.org.au).

The Keys Memorial Gates are currently at the entrance of Olympic Park at Wilkinson Avenue. Formerly they were located at the entrance of Gerald Park but were relocated in the 1960s. The gates are constructed of wrought iron mounted on sandstone pillars (Tickle, 2008).

The conservation management plan (Tickle, 2008) assessed the Keys Gates under the four values in the Australian ICOMOS Burra Charter and determined the following heritage values:

> Historical significance: The Gates record the value the community placed on the work of the late Richard Thom Keys;

> Aesthetic significance: The Gates are of impressive form and size for what was then a small country town;

> Scientific significance The Gates are an example of the skill of D Sims & Sons' ability to construct wrought iron gates and the ability of William Armitage to work sandstone; and

> Social significance: The Gates show the formal way a community expressed its feelings and thanks for the work of one member of that community. The monument is also of value to the descendants of Richard Thom Keys.

The conservation management plan determined that the Gates have a high level of heritage significance as there is a high level of original fabric, but it is of local importance as the gates show how a community honoured a local person. Section 6.3 of the conservation management plan (Tickle, 2008) states that there are no statutory controls on the Gates under Australian, State or Local legislation; however, the Gates form part of the Muswellbrook Heritage Study Inventory 1996.

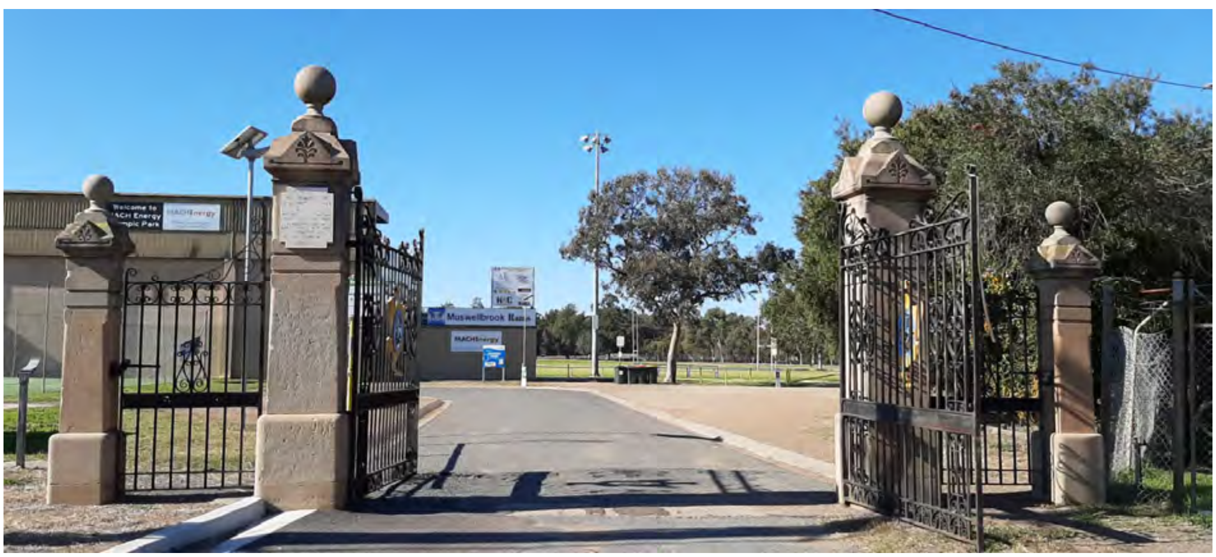


Figure 6-6 The Keys Memorial Gates

6.7.2 Potential Impact

The conservation management plan recommended that Council "consider relocating the gates to a position where there is no vehicular traffic" (Tickle, 2008). It is intended as part of the proposal to relocate in their entirety the Keys Memorial Gates to the football precinct forecourt at the eastern end of Wilkinson Avenue to allow for the upgrades of the facility. This will remove the gates from an area with vehicular traffic and place them in a location more suitable to their historical values.

6.7.3 Mitigation Measures

The following measures are recommended to mitigate impacts to non-Aboriginal heritage will be incorporated in the CEMP and implemented during construction:

> The CEMP will include an unexpected finds protocol to be followed in the event that any unexpected heritage items, archaeological remains or potential relics of heritage significance are encountered. It will as a minimum require that activity in the vicinity of the find cease, the location designated a no-go area, and that notification of Council's Superintendent for the works be undertaken;

> The proposed relocation of the Gates must follow the conservation principles, processes and practice as set out in the Burra Charter of conservation of places of significance. The method of relocation will be developed with the advice of a suitably qualified heritage architect in consultation with Council's Heritage Officer. This will demonstrate consideration of the NSW Heritage Office's (1998) Moveable Heritage Principles. As a minimum, a record will be made of the Gates in their current location and the new location they are to be relocated; and

> Council will consider providing an interpretation marker at the site from which the Gates were relocated to mark its original location.

6.8 Air Quality

6.8.1 Existing Environment

DPIEs Muswellbrook air quality monitoring site located in Bowman Park on Lorne Street identifies the air quality of Muswellbrook as Very Good (**Appendix B**). This is typical of a rural residential location where the expected pollutants to air quality are likely to be:

> Emissions from vehicles using local roads, highways and arterial roads;

> Emissions from residential functions;

> Dust from agricultural activities; and

> Smoke from paddock stubble burn-off in agricultural areas, wood fires, and bushfires.

6.8.2 Potential Impact

6.8.2.1 Construction

The greatest potential for air quality impacts would be during construction, which has potential to result in a localised impact on air quality as a result of activities including:

> Earthworks;

> The transport of loose materials and vehicle movements both within and to/from the works site; and

> Exhaust emissions from vehicles and equipment used during construction.

Residential and commercial receivers adjacent to the Site have the potential to experience a temporary and minor reduction in air quality. This risk could be managed adequately, provided the safeguards detailed in **Section 6.8.3** are implemented.

6.8.2.2 Operational Phase

In the operational phase the Site will comprise stabilised surfaces including paved internal roads and pathways, car parks, buildings, and turfed and landscaped areas. The Site is not likely to generate additional dust compared to that generated by the existing environment. Therefore, it is not anticipated that the operation of the sporting facility would cause any negative impacts on air quality.

6.8.3 Mitigation Measures

The following mitigation measures to manage air quality impacts would be incorporated into the CEMP and implemented during construction:

> Materials will be covered during transport to minimise dust emissions;

> A stabilised site access will be constructed to reduce tracking sediment off site from the wheels of vehicles exiting the site. The adjacent approaches will be kept free of dust during the works;

> Plant and machinery will not be left in idling and will be turned off when vehicles are not in use; and

> Equipment, machinery and trucks will be adequately maintained.

As the operation of the facility is not anticipated to result in an impact to air quality, no additional measures are required.

6.9 Landform, Geology and Soils

6.9.1 Existing Environment

Examination of acid sulfate occurrence maps published by Australian Soil Resources Information System on revealed the site is situated within an area with no acid sulfate soils occurrence.

A search of the EPA's Contaminated Land Register was undertaken on 20 August 2020. The register did not indicate any contaminated lands within the Site or nearby.

The soil profiles encountered during the geotechnical investigation of Muscle Creek have been characterised into the following geotechnical units as shown below in **Table 6-7** (after Cardno, 2019).

Table 6-7 Generalised Geotechnical Units

Origin	Unit	Description
FILL	F1	Uncontrolled filling comprising Silty Gravelly / Silty SAND with root fibres in BH01 & BH02
ALLUVIUM	A1	CL-CH, SC-CS, SP-SW Variable alluvial deposits containing Silty/Sandy CLAY of low to high plasticity and Clayey SAND / SAND of fine to coarse grain size
RESIDUAL	R1	CI-CH Silty CLAY of medium to high plasticity
WEATHERED ROCK	P1	Fine grained SANDSTONE Inferred rock classification: Class V Sandstone(1)
	P2	Fine grained SANDSTONE Inferred rock classification: Class IV Sandstone(1)

Notes to table:
MC: Moisture Content
HW: Highly Weathered
SW: Slightly Weathered
(1) The rock classification is based on the requirements presented in P.J.N Pells et al [3] , Foundations on Sandstone and Shale in the Sydney Region

6.9.2 Potential Impact

There would be an increased risk of soil erosion during construction due to clearing of vegetation and earthworks. The following activities have potential to result in erosion and sediment transport, including dust generation:

> The excavation and transport of soils;

> Bulk earthworks;

> Temporary stockpiling of material; and

> Use of temporary batters during construction staging on the Site.

Soil erosion can lead to the generation of dust and sediment laden stormwater run-off to nearby waterways. Sedimentation on land can result in smothering of vegetation and where it occurs in a waterway can he negative impacts on aquatic ecosystem health due to smothering of habitat, increasing turbidity and potentially by introducing sediment-bound nutrients, trace metals and other toxicants.

There is significant risk of erosion where management controls are not in place. However, the effective implementation of sedimentation and erosion controls can effectively reduce such risks. Provided the safeguards listed in **Section 6.9.3** below are implemented, teamed with the development and implementation of a Sediment and Erosion Control Plan for the works, the potential for increased erosion and sedimentation would be considered low.

There is the potential for the bridge construction to encounter groundwater as the groundwater levels encountered during the subsurface geotechnical investigation coupled with the expected pile foundation levels, it is likely that groundwater seepage into the pile holes may occur (Cardno 2019). If this is the case, the Contractor would select an appropriate method to manage the groundwater ingress.

The fate of any groundwater extracted from the trench or pits would depend on the groundwater management method adopted, and groundwater quality and rate of inflow (and therefore volume). If the groundwater is of a suitable quality, it could be re-used (e.g. for dust suppression). Alternatively, it may be discharged to the sewer under a licence from Council, for which there will also be certain criteria it must meet. In a worst-case scenario, the water would need to be trucked off site for disposal at a suitably licenced waste facility.

There is potential for accidental spills of chemical, fuel or drilling slurries during construction, which may result in a localised contamination of soils. The potential for contamination is considered to be low provided the safeguards and management measures outlined in **Section 6.9.3** are implemented.

There is also potential to encounter previously unidentified contaminated land.

Following the completion of earthworks, there may be some excess fill material generated. This would be disposed in accordance with the waste management methods discussed in **Section 6.11**.

The potential operational phase impacts on the bed and banks of Muscle Creek are discussed in **Section 6.3.2** and appropriate mitigation measures identified in **Section 6.3.3**.

6.9.3 Mitigation Measures

The following mitigation measures will be incorporated into the CEMP and implemented during construction to manage the potential impacts on soils:

> An Erosion and Sediment Control Plan should be prepared as part of the CEMP in accordance with Managing Urban Stormwater: Soils and Construction Volume 1 (the 'Blue Book'; Landcom, 2004). It should detail the erosion and sediment controls that must be implemented prior to start of construction and maintained in a working order for the duration of the construction period until the site is restored;

> Stabilisation of disturbed areas should be undertaken progressively during the works;

> The CEMP to be prepared by the contractor should manage the potential impacts of the works on soils and receiving watercourses. It will include, but not be limited to:

- Objectives and targets for soil and water quality management,
- Information on the relevant statutory and other requirements relating to soils and water quality, including any permits or licences required for the project,
- Details of any consultation requirements under the Plan,
- An overview of the existing environment and potential impacts arising from the works,
- Measures to manage the impacts of the project in relation to:
  - Soils, erosion and sedimentation,
  - Stockpile management,
  - Spoil and fill management,
  - Surface water quality,
  - Groundwater levels,
  - Discharges from sediment basins and groundwater de-watering,
  - Contaminated lands,
- Significant weather events (e.g. heavy rainfall or flooding),
- Re-fuelling of vehicles and other equipment, and accidental spills,
- Any relevant monitoring requirements, such as monitoring water quality in receiving waterbodies and monitoring of weather forecasts for storm or flood events,
- Auditing and reporting requirements, and
- Site inductions and training for construction personnel;

> An expected finds protocol will be included in the CEMP. If suspected contaminated material is encountered, the works will cease in the vicinity of the find and the subject soils should undergo assessment in accordance the National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 2013) and Part 4 of the Waste Classification Guidelines (EPA, 2014). If confirmed as

contaminated, Council and the EPA should be notified immediately and a remediation plan developed to manage the contaminated material;

> The risk of accidental spills will be managed in accordance with the measures detailed in **Section 6.3.3**.

6.10 Socio/Economic Considerations

6.10.1 Methodology

The socio-economic ramifications of the proposal have been considered via a review of the Australian Bureau of Statistics and consideration of how the proposal (**Section 3.2**) and the construction activities (**Section 3.3**) could impact on the socio-economic function of the locality.

6.10.2 Existing Environment

A review of the 2016 Census QuickStats (ABS, 2016) data showed that the state suburb of Muswellbrook has a population of 12,075 people, with a median weekly household income of $1,331.00 and a median rent of $250, the average household comprising of 2.5 people (ABS, 2016).

As of 2016 the most common occupations in the state suburb included:

> Technicians and trade workers (20.7%)

> Machinery operators and drives (18.2%)

> Labourers (12.4%)

> Professionals (11.6%)

> Clerical and administrative workers (9.9%)

> Community and personal service workers (9.7%).

Olympic Park is the largest central sporting facility for Muswellbrook. Olympic Park is currently in use by the following groups and clubs:

> Senior Rugby League;

> Junior Rugby League;

> Touch football club;

> Two tennis clubs;

> Girl Guides;

> Croquet and bowls; and

> Aquatic centre (currently undergoing upgrade works for the next 12 months).

The Masterplan notes that several of the facilities are in a poor state of repair, the velodrome has no signage, and the visual amenity and accessibility of the rugby league precinct is in need of an upgrade (TDP, 2018).

6.10.3 Potential Impact

6.10.3.1 Construction Phase

There would be some short-term, negative socio-economic impacts on local residents and road users during the construction works in regards to traffic, noise and vibration, air quality, and visual amenity. These potential impacts are identified and mitigation measures proposed in **Sections 6.1, 6.2**, and **6.4** respectively. These impacts will result in some disruption and inconvenience to the local residents and community members, and result in a decline in the general amenity of the locale.

During construction there would be some temporary, short term impacts on property access. Affected local residents may experience temporary loss of access to their property and/or on-street parking during the works associated with the bridge construction.

One positive impact of the proposal is the potential opportunity for local people to be employed during construction. It is noted that 20.7% of the working population of the LGA in employed as technicians and trade workers, closely followed by 18.2% as machinery operators and 12.4% as labourers. This would make them well placed to take advantage of any employment opportunities arising from the works. There may also be opportunities for suppliers of construction materials located in the area to provide construction materials, which would provide a benefit to the local economy.

6.10.3.2 Operational Phase

The proposal would have a positive social and economic impact by providing an improved outdoor recreation opportunity for the community, schools and for visitors to the region. When not in use, the sports fields may also be used by the local community.

It would also be used by community groups and sporting clubs, and be able to host local events such as markets or carnivals, thereby fostering community cohesion. The operation of the sports field could have some negative impacts on residential receivers in close proximity to the Site due to the potential for additional traffic on the local roads and potential change in the local noise environment. On balance, the construction of the sporting fields has potential to have a positive impact on local visual amenity due to updated facilities and the use of landscaping across the Site.

The upgrades to the sporting fields would result in employment opportunities for the ongoing operation and maintenance of the Site, such as sports field green keeping and landscape maintenance. Users of the sports field and associated facilities may also visit local businesses such as food and beverage outlets and suppliers of sporting goods. The proposed works also have the potential to attract investment and boost the local economy resulting in wider long term economic, health and social benefits. It would provide an opportunity to bid for events that will broaden sporting tourism in this region.

6.10.4 Mitigation Measures

The mitigation measures in **Sections 6.2.4, 6.1.4, 6.8.3** and **6.4.3** would address the identified impacts on local amenity in relation to noise, traffic and access, air quality and visual impacts. The following additional mitigation measures have been developed to address the identified socio-economic impacts:

> Ongoing consultation and communication with affected residents regarding the timing duration and likely impacts of construction works would be undertaken to manage impacts to local residents, businesses and the community;

> Where the construction works impact footpaths, alternative pedestrian access would be provided. Impacted property accesses would be temporarily reinstated at the conclusion of each day’s works, and alternative or temporary access provided as required.

6.11 Waste Management

The *Waste Avoidance and Resource Recovery Act 2001* promotes waste avoidance and resource recovery, and establishes a waste management hierarchy as follows:

> Reduce: minimise the potential for waste generation by avoiding unnecessary consumption of materials and materials that have excessive packaging

> Recovery: re-use, reprocess or recycle waste products to minimise the amount of waste requiring disposal

> Disposal: as a last resort, dispose of resources that cannot be recovered.

Further detail is provided in the NSW Waste Avoidance and Resource Recovery Strategy 2007 (EPA, 2014b).

Section 143 of the *POEO Act 1997* requires waste to be transported to a place that can lawfully accept it. Stipulating that the owner and transporter of the waste are responsible for ensuring that it is transported to a suitable waste facility.

The Waste Regulation sets out the provisions related to the following:

> Storage and transportation of waste;

> Reporting and record-keeping requirements for waste facilities;

> Special requirements for the management of certain special wastes including asbestos;

> Payment of waste contributions (referred to as a waste levy) by the occupiers of licensed waste facilities; and

> Exemption of certain occupiers or types of waste from paying waste contributions and from requiring an Environment Protection Licence (Part 9 of the Regulation).

The Waste Regulation provides for exemptions from some of the requirements under the *Protection of the Environment Operations Act 1997* and Regulation for certain wastes and resource recovery activities where it can be demonstrated that waste reuse would not cause harm to human or environmental health. Under these provisions, the EPA requires two separate applications, either or both of which may be applicable to a project, namely:

> A Resource Recovery Order made under clause 93 of the Regulation, which covers the requirements for the generation and / or processing of material for reuse

> A Resource Recovery Exemption made under clauses 91 and 92 of the Regulation, which relates to the consumption of any material for reuse.

There are a number of Resource Recovery Orders and Exemptions that are relevant to similar types of construction projects, including:

> Excavated natural material;

> Recovered aggregate;

> Excavated public road material;

> Treated drilling mud;

> Reclaimed asphalt pavement; and

> Stormwater.

Where no specific Resource Recovery Order and Exemption is currently available for the intended re-use of a waste material, an application can be made to the EPA.

6.11.1 Potential Impacts

6.11.1.1 Construction Phase

The proposed works will generate the following waste streams:

> Timber and green waste from vegetation removal. Any proposal to recover and/or re-use mulch for the landscaping works may be subject to the Waste Regulation, and a Resource Recovery Order or Exemption may be required;

> Demolition waste associated with:
  - Buildings and associated structures
  - Road pavement from roads. Waste materials may include asphalt, road base, concrete, gravel, and scrap metals, and
  - Utility infrastructure

> General construction waste would include:
  - Packaging waste, such as cardboard, paper, plastic containers, plastic sheeting, plastic wrap and glass,
  - Chemical / spill clean-up waste,
  - Wastes from desilting of temporary sediment basins,
  - Water from any washdowns,
  - Excess building materials, pipework associated with the construction access, and
  - General waste from the construction compound, such as paper, cardboard, printer cartridges, plastic, bottles, cans and food wastes; and
  - Excess spoil from excavations, including material that is unsuitable for re-use in backfilling or reshaping works, and drilling waste.

Further discussion on these waste streams is provided below.

Where possible, any road pavement being removed would be re-processed and used to provide sub-pavement layers for the external road works, for which a Resource Recovery Order or Exemption may be required. Any remaining material would be disposed of at an off-site facility. Where buildings are proposed for demolition, there is potential to uncover hazardous materials (such as asbestos) during demolition. If asbestos or other hazardous materials are identified, they would be classified and managed appropriately by certified contractors and disposed of at a licensed facility.

Wherever possible, excess excavated material would be re-used for project construction (e.g. for the bulk earthworks) Any excess excavated would (where required) be classified in accordance with the Waste Classification Guidelines (EPA, 2014) and disposed of at an appropriately licensed off-site facility.

General waste such as tyres, batteries, waste fuels or oils, and oils and lubricant containers associated with the maintenance of plant and equipment would be considered contaminated and stored in dedicated waste storage areas prior to offsite disposal at a suitably licenced facility. Recycling bins would be provided in site compounds to enable recycling of general waste materials where possible. The remaining waste would be disposed of offsite at a suitably licensed facility. Sewage would be directed to the sewage mains or pumped out for disposal at an appropriately licensed facility.

6.11.1.2 Operational Phase

The operation of the facility will include waste generation, to a similar volume as existing, this is including:

> General waste from patrons and personnel;
> Waste from routine maintenance activities;
> Green waste from maintenance of landscaping; and
> Soil, silt and larger waste items from clearing drains, the bioretention basin and culverts. Where possible, green waste would be re-used on site (e.g. as mulch).

Soil and silt from bioretention would be assessed in accordance with the Waste Classification Guidelines (EPA, 2014) and disposed of accordingly.

The Masterplan (TDP 2018) states that waste management facilities would need to be accommodated on site. The design of the forecourt will need to consider how a garbage truck manoeuvres between landscaping elements to pick up waste from the grandstand (both Stage 1 and Stage 2). Vehicular access for maintenance of the riparian corridor should be accommodated.

6.11.2 Mitigation Measures

The following measures would be implemented to manage and mitigate potential impacts of waste during construction:

> The CEMP would include a waste management strategy prepared in accordance with the waste management hierarchy. This would include details of:
  - The waste material likely to be generated,
  - Procedures for sorting and storing waste,
  - A waste register detailing types of waste collected, amounts, date, time, transportation method and details of disposal,
  - A strategy for materials to be recycled or re-used, as well as measures to reduce or avoid waste generation.
> All waste will be taken to a suitably licensed waste disposal facility;
> Waste material is not to be left on site once the works have been completed;
> Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day; and
> EPA is to be notified immediately of any pollution incidents or harm to the environment (as defined under Part 5.7 of the POEO Act). For the management of waste during the operational phase, procedures and proposed re-use and recycling of waste material would be detailed in the Site OEMP.

6.12 Hazards and Risks

6.12.1 Existing Environment

A review of the proposed construction methodology **Section 3.3** and the existing environment was undertaken to identify the potential for further risks and hazards associated with the proposed works.

A Dial Before You Dig (DBYD) was undertaken (**Appendix B**) to identify potential utilities within the project footprint. Ausgrid, NBN Co, Pipe Networks, Roads and Maritime Services and Telstra were contacted. Ausgrid services were identified within the Site.

Overhead power lines are also present along Wilder Street, crossing Muscle Creek at the location of the proposed bridge, and running north-south along the western side of the velodrome.

6.12.2 Potential Impact

Utilities and services in the vicinity of the proposed works may be subject to potential damage by construction activities. It is likely that the overhead power lines at the proposed bridge location will need to be relocated.

6.12.3 Mitigation Measures

The following measures to mitigate impacts to the existing services and utilities in the locality will be implemented:

> The detailed design of the project will seek to avoid impacts to existing utilities as far as is reasonably practical;

> The Contractor must undertake a DBYD enquiry immediately prior to commencement of the works and a service locator employed as required;

> The construction methodology will minimise the potential for disturbance of utilities and services;

> Prior to the commencement of construction, the Contractor will obtain any required approvals from service authorities in order to facilitate the construction activities; and

> An emergency response plan (if required) will be developed by the Contractor in consultation with the asset owner. The plan will need to be approved by Council prior to construction and will be followed in the event that any utilities or services are damaged.

6.13 Cumulative Impacts

6.13.1 Potential Impact

There is potential for cumulative impacts as a result of the potential co-occurrence of construction of the proposal and other current or planned works within the locality. In particular, these impacts may include cumulative noise, air quality and traffic impacts during construction.

A search of the DPIE’s Major Project Register (**Appendix C**) on 19 August 2020 resulted in no current major projects being undertaken in Muswellbrook. It is recommended that, prior to the commencement of construction, Council consider any developments or projects that may interact with this proposal.

6.13.2 Mitigation Measures

Prior to commencement of each Stage of construction, the Contractor should review the potential for other construction projects to coincide with construction of the proposal. If there are coincident construction projects that will result in cumulative impacts on the community, the Contractor will demonstrate they have considered the appropriate measures to manage these cumulative impacts, such as coordination of noisy works and disruptions to traffic and access with the other relevant proponents so as to minimise impacts to the community, in so far as is reasonable and feasible.

7 Environmental Management

7.1 Environmental Management Plan

A CEMP will be prepared by the construction contractor to include the mitigation measures listed in this REF, as well as any relevant conditions under any permits, licenses or other approvals obtained for the project, including:

> Part 7 permit for dredging (Section 200 of the FM Act) and the potential obstruction of fish passage (Section 219 of the FM Act) from DPI (Fisheries).

7.2 Summary of Proposed Mitigation Measures

Environmental mitigation measures relating to each of the aspects considered in this REF are summarised in **Table 7-1**.

Table 7-1 Summary of proposed mitigation measures

Aspect	Mitigation Measure
Traffic, parking and access	Mitigation measures to manage the identified impacts on traffic during construction will include: ▪ A CTMP would be prepared by the Contractor to be included in the CEMP and approved by Council prior to works commencing; ▪ The Contractor will comply with any Council requirements regarding traffic control and access; ▪ The number of construction vehicles accessing the site via Wilder Street will be kept to a minimum. The preferred access route would be via Wilkinson Avenue; ▪ Work vehicles will avoid obstructing vehicular or pedestrian traffic on roadways, or access to private driveways or public facilities, unless absolutely necessary and only if appropriate notification has been provided to potentially affected property owners / parties; ▪ No construction materials, equipment or vehicles would encroach onto private property without prior arrangement with the landowner; ▪ Appropriate signage will be erected to inform users of the disruption to pedestrian movements on local roads and any temporary area closures if required; ▪ All directly affected stakeholders shall be informed about the works, their timing, and expected impacts prior to the commencement of the works; ▪ Parking of vehicles and storage of plant/equipment is to occur on paved areas. Where this is not possible, vehicles and plant / equipment are to be kept away from environmentally sensitive areas and outside the dripline of trees; ▪ All vehicles transporting spoil would be covered and filled to maximum capacity to minimise vehicle movements; ▪ All roads, kerbs and footpaths damaged as a result of construction are to be restored to their preconstruction condition; and ▪ All sealed roads would be kept clean and free of dust and mud at all times. Where material is tracked onto sealed roads at any time, it would be removed immediately so that road pavements are kept safe and trafficable. Recommendations to manage traffic impacts during the operation of the facility include: ▪ It is recommended to upgrade the intersection of Haydon Street and Wilkinson Avenue to improve access for buses. ▪ Site-specific traffic management should be implemented to manage increased traffic loads during events. ▪ Banning the right in/out of Wilder Street is recommended to reduce the safety issue of back to back right-turns at the staggered junction.
Noise and vibration	An updated noise assessment should be undertaken by the Contractor based on the final detailed design and the final construction methodology, schedule and list / number of plant and equipment to be used at each stage of construction. The updated assessment shall, as a minimum: ▪ Identify nearby residences and other sensitive land uses; ▪ Develop noise management levels consistent with the ICNG (DECC, 2009); and

	▪ Assess the potential impact from the proposed construction methods. The outcome of this updated assessment shall inform the development of reasonable and feasible construction noise and vibration management measures as part of the CEMP. The CEMP should consider the following as a minimum: ▪ Develop reactive and proactive strategies for dealing with any noise complaints; ▪ Identify a site contact person to follow up complaints; ▪ Source controls: – Maximising the offset distance between noisy plant and sensitive receivers, – Orienting equipment away from sensitive receivers where possible, – Using lower powered or reduced size equipment where noise benefits are available, where practical, – Using spotters, “smart” reversing alarms, or broadband reversing alarms in place of traditional beeper reversing alarms, – Operating machinery in a manner which reduces maximum noise level events including shaking excavator bucket, loading trucks, handling steel beams and frames and removing concrete sections, – Turning off machinery when not in use, – Ensuring plant and equipment is well maintained and not generating excessive noise, – Specific controls for concrete trucks and site trucks including scheduling activities to avoid numerous trucks operating on site simultaneously; ▪ Administrative controls: – Limiting work strictly to standard construction hours, – Minimising the number of noisy plant operating at once and schedule high noise generating activities to the middle of the day away from more sensitive early morning and late afternoon periods, – Site awareness training / environmental inductions that include a section on noise mitigation techniques / measures to be implemented throughout the project when on site and accessing the site; and ▪ Community management: – Notifying receivers potentially affected by the works at least five days prior to works starting, – Keeping the community informed in relation to noise intensive activities in the immediate area, and – Providing consultation where prolonged periods of construction works, or particularly noisy works, are planned.
Hydrology and water quality	▪ The detailed design of the Muscle Creek bridge will be developed in consultation with DPIE’s flooding team and DPI (Fisheries); ▪ The detailed design of the bridge will consider the requirement for fish passage and scour protection under the Policy and Guidelines for Fish Habitat Conservation and Management (NSW Department of Primary Industries, 2013) and the NSW Office of Water Guidelines for Controlled Activities. Appropriate scour protection measures will be incorporated into the design; ▪ The design of the new Muscle Creek bridge will consider potential flood impacts. Any identified impacts will be minimised through the detailed design process. In the event flood impacts cannot be avoided, Council would undertake consultation with the affected property owners. Appropriate mitigation measures will be developed in consultation with the affected property owners; ▪ The development of the detailed design will demonstrate consideration of options for the provision of water supply for sports field irrigation that meet the required water quality, reduce reliance on the potable water supply, and minimise or appropriately manage any potential impacts on other groundwater users; ▪ In developing the construction methodology for the new Muscle Creek bridge, the Contractor will demonstrate to the satisfaction of Council that they have sought to minimise the duration of the works, minimise impacts to the bed and banks of the creek, and that they can minimise obstruction of flows / fish passage. Should de-watering be required, it will consider appropriate means of disposal of the water and management of any fauna entrapped in the area to be de-watered, as well as the process of reinstating flows;

	▪ The CEMP will include a flood emergency response plan that identifies which parts of the Site are located within the floodplain, the required monitoring of weather forecasts, and the measures to be undertaken in the event a flood is forecast for Muscle Creek; ▪ The CEMP will include procedures for managing the risk of accidental spills, to include, but not be limited to: – Refuelling of plant and equipment, or any other activity which may result in the spillage of a chemical, fuel or lubricant, would be undertaken away from any location with direct drainage to a waterway where possible/practical and within a designated re-fuelling area. – No maintenance of plant or equipment is to be undertaken within 30m of the creek. – A spill kit would be kept on site and staff trained in its use. All spills would be cleaned up promptly. Absorbent materials and affected soil would be promptly collected and bagged for disposal to an appropriately licensed facility.
Visual amenity	▪ Works will be completed within the shortest possible timeframe; ▪ The site should be kept clean of general litter and tidy for the duration of works; ▪ All waste generated during the course of the works will be removed from the work areas as soon as practicable and disposed of in reasonable manner; ▪ All work equipment and materials will be contained within the designated boundaries of the work site. The spread of stockpiles, vehicle parking and waste storage will be minimised and contained to designated areas/site compounds; ▪ Disturbed areas would be re-instated and stabilised progressively, minimising the footprint of the works at any one time; ▪ On completion of the works, all vehicles, materials, and waste relating to the works will be removed from the work areas; and ▪ Ongoing consultation and communication with affected residents regarding the timing duration and likely impacts of construction works would be undertaken to manage impacts to local residents and the community.
Biodiversity	▪ Where possible, limit disturbance within the project footprint to previously cleared and miscellaneous vegetated area (e.g. for the laydown areas) during construction phase; ▪ The detailed design of the proposal will demonstrate it has considered opportunities to minimise the footprint of the works, particularly in the riparian corridor. The works will avoid the Red River Gums; ▪ All works are to be restricted to the project footprint; ▪ Apart from the construction area required necessary to build the bridge, riparian corridors to be fenced off and labelled as No-Go areas to prevent accidental impacts and introduction of pathogens, such as *Batrachonchtrium dendrobatidis*, a pathogen that caused chytridiomycosis, an infection disease on amphibians; ▪ All machinery should be cleaned of foreign soil and vegetative matter to avoid the spread of Phytophthora cinnamomi, Exotic Rust Fungi of the order Pucciniales pathogenic (Myrtle Rust) and dispersal of seeds of non-native plants; ▪ Strict weed management, monitoring and control practices should be implemented as part of the CEMP to minimise the spread of exotic species into natural areas within and outside of the Study Area. In particular, priority weed and high threat exotic species should be targeted in accordance with the NSW DPI WeedWise recommended control measures (DPI 2020); ▪ Strict erosion and sediment control measures should be implemented as part of the CEMP, as discussed in **Section 6.9**; ▪ Implement dust and erosion and sediment control measures where necessary to protect adjacent retained vegetation and water quality in Muscle Creek, as per **Section 6.8.3**; ▪ Stockpiling of materials should occur within previously disturbed areas and not within driplines or retained vegetation; ▪ Stop-work procedure on the chance encounter of any dispersing wildlife during works should be implemented to avoid death or injury; ▪ A suitably qualified ecologist will be present during the removal of all trees to act as a spotter catcher that can relocate any captured wildlife; ▪ Any captured animals are relocated into the nearest suitable native vegetation; ▪ Any injured animals are taken to a local wildlife carer for treatment; and

	▪ Disturbance to instream areas (from the top of banks to the creek bed) will be avoided as far as practicable; ▪ Consider timing of the works during favourable weather conditions to prevent erosion and sedimentation during construction; ▪ Following the completion of the works, riparian areas should be revegetated with native species. Species selection is to consider locally endemic species in the riparian areas of Muscle Creek; and ▪ A part 7 permit is required for dredging (Section 200 of the FM Act) and the potential obstruction of fish passage (Section 219 of the FM Act) prior to the commencement of works. This will require consultation with DPI (Fisheries).
Aboriginal heritage	▪ All construction personnel will be made aware of their responsibilities in relation to Aboriginal heritage under the relevant legislation; ▪ An unexpected finds protocol to manage the risk of unexpected finds will be developed and included in the CEMP. If the works uncover any items of suspected heritage significance, all activity in the immediate area must cease and the area be cordoned off. Council, the DPIE and the Local Aboriginal Land Council will be developed and included in the CEMP. The protocol will manage so that the Aboriginal object can be appropriately assessed and managed. Where the find comprises human remains, NSW Police must be contacted in the first instance.
Non-aboriginal heritage	▪ The CEMP will include an unexpected finds protocol to be followed in the event that any unexpected heritage items, archaeological remains or potential relics of heritage significance are encountered. It will as a minimum require that activity in the vicinity of the find cease, the location designated a no-go area, and that notification of Council's Superintendent for the works be undertaken; and ▪ The proposed relocation of the Gates must follow the conservation principles, processes and practice as set out in the Burra Charter of conservation of places of significance. The method of relocation will be developed with the advice of a suitably qualified heritage architect in consultation with Council's Heritage Officer. This will demonstrate consideration of the NSW Heritage Office's (1998) Moveable Heritage Principles. As a minimum, a record will be made of the Gates in their current location and the new location they are to be relocated; and ▪ Council will consider providing an interpretation marker at the site from which the Gates were relocated to mark its original location.
Air quality	▪ Materials will be covered during transport to minimise dust emissions; ▪ A stabilised site access will be constructed to reduce tracking sediment off site from the wheels of vehicles exiting the site. The adjacent approaches will be kept free of dust during the works; ▪ Plant and machinery will not be left in idling and will be turned off when vehicles are not in use; and ▪ Equipment, machinery and trucks will be adequately maintained.
Landform, geology and soils	▪ An Erosion and Sediment Control Plan should be prepared as part of the CEMP in accordance with Managing Urban Stormwater: Soils and Construction Volume 1 (the 'Blue Book'; Landcom, 2004). It should detail the erosion and sediment controls that must be implemented prior to start of construction and maintained in a working order for the duration of the construction period until the site is restored; ▪ Stabilisation of disturbed areas should be undertaken progressively during the works; ▪ The CEMP to be prepared by the contractor should manage the potential impacts of the works on soils and receiving watercourses. It will include, but not be limited to: – Objectives and targets for soil and water quality management, – Information on the relevant statutory and other requirements relating to soils and water quality, including any permits or licences required for the project, – Details of any consultation requirements under the Plan, – An overview of the existing environment and potential impacts arising from the works, – Measures to manage the impacts of the project in relation to: ▪ Soils, erosion and sedimentation, ▪ Stockpile management, ▪ Spoil and fill management, ▪ Surface water quality, ▪ Groundwater levels,

	▪ Discharges from sediment basins and groundwater de-watering, ▪ Contaminated lands, – Significant weather events (e.g. heavy rainfall or flooding), – Re-fuelling of vehicles and other equipment, and accidental spills, – Any relevant monitoring requirements, such as monitoring water quality in receiving waterbodies and monitoring of weather forecasts for storm or flood events, – Auditing and reporting requirements, and – Site inductions and training for construction personnel; ▪ An expected finds protocol will be included in the CEMP. If suspected contaminated material is encountered, the works will cease in the vicinity of the find and the subject soils should undergo assessment in accordance the National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 2013) and Part 4 of the Waste Classification Guidelines (EPA, 2014). If confirmed as contaminated, Council and the EPA should be notified immediately and a remediation plan developed to manage the contaminated material; ▪ The risk of accidental spills will be managed in accordance with the measures detailed in **Section 6.3.3**.
Socio/economic considerations	▪ Ongoing consultation and communication with affected residents regarding the timing duration and likely impacts of construction works would be undertaken to manage impacts to local residents, businesses and the community; ▪ Where the construction works impact footpaths, alternative pedestrian access would be provided. Impacted property accesses would be temporarily reinstated at the conclusion of each day's works, and alternative or temporary access provided as required.
Waste management	▪ The CEMP would include a waste management strategy prepared in accordance with the waste management hierarchy. This would include details of: – The waste material likely to be generated, – Procedures for sorting and storing waste, – A waste register detailing types of waste collected, amounts, date, time, transportation method and details of disposal, – A strategy for materials to be recycled or re-used, as well as measures to reduce or avoid waste generation. ▪ All waste will be taken to a suitably licensed waste disposal facility; ▪ Waste material is not to be left on site once the works have been completed; ▪ Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working day; and ▪ EPA is to be notified immediately of any pollution incidents or harm to the environment (as defined under Part 5.7 of the POEO Act). For the management of waste during the operational phase, procedures and proposed re-use and recycling of waste material would be detailed in the Site OEMP.
Hazards and risk	▪ The detailed design of the project will seek to avoid impacts to existing utilities as far as is reasonably practical; ▪ The Contractor must undertake a DBYD enquiry immediately prior to commencement of the works and a service locator employed as required; ▪ The construction methodology will minimise the potential for disturbance of utilities and services; ▪ Prior to the commencement of construction, the Contractor will obtain any required approvals from service authorities in order to facilitate the construction activities; and ▪ An emergency response plan (if required) will be developed by the Contractor in consultation with the asset owner. The plan will need to be approved by Council prior to construction and will be followed in the event that any utilities or services are damaged.
Cumulative impacts	Prior to commencement of each Stage of construction, the Contractor should review the potential for other construction projects to coincide with construction of the proposal. If there are coincident construction projects that will result in cumulative impacts on the community, the Contractor will demonstrate they have considered the appropriate measures to manage these cumulative impacts, such as coordination of noisy works and disruptions to traffic and access with the other relevant proponents so as to minimise impacts to the community, in so far as is reasonable and feasible.

8 Conclusion

8.1 Summary of Consideration of Environmental Impacts

This REF has assessed potential environmental impacts that may arise from the proposed works. The factors listed in the *EPBC Act* and under Clause 228(2) of the EP&A Reg. have been addressed and are summarised in **Tables 8-1** and **8-2** respectively to demonstrate that the likely impacts of the proposal on the natural and built environment have been fully considered.

Table 8-1 Consideration of EPBC MNES

Matter	Impact
a) Any environmental impact on World Heritage property?	Nil
b) Any environmental impact on World Heritage places?	Nil
c) Any environmental impact on Ramsar wetlands of international significance?	Nil
d) Any environmental impact on Nationally listed or threatened species and communities?	Nil
e) Any environmental impact on Nationally listed migratory species?	Nil
f) Any environmental impact on Commonwealth marine areas?	Nil

Table 8-2 Consideration of Clause 228(2) Factors

Factor	Impact
a) **Any environmental impact on a community?** Residences and properties located adjacent to the Site have the potential to be affected during construction by noise from construction plant, machinery and vehicles. Air quality impacts during construction may result from dust, vehicle emissions. Properties adjacent to the Site would also be affected by visual impacts relating to earthworks, stockpiling and machinery. These impacts would be minimised through implementation of safeguards in **Sections 6.2.3, 6.8.3, and 6.4.3**. Construction may cause minor changes for traffic and access on local roads. These impacts would be short-term and would be minimized through the implementation of safeguards detailed in **Section 6.1.3**. The operation of the proposal will have a long-term positive impact for the community. The proposal provides a multi-use recreation facility enabling sporting events for the locality and a tourism opportunity and long-term minor negative impacts through the potential for minor increases to noise and the added traffic on the surrounding network.	Short-term minor negative Long-term positive Long-term minor negative
b) Any transformation of a locality? The locality will be temporarily transformed due to the presence of the construction site.	Short-term minor negative
c) Any environmental impact on the ecosystem of the locality? It is not anticipated that the works will have a significant impact on the local ecology, detailed in **Section 6.5**.	Short-term minor negative
d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality? The presence of construction equipment and activities would have a minor impact on the aesthetic value of the locality during construction. However, the operation of the facility will increase the recreational value of the locality, the sports facility will provide a multi-use resource for the community to use for a range of recreational activities.	Short-term minor negative Long-term positive
e) Any effect on the locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? There would be an impact to the locally significant Keys Gates due to their relocation, although the structure would be retained on site.	Minor long-term

Factor	Impact
f) Any impact on the habitat of protected fauna (within the meaning of the *Biodiversity Conservation Act 2016*)? The proposal will not have a significant impact the habitat of protected fauna (refer **Section 6.5**).	Short-term minor negative
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The proposal will not any species (refer **Section 6.5**).	Nil
h) Any long-term effects on the environment?	Nil
i) Any degradation of the quality of the environment? As described above, residences and properties located adjacent to the proposal site have the potential to be affected during construction by noise from construction plant, machinery and vehicles. Air quality impacts during construction may result from dust and vehicle emissions. Properties adjacent to the proposal site would also be affected by visual impacts relating to earthworks, stockpiling and machinery. These impacts would be minimised through implementation of safeguards in **Sections 6.6.3, 6.1.3 and 6.9.3**. Construction may cause minor changes for traffic and access on local roads. These impacts would be short-term and would be minimised through the implementation of safeguards detailed in **Section 6.7.3**.	Short-term minor negative
j) Any risk to the safety of the environment? The potential remains for the infrastructure to experience failures, such as pipe breakage, that pose a minor risk to the local environment. However, the standard operation of the infrastructure does not threaten the safety of the surrounding environment.	Potential minor risk
k) Any reduction in the range of beneficial uses of the environment?	Nil
l) Any pollution of the environment? During construction the proposal could potentially result in soil, water, air quality and noise pollution to the environment if not properly mitigated. Mitigation measures to manage potential impacts are included in **Sections 6.9.3, 6.3.3, 6.8.3, and 6.2.3**.	Short-term minor negative
m) Any environmental problems associated with the disposal of waste?	Nil
n) Any increase demands on resources (natural or otherwise) that are, or are likely to become, in short supply?	Nil
o) Any cumulative environmental effects with other existing or likely future activities?	Nil

8.2 Summary

This REF details that the construction and operation of the proposal is not expected to result in significant environmental impacts, provided the measures outlined in **Section 7** are implemented. The long-term impacts of the proposal would be positive as the facility will provide better quality recreational infrastructure for local residence and visitors.

9 References

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APPENDIX

A

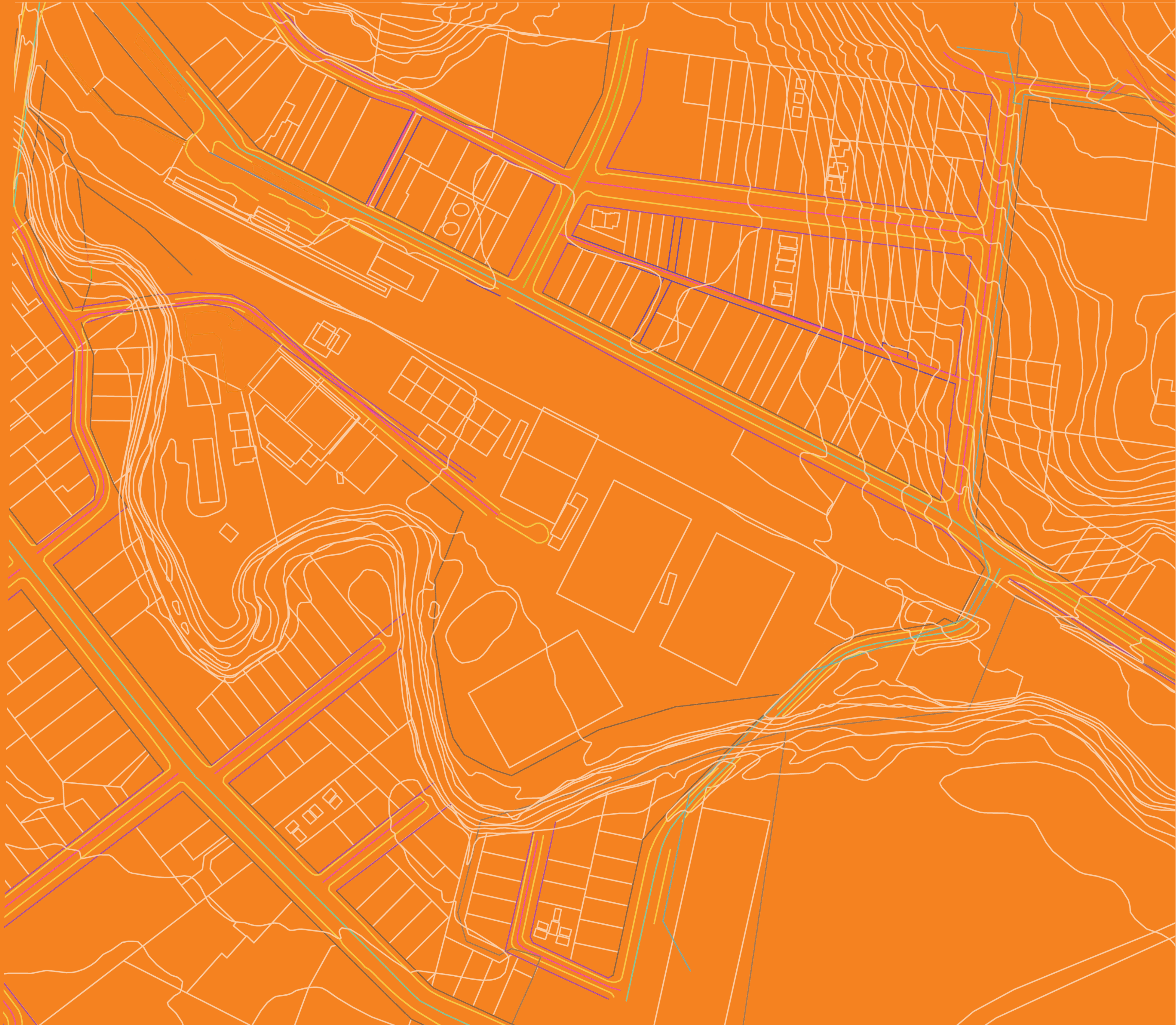
OLYMPIC PARK MASTERPLAN

OLYMPIC PARK MASTERPLAN

AUGUST 2018

CONTENTS

CHAPTER 1



INTRODUCTION

In May 2017, Muswellbrook Shire Council engaged urban design consultancy The Design Partnership to prepare a Master Plan for Olympic Park. Olympic Park is a sporting precinct comprising Rugby League fields and grandstand, tennis courts, the Ron King Velodrome, the Muswellbrook Aquatic Centre and two Bowling Greens.

The intent of the Master Plan is to develop a strategic approach to the redevelopment of Olympic Park.

1.1 AIM OF THE CONCEPT PLAN

The aims of this Concept Plan are:

- To prepare an overall master plan for Olympic Park Precinct which will give a clear vision for the precinct
- To integrate Muswellbrook Aquatic Centre and Urban Riparian Landcare master plans' outcomes into the overall masterplan
- To identify opportunities for improvements including public domain, recreational, parking, traffic movement and landscaping
- To enhance connection between Olympic Park Precinct, town centre and neighbouring residential areas
- To incorporate crime prevention through environmental design principles into planning and development activities
- To provide a coordinated and strategic planning approach to the development of the area and
- To develop detailed concept design for identified key areas.

1.2 THE STRUCTURE OF THE REPORT

The report comprises six parts. The first two sections provide the background and understanding of Olympic Park. This understanding informs the following Masterplan.

Sections 4 - 5 present the Masterplan, from the vision through to the individual projects that collectively make up the Masterplan.

Section 2 Background Summary
Section 2 helps the reader understand the history of Olympic Park and its context.

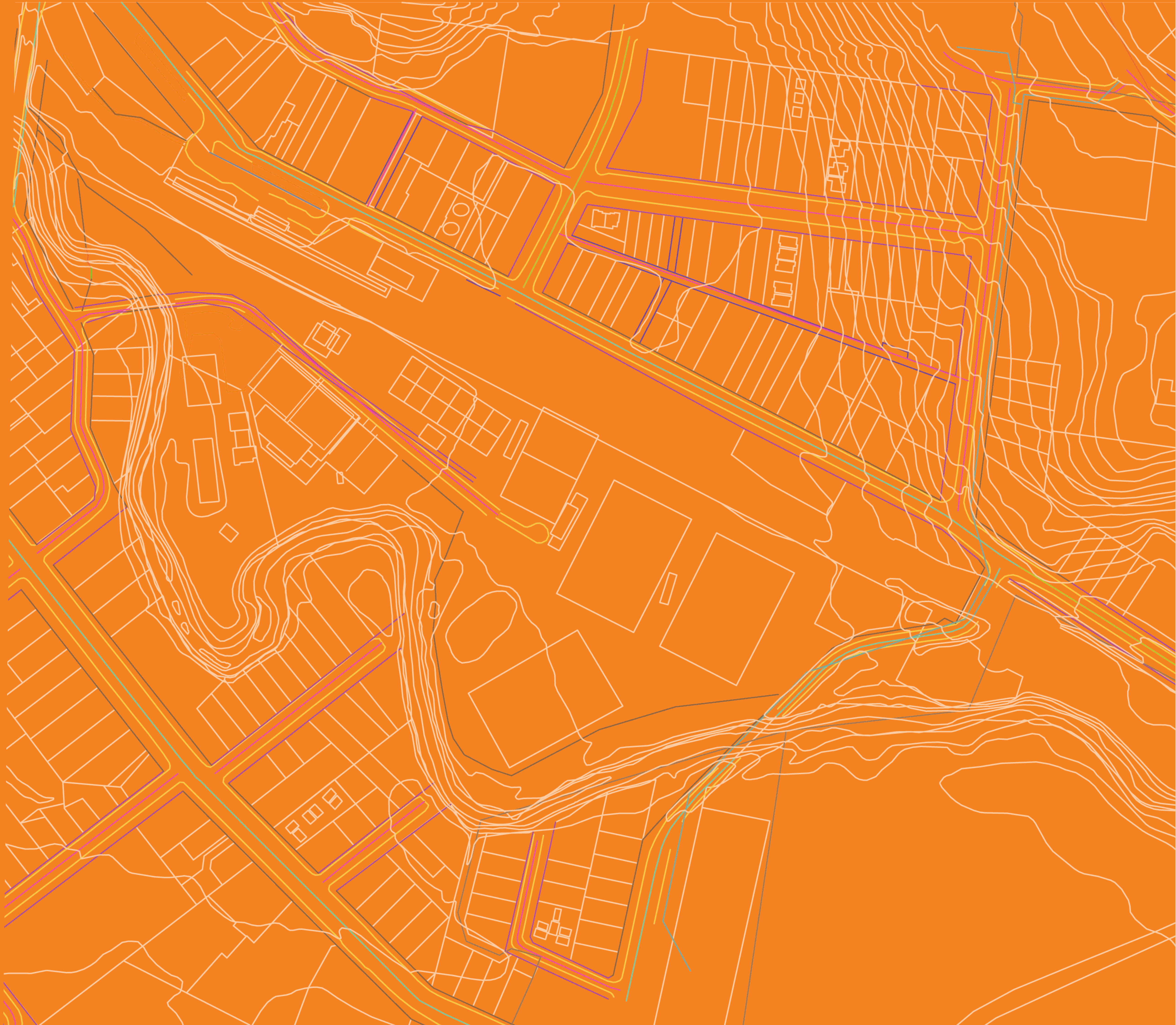
Section 3 Analysis
This section explores the physical site - its topography, movement network and current uses.

Section 4 Masterplan: Framework for Olympic Park
The framework for Olympic Park is set down in this section of the report. The framework clearly articulates the vision and urban design principles. During future development of the Precinct, these principles will help Council ensure they meet the intentions of the Masterplan.

Section 5 Masterplan: Implementation
This section comprises a series of projects which collectively complete the Masterplan for Olympic Park. To assist in project delivery, the projects detail scope of work, indicative budgets, suggested materials and grant and funding opportunities.

Section 6 Grants and funding
This section is useful to Council to identify grants and funding opportunities for future development of the site.

CHAPTER 2



BACKGROUND SUMMARY

Without doubt, Muswellbrook is a very pretty country town – with tree lined streets and numerous historic buildings.

It sits squarely in the center of the Upper Hunter Valley – south of the horse breeding capital of Australia – Scone – and at the northern end of an almost continuous swathe of coal mining operations stretching over 50 km south to the Singleton military area.

The 257 km drive from Sydney takes approximately three hours. From Newcastle, the 130km road journey is covered in an hour and 40 minutes. The township sits astride the New England Highway.

Lake Liddell marks the Shire boundary to the east, Wollemi National Park to the west, Aberdeen to the north and Coricudgy State Forest to the south. 43% of the 3,402km2 shire is national park.

The town lies at the junction of the Main Northern Rail line to Armidale and the Merriwa line to Gulgong. Apart from the movement of general rail freight through Muswellbrook, most tonnage is the result of coal transportation to Newcastle – now over 80 million tonnes annually. Muswellbrook railway station is serviced by local and long-distance rail services, interstate coaches and local bus services.

Apart from coal mining, main industries include agriculture, viticulture, horse breeding and power generation. South of the township are the Liddell and Bayswater power stations, which together employ approximately 500 people from the area.

Before European settlement of the region the Wonnarua and Gamilaroi peoples occupied the land. European exploration began in 1819 - followed by the first settlements in the 1820's. Muswellbrook township, named after the abundance of mussel shells found there, was gazette by the New South Wales Government in 1833. When the municipality was declared in 1870 the population was 1445. According to the 2016 census of population, there were 12,075 people in Muswellbrook.

As someone who has travelled to Muswellbrook numerous times since childhood – seeing the robust prosperity and vitality of the town on a Saturday morning drive through the main shopping precinct is something the local community should be very proud of.

OLYMPIC PARK

Muswellbrook is fortunate in having such a large sporting precinct virtually on the doorstep of the town. Along with the golf course, Olympic Park forms the northern end of an almost 3.2km long green space corridor running primarily east of the New England Highway - from Wilkinson Avenue in the north – then along the length of Bimbadeen Drive in the south.

Main access to parking and facilities is via Wilkinson Avenue in the north. Additional parking and access – although less handy to facilities - is available via Bell Street in the south.

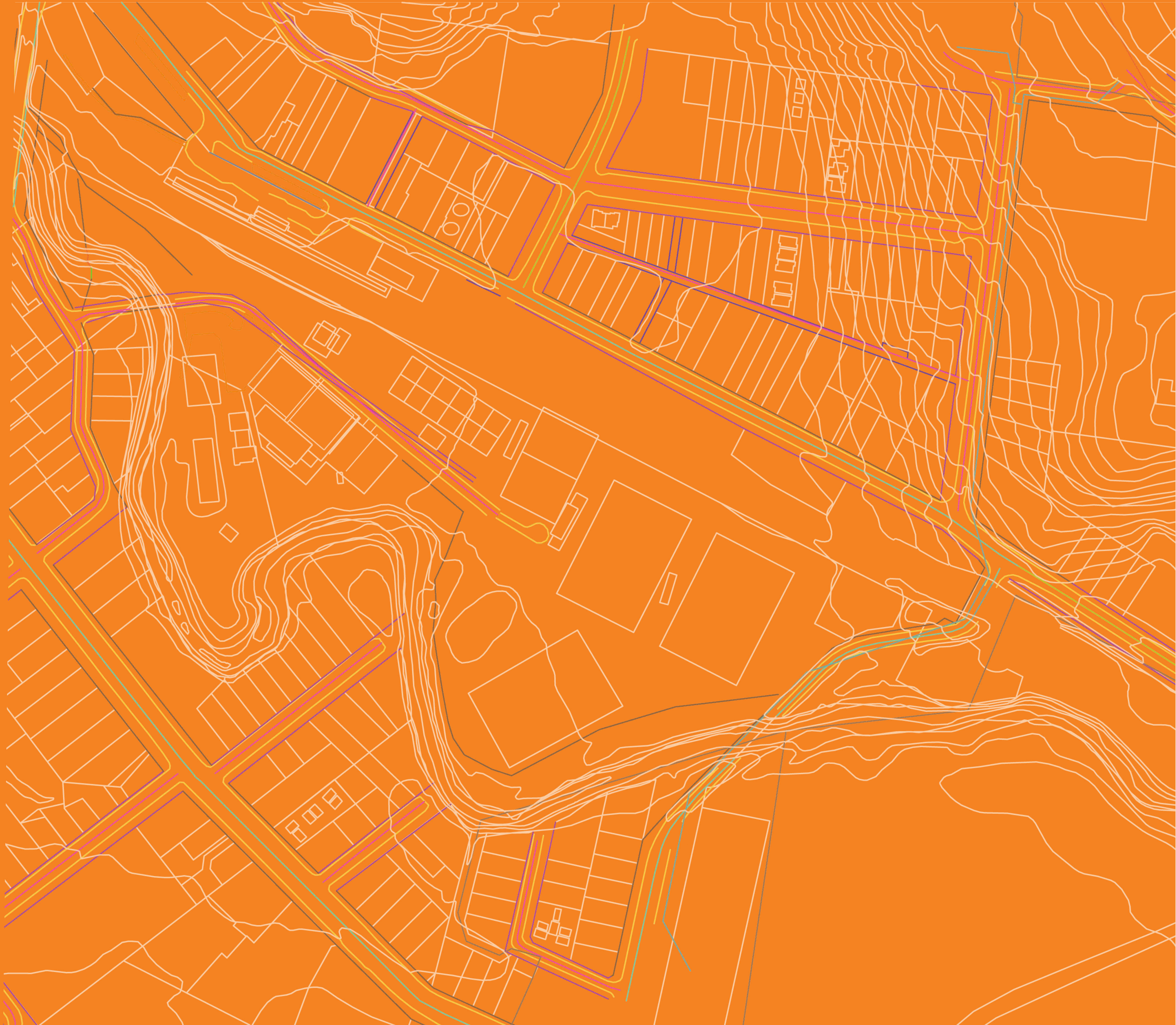
The Park's main facilities include the rugby league fields, grandstand, toilets, canteen, tennis courts, velodrome and the aquatic center.

It is interesting to note that little information on the history of Olympic Park appears to exist – with the exception that the Park Tennis Club was established in 1952.

Once the Park's revitalization is complete, commemoration by way of a public function and dedication will be assisted if Council is able to identify local people or community groups who might be able shed light on the origins of this very important local asset.

Figure X: (top) view of the mines, (middle) example of the historic architecture in Muswellbrook, (bottom) main street of Muswellbrook.

CHAPTER 3



ANALYSIS

Diagram showing study area.

3.1. INTRODUCTION

Analysis of the subject site was undertaken in May 2017. This analysis evolved during subsequent site visits and during engagement with the community and stakeholders.

Two types of analysis have been undertaken

- Use Analysis
- Site Analysis

3.2 USE ANALYSIS - INTRODUCTION

The Precinct could be described as a island. The rail line forms its northern edge, while Muscle Creek defines its southern boundary. The third boundary is Bell Street. This island effect - formed by two immovable boundaries, sets a limit on the scale of the precinct. This is an important consideration when preparing a Master Plan.

Within the island, are a collection of sport and community facilities. These facilities are not necessarily connected. It is likely these uses evolved within Olympic Park as the needs of the Muswellbrook community grew.

The facilities relevant to this Master Plan include:

- Rugby League and Touch football Precinct
- Tennis Facilities which include Olympic Park Tennis and Park Tennis Club Incorporated
- The Ron King Velodrome
- Girl Guides
- Performing Arts Building

Other facilities within the Precinct but which do not form part of this Master Plan include:

Muswellbrook Aquatic and Fitness Centre
This centre is located at the western end of the site, adjacent the Wilkinson Avenue entry to the site. This centre includes:
- 25 metre indoor heated pool
- 50 metre outdoor pool which is currently undergoing renovation
- Children's wading pool with shade cover
- Covered BBQ area
- Breakout cafe
- Change rooms and
- A gymnasium

The complex has already benefited from an upgrade which includes a new indoor pool, carpark upgrade, new security fence and landscaping.

The site is the subject of its own Masterplan.

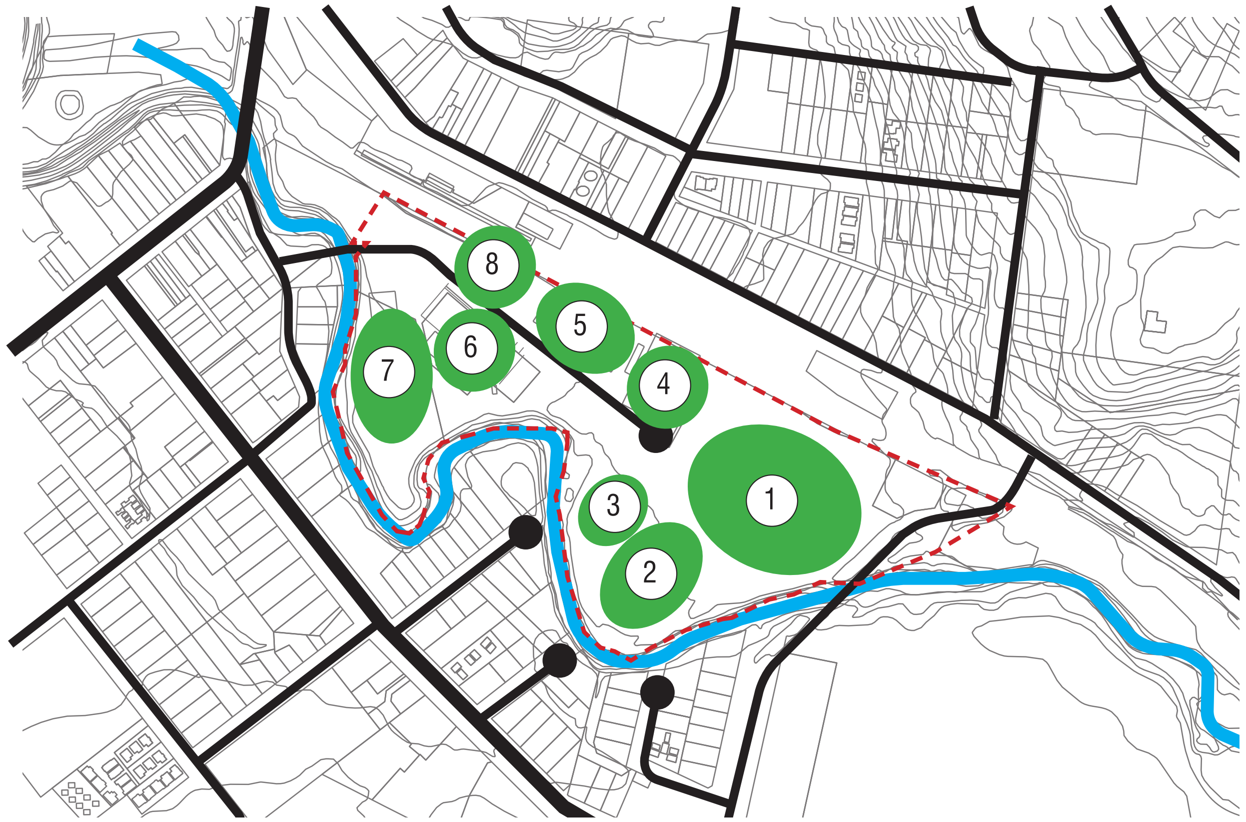
The Boronia Building - Bowling Green
The Boronia Building is located south of Wilkinson Avenue, within the centre of the Precinct. The facility comprises two bowling greens and a club house.

The Boronia Centre and bowling greens where they adjoin the Aquatic Centre carpark.

3.3 USE ANALYSIS

The following provides an analysis of the different uses at Olympic Park.

This information was used to identify Opportunities and Constraints (Section 3.4) and inform the Master Plan presented in Sections 4.



SITE USES & ACTIVITIES

The precinct includes a variety of sporting facilities ranging from football through to swimming.

Two of the facilities - the Boronia Centre and the Aquatic Centre are outside the scope of this project. However they have been identified as their functions/ activity will influence the outcomes of this master plan.

- - - Site Boundary

1. Rugby League/Cricket Fields and associated grandstand
2. Touch Football Fields
3. Velodrome
4. Olympic Park Tennis x 6 synthetic courts + Grandstand/Clubhouse
5. Park Tennis x 6 synthetic synthetic courts + Grandstand/Clubhouse
6. Boronia House Bowling Club x 2 greens
7. Muswellbrook Aquatic Centre and Fitness
8. Girl Guides and derelict Performing Arts Building

RUGBY LEAGUE / TOUCH FOOTBALL PRECINCT

This precinct comprises the eastern end of the site. It has a separate entry from Bell Street which does not connect with the rest of the site.

This precinct includes:

- 2 x Rugby League fields and one unmarked touch football field
- Grandstand which includes :
  -400 seats which are not accessible by wheel chair
  - Men's and women's public toilets and one accessible toilet
  - Change room x 2 and coaches room
  - Bar and kiosk
  - Storage room
  We note, there is no clubhouse, coaches box or referees room.
- There is a separate carpark off Bell Street
- Lighting for night games
- Cricket pitch located on the rugby league fields

KEY EVENTS

NRL Trial Knights v Sharks (26 February 2011) - capacity 4000 people

SITE OBSERVATIONS

- The existing grandstand is in need of an upgrade with regard to accessibility and visual amenity
- Additional change rooms are needed to accommodate women's and men's games overlapping
- Site drainage needs to be addressed
- Secure fence is proposed to lock the grounds after hours or when not in use. This will stop people crossing the fields

The existing Rugby league grandstand

TENNIS FACILITIES

OLYMPIC PARK TENNIS COURTS

- Olympic Courts comprising six (6) synthetic courts
- A single storey clubhouse building with a parents room, kitchen and canteen
- Small grandstand and covered BBQ area
- Lighting for night matches
- The courts are currently used tuesdays and thursdays and as required
- The courts are used for private hire, coaching and competitions

PARK TENNIS CLUB INCORPORATED

- Park Courts comprising six (6) synthetic courts (four (4) with lighting)
- A two storey building with a meeting rooms (available for hire), kitchen, children's play area and outdoor seating
- Small grandstand
- Competition days are held Tuesdays at 6:30pm from Octobers through to March/April

SITE OBSERVATIONS

- Structures associated with both tennis courts/clubs could benefit from an upgrade or replacement. In particular, the clubhouse associated with Park Tennis Club Inc does not enhance the character of Olympic Park
- There is no formal carparking. Cars park on the unformed surface adjacent the clubs
- There is signage associated with both clubs.

View of the tennis facilities looking east on Wilkinson Avenue.

RON KING VELODROME

The velodrome is managed by the Muswellbrook Cycle Club. It was constructed in the 1940's the velodrome is known as one of the smallest in the southern hemisphere. The velodrome is used on Friday evenings from October to March (daylight savings) for approximately 4 hours. The track is 166m for one lap

SITE OBSERVATIONS

- There are a number of structures associated with the velodrome. The first is an unroofed brick structure which has some anti social behaviour associated. The second is a shipping container
- There is a colourbond fence that encloses the site .However, there are currently gaps in the fence
- Upon visual inspection, the velodrome is in a poor state of repair
- There is no signage associated with the velodrome.

GIRL GUIDES, PERFORMING ARTS BUILDINGS AND THE VACANT LOT

There are three spaces which are not core facilities of the Precinct. These facilities include:

Girl Guides
This small weatherboard building is located at the western end of the precinct, between Wilkinson Avenue and the rail corridor. It is in use today.

Performing Arts Building
This building is due for demolition and not currently in use. The site is available for use in the Master Plan.

Vacant Lot
The vacant lot is located between Wilkinson Avenue and the rail corridor. It is currently used by Landcare for maintenance of the creek corridor. It is fenced to restrict access. This is a temporary use of the site.

SITE OBSERVATIONS

- All three buildings/sites are located on the same side of Wilkinson Avenue, in a line. This presents a consolidated site for a new use.

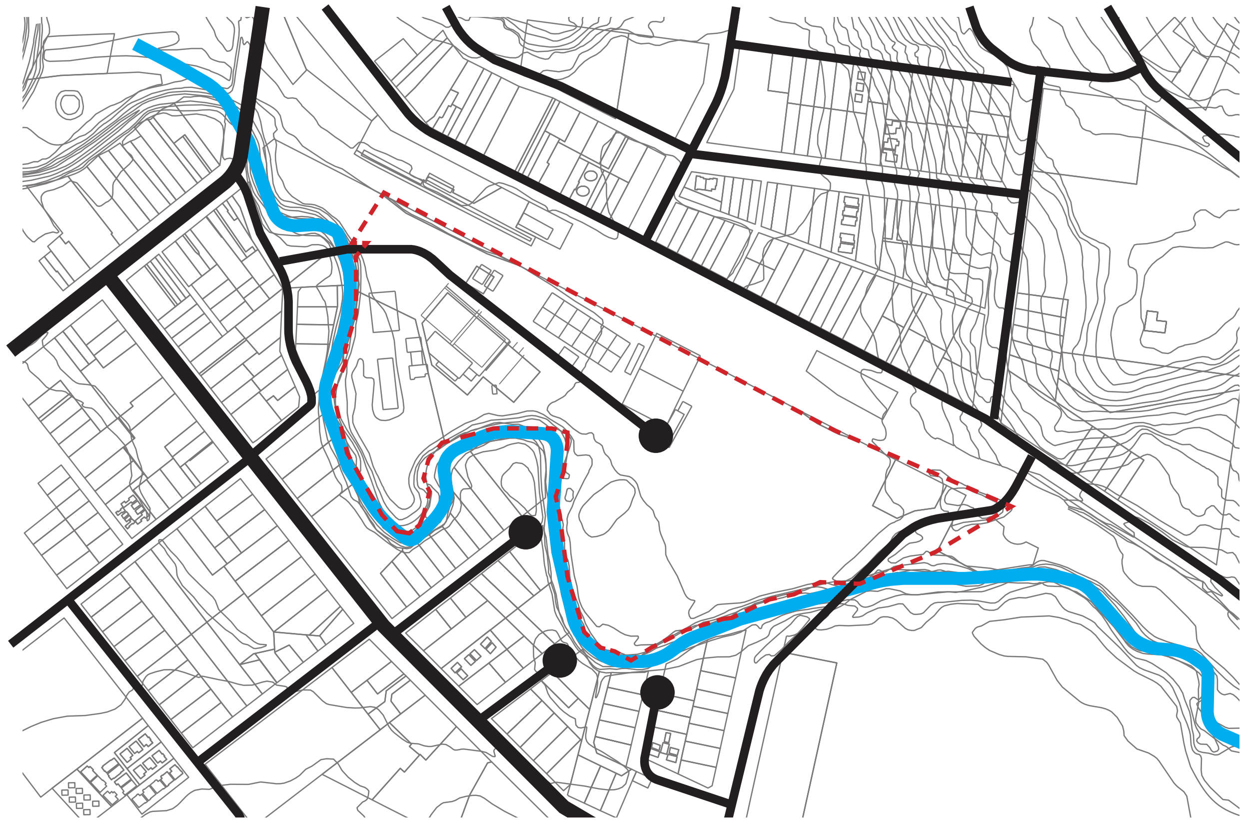
3.4 SITE ANALYSIS

Understanding the site and its context is an important part of creating a Master Plan. It provides a level of understanding necessary for the creation of new uses and spaces over the next 30 years.

The layers of the site analysed at Olympic Park included:

- Topography and Water
- Spatial Uses
- Vehicle Movement
- Pedestrian Movement

This information was used to identify Opportunities and Constraints (Section 3.4) and inform the Master Plan presented in Sections 4.



TOPOGRAPHY & WATER

The site is relatively flat before it falls away towards Muscle Creek which forms the southern boundary.

A pedestrian footpath follows the edge of the river from Bell Street. The footpath concludes within the centre of the site near the Velodrome.

The river is crossed by a bridge from Haydon Avenue. Any new access points into the site from the south will require bridge crossings.

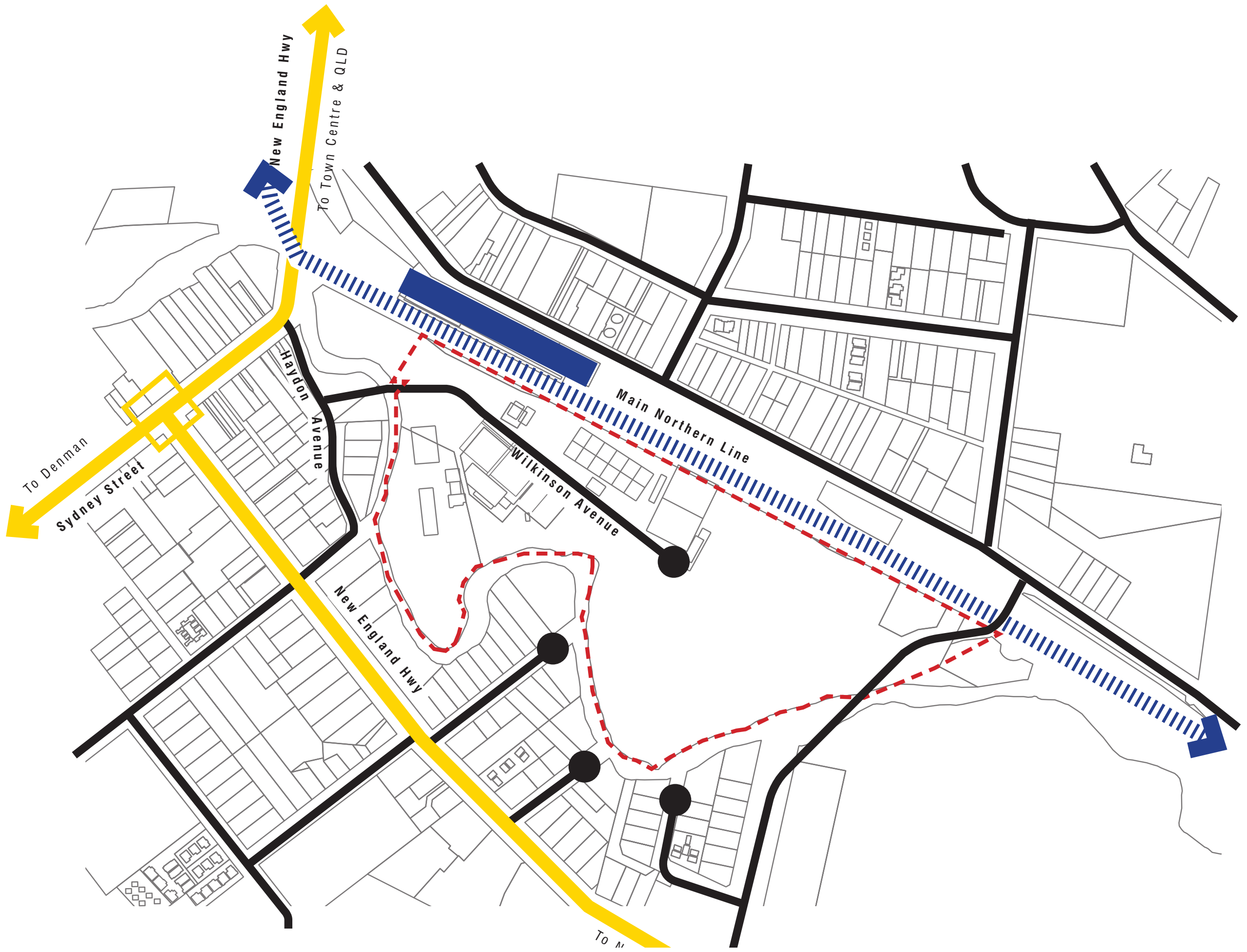
The northern boundary of the site is defined by the rail line and Market Street. From Market Street, the land rises up. These high areas look down on the site.

Site Boundary

Site Contours

Existing Street Network

Muscle Creek



VEHICULAR MOVEMENT

The site located between the New England Highway to the south and the Main Northern Rail Line to the north. There are two vehicular entry points to the site from Wilkinson Avenue and from Bell Street.

The primary entry is via Wilkinson Avenue - Wilkinson Avenue is accessed from Haydon Street, a local street which can be accessed from the New England Highway and Sydney Street.

Neither of Heydon Street's intersections with the New England Highway include traffic lights. Wilkinson Avenue is a cul-de-sac which terminates at the football fields/ grandstand.

The secondary entry is off Bell Street. This entry accesses an informal carpark which serves the football field. There is no access to the rest of the site from this carpark/entry. Waste services are from Wilkinson Avenue and are located adjacent the grandstand for the football fields.

- Site Boundary
- New England Highway
- Existing Street Network
- Cul-de-sacs
- Creek crossings - bridges
- Rail line
- Muswellbrook Station

PEDESTRIAN MOVEMENT

Within the Olympic Park site there few formal footpaths. The limited footpaths available are not continuous nor do they connect with the wider footpath network.

Beyond the site, there is a distinct pattern of footpaths along the New England Highway and Sydney Street. These footpaths connect with the Muswellbrook Town Centre.

There is also a formal footpath on Bell Street which forms into a pedestrian bridge where it crosses the rail line. This footpath provides connection between the Muswellbrook High School and Olympic Park. A pedestrian crossing links the school and the sports grounds. However, there is no formal footpath on the opposite side of the road - only an informal dirt path. Similarly, there is no formal footpath on Market Street until the pedestrian is closer to the train station.

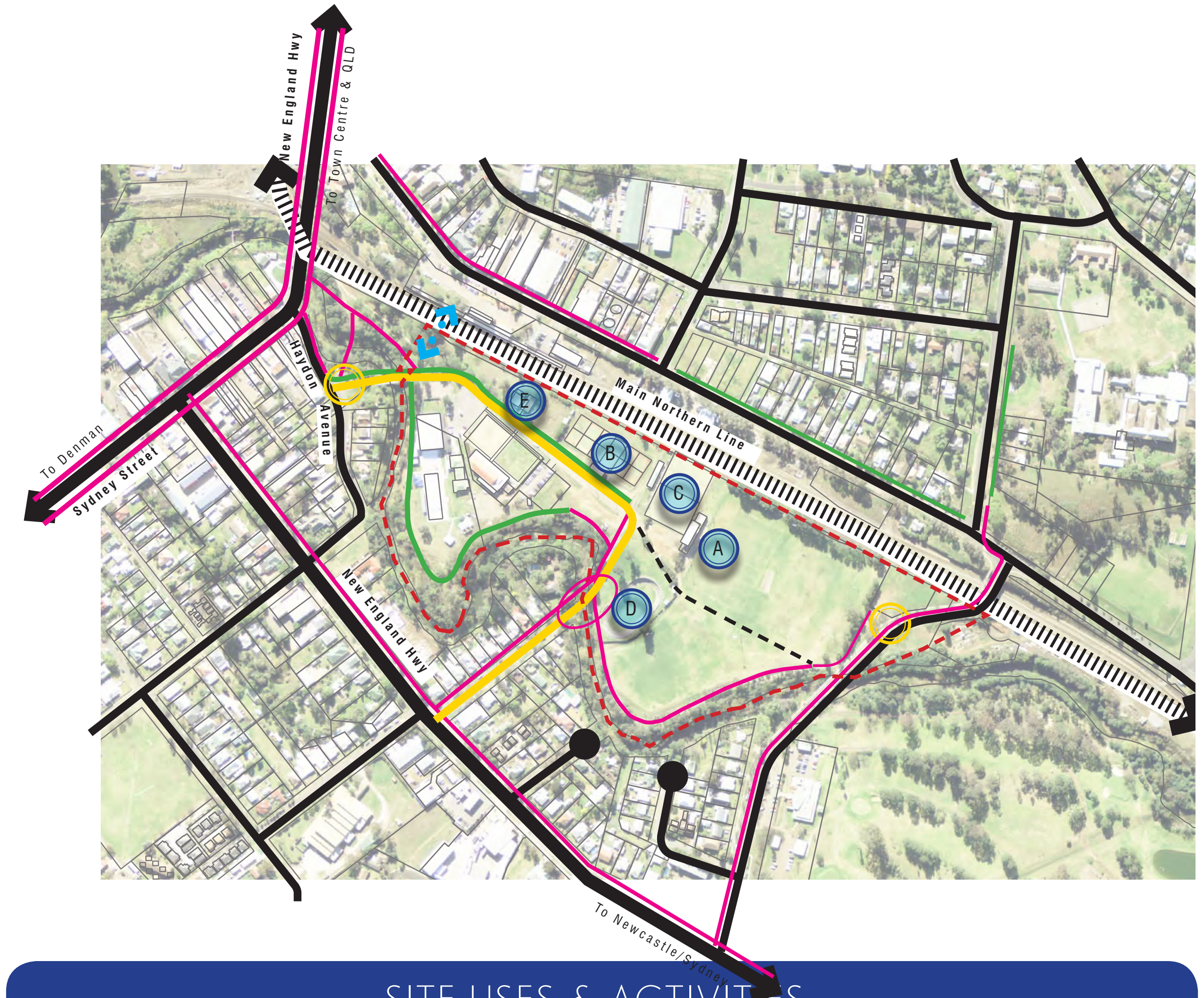
- Site Boundary
- Existing footpaths
- Existing Street Network
- Cul-de-sacs
- Creek crossings - bridges
- Signalised intersections

3.5 OPPORTUNITIES AND CONSTRAINTS FOR OLYMPIC PARK

The outcome of desktop analysis, on-site analysis and community engagement phases of the project, enable identification of opportunities and constraints.

The purpose of this type of analysis is to determine key issues and priorities which will create a framework for developing design options and solutions.

These findings also form the basis of the Structure Plan, Vision and Principles, Master Plan and Implementation Plan.

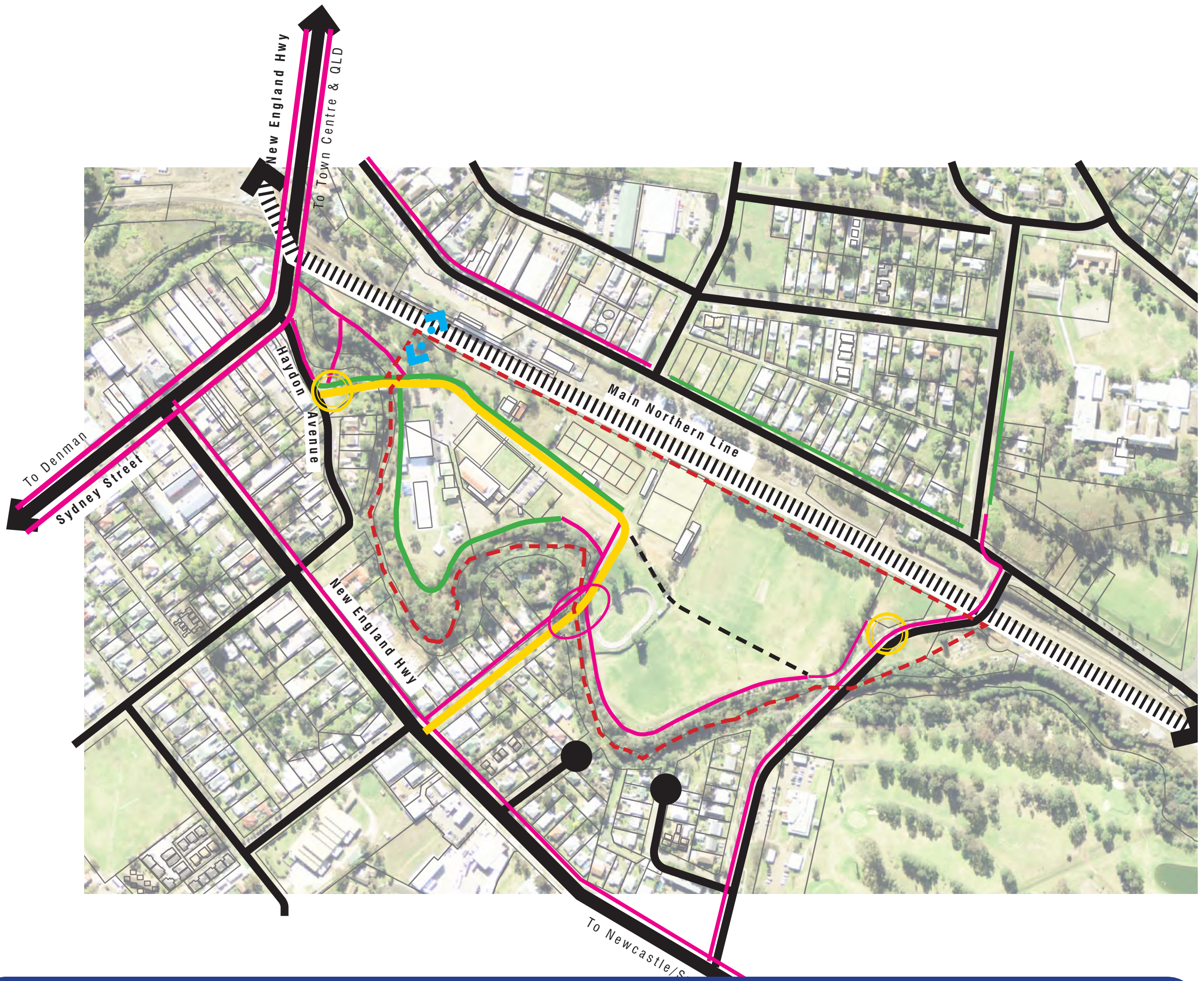


SITE USES & ACTIVITIES

Site Boundary

With the exception of the Muswellbrook Pool and Fitness complex (and Boronia Centre which is outside this scope of work), the majority of buildings are either tired or dilapidated and are in need of renovation or replacement. This does not include any new uses proposed for the precinct.
The following identifies opportunities for each use:

- A Football/Cricket ground: Grandstand is in need of renovation for compliance, functionality and aesthetic reasons. In addition, other buildings are required to provide a well rounded facility (see schedule for recommendations)
- B Replacement of the clubhouse, grandstand and BBQ facilities for Park Tennis
- C Replacement of the clubhouse, grandstand and BBQ facilities for Olympic Park Tennis
- D Upgrade of the Velodrome infrastructure
- E Demolition of the Girl Guides/Performance building



MOVEMENT

There is an opportunity to improve access to the site from the wider area.

This includes:

- Providing an additional vehicular access across Muscle Creek, turning Wilkinson Avenue into a through road. This will require the construction of a new bridge. A pedestrian footpath would be integrated into the bridge
- Providing a shared path connecting Wilkinson Avenue to the Bell Street entry. This path would be wide enough to accommodate service vehicles during events. It would not be open to ordinary vehicles
- Increasing the quality and quantity of carparking by formalising existing spaces
- Provide improved waste management services on site.
- Consider opportunities for a new pedestrian overhead bridge to cross the rail line.
- Enhance the existing entries to the precinct to assist with wayfinding.
- Link external and internal paths to create a pedestrian

Site Boundary

Enhanced gateway experience

New internal Road connecting Wilkinson Ave and Wilder Street

New Bridge over Muscle Creek

Existing Pedestrian Footpaths

New Pedestrian Footpaths to link into the existing network

Potential overhead pedestrian bridge location

VISUAL ENHANCEMENT

The precinct is tired and lacks visual cohesiveness.

The following opportunities exist for this site:

- Upgrade the existing grandstand with new cladding, sun protection and signage. Integrate proposed facade embellishments with new structures for the football/ cricket grounds
- Provide street trees along Wilkinson Avenue to reinforce
- Its role as the main street of the Olympic Park Precinct
- Provide landscape and entry signage treatment at the
- Wilkinson Avenue/Haydon Street entry. Similarly, provide a landscape and entry signage treatment at the Bell Street entry
- Provide a themed wayfinding suite of signage for the Olympic Park precinct. This signage suite would include signs for each activity and associated buildings, directional signage to these activities, directional signage to parking areas, directional signage to the footpaths, heritage interpretive signs which explain the history of the site
- Tie the precinct's, material palette together by using the Muswellbrook Town Centre's Materials and Finishes.

Site Boundary

Enhanced gateway experience

New internal Road connecting Wilkinson Ave and Wilder Street

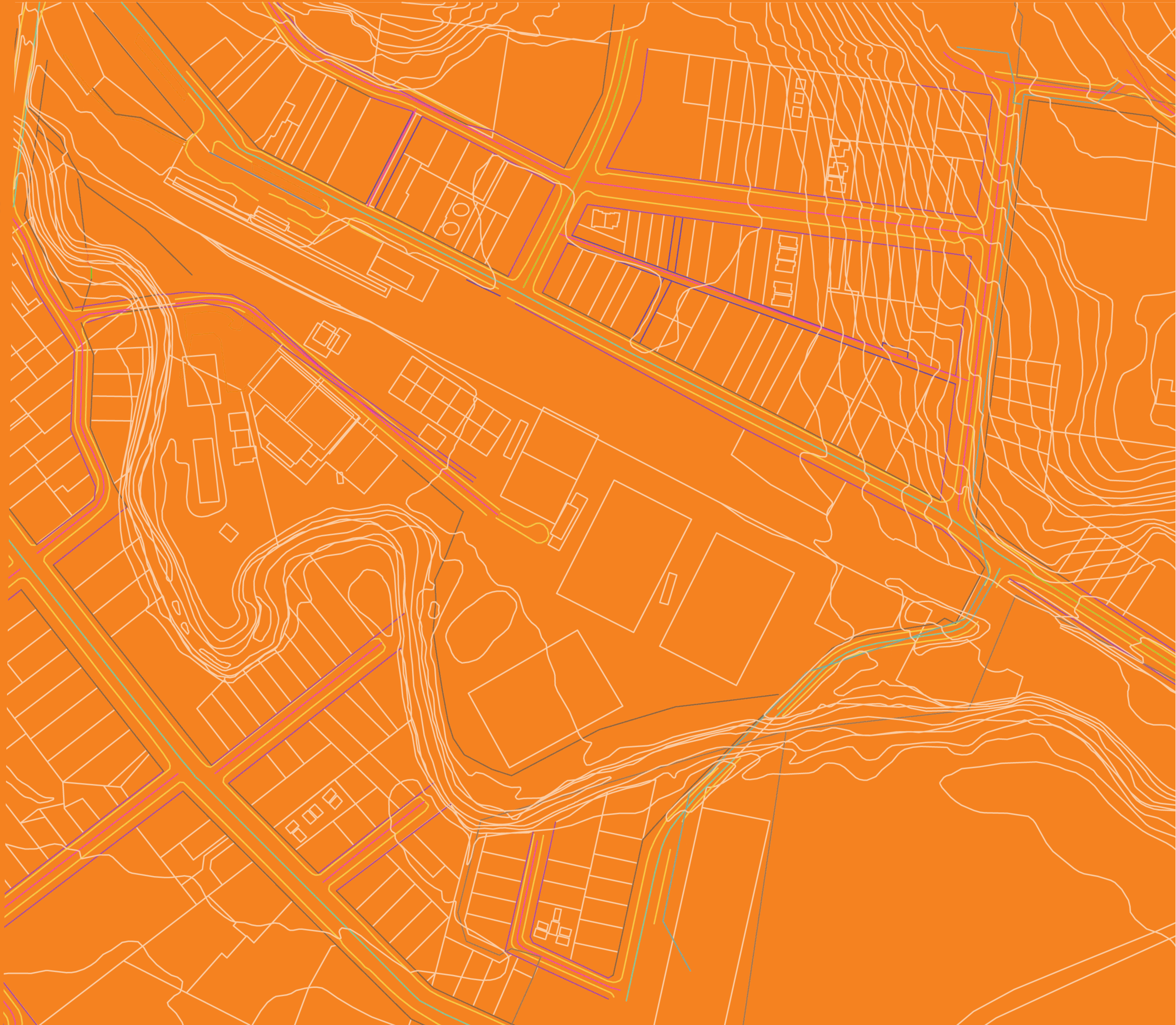
High level wayfinding opportunities

Existing Pedestrian Footpaths

New Pedestrian Footpaths to link into the existing network

Wilkinson Avenue as Main street' landscape enhancement

CHAPTER 4



MASTER PLAN: THE FRAMEWORK FOR OLYMPIC PARK

4.1 INTRODUCTION

As this Master Plan is a strategic document, one of its key functions is to explain Council's vision and objectives for Olympic Park. As design requirements and technology may change over time, its important that this document clearly explains the Master Plan's intent. This allows the future Council and its design team to deliver Olympic Park in line with the project objectives. This is why the imagery and designs presented in this document is indicative. This document presents a possibility.

To understand the intent, the Master Plan is presented in three parts.

- The Vision
- The Objectives and
- The Structure Plan

These layers present the intent without the distraction of stylistic approaches which may change over time. This framework is the product of the research, analysis, and engagement process undertaken for this project. It is possible to connect the outcomes of this report to each of the three sources listed above.

Section 5 identifies the method to deliver this framework as a series of projects.

VISION FOR OLYMPIC PARK

Olympic Park will become Muswellbrook's regional sporting precinct which provides people of all ages and abilities the opportunity to participate in community sport and independent exercise.

The Precinct will be safe, accessible and inclusive.

URBAN DESIGN PRINCIPLES FOR THE REVITALISATION OF OLYMPIC PARK

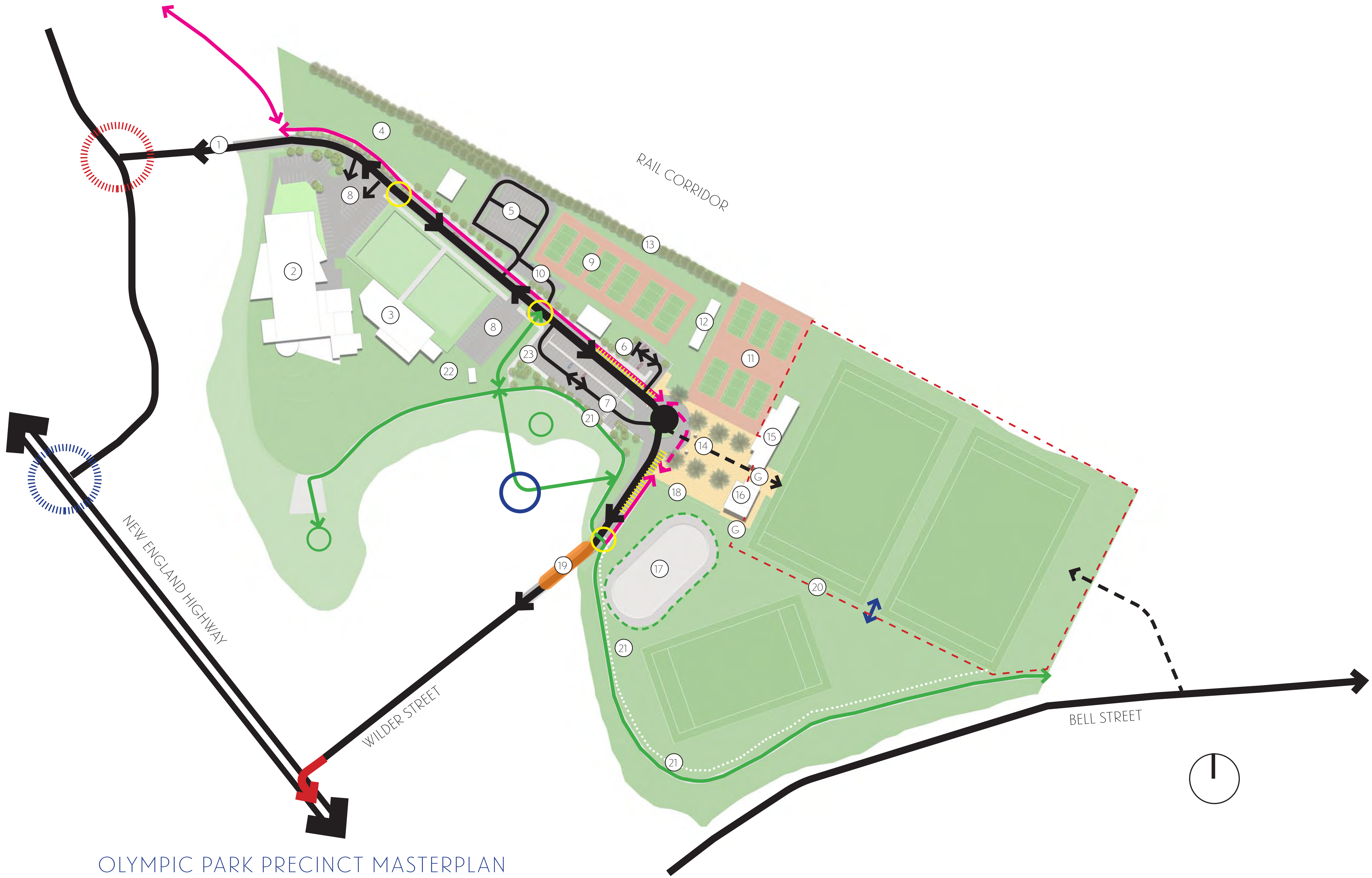
1 Establish Olympic Park as a regional level facility

2 Increase the safety of the users of Olympic Park

3 Modernise the Precinct

4 Improve connections between Olympic Park and the town centre

5 Seek opportunities to collaborate with local groups overtime



OLYMPIC PARK PRECINCT MASTERPLAN

STAGE 1 STRUCTURE PLAN

The first stage undertakes the primary structural changes to Olympic Park including:

General Precinct Upgrades

- Upgrade of Wilkinson Avenue
- Construction of a new bridge over Muscle Creek which provides a new egress from the precinct
- Carparking areas which provide a total of 100 spaces. This includes an allowance for future carparking expansions in Stage 2
- Relocation of the heritage gates to the football precinct forecourt at the eastern end of Wilkinson Avenue
- Intelligent lighting along Wiklinson Avenue and within each precinct. Intelligent lighting – where sensors and timers allow lighting fixtures to function at different times of the day and under varying atmospheric conditions. Lighting intensity will also vary automatically according to a range of factors and requirements
- Street trees and landscaping along Wiklinson Avenue
- Integrate outcomes of the Riparian Corridor Masterplan such as the Riparian Walk and seating/lookout areas
- Integrate outcomes of the Muswellbrook Aquatic Centre Masterplan
- New forecourt for the Rugby League Precinct

Rugby League Precinct

- Field improvement and drainage to Fields 1 and 2
- Irrigation and upgrades to Field 3. Field 3 to be used for touch football and training. Field 3 proposed as a public kick about space
- 1800mm high palisade fence to enclose Fields 1 and 2. The Palisade fence to be black to allow for visual permeability
- New Amenities Building including
  - 2 x change rooms
  - storage for velodrome
  - lift/stair access to multi-function room above

Ron King Velodrome

- New intelligent lighting to allow for night training and competition
- New fencing to secure the track
- Removal of storage facility and derelict brick structure.
- New storage area for the Velodrome to be incorporated into the new amenities building located within the Rugby League Precinct.

LEGEND

WILKINSON AVENUE - TWO WAY ROAD

ONE WAY BRIDGE LINKS WILKINSON AVENUE TO WILDER STREET

CARPARK AISLES INC. DIRECTION

SHARED PATH

RIPARIAN WALK

LEFT OUT ONLY FROM WILDER STREET

VEHICULAR ACCESS TO FIELD 1 & 2

PALISADE FENCING

PEDESTRIAN CROSSING POINTS

LINKS TO POTENTIAL LOOKOUT WITH SEATING (PART OF RIPARIAN MASTER PLAN)

SEATING LOCATIONS

INTERSECTION IS WIDENED AND UPGRADED TO ACCOMMODATE BUSES

INTERSECTION TO BE SIGNALISED BY RMS

LINK BETWEEN FIELDS WITH SLIDING SLIDING GATE

BUS DROP OFF ONLY (NO PARKING)

The Muswellbrook Urban Riparian area and Muswellbrook Aquatic Centre have separate design master plans that are scheduled for public exhibition in 2018.

1 EXISTING BRIDGE OVER MUSCLE CREEK

2 EXISTING POOL COMPLEX*

3 EXISTING BOWLING FACILITY

4 RETAIN EXISTING OPEN SPACE

5 NEW CARPARK B1 - 44 SPACES

6 NEW CARPARK C1 & C2 - 6A 5 SPACES & 6B - 6 SPACES

7 NEW CARPARK D - 45 SPACES

8 EXISTING CARPARK

9 PARK TENNIS (6 COURTS)

10 EXISTING CLUB HOUSE

11 OLYMPIC TENNIS (6 COURTS)

12 EXISTING CLUB HOUSE

13 LANDSCAPED BUFFER

14 NEW FORECOURT

15 EXISTING GRANDSTAND

16 NEW AMENITIES BUILDING INC.
- 2 X CHANGE ROOMS
- STORAGE FOR VELODROME
- LIFT/STAIR ACCESS TO MULTI FUNCTION ROOM ABOVE

17 EXISTING VELODROME WITH NEW FENCE

18 BATTER SEATING FOR VELODROME

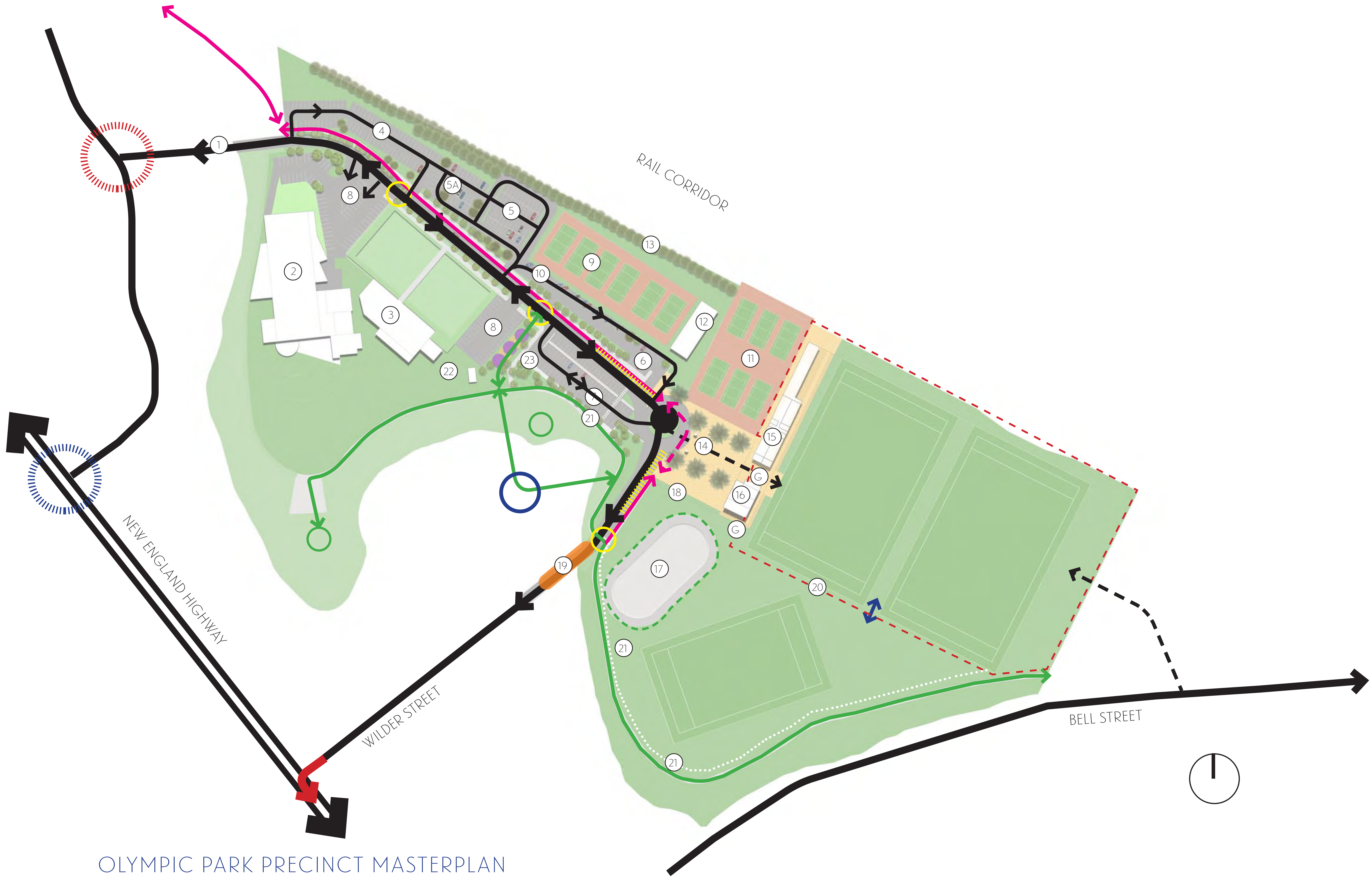
19 NEW ONE WAY BRIDGE OVER MUSCLE CREEK

20 NEW PALISADE FENCE AROUND FIELD 1 AND 2 (RED DASH)

21 NEW BOLLARD AND CHAIN FENCE (WHITE DOTS)

22 SUSTAINABILITY HUB

G GATE



OLYMPIC PARK PRECINCT MASTERPLAN

STAGE 2 STRUCTURE PLAN

The second stage completes the revitalisation of Olympic Park including:

General Precinct Upgrades

- Provision of two new parking areas and the completion of the tennis facility parking areas. This provides an additional 116 parking spaces. This creates a total of 216 spaces. This does not include existing parking for the pool and bowling club facilities
- Installation of an all ages fitness playground

Rugby League Precinct

- New Grandstand
  - 1000 seats
  - 2 x change rooms and associated facilities
  - storage
  - Public amenities
  - Kiosk and Bar
  - Administration and ticket office

Tennis Precinct

- Demolition of existing tennis clubs houses and replaced with single clubhouse that can service two clubs
- Completion of the tennis carpark

LEGEND

WILKINSON AVENUE - TWO WAY ROAD

ONE WAY BRIDGE LINKS WILKINSON AVENUE TO WILDER STREET

CARPARK AISLES INC. DIRECTION

SHARED PATH

RIPARIAN WALK

LEFT OUT ONLY FROM WILDER STREET

VEHICULAR ACCESS TO FIELD 1 & 2

PALISADE FENCING

PEDESTRIAN CROSSING POINTS

LINKS TO POTENTIAL LOOKOUT WITH SEATING (PART OF RIPARIAN MASTER PLAN)

SEATING LOCATIONS

INTERSECTION IS WIDENED AND UPGRADED TO ACCOMMODATE BUSES

INTERSECTION TO BE SIGNALISED BY RMS

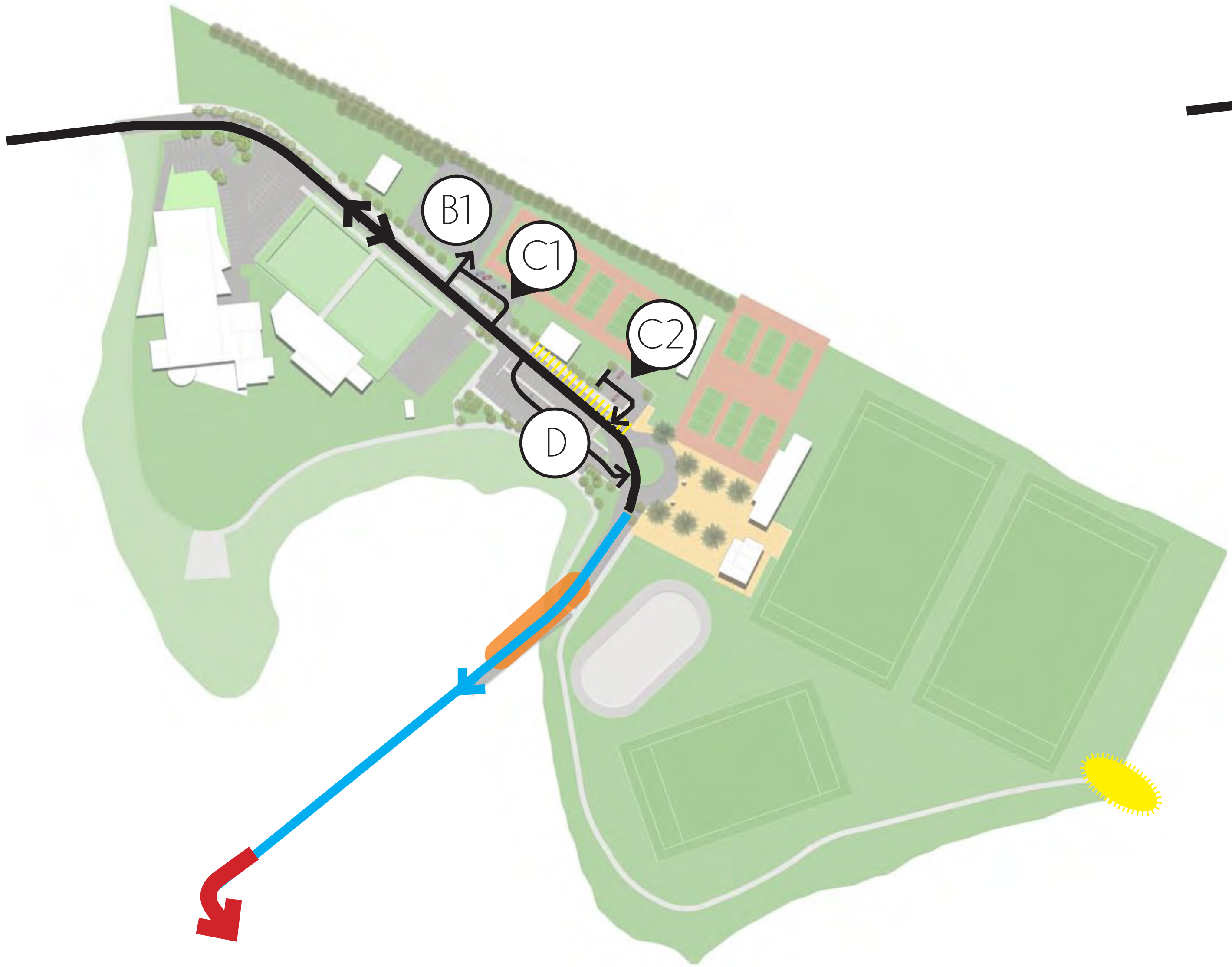
LINK BETWEEN FIELDS WITH SLIDING GATE

BUS DROP OFF ONLY (NO PARKING)

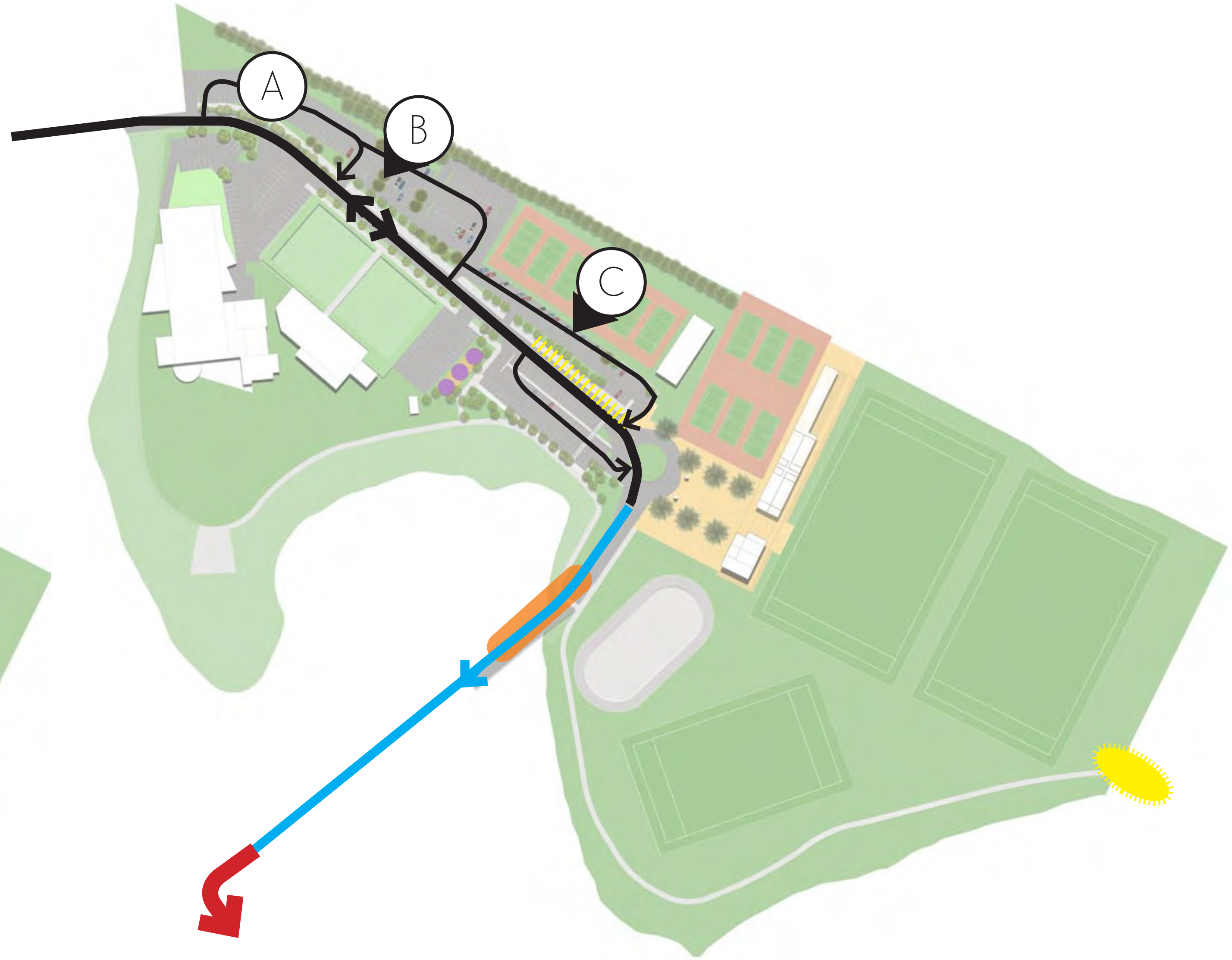
The Muswellbrook Urban Riparian area and Muswellbrook Aquatic Centre have separate design master plans that are scheduled for public exhibition in 2018.

1 EXISTING BRIDGE OVER MUSCLE CREEK
2 EXISTING POOL COMPLEX*
3 EXISTING BOWLING FACILITY
4 NEW CARPARK A - 76 SPACES
5 NEW CARPARK B - 44 SPACES
5A NEW CARPARK B EXTENSION - 25 SPACES
6 NEW CARPARK C - 29 SPACES (AMALGAMATION OF C1 & C2)
7 NEW CARPARK D - 45 SPACES
8 EXISTING CARPARK(S)
9 PARK TENNIS (6 COURTS)
10 DEMOLITION OF TENNIS CLUB HOUSE
11 OLYMPIC PARK TENNIS (6 COURTS)
12 DEMOLITION OF CLUB HOUSE. REPLACE WITH NEW
13 LANDSCAPED BUFFER
14 NEW FORECOURT
15 NEW 1000 SEAT GRANDSTAND
16 NEW AMENITIES BUILDING INC.
- 2 X CHANGE ROOMS
- STORAGE FOR VELODROME
- LIFT/STAIR ACCESS TO MULTI FUNCTION ROOM ABOVE

17 EXISTING VELODROME WITH NEW FENCE
18 BATTER SEATING FOR VELODROME
19 NEW ONE WAY BRIDGE OVER MUSCLE CREEK
20 NEW PALISADE FENCE AROUND FIELD 1 AND 2 (RED DASH)
21 NEW BOLLARD AND CHAIN FENCE (WHITE DOTS)
22 SUSTAINABILITY HUB
G GATE



STAGE 1 PARKING AND MOVEMENT



STAGE 2 PARKING AND MOVEMENT

WILKINSON AVENUE - TWO WAY ROAD

CARPARK AISLES

WILKINSON AVENUE/WILDER STREET - ONE WAY ROAD

ONE WAY BRIDGE LINKS WILKINSON AVENUE TO WILDER STREET

BELL STREET UNDERPASS

The changes to Olympic Park result in changes to the parking and traffic movements through the park. The following documents those changes.

Ingress and Egress to Olympic Park

The entry to Olympic Park is to remain at the intersection of Haydon Street and Wilkinson Avenue. It is recommended that this intersection be upgraded to improve access for buses and the general public.

It is noted, that the intersection of the New England Highway and Haydon Street is to be signalised by RMS. This will improve movements in and out of the Precinct.

An upgrade of Wilkinson Avenue is proposed which includes new kerb and guttering, pavement, shared path, intelligent lighting and street trees. Wilkinson Avenue will remain two way up to the new Rugby League forecourt. No on street parallel parking is proposed on Wilkinson Avenue

The Master Plan proposes a new egress point from the precinct via Wilder Street. This egress requires the construction of a new bridge over Muscle Creek. The new bridge is proposed as one way, to limit impact on existing residential dwellings on Wilder Street. The exit from Wilder Street onto the New England Highway is proposed as left out only.

It is envisaged that Wilder Street will be used by vehicles heading south out of Muswellbrook or using Bell Street to access the town centre. Buses will use Wilder Avenue to eliminate the need for buses to leave via Haydon Street, which would have required a minimum 25 metre turning circle to undertake a U turn.

The existing Bell Street unformed area (currently used as informal carpark) is proposed to be retired. This is due to unsafe conditions accessing this space from Bell Street. This access point may continue to be used by emergency vehicles

Rugby League Fields
Emergency and maintenance vehicle access, to Fields 1 and 2, is proposed via three access points.

The main access is from Wilkinson Avenue, through the forecourt. The second is between Field 1 and 2 and Field 3 and Kick about space. The third is from Bell Street. All access points are gates within the new palisade fence. The gate structure will need to be wide enough to accommodate an emergency vehicle such as a fire engine.

Shared Path
A shared path, for pedestrians and cyclists, is proposed along the Muscle Creek Riparian Corridor and along Wilkinson Avenue. The path is proposed as a 2.5 metre wide concrete path and should connect to the existing footpath network at the junction of Haydon Street and Wilkinson Avenue and the Bell Street underpass. Clear wayfinding signage should be provided along the path to assist with navigation within the Precinct and out of the precinct.

Servicing and Maintenance
Waste management facilities will need to be accommodated on site. Design of the forecourt will need to consider how a garbage truck manoeuvres between landscaping elements to pick up waste from the grandstand (both Stage 1 and Stage 2). This will include consideration of the spacing of the heritage gates.

Vehicular access for maintenance of the riparian corridor should be accommodated. The minimum width of the shared path should be 3 metres to allow for a maintenance vehicle. Operable bollards at road junctions should be provided to prevent unauthorised vehicles from travelling along the shared path. Speed limits should be applied to the path for maintenance vehicles as they may come in contact with pedestrians and cyclists.

Bus Parking
Two locations are proposed for bus parking. The first is on the northern side of Wilkinson Avenue opposite Park Tennis. The second is on the eastern side of Wilkinson Avenue opposite the Velodrome.

Together, these locations provide space for approximately 5 buses.

Egress of the buses will be via Wilder Street and left out onto the New England Highway.

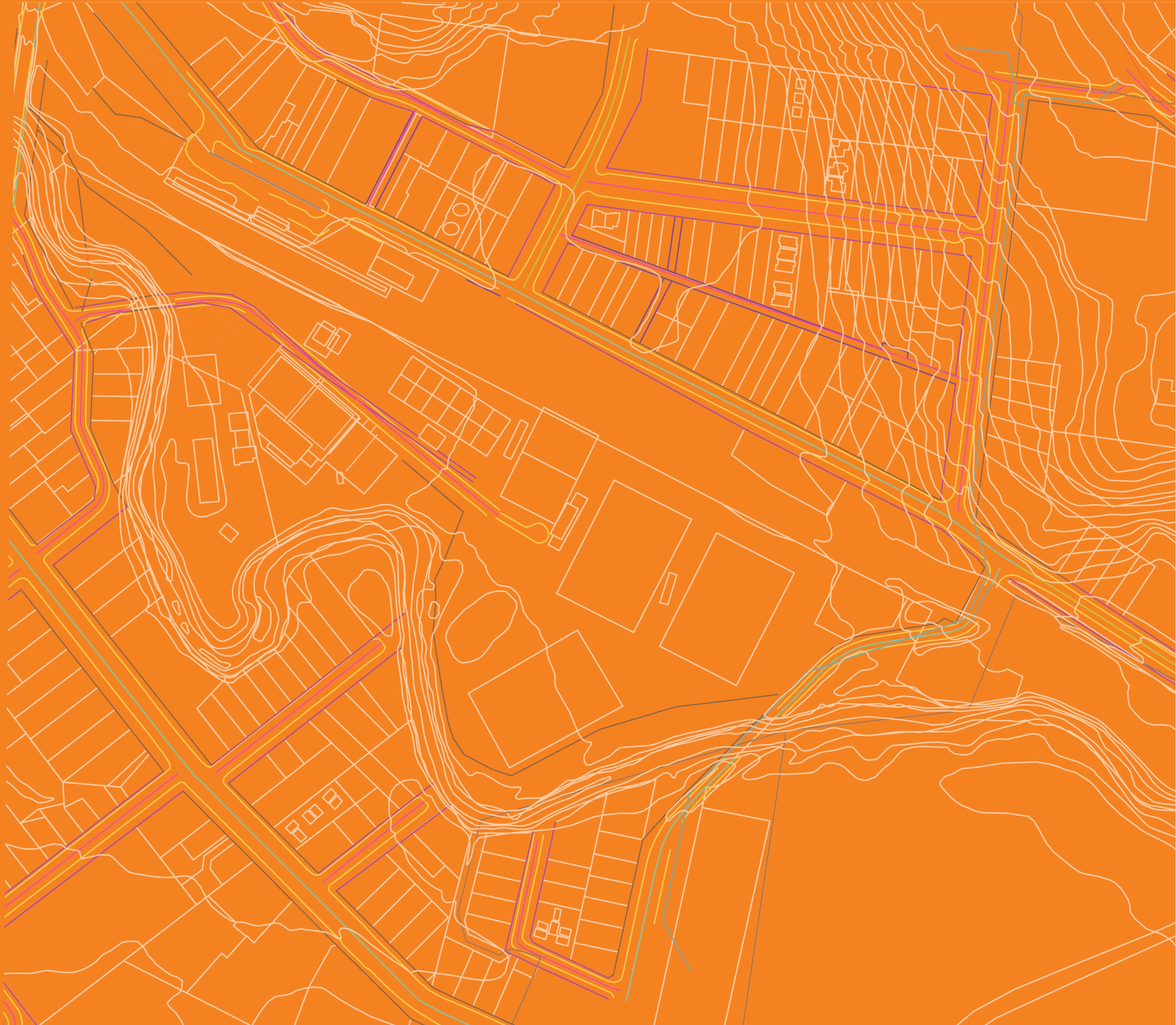
STAGE 1 PARKING SCHEDULE

Carpark No.	No. of spaces	Area serviced	Notes
B1	44	Tennis courts Pool Complex Boronia Centre Girl Guides	This carpark will be linked to Carpark A and B1 in Stage 2
C (C1 & C2)	20	Tennis Courts	These carparks will be linked to form a single one way carpark in Stage 2. The carparks will remain separated until the Park Tennis clubhouse is amalgamated.
D	69	Tennis Courts Rugby League Velodrome Riparian Walk Kick about	
Total	133		

STAGE 2 PARKING SCHEDULE

Carpark No.	No. of spaces	Area serviced	Notes
A	76	Pool Complex Boronia Centre Girl Guides Overflow	This carpark connects to Carpark B1
B	25	Pool Complex Boronia Centre Girl Guides Tennis Courts Overflow	This carpark links B and B1
C	29	Tennis Courts	This carpark connects C1 & C2 together from Stage 1
Stage 1 Parking	113		B1 + D
Total	243		

CHAPTER 5



MASTER PLAN: IMPLEMENTATION

5.1 INTRODUCTION

The revitalisation of Olympic Park is a significant project and will require careful planning, design and management in its delivery. Funding and grants form an important part of that process.

This Master Plan provides the basis for the delivery of projects within the precinct and information for grant applications.

The Implementation Plan assists Council, stakeholders and the community to deliver the Structure Plan proposed in Section 4. This plan is a guide and the staging of each project can be varied to suit as funding and opportunities arise.

5.2 STAGING

5.2.1 Staging
The Master Plan is presented in two stages. Within each stage are a series of projects. Breaking the Master Plan into smaller projects will assist with the delivery of the Master Plan.

The Staging is defined as follows:

Stage 1
Stage 1 projects are generally catalyst projects which enables Stage 2 projects to be undertaken.

Stage 1 includes important infrastructure items such as the Wilkinson Avenue upgrade and the formation of the new bridge. This infrastructure will create a clear and organised urban framework.

Timeframe: 1 - 10 years.

Stage 2
Stage 2 comprises longer term projects. These projects may have greater costs and need access to particular grants or partnerships. These projects may also require amalgamations to be undertaken first.

A Stage 2 project may be brought forward to Stage 1 if the circumstances allow.

Timeframe: 5 - 20 years

5.2.2 Priorities
Within each stage, priorities have been identified. Three priority levels have been nominated.

The priorities are defined as follows:

Priority 1
- A project that is required to be completed prior to a Priority 2 or 3 project
- A project that is necessary to the proper functioning of the Precinct
- A project that is needed immediately by stakeholders or the community.

Priority 2
- A project that supports a Priority 1 project and assists in its function and /or
- A project that is not essential to the Precinct but is desirable.

Priority 3
- A project that is not necessary for the proper function of the Precinct and/or
- A project that may be difficult to fund and/or
- A project that is reliant on infrastructure that is not currently available.

5.3 PROJECT DATA SHEETS

As Olympic Park is developed, it is proposed that Council will call on these data sheets. The data sheets will assist Council in the development of consultant briefs, the allocation of suitable funds, engaging consultants, fabricators and artists. The data sheets will also inform the detailed design of its public spaces.

It will be critical for Council to brief designers, engineers and artists who have the ability and the creativity to design the next evolution of Olympic Park.

The data sheets include the following information about each project within Olympic Park:

- Project Intent
- Location
- Project Stage
- Project Budget
- Considerations
- Funding
- Potential Partners/Collaborators

Refer to the Stage 1 Master Plan (page 28) and Stage 2 Master Plan (page 44) for the location of each of the projects identified on the following pages.

B
K
C
F
A
D
D
E
G
H
J
I

STAGE 1 OLYMPIC PARK

PROJECT INTENT	The revitalisation of Olympic Park is proposed in two stages. The first stage will improve the functionality and visual appeal of the precinct. The key features will include: • New road structure including a new bridge over Muscle Creek • Improved parking conditions • Upgraded Rugby League precinct • Enhanced experience of the riparian corridor • Landscaping and streetscape upgrade • Improvements to the Velodrome To aid the delivery of Stage 1, 11 projects have been identified. Breaking this stage into a series of sub projects enables Council to seek a range of grants and deliver the precinct in a coordinated manner. The sub projects also assist Council in priortising the projects based on the communities current needs. The 11 projects are identified as follows: 1. Wilkinson Avenue Upgrade (Project S1_A) 2. Welcome to Olympic Park (Project S1_B) 3. Carpark B (Project S1_C) 4. Carpark C (Project S1_D) 5. Carpark D (Project S1_E) 6. Buffer landscape (Project S1_F) 7. Forecourt (Project S1_G) 8. Amenities Building (Project S1_H) 9. Velodrome (Project S1_I) 10. Field upgrades (Project S1_J) 11. Intelligent Lighting (Project S1_K) The order of these projects to be determined by Council based on the appropriate procurement methodology and funding opportunities.
PROJECT STAGE	1
BUDGET	$6.91 million (refer to Projects A - K for breakdown)
DESIGN CONSIDERATIONS	• Refer to specific projects for details.

FUNDING	• Regional Growth Fund • Regional Growth – Environment and Tourism Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF) – Community Investments Stream • Infrastructure Grants Liquor and Gaming - Sport and Recreation • The Regional Cultural Fund - Arts and Culture Grant	
POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• Land care • Tourism Board • Youth Groups • Muswellbrook Schools	• Assets • Landscape Maintenance

Imagery to guide the revitalisation of Stage 1
(left): Landscaping, paving treatments and street furniture create an attractive streetscape - Lonsdale Street upgrade in Dandenong
(right): Unique furniture and paving patterns give public spaces an identity - Town Hall Square in Solingen.

STAGE 1 _ PROJECT A WILKINSON AVENUE UPGRADE

PROJECT INTENT	Olympic Park's main street, Wilkinson Avenue, will be upgraded to provide a central landscaped axis. Wilkinson Avenue commences at Haydon Street as a two way street with driveways providing access to each of the proposed carparks. To provide a additional egress from the Precinct a new one way bridge is proposed over Muscle Creek. This bridge will connect Wilkinson Avenue with Wilder Street. Wilder Street is proposed to be left out only onto the New England Highway. The design of Wilkinson Avenue is proposed as a pedestrian priority space with a limited speed limit. The new street is proposed to be landscaped with street trees. A 2.5 metre wide shared path will be provided along the northern edge of Wilkinson Avenue connecting Bell Street, Wilder Street, the Riparian Walk and the town centre. Project A will need to integrate with other Stage 1 projects including: • Welcome to Olympic Park (Project S1_A) pg 32 • Carpark B (Project S1_C) pg 33 • Carpark C1 & C2 (Project S1_D) pg 34 • Carpark D (Project S1_E) pg 35 • Forecourt (Project S1_H) pg 37
LOCATION	Wilkinson Avenue and Wilder Avenue
PROJECT STAGE	Stage 1 Priority 1
BUDGET	Bridge $2 million Road upgrade $700,000 Total Budget for Project A - $2.7 million
DESIGN CONSIDERATIONS	• Design the road as a pedestrian priority zone with the intent to slow traffic within the precinct. • Consider integrating interpretive artwork or text into the proposed footpath pavement • Design the landscaping to ensure good sight lines into carparks, footpaths and open spaces to meet CPTED requirements • Consider opportunities to integrate into the Muswellbrook Heritage Walk
FUNDING	• Regional Growth Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF) • Infrastructure Grants Liquor and Gaming - Sport and Recreation • The Regional Cultural Fund - Arts and Culture Grant

POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• Muswellbrook Cycle Club • Muswellbrook Shire Local and Family History Society Inc • Muswellbrook Regional Art Centre • Local walking groups	• Traffic/Engineering • Assets • Landscape Maintenance

(above): Landscaping, paving treatments and street furniture create an attractive streetscape - Lonsdale Street upgrade in Dandenong.

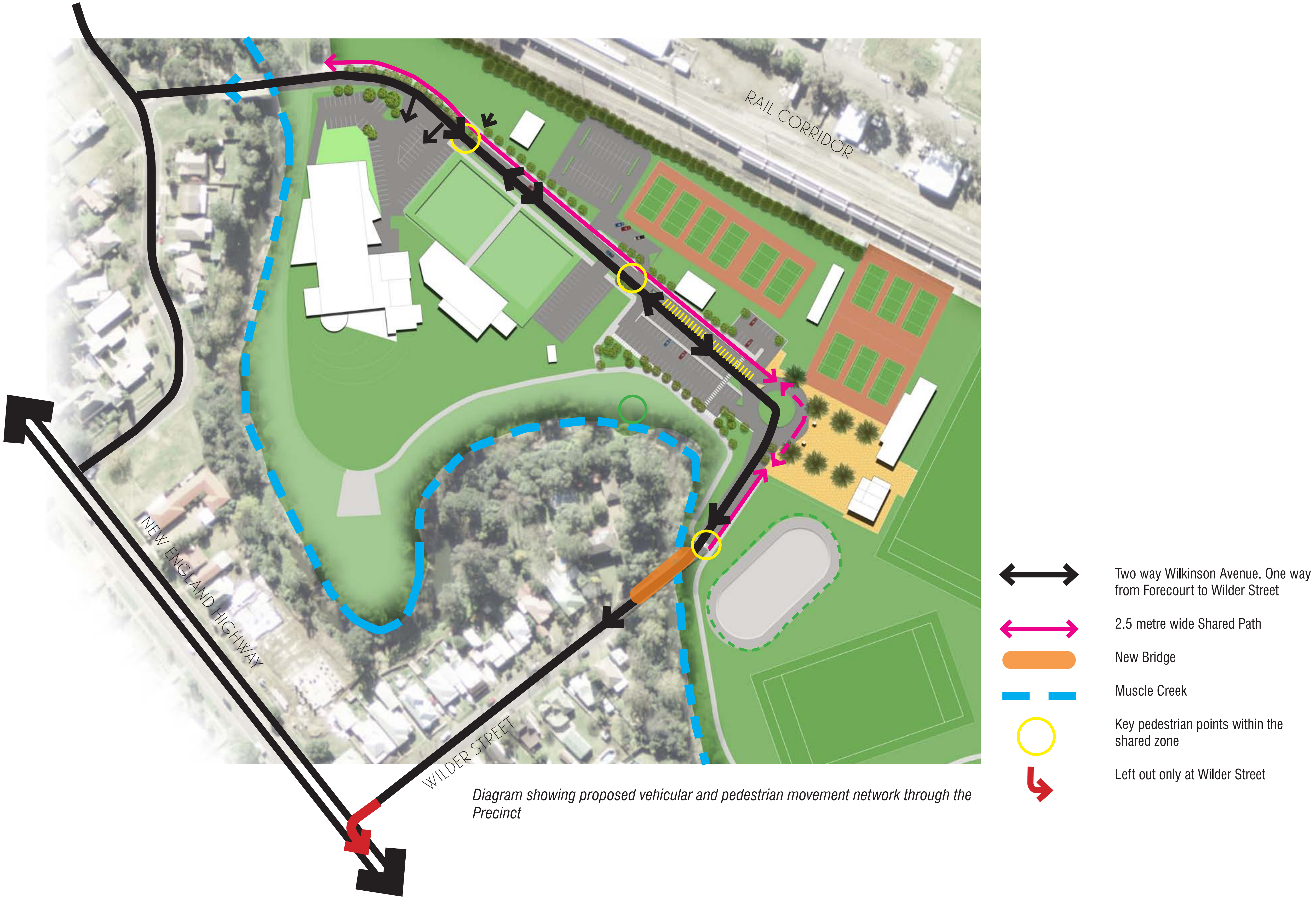


Diagram showing proposed vehicular and pedestrian movement network through the Precinct

STAGE 1 _ PROJECT B WELCOME TO OLYMPIC PARK

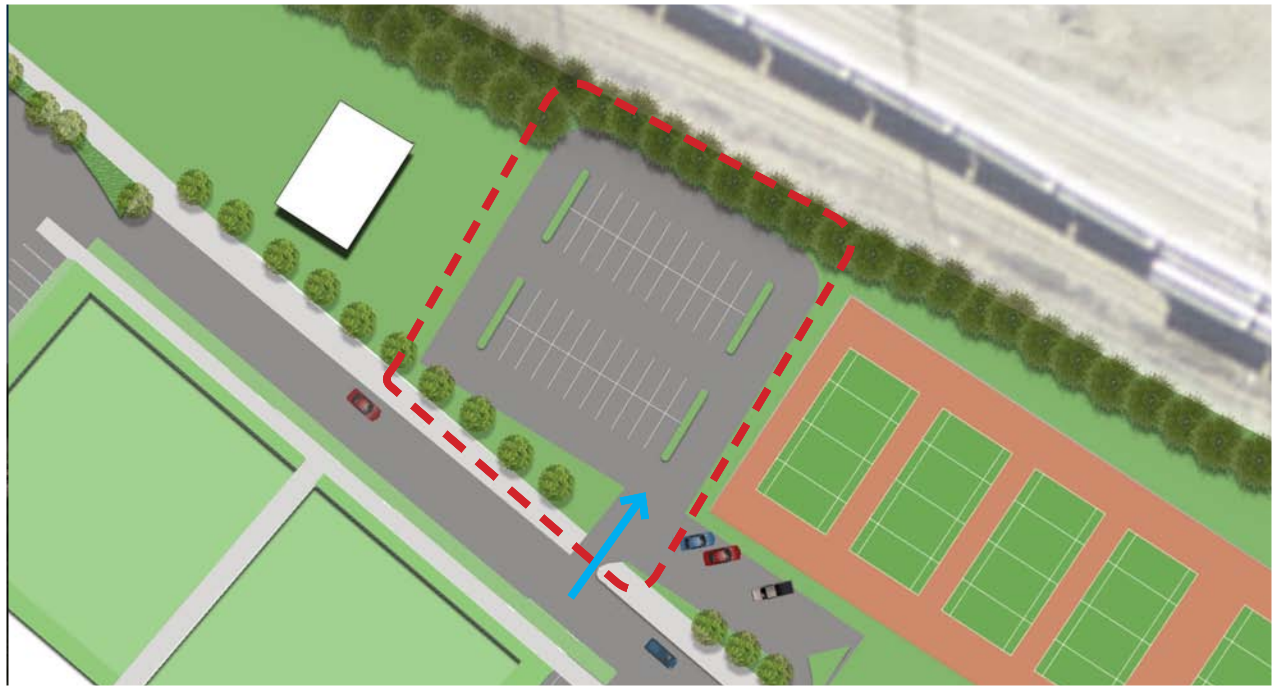
PROJECT INTENT	The entry to Olympic Park sets the tone for the precinct. This project recommends the creation of an entry statement within the triangle verge at the intersection of Haydon Street and Wiklkinson Avenue. The statement will act as a wayfinding device, informing visitors they have arrived at their destination. The entry statement should have two functions. As a signage element and as a visual element. The statement is recommended as a sculptural element, in the round, with integrated signage and lighting. Project B will need to integrate with other Stage 1 projects including: • Wilkinson Avenue Upgrade (Project S1_A), page 30
LOCATION	Intersection of Haydon Street and Wilkinson Avenue.
PROJECT STAGE	Stage 1 Priority 2
BUDGET	$80,000 exc. GST
DESIGN CONSIDERATIONS	• The domestic scale of the intersection recommends a low scale approach • If naming rights are required, ensure the entry statement does not have a commercial character. • Lighting integrated into the element should not impact on adjoining residential development. • As the intersection is bi-directional, the statement should be an element in the round. • Opportunities for pedestrians to move through and under the statement would reinforce this space as a gateway to the Precinct. • Opportunities to establish a counterpoint statement at Wilder Street should be considered.
FUNDING	• The Regional Cultural Fund • Artists with a Disability Funding • Arts Projects for Individuals and Groups • Create NSW : Art and Cultural Development Program • Regional Arts NSW CASP

POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• Muswellbrook Shire Local and Family History Society Inc • Muswellbrook Regional Art Centre • Tourism Board	• Assets • Landscape Maintenance • Cultural department

Examples of entry statement typologies (Top) Gold coast signage demonstrates the use of naming and lighting. (Bottom) Simple forms can be used to mark the entry to a space.

STAGE 1 _ PROJECT C   CARPARK B1

	Upon arrival in Olympic Park, the first carpark in Stage 1 is Carpark B1. Carpark B1 comprises approximately 44 parking spaces. To soften the impact of the parking areas and to enhance the streetscape, low scale landscaping is proposed. A generous landscaped verge is proposed between Wilkinson Avenue and Carpark B1. A single entry to the carpark is proposed which could be integrated into the entry for Carpark C with the intent to reduce the number of driveways entering and exiting onto Wilkinson Avenue. Part of the site is currently occupied by the Performing Arts Building which is significantly dilapidated. This building has been recommended for demolition. Its use as a carpark will be beneficial to the site. Project B will need to integrate with other Stage 1 and 2 projects including: • Wilkinson Avenue Upgrade (Project S1_A), pg 30 • Carpark C1 & C2 (Project S1_D), pg 34 • Carpark B1 (Project S2_C), pg 51	
LOCATION	Northern side of Wilkinson Avenue to the east of the Girl Guides building.	
PROJECT STAGE	Stage 1_Priority 2	
BUDGET	$700,000	
DESIGN CONSIDERATIONS	• Proposed landscape should not create CPTED issues by creating spaces of entrapment and concealment. • The carpark should be lit at night as part of an overall lighting strategy. • During the design of Carpark B, consideration of the future design of Carpark B2 is required. The intent is to merge Carpark B and B1 into a single carpark to reduce the number of driveways entering and exiting into Wilkinson Avenue. This merger will take place during Stage 2.	
FUNDING	• Regional Growth Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF) • Infrastructure Grants Liquor and Gaming - Sport and Recreation	
POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• N/A	• Traffic/Engineering • Landscape Maintenance



(Top) Location of Carpark B1 (Bottom) Example of landscaping that helps soften carparks.

STAGE 1 _ PROJECT D CARPARK C1 & C2

<table>
<tr><td></td><td colspan="2">Carpark C1 and C2 is a temporary carpark located on either side of the Park Tennis Clubhouse.

The carpark provides approximately 20 parking spaces in a form that can be easily connected following future redevelopment of the clubhouses (Stage 2).

The intent is to connect the two parking areas into a single one way carpark during Stage 2. This will increase the parking numbers from 12 to 31.

To soften the impact of the parking areas and enhance the streetscape, low scale landscaping is proposed. A generous landscaped verge is proposed between Wilkinson Avenue and Carpark C1/C2.

Project D will need to integrate with other Stage 1 and 2 projects including:
• Wilkinson Avenue Upgrade (Project S1_A), pg 30
• Carpark C (Project S2_D), pg 52
• Tennis Clubhouse (Project S2_E), pg 53</td></tr>
<tr><td>LOCATION</td><td colspan="2">Northern side of Wilkinson Avenue, to the east and west of the Park Tennis clubhouse.</td></tr>
<tr><td>PROJECT STAGE</td><td colspan="2">Stage 1_Priority 2</td></tr>
<tr><td>BUDGET</td><td colspan="2">$300,000 exc. GST</td></tr>
<tr><td>DESIGN CONSIDERATIONS</td><td colspan="2">• Future design of the carpark to connect the two carparks so a single one way driveway is created
• Proposed landscape should not create CPTED issues by creating spaces of entrapment and concealment
• The carpark should be lit at night as part of an overall lighting strategy.
• An temporary upgrade of the forecourt to the existing clubhouse to be included as part of this project.</td></tr>
<tr><td>FUNDING</td><td colspan="2">• Regional Growth Fund
• Stronger Country Communities Fund Building Better Regions Fund (BBRF)
• Infrastructure Grants Liquor and Gaming - Sport and Recreation</td></tr>
<tr><td rowspan="2">POTENTIAL PARTNERS/ COLLABORATORS</td><td>External</td><td>Internal</td></tr>
<tr><td>• Park Tennis Inc.
• Olympic Tennis Inc.</td><td>• Traffic/Engineering
• Landscape Maintenance
•</td></tr>
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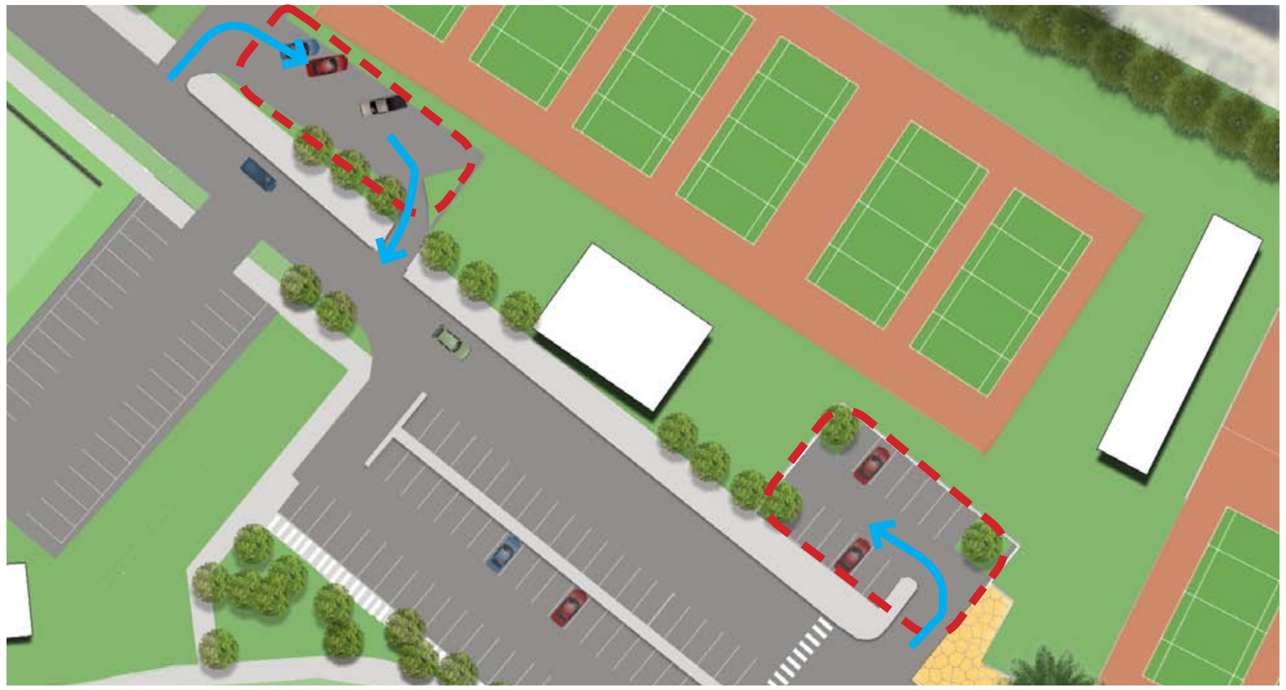


(Top) Location of Carpark C1 (Bottom) Example of landscaping that helps soften carparks.

STAGE 1 _ PROJECT E CARPARK D

	The carpark is proposed as a single one way aisle that exits adjacent the entry to the football fields. Carpark D comprises approximately 69 parking spaces. Although the carpark is available to all visitors, it is envisaged it will be used predominately by the rugby league, tennis and velodrome users. The carpark will be located adjacent the riparian corridor walk and it is recommended that bollards be installed along the perimeter of the walk to reduce risk of drivers falling into the creek. This will protect drivers and pedestrians. To soften the impact of the parking areas and enhance the streetscape, low scale landscaping is proposed. Project E will need to integrate with other Stage 1 projects including: • Wilkinson Avenue Upgrade (Project S1_A), page 30
LOCATION	Southern side of Wilkinson Avenue, adjacent riparian corridor.
PROJECT STAGE	Stage 1_Priority 1
BUDGET	$660,000
DESIGN CONSIDERATIONS	• Proposed landscape should not create CPTED issues by creating spaces of entrapment and concealment. • The carpark should be lit at night as part of an overall lighting strategy.
FUNDING	• Regional Growth Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF) • Infrastructure Grants Liquor and Gaming - Sport and Recreation
POTENTIAL PARTNERS/ COLLABORATORS	**External** • N/A **Internal** • Assets • Landscape Maintenance

(Top) Location of Carpark D (Bottom) Example of landscaping that helps soften carparks.

STAGE 1 _ PROJECT F   BUFFER LANDSCAPING

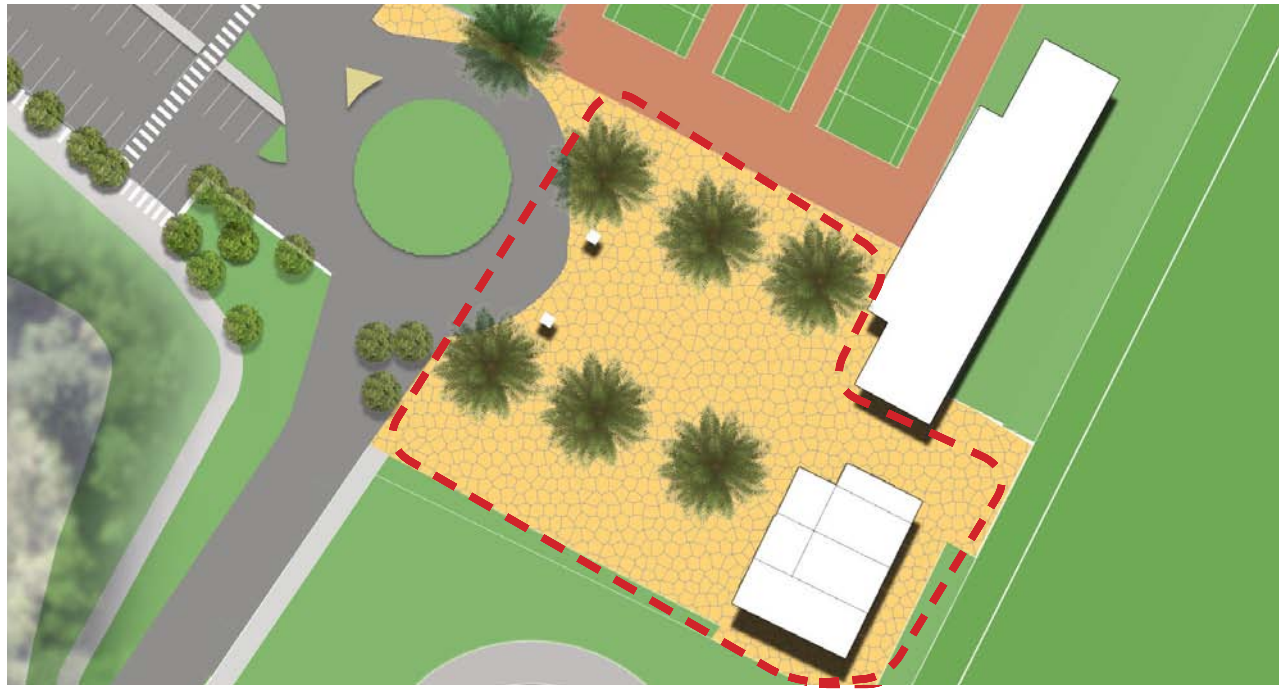
	The northern boundary of the Precinct borders the rail line. There is currently buffer landscaping between the rugby league fields and the rail line in the form of large trees. Project F proposes to continue existing buffer landscape along the northern boundary to screen the train line. Project F will need to integrate with other Stage 1 and 2 projects including: • Carpark B1 (Project S1_C), pg 33 • Carpark B (Project S2_C), pg 51 • Tennis Clubhouse (Project S2_E), pg 53	
LOCATION	Northern boundary between the Precinct and the rail corridor	
PROJECT STAGE	Stage 1_Priority 3	
BUDGET	$100,000	
DESIGN CONSIDERATIONS	• Consider using advanced stock to reduce the time to screen the rail corridor	
FUNDING		
POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• Park Tennis Inc. • Olympic Tennis Inc. • Girl Guides	• Landscape Maintenance •

Top) Location of buffer landscaping (Bottom) Existing screening trees along the northern boundary behind Fields 1 and 2.

STAGE 1 _ PROJECT G   THE FORECOURT

	The Forecourt will be an important space within Olympic Park. This area will function as a gathering and movement space directing pedestrians into the sports grounds. The Forecourt will be aesthetically important as it will provide the visual termination to the precinct. The Forecourt should be designed as a flexible space, to accommodate events such as markets or pre-event functions. The space is proposed to wrap around the amenities building. This provides a concourse opposite the playing fields. Careful design will be required to allow for future demolition and reconstruction of the grandstand. Project G will need to integrate with other Stage 1 and 2 projects including: • Wilkinson Avenue Upgrade (Project S1_A),pg 33 • Amenities Building (Project S1_H), pg 38 • Velodrome (Project S1_I), pg 40 • Field upgrades (Project S1_J), pg 41 • The Pavilion (Project S2_A), pg 46
LOCATION	Eastern side of Wiklinson Avenue, between the existing grandstand and new Amenities Building (Project S1_H)
PROJECT STAGE	Stage 1_Priority 1
BUDGET	$300,000
DESIGN CONSIDERATIONS	• Proposed landscape should not create CPTED issues by creating spaces of entrapment and concealment • Design of Forecourt should allow for flexibility for events of varying requirements • Design of Forecourt should allow for safe and efficient flow of spectators into the grounds • The Forecourt should be lit at night as part of an overall lighting strategy • Incorporate 3 phase power for events and for future proofing the space • Relocate the heritage gates to align with Wilkinson Avenue and the gate between the new Amenities Building and the existing grandstand • Space the relocated heritage gates to allow for emergency vehicles to access the sports fields • The forecourt surface will need to ensure it accommodates vehicle movement and also inhibit slip in accordance with Australian Standards • Integrate interpretive signage or artwork into the paving motif.
FUNDING	• Regional Growth Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF) • Infrastructure Grants Liquor and Gaming - Sport and Recreation

POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• Emergency services	• Landscape Maintenance



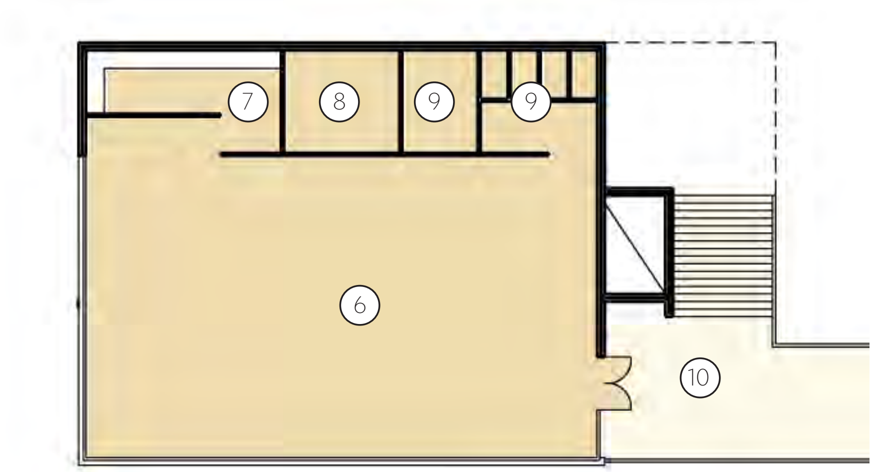
(Top) Location of the proposed forecourt to the rugby league fields (Bottom) Example of a forecourt treatment using paving and unique furniture.

STAGE 1 _ PROJECT H AMENITIES BUILDING

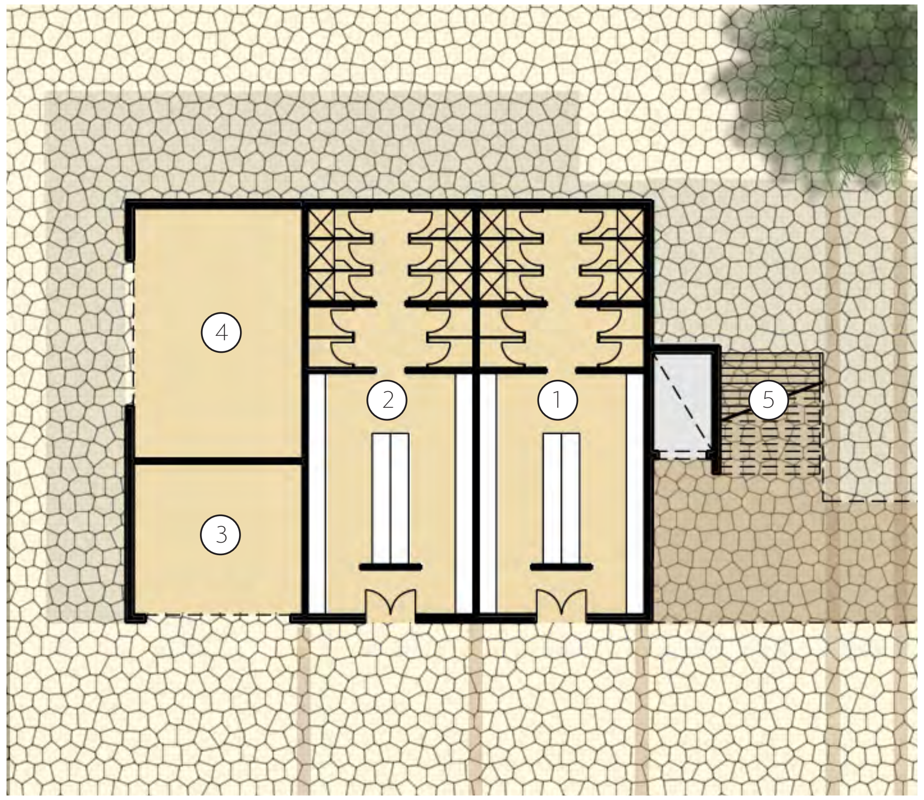
	The current facilities do not meet the needs of the Rugby League and Velodrome user groups. Until funding for a new grandstand can be obtained, Stage 1 will include a new amenities building. The design of this building will need to consider the future grandstand to ensure a unified approach, so the new grandstand and amenities building read as one structure. The new amenities building is proposed to include: • 2 x change rooms • Storage space for the Velodrome • Multi function room • Lift/stair access to multi function room Room requirements provided in Table 1. Project H will need to integrate with other Stage 1 and 2 projects including: • Forecourt (Project S1_G), pg 37 • Velodrome (Project S1_I), pg 40 • Field upgrades (Project S1_J), pg 41 • Intelligent Lighting (Project S1_K), pg 42 • The Pavilion (Project S2_A), pg 46
LOCATION	South of the existing grandstand
PROJECT STAGE	Stage 1_Priority 1
BUDGET	$900,000
DESIGN CONSIDERATIONS	• Design the Amenities Building to faciltate equitable access to the future grandstand - to avoid replication of the lift • Design the Amenities Building to integrate with future grandstand. This included its siting, relationship to the forecourt and roof design.
FUNDING	• Regional Growth Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF) • Infrastructure Grants Liquor and Gaming - Sport and Recreation with focus on disability/regional communities
POTENTIAL PARTNERS/ COLLABORATORS	**External:** • Rugby League - Seniors & Juniors **Internal:** • Assets • Landscape Maintenance

Table 1 Spatial Requirements

Room	No.	Function	Spatial Breakdown	Location	Area (m2)	Notes
Change rooms	**2**	**Provide facilities for players of next game to prepare**		**Ground floor facing Field 1**	**140**	
			Change room no. 1		45	
			Toilets no. 1		10	4 stalls
			Showers no. 1		15	6 stalls
			Change room no. 2		45	
			Toilets no. 2		10	4 stalls
			Showers no. 2		15	6 stalls
Velodrome Storage	**1**	**Provide storage for the Velodrome's equipment**		**Ground floor facing the Velodrome**	**40**	**Garage doors to allow for the removal of large items**
Multi-function room	**1**	**Provide a space for use by the football clubs and Velodrome**		**First floor**	**180**	
			Function room		150	
			Amenities		20	
			Kitchenette		10	
			Balcony		30	View over fields
Lift	**1**	**Provide access to the first floor for people with special needs**		**Ground floor providing access to the first floor**	**6**	
Total area					**366**	
Indicative circulation					36.6	
Estimated Total					**402.6**	



INDICATIVE FIRST FLOOR 1:250



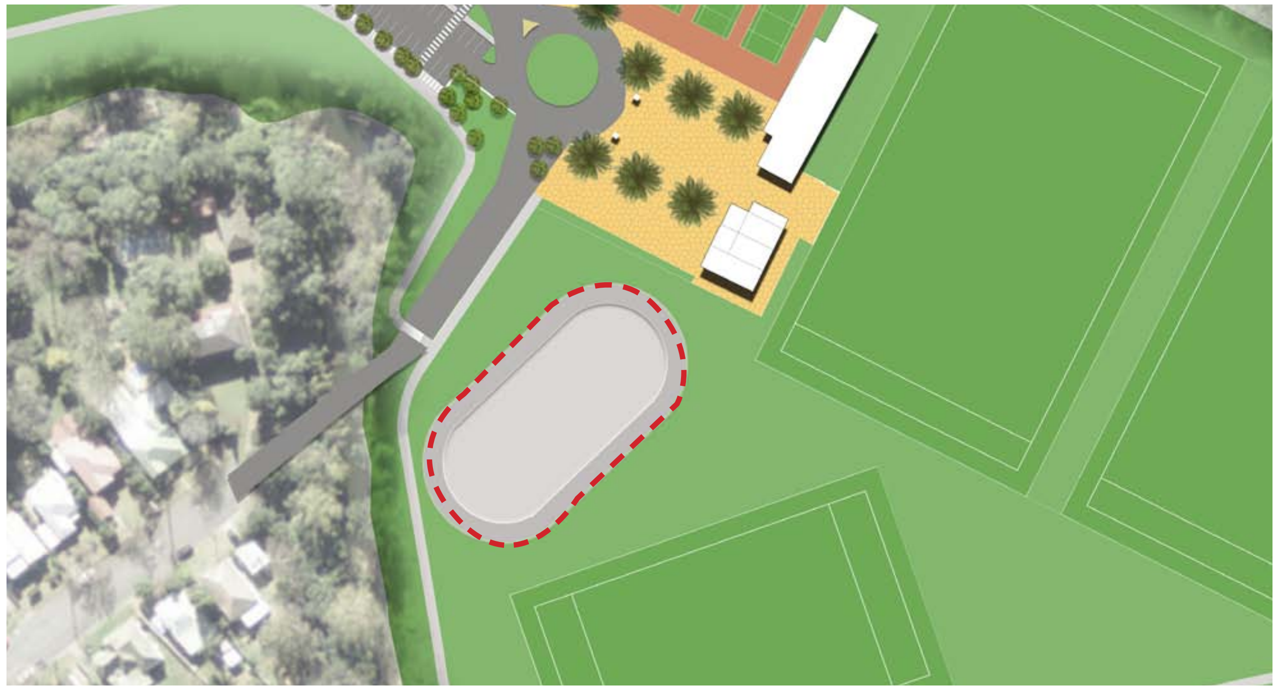
INDICATIVE GROUND FLOOR 1:250

1. CHANGE ROOM 1 INC. CHANGE ROOM, TOILETS AND SHOWERS
2. CHANGE ROOM 2 INC. CHANGE ROOM, TOILETS AND SHOWERS
3. STORAGE - RUGBY LEAGUE FIELD
4. STORAGE - VELODROME
5. LIFT AND STAIRS TO FIRST FLOOR AND FUTURE GRANDSTAND CONCOURSE
6. MULTI PURPOSE ROOM
7. KITCHENETTE
8. STORAGE
9. TOILETS INC. ACCESSIBLE TOILET
10. EXTERNAL LOBBY TO LIFT AND FUTURE GRANDSTAND CONCOURSE

Indicative approach for the Amenities Building (Left) Indicative image (above) Location of the proposed Amenities Building in the Stage 1 Masterplan

STAGE 1 _ PROJECT I VELODROME

	The Velodrome is a rare asset which is in need of some improvement to increase its use and safety. The Velodrome is currently fenced, however the existing colorbond fence is dilapited and is not secure. This project recommends the construction of a new fence around the perimeter of the Velodrome. To facilitate night races, the installation of intelligent lighting around the perimeter is recommended Although the proposed lighting should be undertaken as part of this project, it should be considered part of an overall lighting strategy for the Precinct.	
LOCATION	Existing Velodrome location adjacent extension to Wilkinson Avenue and Field 3	
PROJECT STAGE	Stage 1_Priority 2	
BUDGET	$150,000	
DESIGN CONSIDERATIONS	• Install intelligent lighting that is consistent with the overall lighting strategy for the Precinct • The new perimeter fencing (1000mm high).	
FUNDING	• Regional Growth Fund • Regional Growth – Environment and Tourism Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF) • Infrastructure Grants Liquor and Gaming - Sport and Recreation	
POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• Velodrome user groups	• Landscape Maintenance •



(Top) Location of the Velodrome and indicative fence line

STAGE 1 _ PROJECT J FIELD UPGRADES

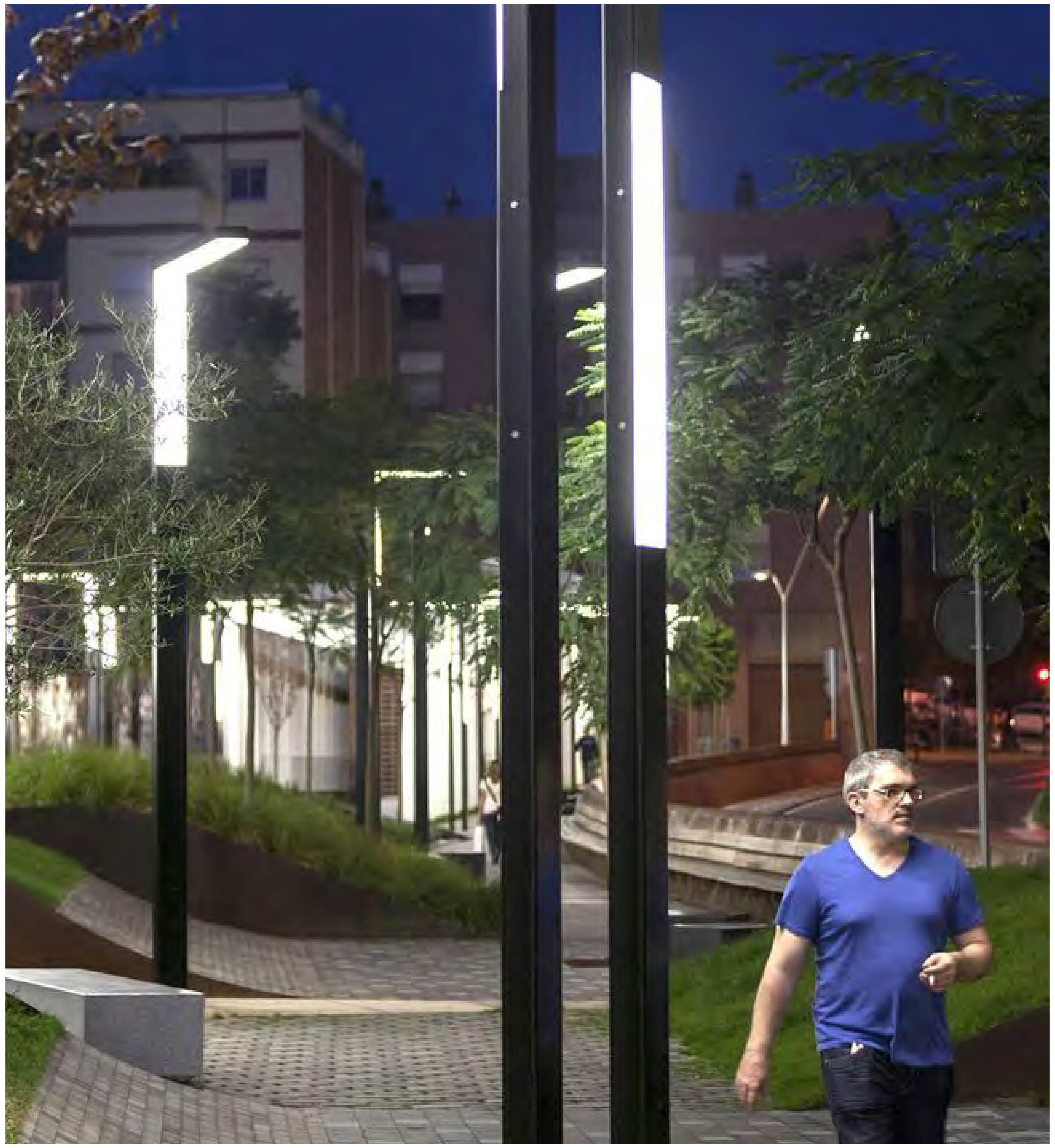
	Olympic Park accommodates three sport fields at present. The Masterplan recommends the upgrade and repositioning of all fields to bring them to a ***Regional Standard***. This will include the improvement of the field quality and drainage to limit field closures, which results in the cancellation of games. Fields 1 and 2 will continue to operate as Rugby League fields used for games and training. Field 3 will operate as a flexible field that can be used for Touch Football, training and act as a kick about space for the public. To allow for public access to Field 3, it is not recommended to be fenced. A 2100mm high black pallisade fence is proposed around the perimeter of Fields 1 and 2, Gates are proposed between the amenities building and existing grandstand, between Fields 1, 2 and 3 and off Bell Street (see locations nominated on the adjacent plan). Project G will need to integrate with other Stage 1 projects including: • Amenities Building (Project S1_H), pg 38 • The Pavillion (Project S2_A), pg 46
LOCATION	Eastern side of Wiklinson Avenue, between the existing grandstand and new Amenities Building (Project S1_H)
PROJECT STAGE	Stage 1_Priority 1
BUDGET	$300,000
DESIGN REQUIREMENTS	The following items are recommended by the Preferred Facility Guidelines for Rugby League to a Regional Standard: • Playing Field Quality - High/Medium standard playing surface is required, including an even cover of turf within limited undulations • Playing Field Drainage - Excellent/Good with appropriately designed surface and subsurface drainage with the intent to limit game cancellation • Maintenance plan is required to maintain the above standards • Playing field markings are required • Goal Posts - 16m H x 5.5m W. Cross bar 3m • Coaches Boxes - Touchline seating for 4 people • Substitutes Bench - Seating for 6 people • Grounds Maintenance Store: Currently located in existing grandstand.
FUNDING	• Regional Growth Fund • Regional Growth – Environment and Tourism Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF) • Infrastructure Grants Liquor and Gaming - Sport and Recreation

POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• Rugby League - Senior/Junior • Country Rugby League	• Assets • Landscape Maintenance

Plan showing the location of the three fields

STAGE 1 _ PROJECT K INTELLIGENT LIGHTING

	Lighting in public spaces improves safety and may increase the use of community spaces. Appropriate street lighting should be provided along public roads within the Precinct. All pathways should have effective lighting to encourage their use by improving visibility and reducing fear. Bollard lighting is discouraged as it is prone to vandalism and is not particularly effective at illuminating faces. Intelligent lighting that is based on sensors may be appropriate along the pathway adjoining the creekline, but care should be taken to ensure that the transition between light and dark does not give rise to concealment opportunities. The open spaces that are designated as parks, should be illuminated at night; the open spaces that are of a bushland reserve type character need not be illuminated. Landscaping should be carefully chosen to ensure it does not diminish the effectiveness of lighting. Any signage on site should be as legible at night as it is during the day.
LOCATION	Throughout the Precinct in the following locations: • Wilkinson Avenue • Wilkinson Avenue bridge • Wilder Street bridge • Carparks B, C and D • Forecourt • Velodrome • Riparian Walk
PROJECT STAGE	Stage 1_Priority to be rolled out with above locations.
BUDGET	Subject to quantity of lights and types of lights selected
DESIGN CONSIDERATIONS	• As Stage 1 is proposed in a series of priorities, the intelligent lighting product may not be rolled out consistently. It is important that any changes to new lighting products over the rollout period ensure a consistent aethetic and maintenance factors. • All lighting should comply with relevant Australian Standards, particularly AS 1158. • Avoid using low-pressure sodium lamps. • Vandal-resistant lamps are recommended.
FUNDING	Regional Growth Fund Regional Growth – Environment and Tourism Fund Stronger Country Communities Fund Building Better Regions Fund (BBRF)



Example of intelligent lighting within public spaces.

View looking west up Wilkinson Avenue. Bus stop is visible in the foreground

A
B
C
D
E
F

STAGE 2 OLYMPIC PARK

PROJECT INTENT	The revitalisation of Olympic Park is proposed in two stages. The second stage will complete the precinct. The key features will include: • Constructing a new grandstand/pavillion that will integrate with the Stage 1 Amenities Building • Provide additional carparking • Construct a new tennis clubhouse to service both court sites • Provide an all ages fitness playground To aid the delivery of Stage 2, six projects have been identified. Breaking this stage into a series of sub projects enables Council to seek a range of grants and deliver the precinct in a coordinated manner. The sub projects also assist Council in priortising the projects based on the communities current needs. The six projects are identified as follows: 1. The Pavillion (Project S2_A) 2. Carpark A (Project S2_B) 3. Carpark B expansion (Project S2_C) 4. Carpark C expansion (Project S2_D) 5. Tennis clubhouse (Project S2_E) 6. All ages fitness playground (Project S2_F) The order of these projects to be determined by Council based on the appropriate procurement methodology and funding opportunities.
PROJECT STAGE	2
BUDGET	$6.65 million (refer to Projects A - F for breakdown)
DESIGN CONSIDERATIONS	• Refer to Projects A - F
FUNDING	• Regional Growth Fund • Regional Growth – Environment and Tourism Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF) – Community Investments Stream • Infrastructure Grants Liquor and Gaming - Sport and Recreation • The Regional Cultural Fund - Arts and Culture Grant

POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• Tourism Board • Youth Groups • Personal Trainers • Local Muswellbrook Schools	• Assets • Landscape Maintenance

Maitland Grandstand provides a good precedent for Muswellbrook.

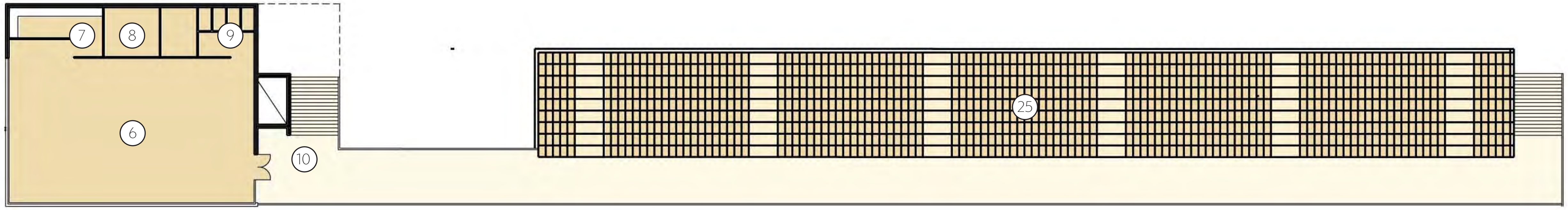
STAGE 2 _ PROJECT A THE PAVILION

PROJECT INTENT	This project will complete the Rugby League precinct by constructing a sporting pavilion that will provide a comfortable and accessible venue to watch matches. The new pavilion will replace the existing structure and increase its capacity. The new structure is proposed to comprise: • 1,000 formal seats. • Accessible seating spaces (as part of the above numbers) • 2 x change rooms (including. change area, showers and toilets) • 2 x massage rooms • Referees room (including toilet and shower) • Scorer and Time Keepers room • First Aid room • Kiosk and Bar • Administration office • Ticket office • Public amenities including accessible amenities • Storage • Cleaners room Room requirements provided in Table 2. Project A will need to integrate with other Stage 1 projects including: • Amenities Building (Project S1_H), pg 38
LOCATION	Replacing the existing grandstand located between the fields and Olympic tennis courts
PROJECT STAGE	Stage 2 Priority 1
BUDGET	$4 million
DESIGN CONSIDERATIONS	• Integrate the new pavilion with the amenities building constructed in Stage 1. • Future design subject to BCA and Australian Standards. Areas and calculations adjacent are indicative.
FUNDING	• Regional Growth Fund • Regional Growth – Environment and Tourism Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF) – Community Investments Stream

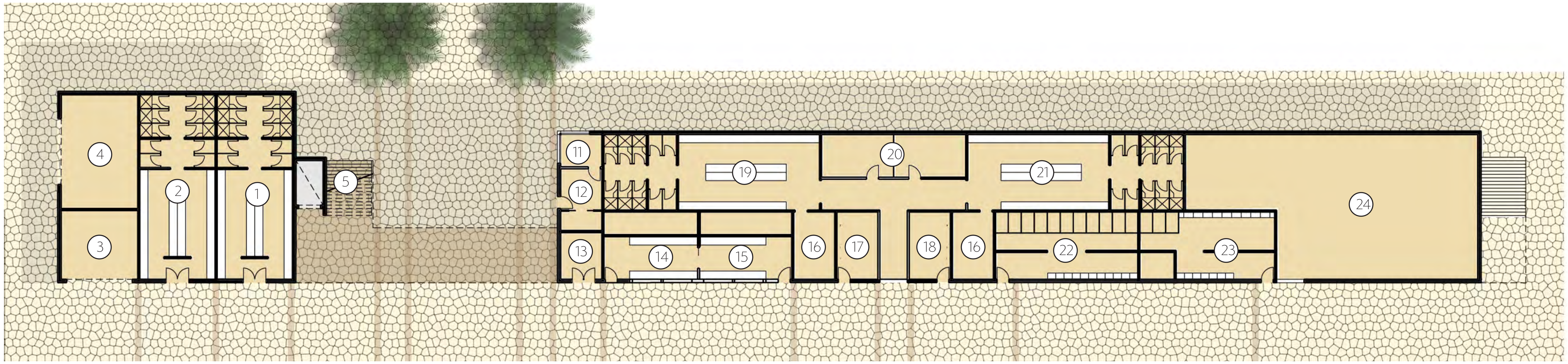
Table 2 Spatial Requirements

Room	No.	Function	Spatial Breakdown	Area (m2)	Notes
Tiered Seating	1000 seats	Provide comfortable seating		500	Design of seating area, aisles and egress to comply wit BCA and relevant Australian Standards
Change rooms	2	To provide facilities for players of next game to prepare		140	
			Change room no. 1	45	
			Toilets no. 1	10	4 stalls
			Showers no. 1	15	6 stalls
			Change room no. 2	45	
			Toilets no. 2	10	4 stalls
			Showers no. 2	15	6 stalls
			Massage no. 1	10	
			Massage no. 2	10	
Referees room	1			15	
Scorer and time keepers room	1			15	
First Aid	1			10	
Administration office	1			15	
Ticket office	1			10	
Public amenities	2	Mens and Womens Amenities including accessible toilet		70	
Storage	1	To provide storage for the ground maintenance and equipment		80	Garage doors to allow for the removal of large items
Cleaners Store	1	To provide a space for cleaners products and equipment		10	
Total area				**1025**	**Area is indicative and subject to concept design.**

note: areas are indicative and subject to future calculations, needs assessment and design.

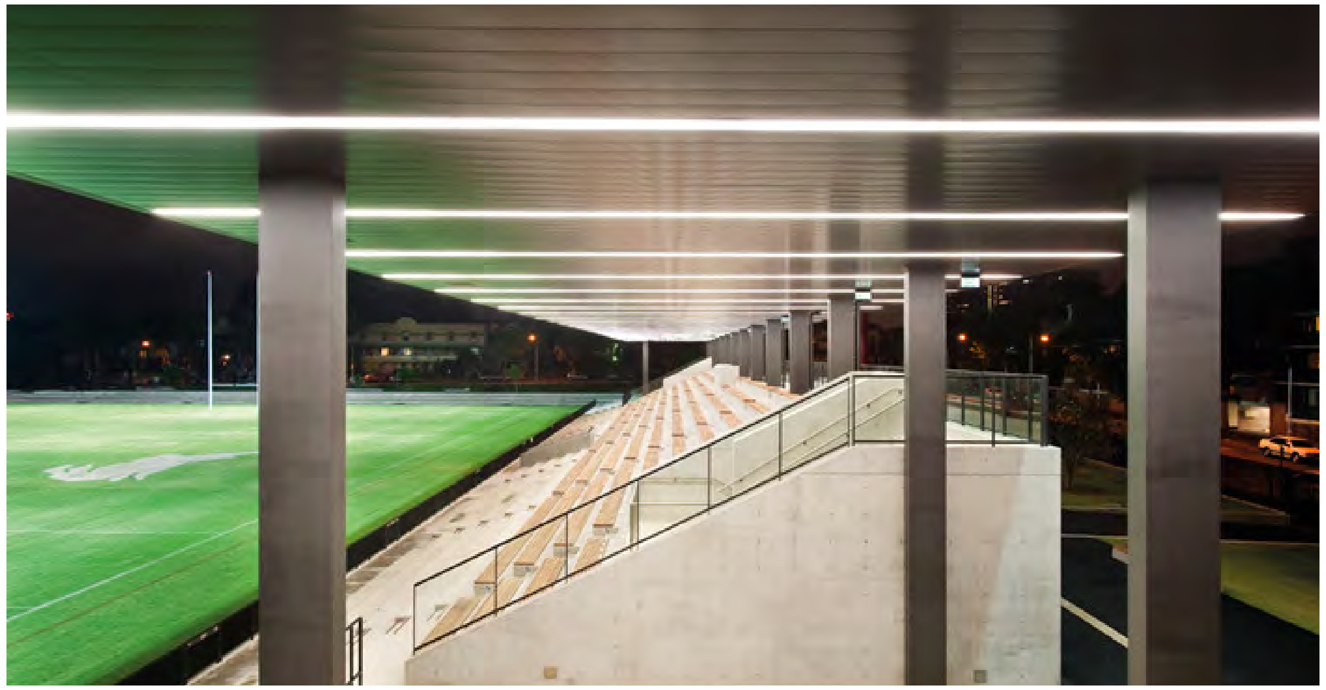


INDICATIVE FIRST FLOOR 1:750



INDICATIVE GROUND FLOOR 1:750

1. CHANGE ROOM 1 INC. CHANGE ROOM, TOILETS AND SHOWERS
2. CHANGE ROOM 2 INC. CHANGE ROOM, TOILETS AND SHOWERS
3. STORAGE - RUGBY LEAGUE FIELD
4. STORAGE - VELODROME
5. LIFT AND STAIRS TO FIRST FLOOR & GRANDSTAND CONCOURSE
6. MULTI PURPOSE ROOM
7. KITCHENETTE
8. STORAGE
9. TOILETS INC. ACCESSIBLE TOILET
10. EXTERNAL LOBBY TO LIFT & GRANDSTAND CONCOURSE
11. TICKET OFFICE
12. ADMINISTRATION & STORAGE
13. FIRST AID
14. KIOSK
15. BAR
16. MASSAGE
17. TIME KEEPERS
18. REFEREES
19. CHANGE ROOM 3 INC. CHANGE ROOM, TOILETS AND SHOWERS
20. CHANGE ROOM 4 INC. CHANGE ROOM, TOILETS AND SHOWERS
21. STRENGTH & CONDITIONING
22. WOMENS PUBLIC TOILETS
23. MENS PUBLIC TOILETS
24. STORAGE
25. 1000 SEATS

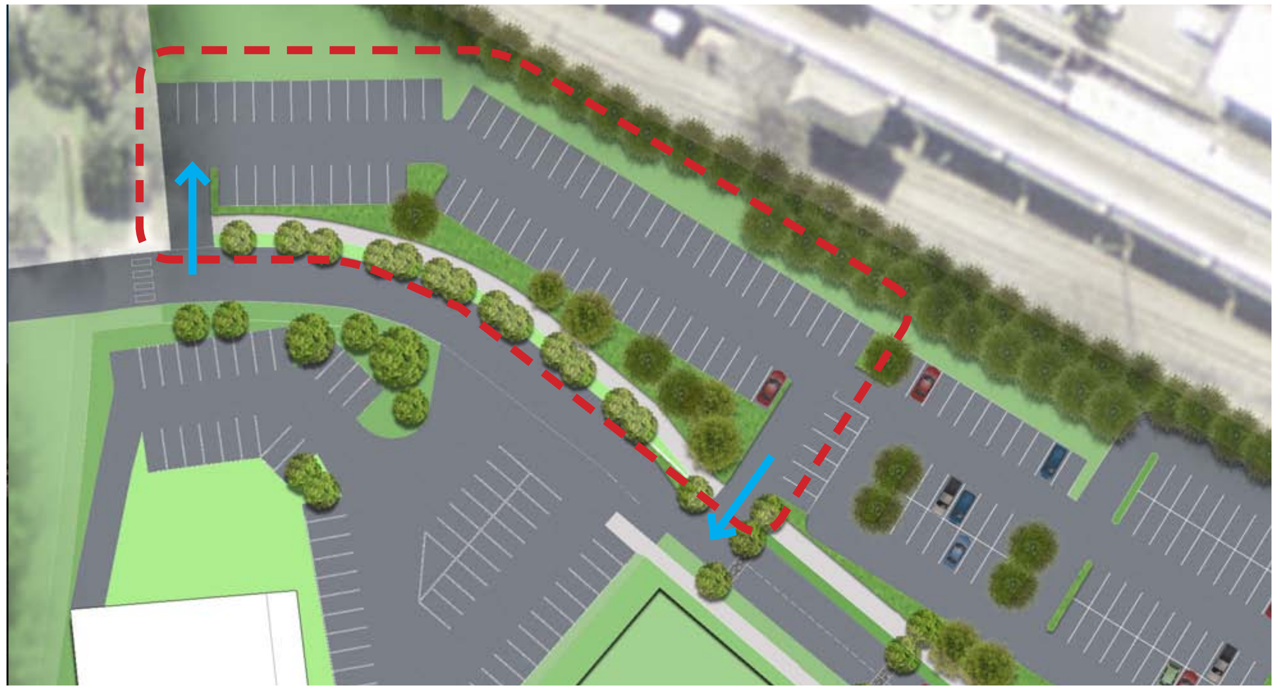



Imagery of two approaches to Rugby League Grandstands in NSW (Top) Redfern Sportsground (Bottom) Glen Wilow Stadium Mudgee

View looking east along Wilkinson Avenue towards the new grandstand (Stage 2 shown)

STAGE2 _ PROJECT B CARPARK A

	The land north of Wilkinson Avenue could be converted into a carpark should parking needs arise in the future. The carpark is proposed as a one way aisle with an entry driveway just after the existing bridge and exits adjacent the Bowling Greens. Carpark A comprises approximately 76 parking spaces. To soften the impact of the parking areas and enhance the streetscape, low scale landscaping is proposed. A generous landscaped verge is proposed between Wilkinson Avenue and Carpark A. Project B will need to integrate with other Stage 2 projects including: • Carpark B2 (Project S2_C)	
LOCATION	Northern side of Wilkinson Avenue, adjacent riparian corridor.	
PROJECT STAGE	Stage 1_Priority 1	
BUDGET	$700,000	
DESIGN CONSIDERATIONS	• Proposed landscape should not create CPTED issues by creating spaces of entrapment and concealment. • The carpark should be lit at night as part of an overall lighting strategy.	
FUNDING	• Regional Growth Fund • Regional Growth – Environment and Tourism Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF) – Community Investments Stream	
POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• N/A	• Assets • Landscape Maintenance

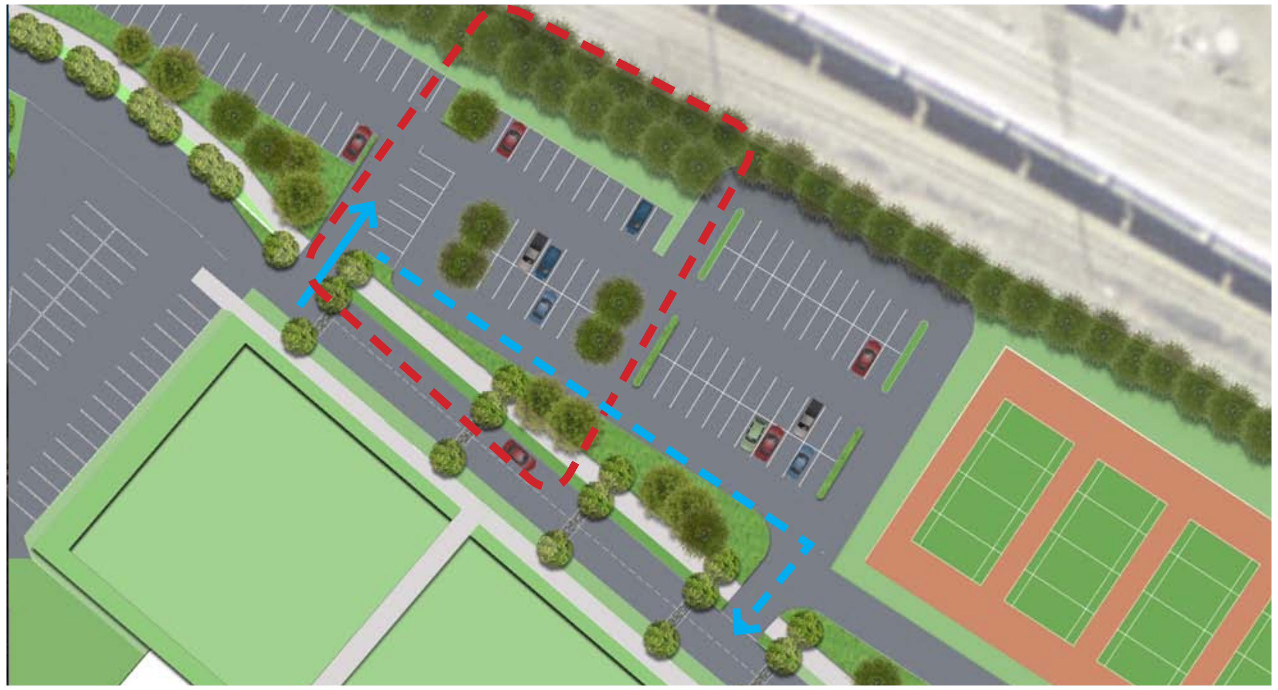


Examples of entry statement typologies (Top) Location of Carpark A (Bottom) Example of carpark landscaping.

STAGE 2 _ PROJECT C CARPARK B

PROJECT INTENT	In the future, the opportunity to relocate the Girl Guides building may be possible. This would provide land for the expansion of carpark B. Carpark B comprises approximately 25 parking spaces. To soften the impact of the parking areas and enhance the streetscape, low scale landscaping is proposed. A generous landscaped verge is proposed between Wilkinson Avenue and Carpark B. Project C will need to integrate with other Stage 2 projects including: • Carpark A (Project S2_B), pg 50
LOCATION	Northern side of Wilkinson Avenue
PROJECT STAGE	Stage 2_Priority 2
BUDGET	$600,000
DESIGN CONSIDERATIONS	• Proposed landscape should not create CPTED isses by creating spaces of entrapment and concealment. • The carpark should be lit at night as part of an overall lighting strategy.
FUNDING	• Regional Growth Fund • Regional Growth – Environment and Tourism Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF)

POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• N/A	• Assets • Landscape Maintenance •



(Top) Location of Carpark B (Bottom) Example of landscaping that helps soften carparks.

STAGE 2 _ PROJECT D   CARPARK C

	Carpark C is the result of joining the two halves of Carpark C1, from Stage 1. Previously, Carpark C1 and C2 provides approximately 12 parking spaces in two parts. This was due to the existing location of the Park Tennis clubhouse. Carpark C joins the two carparks, resulting in a one way aisle with approximately 31 spaces. To soften the impact of the parking areas and to enhance the streetscape, low scale landscaping is proposed. A generous landscaped verge is proposed between Wilkinson Avenue and Carpark C. Project D will need to integrate with other Stage 2 projects including: • Tennis Clubhouse (Project S2_E)	
LOCATION	Northern side of Wilkinson Avenue. Located within Carpark C1	
PROJECT STAGE	Stage 2_Priority 2	
BUDGET	$400,000	
DESIGN CONSIDERATIONS	• Proposed landscape should not create CPTED isses by creating spaces of entrapment and concealment. • The carpark should be lit at night as part of an overall lighting strategy.	
FUNDING	• Regional Growth Fund • Regional Growth – Environment and Tourism Fund • Stronger Country Communities Fund Building Better Regions Fund (BBRF)	
POTENTIAL PARTNERS/ COLLABORATORS	External	Internal
	• Park Tennis Inc. • Olympic Tennis Inc.	• Assets • Landscape Maintenance •

(Top) Location of Carpark C (Bottom) Example of landscaping that helps soften carparks.

STAGE 2 _ PROJECT E TENNIS CLUBHOUSE

PROJECT INTENT	The current facilities are ageing and will require extensive maintenance to keep to current standard. This is a 30 year Masterplan, and it is reasonable to expect a new clubhouse to be provided within that time frame. The location of the Park Tennis Clubhouse does not allow for the best use of space and its character does not contribute to the streetscape of the Precinct. It is recommended that the Park Tennis Clubhouse be demolished and reconstructed in a new location. Its demolition will allow for Stage 2 - Project D to be undertaken, which allows for a more efficient carpark layout and increase in the number of parking spaces. The new building can be built prior to or after an amalgamation of the two clubs. The design of the building should be flexible should an amalgamation never take place. New amenities building to include: • Multi-function room with kitchenette • Amenities • Storage • Children's playroom and BBQ/outdoor area. Room requirements provided in Table 3. Project E will need to integrate with other Stage 2 projects including: • Carpark C2 (Project S2_D) • Intelligent Lighting (Project S1_K)
LOCATION	Between the existing Park Tennis and Olympic Tennis courts. On the site of the existing Olympic Tennis Clubhouse.
PROJECT STAGE	Stage 1_Priority 2
BUDGET	$700,000
DESIGN CONSIDERATIONS	
FUNDING	Regional Growth Fund Regional Growth – Environment and Tourism Fund Stronger Country Communities Fund Building Better Regions Fund (BBRF) Infrastructure Grants Liquor and Gaming - Sport and Recreation
POTENTIAL PARTNERS/ COLLABORATORS	**External:** Park Tennis Inc, Olympic Park Tennis Inc **Internal:** Assets, Landscape Maintenance

Table 3 Spatial Requirements

Room	No.	Function	Spatial Breakdown	Location	Area (m2)	Notes
Multi function room	1	Provide a social space for the tennis club(s)		Ground or first floor (if a second storey is proposed)	100	Multi direction to face both court precincts Ability to be split into two rooms should an amalgamation of the clubs not take place
Kitchenette	1	Provide a space to prepare basic meals		Adjacent Multifunction room	10	Note: this is not proposed as a commercial kitchen
Storage	1	Provide storage for the Tennis Club(s) equipment		Ground floor f	40	Garage doors to allow for the removal of large items
Amenities			Change room		40	Lockers
			Showers		4.5	
			Toilets		6	
Children's Playroom	1	Provide a secure space which allows parents to play tennis while their children are within the grounds		Ground floor	50	Provide an indoor/ outdoor room which is fenced
Total area					250.5	
Indicative circulation			10%		25	
Total					**275.5**	
BBQ area		Provide a space for entertainment		External to the building.	50	

STAGE 2 _ PROJECT F ALL AGES FITNESS PLAYGROUND

<table>
<tr><td>PROJECT INTENT</td><td colspan="2">In the 21st Century, exercise takes many forms. As informal exercise becomes more popular, spaces that can be used at any time of day, alone or in a group will be sought after.

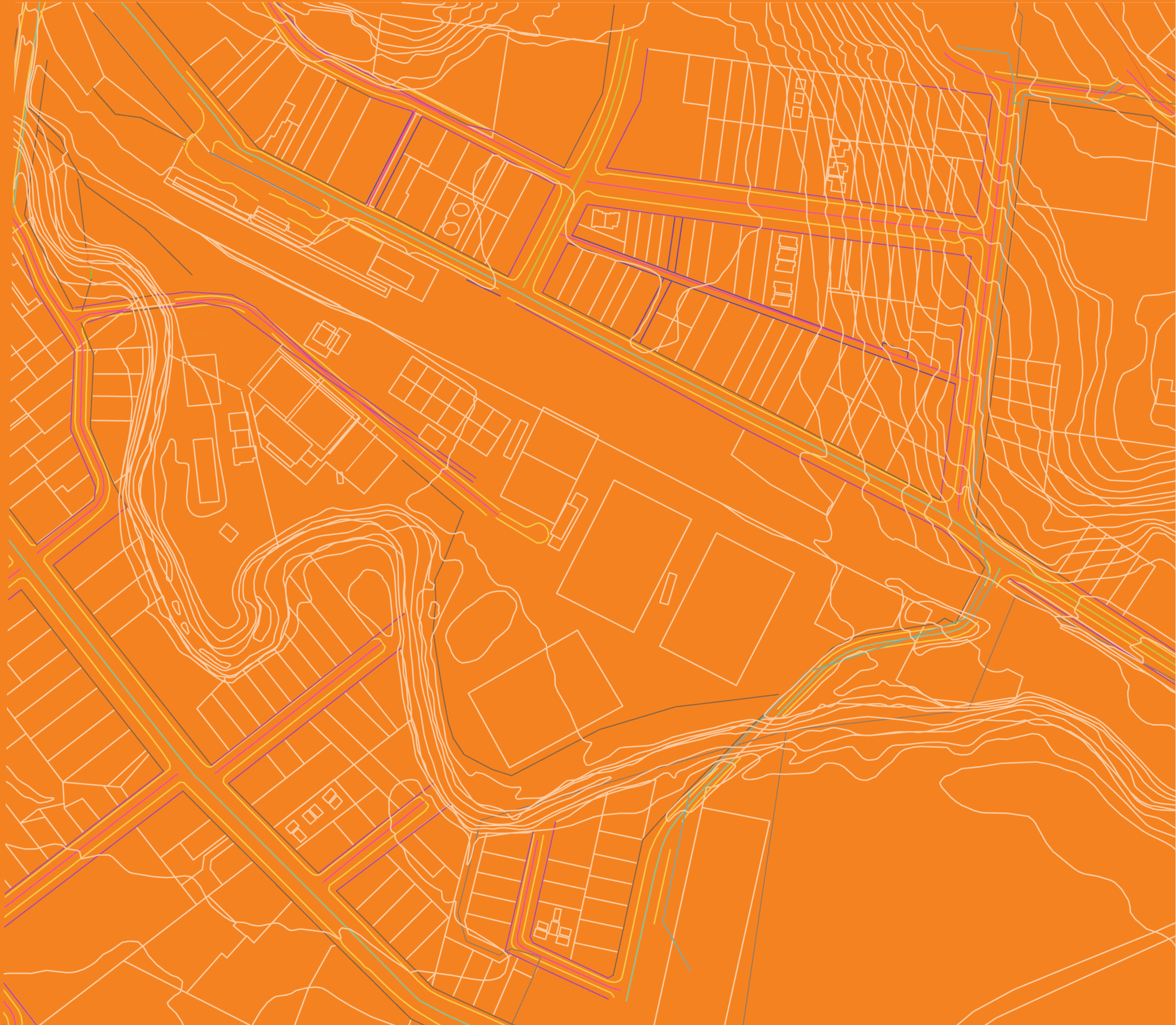
Often exercise stations become the playgrounds of local children - as children can't discern between a push up bar and a piece of children's play equipment.

Within this space, there is an opportunity to blur the boundaries and encourage both adults and children to play together - as a form of casual exercise. This creates a new type of learning space, as children learn from their elders by mimicking them.

The playground should also accommodate the needs of the older population by providing equipment appropriate to their needs.</td></tr>
<tr><td>LOCATION</td><td colspan="2">Between the existing Bowling Green and proposed Carpark D</td></tr>
<tr><td>PROJECT STAGE</td><td colspan="2">Stage 2_Priority 3</td></tr>
<tr><td>BUDGET</td><td colspan="2">$250,000</td></tr>
<tr><td>DESIGN CONSIDERATIONS</td><td colspan="2">• As a fitness playground may be used by all ages, a low fence should be provided to stop children from running onto Wilkinson Avenue or the carpark. This will allow for parents to exercise without fear of injury to their children
• The lighting strategy adopted for the site should include intelligent lighting for the playground. This will allow for use of the playground after hours which will increase passive surveillance of the precinct
• Provide a range of equipment that allows for use by all ages - from young children through to the older community.</td></tr>
<tr><td>FUNDING</td><td colspan="2">• Regional Growth Fund
• Regional Growth – Environment and Tourism Fund
• Stronger Country Communities Fund Building Better Regions Fund (BBRF) – Community Investments Stream</td></tr>
<tr><td rowspan="2">POTENTIAL PARTNERS/ COLLABORATORS</td><td>External</td><td>Internal</td></tr>
<tr><td>• Personal Trainers
• Running Clubs
• Playgroups
• Schools</td><td>• Landscape Maintenance
•</td></tr>
</table>

(Top) Location of the All Ages Fitness Playground (Bottom) Representation of the play spaces.

CHAPTER 6



GRANTS AND FUNDING

6.1 FUNDING

Infrastructure, sporting and cultural projects can be funded through either public or private funding.

Funding need not be from a single source. The funds for developing a single project may be from a number of sources. For instance, many federal and state grants require the value of the grant to be ‘matched’ by Council or private funder.

The table below summarises the range of grants that could be secured for Olympic Park. It’s important to note that grants, timeframes and processes change and a full review should be undertaken regularly to ensure that grant opportunities are not missed.

Examples of public and private funding could include:

PUBLIC	• Federal Grants • State Grants • Regional Specific Grants • Local Authority Grants
PRIVATE	• Private Development • Local or Community Partnerships • Artist Lead Funding • Health Companies and Banking Institutions • Crowd Sourcing • Fundraising

NSW GRANTS

	Eligibility	Opportunities for Olympic Park	Value
CREATE NSW : ART AND CULTURAL DEVELOPMENT PROGRAM	Create NSW offers direct funding to organisations, artists, practitioners and arts and cultural workers through the Arts and Cultural Development Program (ACDP). The program funds everything from multiyear programs to one-off projects and professional development opportunities, across visual arts, museums and history, literature, performing arts, music and more. Create NSW also delivers on defined and developing priorities, new opportunities through specific strategic initiatives and targeted support. As new initiatives and other opportunities are developed throughout the year, information will be published on the website. Who can apply? • Individual artists and arts/cultural workers • Organisations, partnerships and groups.	Installation of entry statement (Welcome to Olympic Park (Project S1_A) pg 32) Interpretive signage and pavement treatments Wilkinson Avenue Upgrade (Project S1_A), page 30 Upgrade and interpretation of the heritage gates (Forecourt (Project S1_H) pg 37)	Up to $60,000 for projects delivered within 12 months OR Up to $75,000 for projects delivered over more than 12 months.
COMMUNITY BUILDING PARTNERSHIP	This group is seeking funding applications for community infrastructure projects that: • promote community participation, inclusion and cohesion • deliver positive social, environmental, and recreational outcomes. Incorporated not-for-profits and local councils are eligible to apply. Grants need to be for: • building/repairing/refurbishing community infrastructure; or • capital equipment with a minimum individual asset value of $2,500 Projects must be completed by 31 March 2019.	Construction of new amenities building, grandstand and tennis clubhouse (Amenities Building (Project S1_H), pg 38, Tennis Clubhouse (Project S2_E), pg 53) Construction of all ages play-ground (Project S2_F)	
CLUBS NSW	Since the scheme began, clubs have given more than $1 billion to recipients such as Surf Life Saving, the Ted Noffs Foundation, Vision Australia and Legacy. ClubGRANTS funding is available to community groups, charities and sporting teams across NSW. Approximately 500 clubs voluntarily allocate funds to the ClubGRANTS scheme. Funding is available under three separate categories: **Category 1:** Supports community welfare and social services; community development; employment assistance activities; community health services; and projects aimed at improving the living standards of low income and disadvantaged people. **Category 2:** Provides funding for general community development and support activities, such as junior sport. **Category 3:** Is a state-wide fund that supports large-scale community infrastructure projects. Grants are available for sport, emergency and disaster relief, and arts and culture infrastructure.	Construction of new amenities building, grandstand and tennis clubhouse (Amenities Building (Project S1_H), pg 38, Tennis Clubhouse (Project S2_E), pg 53)	Subject to application

INFRASTRUCTURE GRANTS LIQUOR AND GAMING	Liquor & Gaming NSW offers grants to communities across NSW to support the building, renovation and fitout of infrastructure. Funding is available for sport and recreation, arts and cultural infrastructure, and projects that enhance facilities used to shelter communities and provide emergency services. Infrastructure Grants are made possible by reinvesting a rebate on gaming machine profits from the state's registered clubs, known as the ClubGrants Category 3 Fund. Infrastructure Grants can be used for costs such as construction, the purchase of capital equipment and professional fees. Examples of projects range from local sports ground facilities, public swimming pools, children's play areas, museums, art galleries, theatres and upgrades to evacuation centres such as back-up power generators, new training facilities and accommodation for volunteers and the community. The Infrastructure Grants process is competitive. Each year the program receives more applications than can be supported and in some instances partial funding may be offered To be eligible for funding, applications must meet all of the following conditions: • Location: built infrastructure in NSW. • Applicant: submitted by an organisation with an ABN that is responsible for operating and/or maintaining the infrastructure. • Benefit: infrastructure that is accessible and available to the general public the majority of the time. • Purpose: infrastructure related to Arts & Culture, Emergency Preparedness or Sports & Recreation. • Development status: infrastructure works with Development Approval or written exemption. • Financial contribution: local government applicants are required to match the funding amount requested. • Process: submitted using the online application form available from the Liquor & Gaming NSW website. **Timing** • Completing your project within two years of the funding commencing. **Priority Framework** When making funding decisions, consideration is also given to applications which provide benefit to: • Aboriginal and Torres Strait Islander communities • regional and remote communities • people with disability • culturally and linguistically diverse communities	Construction of new amenities building, grandstand and tennis clubhouse (Amenities Building (Project S1_H), pg 38, Tennis Clubhouse (Project S2_E), pg 53) Construction of all ages play-ground (Project S2_F) Upgrade of the Velodrome Project S1_I) Installation of entry statement (Welcome to Olympic Park (Project S1_A) pg 32) Interpretive signage and pavement treatments Wilkinson Avenue Upgrade (Project S1_A), page 30 Upgrade and interpretation of the heritage gates (Forecourt (Project S1_H) pg 37)	**Arts & Culture $50,000 to $200,000 available per project** Emergency Preparedness $10,000 to $200,000 available per project **Sport & Recreation $100,000 to $300,000 available per project**

REGIONAL GRANTS

	Eligibility	Opportunities for Olympic Park	Value
	Australia Council for the Arts		
REGIONAL GROWTH FUND	The NSW Government is investing an additional $1.3 billion in regional infrastructure to support growing regional centres, activate local economies and improve services in communities, through the new Regional Growth Fund.Combined with the $300 million to drive regional tourism through the Regional Growth: Environment and Tourism Fund this brings to $1.6 billion the funding available for regional growth. The NSW Government's Regional Development Framework (external link) provides an overall vision for the Regional Growth Fund. The framework establishes a plan for regional development over the next 30 years that ensures every community across the state benefits from NSW's economic success. The Regional Growth Fund will invest in projects that facilitate regional development through six funds. These funds aim to enable essential infrastructure, support arts and culture, enhance and build sporting infrastructure, improve regional voice and data connectivity, invest in our mining-impacted communities, spur job creation and deliver local infrastructure. Applications will be open to local government, regional organisations, industry and other community organisations.	Installation of entry statement (Welcome to Olympic Park (Project S1_A) pg 32) Interpretive signage and pavement treatments Wilkinson Avenue Upgrade (Project S1_A), page 30 Upgrade and interpretation of the heritage gates (Forecourt (Project S1_H) pg 37	N/A
REGIONAL GROWTH – ENVIRONMENT AND TOURISM FUND	Established under the NSW Government's Rebuilding NSW Program, the Regional Growth – Environment and Tourism Fund (RGETF) aims to increase tourist visitation by investing in regional environment and tourism infrastructure, particularly focusing on assets that will grow and further diversify NSW regional economies. The fund has committed $300 million to the RGETF, with up to $100 million available in the first round of funding.	Interpretive signage and pavement treatments Wilkinson Avenue Upgrade (Project S1_A), page 30 Upgrade and interpretation of the heritage gates (Forecourt (Project S1_H) pg 37	$10,000 – 50,000
STRONGER COUNTRY COMMUNITIES FUND	The Stronger Country Communities Fund is investing in infrastructure projects in regional NSW communities to improve the lives of residents and enhance the attractiveness of these areas as vibrant places to live and work. The NSW Government has committed $200 million over the next two years to support local infrastructure projects that will improve amenity and help sustain the social bonds at the heart of strong regional communities. The government will support projects that involve: • building new community facilities (such as parks, playgrounds, walking and cycle pathways) • refurbishing existing local facilities (such as community centres and libraries) • enhancing local parks and the supporting facilities (such as kitchens and toilet blocks). Local councils must consult with their communities to identify project proposals that meet community needs and aspirations. Priority will be given to projects that provide local jobs and support local businesses. **Who can apply** The Stronger Country Communities Fund is available to all 92 NSW regional local government areas (outside Sydney, Newcastle and Wollongong).	Construction of new amenities building, grandstand and tennis clubhouse (Amenities Building (Project S1_H), pg 38, Tennis Clubhouse (Project S2_E), pg 53) Construction of all ages playground (Project S2_F)	

REGIONAL ARTS NSW CASP	Eligible projects include but are not limited to: • Workshops • Arts activities as part of community festivals or events • Artist-in-residence programs • Public art and design projects • Performances • Arts and cultural directories • Community seminars and forums • Exhibitions • Other local arts initiatives Eligible applicants include: • Not for profit incorporated body • Local government authority • Collective with a nominated auspicing body	Interpretive signage and pavement treatments Wilkinson Avenue Upgrade (Project S1_A), page 30 Upgrade and interpretation of the heritage gates (Forecourt (Project S1_H) pg 37	$3-5000
BUILDING BETTER REGIONS FUND (BBRF) – COMMUNITY INVESTMENTS STREAM	Eligible activities include: **1. Local events and activities** • Arts and culture events, for example theatre productions, gallery exhibitions and indigenous cultural events • Community and public events, for example food festivals, field days, seasonal activities, veterans or memorial events • Business events, for example social media or marketing seminars, business networking events • Community sporting events, for example an exhibition sporting match or hosting an interstate sports carnival • Events or activities which attract tourists and visitors to a region **2. Strategic planning** • Regional skills audits • Research projects to support regional development strategic plans • Collecting socio-economic information • Plan development costs **3. Regional leadership and capability** • Leadership courses • Participation and community building measures for young people • Participation in activities to improve local business and industry leadership capability The Program Delegate makes the final decision on what are eligible activities. The program cannot fund activities carried out prior to executing a grant agreement. All project activity must occur during the project period for it to be eligible. The main assessment criteria include: • The economic benefit that the project will deliver to the region during and beyond the construction phase. • The social benefit that the project will deliver to the region during and beyond the construction phase. • The value for money offered by the project. • The applicants' capacity, capability and resources to carry out the project.	Events and activities associated with the new facilities e g. markets, festival and open days.	

PRIVATE GRANTS

	Eligibility	Value	Closing Date
NIB	There are a range of private grants available to community groups that promote health and wellbeing. Organisations including Medibank, NIB, Bupa, and the Commonwealth Bank have annual grants for a range of health related activities. The redevelopment of Olympic Park has the opportunity to enhance the health and wellbeing of its community. One example of a private health grant is NIB. NIB is an Australian owned private health insurance company. It encourages Not for Profit organisations to apply for up to $100,000 in funding for locally-based initiatives as par of NIB's foundation's Community Grant Funding. The Community Grants program aims to support locally-based initiatives which will make a difference to the health and wellbeing of communities. Preference will be given to programs which focus on one of the following areas: • Wellbeing - promoting the physical fitness, nutrition, mental and social wellbeing of the community • Equity and Access - enabling those living in regional, rural and remote areas to participate in activities which enhance their quality of life • Education and training - providing widespread access to resources and information to improve community awareness of health related issues.	Up to $100,000	Annually
CROWD FUNDING	What is Crowd Funding "Crowd Funding is the collective cooperation, attention and trust by people who network and pool their money together, usually via the Internet, to support efforts initiated by other people or organisations" Wikipedia There are a number of emerging Crowd Funding platforms. Should Crowd Funding be appropriate to a Olympic Park, fresh research should be undertaken to determine the best platform.	N/A	N/A

APPENDIX

B

DATABASE RESULTS

AHIMS Web Services (AWS)
Search Result

Purchase Order/Reference : Olympic Park

Client Service ID : 518225

Cardno NSW/ACT pty ltd
205 north albany st
Gosford New South Wales 2250
Attention: Nadine Caff
Email: nadine.caff@cardno.com.au

Date: 06 July 2020

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 7010, DP:DP93327 with a Buffer of 200 meters, conducted by Nadine Caff on 06 July 2020.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

NSW GOVERNMENT | Heritage NSW

Search for NSW Heritage

Item details

Name of item:
Fitzgerald /Olympic Park Gates
Type of item:
Built
Group/Collection:
Parks, Gardens and Trees
Category:
Reserve
Primary address:
Wilkinson Avenue, Muswellbrook, NSW 2333
Local govt. area:
Muswellbrook
All addresses

Street Address	Suburb/town	LGA	Parish	County	Type
Wilkinson Avenue	Muswellbrook	Muswellbrook			Primary Address

Statement of significance:

The gates have historical and social significance for recording the relative status of an eminent local in the early 20th century and for being significant to all descendants of the locally-famous Keys family.
Note: The State Heritage Inventory provides information about heritage items listed by local and State government agencies. The State Heritage Inventory is continually being updated by local and State agencies as new information becomes available. Read the Department of Premier and Cabinet copyright and disclaimer.

Description

Designer/Maker:
Unknown
Builder/Maker:
N/A
Physical description:
Marble plaque attached, commemorating Rev. T. Keys.
Modifications and dates:
Architectural Style: N/A Construction Year: 1914

History

Historical notes:
These gates were built in April 1914 in memory of Richard T. Keys, noted local and descendant of an area pioneer family, for recognising this service to the community, the common name of the gates, identified with the name of the Park with which they would originally have been associated.

Listings

Heritage Listing	Listing Title	Listing Number	Gazette Date	Gazette Number	Gazette Page
Local Environmental Plan	Muswellbrook LEP 2009	I124	17 Apr 09		
Heritage study					

Study details

Title	Year	Number	Author	Inspected by	Guidelines used

Muswellbrook Heritage Study	1996	Form date: 15th February 1996	EJE		No

References, internet links & images

Type	Author	Year	Title	Internet Links
Oral History			R. Tickle, Historian, Muswellbrook	

Note: internet links may be to web pages, documents or images.

Data source

The information for this entry comes from the following source:

Name:

Local Government

Database number:

2120150

File number:

MUSW/R040b

Return to previous page

Every effort has been made to ensure that information contained in the State Heritage Inventory is correct. If you find any errors or omissions please send your comments to the Database Manager.

Search results

Your search for:LGA: MUSWELLBROOK SHIRE COUNCIL

Search Again
Refine Search

did not find any records in our database.

If a site does not appear on the record it may still be affected by contamination. For example:

- Contamination may be present but the site has not been regulated by the EPA under the Contaminated Land Management Act 1997 or the Environmentally Hazardous Chemicals Act 1985.
- The EPA may be regulating contamination at the site through a licence or notice under the Protection of the Environment Operations Act 1997 (POEO Act).
- Contamination at the site may be being managed under the planning process.

More information about particular sites may be available from:

- The POEO public register
- The appropriate planning authority: for example, on a planning certificate issued by the local council under section 149 of the Environmental Planning and Assessment Act.

See What's in the record and What's not in the record.

If you want to know whether a specific site has been the subject of notices issued by the EPA under the CLM Act, we suggest that you search by Local Government Area only and carefully review the sites that are listed.

This public record provides information about sites regulated by the EPA under the Contaminated Land Management Act 1997, including sites currently and previously regulated under the Environmentally Hazardous Chemicals Act 1985. Your inquiry using the above search criteria has not matched any record of current or former regulation. You should consider searching again using different criteria. The fact that a site does not appear on the record does not necessarily mean that it is not affected by contamination. The site may have been notified to the EPA but not yet assessed, or contamination may be present but the site is not yet being regulated by the EPA. Further information about particular sites may be available from the appropriate planning authority, for example, on a planning certificate issued by the local council under section 149 of the Environmental Planning and Assessment Act. In addition the EPA may be regulating contamination at the site through a licence under the Protection of the Environment Operations Act 1997. You may wish to search the POEO public register

Search TIP

To search for a specific site, search by LGA (local government area) and carefully review all sites listed.

... more search tips

20 August 2020

Air Quality Index

Monday
24 August 2020
9 - 10 am (AEST)
Previous | Next | Select
Show data readings

VERY GOOD 0 - 33	GOOD 34 - 66	FAIR 67 - 99	POOR 100 - 149	VERY POOR 150 - 199	HAZARDOUS 200

25 50 75 100 125 150 175 200 225

Pollutants		Ozone O3	Ozone O3	Nitrogen dioxide NO2	Visibility NEPH	Carbon monoxide CO	Sulfur dioxide SO2	Particles PM10	Particles PM2.5	Site AQI	Regional AQI
Averaging Periods		1-hour average	rolling 4-hour average	1-hour average	1-hour average	rolling 8-hour average	1-hour average	1-hour average	1-hour average	highest level at the site	highest level for the region
Sydney East	Cook And Phillip	16	12	15	3	2	0	14	9	16	27
	Chullora	24	21	4	3	0	0	22	4	24	
	Earlwood	27	20	4	2			10	9	27	
	Macquarie Park	23	17	9	2	3	0	13	2	23	
	Randwick	24	21	5	4		0	14	0	24	
	Rozelle	27	24	2	1	1	0	8	6	27	
Sydney North-west	Parramatta North	23	11	6	2	2	0	23	6	23	37
	Prospect	27	14	3	1	1	0	10	8	27	
	Richmond	31	37	0	1		0	7	0	37	
	Rouse Hill	25	19	4	2	1	1	12	11	25	
	St Marys	30	24	0	1			6	1	30	
Sydney South-west	Bargo	28	36	0	1		0	10	3	36	38
	Bringelly	31	37	0	1		0	7	0	37	
	Camden	29	35	0	1	1		6	10	35	
	Campbelltown West	27	19	1	2	2	0	9	1	27	
	Liverpool	28	30	2	1	0	0	11	3	30	
	Oakdale	30	38	0	2			8	4	38	
Illawarra	Wollongong										33
	Kembla Grange	26	32	2	1			19	0	32	
	Albion Park Sth	27	33	0	1		0	10	0	33	
Lower Hunter	Newcastle	23	22	3	1	1	0	8	7	23	23
	Beresfield	22	21	2	1		0	11	0	22	
	Wallsend	22	23	3	2		0	13	8	23	
Central Coast	Wyong	29	29	1	2	1	0	19	0	29	29
Central Tablelands	Bathurst							5	6	6	6
	Orange				2			5	3	5	
Mid-north Coast	Coffs Harbour	26	26	4	2	3		4	1	26	34
	Port Macquarie	29	34	2	2	1	0	6	5	34	
Northern Tablelands	Armidale				3			2	0	3	3
North-west Slopes	Gunnedah	26	16	1				8	3	26	26
	Narrabri							12	12	12	
	Tamworth							8	0	8	
Southern Tablelands	Goulburn	29	36	1	4			6	4	36	36
South-west Slopes	Albury							6	0	6	15
	Wagga Wagga Nth							9	15	15	
Muswellbrook	Muswellbrook			1			0	14	0	14	14
Singleton	Singleton			2			0	16		16	16

NSW ALERTS

Updated hourly

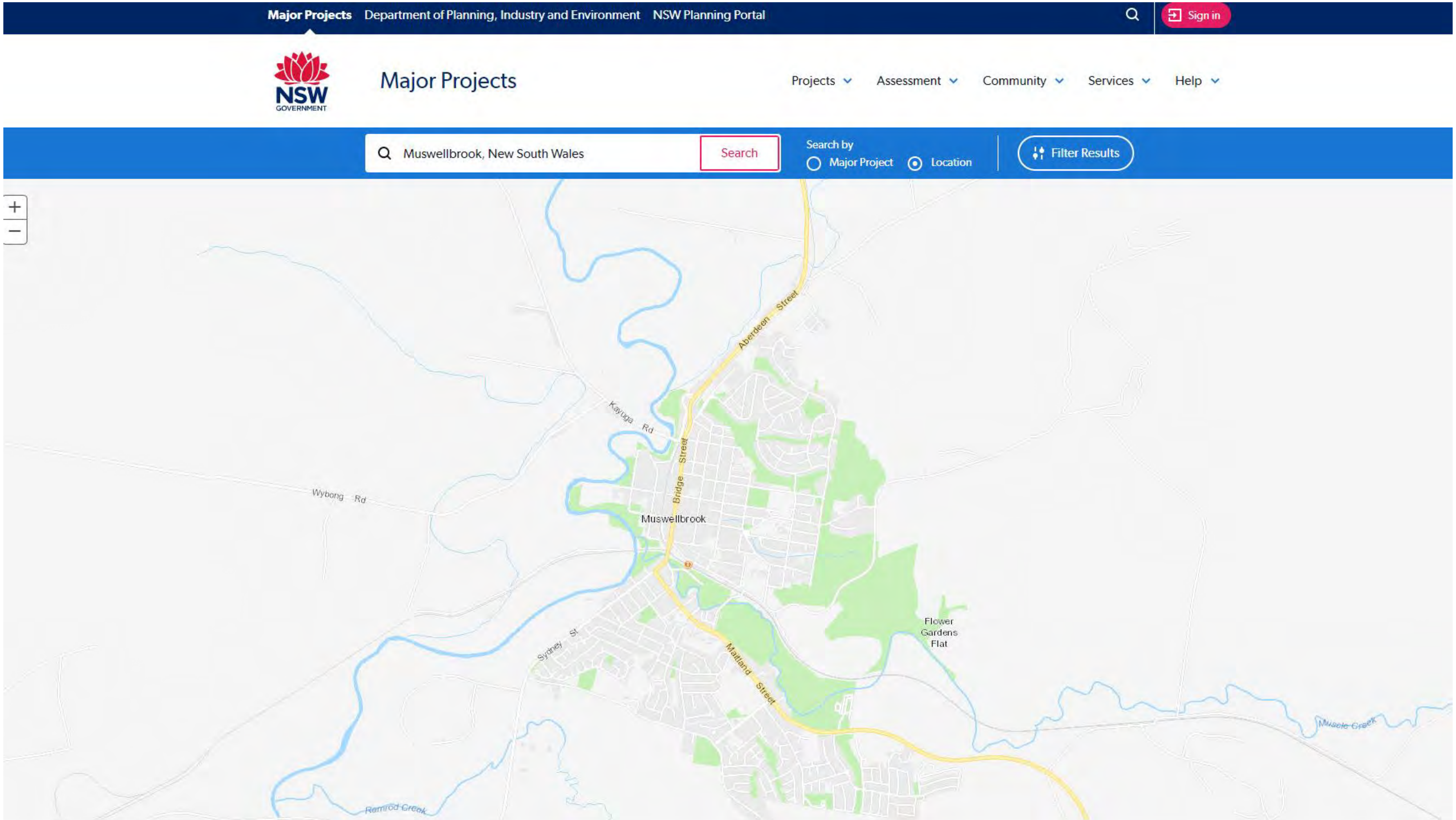
SYDNEY FORECAST

Mon 24 Aug 2020

Updated daily at 4:00pm

Gaps indicate that an instrument was not online for that period OR an average could not be calculated as there were not enough valid hourly data values OR that a pollutant is not measured at the site. Data from monitoring sites is collected, stored and shown in reports using Australian Eastern Standard time (AEST). Normally data for any hour should be available approximately 30 minutes later. However, during daylight saving, data is still collected and stored in AEST and will be presented with an apparent 90 minutes delay.

Major Projects



DIAL BEFORE YOU DIG www.1100.com.au

Job No 19833895

Phone: 1100
www.1100.com.au

Caller Details

Contact:	Ms Nadine Caff	**Caller Id:**	2277190	**Phone:**	0450677346
Company:	Cardno	**Mobile:**	Not Supplied	**Fax:**	Not Supplied
Address:	1/10 Denney Street Broadmeadow NSW 2292	**Email:**	nadine.caff@cardno.com.au		

Dig Site and Enquiry Details

WARNING: The map below only displays the location of the proposed dig site and does not display any asset owners' pipe or cables. The area highlighted has been used only to identify the participating asset owners, who will send information to you directly.

User Reference: Not Supplied
Working on Behalf of: Muswellbrook Shire Council

Enquiry Date:	**Start Date:**	**End Date:**
06/07/2020	23/08/2020	27/11/2020

Address:
Victoria Street
Muswellbrook NSW 2333

Job Purpose:	**Onsite Activity:**
Design	Planning & Design
Location of Workplace:	**Location in Road:**
Both	CarriageWay,Footpath,Nature Strip

- Check the location of the dig site is correct. If not submit a new enquiry.
- If the scope of works change, or plan validity dates expire, resubmit your enquiry.
- Do NOT dig without plans. Safe excavation is your responsibility. If you do not understand the plans or how to proceed safely, please contact the relevant asset owners.

Notes/Description of Works:

Your Responsibilities and Duty of Care

- The lodgement of an enquiry does not authorise the project to commence. You must obtain all necessary information from any and all likely impacted asset owners prior to excavation.
- If plans are not received within 2 working days, contact the asset owners directly & quote their Sequence No.
- ALWAYS perform an onsite inspection for the presence of assets. Should you require an onsite location, contact the asset owners directly. Please remember, plans do not detail the exact location of assets.
- Pothole to establish the exact location of all underground assets using a hand shovel, before using heavy machinery.
- Ensure you adhere to any State legislative requirements regarding Duty of Care and safe digging requirements.
- If you damage an underground asset you MUST advise the asset owner immediately.
- By using this service, you agree to Privacy Policy and the terms and disclaimers set out at **www.1100.com.au**
- **For more information on safe excavation practices, visit www.1100.com.au**

Asset Owner Details

The assets owners listed below have been requested to contact you with information about their asset locations within 2 working days. Additional time should be allowed for information issued by post. It is **your responsibility** to identify the presence of any underground assets in and around your proposed dig site. Please be aware, that not all asset owners are registered with the Dial Before You Dig service, so it is **your responsibility** to identify and contact any asset owners not listed here directly.
** Asset owners highlighted by asterisks ** require that you visit their offices to collect plans.
# Asset owners highlighted with a hash require that you call them to discuss your enquiry or to obtain plans.

Seq. No.	Authority Name	Phone	Status
99411628	Ausgrid	0249510899	NOTIFIED
99411630	NBN Co, NswAct	1800626329	NOTIFIED
99411627	PIPE Networks, Nsw	1800201100	NOTIFIED
99411626	Roads and Maritime Services	0288370285	NOTIFIED
99411629	Telstra NSW, Central	1800653935	NOTIFIED

END OF UTILITIES LIST

Indicative Plans

Issue Date:	06/07/2020
Location:	Victoria Street , Muswellbrook , NSW , 2333

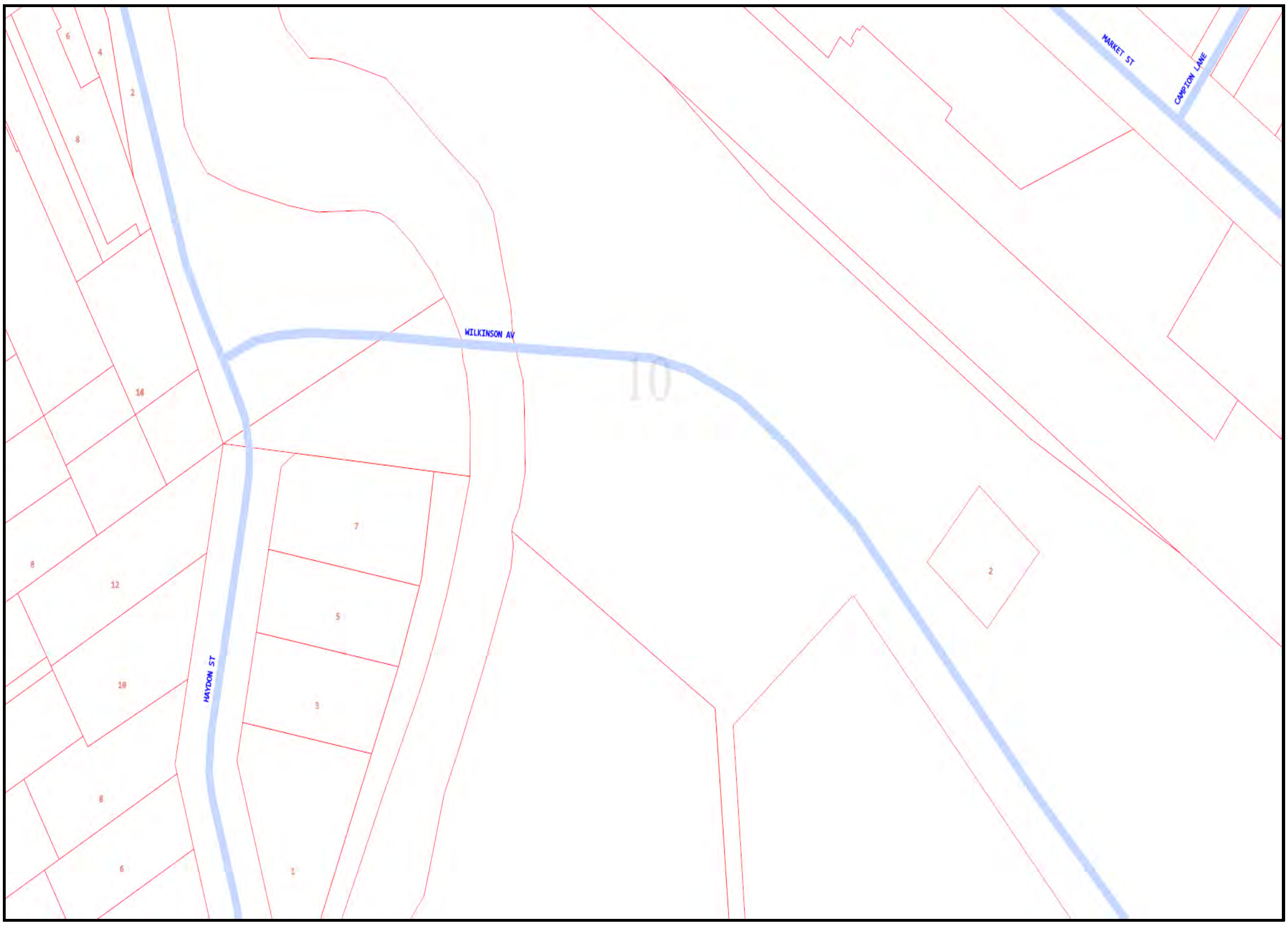
2	9	16	23
3	10	17	24
4	11	18	25
5	12	19	26
6	13	20	27
7	14	21	28

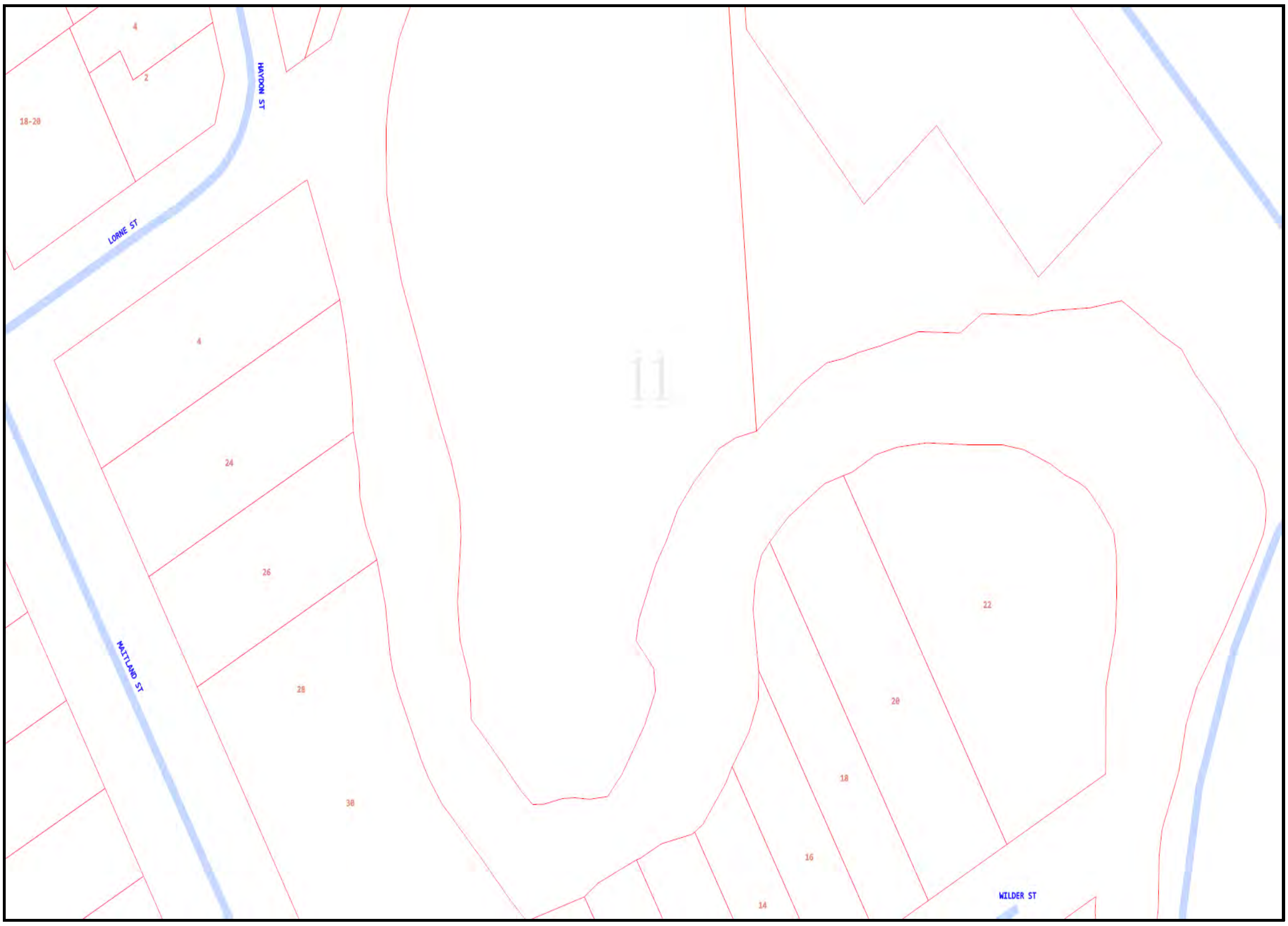
Level 11, 100 Arthur Street, North Sydney NSW 2060

Email info@nbn.com.au Web nbn.com.au

LEGEND

14	Parcel and the location
5	Pit with size "5"
2E	Power Pit with size "2E". Valid PIT Size: e.g. 2E, 5E, 6E, 8E, 9E, E, null.
	Manhole
	Pillar
2 PO – T- 25.0m P40 – 20.0m 5 9	Cable count of trench is 2. One "Other size" PVC conduit (PO) owned by Telstra (-T-), between pits of sizes, "5" and "9" are 25.0m apart. One 40mm PVC conduit (P40) owned by NBN, between pits of sizes, "5" and "9" are 20.0m apart.
2 10.0m 5 9	2 Direct buried cables between pits of sizes ,"5" and "9" are 10.0m apart.
5 9	Trench containing any INSERVICE/CONSTRUCTED (Copper/RF/Fibre) cables.
5 9	Trench containing only DESIGNED/PLANNED (Copper/RF/Fibre/Power) cables.
5 9	Trench containing any INSERVICE/CONSTRUCTED (Power) cables.
BROADWAY ST	Road and the street name "Broadway ST"
Scale	0 20 40 60 Meters 1:2000 1 cm equals 20 m


WILKINSON AV
HAYDON ST
MARKET ST
CAMPION LANE


HAYDON ST
LORNE ST
MAITLAND ST
WILDER ST
18-20
4
2
4
24
26
28
30
22
20
18
16
14


WILDER ST
FRANCIS ST
MAITLAND ST
GYARRAN ST

Response Cover Letter

Date: 06/07/2020

PIPE Networks
Level 17, 127 Creek St
Brisbane QLD 4000
Phone: +61 732339895
Fax: +61 732339880

To:

Ms Nadine Caff - Customer ID: 2277190
Cardno - Ms Nadine Caff
1/10 Denney Street
Broadmeadow
NSW
2292

Email: nadine.caff@cardno.com.au
Phone: 0450677346
Fax: Not Supplied
Mobile: Not Supplied

Dear Ms Nadine Caff

The following is our response to your Dial Before You Dig enquiry.

Assets Affected: SL, Soul

Sequence Number: 99411627

Location: Victoria Street
Muswellbrook
NSW
2333

Commencement Date: 23/08/2020

Please read over the attached documents for more information about your enquiry.

DISCLAIMER: *No responsibility/liability is taken by PIPE Networks for any inaccuracy, error, omission or action based on the information supplied in this correspondence.*

Note: *If the works fall in an area that adjacent to PIPE Networks infrastructure, a pre-inspection is required prior to commencement of works. Contact PIPE Networks to arrange an inspection time.* ***NO WORKS TO COMMENCE PRIOR TO INSPECTION.***

Level 17, PIPE Networks House, 127 Creek Street, Brisbane 4000
PH:(07) 3233 9895 FAX:(07) 3233 9880

Attention: Ms Nadine Caff
Fax: Not Supplied
DBYD Enquiry Number: 99411627

Date: 06/07/2020

Location: Victoria Street
Muswellbrook
NSW
2333

DBYD ENQUIRY RETURN:

PIPE Networks **DOES** own or operate telecommunications network infrastructure within the area detailed above.

The affected network **is contained in the PIPE Networks duct network** and can be found on **PIPE Networks** own network plans.

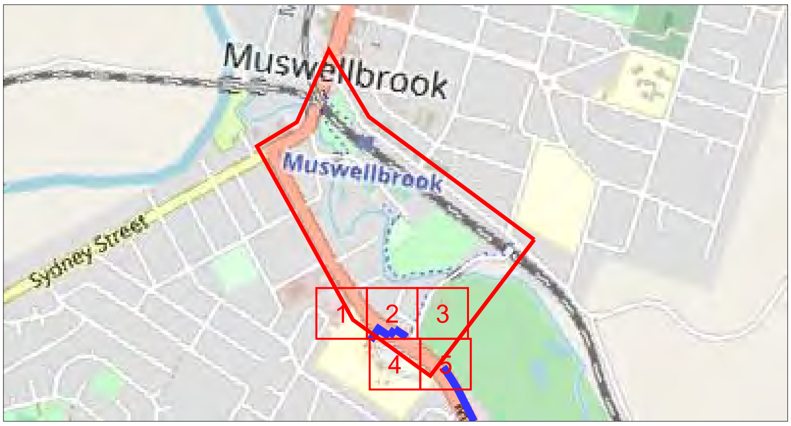
This network is vital to our operations and as such, it is critical that no works commence within the area until a PIPE Networks representative has contacted you.

A PIPE Networks representative will contact you within 24 hours to further discuss your intended works. If you do not hear from PIPE networks within 24hours please call us for assistance.

Due to continued network expansion, this network information can only be considered valid and accurate for 28 days from issue.

PIPE Networks will seek compensation for any damage to its network through negligence or ignorance of your duty of care.

Overview Map



0 0.2km **Scale: 1:** 19500

PIPE Networks (for information specific to this job only)
Ph (07) 3233 9895
Email: dbyd@pipenetworks.com

DISCLAIMER: *No responsibility/liability is taken by PIPE Networks for any inaccuracy, error, omission or action based on the information supplied in this correspondence.*

Note: *If the works fall in an area that adjacent to PIPE Networks infrastructure, a pre-inspection is required prior to commencement of works. Contact PIPE Networks to arrange an inspection time.* ***NO WORKS TO COMMENCE PRIOR TO INSPECTION.***

Only PIPE Networks' duct displayed.

For location of PIPE Networks cable in third-party duct, please contact third-party named on attached cover letter.

Enquiry Number: 99411627

Map Sheet: 1

Scale: 1:750

0 0.008km

LEGEND

DBYD Request Area **Asset**

Line Manhole

Area Duct

N

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Note: *If the works fall in an area that is adjacent to PIPE Networks infrastructure, a pre-inspection is required prior to commencement of works. Contact PIPE Networks to arrange an inspection time.* ***NO WORKS TO COMMENCE PRIOR TO INSPECTION.***

Only PIPE Networks' duct displayed.
For location of PIPE Networks cable in third-party duct, please contact third-party named on attached cover letter.

Enquiry Number: 99411627

Map Sheet: 2

Scale: 1:750

0 0.008km

LEGEND

DBYD Request Area
Line
Area

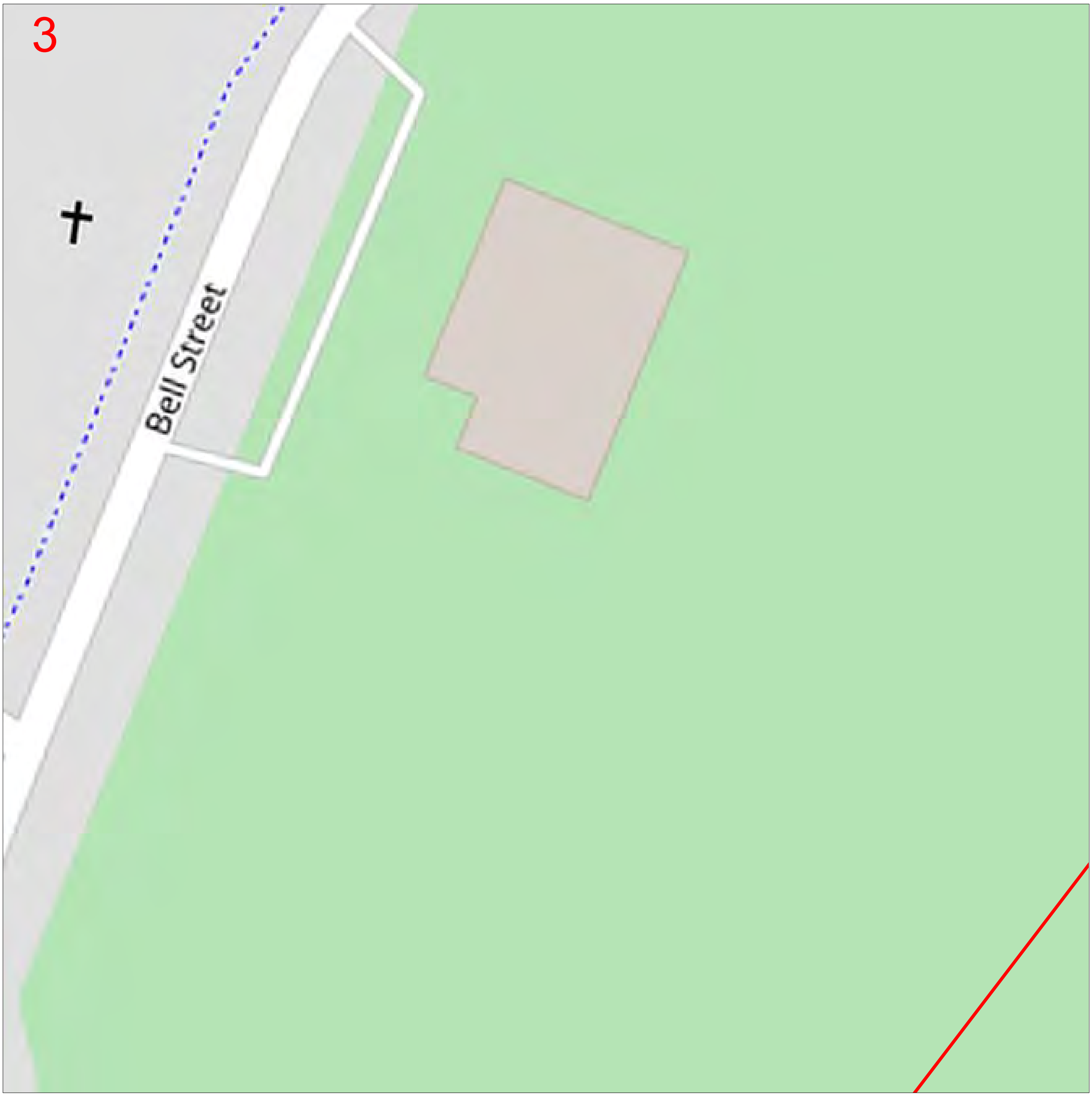
Asset
Manhole
Duct

N

Note: *If the works fall in an area that is adjacent to PIPE Networks infrastructure, a pre-inspection is required prior to commencement of works. Contact PIPE Networks to arrange an inspection time.* ***NO WORKS TO COMMENCE PRIOR TO INSPECTION.***

Only PIPE Networks' duct displayed.

For location of PIPE Networks cable in third-party duct, please contact third-party named on attached cover letter.



Enquiry Number: 99411627

Map Sheet: 3

Scale: 1:750

0 0.008km

LEGEND

DBYD Request Area		Asset	
	Line		Manhole
	Area		Duct

N

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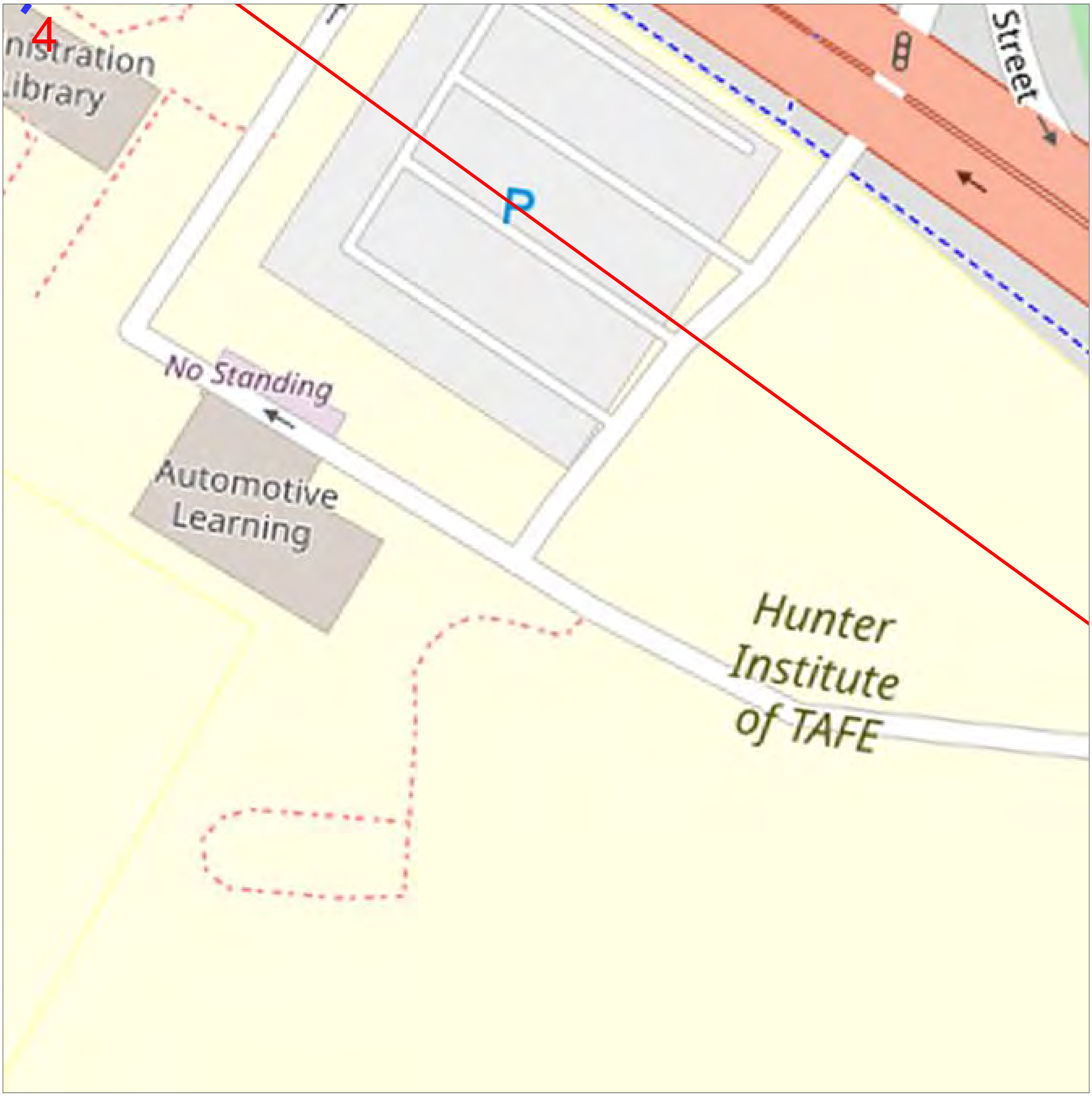
For location of PIPE Networks cable in third-party duct, please contact third-party named on attached cover letter.



Enquiry Number: 99411627

Map Sheet: 4

Scale: 1:750

0 0.008km

LEGEND

DBYD Request Area — Line, Area

Asset — Manhole, Duct

N

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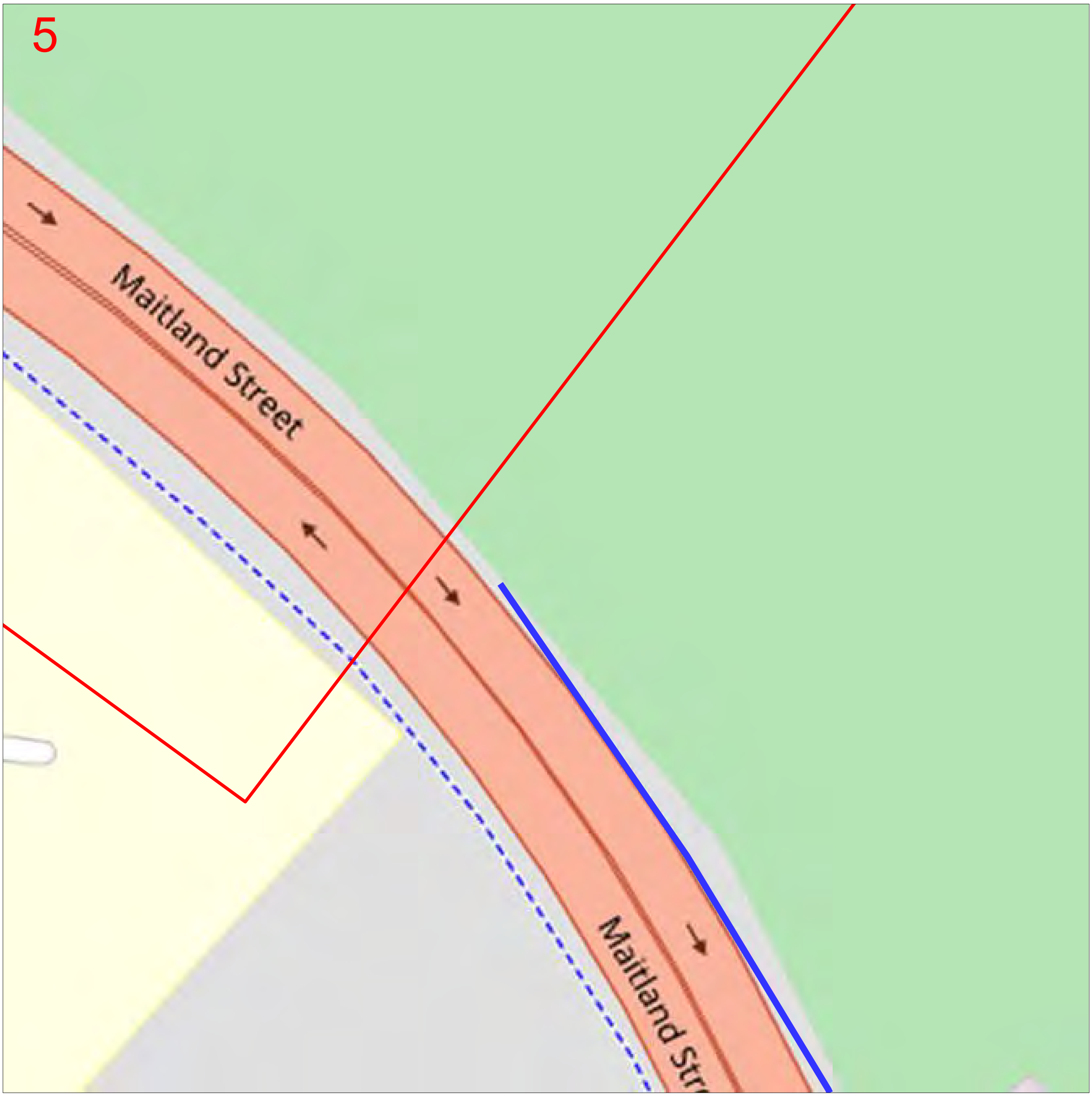
Note: *If the works fall in an area that is adjacent to PIPE Networks infrastructure, a pre-inspection is required prior to commencement of works. Contact PIPE Networks to arrange an inspection time.* ***NO WORKS TO COMMENCE PRIOR TO INSPECTION.***

Only PIPE Networks' duct displayed.

For location of PIPE Networks cable in third-party duct, please contact third-party named on attached cover letter.



Enquiry Number: 99411627

Map Sheet: 5

Scale: 1:750

0 0.008km

LEGEND

DBYD Request Area **Asset**

Line Manhole

Area Duct

N

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Note: *If the works fall in an area that is adjacent to PIPE Networks infrastructure, a pre-inspection is required prior to commencement of works. Contact PIPE Networks to arrange an inspection time.* ***NO WORKS TO COMMENCE PRIOR TO INSPECTION.***

If further information is required, please contact:
Ausgrid DBYD
Phone: (02) 4951 0899
Fax: (02) 4951 0729

Emergency Phone Number 131388

Underground Cable Location Search Advice

-- Ausgrid Assets Affected –

To:	Ms Nadine Caff Cardno 1/10 Denney Street Broadmeadow NSW 2292		
		Phone No:	0450677346
		Issue Date:	6/07/2020

In response to your enquiry, Sequence No: 99411628 the records of Ausgrid disclose that there **are** Ausgrid underground cables in the defined search location and relevant Ausgrid plans have been provided.

This search is based on the geographical position of the dig site as denoted in the Dial Before You Dig caller confirmation sheet and an overview is provided:

Address:	Victoria Street Muswellbrook NSW 2333
Job #:	19833895

Important

- All information provided to you is **ONLY VALID FOR 30 DAYS** from the date of issue
- You must keep Ausgrid plans on site during excavation works. If the people actually performing the excavation works do not know how to read and interpret Ausgrid's plans, then the work must be directed by a person who knows how to read and interpret plans.
- If you require a full size print of A0 plans and don't have the resources to do so please contact our office on 49510899 to request a hard copy to be posted. **Please allow 3 working days for delivery.**
- Please note you will ONLY receive portions of your search area that contain Ausgrid Underground Assets

YOU MUST READ AND UNDERSTAND THE *SUPPLEMENTARY MATERIAL* CONTAINED IN THIS ADVICE BEFORE PROCEEDING WITH ANY WORKS.

Summary of Supplementary Information:

Material	Purpose	Location
Important Information.pdf	Details important information	Attached
Working near Ausgrid Cables.pdf	Summary of NS156	Attached
COMN0119 How to Read Ausgrid Plans.pdf	Details how to read Ausgrid plans	Attached
SafeWork NSW "*Work near underground assets: Guide*"	To assist you in deciding appropriate measures to eliminate or control risks when working near underground assets.	Web Link [Click Here]
Ausgrid's Network Standard NS156	For important information for work near or around underground cables	Web Link [Click Here]
Ausgrid's Network Standard NS199	This Network Standard applies to specific work on Ausgrid Low Voltage Underground Assets and associated Hazards	Web Link [Click Here]
Working in Confined Spaces	For important information when working in confined spaces	Web Link [Click Here]

APPENDIX

C

ECOLOGICAL IMPACT STATEMENT

Ecological Impact Assessment

4B5BMuswellbrook Olympic Park Precinct

NE30034

Prepared for

Muswellbrook Shire Council

4 January 2021

Contact Information

Cardno (NSW/ACT) Pty Ltd
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St Leonards NSW 2065
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Document Information

Prepared for	Muswellbrook Shire Council
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Author(s):

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Effective Date 22/12/2020

Approved By:

Craig Blount
Senior Regional Principal

Date Approved 22/12/2020

Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
D01	5/08/2020	Draft preparation	Adriana Corona Mothe	Craig Blount
D02	10/08/2020	Final draft	Adriana Corona Mothe	Craig Blount
Rev 0	24/08/2020	Final for issue	Adriana Corona Mothe	Craig Blount
Rev 1	22/12/2020	Revised final for issue	Adriana Corona Mothe	Craig Blount

Executive Summary

Muswellbrook Shire Council (MSC) is proposing to upgrade and construct sports area and ancillary structures at the Muswellbrook Olympic Park Precinct, located in Muswellbrook NSW (the proposed project). Cardno NSW/ACT Pty Ltd (Cardno) was engaged by MSC to prepare an Ecological Impact Assessment (EIA) to inform a Review of Environmental Factors (REF) for Stage 1 of the proposed project. Cardno undertook desktop searches and a field survey to identify biodiversity values across the proposed project area and its immediate surroundings (the Biodiversity Study Area). The following was found with regards to biodiversity values:

> The proposed Stage 1 project footprint would be located on highly disturbed and cleared land, apart from the proposed bridge which would cross Muscle Creek and its riparian corridor;

> Native vegetation and suitable fauna and flora habitat are mostly absent from the project footprint due to historical clearing but there is some remnant vegetation along the riparian corridor of Muscle Creek, which runs along the southern and western edges of the Biodiversity Study Area;

> A total of 45 plant species were recorded across the Biodiversity Study Area, including 19 native species (42 %) and 26 exotic species (58 %);

> Threatened biodiversity predicted to occur within the 10 km locality from the proposed project site included four threatened ecological communities (TECs), nine threatened flora species, 37 threatened fauna species (including frogs, reptiles, mammals and birds) and 14 migratory bird species. No threatened ecological communities, however, were recorded within the Biodiversity Study Area. Two threatened species were observed within the Biodiversity Study Area: Grey-headed Flying-fox (listed as Vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) and River Red Gum *Eucalyptus camaldulensis* population in the Hunter Catchment (a BC Act listed Endangered Population). Also, records of seven microbat species exist within the Biodiversity Study Area.

The River Red Gums (*Eucalyptus camaldulensis)* that occur in the riparian corridor are planted but these would form part of the endangered population. None of these trees would be affected by the proposed project. A number of Grey-headed Flying-fox (listed as Vulnerable under the BC Act and EPBC Act) were observed roosting in a tree within the riparian corridor. It is not clear if this is a permanent or temporary roost site, but regardless, there is adequate buffer between the roost tree and the project footprint for the species to be unaffected apart from minor disturbance from construction noise.

Other threatened fauna that are known to occur or have potential to occur in the Biodiversity Study Area are generally highly mobile (e.g. birds and bats) and would move throughout the landscape as they forage and move between areas of higher quality habitat. None of the threatened fauna identified as occurring or having potential to occur within the Biodiversity Study Area were considered to be at risk of impact by the proposed project. These species would generally only transit through, forage in, or roost in Muscle Creek's riparian corridor, which would be unaffected by the project footprint apart from the areas where the new bridge would be constructed. Once the bridge was constructed, fauna would still be able to transit along the riparian corridor by travelling underneath the bridge or by flying over it.

Aquatic habitat in Muscle Creek has potential to be affected by the project as a consequence of construction of a bridge over the creek. The bridge would however, be designed as far as practicable, to avoid impacts to hydrology, instream ecology and riparian habitat. Notwithstanding this, given the potential for instream construction activity it would be precautionary to consult with DPIE (Fisheries) in regard to the need for a part 7 permit for dredging (Section 200 of the FM Act) or for the potential obstruction of fish passage (Section 219 of the FM Act).

During construction of the bridge, an Erosion and Sediment Control Plan will be implemented to ensure that the water quality of Muscle Creek is not impacted. According to *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and* Management (2013 update) development controls at the bridge construction site should include as a minimum, erosion and sediment controls during construction and scour protection for the operational phase as required. Following the completion of the works, riparian areas will be revegetated with native species. Species selection is to consider those present in the riparian areas of Muscle Creek.

The proposed project would avoid impacts to River Red Gum trees and other threatened entities and mitigation measures have been proposed to minimise potential impacts to instream and riparian habitats of Muscle Creek. Based on the avoid and minimise impact approach, it is concluded that the proposed Stage 1 of the Muswellbrook Olympic Park Precinct is unlikely to have significant effects on biodiversity values within the Biodiversity Study Area.

Terms and Abbreviations

Abbreviation	Description
AOBV	Areas of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
Bio Act	NSW *Biosecurity Act 2015*
BoM	Bureau of Meteorology
Cardno	Cardno (NSW/ACT) Pty Ltd
CEMP	Construction Environmental Management Plan
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DPIE	NSW Department of Primary Industry and Environment
DoEE	Commonwealth Department of Environment and Energy (now called DAWE)
DPIE	NSW Department of Planning, Industry and Environment
EIA	Ecological Impact Assessment
EP&A Act	NSW *Environmental Planning & Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FM Act	NSW *Fisheries Management Act 1994*
KFH	Key Fish Habitat
KTP	Key Threatening Processes
LGA	Local Government Area
LoOR	Likelihood of Occurrence
MNES	Matters of National Environmental Significance
NPWS	NSW National Parks and Wildlife Service
OEH	NSW Office of Environment and Heritage (now DPIE)
PCT	Plant Community Types
PMST	Protected Matters Search Tool
RCE	Riparian, channel and environment inventory for small streams
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
TEC	Threatened Ecological Community
TSC Act	NSW *Threatened Species Conservation Act 1995* (replaced by the BC Act)
WoNS	Weed of National Significance

Table of Contents

Appendices

Tables

Figures

1 Introduction

1.1 Background

Muswellbrook Olympic Park is a sports and entertainment area within the suburb of Muswellbrook, NSW (see **Figure 1-1**). Muswellbrook Shire Council (MSC) seeks to upgrade accessibility and improve amenity services at the Muswellbrook Olympic Park Precinct (OPP). MSC will deliver the OPP in stages and priority projects were identified as part of the project's public exhibition late 2018. Cardno was engaged by MSC to prepare an Ecological Impact Assessment to inform the Review of Environmental Factors (REF) for implementation works for Stage 1 Structure Plan within the Olympic Park Master Plan (2018).

1.2 Description of the Proposed Project.

Stage 1 Structure Plan within the Olympic Park Master Plan includes:

- General Precinct Upgrades:
  - Upgrade of Wilkinson Avenue (from current entry at Hayden Street to proposed exit at Wilder Street). This will include intelligent lighting, new pedestrian crossing, shared path, bus drop-off only zones;
  - New B1 carpark for 44 spaces; and
  - Construction of a new bridge over Muscle Creek connecting Olympic Park (Wilkinson Avenue) to Wilder Street:
    - Likely designed to be a single span super-T bridge with piles, but not in waterway;
    - Piles would located on each bank of Muscle Creek, running parallel to the banks for the width of the bridge and encroach into the waterway on each bank for some water levels:
    - Piles would be bored and include a concrete headstock.
    - Some groundwater may be encountered during piling.
- Rugby League Precinct:
  - Field improvements and drainage to Fields 1 and 2;
  - Irrigation and upgrades to Field 3. Field 3 is to be used for touch football and training, and is proposed as a public kick about space;
  - 1,800 mm high palisade fence to enclose Fields 1 and 2; and
  - New amenities building including:
    - Two change rooms
    - Storage for velodrome
    - Lift/stair access to multi-function room above.
- Ron King Velodrome:
  - New intelligent lighting to allow for night training and competition;
  - New fencing to secure the track;
  - Removal of storage facility and derelict brick structure; and
  - New storage area for the Velodrome to be incorporated into the new amenities building located within the Rugby League Precinct.

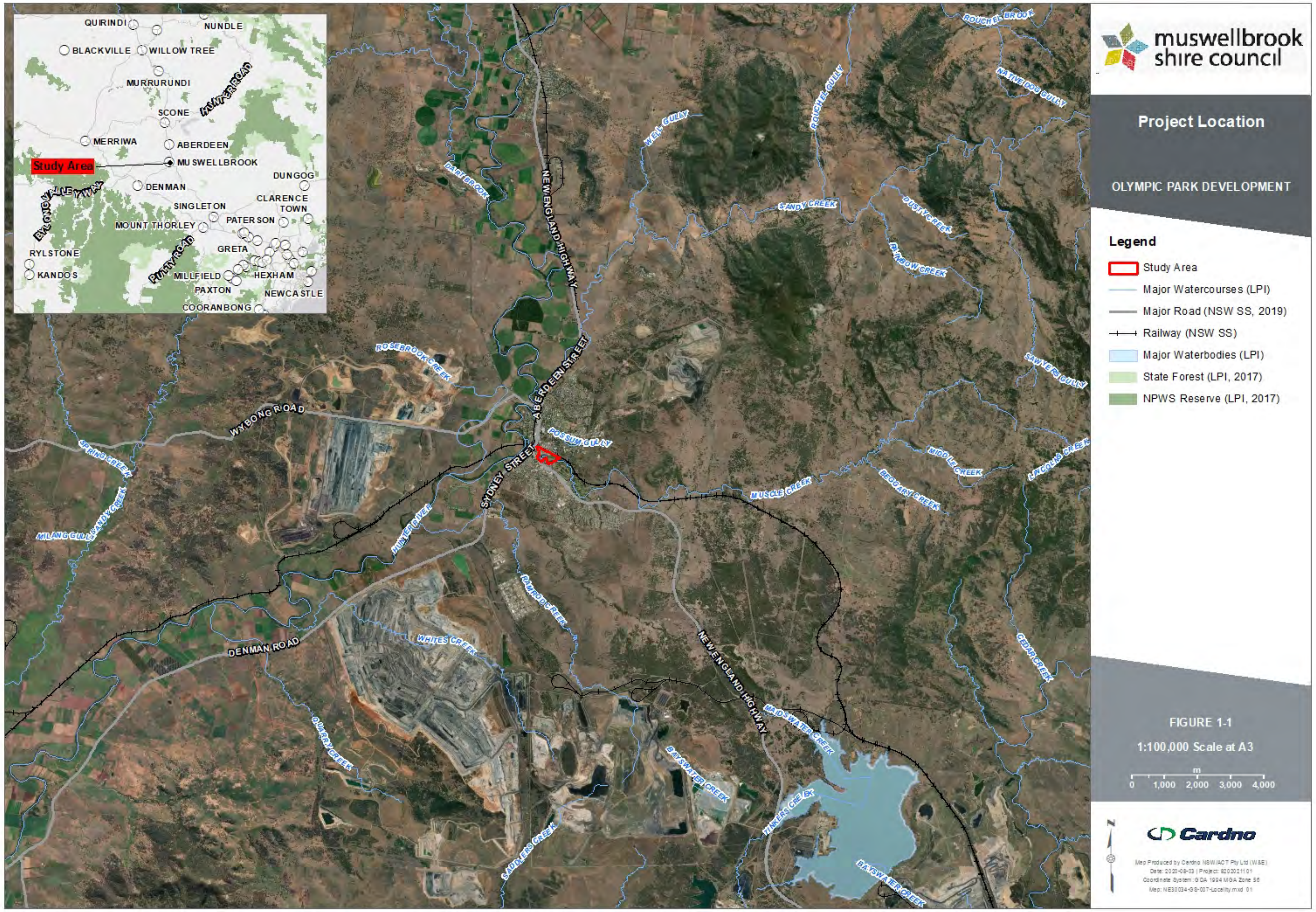

Figure 1-1 Olympic Park Precinct Location

1.3 Purpose of the Ecological Impact Assessment

The purpose of this EIA is to inform the REF with regards to environmental impacts likely to arise as result of the proposed project. The objectives of the EIA are to:

> Identify the presence or likely presence of any threatened species, population or Threatened Ecological Communities (TECs) listed under the NSW *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act) and/or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in the Biodiversity Study Area;

> Determine whether the proposed project would have a significant impact on any identified listed entity; and

> Make recommendations to prevent, mitigate and/or minimise any potential impacts to native flora, fauna and ecological communities.

1.4 Biodiversity Study Area

The Biodiversity Study Area is approximately 16 ha of land located between the western bank of Muscle Creek and the limit of the railway corridor (see **Figure 1-2**). It includes portions of Wilkinson Avenue and Bell Street.

Figure 1-2 Biodiversity Study Area Layout

1.5 Legislative Requirements

This report presents an assessment of the flora and fauna values present on the Biodiversity Study Area. It addresses the following specific legislative planning requirements relating to flora and fauna:

> Threatened species, populations and ecological communities listed under the BC Act; and

> Nationally listed threatened species, populations and ecological communities listed under the EPBC Act.

This report also considers the following legislative instruments:

> NSW *Biosecurity Act 2015* (Bio Act);

> NSW *Fisheries Management Act 1994* (FM Act); and

> NSW State Environmental Planning Policy (Koala Habitat Protection) 2020.

2 Methodology

2.1 Database Searches and Literature Review

Prior to inspecting the Biodiversity Study Area, Cardno ecologists undertook a desktop study that included a review of:

> Existing vegetation mapping as available in NSW BioNet Vegetation Information System for a 10 km locality surrounding the Biodiversity Study Area;

> Local threatened species records within the NSW BioNet Atlas for a 10 km locality surrounding the Biodiversity Study Area;

> Relevant Threatened Ecological Community (TEC) description and assessment guidelines (DEC 2004; DPIE 2020);

> Predicted Matters of National Environmental Significance (MNES), including threatened species, threatened ecological communities and migratory species as per the Commonwealth's Protected Matters Search Tool (PMST) within a 10 km locality surrounding the Biodiversity Study Area;

> NSW DPIE Biodiversity Values Map and Threshold Report for the Biodiversity Study Area;

> Review of Outstanding Biodiversity Values under the BC Act;

> NSW Department of Primary Industries (DPI) threatened freshwater fish indicative distribution mapping;

> The NSW DPI threatened species database; and

> Sensitive ecological sites and conservation areas protected by local, State and Commonwealth planning instruments.

2.2 Field Surveys

Table 2-1 describes survey methods and their objectives.

Table 2-1 Surveys conducted

Group	Survey Type	Survey Method and Objectives
Terrestrial Ecology		
Vegetation	Random Meander Transect (RMT); and Rapid Biodiversity Assessment (RBA)	A random meander transect was undertaken across the Biodiversity Study Area to ground-truth vegetation mapping. Vegetation ground-truthing consisted of: ▪ Preparation of a field map showing existing vegetation mapping. Field map was prepared as a hard copy and electronic using the ArcGIS application Collector; ▪ A RMT was walked and rapid biodiversity assessment points (RBA) collected. A RBA point consisted of collecting a geographic reference point (e.g. photo-point in Collector and/or waypoint with a Geographic Positioning System (GPS)), followed by collection of biodiversity values notes to: – Identify biodiversity values at the point, including the presence of native vegetation (including Threatened Ecological Communities (TEC)), threatened flora and fauna species and habitat for fauna; – Allocate native vegetation to a Plant Community Type (PCT). In NSW, and in accordance with the Vegetation Information System (VIS), native vegetation communities are allocated to a given PCT. A PCT identification number (e.g. PCT 1081) refers to a specific vegetation community within a given vegetation formation and class; and – Assess the general condition of the point in terms of disturbance and/or condition. The field data was used to generate an updated map of the Biodiversity Study Area.
Flora and Fauna Species	Opportunistic sightings	Opportunistic sightings of flora and fauna were recorded.

Group	Survey Type	Survey Method and Objectives
Fauna Habitat	RMT	General fauna habitat assessment was undertaken along RMT. The availability and quality of habitat within the Biodiversity Study Area was assessed with respect to the following factors: ▪ Structural and floral diversity; ▪ Diversity and extent of habitat types; ▪ Habitat connectivity, including continuity with similar habitats within the Biodiversity Study Area, and adjacent areas via habitat corridors; ▪ Location and utilisation of key habitat features including tree hollows, water bodies, caves and crevices and rocky areas; ▪ Degree of disturbance and degradation evident from visual inspections; and ▪ Topographic features such as aspect and slope. Fauna occupation was assessed by collecting: ▪ Direct fauna habitat evidence: opportunistic records of fauna sightings and fauna habitat features such as creeks, hollow-bearing trees, caves, rocky sites, bird nests, culverts, etc.; and ▪ Indirect fauna habitat evidence: recording scats, nests, burrows, and other incidental evidence of fauna occupation.
Threatened Species	Opportunistic sightings in RMT	Threatened species predicted to occur within the Biodiversity Study Area as per the BioNet Atlas and PMST report were considered for opportunistic survey by: ▪ Adding threatened species sightings to the field map; ▪ Preparing a threatened species profile summary (e.g. description from PlantNet, description as per the species' profile in the Threatened Biodiversity Data Collection (TBDC)) and based on ecologists' experience; and ▪ Undertaking a search in areas where threatened species were predicted to occur.
Targeted Flora Surveys	Targeted Surveys	Targeted searches for threatened flora and fauna species identified in the desktop review as potentially occurring within the project Biodiversity Study Area, and their habitat. In particular, *Eucalyptus camaldulensis* (River Red Gum) which forms part of an endangered population, is known to occur in the local area.
Aquatic Ecology		
Aquatic Habitat Assessment		Aquatic habitat assessment along RMT consisted of descriptions of physical habitat including visual assessment of streambed composition, aquatic and riparian vegetation and evidence of disturbance (e.g. dumping and unauthorized tree felling or vegetation removal) within Muscle Creek riparian area.
Aquatic Flora and Fauna	Opportunistic sightings	Opportunistic sightings of aquatic fauna in creeks within the Biodiversity Study Area.

2.3 Survey Limitations

Snapshot surveys as undertaken during this biodiversity study do not account for temporal variation. Given the short period of time spent on site, the detection of certain species and ecological values may be affected by:

> Seasonal migration (particularly migratory birds);
> Seasonal flowering periods (some species are cryptic and are unlikely to be detected outside of the known flowering period);
> Seasonal availability of food, such as blossoms for some fauna;
> Weather conditions during the survey period (some species may go through cycles of activity related to specific weather conditions, for example some microchiropteran bats (microbats), reptiles and frogs can be inactive during cold weather); and

> Species life-cycle (cycles of activity related to breeding).

These potential limitations have been addressed by applying the precautionary principle in cases where the survey methodology may have given a false negative result (e.g. a species that could reasonably be expected to occur, based on previous records and available habitat, was not observed). All species have been assessed on the basis of the presence of suitable habitat and the likely significance of that habitat to support a viable local population.

3 Results

3.1 Database Searches and Literature Review

3.1.1 BioNet Atlas Database

The results from the BioNet Atlas database searches indicated that 46 threatened species have been recorded within 10 km of the Biodiversity Study Area, including one reptile, 22 birds, 14 mammals and nine flora species (**Appendix A**: **Table A1-1**).

Nine threatened species have been recorded within the Biodiversity Study Area (see **Figure 3-1**), including:

> River Red Gum (*Eucalyptus camaldulensis*);

> Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);

> Eastern Coastal Free-tailed Bat (*Micronomus nofrokensis*);

> Little Bent-winged Bat (*Miniopterus australis*);

> Large Bent-winged Bat (*Miniopterus orianae oceanensis*);

> Southern Myotis (*Myotis macropus*);

> Greater Broad-nosed Bat (*Scoteanax rueppellii*);

> Eastern Cave Bat (*Vespadelus troughtoni*); and

> Grey-headed Flying-fox (*Pteropus poliocephalus*).

Figure 3-1 BioNet Atlas records of threatened species

3.1.2 Protected Matters Search Tool

The results of Commonwealth EPBC Act Protected Matters Search Tool (PMST) indicated that a total of four MNES are predicted to occur within the Biodiversity Study Area as listed in **Table 3-1**.

See **Appendix B** for the full PMST report.

Table 3-1 PMST's predicted Matters of National Environmental Significance (MNES)

<table>
<tr><th>MNES</th><th>PMST predicted</th><th>Applicability to Biodiversity Study Area</th></tr>
<tr><td>World Heritage Places</td><td>None</td><td>NA</td></tr>
<tr><td>National Heritage Places</td><td>None</td><td>NA</td></tr>
<tr><td>Wetlands of International Importance</td><td>One wetland of international importance was predicted to occur:
▪ Hunter Estuary Wetlands</td><td>Hunter Estuary Wetlands are located in Kooragan NSW at approximately 103 km south-east from the Biodiversity Study Area.
No further assessment is required.</td></tr>
<tr><td>Great Barrier Reef Marine Park</td><td>None</td><td>NA</td></tr>
<tr><td>Commonwealth Marine Area</td><td>None</td><td>NA</td></tr>
<tr><td>Threatened Ecological Communities (TECs)</td><td>Four (4) TECs were predicted to occur:
▪ Central Hunter Valley Eucalypt Forest and Woodland (CEEC);
▪ Hunter Valley Weeping Myall (Acacia pendula) Woodland (CEEC);
▪ Lowland Rainforest of Subtropical Australia (CEEC); and
▪ White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (CEEC).</td><td>Further assessment is presented in Section 4.3.</td></tr>
<tr><td>Threatened Species</td><td>A total of 31 threatened species were predicted to occur within the 10 km locality as per Table below.
<table>
<tr><th>Group</th><th colspan="3">Number of species predicted</th></tr>
<tr><th></th><th>Vulnerable</th><th>Endangered</th><th>Critically Endangered</th></tr>
<tr><td>Birds</td><td>3</td><td>2</td><td>4</td></tr>
<tr><td>Frogs</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Mammals</td><td>7</td><td>1</td><td></td></tr>
<tr><td>Plants</td><td>4</td><td>3</td><td>2</td></tr>
<tr><td>Reptiles</td><td>2</td><td></td><td></td></tr>
</table></td><td>Further assessment of threatened species was undertaken as shown in Section 4.3.</td></tr>
<tr><td>Migratory Species</td><td>Fourteen migratory species were predicted to occur within the 10 km locality.</td><td>Further assessment of migratory species was undertaken as shown in Section 4.3.</td></tr>
</table>

3.1.3 Aquatic Threatened Species Indicative Mapping

Muscle Creek, a tributary of the Hunter River, runs west-east on the southern portion of the Biodiversity Study Area. Review of the DPI's threatened freshwater fish indicative distributions map indicates that Muscle Creek is not known habitat for threatened fish.

The Hunter River is mapped as habitat for the Purple Spotted Gudgeon (*Mogurnda adspersa*) and Darling River Hardyhead (*Craterocephalus amniculus*), which are listed as an Endangered species and Endangered Population, respectively, under the FM Act and the EPBC Act.

3.1.4 Biodiversity Values Map

Review of DPIE's Biodiversity Values Map showed that no biodiversity values are mapped within the Biodiversity Study Areas per 30 June 2020.

3.1.5 Areas of Outstanding Biodiversity Values

A search in DPIE's register of declared Areas of Outstanding Biodiversity Values (AOBV) under the BC Act indicated that no AOBV are mapped within the Biodiversity Study Area.

3.1.6 Koala Habitat Protection

State Environmental Planning Policy (Koala Habitat Protection) 2020 (Koala SEPP) provides Council with an updated definition of core koala habitat. DPIE have developed two key spatial layers to help identify core koala habitat. The key categories are:

> **Koala Development Application Map** – used to identify areas that have highly suitable koala habitat and that are likely to be occupied by koalas. On land where there is no approved Koala Plan of Management, Council will need to consider the development application requirements in the Guideline.

> **Site Investigation Area for Koala Plans of Management Map** – identifies the land Councils are to focus their survey efforts on, particularly when identifying core koala habitat.

As shown in **Figure 3-1**, the Biodiversity Study Area has been identified as part of the Koala Development Application Map and within the Site Investigation Area for Koala Plans of Management.

Further discussion of koala and koala habitat is provided in **Section 3.3.3.3**.

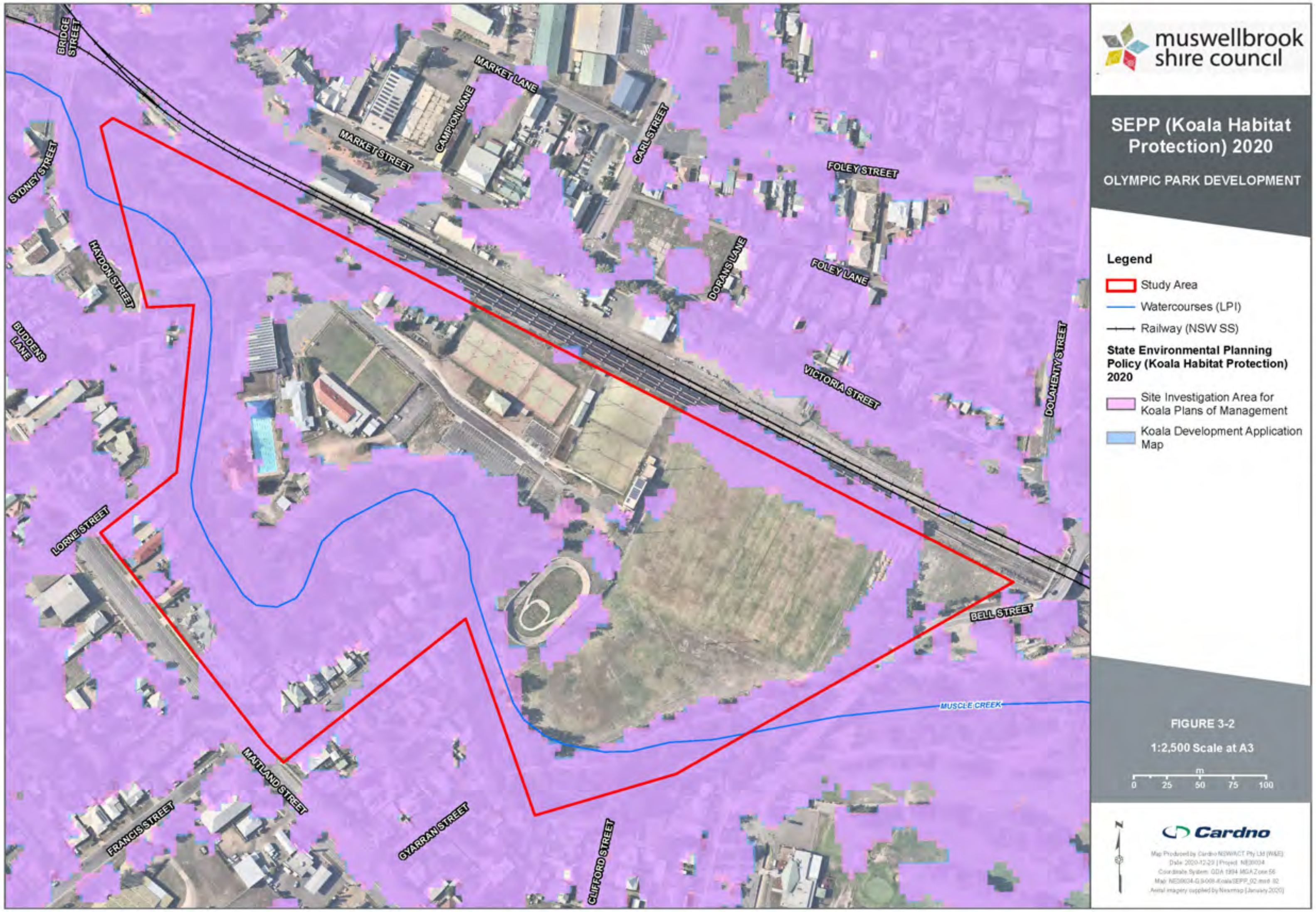

Figure 3-2 SEPP (Koala Habitat Protection) 2020

3.1.7 Local Vegetation Mapping

The State Vegetation Type Map – Greater Hunter (VIS ID 4894) vegetation mapping was interrogated with regards to existing vegetation at the Biodiversity Study Area. A total of twenty-nine Plant Community Types (PCTs) were expected to occur within the 10 km locality surrounding the Biodiversity Study Area as listed in **Table 3-2**. Only one PCT was predicted to occur within the Biodiversity Study Area (see **Figure 3-3**), PCT 485 'River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion).

Table 3-2 PCTs as per the State Vegetation Type Map – Greater Hunter (VIS ID 4894) Mapping.

PCT ID	PCT Name	TEC Associated
PCT 42	River Red Gum / River Oak riparian woodland wetland in the Hunter Valley	Yes
PCT 484	Derived tall spear grass Plains Grass? grassland on mainly basalt hills of the Liverpool Plains, Liverpool Range and in the upper Hunter Valley (Merriwa district), south-eastern Brigalow Belt South Bioregion	Yes
PCT 485	**River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)**	**No**
PCT 618	White Box x Grey Box – red gum – Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley	Yes
PCT 796	Derived grassland of the NSW South Western Slopes	Yes
PCT 1176	Slaty Box – Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	Yes
PCT 1543	Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley	Yes
PCT 1584	White Mahogany – Spotted Gum – Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	No
PCT 1598	Forest Red Gum grassy open forest on floodplains of the lower Hunter	Yes
PCT 1600	Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub-grass open forest of the lower Hunter	Yes
PCT 1601	Spotted Gum – Narrow-leaved Ironbark-Red Ironbark shrub – grass open forest of the central and lower Hunter	Yes
PCT 1602	Spotted Gum – Narrow-leaved Ironbark shrub – grass open forest of the central and lower Hunter	Yes
PCT 1603	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	Yes
PCT 1604	Narrow-leaved Ironbark – Grey Box – Spotted Gum shrub – grass woodland of the central and lower Hunter	Yes
PCT 1605	Narrow-leaved Ironbark – Native Olive shrubby open forest of the central and upper Hunter	Yes
PCT 1606	White Box – Narrow-leaved Ironbark – Blakelys Red Gum shrubby open forest of the central and upper Hunter	Yes
PCT 1607	Blakely's Red Gum – Narrow-leaved Ironbark – Rough-barked Apple shrubby woodland of the upper Hunter	No
PCT 1608	Grey Box - Grey Gum - Rough-barked Apple - Blakelys Red Gum grassy open forest of the central Hunter	Yes
PCT 1611	Narrow-leaved Ironbark - Black Cypress Pine shrub - grass woodland upper Hunter and northern Wollemi	Yes
PCT 1691	Narrow-leaved Ironbark – Grey Box grassy woodland of the central and upper Hunter	Yes
PCT 1692	Bull Oak grassy woodland of the central Hunter Valley	Yes

PCT ID	PCT Name	TEC Associated
PCT 1693	Yellow Box - Rough-barked Apple grassy woodland of the upper Hunter and Liverpool Plains	Yes
PCT 1708	Rock outcrops shrublands complex of the lower North Coast	No
PCT 1731	Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	Yes
PCT 1748	Grey Box grassy open forest of the Central and Lower Hunter Valley	No
PCT 1766	Weeping Myall – Plains Grass grassy woodland of the Brigalow Belt South	Yes
PCT 1881	Western Hunter Flats Rough-barked Apple Forest	No
PCT 1895	Sydney Hinterland Grey Myrtle Dry Rainforest	No
NA	Cleared Land	No

NB. Bold text indicates predicted to occur within the Biodiversity Study Area

Figure 3-3 PCTs in the Biodiversity Study Area as per the State Vegetation Type Map – Upper Hunter (VIS ID 4894)

3.1.8 Previous Studies

An Ecological Impact Assessment was previously undertaken for a small portion of the Biodiversity Study Area (Cardno 2019). Cardno (2019) identified presence of one threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*), and seven vulnerable microbat species were identified as possibly present based on call data analysis. These included Eastern Bentwing-bat (*Minopterus schreibersii oceanensis*), Easter Cave Bat (*Vespadelus throughtoni*), Eastern Freetail-bat (*Mormopterus nofrolkensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Little Bentwing-bat (*Miniopterus australis*) and Southern Myotis (*Myotis macropus*).

3.2 Field Survey and Effort

The field survey was undertaken by Cardno's Ecologist, Dr Adriana Corona Mothe, on the 9 and 10 July 2020. A summary of field survey effort and environmental conditions are presented in **Table 3-3** and **Table 3-4**, respectively. Survey effort tracks are shown in **Figure 3-1**.

Table 3-3 Field Survey Effort

Date	Survey Period	Hours	Survey Method	Survey Effort
9/07/2020	10:30 – 14:30	4	RMT, RBA, flora, fauna and habitat observations.	4 hours
9/07/2020	17:40 – 18:40	1	Spotlighting	1 hours
10/07/2020	8:00 – 8:30	0.5	RMT, RBA, flora, fauna and habitat observations	0.5 hours
			Total Effort	**5.5 hours**

Table 3-4 Environmental Conditions on the day of survey

Date	Temperature (°C) (Minimum – Maximum)	Rainfall (mm)	Other observations
9/07/2020	1.9 – 17.2	0	Wind at 10:30am 54 km/h, overcast, foggy
10/07/2020	5.4 – 16.4	0	Clear

3.3 Terrestrial Ecology

3.3.1 Ground-truthed Vegetation

The Biodiversity Study Area consisted predominantly of cleared land with some remnant vegetation observed consistent with the desktop results. **Table 3-5** summarises the type and extent of vegetation communities and cleared areas within the Biodiversity Study Area.

The vegetation communities are shown in **Figure 3-4**.

Table 3-5 Vegetation communities and cleared areas within the Biodiversity Study Area

PCT ID	PCT Name	Condition	Area (ha)
Plant Community Types (PCTs)			
485	River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)	Low	1.05
485	River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)	Very Low	1.85
Miscellaneous Vegetated Areas			
-	Mix of Planted/Remnant Vegetation	N/A	0.61
-	Planted natives	N/A	0.18
-	Planted exotics	N/A	0.31
-	Exotic grasslands	N/A	5.49
Cleared Land			
-	Cleared Land		6.7
		Total Area (ha)	**16.19**

Description of vegetation communities present within the Biodiversity Study Area are provided in the sub-sections below.

3.3.1.2 River Oak Woodland

River Oak Woodland refers to PCT 485 ‘River Oak riparian grassy tall woodland of the western Hunter Valley (Brigalow Belt South Bioregion and Sydney Basin Bioregion)’. It is the vegetation with the highest biodiversity value within the Biodiversity Study Area.

PCT 485 was present along Muscle Creek riparian corridor and consisted of remnant trees mixed with non-characteristic species of this vegetation community. Remnant tree species included Forest Red Gum (*Eucalyptus tereticornis*) and River Oak (*Cassuarina cunninghamiana*) and no naturally occurring shrub or ground-cover was present. The presence of large trees such as Silk Oak (*Grevillea robusta*), Sydney Blue Gum (*Eucalyptus saligna*) and Canary Island Date Palm (*Phoenix canariensis*) suggest that plantings in the riparian corridor have occurred in the past. Other species present in this riparian vegetation community included planted native and exotic species.

PCT 485 was present in two overall conditions as follows:

> River Oak Woodland in Low condition: This vegetation community was present along Muscle Creek’s riparian corridor, mainly in the riparian zone along the northern edge of the creek. The area consists of remnant trees characteristic of PCT 485 with non-characteristic canopy, shrub and ground cover (see **Plate 1** and **Plate 2**). Historical planting and current revegetation works are evident in this vegetated area, which results in the vegetation community having a structure and species composition different to those expected in the naturally occurring PCT. Erosion and sedimentation works were also evident in this vegetation zone, which in addition to revegetation works has resulted in a vegetation community with only the remnant trees being characteristic of PCT 485. Notwithstanding, this PCT has value with regards of native species biodiversity and structural complexity (e.g. strata). Although not meeting the expected structure of PCT 485, this vegetation zone is rated as having low to moderate condition due to its low cover of weeds and due to revegetation works increasing its overall ecological value in the riparian corridor.

> River Oak Woodland in Very Low condition: This was mainly present along Muscle Creek’s southern riparian corridor (see **Plate 3** and **Plate 4**). The vegetation included remnant trees characteristic of the

vegetation community mixed with planted and exotic species. High weed density was evident. There was evidence of erosion and sedimentation works in some sections.

Plate 1: View of River Oak Woodland with revegetation plantings

Plate 2: View of River Oak Woodland with mix of native and exotic canopy

Plate 3: View of River Oak Woodland with exotic cover

Plate 4: View of River Oak Woodland with high weed cover

3.3.1.3 Miscellaneous Vegetated Areas

Miscellaneous vegetated areas are areas which do not correspond to any known native vegetation community or PCT. Miscellaneous vegetated areas include:

> Mix of planted/remnant vegetation: these are areas that include vegetation that was a mix of remnant trees with planted non-endemic and/or exotic species. Species present included Silk Oak (*Grevillea robusta*), Forest Red Gum (*Eucalyptus tereticornis*), River Red Gum (*Eucalyptus camaldulensis*), Sydney Blue Gum (*E. saligna*), *Callistemon* spp. and *Acacia* spp. Overall, this area lacked a mid or ground layer (see **Plate 5**).

> Planted natives: planted native with no remnant trees occurred across the Biodiversity Study Area, near fences, walking tracks and in landscaped areas near buildings (see **Plate 6**). This area included species such as Spotted Gum (*Corymbia maculata*), River Oak (*Casuarina cunninghamiana*), Prickly-leaved Tea Tree (*Melaleuca styphelioides*), Crimson Bottlebrush (*Callistemon citrinus*), Spotted Fuchsia (*Eremophila maculata*) and Lomandra (*Lomandra longifolia*).

> Planted exotics: mainly along the northern boundary of the Biodiversity Study Area and included planted walls adjacent to the rail corridor, trees and vegetables gardens (e.g. Muscle Creek Landcare, see **Plate 7**). Species included Jacaranda (*Jacaranda mimosifolia*), Pepper Tree (Schimus mole), Pine Tree (*Pinus* sp.), Common Olive (*Olea europea subsp. cuspidata*), Silk Oak (*G. robusta*), palms (*Chamaedorea* sp.), Orange (*Citrus sinensis*).

> Exotic grasslands mainly Kikuyu Grass (*Pennisetum clandestinum*) (see **Plate 8**).

Plate 5: View of Planted vegetation with native trees

Plate 6: View of Crimson Bottlebrush planted along fence of the velodrome

Plate 7: View of planted citric trees part of Landcare group

Plate 8: View of maintained grasslands in sports fields

3.3.1.4 Cleared Land

Cleared land within the Biodiversity Study Area included developed and disturbed areas such as buildings, access road, carparks, exposed soils (e.g. stockpiled soils, exposed soils with waste in riparian corridor and exposed soils in works areas), walking tracks and other infrastructure (see Plate 9 to Plate 12).

Plate 9: View of carpark areas, buildings and Wilkinson Avenue towards Haydon Street

Plate 10: View of Velodrome

Plate 11: View of exposed soils on north-western portion of the Biodiversity Study Area towards Wilkinson Avenue

Plate 12: View of exposed soils with waste in riparian corridor

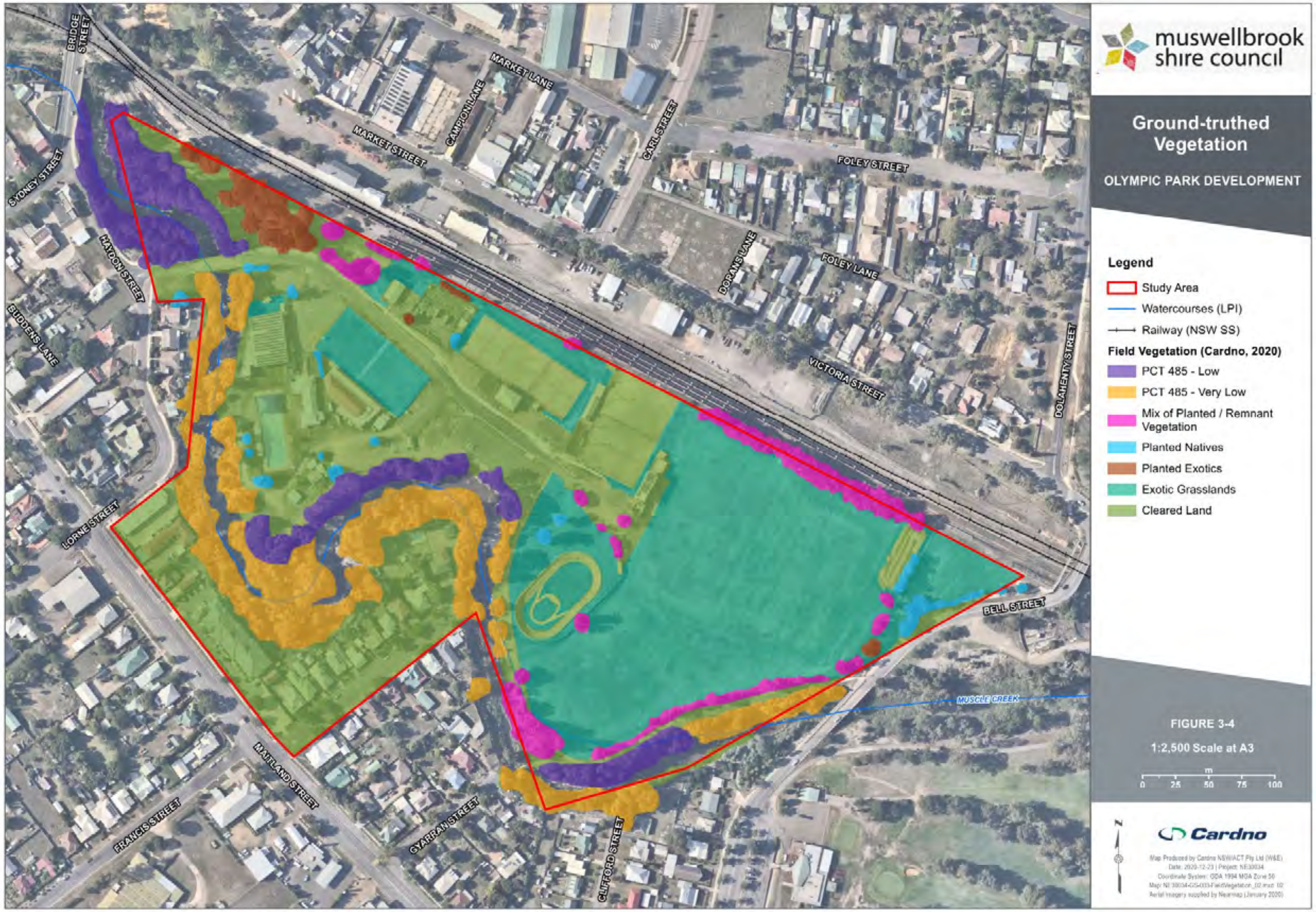

Figure 3-4 Ground-truthed Vegetation

3.3.2 Flora Species

A total of 45 flora species were recorded across the traversed parts of the Biodiversity Study Area, including 19 native species (42 %) and 26 exotics (58 %) across 27 families. The most diverse families were Myrtaceae (8 species), Poaceae (6 species) and Asteraceae (4 species).

Table 3-7shows the full list of flora.

3.3.2.1 Threatened Flora Species

River Red Gum (*Eucalyptus camaldulensis*) was recorded within the Biodiversity Study Area and on the top of bank within Muscle Creek's riparian corridor. The population of River Red Gum in the Hunter Catchment is listed as an Endangered Population under the BC Act. Five River Red Gum trees were recorded within 3 meters of a walking track as shown in **Plate 13** and **Figure 3-5,** to the south-east from the Velodrome, at approximately 50 m east from Wilder Street.

The River Red Gum recorded are not large specimens with regards to diameter at breast height (DBH) or height (see **Table 3-6**). The species has one of the fastest growth rates, particularly when they occur near water sources, where they can reach between 12 – 15 m height in a few years (CSIRO 2004). Given that the trees are located in a line and their size is not large (e.g. height), it is possible that these River Red Gum were planted specimens rather than being a naturally occurring population. It is also noted that no regeneration of gum trees generally was observed during surveys in the Biodiversity Study Area.

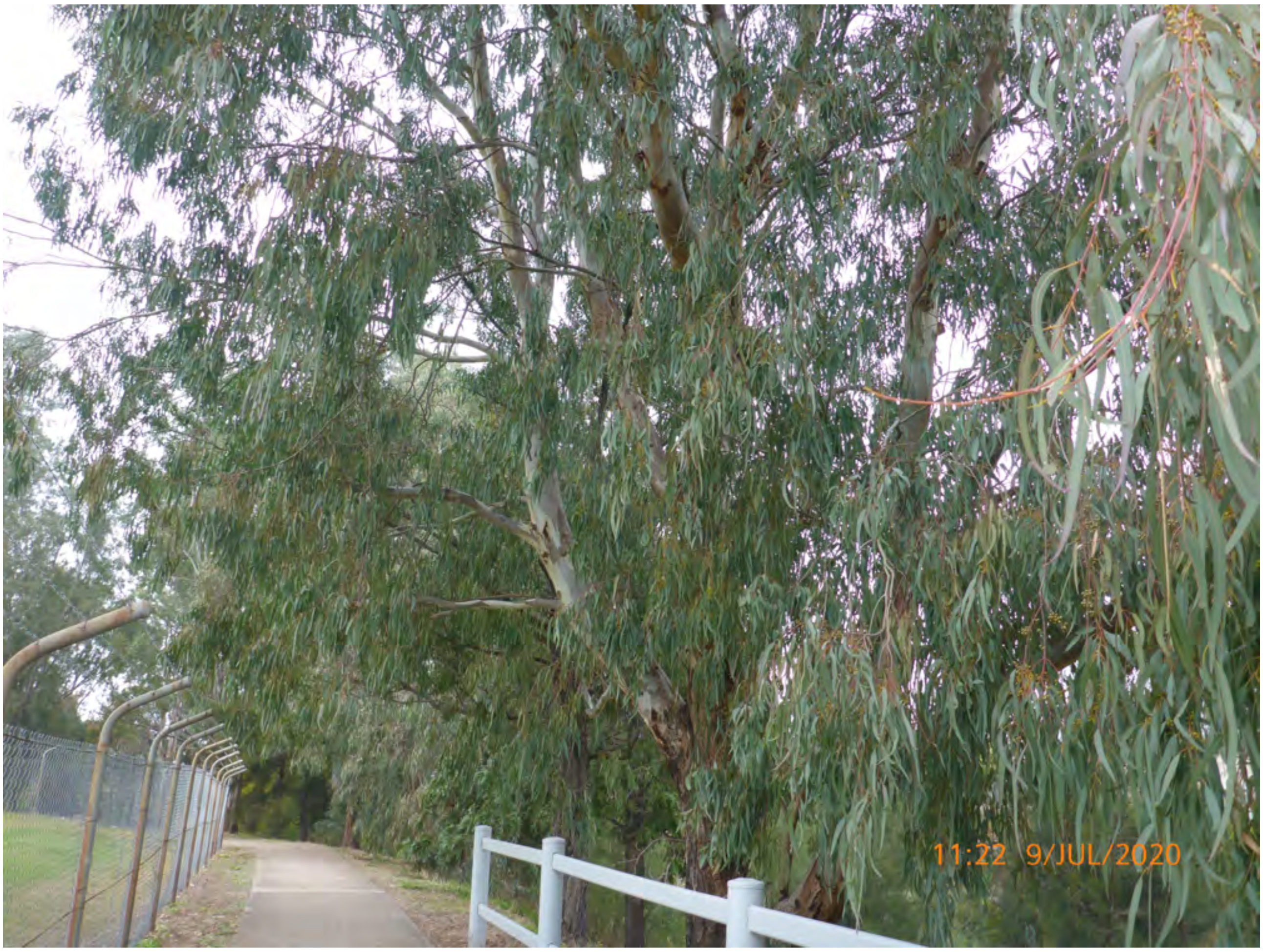

Plate 13. River Red Gums within the Biodiversity Study Area

Table 3-6 Records of River Red Gum (*Eucalyptus camaldulensis*)

Tree Number	Easting	Northing	DBH (cm)	Height* (m)	Crown Spread* (m)
1	301425	6427596	57	6	3
2	301426	6427589	40	4	3
3	301428	6427577	23.7	4	2
4	301428	6427573	46	7	3
5	301471	6427526	25	5	2

Notes:
DBH = Diameter at Breast Height measured at 1.3m above ground level
**Estimate only*

3.3.2.2 Weeds

A total of 26 exotic species were recorded within the Biodiversity Study Area, one of these species is recognised as a priority weed within the Muswellbrook LGA and eight species are identified as high threat exotics, as follows:

> African Olive (*Olea europea subsp. cuspidata*) is listed as a priority weed within the Hunter Local Land Service Area, to which the Muswellbrook LGA is part of. African Olive has the following Duty under the Biosecurity Act 2015:

  - **Regional Recommended Measure**

    Land managers mitigate the risk of the plant being introduced to their land. Land managers reduce impacts from the plant on priority assets. Land managers prevent spread from their land where feasible. The plant or parts of the plant are not traded, carried, grown or released into the environment.

> The following eight species observed in the Biodiversity Study Area are listed as High Threat Exotic (HTE) under the Biodiversity Assessment Method (BAM) under the BC Act. HTE are plants not native to Australia that if not controlled will invade and outcompete native species. These exotic plants are required to be managed and controlled.

  - Canary Island Date Palm (*Phoenix canariensis*).
  - Mothvine (*Araujia sericifera*).
  - Cobbler's Pegs (*Bidens pilosa*).
  - Castor Oil Plant (*Ricinus communis*).
  - Camphor Laurel (*Cinnamomum camphora*).
  - Rhodes Grass (*Chloris gayana*).
  - Panic Vedgrass (*Ehrharta erecta*).
  - Balloon Vine (*Cardiospermum grandiflorum*).

Table 3-7 Flora Species List

Family	Scientific Name	Common Name	Native / Exotic	Growth Form*	BC Act Status	EPBC Act Status
Anacardiaceae	*Schinus molle*	Pepper Tree	E			
Arecaceae	*Chamaedorea sp.*	A Palm	E			
Arecaceae	*Phoenix canariensis*	Canary Island Date Palm	E (HTE)			
Asclepiadaceae	*Araujia sericifera*	Mothvine	E (HTE)			
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	E (HTE)			
Asteraceae	*Conyza bonariensis*	Flax-leaf Fleabane	E			
Asteraceae	*Sonchus oleraceus*	Common Sow-thistle	E			
Asteraceae	*Taraxacum officinale*	Dandelion	E			
Bignoniaceae	*Jacaranda mimosifolia*	Jacaranda	E			
Brassicaceae	*Capsella bursa-pastoris*	Shepherds purse	E			
Casuarinaceae	*Casuarina cunninghamiana*	River Oak	N			
Chenopodiaceae	*Einadia trigonos*	Fishweed	N			
Euphorbiaceae	*Ricinus communis*	Castor Oil Plant	E (HTE)			
Fabaceae - Mimosoideae	*Acacia implexa*	Hickory Wattle	N	Shrub (SG)		
Fabaceae (Faboideae)	*Trifolium dubium*	Yellow Sucking Clover	E			
Lauraceae	*Cinnamomum camphora*	Camphor Laurel	E (HTE)			
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush	N	Grass & grasslike (GG)		
Malvaceae	*Malva sp.*	Mallow	E			
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow	E			
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	E			
Myoporaceae	*Eremophila maculata*	Spotted Fuchsia	N			
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	N	Tree (TG)		
Myrtaceae	*Callistemon citrinus*	Crimson Bottlebrush	N	Shrub (SG)		
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush	N	Shrub (SG)		
Myrtaceae	*Corymbia maculata*	Spotted Gum	N	Tree (TG)		
Myrtaceae	*Eucalyptus camaldulensis*	River Red Gum	N	Tree (TG)	EP	
Myrtaceae	*Eucalyptus saligna*	Sydney Blue Gum	N	Tree (TG)		

Family	Scientific Name	Common Name	Native / Exotic	Growth Form*	BC Act Status	EPBC Act Status
Myrtaceae	*Melaleuca decora*	-	N	Shrub (SG)		
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree	N			
Oleaceae	*Olea europaea subsp. cuspidata*	African Olive	E (PW)			
Phormiaceae	*Dianella caerulea*	Blue Flax-lily	N			
Pinaceae	*Pinus sp.*	-	E (C)			
Plantaginaceae	*Plantago lanceolata*	Ribwort	E			
Poaceae	*Bromus carthartícus*	Prairie Grass	E			
Poaceae	*Chloris gayana*	Rhodes Grass	E (HTE)			
Poaceae	*Ehrharta erecta*	Panic Veldtgrass	E (HTE)			
Poaceae	*Lolium perrenne*	Perennial Ryegrass	E			
Poaceae	*Pennisetum clandestinum*	Kikuyu, Kikuyu Grass	E			
Poaceae	*Phragmites australis*	Common Reed	N	Grass & grasslike (GG)		
Polygonaceae	*Persicaria lapathifolia*	Pale Knotweed	N	Forb (FG)		
Proteaceae	*Grevillea robusta*	Silky Oak	N	Tree (TG)		
Rutaceae	*Citrus sinensis*	Orange Tree	E (C)			
Sapindaceae	*Cardiospermum grandiflorum*	Balloon Vine, Love in a Puff	E (HTE)			
Sterculiaceae	*Brachychiton populneus*	Kurrajong	N	Tree (TG)		
Typhaceae	*Typha orientalis*	Cumbungi	N	Grass & grasslike (GG)		

Notes:
BC Act = NSW Biodiversity Conservation Act 2016; EPBC Act = Commonwealth Environment Protection and Biodiversity Conservation Act 1999;
Listing status: E = Endangered; EP = Endangered Population;
Native/Exotic: N = Native; E = Exotic; HTE = high threat exotics as per the BC Act; WoNS = Weeds of National Significance; PW = Priority Weed under the NSW Biosecurity Act 2015
**Growth Form only provided for native species*

3.3.3 Fauna Species

A total of 15 native fauna species were observed (heard or seen) during surveys. **Table 3-8** shows the full list of fauna.

Table 3-8 Fauna Species List

Family	Scientific Name	Common Name	BC Act Status	EPBC Act Status	Type of Observation
Amphibia					
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet			Heard
Aves					
Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra			Heard
Columbidae	*Ocyphaps lophotes*	Crested Pigeon			Seen
Artamidae	*Cracticus tibicen*	Australian Magpie			Seen
Cacatuidae	*Eolophus roseicapillus*	Galah			Seen
Corvidae	*Corvus coronoides*	Australian Raven			Seen
Monarchidae	*Grallina cyanoleuca*	Magpie-lark			Seen
Meliphagidae	*Manorina melanocephala*	Noisy Miner			Seen
Psittacidae	*Platycercus elegans*	Crimson Rosella			Seen
Psittacidae	*Psephotus haematonotus*	Red-rumped Parrot			Seen
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet			Seen
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail			Seen
Mammals					
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum			Seen
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	Seen
Pteropodidae	*Pteropus alecto*	Black Flying-fox			Seen

Notes:
** = introduced; V = Vulnerable; BC Act = NSW Biodiversity Conservation Act 2016; EPBC Act = Commonwealth Environment Protection and Biodiversity Conservation Act 1999*

3.3.3.2 Threatened Fauna Species

Over 30 individuals of the threatened Grey-headed Flying-fox were recorded within the Biodiversity Study Area roosting in a tree approximately 130 m north-west from Wilder Street and 160 m south-west from Wilkinson Avenue (**Figure 3-5**). A known Grey-headed Flying-fox (GHFF) camp is located at approximately 400 m north-west from the Biodiversity Study Area and near the convergence of the Hunter River and Muscle Creek area (DoE 2019), where the size of the population has been variable. GHFF is a highly mobile species that travel up to 20 km each night in search for food, while roosting during the day in a given 'camp'. The location of a GHFF camp varies over time in response to food availability, habitat loss, disturbances in the camp area (e.g. development, GHFF-human interactions) or other factors causing disturbance to the local population. Given the close proximity of the Biodiversity Study Area to the known camp location, it is expected the GHFFs present within the Biodiversity Study Area would be part of the same camp population known from other parts of the Muscle Creek riparian corridor (outside of the Biodiversity Study Area). As mentioned in **Section 3.1.8**, eight Vulnerable microbat species were recorded to occur within Muscle Creek riparian corridor in the Biodiversity Study Area in a previous study. No other threatened fauna species were observed during surveys in July 2020.

Plate 14. Roosting Grey-headed Flying-foxes within the Biodiversity Study Area

3.3.3.3 Fauna Habitat

Table 3-8 provides a summary of fauna habitat observed in the Biodiversity Study Area.

Table 3-9 Fauna Habitat Values

Habitat Value	Description
Koala Habitat	Two species of tree listed as Koala Feed Trees (KFTs) listed under the SEPP (Koala Habitat Protection) 2020 were recorded within the Biodiversity Study Area during surveys: Forest Red Gum (*Eucalyptus tereticornis*), and River Red Gum (*Eucalytus camaldulensis*). The following is noted about the Biodiversity Study Area value as habitat for koala: ▪ The Biodiversity Study Area is highly modified, with no suitable habitat present in most part of the Biodiversity Study Area, except for Muscle Creek riparian corridor, which has the potential to be used by other mobile fauna, in addition to koala. ▪ The identified KFTs are present within Muscle Creek's riparian corridor or as planted trees primarily along walking tracks and along the Biodiversity Study Area's boundary. ▪ BioNet Atlas has no known records of koala within the Biodiversity Study Area. The nearest known koala record was reported in 2016 and refers to a motor vehicle collision in a road located at approximately 200 m north-west from the site, west of New England Highway. ▪ No koala scats were observed during surveys and at the base of trees with scratch marks. It is considered that Muscle Creek has some potential as corridor for movement of mobile fauna, including the koala. However, core koala habitat is not present within the Stage 1 works footprint within the Biodiversity Study Area.
Hollow-bearing Trees	A total of three hollow-bearing trees (HBT) were recorded during surveys (see **Figure 3-5**). Tree hollows observed included small hollows (<10cm diameter) and one large hollow (>20

Habitat Value	Description
	cm diameter), the latter hollow was observed in a tree with a broken trunk and used by Galah (*Eolophus roseicapillus*). The small hollows are suitable as habitat for a range of small fauna groups including microbats, reptiles and small birds.  **Plate 15:** View of HBT used by Galah
Stags	A large stag was observed on the north-western portion of the Biodiversity Study Area, this stag has potential to be habitat for small fauna groups including microbats, small birds and reptiles. The stag is present within a revegetated area along Muscle Creek's riparian corridor.  **Plate 16:** View of Stag
Connectivity	Muscle Creek's riparian corridor provides connectivity passage for terrestrial mobile fauna to move across the Biodiversity Study Area and along the creek's riparian corridor. Bridges occur at Wilkinson Avenue and at Bell Street, on the western and eastern portion of the Biodiversity Study Area, respectively. The road bridges would assist fauna movement along the riparian corridor. No other connectivity values were present within the Biodiversity Study Area.
Rocky Outcrops	No naturally occurring rocky outcrops were present within the Biodiversity Study Area.
Caves	No caves were observed within the Biodiversity Study Area during surveys.

Habitat Value	Description
Leaf Litter	Leaf litter was only present in small portions of Muscle Creek's riparian corridor. Other parts of the Biodiversity Study Area are built up areas or maintained areas (e.g. lawns, landscaped areas).
Logs	Logs larger than 10cm diameter and longer than 0.5 m were observed within the riparian corridor.
Burrows, nests and other fauna made habitat	A small bird nest was observed during surveys. The bird nest was located on a small tree within the riparian corridor.  **Plate 17:** View of bird nest
Aquatic Habitat	Aquatic habitat was present within the Biodiversity Study Area. See **Section 3.4** for further details.

Figure 3-5 Threatened Species and Fauna Habitat Features

3.4 Aquatic Ecology

Muscle Creek runs along the southern and western portions of the Biodiversity Study Area and is classified as a fifth (5th) order stream under the Strahler classification method. The following was observed in Muscle Creek:

> The creek has a defined channel with well-defined banks. Where visible, the streambed includes sandy silts;

> Water was present along the creek during surveys, with water flow varying from no visible flow to low flow in some sections;

> Vegetation was present in the creek and along the riparian corridor. Aquatic vegetation included submerged and emergent vegetation (e.g. *Typha* sp.). Vegetation was variable along the riparian corridor, with variations ranging from sections landscaped and revegetated to sections with high weed invasion;

> Severe evidence of erosion was observed in some sections along the creek's bank. Also, erosion works appeared to be occurring in some sections of the creek banks;

> Landscaping works and sandstone blocks were observed at two points along the creek that included steps to the top of bank on both sides of the creek;

> Waste dumping was evident in portions of the riparian corridor;

> Evidence of weed removal works, including herbicide application was observed within the riparian corridor;

> The stretch of Muscle Creek within the Biodiversity Study Area corresponds to Type 1 – Highly sensitive KFH (DPI 2013) due to the presence of native aquatic plants (e.g. *Typha* sp.), presence of snags greater than 300 mm in diameter or 3 metres in length. The classification of Muscle Creek in relation to classification of waterways for fish passage (DPI 2013) corresponds to Class 1 – Moderate key fish habitat as it is an intermittent stream with a clearly defined bed and bank with freshwater aquatic vegetation present.

Examples of the varying condition of Muscle Creek within the Biodiversity Study Area are shown in **Plate 18** to **Plate 25**.

Plate 18: Aquatic vegetation in Muscle Creek

Plate 19: Aquatic vegetation, eroded banks and waste in Muscle Creek

Plate 20: Exposed soils and landscape works on Muscle Creek's bank

Plate 21: Weeds on banks, and aquatic vegetation in Muscle Creek towards Bell Street bridge

Plate 22: Eroded banks and weedy vegetation in Muscle Creek's under Wilkinson Avenue bridge

Plate 23: Erosion works (front left) and weed invasion (back) in Muscle Creek

Plate 24: Built creek crossing and culvert in Muscle Creek

Plate 25: Built creek crossing and landscaped works in Muscle Creek

4 Likelihood of Occurrence and Potential Impacts

4.1 Terrestrial Threatened Species, Populations and Ecological Communities

Threatened biodiversity (e.g. TECs, threatened species and their habitats) listed under the BC Act and with known records within the 10 km locality surrounding the Biodiversity Study Area were determined using the BioNet Atlas (**Appendix A**).

Although the database identified threatened biodiversity for consideration during field surveys, targeted surveys were not part of the scope of works for the present assessment. The following is noted regarding threatened biodiversity in the Biodiversity Study Area:

> No TEC was observed within the Biodiversity Study Area;

> River Red Gum (*Eucalyptus camaldulensis*) was recorded within the Biodiversity Study Area. The River Red Gum population in the Hunter is listed as an Endangered Population. Five trees were recorded in the riparian corridor but these would not be directly affected by the Project. Field observations on tree sizes and alignment suggest the possibility of the trees being planted;

> Grey-headed Flying-fox (*Pteropus poliocephalus*) was present within the Biodiversity Study Area. Grey-headed Flying-fox is listed as a Vulnerable species under the BC Act and the EPBC Act;

> Seven vulnerable microbat species were identified as possibly present based on call data analysis in a previous study (Cardno 2019). The microbat species include:
  - Eastern Bentwing-bat (*Minopterus schreibersii oceanensis*);
  - Easter Cave Bat (*Vespadelus throughtoni*);
  - Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
  - Eastern Freetail-bat (*Mormopterus nofrolkensis*);
  - Greater Broad-nosed Bat (*Scoteanax rueppellii*);
  - Little Bentwing-bat (*Miniopterus australis*); and
  - Southern Myotis (*Myotis macropus*).

Subsequent to field surveys, an assessment of likelihood of occurrence and potential risk of impact (LoOR) was undertaken for all threatened biodiversity identified with potential to occur within the 10 km locality surrounding the Biodiversity Study Area (**Appendix D**). Generally, threatened biodiversity identified in the LoOR assessment as having moderate, high or known ranking were subjected to further survey and analysis of significance.

A total of 14 threatened biodiversity was identified as having moderate, high or known likelihood of occurrence. Any threatened species likely to be impacted by the proposed works or activities were subject to an analysis of significance (i.e. Test of Significance (BC Act) and/or Assessment of Significance (EPBC Act)) to help determine if the proposal would result in significant impacts (see **Appendix E**). It was concluded that the proposed works for Stage 1 would be unlikely to result in significant impacts on any threatened entity listed under the BC Act provided mitigation measures are implemented.

4.2 Aquatic Threatened Species, Populations and Ecological Communities

Muscle Creek is not mapped as habitat for threatened fish species. It is noted that the Hunter River, is mapped as habitat for one endangered fish species (Southern Purple-spotted Gudgeon (*Mogurnda adspersa*)) and one endangered population (Darling River Hardy Head Hunter River population). Aquatic fish surveys were previously undertaken by Cardno (2019) in Muscle Creek and the threatened fish were not recorded. Furthermore, it was noted that the large numbers of European Carp (*Cyprinus carpio*) were observed in ponds of Muscle Creek, which affects water quality and disrupts Southern Purple-spotted Gudgeon populations.

An assessment of aquatic habitat at Muscle Creek within the Biodiversity Study Area indicated that exposed soils, weeds and dumped waste was present in the section of Muscle Creek close to Wilder Street, where a bridge is proposed to be built to connect Wilkinson Avenue with Wilder Street. It is considered that, in its current condition, the section of Muscle Creek near Wilder Street does not appear to be suitable habitat for native fish. However, given that rehabilitation works are underway in other sections of Muscle Creek, and that there is connectivity between Muscle Creek and the Hunter River, the possibility of future occupation of the section of Muscle Creek near Wilder Street by native fish cannot be precluded.

4.3 Matters of National Environmental Significance

As detailed in **Section 3.1.2**, the PMST indicated that only four out of the eight MNES listed under the EPBC Act are known or predicted to occur within a 10 km locality surrounding the Biodiversity Study Area (**Appendix B**). The four MNES included wetlands of international importance, TECs, threatened species and migratory species.

As noted in **Section 3.1.2**, the Hunter Estuary Wetlands, a wetland of international importance, is located 103 km from within the Biodiversity Study Area and no further assessment is required. Information gathered from the Biodiversity Study Area during desktop review and surveys was used to assess the likelihood of occurrence and risk of impact on the remaining three MNES (**Appendix D**).

The result of the assessment is provided in the following subsections.

4.3.1 Listed Threatened Ecological Communities

The PMST report indicated that 10 TECs are known or predicted to occur within the 10 km locality from the Biodiversity Study Area. These TECs include:

> Central Hunter Valley eucalypt forest and woodland, listed as Critically Endangered Ecological Community (CEEC);

> Hunter Valley Weeping Myall (*Acacia pendula*) Woodland (CEEC);

> Lowland Rainforest of Subtropical Australia (CEEC); and

> White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland (CEEC).

Based on the LoOR assessment (**Appendix D**), it was found that these TECs were not present in the Biodiversity Study Area and that works and therefore activities reasonably anticipated from Stage 1 works are unlikely to result in impacts on these TECs.

4.3.2 Listed Threatened Species

The PMST report indicated that 31 threatened species are known or predicted to occur within the 10 km radius from the Biodiversity Study Area. The threatened species include nine birds, three frogs, eight mammals, two reptiles and nine flora species.

One threatened species, the Grey-headed Flying-fox (*Pteropus poliocephalus*), listed as Vulnerable under the EPBC Act, was observed within the Biodiversity Study Area during surveys.

An assessment of likelihood of occurrence and risk (LoOR) assessment was undertaken for all threatened species (see **Appendix D**). Based on the LoOR assessment, it was found that only the Grey-headed Flying-fox have known likely occurrence within the Biodiversity Study Area. Given that the Stage 1 proposed works will occur further than 120 m away from the area where the flying-foxes occur, it is considered unlikely the proposal will result in significant impacts on this threatened species.

4.3.3 Listened Migratory Species

The PMST report indicated that 14 migratory species are known or predicted to occur within the 10 km radius of the Biodiversity Study Area, including one migratory marine bird, five migratory terrestrial birds, and eight migratory wetland birds.

Based on the LoOR assessment, it was found that none of the 14 migratory bird species have moderate, high or known likely occurrence within the Biodiversity Study Area (see **Appendix D**).

5 Impact Assessment

5.1 Terrestrial Ecology

5.1.1 Vegetation

The proposed project footprint will be located in highly disturbed land consisting of cleared land with miscellaneous vegetation not consistent with endemic native vegetation communities. The only flora species present within the proposed project footprint are planted natives and exotics. Native vegetation was recorded within Muscle Creek's riparian corridor, including five River Red Gum (*Eucalyptus camaldulensis*) trees which are considered part of the listed endangered River Red Gum population in the Hunter. Although a bridge is proposed to be built over Muscle Creek these trees are not proposed to be affected as part of Stage 1 works for the Muswellbrook OPP.

The proposed project is unlikely to result in impacts on TECs as none are present within the project footprint or within or adjacent to the Biodiversity Study Area.

5.1.2 Threatened Species

Two threatened species were recorded during surveys within the Biodiversity Study Area, the Grey-headed Flying-fox (listed as a Vulnerable species under the BC Act and EPBC Act) and the River Red Gum (*Eucalyptus camaldulensis)* population in the Hunter Catchment (listed as Endangered under the BC Act). Also, seven microbat species were recorded within the Biodiversity Study Area in a previous study (Cardno 2019); Eastern Bentwing-bat (*Minopterus schreibersii oceanensis*), Easter Cave Bat (*Vespadelus throughtoni*), Eastern Freetail-bat (*Mormopterus nofrolkensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Little Bentwing-bat (*Miniopterus australis*) and Southern Myotis (*Myotis macropus*).

A total of 14 threatened species were identified as having a moderate or known likelihood of occurrence within the Biodiversity Study Area (see **Appendix D**). Assessment of significance on those species concluded that the proposed Stage 1 works for the Muswellbrook OPP would not result in significant impacts on those threatened species (see **Appendix E**).

5.1.3 Fauna Habitat and Wildlife Corridor

The proposed Stage 1 works part of the Muswellbrook OPP are located within a mostly cleared and highly disturbed landscape within the Biodiversity Study Area. Endemic native vegetation in poor condition occurs within Muscle Creek's riparian corridor, also part of the Biodiversity Study Area, and the proposal includes the construction of a bridge with piers in the banks. Vegetation within Muscle Creek's riparian corridor connects to that part of the riparian corridor outside of the Biodiversity Study Area.

Presently, a certain level of aquatic habitat connectivity is maintained along the creek line as road bridges on Wilkinson Avenue and Bell Street do not prevent water movement along the creek (see further discussion in **Section 5.2**). Sandstone blocks have been placed at two points on the creek channel as part of landscaping and rehabilitation of the riparian corridor. Spaces between sandstone blocks, however, allows for water flow.

The condition of the riparian corridor is variable and includes sections with exposed soils, stabilised bank walls, revegetated banks and weedy areas. In spite of its variable condition, there is no barrier that would restrict the movement of terrestrial fauna along the corridor. Therefore, the riparian corridor presently has the potential to provide connectivity to native terrestrial species to areas outside of the Biodiversity Study Area.

The proposed bridge over Muscle Creek includes piers in the banks. The piers have been designed to be narrow and parallel to the bank. Terrestrial fauna will still be able to transit along the riparian corridor beneath or above the bridge once constructed. Indirect impacts on the riparian corridor will be further avoided and minimised by implementing erosion and sedimentation measures to manage runoff.

Based on the above, it is predicted that the proposed Stage 1 works of the Muswellbrook OPP would not result on impacts on habitat and corridors in the riparian zones at or adjacent to the project's footprint.

5.1.4 Area of Outstanding Biodiversity Value

AOBV are declared by the NSW Minister for the Environment and under the BC Act. The register of AOBV indicates that at the time of assessment (3 August 2020) There are four declared AOBV:

> Gould's Petrel – Critical Habitat Declaration;

- Little penguin population in Sydney's North Harbour – Critical Habitat Declaration;
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve – Critical Habitat Declaration; and
- Wollemi Pine – Critical Habitat Declaration.

The proposed project is not located near or at any of the AOBV. Therefore, it is considered that the proposed project is unlikely to result on any direct or indirect impacts on AOBV.

5.1.5 Koala Habitat Protection

Part of the Biodiversity Study Area, mainly along the riparian corridor, is mapped as assessment areas for koala habitat as per mapping in the SEPP (Koala Habitat Protection) 2020. As detailed in **Section 3.3.3.3** koala feed trees were recorded within the Biodiversity Study Area but no koala or potential core koala habitat is present within the proposed Stage 1 footprint. Therefore, it is considered that the proposed project is unlikely to result on any direct or indirect impacts on koalas or their habitat.

5.2 Aquatic Ecology

Waterway crossings should be designed and constructed in accordance with the national guidelines entitled 'Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings' (Fairfull and Witheridge 2003). A bridge is proposed to be built within the Biodiversity Study Area over Muscle Creek as part of Stage 1 works. The single span super-T bridge design proposed would minimise impacts on Muscle Creek or its riparian corridor.

Disturbance of riparian vegetation and the creek bed during construction is likely to result in a short-term temporary increase in turbidity and suspended sediments downstream of the bridge site. Furthermore, there is potential for the banks to erosion or instability during excavation if unmitigated. Erosion and sediment controls during excavation are particularly important at this site due to the high gradient of the banks and their potential susceptibility to erosion during earthworks. Piling for the bridge is proposed to be located on the banks of the waterway but close to the bases of either side of the creek. They have been designed to be narrow and parallel to the slope of the banks but would be in the waterway for some water levels of the creek. For the purposes of this assessment it has been precautionary to assume that part of the footprints of the piles, or the coffer dams required for their construction, may impinge upon the instream habitat of Muscle Creek. Given instream construction activity could occur a Part 7 permit is required for dredging (Section 200 of the FM Act) and for the potential obstruction of fish passage (Section 219 of the FM Act) prior to the commencement of works. This will require consultation with DPIE (Fisheries).

Given pile drilling rigs and other plant would need to be placed on the banks of Muscle Creek to construct and install the piles, management measures will need to be incorporated according to *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management* (2013 update) so that direct or indirect effects on riparian habitat would be minimised. The Guidelines recommend that developments should ensure that existing native riparian vegetation is retained to the greatest extent possible in an undamaged and unaltered condition. A small amount of riparian vegetation would be permanently removed for construction of the piles and shading by the bridge may stop it recovering. However, the area lost would be of poor condition and relatively small compared to the extent retained in the Biodiversity Study Area. The bed and banks would also be at risk of scour without adequate scour protection, particularly around the piles.

Given the piles are narrow and run along the banks on the edge of the waterway, and would be above the waterline of Muscle Creek for low flow, they would not constrict the channel substantially so that water levels and fish passage are expected to be maintained throughout this reach in the future. Scour protection of the piles would likely be required to prevent erosion of the banks in this section of the river in the future.

Provided specific safeguards and recommendations are implemented (see **Section 6.2.4**), it is considered that the proposed project is unlikely to result on any direct or indirect impacts on the aquatic and riparian environment that would substantially threaten the ecosystem services provides by these habitats.

5.3 Key Threatening Processes

Key Threatening Processes (KTPs) are listed under the BC Act, the FM Act and the EPBC Act. Of these, there are three KTPs that have the potential to occur as result of the proposal:

- Human-caused Climate Change;
- Alteration of the natural flow regimes of rivers, streams, floodplains & wetlands; and
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis; and

> Degradation of native riparian vegetation along NSW water courses.

5.3.1 Human-caused Climate Change

The Biodiversity Study Area includes cleared land and vegetated areas. Vegetated areas are mainly located along Muscle Creek's riparian corridor, whereas other vegetation across the Biodiversity Study Area is miscellaneous vegetation that do not conform with native vegetation communities. The proposed project would require removal of planted vegetation and potentially clearing of poor-quality riparian vegetation for construction of a bridge.

The project would not contribute to clearing of native vegetation which is associated with loss of cooling effects provided by vegetation, particularly canopy cover. Although most of the project area will be used for sports courts and build structures and will continue to be cleared land as open space; new street trees and landscaping will be planted along Wilkinson Avenue. Planted trees would provide localized cooling effects within the proposed project area.

5.3.2 Alteration of the natural flow regimes of rivers, streams, floodplains & wetlands

The proposed project requires the construction of a road bridge above Muscle Creek to connect Wilkinson Avenue with Wilder Street. The bridge would be designed so that direct effects on the hydrological patterns and/or processes in Muscle Creek would be avoided and minimised (see **Section 5.20**). Furthermore, potential indirect impacts would be minimized through diversion of run-off in future planted stormwater channels included in the design. Vegetation in planted stormwater channels would minimize sediment discharge into the creek line. Therefore, it is expected the proposal would not result in triggering this KTP.

5.3.3 Infection of frogs by amphibian chytrid causing the disease chytridiomycosis

As noted in **Section 5.3.2**, the project would mostly avoid Muscle Creek and its riparian corridor apart from construction of the bridge. No direct use of these aquatic environments is proposed as part of the proposed project apart from the piles for the bridge being constructed along the edges of Muscle Creek. The possibility exists of use of the project site to indirectly impact on these aquatic environments, and their aquatic fauna (where present), such as frogs, by cross-contamination and importation of pathogens. Given the proximity of the majority of the project to aquatic environments, effective control measures would be considered to restrict access to creeks during construction and operational phases of the project. Inclusion of control measures to prevent run off, access to creek lines and educational information during construction and operation of the OPP would significantly minimise the possibility of triggering of this KTP.

5.3.4 Degradation of native riparian vegetation along NSW water courses

Riparian vegetation is vegetation on land that adjoins, directly influences or is influenced by, a body of water. Riparian habitats include land immediately alongside Muscle Creek (including the bank). As indicated, the project would generally avoid Muscle Creek and its riparian corridor and effective control measures would be considered to restrict access to creeks during construction and operational phases of the project. The exception to this would be that a bridge is proposed to be built within the Biodiversity Study Area over Muscle Creek as part of Stage 1 works. It is understood, however, that the bridge would been designed so as to prevent impacts, as far as practicable, on Muscle Creek hydrology, aquatic ecology or its riparian corridor. Inclusion of control measures to manage runoff, erosion and sedimentation during construction and operation of the OPP, including the bridge, would significantly minimise the possibility of triggering of this KTP. Further, rehabilitation of riparian vegetation disturbed during construction is proposed (see **Section 6.2.4**).

6 Recommended Avoidance and Mitigation Measures

Recommended impact avoidance and mitigation measures that should be incorporated into design of the proposed project are described in **Sections 6.1** and **Section 6.2**. These recommendations would avoid and mitigate impacts to flora, fauna and their habitat in the Biodiversity Study Area and in adjacent areas.

6.1 Avoidance

> Where possible, limit disturbance to previously cleared and miscellaneous vegetated area (e.g. for the laydown areas) during construction phase;

> The detailed design of the proposal will demonstrate it has considered opportunities to minimise the footprint of the works, particularly in the riparian corridor. The works will avoid the Red River Gums;

> All works are to be restricted to the project footprint.

6.2 Mitigation

6.2.1 General

> Apart from the construction area required to build the bridge, riparian corridors to be fenced off and labelled as No-Go areas to prevent accidental impacts and introduction of pathogens, such as *Batrachonchtrium dendrobatidis*, a pathogen that caused chytridiomycosis, an infection disease on amphibians;

> All machinery should be cleaned of foreign soil and vegetative matter to avoid the spread of *Phytophthora cinnamomi*, Exotic Rust Fungi of the order Pucciniales pathogenic (Myrtle Rust) and dispersal of seeds of non-native plants;

> Strict weed management, monitoring and control practices should be implemented as part of the Construction Environmental Management Plan (CEMP) to minimise the spread of exotic species into natural areas within and outside the works footprint. In particular, priority weed and high threat exotic species should be targeted in accordance with the NSW DPI WeedWise recommended control measures (DPI 2020);

> Strict erosion and sediment control measures should be implemented as part of the CEMP, monitored and maintained to prevent impacts on adjacent areas, particularly following erosion and sediment mobilisation from rain events;

> Implement dust and erosion and sedimentation control measures to protect adjacent retained vegetation and water quality in Muscle Creek; and

> Stockpiling of materials should occur within previously disturbed areas and not within driplines or retained vegetation.

6.2.2 Vegetation Clearing

> Weed removal shall follow weed management mitigation measures as listed in **Section 6.2.1**.

> Tree removal to be supervised as detailed in **Section 6.2.3**.

6.2.3 Wildlife Protection during construction

> The CEMP will include a stop-work procedure on the chance encounter of any dispersing wildlife during works should be implemented to avoid death or injury;

> Ensure that a suitably qualified ecologist is present during the removal of all trees to act as a spotter-catcher that can relocate any captured wildlife;

> Ensure that all captured animals are relocated into the nearest suitable native vegetation; and

> Ensure that all injured animals are taken to a local wildlife carer for treatment.

6.2.4 Aquatic Habitat

> Disturbance to instream areas (from the top of banks to the creek bed) will be avoided as far as practicable.

> A part 7 permit is required for dredging (Section 200 of the FM Act) and the potential obstruction of fish passage (Section 219 of the FM Act) prior to the commencement of works. This will require consultation with DPI (Fisheries);

> Consider timing of the works in Muscle Creek during favourable weather conditions to prevent erosion and sedimentation during construction;

> Erosion and sedimentation control measures will be implemented and maintained as part of an Erosion and Sediment Control Plan to ensure that the water quality of Muscle Creek adjacent to the project footprint is not impacted. This is particularly important for the construction of the bridge over Muscle Creek. According to *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management* (2013 update) development controls should include an erosion and sediment control plan;

> The detailed design for the Muscle Creek Bridge will incorporate scour protection as required;

> Following the completion of the works in Muscle Creek, disturbed riparian areas not under the bridge should be revegetated with native species. Species selection is to consider those present in the riparian areas of Muscle Creek.

7 Conclusion

The footprint of the proposed Stage 1 of Muswellbrook OPP works is located in highly disturbed, mostly cleared land or in miscellaneous vegetation not conforming to any known native vegetation community. Native vegetation plant communities do occur, however, in the riparian corridor of Muscle Creek. Although these are in poor condition, the footprint of Stage 1 of the project would not impinge upon these, apart from the footprint of the bridge and there would not be substantial localised impacts on native vegetation or fauna habitat. Some planted River Red Gums (*Eucalyptus camaldulensis)* occur in the riparian corridor and these would form part of the population in the Hunter Catchment listed as Endangered under the BC Act. None of these trees would be affected by the proposed project.

Some threatened fauna are known to occur or have potential to occur in the Biodiversity Study Area. These are generally highly mobile species (e.g. birds and bats) that are known to move throughout the landscape as they forage and move between areas of higher quality habitat. None of the threatened fauna identified as occurring or having potential to occur within the Biodiversity Study Area were considered to be at risk of impact by the proposed project. These species would generally only transit through, forage in, or roost in Muscle Creek’s riparian corridor, which would be generally unaffected by the project footprint apart from the areas where the new bridge would be constructed. Once the bridge has been constructed, fauna would still be able to transit along the riparian corridor by travelling underneath the bridge or by flying over it. In particular, a number of Grey-headed Flying-fox (listed as Vulnerable under the BC Act and EPBC Act) were observed roosting in a tree within the riparian corridor. It is not clear if this is a permanent or temporary roost site, but regardless, there is adequate buffer between the roost tree and the project footprint for the species to be unaffected apart from minor disturbance from construction noise.

Aquatic habitat in Muscle Creek has potential to be affected by the project as a consequence of construction of a bridge over Muscle Creek. The bridge would however, be designed, as far as practicable, to avoid impacts to hydrology or fish passage and would have no downstream impacts if development controls include as a minimum, stabilisation of sediment and sediment filters during and post-construction. Notwithstanding this, given the potential for instream construction activity it would be precautionary to consult with DPI (Fisheries) in regard to the need for a part 7 permit for dredging (Section 200 of the FM Act) or for the potential obstruction of fish passage (Section 219 of the FM Act).

8 References

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APPENDIX

A

BIONET ATLAS SEARCH RESULTS

Appendix A – BioNet Atlas Search Results

Table A-1. BioNet Atlas Records within the 10 km locality surrounding the Biodiversity Study Area

Family	Scientific Name	Common Name	BC Act status	EPBC Act status	Records
Reptilia					
Pygopodidae	*Delma impar*	Striped Legless Lizard	V	V	7
Aves					
Anseranatidae	*Anseranas semipalmata*	Magpie Goose	V		1
Apodidae	*Hirundapus caudacutus*	White-throated Needletail		V, C, J, K	4
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	E		2
Ardeidae	*Ardea ibis*	Cattle Egret		C, J	6
Accipitridae	*Circus assimilis*	Spotted Harrier	V		3
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V	C	4
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V		4
Accipitridae	*Lophoicinia isura*	Square-tailed Kite	V		1
Falconidae	*Falco subniger*	Black Falcon	V		1
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V		3
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V		19
Psittacidae	*Lathamus discolor*	Swift Parrot	E	CE	6
Meropidae	*Merops ornatus*	Rainbow Bee-eater		J	4
Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V		8
Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	V		36
Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	CE	CE	1
Meliphagidae	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V		1
Pomatostomidae	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V		21
Petroicidae	*Melanodryas cucullate cucullata*	Hooded Robin (south-eastern form)	V		1
Petroicidae	*Petroica boodang*	Scarlet Robin	V		1
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V		13
Artamidae	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V		8
Estrildidae	*Stagonopleura guttata*	Diamond Firetail	V		5
Tytonidae	*Tyto tenebricosa*	Sooty Owl	v		1
Mammalia					
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	8
Dasyuridae	*Phascogale tapoatafa*	Brush-tailed Phascogale	V		3
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	V		28
Phascolarctidae	*Phascolarctos cinereus*	Koala	V	V	11
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	26
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V		9
Miniopteridae	*Miniopterus australis*	Little Bent-winged Bat	V		7
Miniopteridae	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V		37

Family	Scientific Name	Common Name	BC Act status	EPBC Act status	Records
Molossidae	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V		17
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	4
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V		9
Vespertilionidae	*Myotis macropus*	Southern Myotis	V		10
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V		8
Vespertilionidae	*Vespadelus troughtoni*	Eastern Cave Bat	V		10
Flora					
Campanulaceae	*Isotoma fluviatilis subsp. fluviatilis*	-		X	1
Fabaceae (Mimosoideae)	*Acacia pendula*	*Acacia pendula* population in the Hunter catchment	E		37
Myrtaceae	*Eucalyptus camaldulensis*	*Eucalyptus camaldulensis* population in the Hunter catchment	E		39
Myrtaceae	*Eucalyptus glaucina*	Slaty Red Gum	V	V	9
Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	1
Orchidaceae	*Cymbidium canaliculatum*	*Cymbidium canaliculatum* population in the Hunter Catchment	E		10
Orchidaceae	*Diuris tricolor*	Pine Donkey Orchid population in the Muswellbrook local government area	E		652
Orchidaceae	*Diuris tricolor*	Pine Donkey Orchid	V		652
Orchidaceae	*Prasophyllum petilum*	Tarengo Leek Orchid	E	E	1

Notes: V = Vulnerable; E = Endangered; CE = Critically Endangered; X = assumed extinct; Migratory agreements: C = CAMBA; J = JAMBA, K = ROKAMBA;

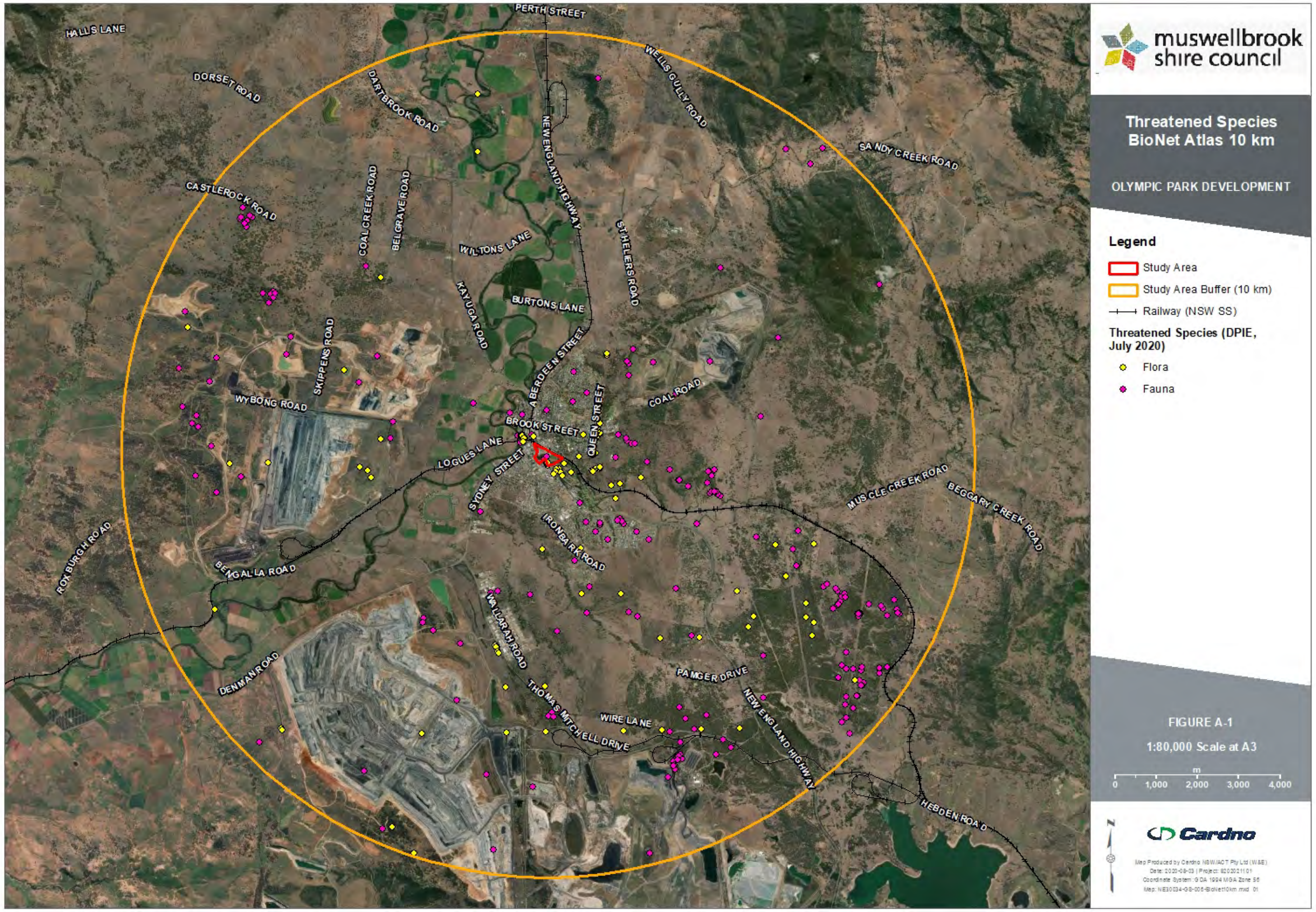


Figure A-1 BioNet Atlas records of threatened species within 10 km locality surrounding the Biodiversity Study Area

APPENDIX

B

PMST REPORT

Cardno

Australian Government

Department of the Environment and Energy

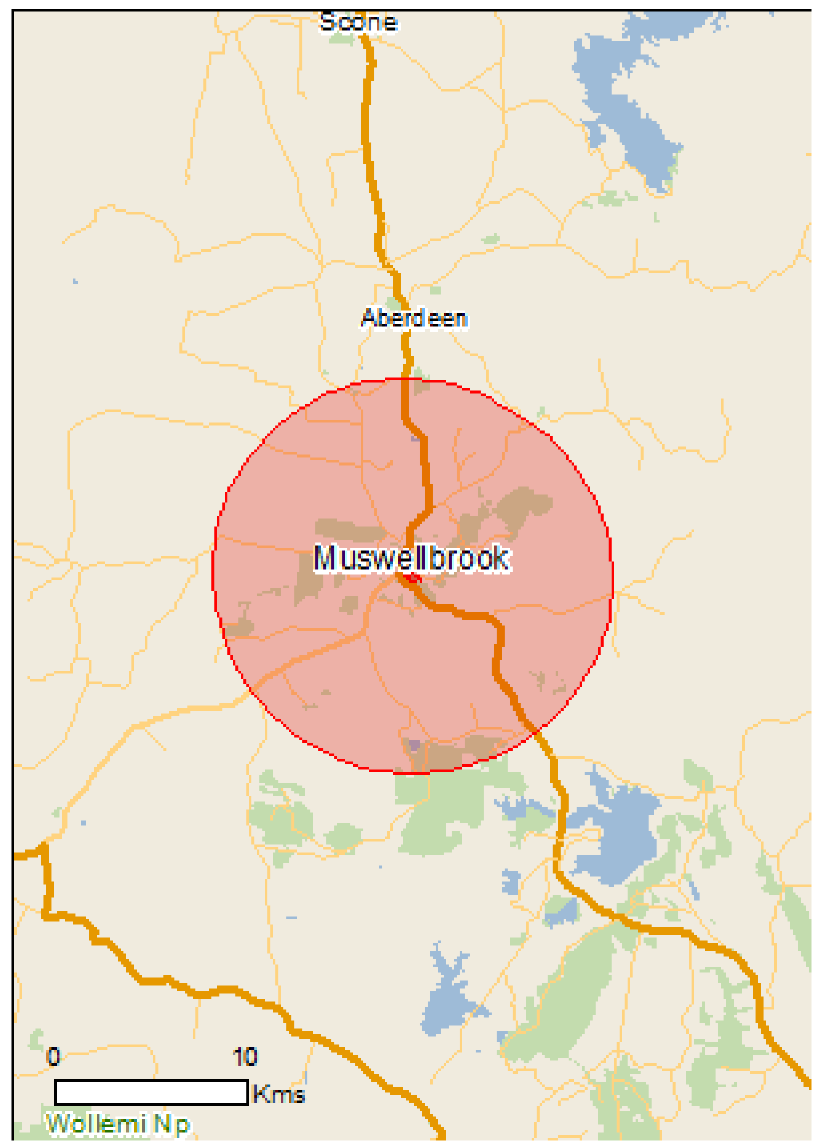
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

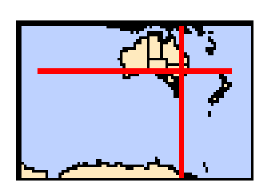
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 30/06/20 09:59:30



Coordinates

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	31
Listed Migratory Species:	14

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	7
Commonwealth Heritage Places:	1
Listed Marine Species:	21
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	1
Invasive Species:	31
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Hunter estuary wetlands	50 - 100km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community likely to occur within area
Hunter Valley Weeping Myall (Acacia pendula) Woodland	Critically Endangered	Community may occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat may occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
Litoria booroolongensis Booroolong Frog [1844]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat likely to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Androcalva procumbens [87153]	Vulnerable	Species or species habitat may occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat may occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus glaucina Slaty Red Gum [5670]	Vulnerable	Species or species habitat known to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Pterostylis gibbosa		
Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Thesium australe		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Tylophora linearis		
[55231]	Endangered	Species or species habitat may occur within area
Reptiles		
Aprasia parapulchella		
Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat likely to occur within area
Delma impar		
Striped Legless Lizard, Striped Snake-lizard [1649]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus		
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Commonwealth Bank of Australia
Commonwealth Land - Commonwealth Trading Bank of Australia
Commonwealth Land - Defence Housing Authority
Defence - MUSWELLBROOK GRES DEPOT

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Muswellbrook Post Office	NSW	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.266929 150.888563,-32.270222 150.895719,-32.270222 150.895719,-32.270775 150.896567,-32.270938 150.895837,-32.270857 150.894925,-32.271183 150.893445,-32.271319 150.893048,-32.271319 150.89293,-32.271628 150.892243,-32.27151 150.891921,-32.271374 150.89176,-32.270947 150.891589,-32.270104 150.891492,-32.269641 150.891675,-32.269532 150.891439,-32.269568 150.891278,-32.269496 150.891042,-32.269496 150.890784,-32.269614 150.890355,-32.269931 150.890097,-32.270122 150.890194,-32.270458 150.889979,-32.270458 150.889819,-32.270285 150.889615,-32.269206 150.889164,-32.268879 150.889293,-32.268298 150.889454,-32.267945 150.889357,-32.267754 150.889282,-32.267672 150.889057,-32.267591 150.888703,-32.267555 150.888553,-32.266983 150.888467,-32.266929 150.888563

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- -Office of Environment and Heritage, New South Wales
- -Department of Environment and Primary Industries, Victoria
- -Department of Primary Industries, Parks, Water and Environment, Tasmania
- -Department of Environment, Water and Natural Resources, South Australia
- -Department of Land and Resource Management, Northern Territory
- -Department of Environmental and Heritage Protection, Queensland
- -Department of Parks and Wildlife, Western Australia
- -Environment and Planning Directorate, ACT
- -Birdlife Australia
- -Australian Bird and Bat Banding Scheme
- -Australian National Wildlife Collection
- -Natural history museums of Australia
- -Museum Victoria
- -Australian Museum
- -South Australian Museum
- -Queensland Museum
- -Online Zoological Collections of Australian Museums
- -Queensland Herbarium
- -National Herbarium of NSW
- -Royal Botanic Gardens and National Herbarium of Victoria
- -Tasmanian Herbarium
- -State Herbarium of South Australia
- -Northern Territory Herbarium
- -Western Australian Herbarium
- -Australian National Herbarium, Canberra
- -University of New England
- -Ocean Biogeographic Information System
- -Australian Government, Department of Defence
- Forestry Corporation, NSW
- -Geoscience Australia
- -CSIRO
- -Australian Tropical Herbarium, Cairns
- -eBird Australia
- -Australian Government – Australian Antarctic Data Centre
- -Museum and Art Gallery of the Northern Territory
- -Australian Government National Environmental Science Program
- -Australian Institute of Marine Science
- -Reef Life Survey Australia
- -American Museum of Natural History
- -Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
- -Tasmanian Museum and Art Gallery, Hobart, Tasmania
- -Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
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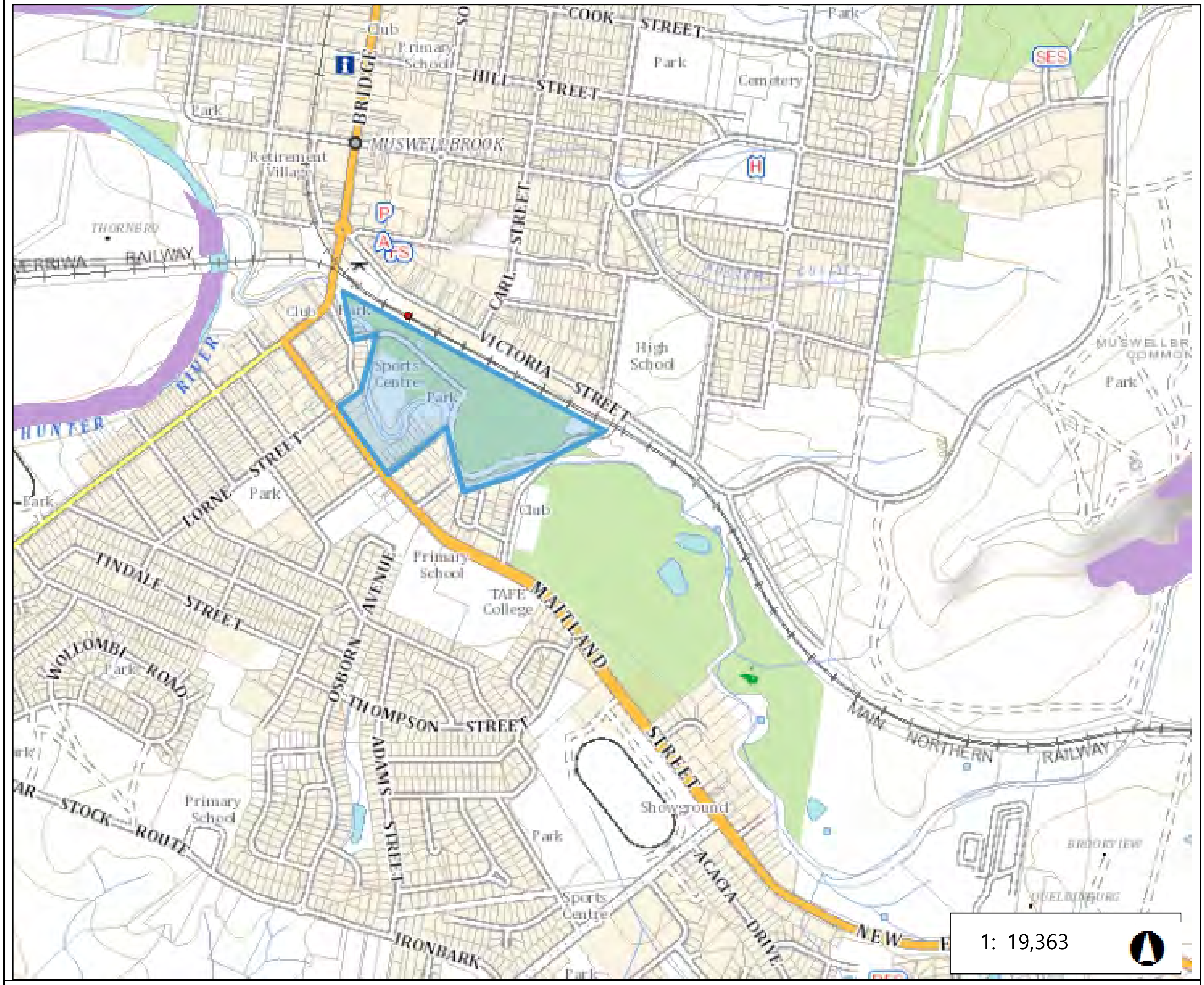
APPENDIX

C

BOSET REPORT

Biodiversity Offset Scheme (BOS) Entry Threshold Map



983.7 0 491.83 983.7 Metres

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Legend

- Biodiversity Values that have been mapped for more than 90 days
- Biodiversity Values added within last 90 days

Notes

Biodiversity Values Map and Threshold Report

Results Summary

Date of Calculation	30/06/2020 3:35 PM		**BDAR Required***
Total Digitised Area	17.01	ha	
Minimum Lot Size Method	LEP		
Minimum Lot Size	0.06	ha	
Area Clearing Threshold	0.25	ha	
Area clearing trigger Area of native vegetation cleared	Unknown #		Unknown #
Biodiversity values map trigger Impact on biodiversity values map(not including values added within the last 90 days)?	no		no
Date of the 90 day Expiry	N/A		

*If BDAR required has:

- at least one 'Yes': you have exceeded the BOS threshold. You are now required to submit a Biodiversity Development Assessment Report with your development application. Go to https://customer.lmbc.nsw.gov.au/assessment/AccreditedAssessor to access a list of assessors who are accredited to apply the Biodiversity Assessment Method and write a Biodiversity Development Assessment Report
- 'No': you have not exceeded the BOS threshold. You may still require a permit from local council. Review the development control plan and consult with council. You may still be required to assess whether the development is '"likely to significantly affect threatened species' as determined under the test in s. 7.3 of the Biodiversity Conservation Act 2016. You may still be required to review the area where no vegetation mapping is available.

Where the area of impact occurs on land with no vegetation mapping available, the tool cannot determine the area of native vegetation cleared and if this exceeds the Area Threshold. You will need to work out the area of native vegetation cleared - refer to the BOSET user guide for how to do this.

On and after the 90 day expiry date a BDAR will be required.

Disclaimer

This results summary and map can be used as guidance material only. This results summary and map is not guaranteed to be free from error or omission. The State of NSW and Office of Environment and Heritage and its employees disclaim liability for any act done on the information in the results summary or map and any consequences of such acts or omissions. It remains the responsibility of the proponent to ensure that their development application complies will all aspects of the *Biodiversity Conservation Act 2016.*

The mapping provided in this tool has been done with the best available mapping and knowledge of species habitat requirements. This map is valid for a period of 30 days from the date of calculation (above).

Acknowledgement

I as the applicant for this development, submit that I have correctly depicted the area that will be impacted or likely to be impacted as a result of the proposed development.

Signature__________________________ Date: 30/06/2020 03:35 PM

APPENDIX

D

LIKELIHOOD OF OCCURRENCE AND RISK ASSESSMENT TABLE

Appendix D – LoOR Table

Threatened species, populations and ecological communities, and migratory species (listed under the BC Act, FM Act and/or EPBC Act) that are known, or have potential, to occur within a 10 km radius of the Biodiversity Study Area have been considered in this section. The likelihood of occurrence within the Biodiversity Study Area of each species or TEC was assessed using the criteria described in **Table D1-1** and the findings presented in **Table D1-2**. This assessment was undertaken based on previous records, the results of the field survey and known species habitat requirements. **Table D1-2** also provides an assessment of the potential impact of the proposed project on each species and TEC.

Table C1-1. Likelihood of occurrence criteria

Likelihood Rating	Criteria
Known	The species was recorded within the Biodiversity Study Area during the field surveys.
High	It is likely that a species would inhabit or utilise habitat within the Biodiversity Study Area. Criteria for this category may include: > Species recently and/or regularly recorded in contiguous or nearby habitat; > High quality habitat or resources present within the Biodiversity Study Area; > Species is known or likely to maintain a resident population surrounding the Biodiversity Study Area; and > Species is known or likely to visit during migration or in response to seasonal availability of resources present on site.
Moderate	Potential habitat for a species occurs within the Biodiversity Study Area. Criteria for this category may include: > Species previously recorded in contiguous habitat albeit not recently (>10 years); > Habitat present, but poor quality, depauperate or modified types and/or resources; > Species has potential to utilise habitat during migration or seasonal availability of resources; and > Cryptic flora species with potential habitat within the Biodiversity Study Area that have not been targeted by surveys (for example, surveys were not undertaken with the flowering season.
Low	It is unlikely that the species inhabits the area, if it did, it would likely be a transient visitor. Criteria for this category may include: > The Biodiversity Study Area does not support the specific habitat types or resources required by the species; > The Biodiversity Study Area is beyond the current distribution of the species or is isolated from known populations; and > Non-cryptic flora species not observed during targeted surveys.
None/Absent	The habitat within the Biodiversity Study Area is unsuitable for the species.

Table D1-2. Likelihood of Occurrence and risk of impact assessment of threatened species, populations and ecological communities

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
Frogs						
Giant Burrowing Frog (*Heleioporus australiacus*)	V	V	PMST	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are approximately 0.04 ha in size.	**Low:** suitable habitat for the species occurs within the site. Although no known records of the species exist within the site, it is acknowledged that surveys have not been undertaken therein.	**Likely:** The possibility of the species occurring at the site cannot be precluded. Targeted surveys in suitable habitat would be required if impacts to Muscle Creek habitat occurs.
Green and Golden Bell Frog (*Litoria aurea*)	E	V	PMST	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available.	**Low:** suitable habitat for the species is present along riparian corridor of Muscle Creek. No known records of the species are known within the 10 km locality.	**Likely:** The possibility of the species occurring at the site cannot be precluded. Targeted surveys in suitable habitat would be required if impacts to Muscle Creek habitat occurs.
Booroolong Frog (*Litoria booroolongensis*)	E	E	PMST	Booroolong frog live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins. The species shelter under rocks or amongst vegetation near the ground on the stream edge. It sometimes basks in the sun on exposed rocks near flowing water during summer. Breeding occurs in spring and early summer and tadpoles metamorphose in late summer to early autumn. Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools.	**Low:** limited suitable habitat for the species is present along riparian corridor of Muscle Creek. Given that the stream is intermittent, there is low potential for the species to occur. No known records of the species are known within the 10 km locality.	**Likely:** The possibility of the species occurring at the site cannot be precluded. Targeted surveys in suitable habitat would be required if impacts to Muscle Creek habitat occurs.
Birds						
Regent Honeyeater (*Anthochaera phrygia*)	CE	CE	BioNet – 1 PMST	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	**Low:** limited suitable habitat for the species is present at the site. The nearest known record of the species is located at approximately 430 m north-east and was recorded in 1905.	**Unlikely:** although limited suitable habitat for the species occurs at the site, the species has not occurred in the locality for over 20 years. It is unlikely the proposed development would affect habitat for the species.
Magpie Goose (*Anseranas semipalmata*)	V	-	BioNet – 1	Magpie Goose is mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. The species is found equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. The species activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW. Often seen in trios or flocks on shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains; roosts in tall vegetation.	**Low:** limited suitable habitat for the species is present at the site. The nearest known record of the species is located at approximately 4.5 km south-east and was recorded in 2014.	**Unlikely:** although limited suitable habitat for the species occurs at the site, no known records of the species are known within the site. The proposed development will occur in cleared land with only a small area of Muscle Creek likely to be impacted for construction of a road bridge connecting Wilder Street and Wilkinson Avenue. It is unlikely the proposed development would affect habitat for the species.
Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)	V	-	BioNet – 8	Often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests and very occasionally in moist forests or rainforests.	**Low:** limited suitable habitat for the species is present within the site. The nearest known record of the species is located at approximately 415 m north-west and was recorded in 1959.	**Unlikely:** the species is not known to occur at the site. The proposed development will not occur in suitable habitat for the species. It is unlikely the proposed development would affect habitat for the species.
Australasian Bittern (*Botaurus poiciloptilus*)	E	E	PMST	In NSW, they may be found over most of the state except for the far north-west. Favors permanent freshwater wetlands with tall, dense vegetation, particularly 53agittate (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails.	**Low:** suitable habitat for the species is present in Muscle Creek within the site. No record of the species is known within the 10 km locality.	**Unlikely:** the species is not known to occur at the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would affect habitat for the species.

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
Curlew Sandpiper (*Calidris ferruginea*)		CE, Bonn, C, J, K	PMST	It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed.	**Low:** no suitable habitat for the species is present at the site. Given that the species is migratory, occasional occurrence might occur as result of the species migratory pathway.	**Unlikely:** the site does not provide suitable habitat for long-term survival of this migratory species. Therefore, it is unlikely that development at the site would result in significant impacts on the species.
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	V	-	BioNet – 3	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, *Allocasuaraina diminuta*, and *A. gymnathera*. Belah is also utilised and may be a critical food source for some populations.	**Low:** suitable foraging and roosting habitat for the species occurs in within the site and within Muscle Creek riparian corridor. The nearest known record of the species within the 10 km locality was recorded at approximately 1.7 km south-east from the site and was recorded in 2014.	**Unlikely:** suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would affect habitat for the species.
Speckled Warbler (*Chthonicola sagittata*)	V	-	BioNet – 36	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	**Low:** limited substandard suitable habitat for the species occurs within the site. The nearest known record of the species within the 10 km locality was recorded at approximately 35 km south-east in 2015.	**Unlikely:** suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would affect habitat for the species.
Spotted Harrier (*Circus assimilis*)	V	-	BioNet – 3	The Spotted Harrier occurs in grassy open woodland including *Acacia* and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Preys on terrestrial mammals (eg bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion.	**Low:** limited substandard suitable habitat for the species occurs within the site. The nearest known record of the species within the 10 km locality was recorded at approximately 1 km north-east in 1982.	**Unlikely:** suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would affect habitat for the species.
Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)	V		BioNet – 8	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Sedentary, considered to be resident in many locations throughout its range; present in all seasons or year-round at many sites; territorial year-round, though some birds may disperse locally after breeding.	**Moderate:** limited suitable habitat for the species occurs within the site. The nearest known record of the species within the 10 km locality was recorded at approximately 2 km south-east in 2017.	**Unlikely:** suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would affect habitat for the species.
Varied Sittella (*Daphoenositta chrysoptera*)	V	-	BioNet – 13	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	**Low:** limited substandard suitable habitat for the species occurs within the site. The nearest known record of the species within the 10 km locality was recorded at approximately 4 km south-east in 2020.	**Unlikely:** limited substandard habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would affect habitat for the species.
Black-necked Stork (*Ephippiorhynchus asiaticus*)	E	-	BioNet – 2	Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the	**Low:** limited suitable habitat for the species occurs within the site. The nearest known record of the species within the 10 km locality was recorded at approximately 800 m north-west in 2015.	**Unlikely:** limited suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
				floodplain habitat). Storks usually forage in water 5-30cm deep for vertebrate and invertebrate prey (eels, fish, frogs and invertebrates).		development would affect habitat for the species.
Red Goshawk (*Erythrotriorchis radiatus*)	CE	V	PMST	The Red Goshawk is a large, reddish-brown hawk that inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, *Melaleuca* swamp forest and riparian *Eucalyptus* forest of coastal rivers. Red Goshawks mainly eat medium to large birds, including species as large as Australian Brush-turkeys, Kookaburras, Tawny Frogmouths, Sulphur-crested Cockatoos and Rainbow Lorikeets, but they also take mammals, reptiles and insects. These raptor species stick nest in a tall tree (>20 m tall) within 1 km of a watercourse or wetland.	**Low:** limited suitable habitat for the species occurs within the site. No record of the species is known within the 10 km locality.	**Unlikely:** limited suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would affect foraging habitat for the species.
Black Falcon (*Falco subniger*)	V	-	BioNet – 1	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. It is found along tree-lined watercourses and in isolated woodlands, mainly in arid and semi-arid areas. It roosts in trees at night and often on power poles by day.	**Low:** limited suitable habitat for the species occurs within the site. The nearest known record of the species within the 10 km locality was recorded at approximately 3.5 km south-west in 1987.	**Unlikely:** suitable foraging habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would affect habitat for the species.
Little Lorikeet (*Glossopsitta pusilla*)	V	-	BioNet – 19	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species.	**Moderate:** suitable habitat for the species occurs within the site. The nearest known record of the species within the 10 km locality was recorded at approximately 3.1 km south-east in 2019.	**Unlikely:** suitable foraging habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would remove suitable foraging habitat for the species.
Painted Honeyeater (*Grantiella picta*)		V	PMST	The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*.	**Low:** no suitable foraging habitat for the species occurs within the site. No record of the species is known within the 10 km locality.	**Unlikely:** no suitable foraging habitat for the species occurs within the site. It is unlikely the proposed development would affect habitat for the species.
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	V	C	BioNet – 4	Habitats are characterized by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest).	**Moderate:** suitable habitat for the species occurs within the site. The nearest known record of the species within the 10 km locality was recorded at approximately 2.1 km south-west in 2014.	**Unlikely:** suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would remove suitable habitat for the species.
Little Eagle (*Hieraaetus morphnoides*)	V	-	BioNet – 4	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	**Moderate:** suitable habitat for the species occurs within the site. The nearest known record of the species within the 10 km locality was recorded at approximately 2.1 km east in 2018.	**Unlikely:** suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would remove suitable habitat for the species.
White-throated Needletail (*Hirundapus caudacutus*)	-	V, Mi	BioNet – 4 PMST	Found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial. Large tracts of native vegetation, particularly forest, may be a key habitat requirement for the species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. Appears to have traditional roost sites.	**Low:** limited suitable habitat for the species occurs within the site. The nearest known record of the species within the 10 km locality was recorded at approximately 5.1 km south-east in 2012.	**Unlikely:** limited suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
						development would remove suitable habitat for the species.
Swift Parrot (*Lathamus discolor*)	E	CE	BioNet – 6 PMST	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*.	**Low:** limited suitable habitat for the species occurs within the site. Known records of the species occur within the 10 km locality and outside the site.	**Unlikely:** limited suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would remove suitable habitat for the species.
Square-tailed Kite (*Lophoictinia isura*)	V		BioNet – 1	The Square-tailed Kite is a long-winged raptor with scattered known records across most of NSW. It is found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. The species appears to occupy large hunting ranges of more than 100km^2	**Low:** limited suitable habitat for the species occurs within the site. Known records of the species occur within the 10 km locality and outside the site.	**Unlikely:** limited suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would remove suitable habitat for the species.
Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*)	V		BioNet – 1	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season.	**Low:** limited suitable habitat for the species occurs within the site. Known records of the species occur within the 10 km locality and outside the site.	**Unlikely:** limited suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would remove suitable habitat for the species.
Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*)	V		BioNet – 1	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	**Low:** limited suitable habitat for the species occurs within the site. Known records of the species occur within the 10 km locality and outside the site.	**Unlikely:** limited suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would remove suitable habitat for the species.
Rainbow Bee-eater (*Merops ornatus*)	-	J	PMST	The Rainbow Bee-eater is distributed across much of mainland Australia, and occurs on several near-shore islands. It occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water.	**Low:** limited suitable habitat for the species occurs within the site. No record of the species is known within the 10 km locality.	**Unlikely:** the site has limited suitable habitat for the species, but it does not provide suitable habitat for long-term survival of this migratory species. Therefore, it is unlikely that development at the site would result in significant impacts on the species.
Eastern Curlew, Far Eastern Curlew (*Numenius madagascariensis*)		CE, Mi	PMST	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. The birds are also found in saltworks and sewage farms. The numbers of Eastern Curlew recorded during one study were correlated with wetland areas.	**None:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10km locality.	**Unlikely:** the site does not provide suitable habitat for the species.
Scarlet Robin (*Petroica boodang*)	V		BioNet – 1	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat.	**Low:** limited suitable habitat for the species occurs within the site. Known records of the species occur within the 10 km locality and outside the site.	**Unlikely:** limited suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
						development would remove suitable habitat for the species.
Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)	V	-	BioNet – 21	Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions. The species has limited flight abilities and lives in family groups in territories (1 – 50 ha) where several nests are maintain for nocturnal used as dormitory for roosting. Feed on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses.	**Low:** limited suitable habitat for the species occurs within the site. The nearest known record of the species within the 10 km locality was recorded at approximately 6.5 km south in 2009.	**Unlikely:** limited suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would remove suitable habitat for the species.
Australian Painted Snipe (*Rostratula australis*)	-	E	PMST	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	**None:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10km locality.	**Unlikely:** the site does not provide suitable habitat for the species.
Diamond Firetail (*Stagonopleura guttata*)	V	-	BioNet – 5	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	**Low:** limited suitable habitat for the species occurs within the site. Known records of the species occur within the 10 km locality and outside the site.	**Unlikely:** limited suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would remove suitable habitat for the species.
Sooty Owl (*Tyto tenebricosa*)	V	-	BioNet – 1	Sooty Owl occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Territories are occupied permanently. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (*Pseudocheirus peregrinus*) or Sugar Glider (*Petaurus breviceps*). Nests in very large tree-hollows.	**Low:** limited suitable habitat for the species occurs within the site. Known records of the species occur within the 10 km locality and outside the site. No suitable Hollow-bearing trees for the species occur within the site.	**Unlikely:** limited suitable habitat for the species occurs within the site. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would remove suitable habitat for the species.
Migratory Marine Birds						
Fortk-tailed Swift (*Apus pacificus*)		Ma, C, J, R	PMST	The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea; over settled areas, including towns, urban areas and cities. They forage aerially, up to hundreds of metres above ground, but also less then 1 m above open areas or over water.	**Low:** limited suitable habitat for the species occurs within the site. No known records of the species occur within the 10 km locality. Given that the species is migratory, its occasional occurrence at the site cannot be precluded.	**Unlikely:** suitable habitat for the species occurs within the site. Given its migratory nature, the species would not depend on resources within the site for its long-term survival. It is unlikely that the proposal would result in significant impact on the species.
Migratory Terrestrial Birds						
Black-faced Monarch (*Monarcha melanopsis*)	-	K	PMST	Wet forest specialist, found mainly in rainforest and wet sclerophyll forest, especially in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs.	**Low:** limited suitable habitat for the species occurs within the site. No known records of the species occur within the 10 km locality. Given that the species is migratory, its occasional occurrence at the site cannot be precluded.	**Unlikely:** suitable habitat for the species occurs within the site. Given its migratory nature, the species would not depend on resources within the site for its long-term survival. It is unlikely that the proposal would result in significant impact on the species.
Yellow Wagtail (*Motacilla flava*)	-	C, J, K, Ma	PMST	Non-breeding habitat only: mostly well-watered open grasslands and the fringes of wetlands. Roosts in mangroves and other dense vegetation.	**None:** no suitable habitat for this bird species occurs within the site. No known records occur within the 10 km locality. The species is migratory and its occasional presence over the site during its migratory movements could occur.	**Unlikely:** No suitable habitat for the species occurs within the site. Given its migratory nature, the species would not depend on resources within the site for its long-term survival. It is unlikely that the proposal would result in significant impact on the species.
Satin Flycatcher (*Myagra cyanoleuca*)		K, Ma	PMST	Eucalypt forest and woodlands, at high elevations when breeding. They are particularly common in tall wet sclerophyll forest, often in gullies or along watercourses. In woodlands they prefer open, grassy woodland	**Low:** limited suitable habitat for the species occurs within the site. No known records of the species occur	**Unlikely:** suitable habitat for the species occurs within the site. Given its migratory nature, the species

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
				types. During migration, habitat preferences expand, with the species recorded in most wooded habitats except rainforests. Wintering birds in northern Qld will use rainforest - gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps.	within the 10 km locality. Given that the species is migratory, its occasional occurrence at the site cannot be precluded.	would not depend on resources within the site for its long-term survival. It is unlikely that the proposal would result in significant impact on the species.
Rufous Fantail (*Rhipidura rufifrons*)		Bonn, Ma	PMST	Moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey. When on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrublands.	**Low:** Limited suitable habitat for this bird species occurs within the site. No known records occur within the 10 km locality. The species is migratory and its occasional presence over the site during its migratory movements could occur.	**Unlikely:** suitable habitat for the species occurs within the site. Given its migratory nature, the species would not depend on resources within the site for its long-term survival. It is unlikely that the proposal would result in significant impact on the species.
Migratory Wetland Birds						
Common Sandpiper (*Actitis hypoleucos*)	-	L	PMST	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia.	**None:** no suitable habitat for this bird species occurs within the site. No known records occur within the 10 km locality. The species is migratory and its occasional presence over the site during its migratory movements might occur.	**Unlikely:** No suitable habitat for the species occurs within the site. Given its migratory nature, the species would not depend on resources within the site for its long-term survival. It is unlikely that the proposal would result in significant impact on the species.
Sharp-tailed Sandpiper (*Calidris acuminata*)	-	Bonn, C, J, K	PMST	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland.	**None:** No suitable coastal habitat for this bird species occurs within the site. No known records occur within the 10 km locality. The species is migratory and its occasional presence over the site during its migratory movements might occur.	**Unlikely:** No suitable habitat for the species occurs within the site. Given its migratory nature, the species would not depend on resources within the site for its long-term survival. It is unlikely that the proposal would result in significant impact on the species.
Pectoral Sandpiper (*Calidris melanotos*)	-	Bonn, J, R, Ma	PMST	In New South Wales (NSW), the Pectoral Sandpiper is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. The species prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	**Moderate:** no suitable habitat for this aquatic bird species occurs within the site. No known records occur within the 10 km locality. The species is migratory and its occasional presence over the site during its migratory movements could occur.	**Unlikely:** no suitable habitat for the species occurs within the site. Given its migratory nature, the species would not depend on resources within the site for its long-term survival. Therefore, it is considered unlikely that the proposal would result in significant impact on the species.
Latham's Snipe, Japanese Snipe (*Gallinago hardwickii*)	-	Bonn, J, Ki	PMST	Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity.	**Moderate:** suitable habitat for this aquatic bird species occurs within the site. No known records occur within the 10 km locality. The species is migratory and its occasional presence over the site during its migratory movements could occur.	**Unlikely:** suitable habitat for the species occurs within the site. Given its migratory nature, the species would not depend on resources within the site for its long-term survival. Therefore, it is considered unlikely that the proposal would result in significant impact on the species.
Osprey (*Pandion haliaetus;* syn *Pandion cristatus*)	V	Bonn, Ma	PMST	Eastern Osprey favor coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometer of the sea.	**None:** No suitable coastal habitat for this bird species occurs within the site. No known records occur within the 10 km locality. The species is migratory and its occasional presence over the site during its migratory movements might occur.	**Unlikely:** No suitable habitat for the species occurs within the site. Given its migratory nature, the species would not depend on resources within the site for its long-term survival. It is unlikely that the proposal would result in significant impact on the species.
Common Greenshank (*Tringa nebularia*)		Bonn, C, J, R, Ma	PMST	Common Greenshank is a wader that migrates to Australia on its non-breeding phase. It occurs in all types of wetlands and has a wide distribution in Australia. Feeding habitat: forage at edges of wetlands, in soft mud on mudflats, in channels, or in shallows around the edges of water often among pneumatophores of mangroves or other sparse, emergent or fringing vegetation, such as sedges or saltmarsh. It will occasionally feed on exposed seagrass beds. Roosting habitat: roosts and loafs round wetlands, in shallow pools and puddles, or slightly elevated on rocks, sandbanks or small muddy islets. Occasionally the species will perch and roost on stakes.	**Low:** no natural habitat for the species is present within the site. The species could also occasionally occupy riparian habitat. No known records occur within the 10 km locality. The species is migratory and its occasional presence over the site during its migratory movements might occur.	**Unlikely:** no suitable habitat for the species occurs within the site. Given its migratory nature, the species would not depend on resources within the site for its long-term survival. It is unlikely that the proposal would result in significant impact on the species.
Mammals						

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	V	BioNet – 4 PMST	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies.	**Low:** no suitable foraging and suitable foraging habitat for the species occurs within the site. The nearest known record of the species was recorded in 2019 at approximately 2.5 km south-east from the site.	**Likely:** suitable foraging habitat for the species is present within Muscle Creek riparian corridor. Although the proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue, it is unlikely the proposed development would remove suitable habitat for the species.
Spotted-tailed Quoll (*Dasyurus maculatus*) Spotted-tailed Quoll (southeastern mainland population) (*Dasyurus maculatus maculatus*)	V	E E	BioNet – 8 PMST	Spotted-tailed quolls live in various environments including forests, woodlands, coastal heathlands and rainforests. They are sometimes seen in open country, or on grazed areas and rocky outcrops. They are mainly solitary animals, and will make their dens in rock shelters, small caves, hollow logs and tree hollows. They use these dens for shelter and to raise young. These animals are highly mobile. They can move up to several kilometres in a night and may have quite large territories. Within their territories, they will have latrine areas where they defecate. These are often in exposed areas, such as on rocky outcrops.	**Low:** no suitable habitat for the species occurs within the site. The nearest known record of the species was recorded in 2008 at approximately 2 km from the site.	**Unlikely:** no suitable habitat for the species is present. The proposed development will not result in impacts on the species or its habitat.
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V	-	BioNet – 9	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	**Known:** suitable habitat for the species occurs within the site. The echolocation call of species was recorded with acoustic recorders in 2019 and within Muscle Creek riparian corridor.	**Unlikely:** suitable habitat for the species is present within the riparian corridor. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. The possibility exists that stags or trees with suitable habitat might be removed. However, it is unlikely the proposed development would result on significant impact on the species.
Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) (synonym *Mormoprterus norfolkensis*)	V	-	BioNet – 17	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. It occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous	**Known:** suitable habitat for the species occurs within the site. The echolocation call of species was recorded with acoustic recorders in 2019 and within Muscle Creek riparian corridor.	**Unlikely:** suitable habitat for the species is present within the riparian corridor. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. The possibility exists that stags or trees with suitable habitat might be removed. However, it is unlikely the proposed development would result on significant impact on the species.
Little Bent-winged Bat (*Miniopterus australis*)	V	-	BioNet – 7	The Little Bent-winged Bat occurs in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. The species roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters.	**Known:** suitable habitat for the species occurs within the site. The echolocation call of species was recorded with acoustic recorders in 2019 and within Muscle Creek riparian corridor.	**Unlikely:** suitable habitat for the species is present within the riparian corridor. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. The possibility exists that stags or trees with suitable habitat might be removed. However, it is unlikely the proposed development would result on significant impact on the species.
Large Bent-winged Bat (*Miniopterus orianae oceanensis*)	V	-	BioNet – 37	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves.	**Known:** suitable habitat for the species occurs within the site. The echolocation call of species was recorded with acoustic recorders in 2019 and within Muscle Creek riparian corridor.	**Unlikely:** suitable habitat for the species is present within the riparian corridor. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. The possibility exists that stags or trees with suitable habitat might be removed. However, it is unlikely the proposed development would result on significant impact on the species.

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
Southern Myotis (*Myotis Macropus*)	V	-	BioNet – 10	Generally, the Southern Myotis roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	**Known:** suitable habitat for the species occurs within the site. The echolocation call of species was recorded with acoustic recorders in 2019 and within Muscle Creek riparian corridor.	**Unlikely:** suitable habitat for the species is present within the riparian corridor. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. The possibility exists that stags or trees with suitable habitat might be removed. However, it is unlikely the proposed development would result on significant impact on the species.
Corben's Long-eared Bat, South-eastern Long-eared Bat (*Nyctophilus corbeni*)	V	V	PMST	Corben's Long-eared bat inhabits a variety of vegetation types, including mallee, bulloke (*Allocasuarina leuhmanni*) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/ cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. It roosts in tree hollows, crevices, and under loose bark. It is a slow flying agile bat, utilising the understorey to hunt non-flying prey - especially caterpillars and beetles - and will even hunt on the ground. Mating takes place in autumn with one or two young born in late spring to early summer.	**Low:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality..	**Unlikely:** no suitable habitat for the species is present. The proposed development will not result in impacts on the species or its habitat.
Greater Glider (*Petauroides volans*)	-	V	PMST	The greater glider is an arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The distribution may be patchy even in suitable habitat. The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species.	**Low:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** no suitable habitat for the species is present. The proposed development will not result in impacts on the species or its habitat.
Squirrel Glider (*Petaurus norfolcensis*)	V	-	BioNet – 28	The Squirrel Glider is an arboreal tree hollow dependent mammal that inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. The species prefers mixed species stands with a shrub or Acacia midstorey. Live in family groups of a single adult male one or more adult females and offspring. Require abundant tree hollows for refuge and nest sites. Its diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	**Low:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** no suitable habitat for the species is present. The proposed development will not result in impacts on the species or its habitat.
Brush-tailed Rock Wallaby (*Petrogale penicillata*)		V	PMST	Occurs in forests and woodlands along the Great Divide and on the western slopes in escarpment country with rocky outcrops, steep rocky slopes, gorges, boulders and isolated rocky areas. The majority of populations favour north-facing aspects, but some southern aspects have been recorded. Apart from the critical rock structure, Brush-tailed Rock-wallaby also requires adjacent vegetation types, associated types include, dense rainforest, wet sclerophyll, vine thicket, dry sclerophyll forest and open forest. They also require suitable caves and rocky overhangs for shelter and also for 'lookout' posts.	**Low:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** no suitable habitat for the species is present. The proposed development will not result in impacts on the species or its habitat.
Brush-tailed Phascogale (*Phascogale tapoatafa*)	V	-	BioNet – 3	Brush-tailed Phascogale prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. The species is agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. It feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20 - 40 ha, while males have overlapping territories often greater than 100 ha. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span.	**Low:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** no suitable habitat for the species is present. The proposed development will not result in impacts on the species or its habitat.
Koala (*Phascolarctos cinereus*)	V	V V	BioNet – 11 PMST	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	**Low:** no suitable habitat for the species occurs within the site. The nearest known record of the species exist within the 10 km locality was	**Unlikely:** although some known koala feed trees are present within the Biodiversity Study Area, no suitable habitat for the species is present. The proposed development will not result

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
Koala (combined populations of Queensland, NSW and ACT) (*Phascolarctos cinereus*)					recorded in 2013 at approximately 2 km from the site.	in impacts on the species or its habitat.
New Holland Mouse, Pookila (*Pseudomys novaehollandiae*)	-	V	PMST	New Holland Mouse are known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals. Its distribution is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire.	**Low:** no suitable habitat for the species occurs within the site. No known record of the species occurs within the 10km locality.	**Unlikely:** No suitable habitat for the species occurs within the site.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	BioNet – 26 PMST	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.	**Known:** suitable foraging habitat for the species occurs within the site and the species was observed roosting within the site. The species roosts in 'roost camps' where hundreds to thousands of individuals co-exist and breed. At dusk, the colony fly out in search for food, individuals can travel over 20km each night in search for food. The site is not a known 'roost camp', however Muscle Creek riparian corridor is suitable habitat for species to roost.	**Unlikely:** suitable habitat for the species is present. The species was observed roosting in trees located at least 120 m from Wilkinson Avenue and Wilder Street, outside of proposed development footprint. It is considered unlikely that Stage 1 of the proposed development will result in significant impacts on the species.
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	V	-	BioNet – 9	Yellow-bellied Sheathtail-bat is an insectivorous microbat that roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.	**Moderate:** suitable habitat for the species occurs within the site. Known records of the species exist within the 10 km locality. The nearest record is located at approximately 2.3 km south-east from the site and was recorded in 2019.	**Unlikely:** suitable habitat for the species is present. Targeted surveys would be required to confirm presence of the species. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. The possibility exists that stags or trees with suitable habitat for the species might be removed. However, it is unlikely the proposed development would result on significant impact on the species.
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	-	BioNet – 8	Greater Broad-nosed Bat is found mainly in the gullies and river systems, it utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 – 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.	**Known:** suitable habitat for the species occurs within the site. The echolocation call of species was recorded with acoustic recorders in 2019 and within Muscle Creek riparian corridor.	**Unlikely:** suitable habitat for the species is present within the riparian corridor. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. The possibility exists that stags or trees with suitable habitat might be removed. However, it is unlikely the proposed development would result on significant impact on the species.
Eastern Cave Bat (*Vespadelus troughtoni*)	V	-	BioNet – 10	The Eastern Cave Bat is a cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. It is occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.	**Known:** suitable habitat for the species occurs within the site. The echolocation call of species was recorded with acoustic recorders in 2019 and within Muscle Creek riparian corridor.	**Unlikely:** suitable habitat for the species is present within the riparian corridor. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. The possibility exists that stags or trees with suitable habitat might be removed. However, it is unlikely the proposed development would result on significant impact on the species.
Reptiles						

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
Pink-tailed Worm-lizard, Pink-tailed Legless Lizard (*Aprasia parapulchela*)	V	V	PMST	Pink-tailed Worm-lizard inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black ants and termites. Feeds on the larvae and eggs of the ants with which it shares its burrows. It is thought that this species lays 2 eggs inside the ant nests during summer; the young first appear in March.	**Low:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** no suitable habitat for the species is present. The proposed development is unlikely to affect habitat for the species.
Striped Legless Lizard (*Delma impar*)	V	V	BioNet – 7 PMST	The Striped Legless Lizard is found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass (*Themeda australis*), spear-grasses (*Austrostipa* spp.) and poa tussocks (*Poa* spp.), and occasionally wallaby grasses (*Austrodanthonia* spp.). Sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter. Sometimes utilises dried cowpats for shelter. The species actively hunts for spiders, crickets, moth larvae and cockroaches. Females lay two papery eggs are laid in early summer. Individuals goes below ground or under rocks or logs over winter.	**Low:** no suitable habitat for the species occurs within the site. Known records of the species exist within the 10 km locality. The nearest record is located at approximately 2 km north-east from the site and was recorded in 2015.	**Unlikely:** no suitable habitat for the species is present within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Flora						
Acacia pendula population in the Hunter catchment (*Acacia pendula*)	E	-	BioNet – 37	Within the Hunter catchment, *Acacia pendula* typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations. This Hunter population is known to occur naturally as far east as Warkworth, and extends northwest to Muswellbrook and to the west of Muswellbrook at Wybong. Only recorded to date at 6 locations: Jerrys Plains, Edderton, Wybong, Appletree Creek, Warkworth and Appletree Flat. These locations occur within the Muswellbrook and Singleton Local Government Areas, with the population potentially also occurring within the Mid-Western Regional and Upper Hunter LGA's.	**Low:** no suitable habitat for the species occurs within the site. Known records of the species exist within the 10 km locality and outside the site.	**Unlikely:** no suitable habitat for the species is present within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Androcalva procumbens *(syn. Rulingia procumbens, Commersonia procumbens)*		V	PMST	Commersonia procumbens is Endemic to NSW, mainly confined to the Dubbo-Mendooran-Gilgandra region, but also in the Pilliga and Nymagee areas. Recent collections made from the Upper Hunter region, and additional populations found in Goonoo SCA in response to the 2007 fires. Grows in sandy sites, often along roadsides. Recorded in *Eucalyptus dealbata* and *Eucalyptus sideroxylon* communities, *Melaleuca uncinata* scrub, under mallee eucalypts with a *Calytrix tetragona* understorey, and in a recently burnt Ironbark and *Callitris* area. Also, in *Eucalyptus fibrosa subsp. nubila*, *Eucalyptus dealbata*, *Eucalyptus albens* and *Callitris glaucophylla* woodlands north of Dubbo. Other associated species include *Acacia triptera*, *Callitris endlicheri*, *Eucalyptus melliodora*, *Allocasuarina diminuta*, *Philotheca salsolifolia*, *Xanthorrhoea* species, *Exocarpos cupressiformis*, *Leptospermum parvifolium* and *Kunzea parvifolia*. Fruiting period is summer to autumn. Flowers from August to December.	**Low:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** no suitable habitat for the species is present within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Cymbidium canaliculatum population in the Hunter Catchment (*Cymbidium canaliculatum*)	E	-	BioNet – 10	*Cymbidium canaliculatum* is an epiphytic orchid that typically grows in the hollows, fissures, trunks and forks of trees in dry sclerophyll forest or woodland, where its host trees typically occur on Permian Sediments of the Hunter Valley floor. It usually occurs singly or as a single clump, which can form large colonies on trees, between two and six metres from the ground. Within the Hunter Catchment, *Cymbidium canaliculatum* is most commonly found in White Box (Eucalyptus albens) dominated woodlands. It has been found, less commonly, to grow on Slaty Box (E. dawsonii), Narrow-leaved Ironbark (E. crebra), Grey Box (E. moluccana), Rough-barked Apple (Angophora floribunda), Cooba	**Low:** no suitable habitat for the species occurs within the site. Known records of the species exist within the 10 km locality and outside the site.	**Unlikely:** no suitable habitat for the species is present within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
				(*Acacia salicina*) and on some other species, including dead stags. It is also known to use man-made structures, such as fence posts and wooden bridges as its host. The species flowers from September to November.		
White-flowered Wax Plant (*Cynachum elegans*)	E	E	PMST	White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree (*Leptospermum laevigatum*) – Coastal Banksia (*Banksia integrifolia subsp. Integrifolia*) coastal scrub; Forest Red Gum (*Eucalyptus tereticornis*) aligned open forest and woodland; Spotted Gum (*Corymbia maculata*) aligned open forest and woodland; and Bracelet Honeymyrtle (*Melaleuca armillaris*) scrub to open scrub	**Low:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** no suitable habitat for the species is present within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Bluegrass (*Dichanthium setosum*)	V	V	PMST	Bluegrass flowering time is mostly in summer. The species is associated with heavy basaltic black soils and red-brown loams with clay subsoil. It is often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. (Often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched). It is open to question whether the species tolerates or is promoted by a certain amount of disturbance, or whether this is indicative of the threatening processes behind its depleted habitat. Associated species include *Eucalyptus albens, Eucalyptus melanophloia, Eucalyptus melliodora, Eucalyptus viminalis, Myoporum debile, Aristida ramosa, Themeda triandra, Poa sieberiana, Bothriochloa ambigua, Medicago minima, Leptorhynchos squamatus, Lomandra aff. longifolia, Ajuga australis, Calotis hispidula* and *Austrodanthonia, Dichopogon, Brachyscome, Vittadinia, Wahlenbergia and Psoralea* species.	**Low:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** no suitable habitat for the species is present within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Pine Donkey Orchid (*Diuris tricolor*) Pine Donkey Orchid population in the Muswellbrook local government area (*Diuris tricolor*)	V E	-	BioNet – 652	The Pine Donkey Orchid is a terrestrial orchid that grows from the ground. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Associated species include White Cypress Pine (*Callitris glaucophylla*), Poplar Box (*Eucalyptus populnea*), Gum Coolibah (*Eucalyptus intertexta*), Ironbark and *Acacia* shrubland. The understorey is often grassy with herbaceous plants such as Bulbine lily species (*Bulbine* spp.). Usually flowers between early September to late October.	**Low:** no suitable habitat for the species occurs within the site. Numerous known records of the species exist within the 10 km locality and outside the site.	**Unlikely:** no suitable habitat for the species is present within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Eucalyptus camaldulensis population in the Hunter catchment (*Eucalyptus camaldulensis*)	E	-	BioNet – 39	The Hunter population occurs from the west at Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River, in the Port Stephens local government area. It has been recorded in the local government areas of Lithgow, Maitland, Mid-Western Regional, Muswellbrook, Port Stephens, Singleton and Upper Hunter. Prior to European settlement, it is likely that the species formed extensive stands of woodland and open woodland on the major floodplains of the Hunter and Goulburn rivers, especially in areas where water impoundment occurs after flood. The species may occur with Forest Red Gum (*Eucalyptus tereticornis*), Yellow Box (*Eucalyptus melliodora*), River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) and Rough-barked Apple (*Angophora floribunda*).	**Known:** six trees of the species are present within the site. The site is within the known distribution of the endangered population. The trees are present adjacent to a walking track and their alignment suggest they might be planted individuals.	**Likely:** six individuals of the species are present within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. Wilder Street is located within 50 m from the River Red Gums. An arborist report would be required to assess whether the final bridge design would impact the tree root zone of River Red Gums.
Slaty Red Gum (*Eucalyptus glaucina*)	V	V	BioNet – 9 PMST	Slaty Red Gum grows in grassy woodland and dry eucalypt forest. It grows on deep, moderately fertile and well-watered soils. Found only on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, west of Maitland.	**Low:** limited suitable habitat for the species occurs within the site. Known records of the species exist within the 10 km locality and outside the site. The nearest record was recorded in 2018 at approximately 1.6 km south-east from the site. The species was not recorded within the site during surveys.	**Unlikely:** the species was not recorded within the site during surveys. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Narrow-leaved Black Peppermint (*Eucalyptus nicholii*)	V	V	BioNet – 1	The Narrow-leaved Black Peppermint typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock. Seedling	**Low:** limited suitable habitat for the species occurs within the site.	**Unlikely:** the species was not recorded within the site during surveys. The proposed development

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
				recruitment is common, even in disturbed soils, if protected from grazing and fire. Tends to grow on lower slopes in the landscape.	Known records of the species exist within the 10 km locality and outside the site. The nearest record was recorded in 2005 at approximately 6.5 km south from the site. The species was not recorded within the site during surveys.	includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Euphrasia arguta	CE	CE	PMST	*Euphrasia arguta* is an erect annual herb ranging in height from 20-35 cm. The species was rediscover in 2008 after 100 of no sightings. Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. The new records have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance. *Euphrasia arguta* has an annual habit and has been observed to die off over the winter months, with active growth and flowering occurring between January and April.	**Low:** limited suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** limited suitable habitat for the species occurs within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Isotoma fluviatilis subsp. fluviatilis (listed as *Hypsela sessiliflora*)	-	X	BioNet – 1	Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone. May be an early successional species that benefits from some disturbance. Possibly out competed when overgrown by some species such as *Cyndon dactylon.*	**Low:** limited suitable habitat for the species occurs within the site. A known record of the species exist within the 10 km locality and outside the site.	**Unlikely:** limited suitable habitat for the species occurs within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
A Leek Orchid (*Prasophyllum* sp. Wybong (C. Phelps ORG 5269))	-	CE	PMST	Prasophyllum sp. Wybong (C. Phelps ORG 5269) is a terrestrial orchid that grows to approximately 30 cm high. The species is perennial, appearing as a single leaf over winter and spring. It flowers in spring and dies back to a dormant tuber over summer and autumn. It is known to occur in open eucalypt woodland and grassland.	**Low:** limited suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality	**Unlikely:** limited suitable habitat for the species occurs within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood (Pterostylis gibbosa)	E	E	PMST	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). It is apparently extinct in western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage.	**Low:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** no suitable habitat for the species occurs within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Austral Toadflax, Toadflax (*Thesium australis*)	V	V	PMST	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	**Low:** no suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** no suitable habitat for the species occurs within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.
Tylophora linearis	V	E	PMST	*Tylophora linearis* grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii*. Also grows in association with *Acacia hakeoides*, *Acacia lineata*, *Melaleuca uncinata*, *Myoporum* species and *Casuarina* species. Flowers in spring, with flowers recorded in November or May with fruiting probably 2 to 3 months later.	**Low:** limited suitable habitat for the species occurs within the site. No known records of the species exist within the 10 km locality.	**Unlikely:** limited suitable habitat for the species occurs within the site. The proposed development includes construction of a road bridge across Muscle Creek and joining Wilder Street with Wilkinson Avenue. It is unlikely the proposed development would result on impact on habitat for the species.

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact
Vegetation Communities						
EPBC Act: Central Hunter Valley eucalypt forest and woodland BC Act: Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions	E	CE	PMST	The ecological community is an open forest or woodland, typically dominated by eucalypt species; it has an open to sparse mid-layer of shrubs and a ground layer of grasses, forbs and small shrubs. The composition of the ecological community at a particular site is influenced by the size of the site, recent rainfall, and drought conditions and by its disturbance history (including clearing, grazing and fire). The canopy of the ecological community is dominated by one or more of the following four eucalypt species: *Eucalyptus crebra* (narrow-leaved ironbark), *Corymbia maculata* (syn. *E. maculata*) (spotted gum), *E. dawsonii* (slaty gum) and *E. moluccana* (grey box). Under certain circumstances a fifth species, *Allocasuarina luehmannii* (bulloak or buloke), may be part of the mix of dominants.	**Absent:** The vegetation community is not present at the Biodiversity Study Area. Vegetation ground-truthing was undertaken in July 2020 across the Biodiversity Study Area.	**Unlikely:** The vegetation community does not occur within the Biodiversity Study Area. Therefore, the proposed development would not result in impacts on it.
EPBC Act: Hunter Valley Weeping Myall (Acacia pendula) Woodland BC Act: Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion	CE	CE	PMST	The Hunter Valley Weeping Myall Woodland ecological community is a low forest to woodland with a canopy dominated by *Acacia pendula* (weeping myall). It occurs on undulating plains that are associated with a range of grassy woodland communities in the Hunter Valley (NSW). It is considered to have been a low forest to woodland that is 5 to 15 metres in height, with a sparse shrub layer 1-3 metres tall ozver a generally grassy ground layer.	**Absent:** The vegetation community is not present at the Biodiversity Study Area. Vegetation ground-truthing was undertaken in July 2020 across the Biodiversity Study Area.	**Unlikely:** The vegetation community does not occur within the Biodiversity Study Area. Therefore, the proposed development would not result in impacts on it.
EPBC Act: Lowland Rainforest of Subtropical Australia BC Act: Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E	CE	PMST	The Lowland Rainforest of Subtropical Australia ecological community primarily occurs from Maryborough in Queensland to the Clarence River (near Grafton) in New South Wales (NSW). The ecological community also includes isolated areas between the Clarence River and Hunter River such as the Bellinger and Hastings Valleys. The ecological community is generally a moderately tall (≥20 m) to tall (≥30 m) closed forest (canopy cover ≥70%). Tree species with compound leaves are common and leaves are relatively large (notophyll to mesophyll). Typically, there is a relatively low abundance of species from the genera Eucalyptus, Melaleuca and Casuarina. The canopy comprises a range of tree species but in some areas a particular species may dominate e.g. palm forest, usually dominated by *Archontophoenix cunninghamiana* (bangalow palm) or *Livistona australis* (cabbage palm); and riparian areas dominated by *Syzygium floribundum* (syn. *Waterhousea floribunda*) (weeping satinash/weeping lilly pilly).	**Absent:** The vegetation community is not present at the Biodiversity Study Area. Vegetation ground-truthing was undertaken in July 2020 across the Biodiversity Study Area.	**Unlikely:** The vegetation community does not occur within the Biodiversity Study Area. Therefore, the proposed development would not result in impacts on it.
BC Act: White Box Yellow Box Blakely's Red Gum Woodland EPBC Act: White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland	E	CE	PMST	White Box Yellow Box Blakely's Red Gum Woodland (commonly referred to as Box-Gum Woodland) is an open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: White Box *Eucalyptus albens*, Yellow Box *E. melliodora* and Blakely's Red Gum *E. blakelyi*. Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses and a very high diversity of herbs. The community also includes a range of mammal, bird, reptile, frog and invertebrate fauna species. Intact stands that contain diverse upper and mid-storeys and groundlayers are rare. Modified sites include the following: ▪ Areas where the main tree species are present ranging from an open woodland formation to a forest structure, and the groundlayer is predominantly composed of exotic species; and ▪ Sites where the trees have been removed and only the grassy groundlayer and some herbs remain. The Australian Government listing of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland is slightly different to the NSW listing. Areas that are part of the Australian Government listed ecological community must have either: ▪ An intact tree layer and predominately native ground layer; or An intact native ground layer with a high diversity of native plant species but no remaining tree layer.	**Absent:** The vegetation community is not present at the Biodiversity Study Area. Vegetation ground-truthing was undertaken in July 2020 across the Biodiversity Study Area.	**Unlikely:** The vegetation community does not occur within the Biodiversity Study Area. Therefore, the proposed development would not result in impacts on it.

Species / Community Name	BC Act / FM Act	EPBC Act	Records Source	Habitat / Community Description	Likelihood of Occurrence	Potential for Impact

Notes:
BC Act = NSW Biodiversity Conservation Act 2016; EPBC Act = Commonwealth Environment Protection and Biodiversity Conservation Act 1999
Listing status: V = Vulnerable; E = Endangered; CE = Critically Endangered; X = Extinct; Ma = Marine;
Migratory agreements: C = CAMBA (China – Australia Migratory Bird Agreement); J = JAMBA (Japan - Australia Migratory Bird Agreement); R = ROKAMBA (Republic of Korea - Australia Migratory Bird Agreement);

APPENDIX

E

ASSESSMENT OF SIGNIFICANCE

Appendix E – Assessment of Significance

Where threatened species and vegetation communities are identified as likely to be impacted by a given proposal, an assessment of those impacts is undertaken to identify whether or not significant impacts are likely to occur. Requirements for assessment of significance involve several steps to identify extent of impacts on population and/or community structure and long-term survival and consist of addressing several questions. Assessments of significance as per different legislative instruments in the state of NSW include:

> Test of Significance as detailed in Section 7.3 of the NSW *Biodiversity Conservation Act 2016*. Where significant impacts are identified, preparation of a Species Impact Statement (SIS) is triggered;

> Assessment of Significance under the NSW *Fisheries Management Act 1994*; and

> Significant Impact Assessment under the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*.

Selection of threatened species and vegetation communities for assessment of significance is based on the LoOR assessment. Where the LoOR assessment identifies a threatened species or ecological community as having a moderate, high or known likely of occurrence and is likely to be impacted, an assessment of significance is undertaken.

All threatened species and vegetation communities with potential to occur within the 10 km locality surrounding the Biodiversity Study Area were identified during database searches (see **Appendix A** and **B**) and LoOR assessment undertaken (see **Appendix D**). A total of 14 threatened species were assessed as having a moderate (five species) or known (nine species) likelihood of occurrence. These species are:

> Moderate likelihood of occurrence:

- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
- Little Eagle (*Hieraaetus morphnoides*)
- Little Lorikeet (*Glossopsitta pusilla*)
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)

> Known likelihood of occurrence:

- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Little Bent-winged Bat (*Miniopterus australis*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Southern Myotis (*Myotis macropus*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Eastern Cave Bat (*Vespadelus troughtoni*)
- *Eucalyptus camaldulensis* population in the Hunter catchment

Table E-1 to **Table E-3** provide five-part tests assessing likelihood of significant impact on the above listed threatened species.

There are three KTPs that have the potential to be triggered as a result of the project (See **Section 5.3**).

Table E-1. Five-part test: Threatened Birds

Threatened Species Assessed: Birds
This five-part test assesses the following bird species: ▪ White-bellied Sea-Eagle (*Haliaeetus leucogaster*) ▪ Little Eagle (*Hieraaetus morphnoides*)

Threatened Species Assessed: Birds	
	▪ Little Lorikeet (*Glossopsitta pusilla*) ▪ Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*) Habitat for these bird species is present within Muscle Creek riparian corridor. Very limited substandard foraging habitat is present in other parts of the Biodiversity Study Area. No known records of these bird species exist within the Biodiversity Study Area, nor were these species recorded during surveys therein. The presence of limited suitable habitat for these species, mainly foraging resources, resulted in their likelihood of occurrence being assessed as moderate (see **Appendix D**).
Five-part Test	
a)	*in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction*
	The threatened bird species assessed have moderate likelihood of occurrence in vegetation within Muscle Creek riparian corridor. Stage 1 of Muswellbrook Olympic Park Precinct, do not include clearing of vegetation within Muscle Creek riparian corridor. Therefore, it is unlikely the proposed works for Stage 1 would result in adverse effect on the life cycle of these bird species, nor would a local population of these species be placed at risk of extinction.
b)	*in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
	Not applicable
c)	*In relation to the habitat of a threatened species or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
	Only planted trees are proposed to be removed, these trees do not represent relevant feeding resources of habitat for the threatened bird species assessed herein. Limited suitable habitat for the species occurs within Muscle Creek riparian corridor, which would not be cleared or modified as part of Stage 1 works of the proposed development.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
	The planted trees to be removed are located in a historically cleared area. Their removal will not result in habitat for the threatened bird species being fragmented or isolated. Furthermore, new planted trees and landscaped areas will be planted in Wilkinson Avenue extent, which would provide stepping stone habitat by reducing gaps between vegetated areas on Muscle Creek riparian corridor and other vegetated areas in the immediate locality.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,
	Only planted trees are proposed to be removed, these trees do not represent relevant feeding resources of habitat for the threatened bird species assessed herein. These trees are not important habitat for the long-term survival of the threatened bird species.
d)	*whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)*
	The Biodiversity Study Area do not contain Areas of Outstanding Biodiversity Value (AOBV) listed under the BC Act. Therefore, the proposed development will not have an adverse effect on declared AOBV.
e)	*whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.*
	The proposed development has the potential to trigger three key threatening processes (KTPs): ▪ Human-caused Climate Change ▪ Alteration of the natural flow regimes of rivers, streams, floodplains and wetlands ▪ Infection of frogs by amphibian chytrid causing the disease chytridiomycosis

Threatened Species Assessed: Birds
As detailed in Section 5.3, a range of project design, proposed plantings and mitigation measures would avoid triggering the above listed KTPs.
Conclusion
Muscle Creek riparian corridor contains limited foraging habitat suitable for White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Little Eagle (*Hieraaetus morphnoides*), Little Lorikeet (*Glossopsitta pusilla*) and Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*). Proposed works part of Stage 1 of Muswellbrook Olympic Park Precinct, do not require removal or impact of habitat within Muscle Creek riparian corridor. Therefore, the proposed Stage 1 development would not result in significant impacts on habitat of these threatened bird species.

Table E-2. Five-part Test: Threatened Mammals

Threatened Species Assessed: Mammals	
	This five-part test assesses the following mammal species: ▪ Grey-headed Flying-fox (*Pteropus poliocephalus*) ▪ Little Bent-winged Bat (*Miniopterus australis*) ▪ Large Bent-winged Bat (*Miniopterus orianae oceanensis*) ▪ Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) ▪ Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) ▪ Southern Myotis (*Myotis macropus*) ▪ Greater Broad-nosed Bat (*Scoteanax rueppellii*) ▪ Eastern Cave Bat (*Vespadelus troughtoni*) ▪ Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) Habitat for the fruit megabat (Grey-headed Flying-fox) and the eight insectivorous microbats is present within Muscle Creek riparian corridor and hollow-bearing trees within the Biodiversity Study Area. These flying mammals are highly mobile and have foraging ranges of tens of kilometres. Grey-headed Flying-foxes (GHFF) were observed within the Biodiversity Study Area during surveys in July 2020. The GHFF were roosting in trees within the riparian corridor. Seven of the microbat species were recorded using acoustic recorders in a previous study in 2019 (Cardno 2019), they were recorded within Muscle Creek riparian corridor. The eight microbat species, Yellow-bellied Sheathtail-bat was assessed as having a Moderate likelihood of occurrence within the Biodiversity Study Area due to foraging habitat for the species being present therein (see **Appendix D**). Roosting habitat for microbat species occurs in tree hollows, whereas forging resources for these insectivorous species occurs in vegetated areas and Muscle Creek. The Southern Myotis also hunts on surface of water bodied, such as Muscle Creek.
Five-part Test	
a)	*in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction*
	The threatened bat species assessed have moderate and known likelihood of occurrence in vegetation within Muscle Creek riparian corridor. Stage 1 of Muswellbrook Olympic Park Precinct, do not include clearing of vegetation within Muscle Creek riparian corridor. Therefore, it is unlikely the proposed works for Stage 1 would result in adverse effect on the life cycle of these bat species, nor would a local population of these species be placed at risk of extinction.
b)	*in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
	Not applicable
c)	*In relation to the habitat of a threatened species or ecological community:*

Threatened Species Assessed: Mammals	
	(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
	UP to 15 planted trees are proposed to be removed, these trees represent limited foraging resources for bat species (e.g. nectar for GHFF and insects over canopy for microbats), compared to larger potential foraging resources likely to occur within Muscle Creek riparian corridor and other vegetated areas within the locality. Trees proposed for removal and containing tree hollows are potential roosting habitat for microbat species. These trees are only a minimal amount of potential roosting habitat for microbats within the Biodiversity Study Area and wider locality. Therefore, only planted trees outside the riparian corridor are likely to require removal and they represent a very small amount of potential habitat for bat species compared to available habitat present elsewhere within the Biodiversity Study Area and wider locality.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
	The planted trees to be removed are located in a historically cleared area. Their removal will not result in habitat for the threatened bat species being fragmented or isolated. Furthermore, new planted trees and landscaped areas are proposed as part of Stage 1 works of the Muswellbrook Olympic Park Precinct. Planted trees will be located in Wilkinson Avenue and would provide stepping stone habitat for bats by reducing gaps between vegetated areas on Muscle Creek riparian corridor and other vegetated areas in the immediate locality.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,
	Only planted trees are proposed to be removed, these trees do not represent relevant feeding or roosting habitat resources for the threatened bat species assessed herein. These trees are not important habitat for the long-term survival of the threatened bat species.
d)	*whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)*
	The Biodiversity Study Area do not contain Areas of Outstanding Biodiversity Value (AOBV) listed under the BC Act. Therefore, the proposed development will not have an adverse effect on declared AOBV.
e)	*whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.*
	The proposed development has the potential to trigger three key threatening processes (KTPs): ▪ Human-caused Climate Change ▪ Alteration of the natural flow regimes of rivers, streams, floodplains and wetlands ▪ Infection of frogs by amphibian chytrid causing the disease chytridiomycosis As detailed in **Section 5.3**, a range of project design, proposed plantings and mitigation measures would avoid triggering the above listed KTPs.
Conclusion	
	Muscle Creek riparian corridor contains foraging and roosting habitat suitable for fruit bat Grey-headed Flying-fox (*Pteropus poliocephalus*) and the microbat species Little Bent-winged Bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Southern Myotis (Myotis macropus), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Eastern Cave Bat (*Vespadelus troughtoni*) and Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*). Proposed works part of Stage 1 of Muswellbrook Olympic Park Precinct, do not require removal or impact of habitat within Muscle Creek riparian corridor. Therefore, the proposed Stage 1 development would not result in significant impacts on habitat of these threatened bat species.

Table E-3. Five-part Test: *Eucalyptus camaldulensis* population in the Hunter catchment

Threatened Species Assessed: *Eucalyptus camaldulensis* population in the Hunter Catchment	
	This five-part test assesses *Eucalyptus camaldulensis* population in the Hunter Catchment, listed as Endangered under the BC Act.

Threatened Species Assessed: *Eucalyptus camaldulensis* population in the Hunter Catchment	
	River Red Gum (*Eucalyptus camaldulensis*) is present within the Biodiversity Study Area and adjacent to the Muscle Creek riparian corridor. Five River Red Gum trees were recorded adjacent to a walking track to the south-east of the Velodrome and at approximately 50m east from Wilder Street. The trees are aligned and that alignment suggest they might have been planted. Due to the proximity of the River Red Gums to Wilder Street, there is a possibility for the tree root zone of some of these trees be impacted by the proposed bridge to be built over Muscle Creek. The proposed bridge will connect Wilkinson Avenue to Wilder Street. River Red Gum was assessed as having a known likelihood of occurrence within the Biodiversity Study Area (see **Appendix D**).
Five-part Test	
a)	*in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction*
	Five River Red Gum (*Eucalyptus camaldulensis*) were recorded within the Biodiversity Study Area and within 50 m east of Wilder Street. There is potential for the tree root zone of at least one of these River Red Gums to be impacted as result of construction of the bridge over Muscle Creek. It is recommended that an arborist report assessing potential impact on the TRZ of River Red Gums be undertaken after completion of bridge design. In the event that a River Red Gum is identified as requiring removal to give way to the bridge construction, it is recommended that trees be replanted at a rate of 1:1. The loss of one River Red Gum would not result in an impact on the species such that a local population is likely to be placed at risk of extinction.
b)	*in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:*
	(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
	Not applicable
	(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
	Not applicable
c)	*In relation to the habitat of a threatened species or ecological community:*
	(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
	It is likely that up to one River Red Gum might require removal to give way to the construction of a bridge over Muscle Creek. The River Red Gums are adjacent to a walking track and in an area where no native ground or mid storey is present. Removal of one River Red Gum would not result in impact of good quality habitat for the species.
	(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
	The River Red Gums occur in an area where historical clearing is likely to have occurred. The trees are aligned suggesting they might be planted trees. Therefore, removal of one River Red Gum would not result in further riparian corridor fragmentation as other trees are present in the area and no net gap in canopy cover is likely to occur.
	(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,
	Removal of up to one River Red Gum might be required for bridge construction. The tree is located in an area where historical clearing has occurred and where no recruitment of new trees appears likely to occur due to its proximity to a hard stand walking track and where maintenance of ground occurs. Therefore, it is considered that the area where the River Red Gum occur is highly modified and the habitat therein has low ecological value for the long-term survival of a local population.
d)	*whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)*
	The Biodiversity Study Area do not contain Areas of Outstanding Biodiversity Value (AOBV) listed under the BC Act. Therefore, the proposed development will not have an adverse effect on declared AOBV.
e)	*whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.*

Threatened Species Assessed: *Eucalyptus camaldulensis* population in the Hunter Catchment
The proposed development has the potential to trigger three key threatening processes (KTPs): ▪ Human-caused Climate Change ▪ Alteration of the natural flow regimes of rivers, streams, floodplains and wetlands ▪ Infection of frogs by amphibian chytrid causing the disease chytridiomycosis As detailed in **Section 5.3**, a range of project design, proposed plantings and mitigation measures would avoid triggering the above listed KTPs. Furthermore, replacement planting of trees at a 1:1 ratio would minimise risk fo these KTPs being triggered.
Conclusion
Five River Red Gums (*Eucalyptus camaldulensis*) were recorded within the Biodiversity Study Area. The possibility exists that these trees are planted individuals. They are located in low quality habitat where historical clearing appears to have occurred and adjacent to a hard stand walking track. The possibility exists that up to one River Red Gum might require removal for bridge construction. It is recommended that subsequently to bridge design completion, an arborist assessment is undertaken to assess actual number of River Red Gums requiring removal and/or being at risk of impacts due to bridge construction. Therefore, the proposed bridge proposed to be built over Muscle Creek as part of Stage 1 development is likely to require removal of up to one River Red Gum. However, it is considered that provided replacement planting occurs, removal of one River Red Gum would not result in significant impacts on habitat of the endangered population of River Red Gum in the Hunter catchment.

APPENDIX

D

TRAFFIC IMPACT ASSESSMENT

Traffic Impact Assessment

Muswellbrook Olympic Park

NE30034

Prepared for
Muswellbrook Shire Council

26 October 2020

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1	03/08/2020	Draft	Sabal Sharma	Hayden Calvey
2	26/10/2020	Final	Sabal Sharma	Tanja Mackenzie

Executive Summary

Cardno has been commissioned by Muswellbrook Shire Council to prepare a Traffic Impact Assessment (TIA) for the proposed masterplan development in the Olympic Park Precinct area. The study area is bounded by Haydon Street to the west, New England Highway to the south, Bell Street to the east, and ARTC (Australian Rail Track Corporation) Railway corridor to the north.

Council has recently adopted a draft Masterplan for the Olympic Park precinct which is split into two stages. Stage 1 is where the primary structural changes to Olympic Park will take place whilst Stage 2 will complete the revitalisation of Olympic Park.

Strategic Context

In May 2017, Muswellbrook Shire Council engaged urban design consultancy The Design Partnership to prepare a Masterplan for Olympic Park. Olympic Park is a sporting precinct comprising Rugby League fields and grandstand, tennis courts, the Ron King Velodrome, the Muswellbrook Aquatic Centre, and two Bowling Greens.

The Masterplan is presented in two stages. within each stage are a series of projects. breaking the masterplan into smaller projects will assist with the delivery of the masterplan. the staging is defined as described below.

Stage 1

Stage 1 projects are generally catalyst projects which enable Stage 2 projects to be undertaken. Stage 1 includes important infrastructure items such as the Wilkinson Avenue upgrade and the formation of the new bridge. This infrastructure will create a clear and organised urban framework.

> Timeframe: 1 - 10 years.

Stage 2

Stage 2 comprises longer-term projects. These projects may have greater costs and need access to particular grants or partnerships. These projects may also require amalgamations to be undertaken first. A Stage 2 project may be brought forward to Stage 1 if the circumstances allow.

> Timeframe: 5 - 20 years.

Assessment Approach

The study is based on the following approach:

- Review background documentation including Muswellbrook Shire Council LEP, DCP, and TfNSW Guidelines;
- Review the current transport context, including pedestrian, cycling and public transport networks and the integration of these transport modes with the wider transport network;
- Undertake peak hour surveys to establish the existing traffic movements in the area; and
- Detail traffic generation and assess the impact of the proposed development on the external road network.

Furthermore, TfNSW has also outlined the following requirements, which are included in this assessment:

- Current traffic counts for the New England Highway and Wilder Street/Francis Street intersection
- Peak and peak hour traffic generation of the site following connection and following any intensification resulting from the implementation of the masterplan in stages and as a whole. The distribution of the trips generated by the proposed development is to be shown diagrammatically; and
- Traffic analysis of the intersection using SIDRA and including submission of files.

Traffic Assessment

The construction of a new bridge over Muscle Creek is assumed to result in the traffic distribution based on the intersection configuration at New England Highway/Wilder Street. It is envisaged that Wilder Street will be predominantly used by vehicles to/from the south of Muswellbrook.

The future traffic assessment, based on the 2021 year of the bridge opening and 2031 design horizon year, shows that the intersection LoS is relatively unchanged by reassignment of traffic due to the proposed bridge. Also, the single-lane bridge over Muscle Creek will continue to operate satisfactorily at LoS A which represents good performance.

This traffic assessment firstly assessed the New England Highway/Wilder Street intersection configuration as all movements to be permitted in the first instance. However, it should be noted that due to the forecast traffic volume increase on Wilder Street due to the proposed Masterplan the Wilder Street approach is forecast to operate at LoS E in the PM peak and LoS F in the SAT peak by 2031.

The intersection of Wilder Street/New England Highway is in a location that results in a staggered-T junction with Francis Street/New England Highway. The staggered junctions could attract safety concerns when the traffic intensifies at the Wilder Street approach, hence banning the right in/out of Wilder Street is proposed as mitigation that reduces the safety issue due to the back to back right-turns at the staggered junction. Under the restriction of right turns in/out of Wilder Street the approach LoS improves to LoS A in both PM and SAT peak for the year 2031.

The proposed masterplan development is supported on traffic grounds. The potential traffic impact of the masterplan has been shown to have a negligible impact on the surrounding road network and can be accommodated accordingly.

Future Transport and Access Strategy

The entry to Olympic Park via the intersection of Haydon Street and Wilkinson Avenue will be retained as it is. The Masterplan proposes a new access point to the precinct via Wilder Street. It is envisaged that Wilder Street will be predominantly used by vehicles to/from the south of Muswellbrook.

According to the Masterplan a shared path, for pedestrians and cyclists, is proposed along the Muscle Creek Riparian Corridor and Wilkinson Avenue. The path is proposed as a 2.5 metre wide concrete path and should connect to the existing footpath network at the junction of Haydon Street and Wilkinson Avenue and the Bell Street overpass.

Also, there will be the construction of a new bridge providing additional vehicular access across Muscle Creek where a pedestrian footpath would be integrated into the bridge.

According to the Masterplan it is envisaged that Wilder Street will be used by vehicles heading south out of Muswellbrook. Buses will use Wilder Avenue to eliminate the need for buses to leave via Haydon Street,

The intersection of Haydon Street and Wilkinson Avenue will provide access to the buses if they want to go north. It is recommended that this intersection be upgraded to improve access for buses.

Table of Contents

Appendices

Tables

Figures

1 Introduction

Cardno has been commissioned by Muswellbrook Shire Council to prepare a Traffic Impact Assessment (TIA) for the proposed masterplan development in the Olympic Park Precinct area. The study area is bounded by Haydon Street to the west, New England Highway to the south, Bell Street to the East, and ARTC (Australian Rail Track Corporation) Railway corridor to the North.

Council has recently adopted a draft Masterplan for the Olympic Park precinct which is split into two stages. Stage 1 is where the primary structural changes to Olympic Park will take place whilst Stage 2 will complete the revitalisation of Olympic Park.

As part of Council's early engagement with relevant stakeholders, Transport for NSW (TfNSW) have identified the need for a supporting Traffic Impact Statement for the masterplan, particularly the impact of connecting Wilder Street to Olympic Park and the use of this connection as a bus route out of the park.

1.1 Scope of Works

Cardno's scope of works for this study includes:

> Review background documentation including Muswellbrook Shire Council LEP, DCP, and TfNSW Guidelines;

> Review the current transport context, including pedestrian, cycling and public transport networks and the integration of these transport modes with the wider transport network;

> Undertake peak hour surveys to establish the existing traffic movements in the area; and

> Detail traffic generation and assess the impact of the proposed development on the external road network.

Furthermore, TfNSW has also outlined the following requirements, which are included as a scope of works for this Traffic Impact Assessment.

> Current traffic counts for the New England Highway and Wilder Street/Francis Street intersection

> Peak and peak hour traffic generation of the site following connection and following any intensification resulting from the implementation of the masterplan in stages and as a whole. The distribution of the trips generated by the proposed development is to be shown diagrammatically; and

> Traffic analysis of the intersection using SIDRA and including submission of files.

Therefore, this assessment has been undertaken to address the above requirements and demonstrate the compliance of the development with relevant standards and Council controls as well as identifying the relevant traffic and parking impacts (if any) including strategies to mitigate those impacts associated with the Masterplan development.

1.2 Purpose of the Report

This Traffic Impact Assessment (TIA) has been prepared by Cardno on behalf of Muswellbrook Shire Council. The purpose of this report is to define the proposal, detail its likely impacts on the traffic and transport environment. The TIA report has been prepared to enable assessment under a Review of Environmental Factors (REF).

1.3 Structure of the Report

The report is structured as follows:

> **Introduction** – provides project background, scope, and objectives for the study;

> **Strategic transport context** – provides an overview of the relevant policies (from a state government perspective) and standards relevant to the study;

> **Existing Environment**– provides a description of the existing study area;

> **Proposed Masterplan-** provides an explanation of the proposed Masterplan in more detail;

- **Traffic Assessment** - provides an assessment of the proposal on the key intersections for the year 2021 and year 2031;
- **Access Strategy-** review the access strategy; and
- **Conclusion** - presentation of the key findings.

1.4 Reference Documents

In preparing this report, reference has been made to a number of background documents, including:

- Guide to Traffic Generating Developments, Transport for NSW, 2002;
- Technical Direction (Transport for NSW, TDT 2013/04a);
- NSW TFNSW Guide to Traffic Generating Developments (2002);
- Muswellbrook Local Environmental Plan (LEP) 2009;
- Muswellbrook Shire Council Development Control Plan (DCP) 2009; and
- Australian Standard 2890.1:2004 off Street Car Parking.

2 Strategic Context

2.1 Olympic Park Masterplan

In May 2017 Muswellbrook Shire Council engaged urban design consultancy The Design Partnership to prepare a Masterplan for Olympic Park. Olympic Park is a sporting precinct comprising Rugby League fields and grandstand, tennis courts, the Ron King Velodrome, the Muswellbrook Aquatic Centre, and two Bowling Greens.

The Masterplan is presented in two stages. Within each stage are a series of projects. Breaking the Masterplan into smaller projects will assist with the delivery of the Masterplan. The Staging is defined as follows:

Stage 1

Stage 1 projects are generally catalyst projects which enable Stage 2 projects to be undertaken. Stage 1 includes important infrastructure items such as the Wilkinson Avenue upgrade and the formation of the new bridge. This infrastructure will create a clear and organised urban framework.

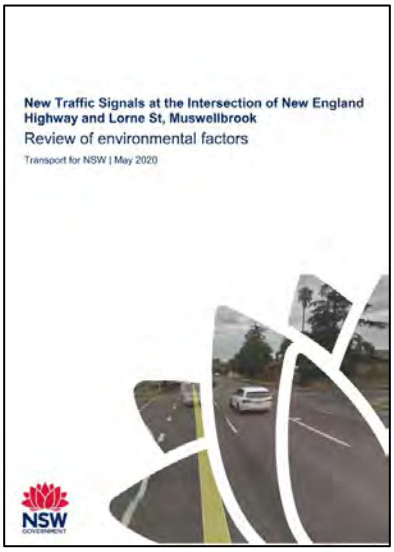
> Timeframe: 1 - 10 years.

Stage 2

Stage 2 comprises longer-term projects. These projects may have greater costs and need access to particular grants or partnerships. These projects may also require amalgamations to be undertaken first. A Stage 2 project may be brought forward to Stage 1 if the circumstances allow.

> Timeframe: 5 - 20 years

2.2 The intersection of New England Highway and Lorne St Review of Environmental Factors (TfNSW, 2020)


New Traffic Signals at the Intersection of New England Highway and Lorne St, Muswellbrook
Review of environmental factors
Transport for NSW | May 2020
NSW

Transport for NSW proposes to construct Traffic Signals at the intersection of the New England Highway and Lorne St, Muswellbrook.

The New England Highway is under the care and control of Transport for NSW. It principally serves as a north-south arterial link between Newcastle, the Hunter Valley, and the Northern Tablelands. The New England Highway within the proposal site does not have any existing traffic signals and there are no dedicated crossing locations for pedestrians, with the closest formalised crossing located more than 200 metres away. Key features of the proposal include:

> Relocation of existing signage, and installation of new signage;

> Minor impacts to sandstone kerb and gutter;

> Provision of new concrete footpaths and pram ramps;

> Installation of new traffic signals including conduits, cables, signal light posts, controllers, and power;

> distribution board;

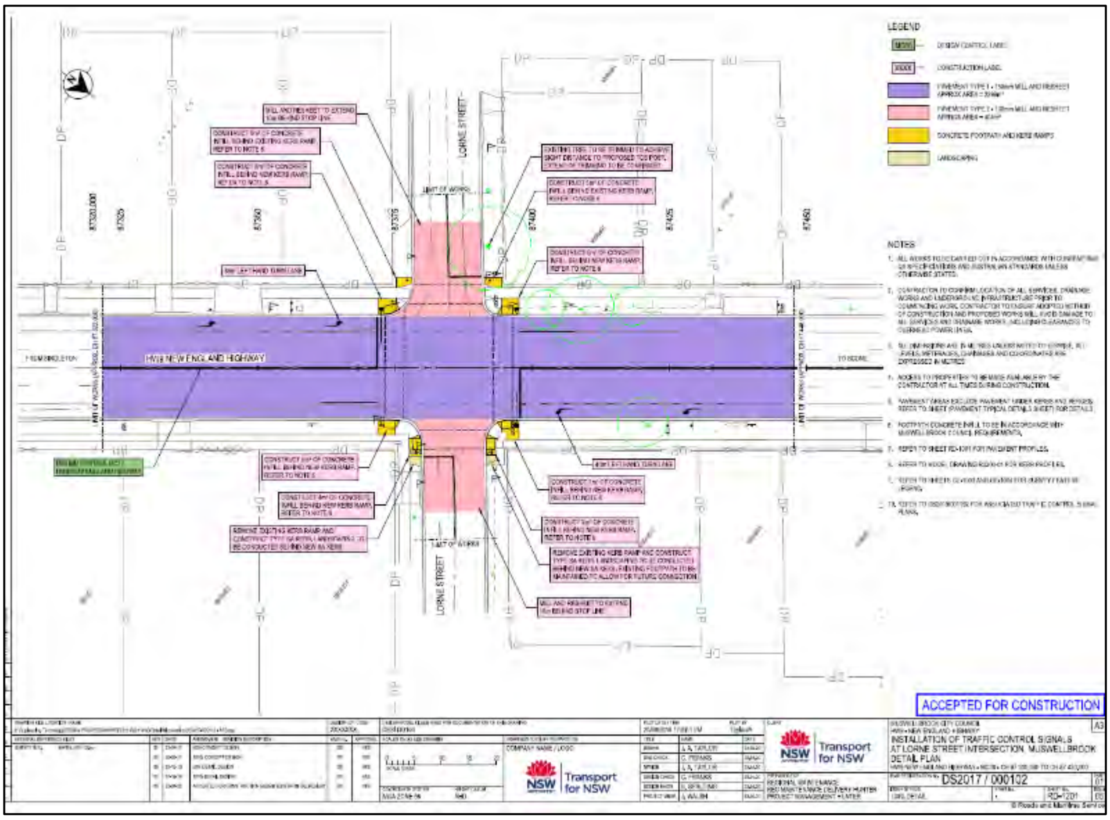
> Connection of new traffic signals to existing power supply;

> Installation of new asphaltic concrete;

> Provision of a new dedicated left hand turning lanes into Lorne Street from both the southbound and Northbound carriageway of the New England Highway;

> Provision of new line marking; and

> Minor tree trimming.



2.3 Muswellbrook bypass - New England Highway

The NSW Government is providing $266 million to fund a New England Highway bypass of Muswellbrook. The bypass would improve travel times for long haul freight movements and safety for all road users.

The New England Highway is part of the inland Sydney to Brisbane National Land Transport Network and the primary route connecting the Upper Hunter with Maitland and Newcastle.

The highway passes through the centre of Muswellbrook and is a two-lane road, restricted by numerous intersections and adjacent buildings with minimal setback from the road. The highway carries between 9,600 to 19,500 vehicles through the township each day, about 13 per cent being heavy vehicles.

The project benefits of Muswellbrook bypass are listed below:

> Improve network efficiency on the New England Highway, particularly travel times for long haul freight movements;

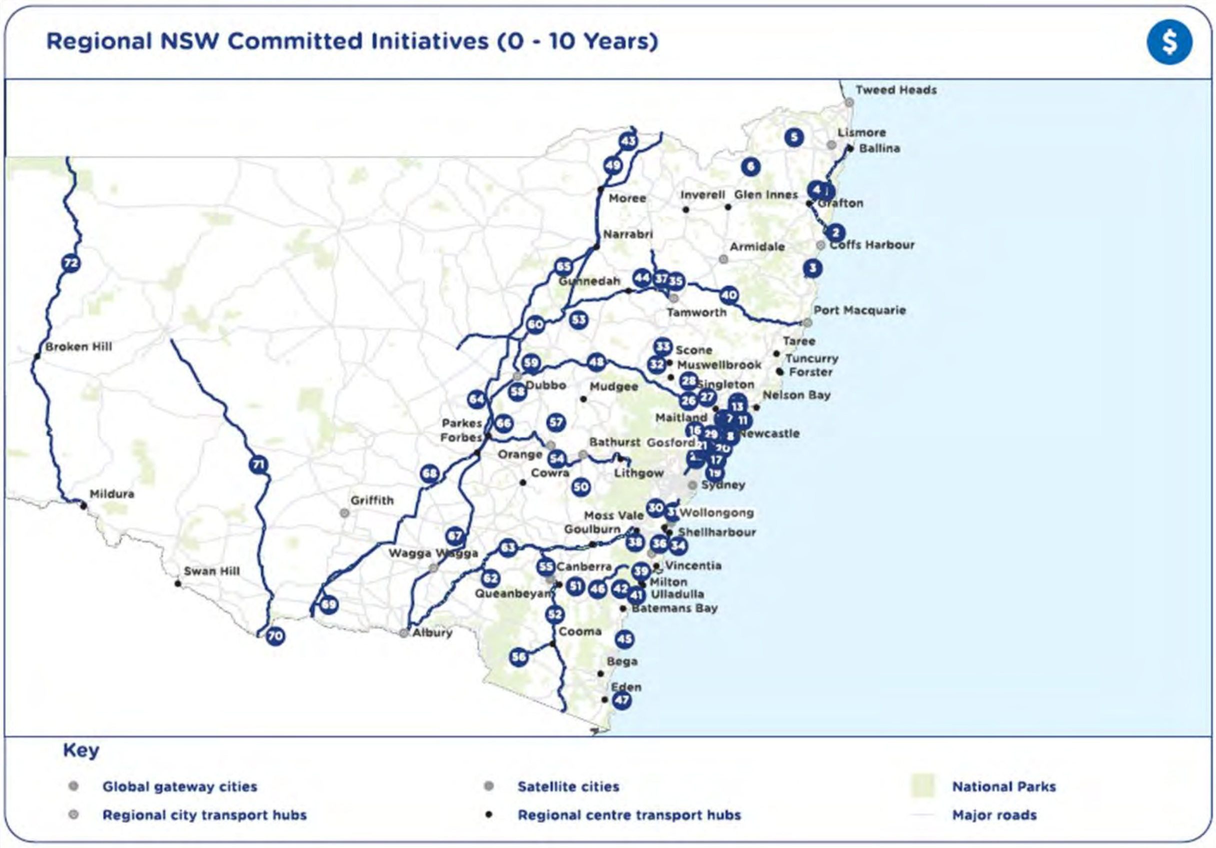
> Improve safety for all road users in the town centre, particularly relating to heavy and light vehicle interactions; and

> Improve amenity of Muswellbrook township.

Preferred route option

2.4 Future Transport Strategy 2056

The Strategy lists a number of infrastructure commitments within the regional NSW and identifies New England Highway - Muswellbrook bypass, and duplication of New England Highway- Muswellbrook to Scone as committed and visionary initiatives, as shown in **Figure 2-1** to **Figure 2-2.**



1. Woolgoolga to Ballina (State and Federal funded)
2. Coffs Harbour Bypass (Subject to final business case and Federal funding)
3. Warrell Creek to Nambucca Heads (State and Federal Funded)
4. Summerland Way, Additional Clarence River Crossing (Grafton Bridge)
5. Bruxner Highway, Replacement Bridge over Clarence River
6. New England Highway, Bolivia Hill Upgrade (State and Federal Funded)
7. Nelson Bay Road improvements - Fern Bay to Williamtown
8. Newcastle Cruise Terminal
9. Newcastle Light Rail
10. Cormorant Road, Industrial Drive to Stockton Bridge (State and Federal funded)
11. Lower Hunter Freight Corridor Protection
12. Newcastle Inner City Bypass, Rankin Park to Jesmond
13. Hunter Pinch Points
14. M1, Hexham, Raymond Terrace upgrades
15. Wyong Road, Mingara Drive to Tumbi Road Upgrade
16. Warnervale Link Road, Albert Warner Drive to Pacific Highway (Planning)
17. Pacific Highway, Wyong Town Centre (Planning)
18. Pacific Motorway Widening and Reconstruction, Wyong Road to Doyalson Link Road (State and Federal funded)
19. Empire Bay Drive, The Scenic Road and Cochrone Street Intersection Upgrade
20. Kangy Angy Train Maintenance Facility for New Intercity Fleet
21. Pacific Highway, Ourimbah Street to Glen Road
22. Pacific Highway, Parsons Road to Ourimbah Street (Planning)
23. Pacific Highway and Manns Road, Narara Creek Road to Parsons Road (Planning)
24. Manns Road, Central Coast Highway to Narara Creek Road (Planning)
25. Pacific Motorway Widening, Kariong Interchange to Somersby Interchange (State and Federal Funded)
26. New England Highway, Belford to Golden Highway Upgrade (Planning)
27. New England Highway, Singleton Bypass (Planning)
28. New England Highway, Gowrie Gates, Widen Rail Underpass
29. New Intercity Fleet
30. Princes Motorway, Interchange at Base of Mount Ousley (Planning)
31. Princes Motorway Improvements, Bulli Tops to Picton Road (Planning) (State and Federal Funded)
32. New England Highway, Muswellbrook Bypass (Planning)
33. New England Highway, Scone Bypass (State and Federal Funded)
34. Albion Park Rail Bypass (Planning and Preconstruction)
35. Tamworth Rail Freight Centre
36. Berry to Bomaderry Upgrade
37. Barraba Branch Line
38. Nowra Bridge over Shoalhaven River (Planning) (State and Federal Funded) subject to final business case and Federal funding
39. Burrill Lake Bridge Replacement
40. Oxley Highway Safety and Realignment Works (Planning)
41. Batemans Bay Bridge (Planning)
42. Kings Highway, Replacement Clyde River Bridge
43. Newell Highway, Mungle Back Creek to Boggabilla Heavy Duty Pavement (State and Federal Funded)
44. Oxley Highway, Gunnedah Bridge over Rail
45. Dignams Creek Realignment

Figure 2-1 Infrastructure commitments 0-10 years

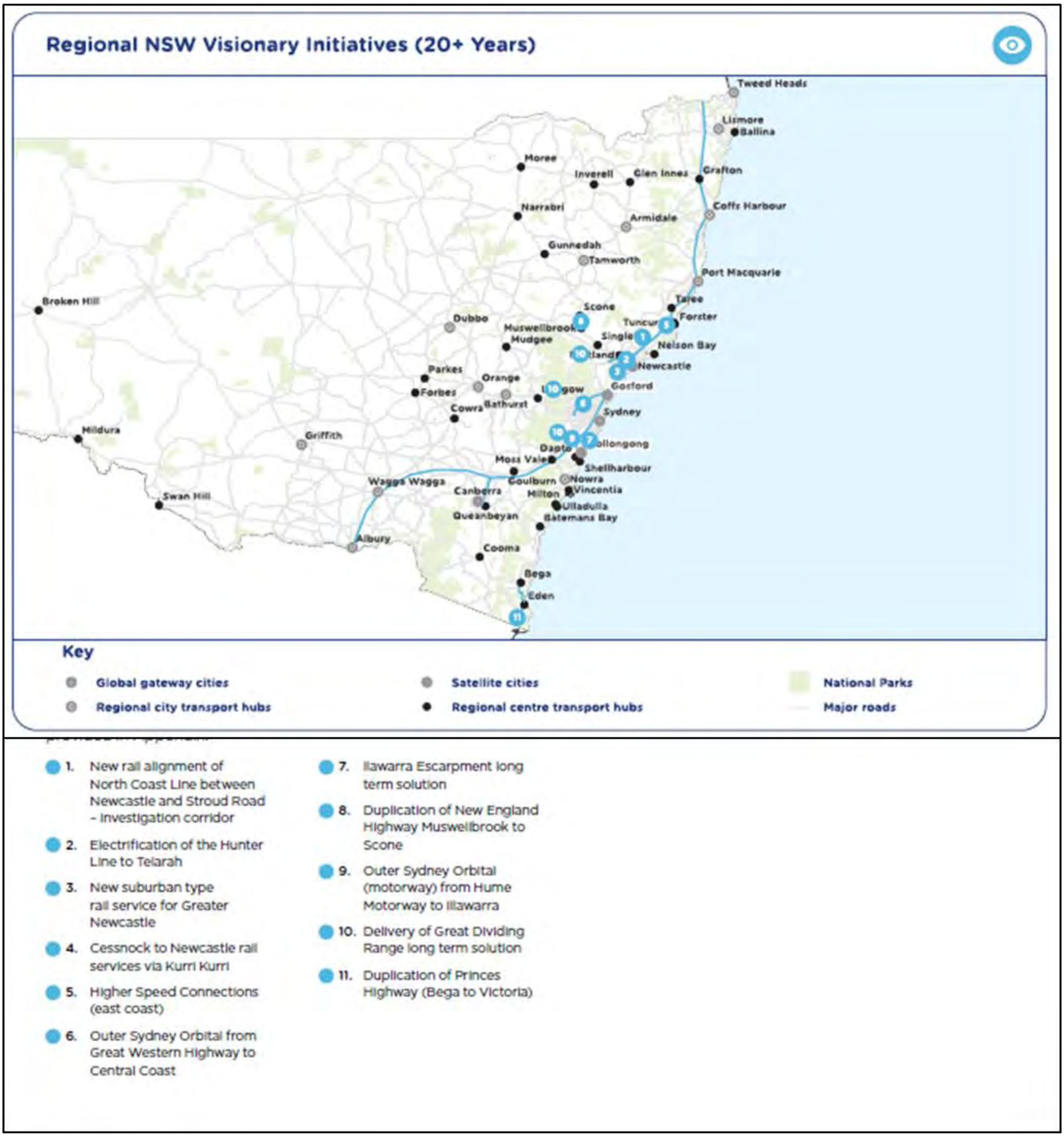


Figure 2-2 Visionary initiatives 20+ years

3 Existing Condition

3.1 Site Location

The subject site is bound by Haydon Street to the west, New England Highway to the south, Bell Street to the east, and Australian Rail Track Corporation (ARTC) Railway corridor to the north.

The site is subject to the local planning controls of the Muswellbrook LEP and Muswellbrook Shire Council DCP.

Nearby land uses are predominantly Local Centres and industrial with the site being within an existing RE1 – Public Recreation zoning.

The subject site and surrounding environments are illustrated in **Figure 3-1**.

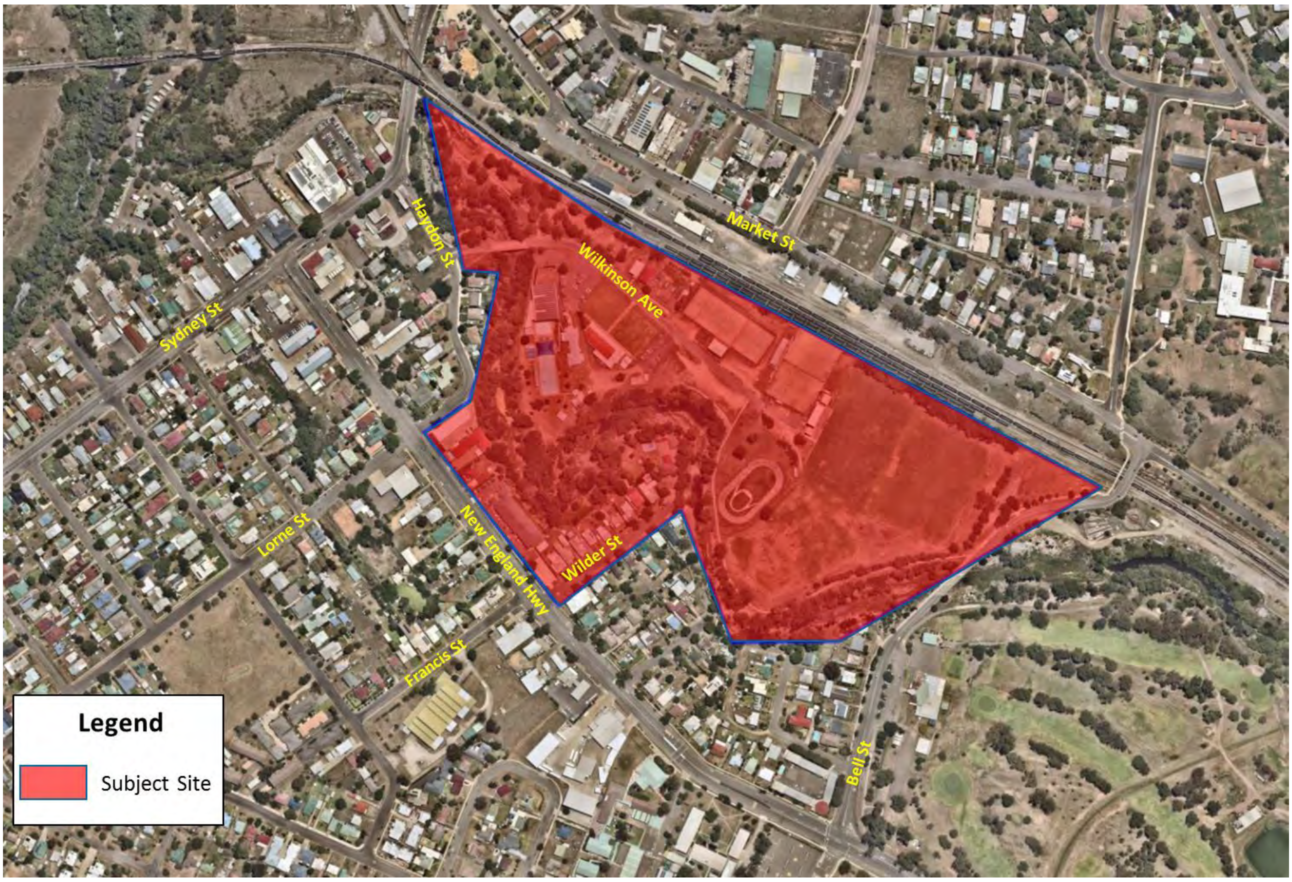


Figure 3-1 Site Location

3.2 Existing Road Network

3.2.1 Schedule of Road Classification

TfNSW in partnership with local government established an administrative framework of State, Regional and Local Road categories to help manage the extensive network of roads:

> State Roads link urban and rural centres for the movement of people and freight across the state;

> Regional Roads are secondary roads that provide connectivity between towns or places of interest within a region; and

> Local Roads are low-capacity roads that provide local access to residences and businesses within a town or locality.

State Roads are managed and financed by TfNSW. Regional and local roads are managed and financed by councils, however TfNSW may provide financial assistance to councils for the management of Regional Roads due to their network significance.

Roads can also be classified functionally by the traffic volume they are expected to convey and their typical characteristics:

> Arterial Roads are major roads that connect one region to another;
> Sub-arterial Roads are secondary roads the connect different areas within a region;
> Collector Roads are minor roads that link local areas to sub-arterial and arterial roads; and
> Local Roads are minor roads that provide access to houses and carry low traffic volumes.

The key road network surrounding the subject site consists of:

> New England Highway;
> Sydney Street;
> Haydon Street;
> Lorne Street;
> Wilkinson Avenue;
> Wilder Street;
> Market Street; and
> Bell Street.

3.2.1.1 New England Highway

New England Highway is classified as a State Road, part of the NSW State Road Number 9 under the care and maintenance of TfNSW. The road is configured as a single carriageway with four lanes (two lanes in each direction). The posted speed limit is 50 Km/h in the vicinity of the subject site.

3.2.1.2 Sydney Street

Sydney St is classified as a State Road under the care and maintenance of Roads and Maritime. The road is configured as a single carriageway with two lanes (one lane in each direction). The posted speed limit is 50 Km/h.

3.2.1.3 Haydon Street

Haydon Street is a local, unclassified road under the care and maintenance of the local Council. It has a two-lane undivided carriageway (one lane in each direction). The posted speed limit is 50 Km/h. Unrestricted Kerbside parking is available along the road.

3.2.1.4 Lorne Street

Lorne Street is a local, unclassified road under the care and maintenance of the local Council. It has a two-lane carriageway (one lane in each direction). The posted speed limit is 50 Km/h. Unrestricted Kerbside parking is available along the road.

3.2.1.5 Wilkinson Avenue

Wilkinson Ave is a local, unclassified road under the care and maintenance of the local Council. It has a two-lane undivided carriageway (one lane in each direction). Unrestricted Kerbside parking is available along the road.

3.2.1.6 Wilder Street

Wilder Street is a local, unclassified road under the care and maintenance of the local Council. It has a two-lane undivided carriageway (one lane in each direction). The posted speed limit is 50 Km/h with a 40 Km/h school zone restriction from 8- 9:30 AM and 2:30 – 4 PM during school days. Unrestricted parking is available along the road.

3.2.1.7 Bell Street

Bell Street is a local, unclassified road under the care and maintenance of the local Council. It has a two-lane carriageway (one lane in each direction). The posted speed limit is 50 Km/h with a 40 Km/h school zone restriction from 8am- 9.30am and 2.30pm – 4pm during school days. Unrestricted parking is available along the road.

3.2.2 Key Intersections

The four key intersections, as shown in **Figure 3-2** that are to be assessed as part of this assessment.

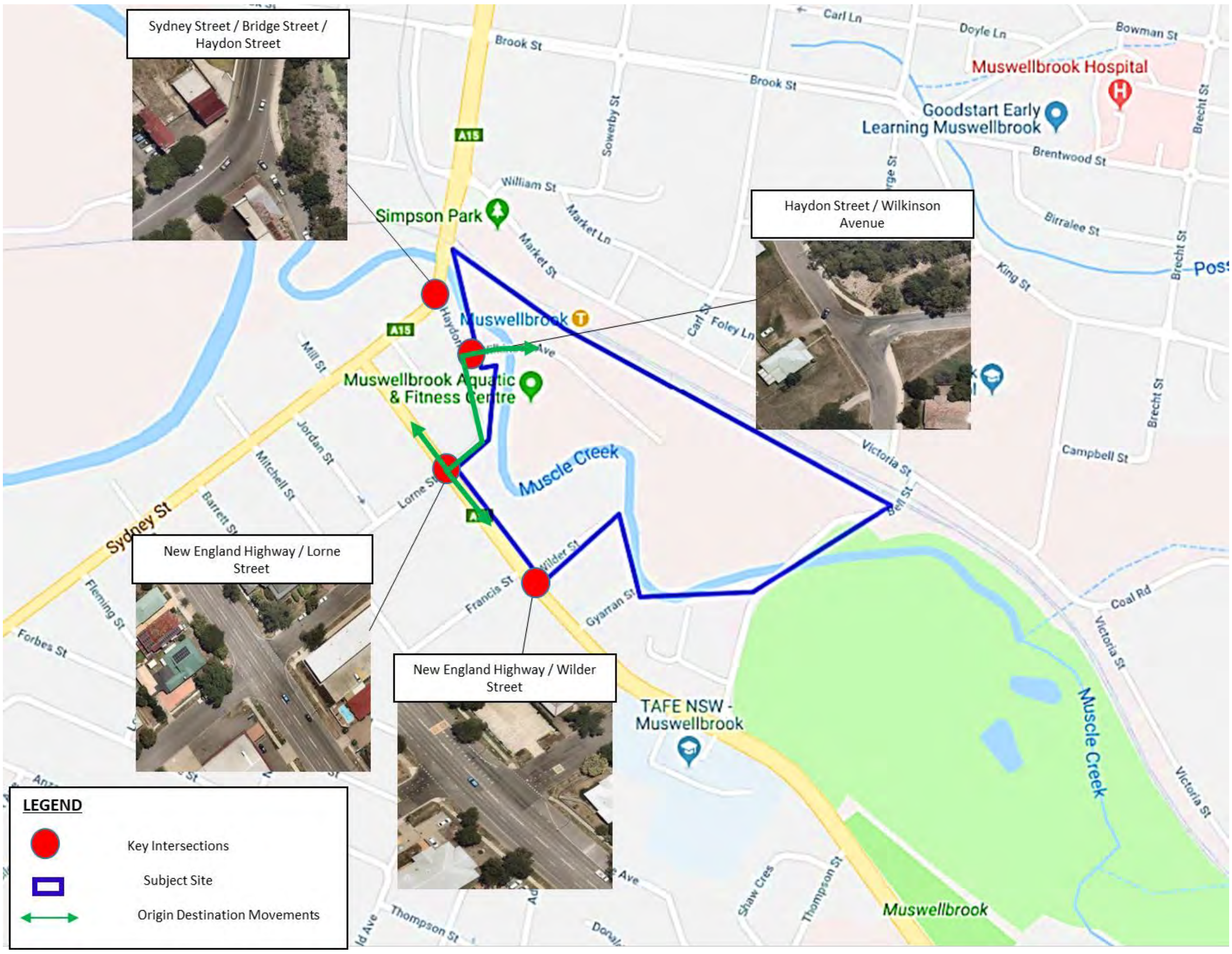


Figure 3-2 Key Intersections

3.3 Traffic Volume

3.3.1 Intersection Counts

Intersection traffic surveys were undertaken on Tuesday, 7 May 2019, and Saturday 11 May 2019 at the following locations:

> Sydney Street/Bridge Street;
> Wilkinson Avenue/Haydon Street;
> Lorne Street/Haydon Street; and
> Wilder Street/New England Highway.

The period for the surveys were as follows:

> Saturday, 7am to 1pm; and
> Tuesday, 4pm to 7pm.

The turning movement volumes are shown in **Figure 3-3** and **Figure 3-6** for the above intersection locations, based on the Weekday PM and Saturday peak hours.

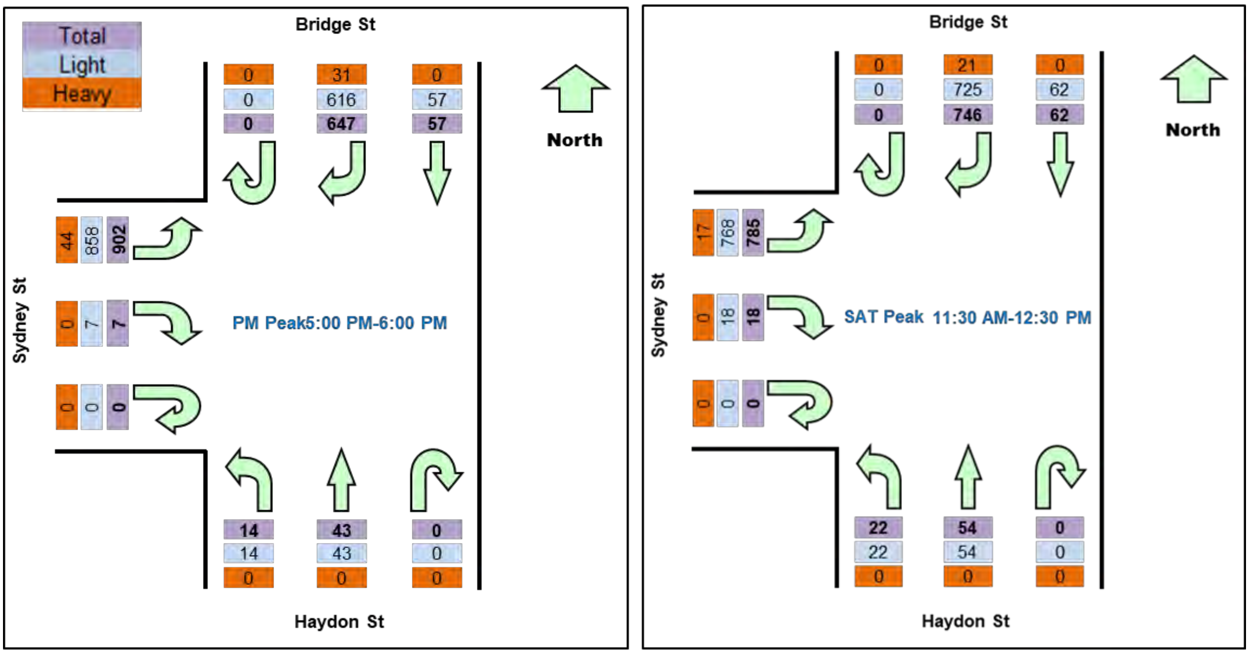


Figure 3-3 Haydon Street/Bridge Street

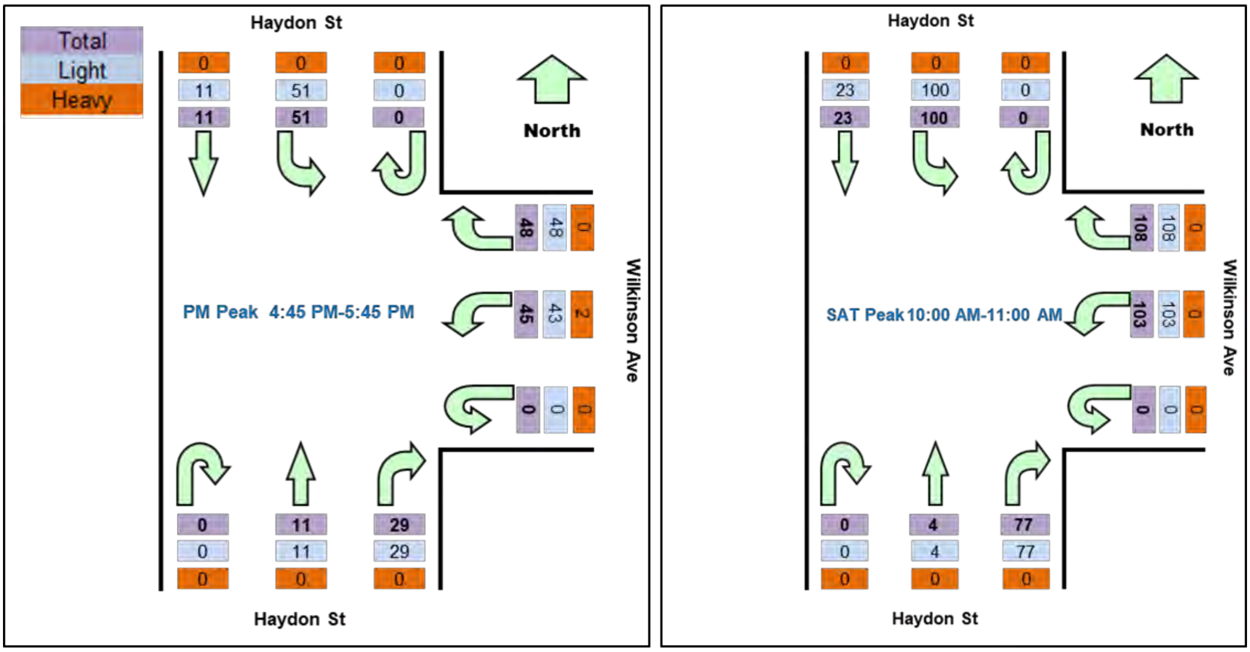


Figure 3-4 Haydon Street/Wilkinson Avenue

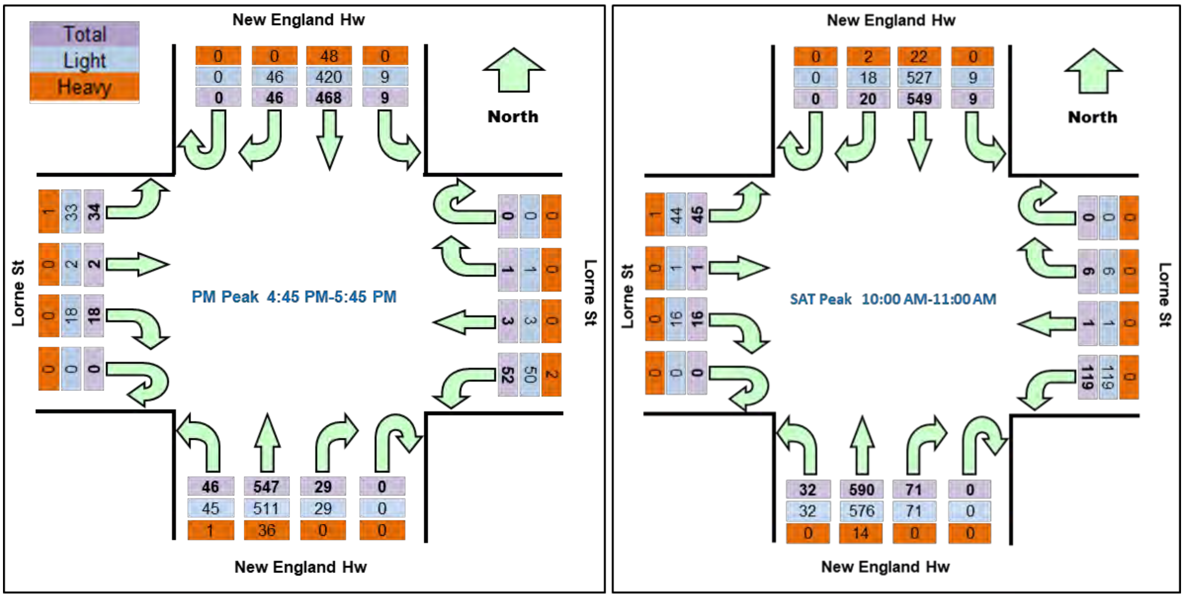


Figure 3-5 New England Highway/Lorne Street

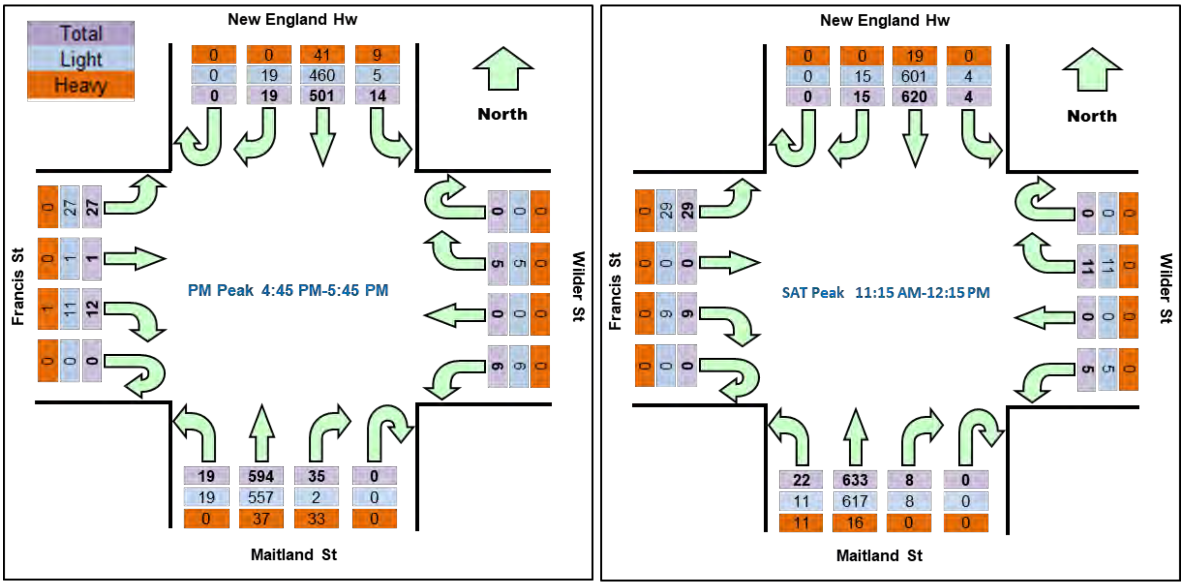


Figure 3-6 New England Highway/Wilder Street/Francis Street

The turning movement volumes for the above intersections were used to determine the traffic profile. The traffic was plotted for the periods in which the surveys were done and are shown in **Figure 3-7** to **Figure 3-8** below.

3.3.2 Origin Destination Data

The Origin-Destination Data was also collected for key movements concurrently with the intersection counts on Tuesday, 7 May 2019 from 4pm to 7pm and Saturday 11 May 2019 from 7am to 1pm.

The key movements where the origin-destination data was collected is shown in **Figure 3-2**.

3.3.3 Historical traffic counts

TfNSW has two nearest count station (ID 6157 and ID 6154) is located close to the subject site. The most recent and complete dataset for the two locations is summarised in the following **Table 3-1.**

Table 3-1 Historical Traffic Flows

Station ID	Location on New England Highway	Average weekday traffic volumes			Traffic growth per year 2017 – 2019 (2 years)
		2017	2018	2019	
6154	1.64km south of Muscle Creek Road	9,824	9,817	10,124	1.5%
6157	60m north of Burtons Lane	10,336	10,324	10,299	-0.01%

Based on the historic traffic volumes obtained from the TfNSW count sites the traffic volumes on an average, are in the order of 10,000 respectively. Also, the volumes have increased by a maximum of 1.5% in the most recent 2 year period.

3.3.4 Weekday Profile

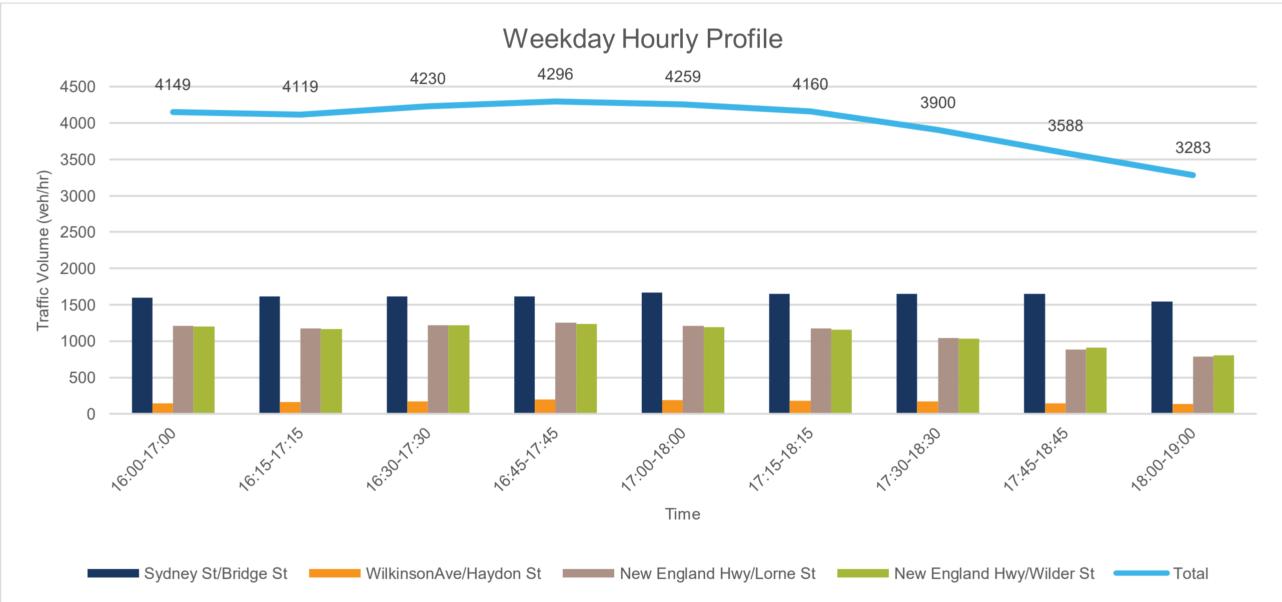


Figure 3-7 Weekday Traffic Profile

The weekday traffic profile of the surveyed intersections is shown in **Figure 3-7**. The weekday profile is developed summing the volumes of all the vehicles approaching the intersections during the surveyed hour. The traffic profile is used to determine weekday peak hours for the individual intersection. For example, for Sydney Street/Bridge Street intersection the weekday peak hour is 5pm to 6pm with 1670 veh/h approaching the intersection during the peak hour.

3.3.5 Saturday Profile

The Saturday traffic profile for the surveyed intersections is shown in **Figure 3-8.**

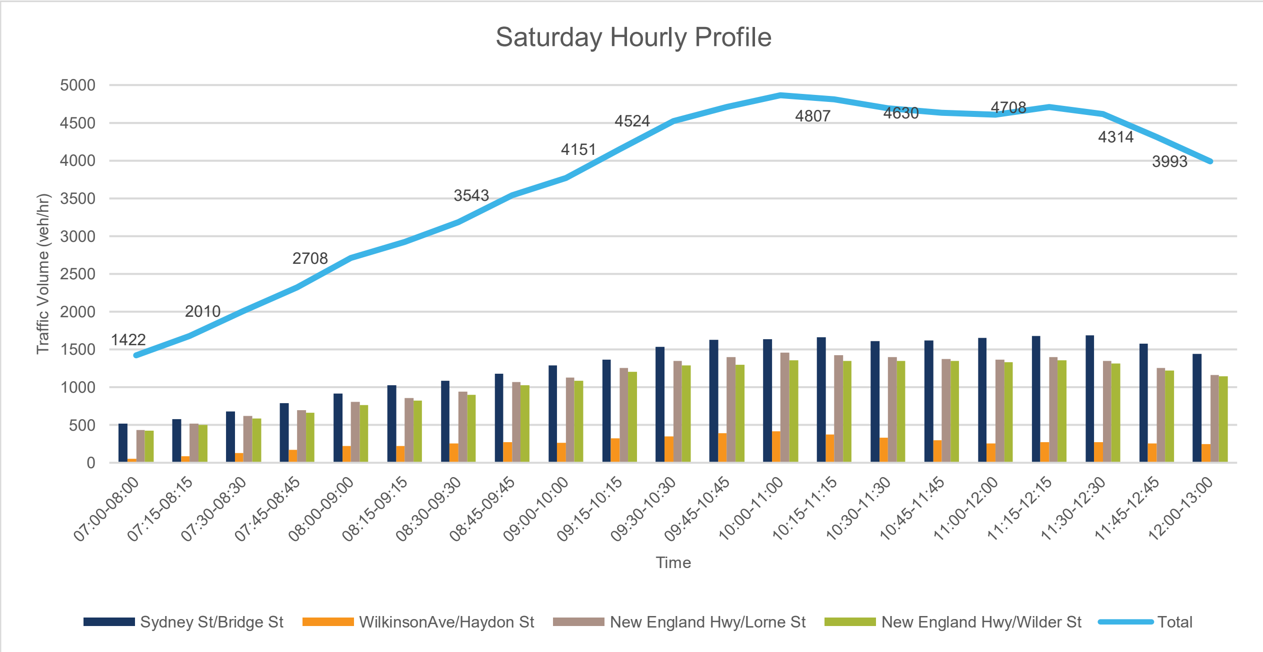


Figure 3-8 Saturday Traffic Profile

The Saturday traffic profile of the surveyed intersections is shown in **Figure 3-8**. The Saturday profile is developed summing the volumes of all the vehicles approaching the intersections during the surveyed hour. The traffic profile is used to determine Saturday peak hours for the individual intersection. For example, Sydney Street/Bridge Street intersection the Saturday peak hour is 11.30am to 12.30pm with 1687 veh/h approaching the intersection during the peak hour.

3.3.6 Haydon Street Wilkinson Street Profile

3.3.6.1 Weekend

The weekend traffic profile of Haydon Street/Wilkinson Avenue only for the surveyed hours are shown in **Figure 3-9.** The traffic profile for Haydon Street/Wilkinson Avenue only includes the traffic coming in/out of the Olympic Park.

Figure 3-9 Haydon Street/Wilkinson Avenue Hourly Profile

The weekend traffic profile of Haydon Street/Wilkinson Avenue for the surveyed hours shows that the traffic associated with the Olympic Park peaks from 10am to 11.30am with a volume of circa 100 veh/h. The weekend daily profile for Haydon Street/ Wilkinson Avenue has been estimated by maintaining the linear trend beyond the surveyed Hours. **Figure 3-10** shows the daily profile for Haydon Street/Wilkinson Avenue.

Figure 3-10 Haydon Street/Wilkinson Avenue Weekend 24 Hour Traffic Profile

3.3.6.2 Weekday

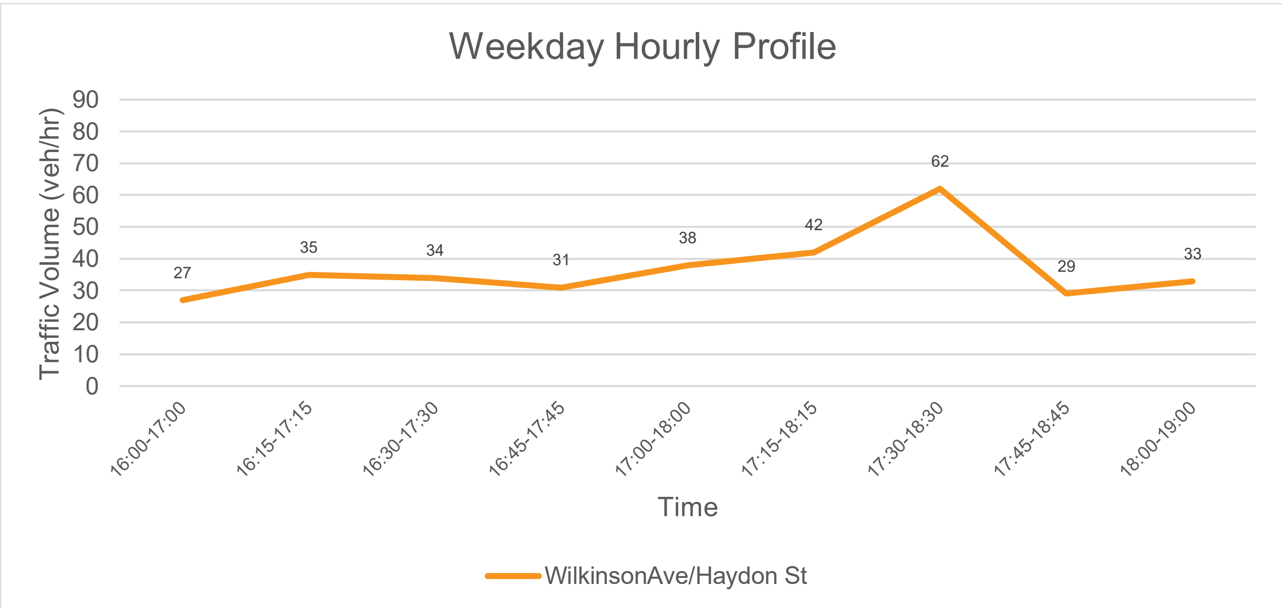


Figure 3-11 Haydon Street/Wilkinson Avenue Weekday Hourly Profile

The weekday traffic profile of Haydon Street/Wilkinson Avenue for the surveyed hours shows that the traffic associated with the Olympic Park peaks from 5.30pm to 6.30 pm with a volume of 52 veh/h.

3.4 Existing Parking Conditions

3.4.1 Existing Facility Utilisation

The analysis of observation cameras allowed the identification of parking demand and identification of several patterns and behaviours by the users. The video observation was analysed for weekdays during the hours 4:00 PM to 7:00 PM and Saturday during the hours 7.00am to 1.00pm to obtain the car parking demand.

3.4.2 Car Park Location

The location of the car parks are shown in **Figure 3-12** below. Based on Nearmap aerial imagery, a total of 65 and 107 formalised car parking spaces were identified in Area A and B respectively. Also, there are locations identified for overflow parking from Area B.

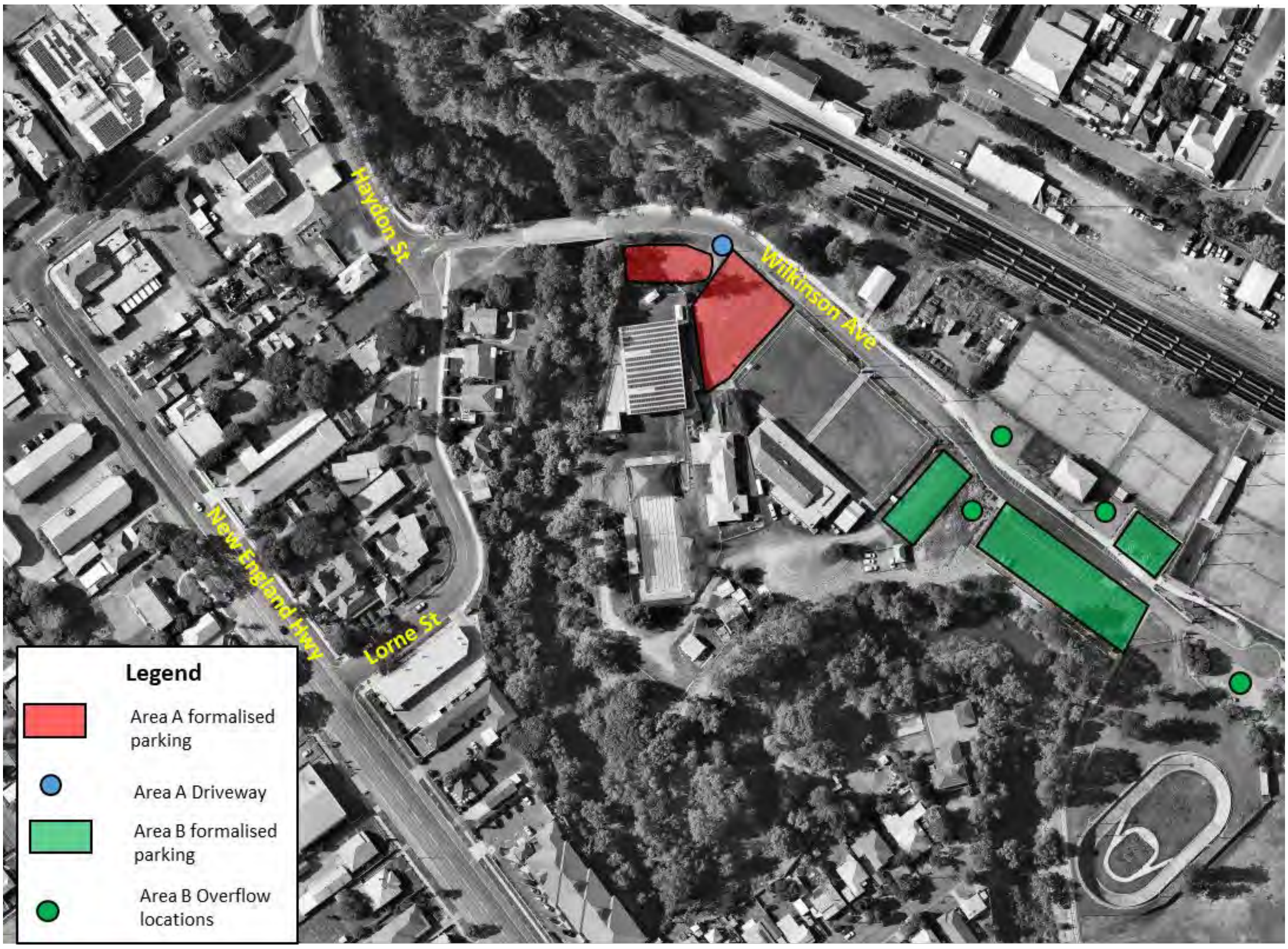


Figure 3-12 Olympic Park Car Park

The parking utilisation of Area A was determined from the number of ingress/egress vehicles from the car park driveway as observed from the observation cameras.

The number of ingress/egress vehicles from the Area A car park was reduced from the ingress/egress vehicles from Haydon Street/Wilkinson Avenue to get the car parking demand of the remaining precinct.

3.4.2.2 Weekday

Figure 3-13 shows that Area A car park is approximately up to 50% utilised at 6.00pm on Weekday.

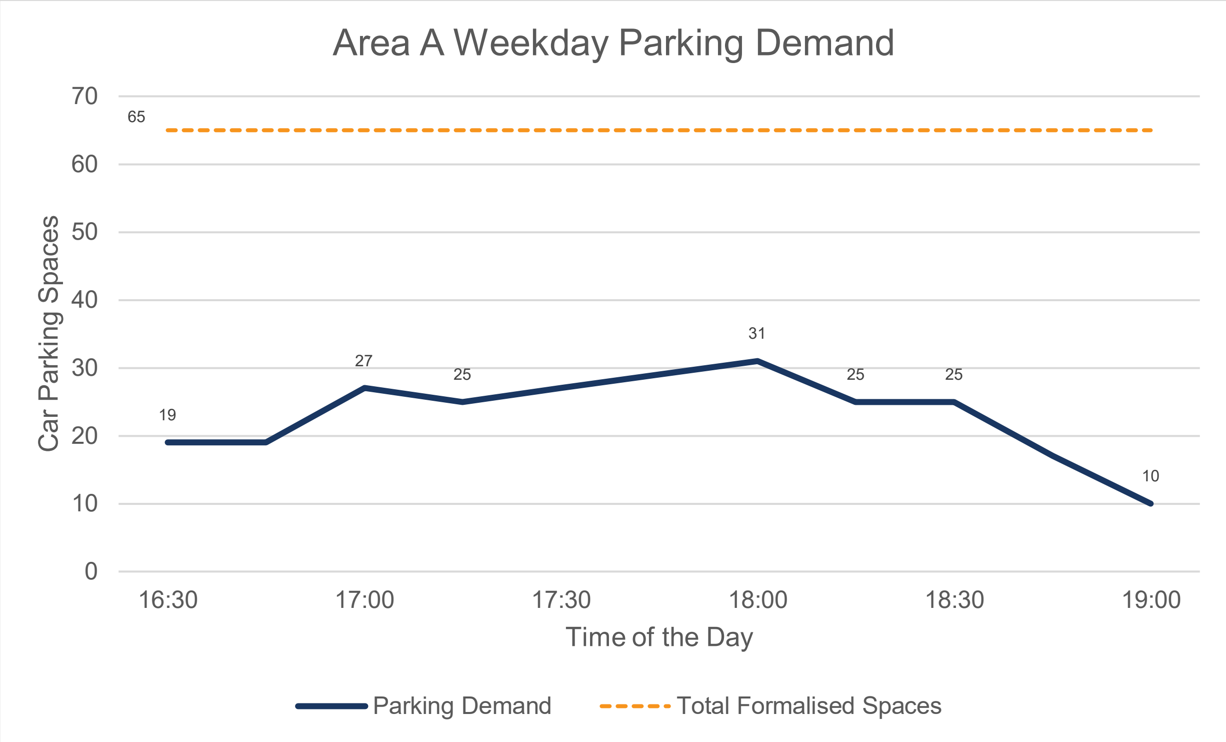


Figure 3-13 Area A Weekday Car parking Demand

Note: Video footage from 16:00 to 16:15 was not available completely

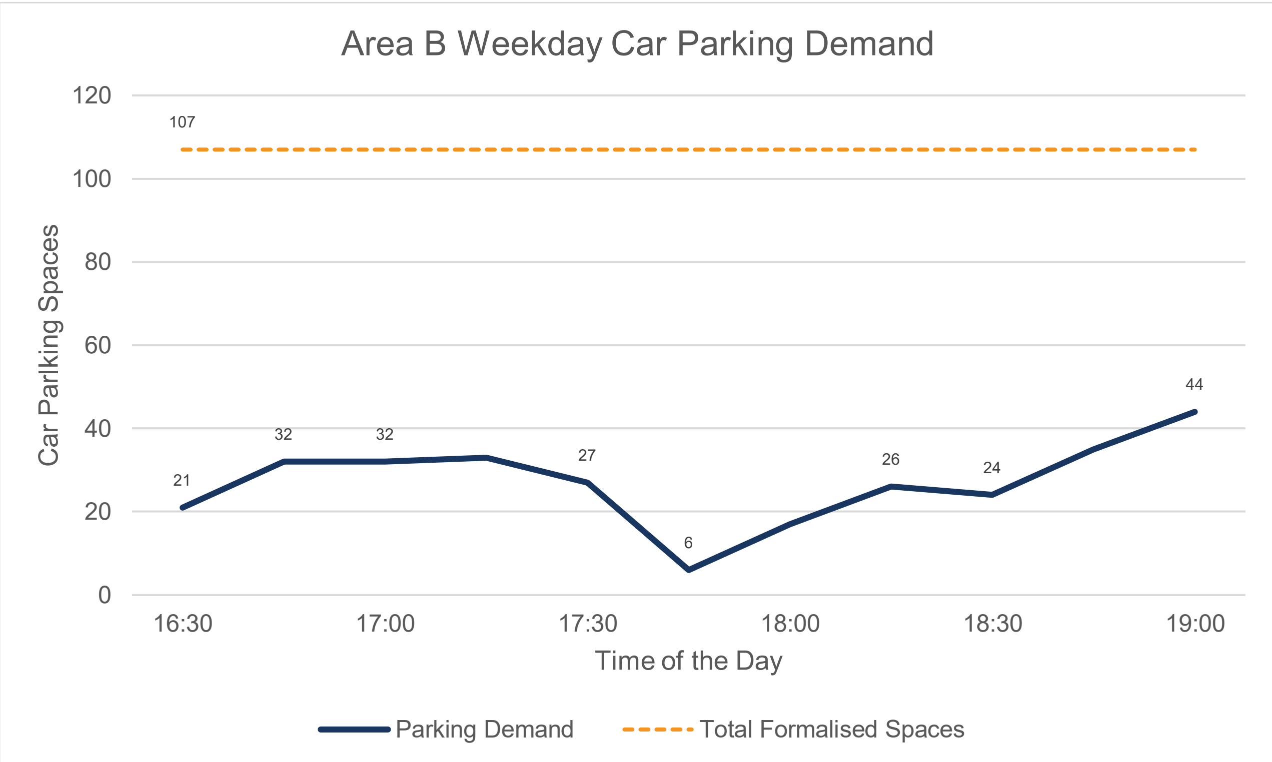
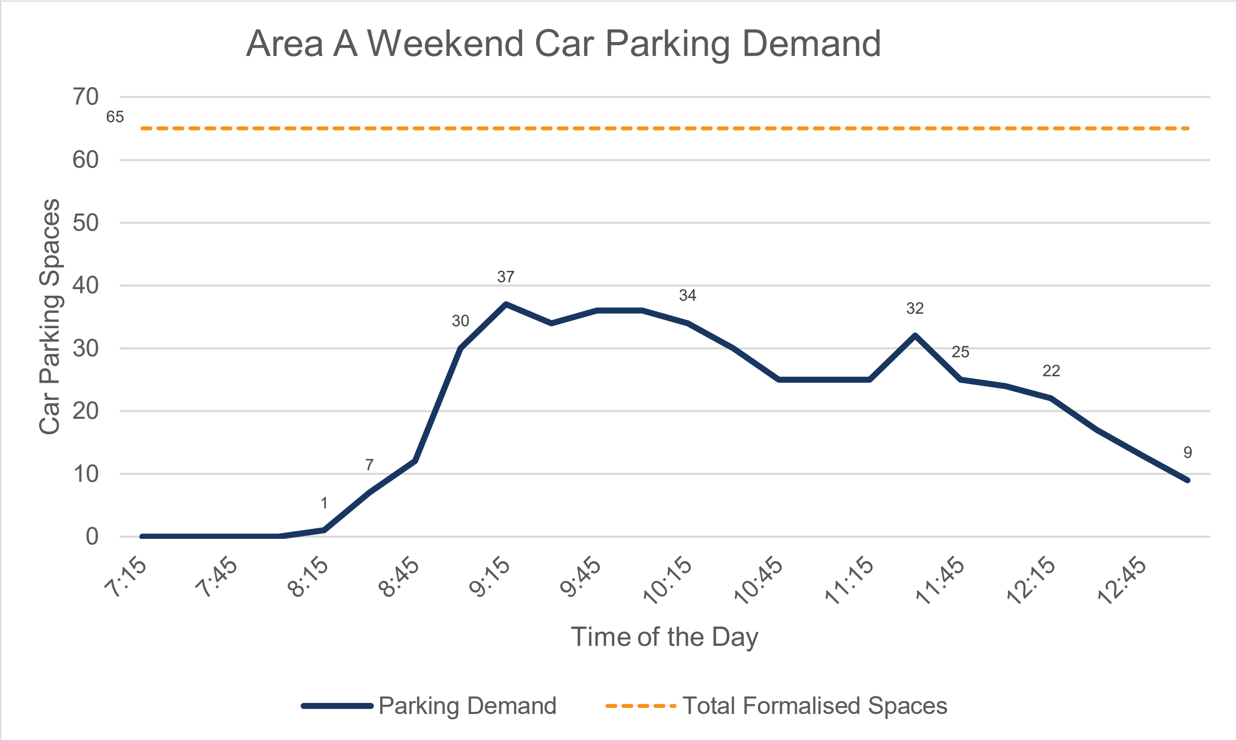


Figure 3-14 Area B Weekday Car Parking Demand

Figure 3-14 shows that Area B car park is approximately up to 40% utilised at 7.00pm on Weekday.

3.4.2.3 Saturday

Figure 3-15 shows that Area A car park parking demand crosses the 50% capacity from 9.15am– 10.15am on Saturday.



Note: The parking utilisation values were calculated from the in/out from the car park observed from video footage.

Figure 3-15 Area A Weekend Car Parking Demand

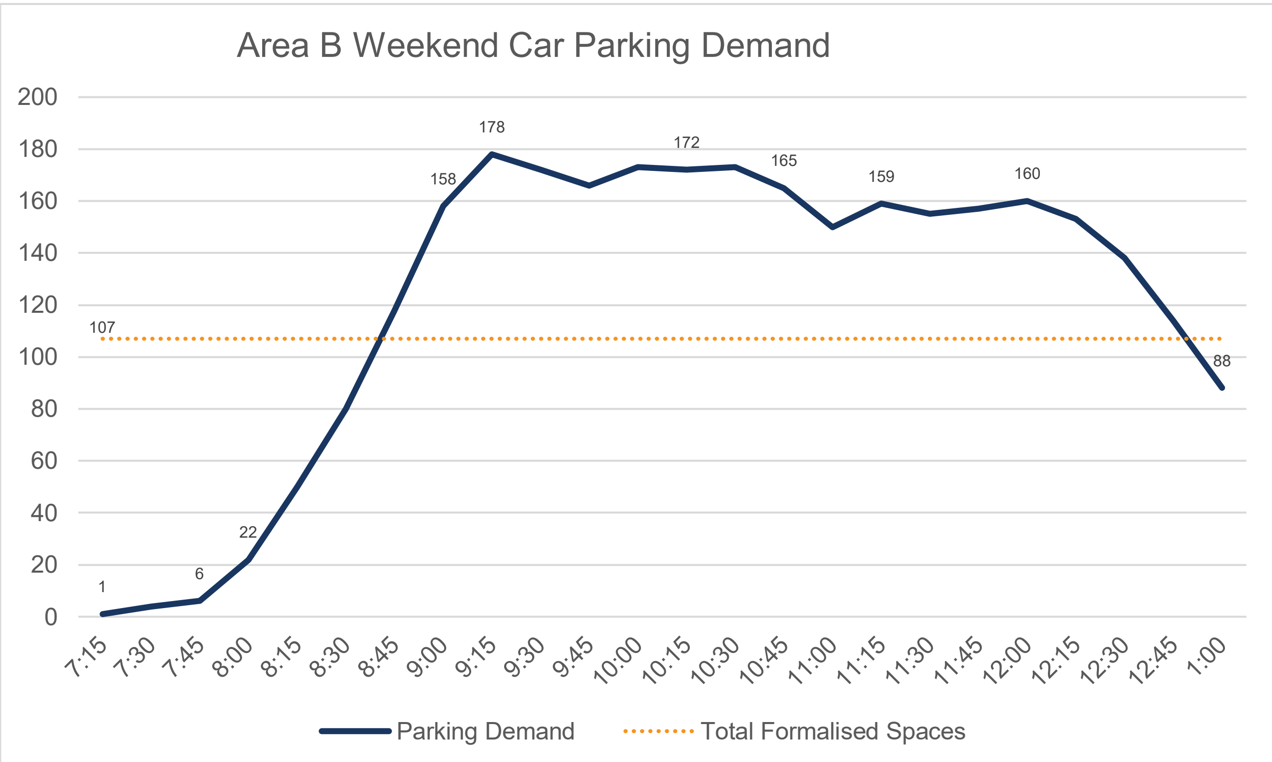


Figure 3-16 Area B Weekend Car Parking Demand

Figure 3-16 shows that the Area B car park parking demand crosses the capacity of formalised parking areas from 8:45am – 1.00pm which results in the usage of overflow parking locations identified in **Figure 3-12**.

3.5 Crash History

Crash data is reliant on incidents being reported to the NSW Police, either through police attendance at a crash scene or reporting by involved parties. It is generally understood that minor collisions without injuries are not reported. As such, analytics of all crashes is not possible. Notwithstanding, crash data does include more serious accidents. This allows analytics to identify trends in accidents and location issues/ crash clusters.

Five-year crash data history from TfNSW (the Centre for Road Safety) was analysed from 2014 to 2018 (inclusive).

The locations of crashes in the vicinity of the Olympic Park are shown in **Figure 3-17**.

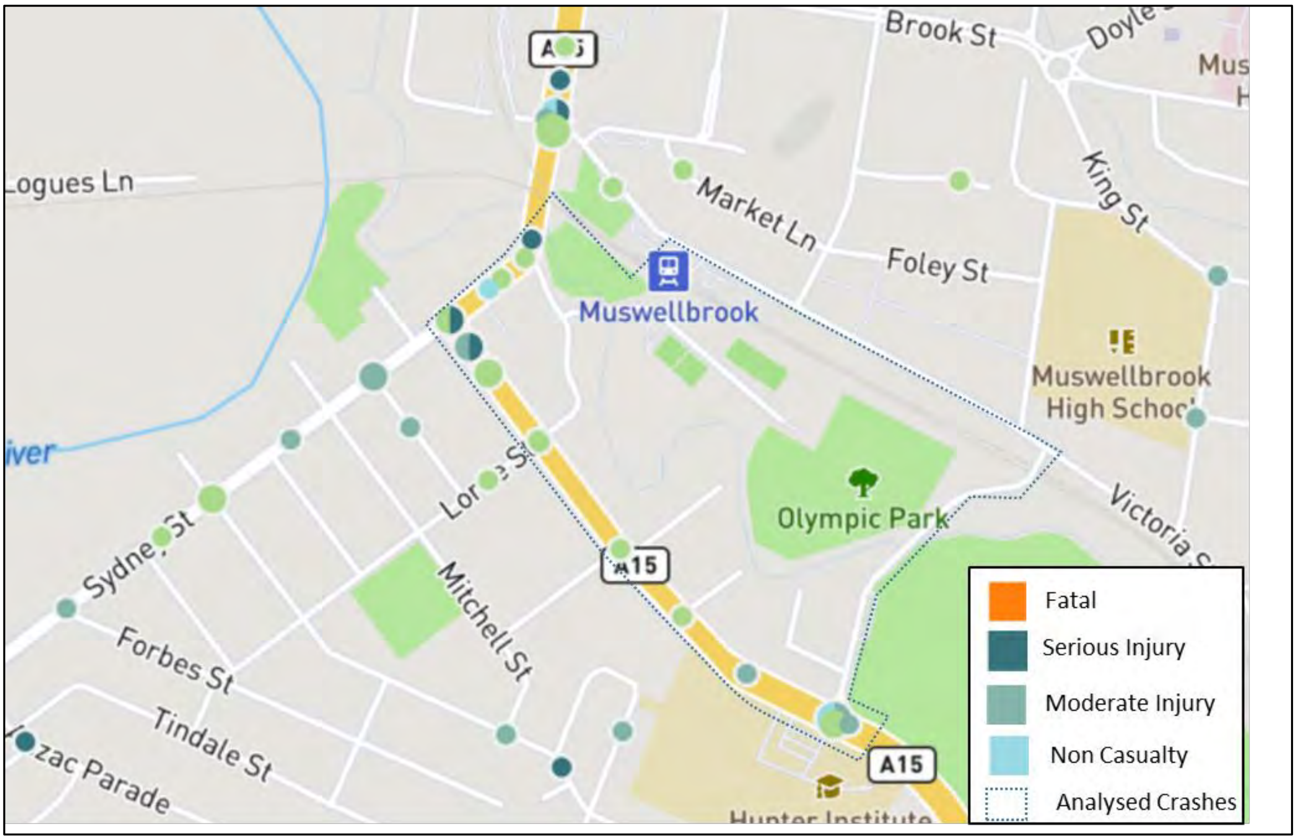


Figure 3-17 Crashes in the vicinity of Olympic Park Precinct

Source: Crash and casualty statistics, TfNSW via *https://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/nsw.html?tabnsw=7, viewed 1407/2020*

Overall, there were 22 crashes within proximity to the Olympic Park. A summary of crashes analysed by severity is shown in **Table 3-2** and by crash type in **Table 3-3**. Further detailed breakdown of the results for the New Engand Highway/Lorne Street/Haydon Street and New England Highway/Wilder Street intersections are also provided in **Table 3-4** and **Table 3-5**.

Table 3-2 Crash Summary by Severity

Crash severity	2014	2015	2016	2017	2018	Total
Non-casualty (tow-away)	5	3	3		1	**12**
Minor/other injury		1		2		**3**
Moderate injury	1			2	1	**4**
Serious injury			2		1	**3**
Total	**6**	**4**	**5**	**4**	**3**	**22**

Source: Crash and casualty statistics, TfNSW via https://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4, viewed 14/07/2020

Table 3-3 Crash Summary by Road User Movement (RUM) Code

RUM code and description	2014	2015	2016	2017	2018	Total
0 - Pedestrian nearside				1		**1**
2 - Pedestrian far side					1	**1**
19 - Other Adjacent		1				**1**
20 - Head On			1			**1**
21 - Right Through	1		1		1	**3**
30 - Rear end	1	2	1	2		**6**
31 - Left rear				1		**1**
32 - Right rear					1	**1**
33 - Lane sideswipe	1					**1**
36 - Right turn sideswipe	1					**1**
39 - Other same direction			1			**1**
47 - Emerging from drive			1			**1**
71 - Off road left=> obj	1					**1**
81 - off left/right bend =obj	1	1				**2**
Total	**6**	**4**	**5**	**4**	**3**	**22**

Source: Crash and casualty statistics, TfNSW via https://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4, viewed 14/07/2020

There were no fatal crashes in the vicinity of the Olympic Park in the reporting period.

3.5.2 New England Highway/Lorne Street

There was a total of two crash at the intersection of New England Highway/ Lorne Street. A summary of crash at the intersection is provided in **Table 3-4**.

Table 3-4 New England Highway/Lorne Street Crashes

Crash Severity	Year	RUM Code	RUM Description	Lightning Condition
Non-casualty (tow-away)	2014	36	Right turn Sideswipe	Daylight
Non-casualty (tow-away)	2018	21	Right through	Darkness

3.5.3 New England Highway/ Wilder Street/Francis Street

There was a total of one crash at the intersection of New England Highway/ Wilder Street/Francis Street. A summary of crash at the intersection is provided in **Table 3-5**.

Table 3-5 New England Highway/Wilder Street/Francis Street Crashes

Crash Severity	Year	RUM Code	RUM Description	Lightning Condition
Non-casualty (tow-away)	2015	19	Other adjacent	Dusk

3.6 Existing Intersection Performance

The existing intersection operation performance was assessed using the SIDRA Intersection 7.0 software package. The key indicator of intersection performance is typically the Level of Service (LoS), where results are placed on a scale from 'A' to 'F', outlined in **Table 3-6**.

Table 3-6 Level of Service Criteria for Intersections

Level of Service	Average Delay per Vehicle (sec/veh)	Traffic Signals, Roundabout	Giveway & Stop Signs
A	< 14	Good Operation	Good Operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near Capacity & accident study required
E	57 to 70	At Capacity, at signals incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires additional capacity.

Source: Guide to Traffic Generating Developments (TfNSW, 2002)

The Average Vehicle Delay (AVD) provides a measure of the operational performance of an intersection and determines the LoS when applying the TfNSW method (as above). It should be noted that the AVD's should be taken as a guide only as longer delays could be tolerated in some locations (i.e. inner city conditions) and on some roads (i.e. minor side street intersecting with a major arterial route). For traffic signals, the weighted average delay over all movements should be utilised. For roundabouts and priority control intersections (sign control) the critical movement for assessing LoS should be the movement with the highest average delay.

The Degree of Saturation (DoS) is another measure of the operational performance of individual intersections. For intersections controlled by traffic signals, both queue length and delay increase rapidly as DOS approaches 1.0. It is usual to attempt to keep DOS to less than 0.9. Degrees of Saturation in the order of 0.7 generally represent satisfactory intersection operation. When DOS exceed 0.9 queues can be anticipated.

3.6.2 Sydney St /Bridge Street/Haydon Street

The existing Sydney Street /Bridge Street/Haydon Street intersection layout was modelled in SIDRA. The performance of the existing intersection layout was then assessed for the Weekday PM and Saturday peak periods, observed during the surveys.

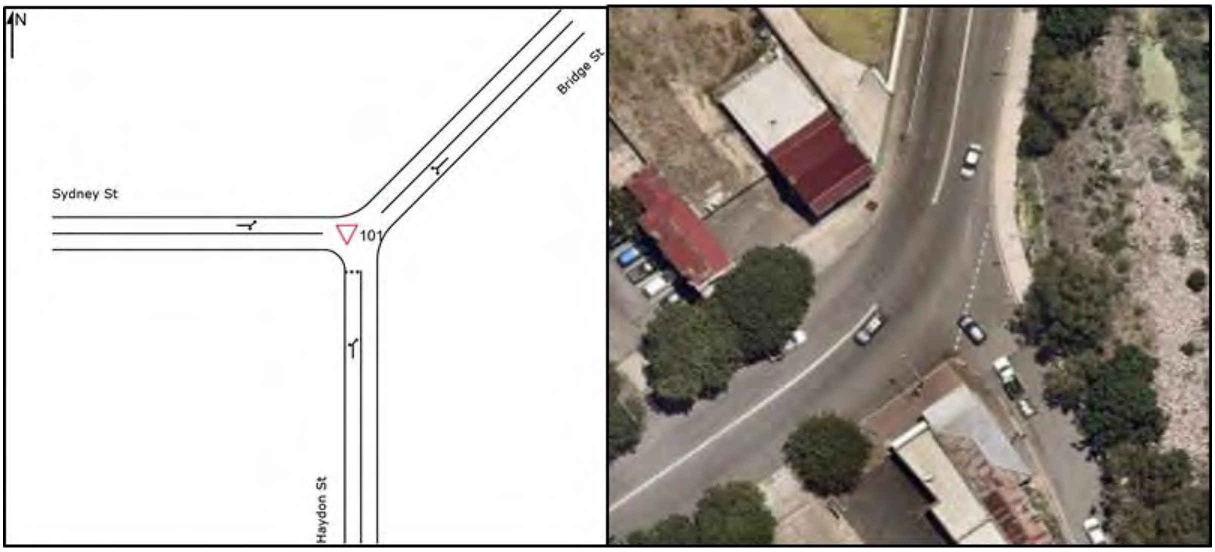


Figure 3-18 SIDRA intersection base layout of Sydney Street /Bridge Street/Haydon Street

The SIDRA assessment of the Sydney Street /Bridge Street/Haydon Street intersection for the existing condition is summarised in **Table 3-7.**

Table 3-7 Sydney Street /Bridge Street/Haydon Street Intersection Performance

Scenario	PM Peak			SAT Peak		
	DoS	Delay (sec)	LoS	DoS	Delay (sec)	LoS
2019 Base	0.518	41.6	C	0.484	36.9	C

The above SIDRA results indicate that the intersection is currently operating satisfactorily at LoS C in the PM and SAT Peak.

3.6.3 Haydon Street /Wilkinson Avenue

The existing Haydon Street /Wilkinson Avenue intersection layout was modelled in SIDRA. The performance of the existing intersection layout was then assessed for the Weekday PM and SAT peak periods, observed during the surveys.

Figure 3-19 SIDRA intersection base layout of Haydon Street /Wilkinson Avenue

The SIDRA assessment of the Haydon Street /Wilkinson Avenue intersection for the existing condition is summarised in **Table 3-8.**

Table 3-8 Haydon Street /Wilkinson Avenue Intersection Performance

Scenario	PM Peak			SAT Peak		
	DoS	Delay (sec)	LoS	DoS	Delay (sec)	LoS
2019 Base	0.072	4.8	A	0.169	5.2	A

The above SIDRA results indicate that the intersection is currently operating satisfactorily at LoS A in the PM and SAT Peak.

3.6.4 New England Highway/ Lorne Street

The existing New England Highway/ Lorne Street Intersection layout was modelled in SIDRA. The performance of the existing intersection layout was then assessed for the Weekday PM and SAT peak periods, observed during the surveys.

Figure 3-20 SIDRA intersection base layout of New England Highway/Lorne Street

The SIDRA assessment of the New England Highway/ Lorne Street intersection for the existing condition is summarised in **Table 3-9.**

Table 3-9 New England Highway/ Lorne Street Intersection Performance

Scenario	PM Peak			SAT Peak		
	DoS	Delay (sec)	LoS	DoS	Delay (sec)	LoS
2019 Base	0.214	37.4	C	0.285	58.2	E

The above SIDRA results indicate that the intersection is currently operating satisfactorily at LoS C in the PM and operating at capacity with LoS E in the SAT Peak. The worse delay in the SAT peak is caused by the right-turning vehicles, with a demand of 17veh/h, turning from Lorne Street into the New England Highway. It should be noted that the right turning volumes from the minor street are relatively low and not reflective of the overall intersection which would otherwise operate satisfactorily.

3.6.5 New England Highway/Wilder Street/Francis Street

The existing New England Highway/Wilder Street Intersection layout was modelled in SIDRA. The performance of the existing intersection layout was then assessed for the Weekday PM and SAT peak periods, observed during the surveys.

Figure 3-21 SIDRA intersection base layout of New England Highway /Wilder Street/Francis Street

The SIDRA assessment of the New England Highway/Wilder Street intersection for the existing condition is summarised in **Table 3-10.**

Table 3-10 New England Highway /Wilder Street/Francis Street Intersection Performance

Scenario	PM Peak			SAT Peak		
	DoS	Delay (sec)	LoS	DoS	Delay (sec)	LoS
2019 Base	0.223	45.6	D	0.188	45.7	D

The above SIDRA results indicate that the intersection is currently operating near capacity at LoS D in the PM and SAT Peak. The worse delay in both the PM and SAT peak is caused by the right-turning vehicles from Francis Street into the New England Highway. The demand for the right-turning vehicles from Francis Street is 13 veh/h and 9 veh/h in the PM and SAT peak respectively. It should be noted that the right turning volumes from the minor street are relatively low and not reflective of the overall intersection which would otherwise operate satisfactorily.

3.7 Existing Public Transport Services

The proposed location of the subject site is currently well served by public transport services as it is located within 1000 metres walk from Muswellbrook Station, which is served by NSW TrainLink Hunter Line services travelling between Newcastle and Scone. The train station is also served by NSW TrainLink Xplorer services from Sydney to Armidale and Moree.

The subject site has access to numerous bus stops located at Sydney Street and New England Highway which is served by numerous bus services as shown in **Figure 3-22**.

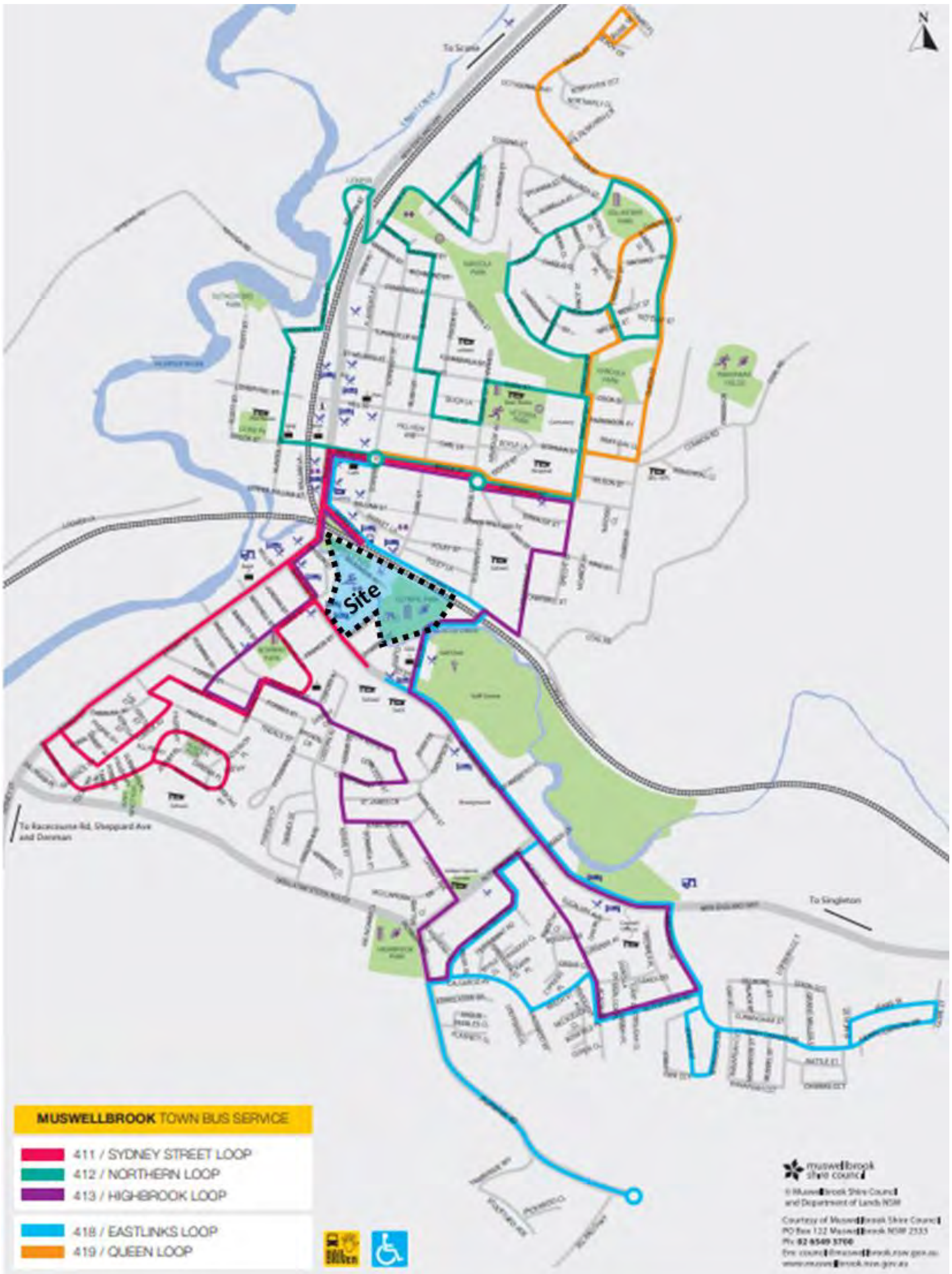


Figure 3-22 Bus Services Map

Source: Osborn’s Transport (Viewed July 2020)

As seen from **Figure 3-22** the subject site is mostly serviced by Route 411 and Route 413 through bus stops along Sydney Street and New England Highway. A summary of the bus service information is provided in **Table 3-11**.

Table 3-11 Bus Service Summary

Bus Route	Day	First Service	Last Service	Number of Services
411/Sydney Street Loop	Weekday	9.10	1.51	4
	Saturday	9.10	12.09	3
413/Highbrook Loop	Weekday	10.23	2.54	5
	Saturday	10.23	12.35	3

The location of the subject site relative to the train and bus stations is shown in **Figure 3-23**.

Figure 3-23 Public Transport

On the above basis, the proposed development site is conveniently located to take advantage of the connectivity of existing public transport services and encourage the greater use of sustainable modes of transport, therefore reducing reliance on private vehicles.

3.8 Walking & Cycling

A desktop review using nearmap showed that the site is surrounded by footpaths. A figure showing the surrounding footpath is given below in **Figure 3-24**.

Figure 3-24 Pedestrian Footpath

The TFNSW Cycle Way finder was accessed and reviewed and the cycleway network surrounding the subject site is shown in **Figure 3-25.**

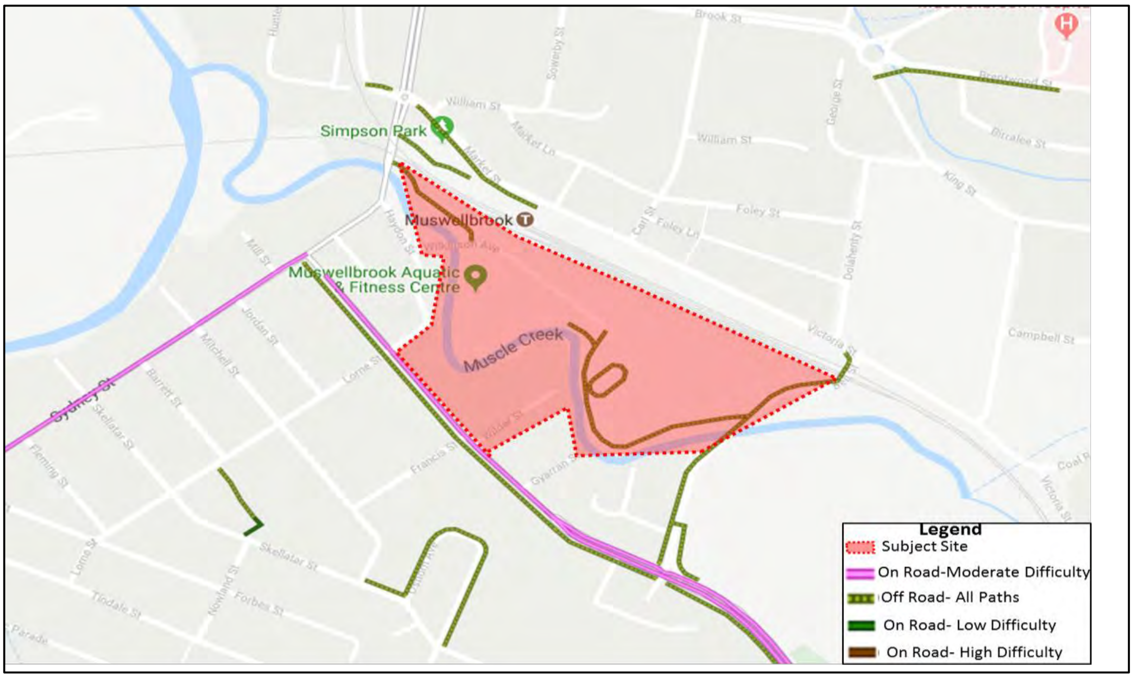


Figure 3-25 Existing Cycleway Network

Source: TFNSW Cycleway Finder (viewed July 2020)

It is evident that visitors and staff can make use of the available cycle network as part of their journey to the site.

4 Proposed Masterplan

4.1 Overview

The Masterplan is presented in two stages. Within each stage are a series of projects. Breaking the Masterplan into smaller projects will assist with the delivery of the Masterplan. The details of the Masterplan are as follows:

4.1.1 Stage 1

The first stage undertakes the primary structural changes to Olympic Park. Stage 1 of the Masterplan is illustrated in **Figure 4-1**

Figure 4-1 Stage 1 Masterplan

4.1.2 Stage 2

The second stage completes the revitalisation of Olympic Park including. Stage 2 of the Masterplan is illustrated in **Figure 4-2.**

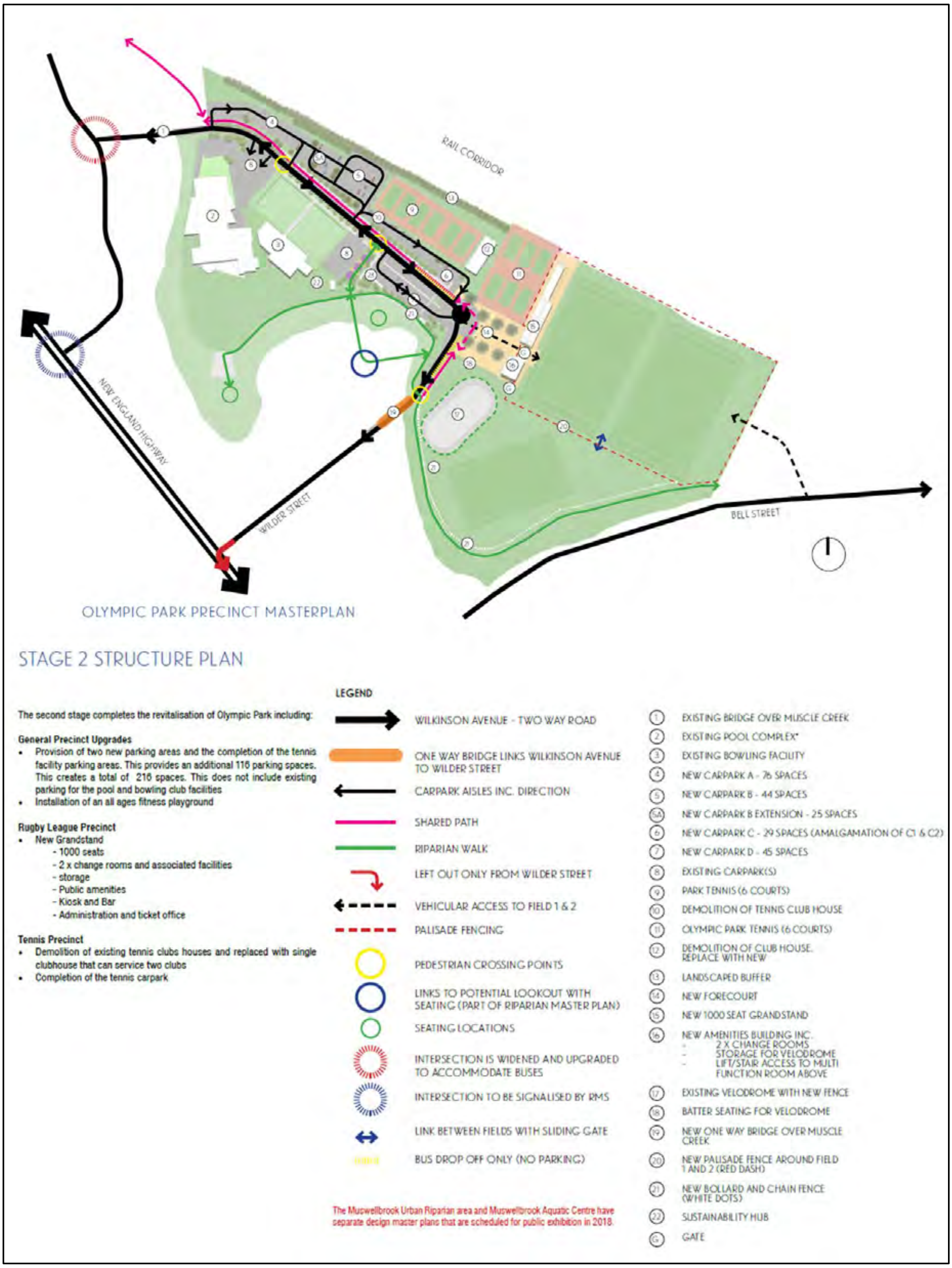


Figure 4-2 Stage 2 of Masterplan

This traffic assessment detailed in **Section 5** assesses the New England Highway/ Wilder Street intersection configuration as all movements to be permitted in the first instance unless the intersection performance is unsatisfactory suggesting that mitigation is necessary.

5 Traffic Assessment

The assumptions for the traffic assessment are detailed in this section. It should be noted that Cardno consulted with TfNSW before the start of the traffic assessment to gain TfNSW concurrence on the assumptions which are detailed below.

5.1 Traffic Generation

As the masterplan development as described in **Section 4** does not show any additional sports field or land-use changes rather only aesthetic changes, it is assumed that there will be no additional traffic generation due to the proposal.

Traffic generation during special or atypical events is not proposed to be assessed as it is assumed that site-specific traffic management will be in place to manage the impact of this.

5.2 Trip Distribution

5.2.1 Existing Traffic Distribution

Considering the shortest path assignment, it is obvious that the trips entering the site through Bridge Street/ Haydon Street will continue to do so even when new access through Wilder Street will be available. It is only the trips that currently utilise the New England Highway/ Lorne Street access will have a redistribution of traffic due to the new access bridge at Wilder Street. To determine the direction of trips that come in/out of the Olympic Park from the New England Highway/Lorne Street the Origin-Destination Data was reviewed and the results summarised in **Figure 5-1** and **Figure 5-2**.

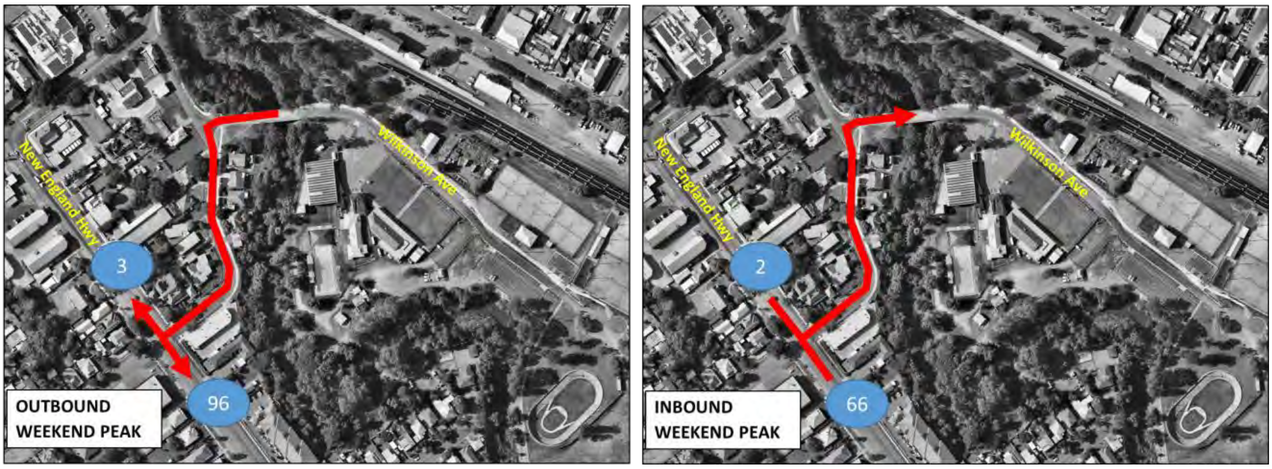


Figure 5-1 Weekend In/Out Trips Existing

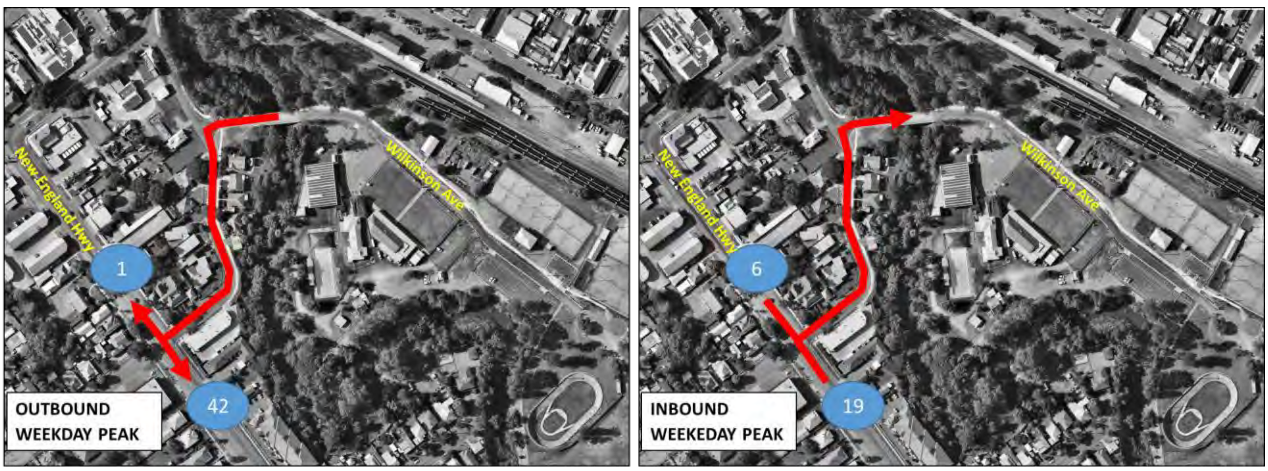


Figure 5-2 Weekday In/Out Trips Existing

The origin-destination data as seen in the figures above demonstrate that majority of vehicles that utilise the New England Highway/Lorne Street intersection to access the sports precinct do so from the south on New England Highway for ingress and egress

5.2.2 Bridge Options

The various bridge options assessed are summarised below.

> **Single Lane Bridge** which will would predominantly be used as a cycle and footway linking the precinct to the south. However, the bridge would be opened to traffic during events to allow for improved egress from the site.

> **Single Lane Bridge** with additional pedestrian and cycle paths. Stop sign/give way sign will be utilised at either end of the bridge to manage flows.

> **Two-Lane Bridge** with standard two-lane direction and additional pedestrian cycle path

For the bridge under special events, it is expected that internal and external traffic management and potential temporary traffic control measures will be in place.

The traffic distribution assumption due to a single lane and two lane bridge is provided below.

5.2.3 Intersection Configuration Options

The following intersection configuration for New England Highway/Wilder Street has been assessed.

> **All movement unrestricted**: This scenario assumes there are no restrictions of movements to/from New England Highway at Wilder Street; and

> **Left in/Left out (LILO)**: This scenario restricts the right turns in/out of Widler Street at New England Highway.

5.2.4 Traffic Distribution

The construction of a new bridge over Muscle Creek will result in the following traffic distribution based on the intersection configuration at New England Highway/ Wilder Street.

5.2.4.1 All movement unrestricted

Single Lane, Two-Way Bridge - All movement unrestricted

A single-lane bridge with a “Stop” or “Giveaway” sign installed at either end of the bridge to manage flows. As a worst-case scenario, it will be assumed that all (100%) of traffic that travels to/from the south on New England Highway will utilise the new bridge crossing. The resulting trip assignment is shown in **Figure 5-3** and **Figure 5-4**.

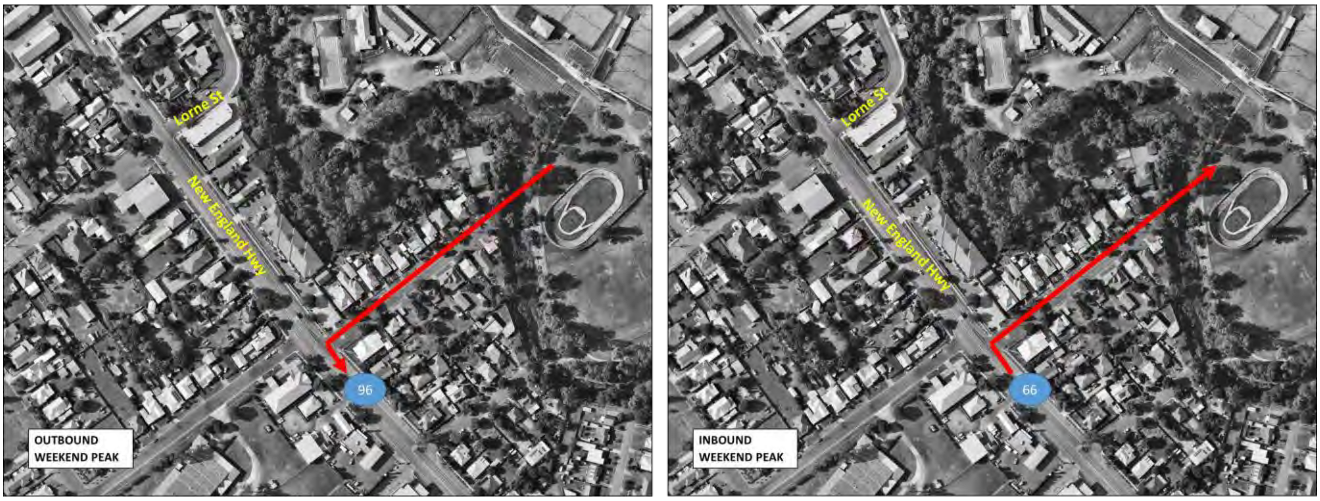


Figure 5-3 Weekend In/Out Trips Single Lane, Two-Way Bridge- Unrestricted Movements

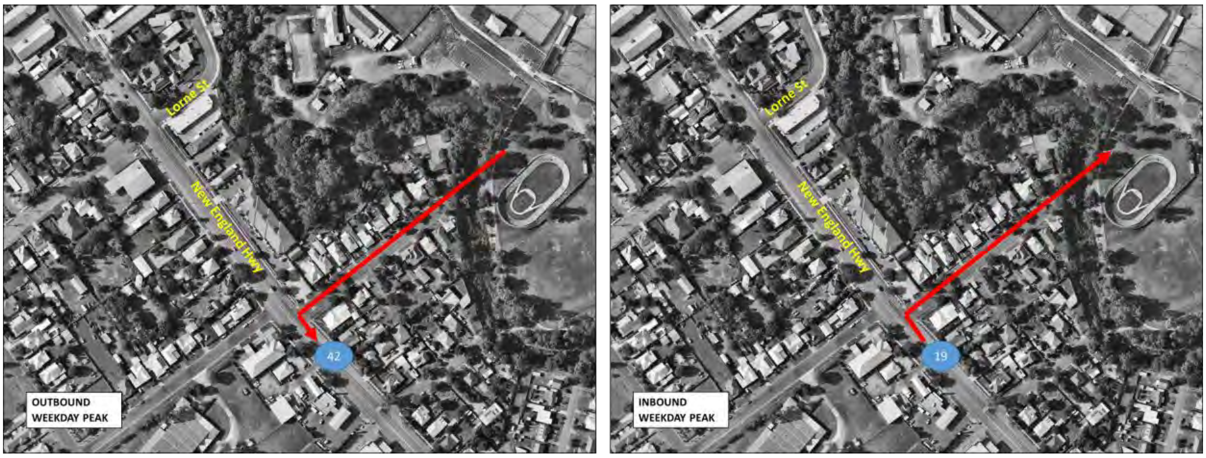


Figure 5-4 Weekday In/Out Trips Single Lane, Two-Way Bridge- Unrestricted Movements

Two-Lane, Two-Way Bridge- All movement Unrestricted

Standard two-lane two-way bridge. As a worst-case scenario, it will be assumed that all (100%) of traffic that travels to/from the south on New England Highway will utilise the new bridge crossing. The resulting trip assignment is shown in **Figure 5-3** to **Figure 5-4**.

5.2.4.2 Left in Left Out

This scenario restricts the right turns in/out of Widler Street at New England Highway. In this scenario, it is assumed the vehicles turning right into the precinct would use the Lorne Street intersection (no change from existing behaviour) however vehicles turning left out would use the Wilder Street access to go south.

Single Lane, Two-Way Bridge- LILO

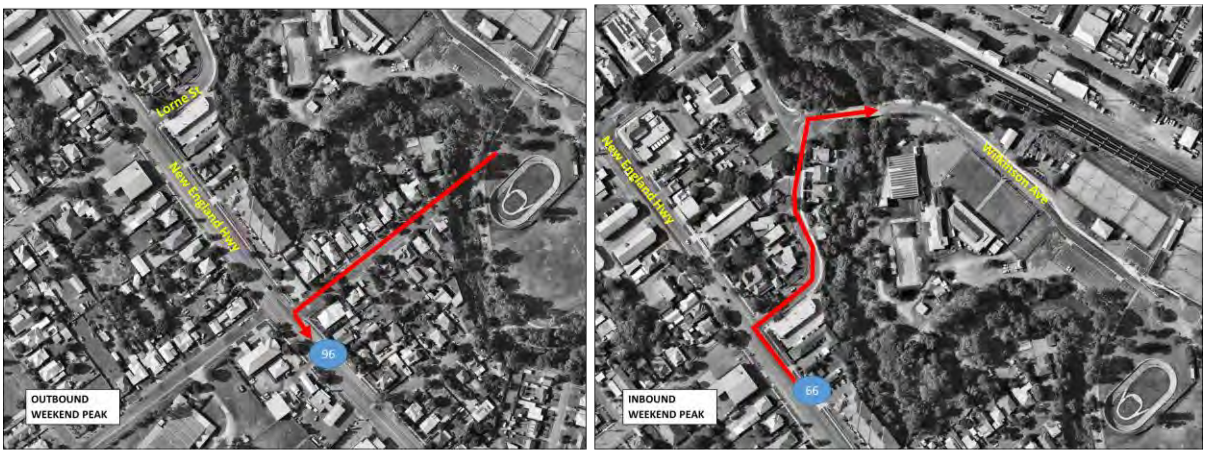


Figure 5-5 Weekend In/Out Trips Single Lane, Two-Way Bridge- LILO

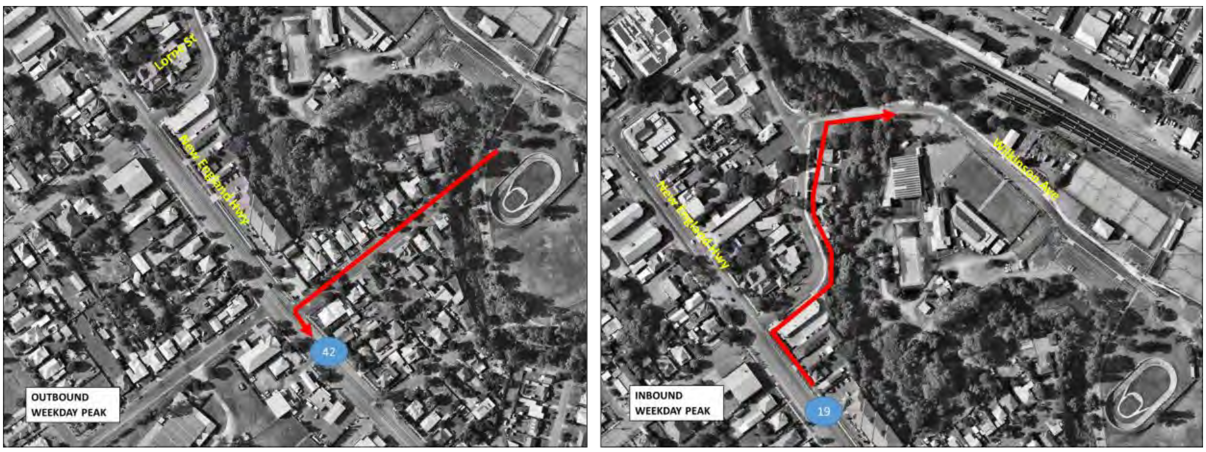


Figure 5-6 Weekday In/Out Trips Single Lane, Two-Way Bridge- LILO

Two-Lane, Two-Way Bridge- LILO

A two-lane two-way bridge for left in left out configuration at Wilder Street also assumes the same trip distribution as shown in **Figure 5-5** to **Figure 5-6**.

5.3 Assessment Years

Cardno believes that the proposed Wilder Street Bridge opening year will be the determining factor for the assessment year. This is on the basis that the bridge itself is the only responsible factor for the changed traffic conditions as there will be no traffic generation due to the proposal.

Hence, the assessment years are assumed to be the year of opening for the Wilder Street Bridge and a 10-year horizon. The proposed Wilder Bridge is forecast to be opened for the public by 2021. Hence, the assessment years is assumed to be the following:

> Year of Opening: the year of opening is assumed to be 2021; and

> Design Horizon: the 10-year design horizon is assumed to be 2031.

5.4 Traffic Growth Rate

As explained in **Section 3.3** on review of historic traffic volumes obtained from the TfNSW count sites, volumes have increased by a maximum of 1.5% p.a in the most recent 2 year period. Hence a growth rate of 1.5% p.a is adopted for this assessment and is considered to be an appropriate growth rate.

It should be noted that the background traffic growth is unlikely to occur to/from the Olympic Park sports precinct. However, this assessment has adopted a consistent approach and considered it as a worst-case outcome.

5.5 Single Lane Bridge Modelling

Generally, the default SIDRA parameters will be adopted for all the intersections. However, to model, single-lane bridge with priority controlled sign at either end of the bridge the following alterations to the modelling parameter are proposed which was developed after consultation with SIDRA Solutions.

> A giveway model with single-lane approach and departure was utilised;

> Both approaches were adjusted to giveway to each other in the Priorities tab;

> Critical gap acceptance for both approaches was made equivalent to the time for a vehicle to travel along the bridge and pass the opposite end. In this case, a 50m long bridge is assumed with a travel speed of 10km/h which equates to a critical gap of 18 seconds; and

> Headway was adjusted to reflect the queue discharge and will be maintained at the common default 3.5 seconds.

The two-lane bridge is assumed to be relatively free-flow and will not require a specific SIDRA model to be prepared for the bridge.

5.6 Intersection Performance Summary

5.6.1 Sydney Street /Bridge Street/Haydon Street

5.6.1.1 Intersection Layout

The intersection layouts for the Sydney Street /Bridge Street/Haydon Street as per the existing condition is shown in **Figure 3-18**.

5.6.1.2 Intersection Performance

The SIDRA assessment of the Sydney Street /Bridge Street/Haydon Street Intersection for the various scenarios are summarised in **Table 5-1**

Table 5-1 Sydney St /Bridge St/Haydon St Intersection performance

Approach	PM Peak	SAT Peak

	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2019 Base								
Haydon Street (S)	0.42	41.60	C	9.20	0.46	36.90	C	10.80
Bridge Street (NE)	0.42	4.50	A	21.70	0.48	4.50	A	26.60
Sydney Street (W)	0.52	4.90	A	0.60	0.45	4.90	A	1.30
Total	**0.52**	**41.60**	C	**21.70**	**0.48**	**36.90**	C	**26.60**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2021 Future Base (no development)								
Haydon Street (S)	0.49	49.10	D	10.70	0.54	43.50	D	12.80
Bridge Street (NE)	0.44	4.50	A	22.80	0.50	4.50	A	28.10
Sydney Street (W)	0.53	4.90	A	0.60	0.46	4.90	A	1.40
Total	**0.53**	**49.10**	D	**22.80**	**0.54**	**43.50**	D	**28.10**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2021 with Bridge - All Movements								
Haydon Street (S)	0.49	49.10	D	10.70	0.54	43.50	D	12.80
Bridge Street (NE)	0.44	4.50	A	22.80	0.50	4.50	A	28.10
Sydney Street (W)	0.53	4.90	A	0.60	0.46	4.90	A	1.40
Total	**0.53**	**49.10**	D	**22.80**	**0.54**	**43.50**	D	**28.10**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2021 with Bridge - LILO								
Haydon Street (S)	0.49	49.10	D	10.70	0.54	43.50	D	12.80
Bridge Street (NE)	0.44	4.10	A	22.80	0.50	4.50	A	28.10
Sydney Street (W)	0.53	4.90	A	0.60	0.46	4.90	A	1.40
Total	**0.53**	**49.10**	D	**22.80**	**0.54**	**43.50**	D	**28.10**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2031 Future Base (no development)								
Haydon Street (S)	1.14	291.10	F	69.60	1.10	228.80	F	73.80
Bridge Street (NE)	0.50	4.50	A	28.70	0.57	4.60	A	36.30
Sydney Street (W)	0.61	5.10	A	0.80	0.53	4.50	A	1.80
Total	**1.14**	**291.10**	F	**69.60**	**1.10**	**228.80**	F	**73.80**
Approach	**PM Peak**				**SAT Peak**			

	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2031 with Bridge - All Movements								
Haydon Street (S)	1.14	291.10	F	69.60	1.10	228.80	F	73.80
Bridge Street (NE)	0.50	4.50	A	28.70	0.57	4.60	A	36.30
Sydney Street (W)	0.61	5.10	A	0.80	0.53	5.00	A	1.80
Total	**1.14**	**291.10**	**F**	**69.60**	**1.10**	**228.80**	**F**	**73.80**
Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2031 with Bridge - LILO								
Haydon Street (S)	1.14	291.10	F	69.60	1.10	228.80	F	73.80
Bridge Street (NE)	0.50	4.50	A	28.70	0.57	4.60	A	36.30
Sydney Street (W)	0.61	5.10	A	0.80	0.53	5.00	A	1.80
Total	**1.14**	**291.10**	**F**	**69.60**	**1.10**	**228.80**	**F**	**73.80**

This result shows that Sydney Street /Bridge Street/Haydon Street intersection LoS is relatively unchanged by the proposed Wilder Street Bridge.

As explained in **Section 5.2** the construction of a new bridge over Muscle Creek will not result in the traffic redistribution at Sydney Street /Bridge Street/Haydon Street hence there is no difference in the intersection performance between the base case and Wilder Street bridge scenario for this intersection.

5.6.2 Haydon Street /Wilkinson Avenue

5.6.2.1 Intersection Layout

The intersection layouts for Haydon Street /Wilkinson Avenue as per the existing condition is shown in **Figure 3-19**.

5.6.2.2 Intersection Performance

The SIDRA assessment of the Haydon Street /Wilkinson Avenue Intersection for the various scenarios are summarised in **Table 5-2**

Table 5-2 Haydon St /Wilkinson Avenue Intersection Performance

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2019 Base								
Haydon Street (S)	0.02	4.70	A	0.80	0.05	4.90	A	1.70
Wilkinson Avenue E	0.07	4.80	A	1.90	0.17	5.20	A	4.70
Haydon Street (N)	0.04	4.60	A	0.00	0.07	4.60	A	0.00
Total	**0.07**	**4.80**	**A**	**1.90**	**0.17**	**5.20**	**A**	**4.70**
Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2021 Future Base (no development)								
Haydon Street (S)	0.03	4.70	A	0.80	0.05	5.00	A	1.70

Wilkinson Avenue E	0.07	4.80	A	1.90	0.17	5.20	A	4.90
Haydon Street (N)	0.04	4.60	A	0.00	0.07	4.60	A	0.00
Total	**0.07**	**4.80**	**A**	**1.90**	**0.17**	**5.20**	**A**	**4.90**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2021 with Bridge - All Movements								
Haydon Street (S)	0.01	4.70	A	0.30	0.01	4.90	A	0.30
Wilkinson Avenue E	0.05	4.80	A	1.10	0.10	4.90	A	2.50
Haydon Street (N)	0.04	4.60	A	0.00	0.07	4.60	A	0.00
Total	**0.05**	**4.80**	**A**	**1.10**	**0.10**	**4.90**	**A**	**2.50**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2021 with Bridge - LILO								
Haydon Street (S)	0.06	5.40	A	2.70	0.06	5.00	A	1.90
Wilkinson Avenue E	0.05	5.00	A	1.20	0.12	5.20	A	2.90
Haydon Street (N)	0.04	4.60	A	0.00	0.07	4.60	A	0.00
Total	**0.06**	**5.00**	**A**	**2.70**	**0.12**	**5.20**	**A**	**2.90**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2031 Future Base (no development)								
Haydon Street (S)	0.03	4.80	A	0.90	0.06	5.00	A	2.10
Wilkinson Avenue E	0.09	4.90	A	2.30	0.20	5.40	A	5.80
Haydon Street (N)	0.04	4.60	A	0.00	0.08	4.60	A	0.00
Total	**0.09**	**4.60**	**A**	**2.30**	**0.20**	**5.40**	**A**	**5.80**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2031 with Bridge - All Movements								
Haydon Street (S)	0.02	4.80	A	0.40	0.01	5.00	A	0.40
Wilkinson Avenue E	0.05	5.20	A	1.20	0.12	5.00	A	2.90
Haydon Street (N)	0.04	4.60	A	0.00	0.08	4.60	A	0.00
Total	**0.05**	**5.20**	**A**	**1.20**	**0.12**	**5.00**	**A**	**2.90**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2031 with Bridge - LILO								
Haydon Street (S)	0.07	5.40	A	3..2	0.07	5.00	A	2.30
Wilkinson Avenue E	0.06	5.10	A	1.40	0.14	5.40	A	3.40

Haydon Street (N)	0.04	4.60	A	0.00	0.08	4.60	A	0.00
Total	**0.07**	**5.40**	**A**	**3.20**	**0.14**	**5.40**	**A**	**3.40**

This result shows that Haydon Street /Wilkinson Avenue intersection LoS is relatively unchanged by the proposed Wilder Street Bridge. As explained in **Section 5.4** It should be noted that the background traffic growth is unlikely to occur to/from the sports precinct. However, this assessment has adopted a consistent approach and considered a worst-case outcome.

5.6.3 New England Highway/ Lorne Street

5.6.3.1 Intersection Layout

The intersection layouts for New England Highway/Lorne Street as per the existing condition is shown in **Figure 3-20**. TfNSW proposes Traffic Signals at the intersection of the New England Highway and Lorne St with the works construction work starting in May 2020.

The layout of the proposed signalised intersection assumed for the assessment year 2021 and 2031 is shown in **Figure 5-7**.

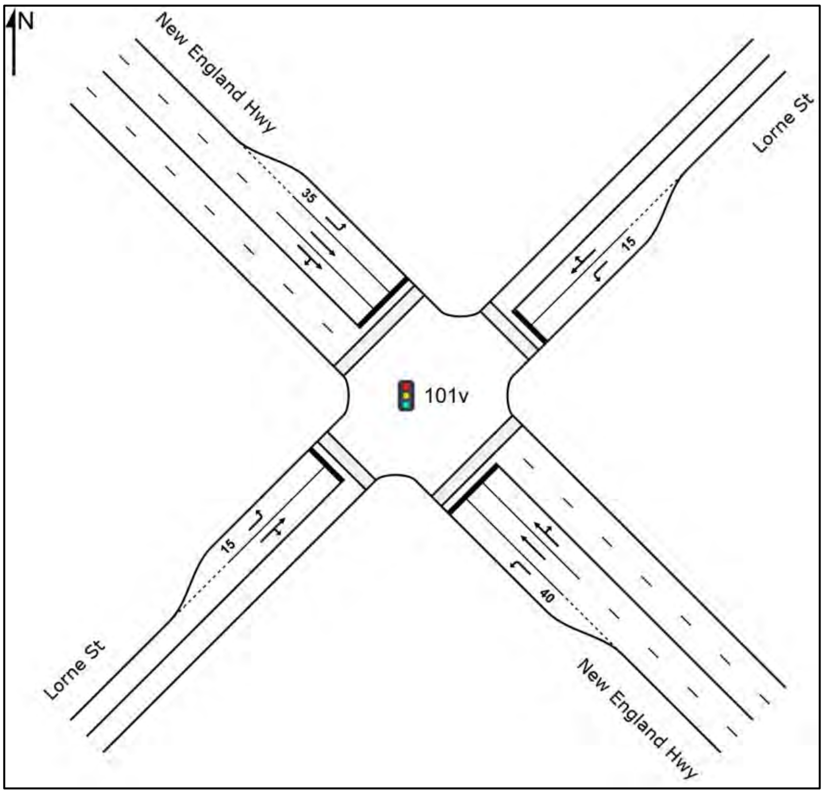


Figure 5-7 New England Highway/ Lorne Street Signalised Intersection

The assumed phasing arrangement shown in **Figure 5-8** has been adopted from the TCS plan provided in the *New England Highway and Lorne St, Review of Environmental Factors (TfNSW, 2020).* 120 seconds of cycle time was adopted for the signalised intersection model.

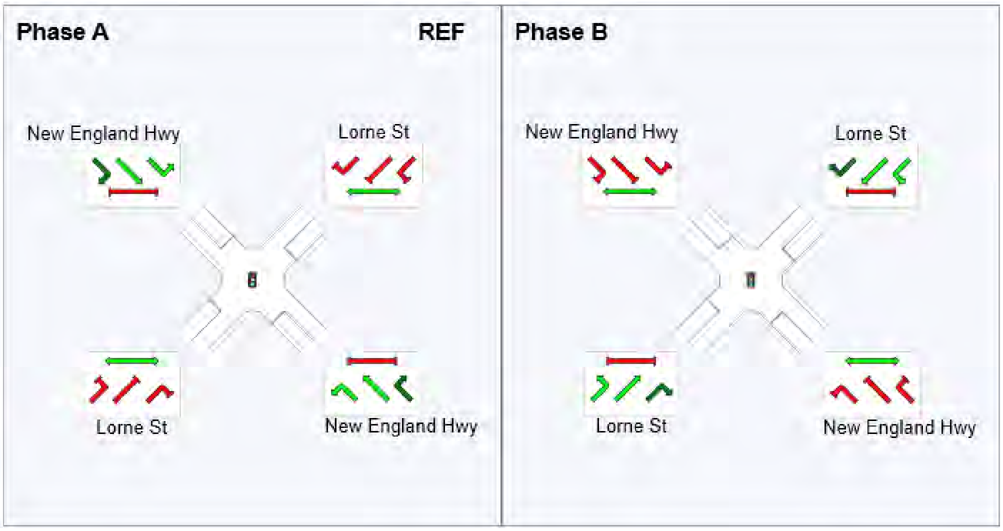


Figure 5-8 New England Highway/ Lorne Street Phasing Arrangement

5.6.3.2 Intersection Performance

The SIDRA assessment of the Haydon Street /Wilkinson Avenue Intersection for the various scenarios are summarised in **Table 5-3**

Table 5-3 New England Highway/ Lorne St Intersection Performance

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2019 Base								
New England Highway (SE)	0.19	7.70	A	3.20	0.22	8.40	A	7.50
Lorne Street (NE)	0.09	34.50	C	2.10	0.21	49.50	D	5.10
New England Highway (NW)	0.17	8.60	A	5.40	0.17	9.60	A	3.10
Lorne Street (SW)	0.21	37.40	C	4.90	0.29	58.20	E	7.10
Total	**0.21**	**37.40**	C	**5.40**	**0.29**	**58.20**	E	**7.50**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2021 Future Base (no development)								
New England Highway (SE)	0.24	5.80	A	44.30	0.34	10.80	A	75.80
Lorne Street (NE)	0.24	55.10	D	22.00	0.33	47.20	D	45.00
New England Highway (NW)	0.24	5.90	A	43.30	0.27	9.60	A	57.30
Lorne Street (SW)	0.15	55.70	D	13.90	0.12	45.90	D	16.30
Total	**0.24**	**10.20**	A	**44.30**	**0.34**	**14.90**	B	**75.80**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2021 with Bridge - All Movements								
New England Highway (SE)	0.21	4.30	A	35.10	0.22	4.70	A	38.70
Lorne Street (NE)	0.07	56.50	E	4.70	0.12	56.60	E	9.40
New England Highway (NW)	0.22	4.50	A	37.50	0.23	4.70	A	39.90
Lorne Street (SW)	0.20	58.10	E	14.70	0.23	56.50	D	18.80
Total	**0.22**	**7.40**	A	**37.50**	**0.23**	**8.30**	A	**39.90**

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2021 with Bridge - LILO								
New England Highway (SE)	0.28	5.10	A	50.00	0.29	5.10	A	50.80
Lorne Street (NE)	0.07	58.40	E	4.70	0.15	59.70	E	9.70
New England Highway (NW)	0.23	4.60	A	37.90	0.23	4.20	A	37.30
Lorne Street (SW)	0.20	58.10	E	14.70	0.27	58.90	E	19.30
Total	**0.28**	**8.00**	A	**50.00**	**0.29**	**8.80**	A	**50.80**

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2031 Future Base (no development)								
New England Highway (SE)	0.28	6.00	A	7.20	0.40	11.20	A	92.10
Lorne Street (NE)	0.27	55.30	D	24.90	0.39	48.70	D	52.40
New England Highway (NW)	0.28	6.20	A	53.00	0.31	9.60	A	66.80
Lorne Street (SW)	0.17	55.90	D	15.90	0.15	47.30	D	19.00
Total	**0.28**	**10.40**	A	**53.20**	**0.40**	**15.30**	B	**92.10**

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2031 with Bridge - All Movements								
New England Highway (SE)	0.25	4.40	A	41.70	0.26	4.80	A	46.10
Lorne Street (NE)	0.07	56.30	D	5.10	0.13	57.00	E	10.70
New England Highway (NW)	0.26	4.70	A	45.80	0.26	5.00	A	47.60
Lorne Street (SW)	0.23	58.80	E	16.80	0.26	56.70	E	21.70
Total	**0.26**	**7.60**	A	**45.80**	**0.26**	**8.60**	A	**47.60**

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2031 with Bridge - LILO								
New England Highway (SE)	0.34	5.60	A	63.00	0.34	5.40	A	63.60

Lorne Street (NE)	0.08	58.50	E	5.10	0.16	59.80	E	10.90
New England Highway (NW)	0.27	5.00	A	46.60	0.26	4.40	A	44.60
Lorne Street (SW)	0.23	58.30	E	16.80	0.30	59.10	E	22.30
Total	**0.34**	**8.40**	A	**63.00**	**0.34**	**9.00**	A	**63.60**

This result shows that Haydon Street /Wilkinson Ave intersection delays are improved by the proposed Wilder Street Bridge because of the trips entering/exiting the intersection from the south on New England Highway are now reassigned to the Wilder Street intersection.

5.6.4 New England Highway/Wilder Street/Francis Street

5.6.4.1 Intersection Layout

The intersection layouts for New England Highway/Wilder Street/Francis Street as per the existing condition is shown in **Figure 3-21**.

5.6.4.2 Intersection Performance

The SIDRA assessment of the New England Highway/Wilder Street/Francis Street for the various scenarios are summarised in **Table 5-4**

Table 5-4 New England Highway/Wilder Street/Francis Street Intersection Performance

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2019 Base								
New England Highway (SE)	0.22	14.30	A	11.30	0.19	9.00	A	1.10
Wilder Street (NE)	0.07	38.90	C	1.40	0.14	44.80	D	3.00
New England Highway (NW)	0.16	9.80	A	2.60	0.18	10.30	A	2.20
Francis Street (SW)	0.17	45.60	D	3.90	0.14	45.70	D	3.10
Total	**0.22**	**45.60**	D	**11.30**	**0.19**	**45.70**	D	**3.00**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2021 Future Base (no development)								
New England Highway (SE)	0.23	14.80	B	12.40	0.19	9.30	A	1.20
Wilder Street (NE)	0.07	42.20	C	0.72	0.16	48.60	D	3.30
New England Highway (NW)	0.17	10.10	A	2.80	0.19	10.50	A	2.30
Francis Street (SW)	0.19	49.60	D	4.30	0.15	49.50	D	3.40
Total	**0.23**	**49.60**	D	**12.40**	**0.19**	**49.50**	D	**3.40**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2021 with Bridge - All Movements								
New England Highway (SE)	0.23	11.20	A	11.30	0.22	8.20	A	7.70
Wilder Street (NE)	0.10	41.20	C	2.40	0.23	45.60	D	5.50

New England Highway (NW)	0.16	9.80	A	2.70	0.16	9.70	A	2.00
Francis Street (SW)	0.19	49.60	D	4.30	0.15	51.70	D	3.30
Total	**0.23**	**49.60**	**D**	**11.30**	**0.23**	**51.70**	**D**	**7.70**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2021 with Bridge - LILO								
New England Highway (SE)	0.19	4.60	A	0.00	0.19	5.10	A	0.00
Wilder Street (NE)	0.05	5.70	A	1.30	0.11	6.00	A	2.90
New England Highway (NW)	0.16	10.40	A	3.00	0.16	10.40	A	2.30
Francis Street (SW)	0.18	48.10	D	3.90	0.15	50.50	D	3.20
Total	**0.19**	**48.10**	**D**	**3.90**	**0.19**	**50.50**	**D**	**3.20**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2031 Future Base (no development)								
New England Highway (SE)	0.27	18.00	B	18.60	0.22	10.70	A	1.70
Wilder Street (NE)	0.13	65.50	E	2.60	0.29	84.50	F	6.20
New England Highway (NW)	0.20	11.50	A	3.80	0.22	12.10	A	3.50
Francis Street (SW)	0.33	81.20	F	8.00	0.27	78.50	F	6.20
Total	**0.33**	**81.20**	**F**	**18.60**	**0.29**	**84.50**	**F**	**6.20**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2031 with Bridge - All Movements								
New England Highway (SE)	0.28	13.10	A	16.30	0.26	9.00	A	10.60
Wilder Street (NE)	0.16	62.90	E	3.50	0.35	72.10	F	10.30
New England Highway (NW)	0.18	11.10	A	3.60	0.19	11.00	A	2.90
Francis Street (SW)	0.34	81.60	F	8.20	0.28	85.10	F	6.40
Total	**0.34**	**81.60**	**F**	**16.30**	**0.35**	**85.10**	**F**	**10.60**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2031 with Bridge - LILO								
New England Highway (SE)	0.22	4.60	A	0.00	0.22	5.10	A	0.00
Wilder Street (NE)	0.06	6.00	A	1.50	0.13	6.30	A	3.50
New England Highway (NW)	0.18	11.90	A	4.10	0.19	11.90	A	3.30
Francis Street (SW)	0.31	75.10	F	7.50	0.27	80.40	F	6.00

Total	**0.31**	**75.10**	**F**	**7.50**	**0.27**	**80.40**	**F**	**6.00**

The following is observed for the intersection of New England Highway/Wilder Street/Francis Street:

> The intersection performance for the year 2021 is LoS D in both the PM and SAT peak hours. The overall LoS is relatively unchanged by the proposed Wilder Street Bridge.
  - Under the LILO scenario for the year 2021, the performance of the Wilder Street approach improves to LoS A in both the PM and SAT peak. This is due to the restriction of right turns in/out of Wilder Street.

> The intersection performance for the year 2031 is LoS F in both the PM and SAT peak hour. The overall LoS is relatively unchanged by the proposed Wilder Street Bridge in 2031.
  - Under the LILO scenario for the year 2031 the performance of the Wilder Street approach improves to LoS A in both PM and SAT peak. This is due to the restriction of right turns in/out of Wilder Street.

> The intersection result suggests that the worse approach for all the scenarios is Francis Street. The total volume at Francis Street approach is 43 veh/h and 42 veh/ h for 2021 PM and SAT peak respectively. For the year 2031, the total volumes of vehicles at the Francis Street approach in the PM and SAT peak are in the order of 49 veh/h and 48 veh/h respectively.
  - The volume at Francis Street approach is relatively low and not reflective of the overall intersection. The operational performance of all other approaches Under LILO scenario is LoS A.

> The intersection of Wilder Street/New England Highway is in a location that results in a staggered-T junction with Francis Street/New England Highway. The staggered junctions could attract safety concerns when the traffic intensifies at the Wilder Street approach, hence banning the right in/out of Wilder Street reduces the safety issue due to the back to back right turn at the staggered junction.

5.6.5 Wilder Street Single Lane Bridge

5.6.5.1 Model Layout

The modelled layout for Wilder Street single-lane bridge is shown in **Figure 5-9**.

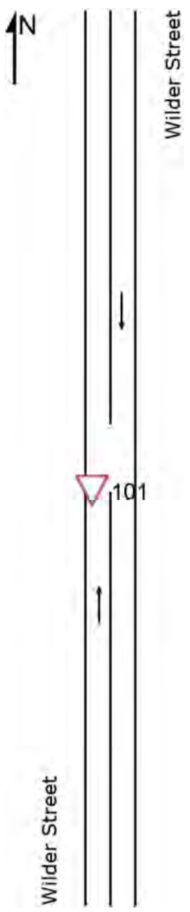


Figure 5-9 Wilder Street Single Lane Bridge

5.6.5.2 Intersection Performance

The SIDRA assessment of Wilder Street single lane bridge for various scenarios is summarised in **Table 5-5.**

Table 5-5 Wilder Street Single Lane Bridge

Approach	PM Peak				SAT Peak			
	DoS	Avg Delay	LoS	Max Queue (m)	DoS	Avg Delay	LoS	Max Queue (m)
2021 with Bridge - All Movements								
Wilder Street (S)	0.03	2.60	A	2.30	0.11	7.50	A	9.80
Wilder Street (N)	0.05	1.20	A	4.70	0.14	5.00	A	13.30
Total	**0.05**	**2.60**	**A**	**4.70**	**0.14**	**7.50**	**A**	**13.30**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2021 with Bridge - LILO								
Wilder Street (S)	0.01	2.50	A	0.60	0.02	6.70	A	1.50
Wilder Street (N)	0.05	0.30	A	4.50	0.11	0.70	A	11.20
Total	**0.05**	**2.50**	**A**	**4.50**	**0.11**	**6.70**	**A**	**11.20**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2031 with Bridge - All Movements								
Wilder Street (S)	0.03	3.10	A	2.60	0.14	8.90	A	11.90
Wilder Street (N)	0.06	1.30	A	5.60	0.17	6.00	A	15.90
Total	**0.06**	**3.10**	**A**	**5.60**	**0.17**	**8.90**	**A**	**15.90**
Approach	**PM Peak**				**SAT Peak**			
	DoS	**Avg Delay**	**LoS**	**Max Queue (m)**	**DoS**	**Avg Delay**	**LoS**	**Max Queue (m)**
2031 with Bridge - LILO								
Wilder Street (S)	0.01	3.00	A	0.70	0.02	8.00	A	1.90
Wilder Street (N)	0.05	0.40	A	5.30	0.12	0.90	A	13.00
Total	**0.05**	**3.00**	**A**	**5.30**	**0.12**	**8.00**	**A**	**13.00**

The above SIDRA results indicate that a single lane bridge will operate satisfactorily at LoS A which represents good performance. The maximum queue for the Wilder Street Bridge southern approach is observed to be 11 m which doesn't reach the New England Highway as it is approximately 170 m upstream of the bridge.

Reference was made to *TfNSW Guide to Traffic Generating Development Version 2.2* regarding the acceptable traffic environment to residents. The environmental capacity performance standards on residential streets based on the guideline are shown in **Table 5-6.**

Table 5-6 Performance Standards on Residential Streets

Road	Road Type	Maximum peak hour volume veh/hr
Local	Street	200 environment goal
		300 maximum

The peak hour traffic volumes at Wilder Street for the year 2021 and 2031 after the construction of Wider Street Bridge are provided in **Table 5-7**.

Table 5-7 Wilder Street Traffic Volumes

Scenario	Year	Peak	Wilder Street Peak Hour Traffic Volumes veh/h (Both Direction)
All Movement Permitted	2021	PM	126
		SAT	196
	2031	PM	144
		SAT	224
LILO	2021	PM	64
		SAT	108
	2031	PM	73
		SAT	124

As expected, the traffic volumes at Wilder Street will be highest when all movements are permitted at Wilder Street/ New England Highway intersection with the highest traffic volumes in the order of 224 veh/h in the 2031 SAT peak. The highest traffic volume is still below the 300 veh/h maximum threshold recommended by TfNSW guide for residential amenity.

6 Access Strategy

6.1 General Traffic and Vehicle Access

The entry to Olympic Park via the intersection of Haydon Street and Wilkinson Avenue will be retained as it is.

The Masterplan proposes a new access point to the precinct via Wilder Street. It is envisaged that Wilder Street will be predominantly used by vehicles to/from the south of Muswellbrook.

The option to restrict the right turns in/out of Wilder Street at New England Highway will result in the vehicles taking right turn in/out of the Wilder Street at the New England Highway being displaced and seeking access to the precinct through the local road network. The volumes of the vehicles taking the right turn in/out of the Wilder Street are in the order of 56 veh/h and 5 veh/h at 2021 PM and SAT peak respectively.

The detour for the residential dwellings due to the restriction of a right turn in/out of Wider Street can be provided via local roads as shown in **Figure 6-1**. The right turn in detour could be provided via Francis Street-Mitchell Street- Lorne Street as shown by route marked in red. The right turn out detour for residential dwellings to travel north and south can be provided by Bell Street and Thompson Street as shown by route marked in yellow.

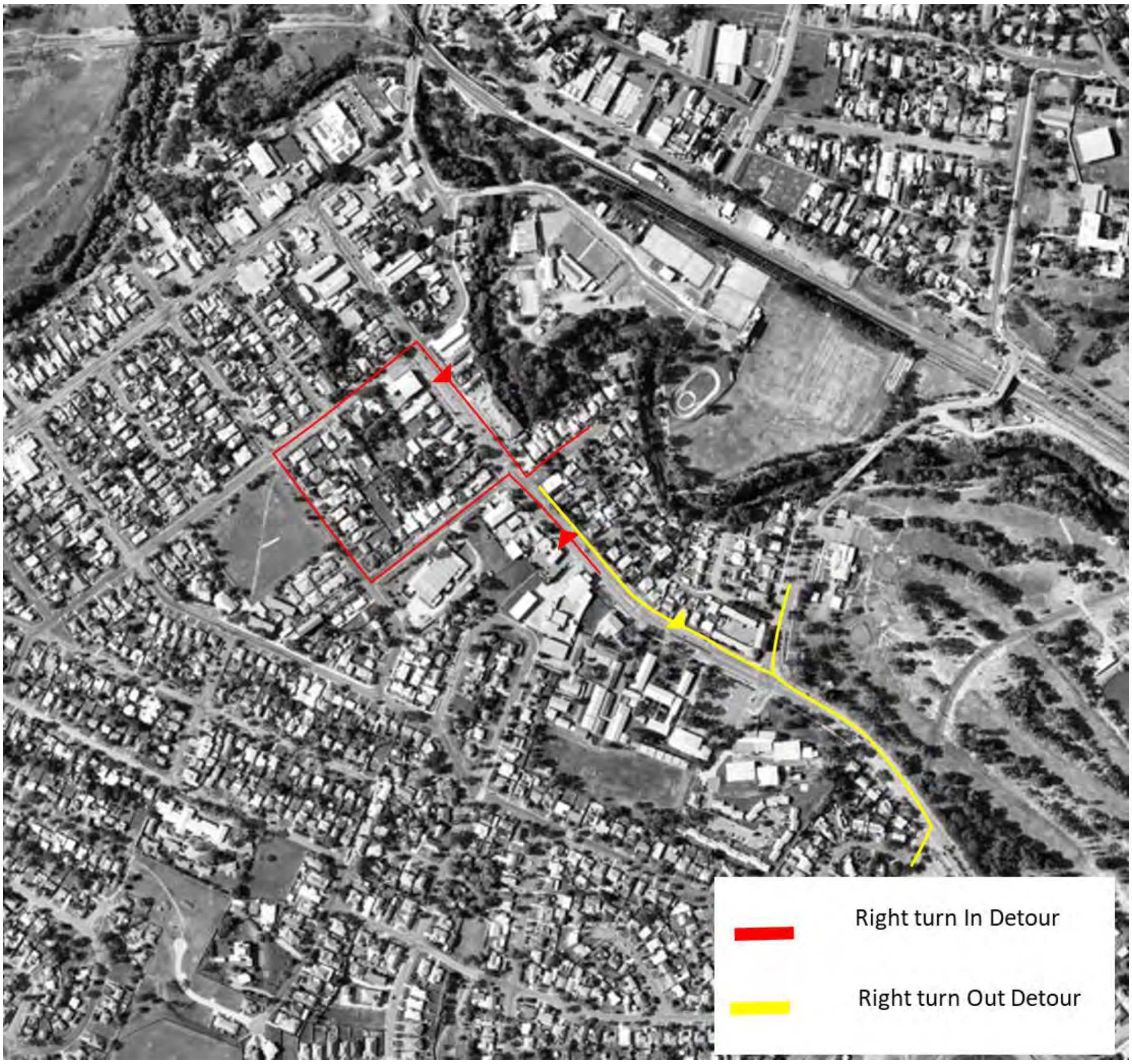


Figure 6-1 Movement Routes

Modelling results show that the even due to the detour of the residents the single-lane bridge will continue to operate satisfactorily at LoS A. Also, it should be noted that the introduction of signalised intersections at

New England Highway/ Lorne Street will reduce queuing and wait times for right-turning vehicles in/out of Lorne Street.

6.2 Active Transport

The Precinct includes rugby league fields and grandstand, tennis courts, a regional swimming pool, and a velodrome. The Masterplan incorporates passive sporting activities such as cycling and walking around its perimeter.

According to the Masterplan a shared path, for pedestrians and cyclists, is proposed along the Muscle Creek Riparian Corridor and Wilkinson Avenue. The path is proposed as a 2.5 metre wide concrete path and should connect to the existing footpath network at the junction of Haydon Street and Wilkinson Avenue and the Bell Street overpass.

Also, there will be the construction of a new bridge providing additional vehicular access across Muscle Creek where a pedestrian footpath would be integrated into the bridge.

6.3 Public Transport

According to the Masterplan it is envisaged that Wilder Street will be used by vehicles heading south out of Muswellbrook. Buses will use Wilder Avenue to eliminate the need for buses to leave via Haydon Street, which would have required a minimum 25 metre turning circle to undertake a U-turn within the site.

Also, there are two locations proposed for bus parking. The first is on the northern side of Wilkinson Avenue opposite Park Tennis. The second is on the eastern side of Wilkinson Avenue opposite the Velodrome. Together, these locations provide space for approximately 5 buses. Egress of the buses will be via Wilder Street and left out onto the New England Highway.

The intersection of Haydon Street and Wilkinson Avenue will provide access to the buses if they want to go north. It is recommended that this intersection be upgraded to improve access for buses.

6.4 Proposed Parking

The proposed Masterplan envisages increasing the quality and quantity of car parking up to 263 spaces by formalising the existing spaces. The number of parking spaces based on the area served as per the Masterplan is provided in **Table 6-1**.

Table 6-1 Masterplan Proposed Parking

Stage	Spaces	Area Served
1	44	Tennis courts Pool Complex Boronia Centre Girl Guides
1	20	Tennis Courts
1	69	Tennis Courts Rugby League Velodrome Riparian Walk Kick about
2	76	Pool Complex Boronia Centre Girl Guides Overflow
2	25	Pool Complex Boronia Centre Girl Guides Tennis Courts Overflow
2	29	Tennis Courts
Total	**263**	

7 Conclusion

Cardno has been commissioned by Muswellbrook Shire Council to prepare a Traffic Impact Assessment (TIA) for the proposed masterplan development in the Olympic Park Precinct area.

The masterplan does not show any additional sports field or land-use changes rather only aesthetic changes, it is assumed that there will be no additional traffic generation due to the proposal.

The construction of a new bridge over Muscle Creek is assumed to result in the traffic distribution based on the intersection configuration at New England Highway/ Wilder Street. It is envisaged that Wilder Street will be predominantly used by vehicles to/from the south of Muswellbrook.

The future traffic assessment, based on the 2021 year of the bridge opening and 2031 design horizon year, shows that the intersection LoS is relatively unchanged by reassignment of traffic due to the proposed bridge. Also, the single-lane bridge over muscle creek will continue to operate satisfactorily at LoS A which represents good performance.

This traffic assessment firstly assessed the New England Highway/ Wilder Street intersection configuration as all movements to be permitted in the first instance. However, it should be noted that due to the forecast traffic volume increase on Wilder Street due to the proposed Masterplan the Wilder Street approach is forecast to operate at LoS E in the PM peak and LoS F in the SAT peak by 2031.

The intersection of Wilder Street/New England Highway is in a location that results in a staggered-T junction with Francis Street/New England Highway. The staggered junctions could attract safety concerns when the traffic intensifies at the Wilder Street approach, hence banning the right in/out of Wilder Street is proposed as mitigation that reduces the safety issue due to the back to back right-turns at the staggered junction. Under the restriction of right turns in/out of Wilder Street the approach LoS improves to LoS A in both PM and SAT peak for the year 2031.

In conclusion, the proposed masterplan development is supported on traffic grounds. The potential traffic impact of the masterplan has been shown to have a negligible impact on the surrounding road network and can be accommodated accordingly.

APPENDIX

A

TRAFFIC SURVEYS

TRANS TRAFFIC SURVEY

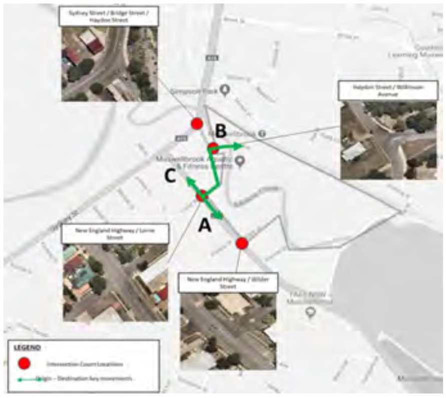
trafficsurvey.com.au

ORIGIN DESTINATION ANALYSIS

Weather:	Overcast
Suburban:	Olympic Park
Customer:	Cardno

All Vehicles

Time		FROM A to		FROM B to		FROM C to	
Period Start	**Period End**	**B**	**C**	**A**	**C**	**A**	**B**
16:00	16:15	3	127	3	1	126	2
16:15	16:30	7	116	1	1	104	3
16:30	16:45	1	151	8	0	117	1
16:45	17:00	7	137	5	0	113	2
17:00	17:15	4	103	9	0	106	1
17:15	17:30	3	166	6	0	121	2
17:30	17:45	5	141	22	1	128	1
17:45	18:00	3	112	5	0	104	1
18:00	18:15	2	94	11	0	100	2
18:15	18:30	5	83	8	0	79	2
18:30	18:45	2	95	10	0	62	1
18:45	19:00	2	73	5	1	74	1
7:00	7:15	1	30	1	0	31	1
7:15	7:30	0	35	0	0	45	0
7:30	7:45	3	58	1	0	51	0
7:45	8:00	3	57	1	0	52	0
8:00	8:15	9	78	2	0	60	1
8:15	8:30	10	71	1	0	84	2
8:30	8:45	15	86	1	0	79	1
8:45	9:00	8	111	2	0	100	1
9:00	9:15	7	95	4	0	86	3
9:15	9:30	12	105	20	0	109	0
9:30	9:45	7	142	14	1	128	0
9:45	10:00	9	123	12	0	122	2
10:00	10:15	20	124	24	0	143	0
10:15	10:30	19	159	22	2	141	0
10:30	10:45	16	160	28	0	125	1
10:45	11:00	11	147	22	1	140	1
11:00	11:15	9	129	13	0	130	1
11:15	11:30	11	150	13	1	147	1
11:30	11:45	13	151	11	0	125	0
11:45	12:00	14	137	8	1	156	0
12:00	12:15	10	154	16	2	127	1
12:15	12:30	7	130	19	0	109	1
12:30	12:45	3	100	21	0	100	0
12:45	13:00	5	95	16	1	118	0



Light Vehicles

Time		FROM A to		FROM B to		FROM C to	
Period Start	**Period End**	**B**	**C**	**A**	**C**	**A**	**B**
16:00	16:15	3	121	3	1	111	2
16:15	16:30	7	109	1	1	93	3
16:30	16:45	1	136	8	0	104	1
16:45	17:00	7	126	5	0	100	2
17:00	17:15	4	98	9	0	92	1
17:15	17:30	3	151	6	0	111	2
17:30	17:45	5	136	22	1	117	1
17:45	18:00	3	104	5	0	92	1
18:00	18:15	2	89	11	0	88	2
18:15	18:30	5	78	8	0	68	2
18:30	18:45	2	87	10	0	51	1
18:45	19:00	2	70	5	1	59	1
7:00	7:15	1	25	1	0	30	1
7:15	7:30	0	31	0	0	43	0
7:30	7:45	3	56	1	0	51	0
7:45	8:00	3	53	1	0	47	0
8:00	8:15	9	75	2	0	56	1
8:15	8:30	10	69	1	0	81	2
8:30	8:45	15	82	1	0	78	1
8:45	9:00	8	105	2	0	99	1
9:00	9:15	7	91	4	0	81	3
9:15	9:30	12	103	20	0	106	0
9:30	9:45	7	136	14	1	123	0
9:45	10:00	9	117	12	0	115	2
10:00	10:15	20	122	24	0	137	0
10:15	10:30	19	155	22	2	138	0
10:30	10:45	16	157	28	0	120	1
10:45	11:00	11	142	22	1	132	1
11:00	11:15	9	126	13	0	127	1
11:15	11:30	11	145	13	1	142	1
11:30	11:45	13	148	11	0	123	0
11:45	12:00	14	133	8	1	147	0
12:00	12:15	10	150	16	2	124	1
12:15	12:30	7	128	19	0	106	1
12:30	12:45	3	94	21	0	99	0
12:45	13:00	5	91	16	1	115	0

Heavy Vehicles

Time		FROM A to		FROM B to		FROM C to	
Period Start	**Period End**	**B**	**C**	**A**	**C**	**A**	**B**
16:00	16:15	0	6	0	0	13	0
16:15	16:30	0	7	0	0	10	0
16:30	16:45	0	14	0	0	10	0
16:45	17:00	0	11	0	0	11	0
17:00	17:15	0	5	0	0	12	0
17:15	17:30	0	15	0	0	8	0
17:30	17:45	0	5	0	0	11	0
17:45	18:00	0	8	0	0	12	0
18:00	18:15	0	5	0	0	11	0
18:15	18:30	0	5	0	0	11	0
18:30	18:45	0	8	0	0	11	0
18:45	19:00	0	3	0	0	15	0
7:00	7:15	0	5	0	0	1	0
7:15	7:30	0	4	0	0	2	0
7:30	7:45	0	2	0	0	0	0
7:45	8:00	0	4	0	0	5	0
8:00	8:15	0	3	0	0	4	0
8:15	8:30	0	2	0	0	3	0
8:30	8:45	0	4	0	0	1	0
8:45	9:00	0	6	0	0	1	0
9:00	9:15	0	4	0	0	5	0
9:15	9:30	0	1	0	0	3	0
9:30	9:45	0	6	0	0	5	0
9:45	10:00	0	5	0	0	7	0
10:00	10:15	0	2	0	0	6	0
10:15	10:30	0	4	0	0	3	0
10:30	10:45	0	3	0	0	4	0
10:45	11:00	0	5	0	0	8	0
11:00	11:15	0	3	0	0	2	0
11:15	11:30	0	4	0	0	5	0
11:30	11:45	0	3	0	0	2	0
11:45	12:00	0	4	0	0	8	0
12:00	12:15	0	4	0	0	3	0
12:15	12:30	0	2	0	0	3	0
12:30	12:45	0	6	0	0	1	0
12:45	13:00	0	4	0	0	3	0

Bus

Time		FROM A to		FROM B to		FROM C to	
Period Start	**Period End**	**B**	**C**	**A**	**C**	**A**	**B**
16:00	16:15	0	0	0	0	2	0
16:15	16:30	0	0	0	0	1	0
16:30	16:45	0	1	0	0	3	0
16:45	17:00	0	0	0	0	2	0
17:00	17:15	0	0	0	0	2	0
17:15	17:30	0	0	0	0	2	0
17:30	17:45	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0
18:00	18:15	0	0	0	0	1	0
18:15	18:30	0	0	0	0	0	0
18:30	18:45	0	0	0	0	0	0
18:45	19:00	0	0	0	0	0	0
7:00	7:15	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0
9:15	9:30	0	1	0	0	0	0
9:30	9:45	0	0	0	0	0	0
9:45	10:00	0	1	0	0	0	0
10:00	10:15	0	0	0	0	0	0
10:15	10:30	0	0	0	0	0	0
10:30	10:45	0	0	0	0	1	0
10:45	11:00	0	0	0	0	0	0
11:00	11:15	0	0	0	0	1	0
11:15	11:30	0	1	0	0	0	0
11:30	11:45	0	0	0	0	0	0
11:45	12:00	0	0	0	0	1	0
12:00	12:15	0	0	0	0	0	0
12:15	12:30	0	0	0	0	0	0
12:30	12:45	0	0	0	0	0	0
12:45	13:00	0	0	0	0	0	0

TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Sydney St and Bridge St, Olympic Park

GPS -32.2672, 150.88803

Date:	Tue 07/05/19	**North:**	Bridge St	**Survey Period**	AM:	4:00 PM-4:00 PM
Weather:	Overcast	**East:**	N/A		PM:	4:00 PM-7:00 PM
Suburban:	Olympic Park	**South:**	Haydon St	**Traffic Peak**	AM:	N/A
Customer:	Cardno	**West:**	Sydney St		PM:	5:00 PM-6:00 PM

All Vehicles

Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St			Hourly Total	
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	Hour	Peak
16:00	16:15	0	164	9	0	6	1	0	1	207	1594	
16:15	16:30	0	168	22	0	6	2	0	1	215	1614	
16:30	16:45	0	155	14	0	8	1	0	2	223	1619	
16:45	17:00	0	164	14	0	6	2	0	1	202	1613	
17:00	17:15	0	154	14	0	11	3	0	1	225	1670	Peak
17:15	17:30	0	168	17	0	13	5	0	2	214	1654	
17:30	17:45	0	151	12	0	15	4	0	1	214	1649	
17:45	18:00	0	174	14	0	4	2	0	3	249	1650	
18:00	18:15	0	155	9	0	7	2	0	2	217	1547	
18:15	18:30	0	183	12	0	7	3	0	5	204		
18:30	18:45	0	139	8	0	8	1	0	3	239		
18:45	19:00	0	156	7	0	8	0	0	1	171		

Peak Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St			Peak total
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	
17:00	18:00	0	647	57	0	43	14	0	7	902	1670

Pedestrians Crossing

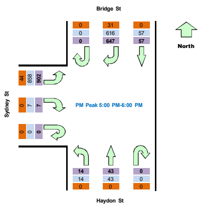
Time		North Approach Bridge St		South Approach Haydon St		West Approach Sydney St		Hourly Total
Period Start	Period End	Westbound	Eastbound	Westbound	Eastbound	Southbound	Northbound	
16:00	16:15	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	4
17:00	17:15	0	0	0	0	0	0	8
17:15	17:30	0	0	0	0	0	0	15
17:30	17:45	0	0	4	0	0	0	16
17:45	18:00	0	0	0	4	0	0	14
18:00	18:15	0	0	1	6	0	0	12
18:15	18:30	0	0	1	0	0	0	0
18:30	18:45	0	0	2	0	0	0	0
18:45	19:00	1	0	0	1	0	0	0

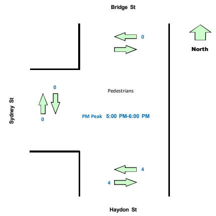
Peak Time		North Approach Bridge St		South Approach Haydon St		West Approach Sydney St		Peak total
Period Start	Period End	Westbound	Eastbound	Westbound	Eastbound	Southbound	Northbound	
17:00	18:00	0	0	4	4	0	0	8

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

Total
Light
Heavy





Light Vehicles

Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St		
Period Start	Period End	U	R	SB	U	NB	L	U	R	L
16:00	16:15	0	158	9	0	6	1	0	1	193
16:15	16:30	0	161	22	0	6	2	0	1	199
16:30	16:45	0	149	14	0	8	1	0	2	207
16:45	17:00	0	158	14	0	6	2	0	1	186
17:00	17:15	0	150	14	0	11	3	0	1	214
17:15	17:30	0	162	17	0	13	5	0	2	207
17:30	17:45	0	138	12	0	15	4	0	1	202
17:45	18:00	0	166	14	0	4	2	0	3	235
18:00	18:15	0	140	9	0	7	2	0	2	204
18:15	18:30	0	176	12	0	7	3	0	5	199
18:30	18:45	0	131	8	0	8	1	0	3	220
18:45	19:00	0	147	7	0	8	0	0	1	163

Peak Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St			Peak total
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	
17:00	18:00	0	616	57	0	43	14	0	7	858	1595

Heavy Vehicles

Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St		
Period Start	Period End	U	R	SB	U	NB	L	U	R	L
16:00	16:15	0	6	0	0	0	0	0	0	14
16:15	16:30	0	7	0	0	0	0	0	0	16
16:30	16:45	0	6	0	0	0	0	0	0	16
16:45	17:00	0	6	0	0	0	0	0	0	16
17:00	17:15	0	4	0	0	0	0	0	0	11
17:15	17:30	0	2	0	0	0	0	0	0	7
17:30	17:45	0	11	0	0	0	0	0	0	12
17:45	18:00	0	8	0	0	0	0	0	0	13
18:00	18:15	0	14	0	0	0	0	0	0	13
18:15	18:30	0	6	0	0	0	0	0	0	5
18:30	18:45	0	8	0	0	0	0	0	0	18
18:45	19:00	0	9	0	0	0	0	0	0	8

Peak Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St			Peak total
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	
17:00	18:00	0	31	0	0	0	0	0	0	44	75

Bus

Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St		
Period Start	Period End	U	R	SB	U	NB	L	U	R	L
16:00	16:15	0	0	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	0	0	0	0
17:15	17:30	0	4	0	0	0	0	0	0	0
17:30	17:45	0	2	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	1
18:00	18:15	0	1	0	0	0	0	0	0	0
18:15	18:30	0	1	0	0	0	0	0	0	0
18:30	18:45	0	0	0	0	0	0	0	0	1
18:45	19:00	0	0	0	0	0	0	0	0	0

Peak Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St			Peak total
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	
17:00	18:00	0	6	0	0	0	0	0	0	1	7

TRANS TRAFFIC SURVEY

trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Wilkinson Ave and Haydon St, Olympic Par

GPS -32.26805, 150.8886

Date:	Tue 07/05/19
Weather:	Overcast
Suburban:	Olympic Park
Customer:	Cardno

North:	Haydon St
East:	Wilkinson Ave
South:	Haydon St
West:	N/A

Survey Period	AM:	4:00 PM-4:00 PM
	PM:	4:00 PM-7:00 PM
Traffic Peak	AM:	N/A
	PM:	4:45 PM-5:45 PM

All Vehicles

Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St			Hourly Total	
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	Hour	Peak
16:00	16:15	0	1	9	0	5	4	0	9	2	149	
16:15	16:30	0	7	16	0	5	3	0	11	3	165	
16:30	16:45	0	2	14	0	8	8	0	4	1	168	
16:45	17:00	0	3	12	0	5	5	0	9	3	195	Peak
17:00	17:15	0	5	10	0	11	11	0	6	3	191	
17:15	17:30	0	2	17	0	14	6	0	5	4	180	
17:30	17:45	0	1	12	0	18	23	0	9	1	175	
17:45	18:00	0	1	16	0	3	5	0	5	3	145	
18:00	18:15	0	0	11	0	7	11	0	4	2	138	
18:15	18:30	0	3	14	0	9	8	0	8	1		
18:30	18:45	0	1	10	0	9	10	0	4	0		
18:45	19:00	1	3	4	0	6	6	0	4	2		

Peak Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
16:45	17:45	0	11	51	0	48	45	0	29	11	195

Pedestrians Crossing

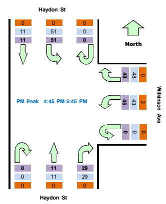
Time		North Approach Haydon St		East Approach Wilkinson Ave		South Approach Haydon St		Hourly Total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	
16:00	16:15	0	0	0	0	0	0	7
16:15	16:30	0	0	3	0	0	0	7
16:30	16:45	0	0	0	2	0	0	6
16:45	17:00	0	0	2	0	0	0	4
17:00	17:15	0	0	0	0	0	0	6
17:15	17:30	0	0	2	0	0	0	8
17:30	17:45	0	0	0	0	0	0	8
17:45	18:00	0	1	0	3	0	0	8
18:00	18:15	0	0	2	0	0	0	7
18:15	18:30	0	0	1	1	0	0	0
18:30	18:45	0	0	0	0	0	0	0
18:45	19:00	1	0	2	0	0	0	0

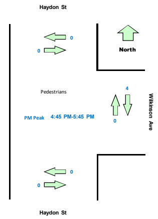
Peak Time		North Approach Haydon St		East Approach Wilkinson Ave		South Approach Haydon St		Peak total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	
16:45	17:45	0	0	4	0	0	0	4

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic

- Total
- Light
- Heavy





Light Vehicles

Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
16:00	16:15	0	1	9	0	5	4	0	9	2
16:15	16:30	0	7	16	0	5	2	0	11	3
16:30	16:45	0	2	14	0	8	8	0	4	1
16:45	17:00	0	3	12	0	5	5	0	9	3
17:00	17:15	0	5	10	0	11	9	0	6	3
17:15	17:30	0	2	17	0	14	6	0	5	4
17:30	17:45	0	1	12	0	18	23	0	9	1
17:45	18:00	0	1	16	0	3	5	0	5	3
18:00	18:15	0	0	11	0	7	11	0	4	2
18:15	18:30	0	3	14	0	9	8	0	8	1
18:30	18:45	0	1	10	0	9	10	0	4	0
18:45	19:00	1	3	4	0	6	6	0	4	2

Peak Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
16:45	17:45	0	11	51	0	48	43	0	29	11	193

Heavy Vehicles

Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
16:00	16:15	0	0	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	1	0	0	0
16:30	16:45	0	0	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	2	0	0	0
17:15	17:30	0	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	0
18:00	18:15	0	0	0	0	0	0	0	0	0
18:15	18:30	0	0	0	0	0	0	0	0	0
18:30	18:45	0	0	0	0	0	0	0	0	0
18:45	19:00	0	0	0	0	0	0	0	0	0

Peak Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
16:45	17:45	0	0	0	0	0	2	0	0	0	2

Bus

Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
16:00	16:15	0	0	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	0	0	0	0
17:15	17:30	0	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	0
18:00	18:15	0	0	0	0	0	0	0	0	0
18:15	18:30	0	0	0	0	0	0	0	0	0
18:30	18:45	0	0	0	0	0	0	0	0	0
18:45	19:00	0	0	0	0	0	0	0	0	0

Peak Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
16:45	17:45	0	0	0	0	0	0	0	0	0	0

TRANS TRAFFIC SURVEY trafficsurvey.com.au

TURNING MOVEMENT SURVEY

Intersection of Lorne St and New England Hw, Olympic Park

GPS *-32.26973, 150.88819*

Date:	Tue 07/05/19
Weather:	Overcast
Suburban:	Olympic Park
Customer:	Cardno

North:	New England Hw
East:	Lorne St
South:	New England Hw
West:	Lorne St

Survey Period	AM:	4:00 PM-4:00 PM
	PM:	4:00 PM-7:00 PM
Traffic Peak	AM:	N/A
	PM:	4:45 PM-5:45 PM

All Vehicles

Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
16:00	16:15	1	7	126	3	0	1	0	4	0	5	127	5	0	6	4	18	1208	
16:15	16:30	1	10	104	3	0	1	0	9	0	10	116	7	0	4	1	14	1173	
16:30	16:45	0	8	117	3	0	1	0	9	0	2	151	8	0	0	0	11	1221	
16:45	17:00	0	10	113	2	0	0	0	8	0	10	137	14	0	6	0	11	1255	Peak
17:00	17:15	0	11	106	1	0	0	2	14	0	7	103	14	0	3	1	10	1206	
17:15	17:30	0	10	121	3	0	0	0	8	0	6	166	8	0	3	0	3	1171	
17:30	17:45	0	15	128	3	0	1	1	22	0	6	141	10	0	6	1	10	1040	
17:45	18:00	0	4	104	1	0	0	0	6	0	6	112	10	0	5	1	13	880	
18:00	18:15	0	6	100	3	0	0	0	11	0	3	94	8	0	6	0	6	791	
18:15	18:30	0	1	79	2	0	0	0	11	0	6	83	6	0	4	1	4		
18:30	18:45	0	2	62	1	0	0	0	11	0	2	95	4	0	3	1	3		
18:45	19:00	0	4	74	1	0	2	0	7	0	3	73	3	0	1	2	3		

Peak Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
16:45	17:45	0	46	468	9	0	1	3	52	0	29	547	46	0	18	2	34	1255

Pedestrians Crossing

Time		orth Approach New England H		East Approach Lorne St		outh Approach New England H		West Approach Lorne St		Hourly Total
Period Star	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	
16:00	16:15	0	0	0	0	1	0	0	0	8
16:15	16:30	0	0	0	0	0	0	1	0	12
16:30	16:45	0	1	0	0	0	1	0	0	18
16:45	17:00	0	0	0	3	0	0	1	0	23
17:00	17:15	0	0	2	0	0	1	1	1	26
17:15	17:30	0	0	5	0	0	0	0	2	28
17:30	17:45	0	0	2	1	2	2	0	0	21
17:45	18:00	0	1	1	4	0	0	0	1	18
18:00	18:15	0	0	3	2	1	0	1	0	16
18:15	18:30	0	0	0	0	0	0	0	0	
18:30	18:45	0	0	4	0	0	0	0	0	
18:45	19:00	2	0	1	0	0	0	2	0	

Peak Time		orth Approach New England H		East Approach Lorne St		outh Approach New England H		West Approach Lorne St		Peak hour
Period Star	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	total
16:45	17:45	0	0	9	4	2	3	2	3	23

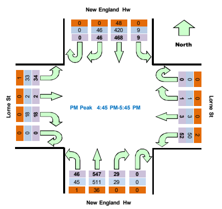
Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

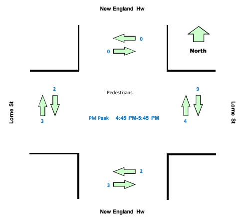
Graphic

Total

Light

Heavy





Light Vehicles

Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
16:00	16:15	1	7	111	3	0	1	0	4	0	4	121	5	0	5	4	18
16:15	16:30	1	10	93	3	0	1	0	8	0	10	109	7	0	4	1	13
16:30	16:45	0	8	104	3	0	1	0	9	0	2	136	8	0	0	0	11
16:45	17:00	0	10	100	2	0	0	0	8	0	10	126	14	0	6	0	11
17:00	17:15	0	11	92	1	0	0	2	12	0	7	98	13	0	3	1	9
17:15	17:30	0	10	111	3	0	0	0	8	0	6	151	8	0	3	0	3
17:30	17:45	0	15	117	3	0	1	1	22	0	6	136	10	0	6	1	10
17:45	18:00	0	3	92	1	0	0	0	6	0	6	104	10	0	5	1	13
18:00	18:15	0	6	88	3	0	0	0	11	0	3	89	8	0	6	0	6
18:15	18:30	0	1	68	2	0	0	0	11	0	6	78	6	0	4	1	4
18:30	18:45	0	2	51	1	0	0	0	11	0	2	87	4	0	3	1	3
18:45	19:00	0	4	59	1	0	2	0	7	0	3	70	3	0	1	2	3

Peak Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
16:45	17:45	0	46	420	9	0	1	3	50	0	29	511	45	0	18	2	33	1167

Heavy Vehicles

Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
16:00	16:15	0	0	13	0	0	0	0	0	0	1	6	0	0	1	0	0
16:15	16:30	0	0	10	0	0	0	0	1	0	0	7	0	0	0	0	1
16:30	16:45	0	0	10	0	0	0	0	0	0	0	14	0	0	0	0	0
16:45	17:00	0	0	11	0	0	0	0	0	0	0	11	0	0	0	0	0
17:00	17:15	0	0	12	0	0	0	0	2	0	0	5	1	0	0	0	1
17:15	17:30	0	0	8	0	0	0	0	0	0	0	15	0	0	0	0	0
17:30	17:45	0	0	11	0	0	0	0	0	0	0	5	0	0	0	0	0
17:45	18:00	0	1	12	0	0	0	0	0	0	0	8	0	0	0	0	0
18:00	18:15	0	0	11	0	0	0	0	0	0	0	5	0	0	0	0	0
18:15	18:30	0	0	11	0	0	0	0	0	0	0	5	0	0	0	0	0
18:30	18:45	0	0	11	0	0	0	0	0	0	0	8	0	0	0	0	0
18:45	19:00	0	0	15	0	0	0	0	0	0	0	3	0	0	0	0	0

Peak Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
16:45	17:45	0	0	48	0	0	0	0	2	0	0	36	1	0	0	0	1	88

Bus

Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
16:00	16:15	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	16:30	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	16:45	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0
16:45	17:00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	17:30	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	18:15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
16:45	17:45	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	6

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

Intersection of Wilder St and New England Hw, Olympic Park

GPS -32.27127, 150.88957

Date:	Tue 07/05/19
Weather:	Overcast
Suburban:	Olympic Park
Customer:	Cardno

North:	New England Hw
East:	Wilder St
South:	Maitland St
West:	Francis St

Survey Period	AM:	4:00 PM-4:00 PM
	PM:	4:00 PM-7:00 PM
Traffic Peak	AM:	N/A
	PM:	4:45 PM-5:45 PM

All Vehicles

Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
16:00	16:15	1	6	125	3	0	0	0	1	0	9	130	8	0	3	0	9	1198	
16:15	16:30	0	6	110	4	0	1	0	2	0	14	132	8	0	3	0	3	1167	
16:30	16:45	0	5	121	4	0	1	0	1	0	5	157	7	0	4	0	5	1222	
16:45	17:00	0	5	122	2	0	1	0	4	0	13	155	2	0	0	0	6	1233	Peak
17:00	17:15	0	3	116	3	0	1	0	1	0	9	119	2	0	4	0	6	1192	
17:15	17:30	0	5	125	4	0	1	0	0	0	8	175	10	0	4	0	6	1155	
17:30	17:45	0	6	138	5	0	2	0	1	0	5	145	5	0	4	1	9	1036	
17:45	18:00	0	6	117	1	0	1	1	2	0	4	119	6	0	6	0	6	913	
18:00	18:15	0	5	103	3	0	0	0	2	0	3	101	5	0	2	0	3	807	
18:15	18:30	2	5	92	1	0	2	0	2	0	9	93	11	0	0	0	2		
18:30	18:45	0	5	71	0	0	1	0	0	0	8	102	5	0	2	0	4		
18:45	19:00	1	4	74	2	0	0	0	0	0	2	74	1	0	1	0	4		

Peak Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
16:45	17:45	0	19	501	14	0	5	0	6	0	35	594	19	0	12	1	27	1233

Pedestrians Crossing

Time		orth Approach New England H		East Approach Wilder St		South Approach Maitland St		West Approach Francis St		Hourly Total
Period Star	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	
16:00	16:15	0	0	0	2	0	0	0	2	14
16:15	16:30	0	0	0	1	0	0	0	1	17
16:30	16:45	0	0	2	2	0	0	0	2	22
16:45	17:00	0	0	0	2	0	0	0	0	22
17:00	17:15	0	0	4	0	0	0	3	0	23
17:15	17:30	0	0	4	0	0	0	2	1	22
17:30	17:45	0	0	1	0	0	0	2	3	20
17:45	18:00	0	0	1	1	0	0	0	1	15
18:00	18:15	0	0	3	1	0	0	2	0	20
18:15	18:30	0	0	1	0	0	0	0	4	
18:30	18:45	0	0	1	0	0	0	0	0	
18:45	19:00	2	0	1	4	0	0	1	0	

Peak Time		orth Approach New England H		East Approach Wilder St		South Approach Maitland St		West Approach Francis St		Peak hour
Period Star	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	total
16:45	17:45	0	0	9	2	0	0	7	4	22

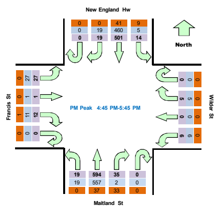
Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

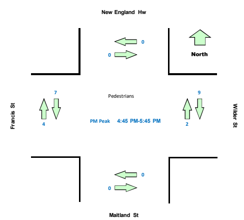
Graphic

Total

Light

Heavy





Light Vehicles

Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
16:00	16:15	1	6	112	0	0	0	0	1	0	2	123	8	0	2	0	9
16:15	16:30	0	6	101	1	0	1	0	2	0	1	125	8	0	3	0	3
16:30	16:45	0	5	111	1	0	1	0	1	0	1	142	7	0	4	0	5
16:45	17:00	0	5	109	0	0	1	0	4	0	2	144	2	0	0	0	6
17:00	17:15	0	3	103	2	0	1	0	1	0	0	113	2	0	3	0	6
17:15	17:30	0	5	118	1	0	1	0	0	0	0	160	10	0	4	0	6
17:30	17:45	0	6	130	2	0	2	0	1	0	0	140	5	0	4	1	9
17:45	18:00	0	6	106	0	0	1	1	2	0	0	111	6	0	6	0	6
18:00	18:15	0	5	94	0	0	0	0	2	0	1	96	5	0	2	0	3
18:15	18:30	2	5	81	1	0	2	0	2	0	1	88	11	0	0	0	2
18:30	18:45	0	5	60	0	0	1	0	0	0	0	94	4	0	2	0	4
18:45	19:00	1	4	60	1	0	0	0	0	0	0	71	1	0	1	0	4

Peak Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
16:45	17:45	0	19	460	5	0	5	0	6	0	2	557	19	0	11	1	27	1112

Heavy Vehicles

Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
16:00	16:15	0	0	11	3	0	0	0	0	0	6	7	0	0	0	0	0
16:15	16:30	0	0	8	3	0	0	0	0	0	13	7	0	0	0	0	0
16:30	16:45	0	0	7	3	0	0	0	0	0	4	14	0	0	0	0	0
16:45	17:00	0	0	11	2	0	0	0	0	0	11	11	0	0	0	0	0
17:00	17:15	0	0	11	1	0	0	0	0	0	9	6	0	0	1	0	0
17:15	17:30	0	0	5	3	0	0	0	0	0	8	15	0	0	0	0	0
17:30	17:45	0	0	8	3	0	0	0	0	0	5	5	0	0	0	0	0
17:45	18:00	0	0	11	1	0	0	0	0	0	4	8	0	0	0	0	0
18:00	18:15	0	0	8	3	0	0	0	0	0	2	5	0	0	0	0	0
18:15	18:30	0	0	11	0	0	0	0	0	0	8	5	0	0	0	0	0
18:30	18:45	0	0	11	0	0	0	0	0	0	8	8	1	0	0	0	0
18:45	19:00	0	0	14	1	0	0	0	0	0	2	3	0	0	0	0	0

Peak Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
16:45	17:45	0	0	41	9	0	0	0	0	0	33	37	0	0	1	0	0	121

Bus

Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
16:00	16:15	0	0	2	0	0	0	0	0	0	1	0	0	0	1	0	0
16:15	16:30	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	16:45	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0
16:45	17:00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	17:30	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:00	18:15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	18:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:45	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St				Peak
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	total
16:45	17:45	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	6

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

Intersection of Sydney St and Bridge St, Olympic Park

GPS -32.2672, 150.88803

Date:	Sat 11/05/19	**North:**	Bridge St	**Survey Period**	AM:	7:00 AM-12:00 PM
Weather:	Overcast	**East:**	N/A		PM:	12:00 PM-1:00 PM
Suburban:	Olympic Park	**South:**	Haydon St	**Traffic Peak**	AM:	11:30 AM-12:30 PM
Customer:	Cardno	**West:**	Sydney St		PM:	12:00 PM-1:00 PM

All Vehicles

Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St			Hourly Total	
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	Hour	Peak
7:00	7:15	0	46	3	0	3	0	0	1	69	515	
7:15	7:30	0	34	3	0	0	1	0	2	67	575	
7:30	7:45	0	59	1	0	2	2	0	1	67	677	
7:45	8:00	0	57	14	0	0	1	0	1	81	793	
8:00	8:15	0	72	14	0	4	0	0	12	80	919	
8:15	8:30	0	86	21	0	3	1	0	10	88	1023	
8:30	8:45	0	98	29	0	1	2	0	4	114	1089	
8:45	9:00	0	101	44	0	4	0	0	10	121	1176	
9:00	9:15	0	115	18	0	5	0	0	7	141	1290	
9:15	9:30	0	104	20	0	18	2	1	3	127	1369	
9:30	9:45	0	140	15	0	19	3	1	8	149	1533	
9:45	10:00	0	163	17	0	15	2	0	5	192	1624	
10:00	10:15	0	147	25	0	23	6	0	3	161	1636	
10:15	10:30	0	190	29	0	20	7	0	3	190	1662	
10:30	10:45	0	161	26	0	27	5	0	5	202	1613	
10:45	11:00	0	144	28	0	21	3	0	4	206	1616	
11:00	11:15	0	173	18	0	10	5	0	5	180	1656	
11:15	11:30	0	165	20	0	8	6	0	4	187	1682	
11:30	11:45	0	182	19	0	18	4	0	2	204	1687	Peak
11:45	12:00	0	214	9	0	9	6	0	6	202	1579	
12:00	12:15	0	182	24	0	17	3	0	2	189	1439	
12:15	12:30	0	168	10	0	10	9	0	8	190		
12:30	12:45	0	130	10	0	14	3	0	2	162		
12:45	13:00	0	134	3	0	19	2	1	1	146		

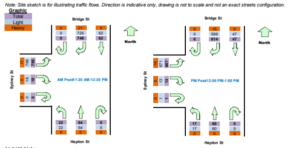
Peak Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St			Peak total
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	
11:30	12:30	0	746	62	0	54	22	0	18	785	1687
12:00	13:00	0	614	47	0	60	17	1	13	687	1439

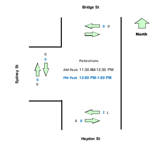
Pedestrians Crossing

Time		North Approach Bridge St		South Approach Haydon St		West Approach Sydney St		Hourly Total
Period Start	Period End	Westbound	Eastbound	Westbound	Eastbound	Southbound	Northbound	
7:00	7:15	0	0	0	2	0	0	8
7:15	7:30	0	0	0	2	0	0	7
7:30	7:45	0	0	1	0	0	0	7
7:45	8:00	0	0	2	1	0	0	8
8:00	8:15	0	0	1	0	0	0	5
8:15	8:30	0	0	0	2	0	0	4
8:30	8:45	0	0	1	1	0	0	3
8:45	9:00	0	0	0	0	0	0	1
9:00	9:15	0	0	0	0	0	0	3
9:15	9:30	1	0	0	0	0	0	5
9:30	9:45	0	0	0	0	0	0	5
9:45	10:00	0	0	1	1	0	0	5
10:00	10:15	0	0	0	2	0	0	3
10:15	10:30	0	1	0	0	0	0	2
10:30	10:45	0	0	0	0	0	0	1
10:45	11:00	0	0	0	0	0	0	1
11:00	11:15	0	0	1	0	0	0	2
11:15	11:30	0	0	0	0	0	0	4
11:30	11:45	0	0	0	0	0	0	7
11:45	12:00	0	0	0	1	0	0	10
12:00	12:15	0	0	0	3	0	0	10
12:15	12:30	0	0	1	2	0	0	
12:30	12:45	0	0	0	3	0	0	
12:45	13:00	0	0	1	0	0	0	

Peak Time		North Approach Bridge St		South Approach Haydon St		West Approach Sydney St		Peak total
Period Start	Period End	Westbound	Eastbound	Westbound	Eastbound	Southbound	Northbound	
11:30	12:30	0	0	1	6	0	0	7
12:00	13:00	0	0	2	8	0	0	10

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.





Light Vehicles

Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St		
Period Start	Period End	U	R	SB	U	NB	L	U	R	L
7:00	7:15	0	43	3	0	3	0	0	1	60
7:15	7:30	0	34	3	0	0	1	0	2	61
7:30	7:45	0	55	1	0	2	2	0	1	64
7:45	8:00	0	54	14	0	0	1	0	1	79
8:00	8:15	0	66	14	0	4	0	0	12	72
8:15	8:30	0	81	21	0	3	1	0	10	85
8:30	8:45	0	98	29	0	1	2	0	4	109
8:45	9:00	0	97	44	0	4	0	0	10	118
9:00	9:15	0	113	18	0	5	0	0	7	135
9:15	9:30	0	100	20	0	18	2	1	3	123
9:30	9:45	0	132	15	0	19	3	1	8	146
9:45	10:00	0	155	17	0	15	2	0	5	181
10:00	10:15	0	144	25	0	23	6	0	3	155
10:15	10:30	0	183	29	0	20	7	0	3	186
10:30	10:45	0	155	26	0	27	5	0	5	199
10:45	11:00	0	140	28	0	21	3	0	4	202
11:00	11:15	0	165	18	0	10	5	0	5	175
11:15	11:30	0	160	20	0	8	6	0	4	183
11:30	11:45	0	179	19	0	18	4	0	2	196
11:45	12:00	0	206	9	0	9	6	0	6	200
12:00	12:15	0	176	24	0	17	3	0	2	186
12:15	12:30	0	164	10	0	10	9	0	8	187
12:30	12:45	0	128	10	0	14	3	0	2	160
12:45	13:00	0	131	3	0	19	2	1	1	138

Peak Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St			Peak total
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	
11:30	12:30	0	725	62	0	54	22	0	18	768	1649
12:00	13:00	0	599	47	0	60	17	1	13	671	1408

Heavy Vehicles

Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St		
Period Start	Period End	U	R	SB	U	NB	L	U	R	L
7:00	7:15	0	3	0	0	0	0	0	0	9
7:15	7:30	0	0	0	0	0	0	0	0	6
7:30	7:45	0	4	0	0	0	0	0	0	3
7:45	8:00	0	3	0	0	0	0	0	0	2
8:00	8:15	0	6	0	0	0	0	0	0	8
8:15	8:30	0	5	0	0	0	0	0	0	3
8:30	8:45	0	0	0	0	0	0	0	0	5
8:45	9:00	0	4	0	0	0	0	0	0	3
9:00	9:15	0	2	0	0	0	0	0	0	6
9:15	9:30	0	4	0	0	0	0	0	0	4
9:30	9:45	0	8	0	0	0	0	0	0	2
9:45	10:00	0	8	0	0	0	0	0	0	10
10:00	10:15	0	3	0	0	0	0	0	0	6
10:15	10:30	0	6	0	0	0	0	0	0	4
10:30	10:45	0	6	0	0	0	0	0	0	2
10:45	11:00	0	3	0	0	0	0	0	0	4
11:00	11:15	0	8	0	0	0	0	0	0	4
11:15	11:30	0	5	0	0	0	0	0	0	4
11:30	11:45	0	2	0	0	0	0	0	0	8
11:45	12:00	0	8	0	0	0	0	0	0	2
12:00	12:15	0	5	0	0	0	0	0	0	3
12:15	12:30	0	3	0	0	0	0	0	0	3
12:30	12:45	0	2	0	0	0	0	0	0	2
12:45	13:00	0	3	0	0	0	0	0	0	8

Peak Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St			Peak total
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	
11:30	12:30	0	21	0	0	0	0	0	0	17	38
12:00	13:00	0	15	0	0	0	0	0	0	16	31

Bus

Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St		
Period Start	Period End	U	R	SB	U	NB	L	U	R	L
7:00	7:15	0	0	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	0	0	0	0
9:30	9:45	0	0	0	0	0	0	0	0	0
9:45	10:00	0	0	0	0	0	0	0	0	1
10:00	10:15	0	0	0	0	0	0	0	0	0
10:15	10:30	0	1	0	0	0	0	0	0	0
10:30	10:45	0	0	0	0	0	0	0	0	1
10:45	11:00	0	1	0	0	0	0	0	0	0
11:00	11:15	0	0	0	0	0	0	0	0	1
11:15	11:30	0	0	0	0	0	0	0	0	0
11:30	11:45	0	1	0	0	0	0	0	0	1
11:45	12:00	0	2	0	0	0	0	0	0	0
12:00	12:15	0	1	0	0	0	0	0	0	0
12:15	12:30	0	1	0	0	0	0	0	0	0
12:30	12:45	0	0	0	0	0	0	0	0	0
12:45	13:00	0	0	0	0	0	0	0	0	0

Peak Time		North Approach Bridge St			South Approach Haydon St			West Approach Sydney St			Peak total
Period Start	Period End	U	R	SB	U	NB	L	U	R	L	
11:30	12:30	0	5	0	0	0	0	0	0	1	6
12:00	13:00	0	2	0	0	0	0	0	0	0	2

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

Intersection of Wilkinson Ave and Haydon St, Olympic I

GPS -32.26805, 150.8886

Date:	Sat 11/05/19
Weather:	Overcast
Suburban:	Olympic Park
Customer:	Cardno

North:	Haydon St
East:	Wilkinson Ave
South:	Haydon St
West:	N/A

Survey Period	AM:	7:00 AM-12:00 PM
	PM:	12:00 PM-1:00 PM
Traffic Peak	AM:	10:00 AM-11:00 AM
	PM:	12:00 PM-1:00 PM

All Vehicles

Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St			Hourly Total	
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	Hour	Peak
7:00	7:15	0	3	1	0	1	1	0	2	2	52	
7:15	7:30	0	3	2	0	1	0	0	2	0	85	
7:30	7:45	0	0	2	0	3	1	0	4	1	126	
7:45	8:00	0	1	14	0	1	2	0	5	0	169	
8:00	8:15	0	3	23	0	3	2	0	11	1	222	
8:15	8:30	0	3	28	0	2	2	0	12	2	224	
8:30	8:45	0	2	31	0	2	2	0	16	1	253	
8:45	9:00	0	5	49	0	3	3	0	15	1	272	
9:00	9:15	0	1	24	0	2	5	0	10	3	262	
9:15	9:30	0	5	18	0	20	21	0	14	0	322	
9:30	9:45	0	1	22	0	22	16	0	12	0	349	
9:45	10:00	0	2	20	0	12	14	0	13	5	387	
10:00	10:15	0	2	26	0	29	24	0	24	0	415	Peak
10:15	10:30	0	4	28	0	27	25	0	21	0	374	
10:30	10:45	0	5	26	0	29	29	0	19	3	334	
10:45	11:00	0	12	20	0	23	25	0	13	1	294	
11:00	11:15	0	3	20	0	11	13	0	13	4	258	
11:15	11:30	0	5	19	0	13	15	0	12	1	270	
11:30	11:45	0	5	16	0	21	14	0	14	1	272	
11:45	12:00	0	4	11	0	15	11	0	17	0	254	
12:00	12:15	0	8	18	0	19	19	0	11	1	248	
12:15	12:30	0	6	12	0	18	22	0	8	1		
12:30	12:45	0	5	7	0	17	21	0	3	0		
12:45	13:00	0	2	2	0	21	19	0	8	0		

Peak Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
10:00	11:00	0	23	100	0	108	103	0	77	4	415
12:00	13:00	0	21	39	0	75	81	0	30	2	248

Pedestrians Crossing

Time		North Approach Haydon St		East Approach Wilkinson Ave		South Approach Haydon St		Hourly Total
Period Start	Period End	Westbound	Eastbound	Northbound	Southbound	Westbound	Eastbound	
7:00	7:15	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	3
7:30	7:45	0	0	0	0	0	0	3
7:45	8:00	0	0	0	0	0	0	4
8:00	8:15	0	0	3	0	0	0	4
8:15	8:30	0	0	0	0	0	0	2
8:30	8:45	0	0	1	0	0	0	4
8:45	9:00	0	0	0	0	0	0	4
9:00	9:15	0	1	0	0	0	0	4
9:15	9:30	0	0	2	0	0	0	5
9:30	9:45	0	0	0	1	0	0	7
9:45	10:00	0	0	0	0	0	0	7
10:00	10:15	0	0	1	1	0	0	11
10:15	10:30	0	1	0	2	1	0	11
10:30	10:45	0	0	1	0	0	0	7
10:45	11:00	0	0	0	4	0	0	7
11:00	11:15	0	0	2	0	0	0	6
11:15	11:30	0	0	0	0	0	0	6
11:30	11:45	0	0	0	1	0	0	7
11:45	12:00	0	1	1	1	0	0	8
12:00	12:15	0	0	0	2	0	0	6
12:15	12:30	0	0	1	0	0	0	
12:30	12:45	0	0	2	0	0	0	
12:45	13:00	1	0	0	0	0	0	

Peak Time		North Approach Haydon St		East Approach Wilkinson Ave		South Approach Haydon St		Peak total
Period Start	Period End	Westbound	Eastbound	Northbound	Southbound	Westbound	Eastbound	
10:00	11:00	0	1	2	7	1	0	11
12:00	13:00	1	0	3	2	0	0	6

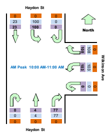
Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

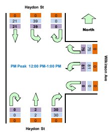
Graphic

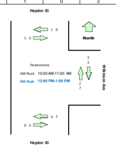
Total

Light

Heavy







Light Vehicles

Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	3	1	0	1	1	0	2	2
7:15	7:30	0	3	2	0	1	0	0	2	0
7:30	7:45	0	0	2	0	3	1	0	4	1
7:45	8:00	0	1	14	0	1	1	0	5	0
8:00	8:15	0	3	23	0	3	2	0	11	1
8:15	8:30	0	3	28	0	2	2	0	12	2
8:30	8:45	0	2	31	0	2	2	0	16	1
8:45	9:00	0	5	49	0	3	3	0	15	1
9:00	9:15	0	1	24	0	2	5	0	10	3
9:15	9:30	0	5	18	0	20	21	0	14	0
9:30	9:45	0	1	22	0	22	16	0	12	0
9:45	10:00	0	2	20	0	12	14	0	13	5
10:00	10:15	0	2	26	0	29	24	0	24	0
10:15	10:30	0	4	28	0	27	25	0	21	0
10:30	10:45	0	5	26	0	29	29	0	19	3
10:45	11:00	0	12	20	0	23	25	0	13	1
11:00	11:15	0	3	20	0	11	13	0	13	4
11:15	11:30	0	5	19	0	13	15	0	12	1
11:30	11:45	0	5	16	0	21	14	0	14	1
11:45	12:00	0	4	11	0	15	11	0	17	0
12:00	12:15	0	8	18	0	19	19	0	11	1
12:15	12:30	0	6	12	0	18	22	0	8	1
12:30	12:45	0	5	7	0	17	21	0	3	0
12:45	13:00	0	2	2	0	21	19	0	8	0

Peak Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
10:00	11:00	0	23	100	0	108	103	0	77	4	415
12:00	13:00	0	21	39	0	75	81	0	30	2	248

Heavy Vehicles

Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	0	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	1	0	0	0
8:00	8:15	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	0	0	0	0
9:30	9:45	0	0	0	0	0	0	0	0	0
9:45	10:00	0	0	0	0	0	0	0	0	0
10:00	10:15	0	0	0	0	0	0	0	0	0
10:15	10:30	0	0	0	0	0	0	0	0	0
10:30	10:45	0	0	0	0	0	0	0	0	0
10:45	11:00	0	0	0	0	0	0	0	0	0
11:00	11:15	0	0	0	0	0	0	0	0	0
11:15	11:30	0	0	0	0	0	0	0	0	0
11:30	11:45	0	0	0	0	0	0	0	0	0
11:45	12:00	0	0	0	0	0	0	0	0	0
12:00	12:15	0	0	0	0	0	0	0	0	0
12:15	12:30	0	0	0	0	0	0	0	0	0
12:30	12:45	0	0	0	0	0	0	0	0	0
12:45	13:00	0	0	0	0	0	0	0	0	0

Peak Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
10:00	11:00	0	0	0	0	0	0	0	0	0	0
12:00	13:00	0	0	0	0	0	0	0	0	0	0

Bus

Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	0	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	0	0	0	0
9:30	9:45	0	0	0	0	0	0	0	0	0
9:45	10:00	0	0	0	0	0	0	0	0	0
10:00	10:15	0	0	0	0	0	0	0	0	0
10:15	10:30	0	0	0	0	0	0	0	0	0
10:30	10:45	0	0	0	0	0	0	0	0	0
10:45	11:00	0	0	0	0	0	0	0	0	0
11:00	11:15	0	0	0	0	0	0	0	0	0
11:15	11:30	0	0	0	0	0	0	0	0	0
11:30	11:45	0	0	0	0	0	0	0	0	0
11:45	12:00	0	0	0	0	0	0	0	0	0
12:00	12:15	0	0	0	0	0	0	0	0	0
12:15	12:30	0	0	0	0	0	0	0	0	0
12:30	12:45	0	0	0	0	0	0	0	0	0
12:45	13:00	0	0	0	0	0	0	0	0	0

Peak Time		North Approach Haydon St			East Approach Wilkinson Ave			South Approach Haydon St			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
10:00	11:00	0	0	0	0	0	0	0	0	0	0
12:00	13:00	0	0	0	0	0	0	0	0	0	0

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

Intersection of Lorne St and New England Hw, Olympic Park

GPS -32.26973, 150.88819

Date:	Sat 11/05/19	**North:**	New England Hw	**Survey Period**	AM:	7:00 AM-12:00 PM
Weather:	Overcast	**East:**	Lorne St		PM:	12:00 PM-1:00 PM
Suburban:	Olympic Park	**South:**	New England Hw	**Traffic Peak**	AM:	10:00 AM-11:00 AM
Customer:	Cardno	**West:**	Lorne St		PM:	12:00 PM-1:00 PM

All Vehicles

Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
7:00	7:15	0	1	31	1	0	0	0	4	0	3	30	2	0	6	0	2	431	
7:15	7:30	0	1	45	1	0	0	0	3	0	0	35	5	0	2	1	2	521	
7:30	7:45	0	0	51	0	0	0	0	1	0	5	58	2	0	2	0	5	620	
7:45	8:00	0	4	52	2	0	0	0	3	1	3	57	4	0	3	0	3	692	
8:00	8:15	0	3	60	2	0	0	0	5	0	9	78	2	0	2	1	8	806	
8:15	8:30	0	4	84	3	0	1	0	4	0	10	71	2	0	4	1	10	857	
8:30	8:45	0	1	79	1	0	1	0	3	0	16	86	2	0	3	0	4	942	
8:45	9:00	0	1	100	6	0	2	0	6	0	8	111	3	0	1	2	6	1071	
9:00	9:15	0	3	86	3	0	1	0	5	0	10	95	4	0	4	0	10	1130	
9:15	9:30	0	6	109	2	0	1	0	25	0	12	105	8	0	4	0	7	1255	
9:30	9:45	0	4	128	5	0	2	0	15	1	7	142	7	0	5	0	9	1351	
9:45	10:00	0	4	122	2	0	1	1	14	0	15	123	6	0	6	1	10	1399	
10:00	10:15	0	4	143	4	0	0	0	26	0	20	124	8	0	4	0	13	1459	Peak
10:15	10:30	0	7	141	1	0	3	0	26	0	19	159	5	0	5	1	8	1426	
10:30	10:45	0	4	125	1	0	1	0	33	0	21	160	9	0	5	0	14	1403	
10:45	11:00	0	5	140	3	0	2	1	34	0	11	147	10	0	2	0	10	1371	
11:00	11:15	0	3	130	1	0	0	0	16	0	16	129	6	0	5	0	7	1362	
11:15	11:30	0	4	147	1	0	2	0	18	0	11	150	5	0	2	1	11	1400	
11:30	11:45	0	8	125	0	0	1	3	15	0	15	151	8	0	5	0	10	1347	
11:45	12:00	0	4	156	2	0	2	1	12	0	14	137	7	0	8	1	12	1259	
12:00	12:15	0	9	127	2	0	3	1	23	0	10	154	7	0	1	0	14	1162	
12:15	12:30	0	6	109	1	0	1	2	25	0	8	130	6	0	5	0	6		
12:30	12:45	0	5	100	0	0	0	0	26	0	3	100	9	0	3	0	7		
12:45	13:00	0	2	118	3	0	2	1	18	0	5	95	5	0	5	0	5		

Peak Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
10:00	11:00	0	20	549	9	0	6	1	119	0	71	590	32	0	16	1	45	1459
12:00	13:00	0	22	454	6	0	6	4	92	0	26	479	27	0	14	0	32	1162

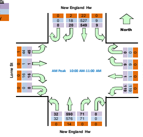
Pedestrians Crossing

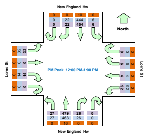
Time		North Approach New England Hw		East Approach Lorne St		South Approach New England Hw		West Approach Lorne St		Hourly Total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	
7:00	7:15	0	0	0	1	0	0	1	1	11
7:15	7:30	0	0	1	0	0	0	0	1	15
7:30	7:45	0	0	2	1	0	0	1	1	26
7:45	8:00	0	0	0	1	0	0	0	0	23
8:00	8:15	0	0	1	3	0	0	1	2	27
8:15	8:30	0	0	3	3	2	3	0	2	24
8:30	8:45	0	0	0	1	0	1	0	0	14
8:45	9:00	0	0	0	1	0	0	1	3	15
9:00	9:15	0	0	0	0	1	0	1	2	16
9:15	9:30	0	0	1	1	0	0	1	0	13
9:30	9:45	0	0	3	0	0	0	0	0	16
9:45	10:00	0	0	0	2	0	0	2	2	16
10:00	10:15	0	0	0	0	0	0	1	0	12
10:15	10:30	0	0	1	1	0	0	1	3	15
10:30	10:45	0	0	0	0	1	2	0	0	13
10:45	11:00	0	0	0	0	0	0	2	0	15
11:00	11:15	1	1	1	0	0	0	1	0	15
11:15	11:30	0	0	0	0	1	1	0	2	14
11:30	11:45	0	0	0	0	1	0	0	4	14
11:45	12:00	0	0	0	0	0	2	0	0	11
12:00	12:15	0	0	0	1	1	1	0	0	11
12:15	12:30	1	0	0	0	0	0	2	1	
12:30	12:45	0	0	0	0	1	1	0	0	
12:45	13:00	0	0	0	0	2	0	0	0	

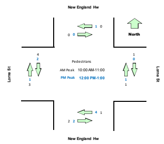
Peak Time		North Approach New England Hw		East Approach Lorne St		South Approach New England Hw		West Approach Lorne St		Peak hour total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	
10:00	11:00	0	0	1	1	1	2	4	3	12
12:00	13:00	1	0	0	1	4	2	2	1	11

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic: Total, Light, Heavy







Light Vehicles

Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	1	30	1	0	0	0	4	0	3	25	2	0	6	0	2
7:15	7:30	0	1	43	1	0	0	0	3	0	0	31	5	0	2	1	2
7:30	7:45	0	0	51	0	0	0	0	1	0	5	56	2	0	2	0	5
7:45	8:00	0	4	47	2	0	0	0	2	1	3	53	4	0	3	0	3
8:00	8:15	0	3	56	2	0	0	0	5	0	9	75	2	0	2	1	8
8:15	8:30	0	4	81	3	0	1	0	4	0	10	69	2	0	4	1	10
8:30	8:45	0	1	78	1	0	1	0	3	0	16	82	2	0	3	0	4
8:45	9:00	0	1	99	6	0	2	0	6	0	8	105	3	0	1	2	6
9:00	9:15	0	3	81	3	0	1	0	5	0	10	91	4	0	4	0	10
9:15	9:30	0	6	106	2	0	1	0	25	0	12	103	8	0	4	0	7
9:30	9:45	0	4	123	5	0	2	0	15	1	7	136	7	0	5	0	8
9:45	10:00	0	4	115	2	0	1	1	14	0	15	117	6	0	6	1	10
10:00	10:15	0	3	137	4	0	0	0	26	0	20	122	8	0	4	0	12
10:15	10:30	0	6	138	1	0	3	0	26	0	19	155	5	0	5	1	8
10:30	10:45	0	4	120	1	0	1	0	33	0	21	157	9	0	5	0	14
10:45	11:00	0	5	132	3	0	2	1	34	0	11	142	10	0	2	0	10
11:00	11:15	0	3	127	1	0	0	0	16	0	16	126	6	0	5	0	6
11:15	11:30	0	4	142	1	0	2	0	18	0	11	145	5	0	2	1	11
11:30	11:45	0	8	123	0	0	1	3	15	0	15	148	8	0	5	0	10
11:45	12:00	0	3	147	2	0	2	1	12	0	14	133	7	0	8	1	12
12:00	12:15	0	9	124	2	0	3	1	23	0	10	150	7	0	1	0	14
12:15	12:30	0	6	106	1	0	1	2	25	0	8	128	6	0	5	0	6
12:30	12:45	0	5	99	0	0	0	0	26	0	3	94	9	0	3	0	7
12:45	13:00	0	2	115	3	0	2	1	18	0	5	91	5	0	5	0	5

Peak Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
10:00	11:00	0	18	527	9	0	6	1	119	0	71	576	32	0	16	1	44	1420
12:00	13:00	0	22	444	6	0	6	4	92	0	26	463	27	0	14	0	32	1136

Heavy Vehicles

Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	0	1	0	0	0	0	0	0	0	5	0	0	0	0	0
7:15	7:30	0	0	2	0	0	0	0	0	0	0	4	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
7:45	8:00	0	0	5	0	0	0	0	1	0	0	4	0	0	0	0	0
8:00	8:15	0	0	4	0	0	0	0	0	0	0	3	0	0	0	0	0
8:15	8:30	0	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0
8:30	8:45	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0
8:45	9:00	0	0	1	0	0	0	0	0	0	0	6	0	0	0	0	0
9:00	9:15	0	0	5	0	0	0	0	0	0	0	4	0	0	0	0	0
9:15	9:30	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0
9:30	9:45	0	0	5	0	0	0	0	0	0	0	6	0	0	0	0	0
9:45	10:00	0	0	7	0	0	0	0	0	0	0	5	0	0	0	0	0
10:00	10:15	0	1	6	0	0	0	0	0	0	0	2	0	0	0	0	1
10:15	10:30	0	0	3	0	0	0	0	0	0	0	4	0	0	0	0	0
10:30	10:45	0	0	4	0	0	0	0	0	0	0	3	0	0	0	0	0
10:45	11:00	0	0	8	0	0	0	0	0	0	0	5	0	0	0	0	0
11:00	11:15	0	0	2	0	0	0	0	0	0	0	3	0	0	0	0	0
11:15	11:30	0	0	5	0	0	0	0	0	0	0	4	0	0	0	0	0
11:30	11:45	0	0	2	0	0	0	0	0	0	0	3	0	0	0	0	0
11:45	12:00	0	0	8	0	0	0	0	0	0	0	4	0	0	0	0	0
12:00	12:15	0	0	3	0	0	0	0	0	0	0	4	0	0	0	0	0
12:15	12:30	0	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0
12:30	12:45	0	0	1	0	0	0	0	0	0	0	6	0	0	0	0	0
12:45	13:00	0	0	3	0	0	0	0	0	0	0	4	0	0	0	0	0

Peak Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
10:00	11:00	0	2	22	0	0	0	0	0	0	0	14	0	0	0	0	1	39
12:00	13:00	0	0	10	0	0	0	0	0	0	0	16	0	0	0	0	0	26

Bus

Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
9:30	9:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
9:45	10:00	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
10:00	10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	10:30	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	10:45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	11:15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
11:15	11:30	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
11:30	11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	12:00	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Time		North Approach New England Hw				East Approach Lorne St				South Approach New England Hw				West Approach Lorne St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
10:00	11:00	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
12:00	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TRANS TRAFFIC SURVEY
TURNING MOVEMENT SURVEY

Intersection of Wilder St and New England Hw, Olympic Park

GPS -32.27127, 150.88957

Date:	Sat 11/05/19
Weather:	Overcast
Suburban:	Olympic Park
Customer:	Cardno

North:	New England Hw
East:	Wilder St
South:	Maitland St
West:	Francis St

Survey Period	AM:	7:00 AM-12:00 PM
	PM:	12:00 PM-1:00 PM
Traffic Peak	AM:	11:15 AM-12:15 PM
	PM:	12:00 PM-1:00 PM

All Vehicles

Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
7:00	7:15	0	0	40	0	0	0	0	0	0	0	35	2	0	3	0	0	424	
7:15	7:30	0	0	50	0	0	0	0	0	0	0	41	0	0	0	0	0	501	
7:30	7:45	0	0	54	0	0	0	0	0	0	0	63	0	0	0	0	2	587	
7:45	8:00	0	0	57	0	0	0	0	3	0	0	65	4	0	4	0	1	665	
8:00	8:15	0	0	64	0	0	3	0	0	0	0	84	4	0	0	0	2	761	
8:15	8:30	0	0	91	1	0	1	0	0	0	0	77	2	0	1	0	4	819	
8:30	8:45	0	0	86	0	0	1	0	2	0	0	98	2	0	4	0	4	900	
8:45	9:00	1	0	106	0	0	0	0	0	0	0	116	0	0	0	0	7	1024	
9:00	9:15	0	2	95	2	0	1	0	3	0	0	102	0	0	4	0	6	1089	
9:15	9:30	0	0	130	0	0	3	0	0	0	1	120	0	0	1	0	3	1205	
9:30	9:45	0	5	148	0	0	1	0	2	0	0	149	2	0	5	0	9	1291	
9:45	10:00	0	1	132	0	0	0	0	4	0	4	139	4	0	5	0	6	1299	
10:00	10:15	0	4	165	0	0	3	0	3	0	2	145	4	0	2	0	3	1355	
10:15	10:30	0	2	164	2	0	1	0	2	0	1	161	2	0	3	0	6	1345	
10:30	10:45	0	3	135	2	0	2	0	2	0	2	168	6	0	1	0	8	1344	
10:45	11:00	0	6	167	0	0	1	1	2	0	0	159	4	0	3	0	8	1349	
11:00	11:15	0	3	151	0	0	0	0	2	0	0	145	14	0	3	0	3	1335	
11:15	11:30	0	5	162	0	0	3	0	3	0	0	156	2	0	4	0	8	1356	Peak
11:30	11:45	0	4	143	0	0	1	0	0	0	4	167	6	0	1	0	8	1310	
11:45	12:00	0	2	171	0	0	3	0	0	0	1	147	6	0	1	0	6	1222	
12:00	12:15	0	4	144	4	0	4	0	2	0	3	163	8	0	3	0	7	1144	
12:15	12:30	0	3	140	1	0	1	0	2	0	0	143	6	0	1	0	0		
12:30	12:45	0	4	125	0	0	0	0	0	0	0	112	2	0	1	0	2		
12:45	13:00	0	7	138	1	0	0	0	1	0	0	105	5	0	1	0	1		

Peak Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
11:15	12:15	0	15	620	4	0	11	0	5	0	8	633	22	0	9	0	29	1356
12:00	13:00	0	18	547	6	0	5	0	5	0	3	523	21	0	6	0	10	1144

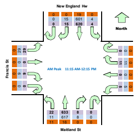
Pedestrians Crossing

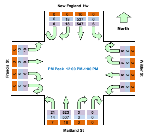
Time		North Approach New England Hw		East Approach Wilder St		South Approach Maitland St		West Approach Francis St		Hourly Total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	
7:00	7:15	0	1	0	0	0	0	1	1	18
7:15	7:30	0	0	3	0	0	0	0	2	22
7:30	7:45	0	0	1	3	0	0	1	0	23
7:45	8:00	1	0	1	2	0	0	0	1	21
8:00	8:15	0	0	2	0	0	0	2	3	21
8:15	8:30	0	0	1	2	0	0	1	2	15
8:30	8:45	0	0	1	0	0	0	2	0	16
8:45	9:00	0	0	1	1	0	0	0	3	17
9:00	9:15	0	0	1	0	0	0	0	0	14
9:15	9:30	0	0	1	2	0	0	2	2	15
9:30	9:45	0	0	4	0	0	0	0	0	12
9:45	10:00	0	0	0	0	0	0	0	2	14
10:00	10:15	0	0	0	0	0	0	2	0	15
10:15	10:30	0	0	1	1	0	0	0	2	14
10:30	10:45	0	0	1	1	0	0	2	2	14
10:45	11:00	0	0	0	0	0	0	2	1	13
11:00	11:15	0	0	0	0	0	0	1	0	11
11:15	11:30	0	0	0	0	0	0	1	3	11
11:30	11:45	0	0	0	0	0	0	1	4	9
11:45	12:00	0	0	1	0	0	0	0	0	4
12:00	12:15	0	0	0	1	0	0	0	0	3
12:15	12:30	0	0	1	0	0	0	1	0	
12:30	12:45	0	0	0	0	0	0	0	0	
12:45	13:00	0	0	0	0	0	0	0	0	

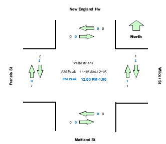
Peak Time		North Approach New England Hw		East Approach Wilder St		South Approach Maitland St		West Approach Francis St		Peak hour total
Period Start	Period End	Westbound	Eastbound	Southbound	Northbound	Westbound	Eastbound	Southbound	Northbound	
11:15	12:15	0	0	1	1	0	0	2	7	11
12:00	13:00	0	0	1	1	0	0	1	0	3

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.

Graphic
Total
Light
Heavy







Light Vehicles

Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	0	39	0	0	0	0	0	0	0	30	1	0	3	0	0
7:15	7:30	0	0	48	0	0	0	0	0	0	0	37	0	0	0	0	0
7:30	7:45	0	0	54	0	0	0	0	0	0	0	61	0	0	0	0	2
7:45	8:00	0	0	52	0	0	0	0	3	0	0	61	2	0	4	0	1
8:00	8:15	0	0	60	0	0	3	0	0	0	0	81	2	0	0	0	2
8:15	8:30	0	0	88	1	0	1	0	0	0	0	75	1	0	1	0	4
8:30	8:45	0	0	85	0	0	1	0	2	0	0	94	1	0	4	0	4
8:45	9:00	1	0	105	0	0	0	0	0	0	0	110	0	0	0	0	7
9:00	9:15	0	2	90	2	0	1	0	3	0	0	98	0	0	4	0	6
9:15	9:30	0	0	127	0	0	3	0	0	0	1	118	0	0	1	0	3
9:30	9:45	0	5	143	0	0	1	0	2	0	0	143	1	0	5	0	9
9:45	10:00	0	1	125	0	0	0	0	4	0	4	133	2	0	5	0	6
10:00	10:15	0	4	159	0	0	3	0	3	0	2	143	2	0	2	0	3
10:15	10:30	0	2	161	2	0	1	0	2	0	1	157	1	0	3	0	6
10:30	10:45	0	3	130	2	0	2	0	2	0	2	165	3	0	1	0	8
10:45	11:00	0	5	160	0	0	1	1	2	0	0	154	2	0	3	0	8
11:00	11:15	0	3	148	0	0	0	0	2	0	0	142	7	0	3	0	3
11:15	11:30	0	5	157	0	0	3	0	3	0	0	151	1	0	4	0	8
11:30	11:45	0	4	141	0	0	1	0	0	0	4	164	3	0	1	0	8
11:45	12:00	0	2	162	0	0	3	0	0	0	1	143	3	0	1	0	6
12:00	12:15	0	4	141	4	0	4	0	2	0	3	159	4	0	3	0	7
12:15	12:30	0	3	137	1	0	1	0	2	0	0	141	3	0	1	0	0
12:30	12:45	0	4	124	0	0	0	0	0	0	0	106	2	0	1	0	2
12:45	13:00	0	7	135	1	0	0	0	1	0	0	101	5	0	1	0	1

Peak Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
11:15	12:15	0	15	601	4	0	11	0	5	0	8	617	11	0	9	0	29	1310
12:00	13:00	0	18	537	6	0	5	0	5	0	3	507	14	0	6	0	10	1111

Heavy Vehicles

Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	0	1	0	0	0	0	0	0	0	5	1	0	0	0	0
7:15	7:30	0	0	2	0	0	0	0	0	0	0	4	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
7:45	8:00	0	0	5	0	0	0	0	0	0	0	4	2	0	0	0	0
8:00	8:15	0	0	4	0	0	0	0	0	0	0	3	2	0	0	0	0
8:15	8:30	0	0	3	0	0	0	0	0	0	0	2	1	0	0	0	0
8:30	8:45	0	0	1	0	0	0	0	0	0	0	4	1	0	0	0	0
8:45	9:00	0	0	1	0	0	0	0	0	0	0	6	0	0	0	0	0
9:00	9:15	0	0	5	0	0	0	0	0	0	0	4	0	0	0	0	0
9:15	9:30	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0
9:30	9:45	0	0	5	0	0	0	0	0	0	0	6	1	0	0	0	0
9:45	10:00	0	0	7	0	0	0	0	0	0	0	5	2	0	0	0	0
10:00	10:15	0	0	6	0	0	0	0	0	0	0	2	2	0	0	0	0
10:15	10:30	0	0	3	0	0	0	0	0	0	0	4	1	0	0	0	0
10:30	10:45	0	0	4	0	0	0	0	0	0	0	3	3	0	0	0	0
10:45	11:00	0	1	7	0	0	0	0	0	0	0	5	2	0	0	0	0
11:00	11:15	0	0	2	0	0	0	0	0	0	0	3	7	0	0	0	0
11:15	11:30	0	0	5	0	0	0	0	0	0	0	4	1	0	0	0	0
11:30	11:45	0	0	2	0	0	0	0	0	0	0	3	3	0	0	0	0
11:45	12:00	0	0	8	0	0	0	0	0	0	0	4	3	0	0	0	0
12:00	12:15	0	0	3	0	0	0	0	0	0	0	4	4	0	0	0	0
12:15	12:30	0	0	3	0	0	0	0	0	0	0	2	3	0	0	0	0
12:30	12:45	0	0	1	0	0	0	0	0	0	0	6	0	0	0	0	0
12:45	13:00	0	0	3	0	0	0	0	0	0	0	4	0	0	0	0	0

Peak Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
11:15	12:15	0	0	19	0	0	0	0	0	0	0	16	11	0	0	0	0	46
12:00	13:00	0	0	10	0	0	0	0	0	0	0	16	7	0	0	0	0	33

Bus

Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
7:00	7:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
9:30	9:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:45	10:00	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
10:00	10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15	10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	10:45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	11:15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	11:30	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
11:30	11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45	12:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	12:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30	12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak Time		North Approach New England Hw				East Approach Wilder St				South Approach Maitland St				West Approach Francis St				Peak total
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	
11:15	12:15	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	2
12:00	13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

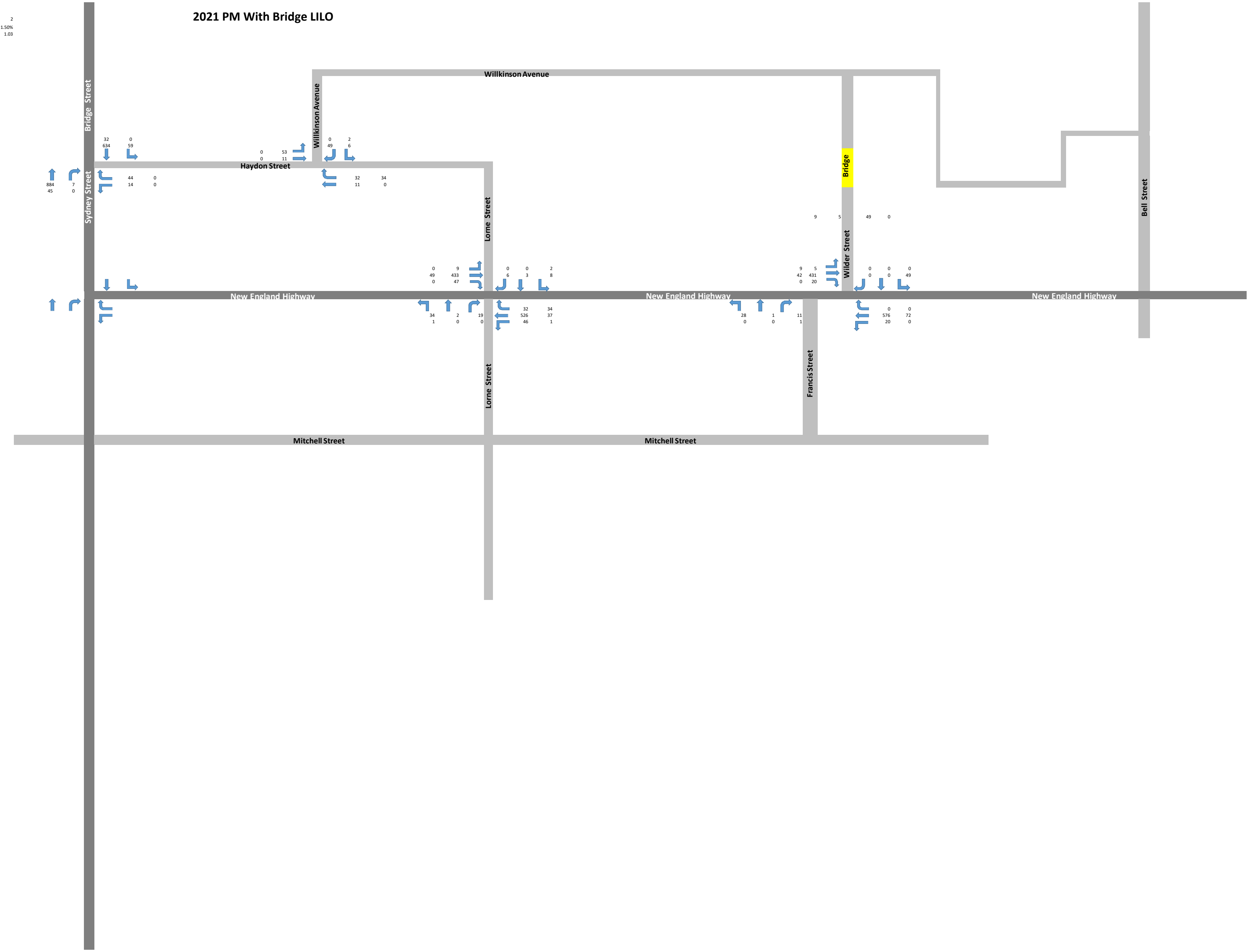
APPENDIX

B

SPREADSHEET DIAGRAMS

Years	2
Growth Rate	1.50%
Factor	1.03

2021 PM With Bridge LILO

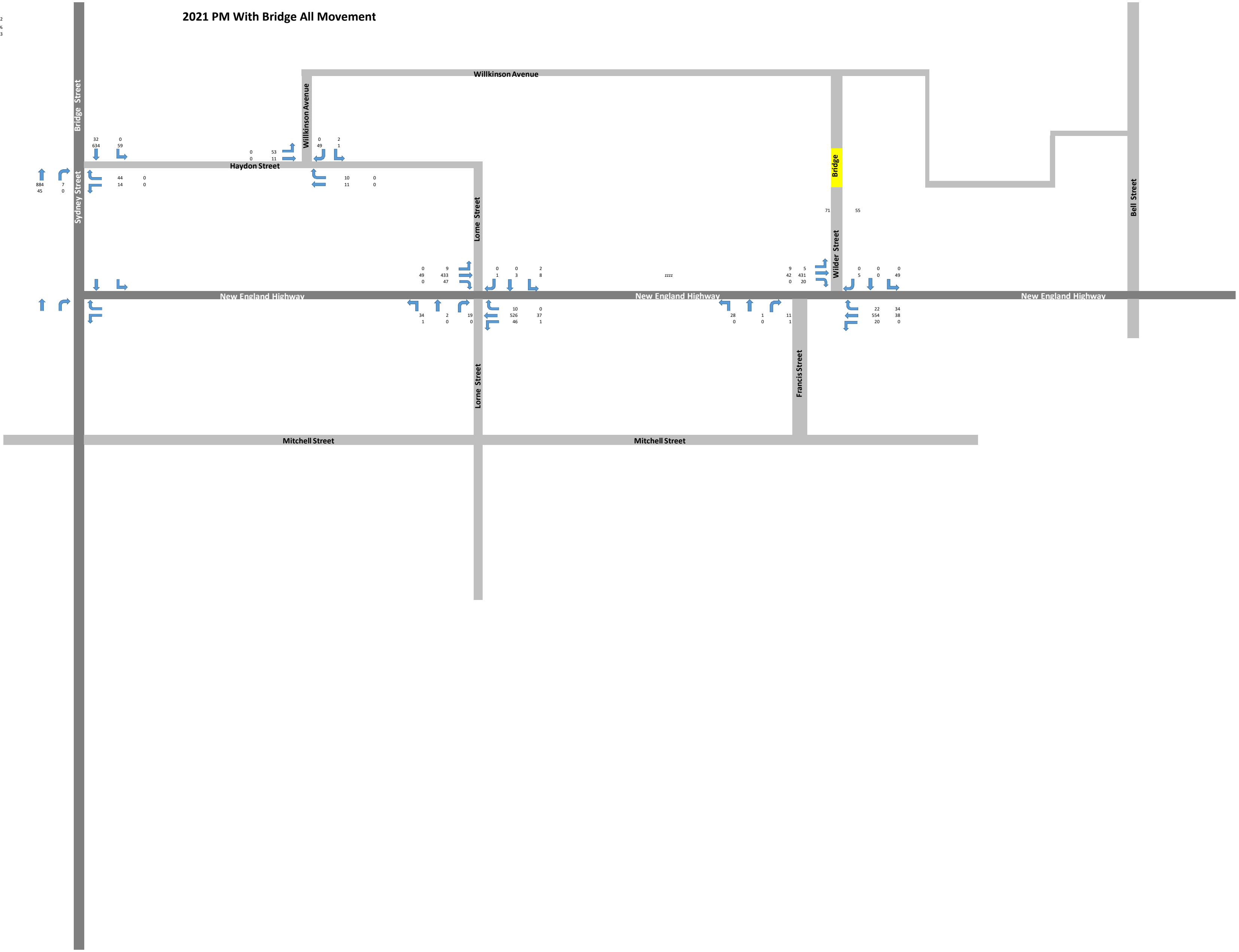


2031 PM With Bridge LILO

Years	12
Growth Rate	1.50%
Factor	1.18

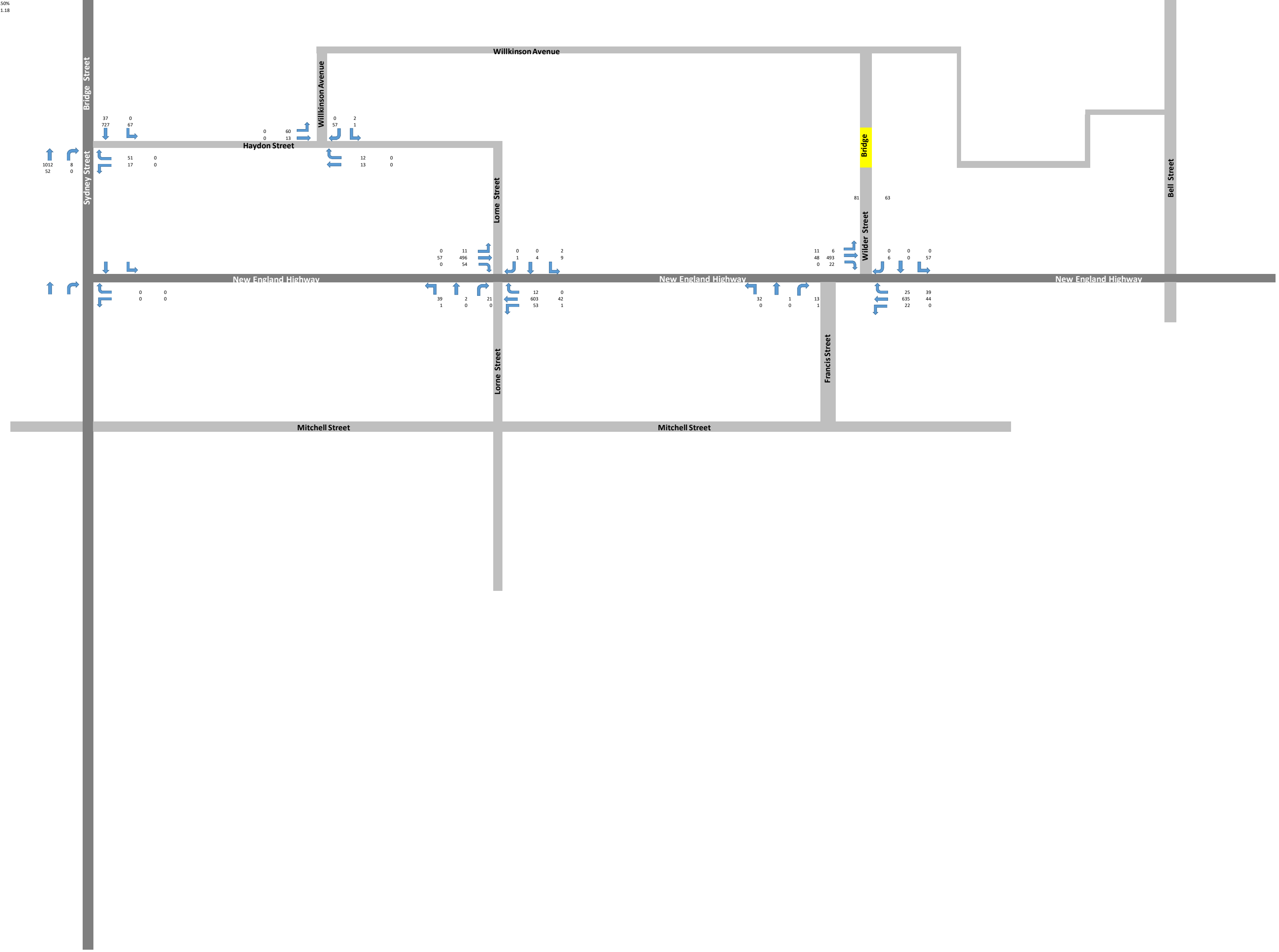
Years	2
Growth Rate	1.50%
Factor	1.03

2021 PM With Bridge All Movement



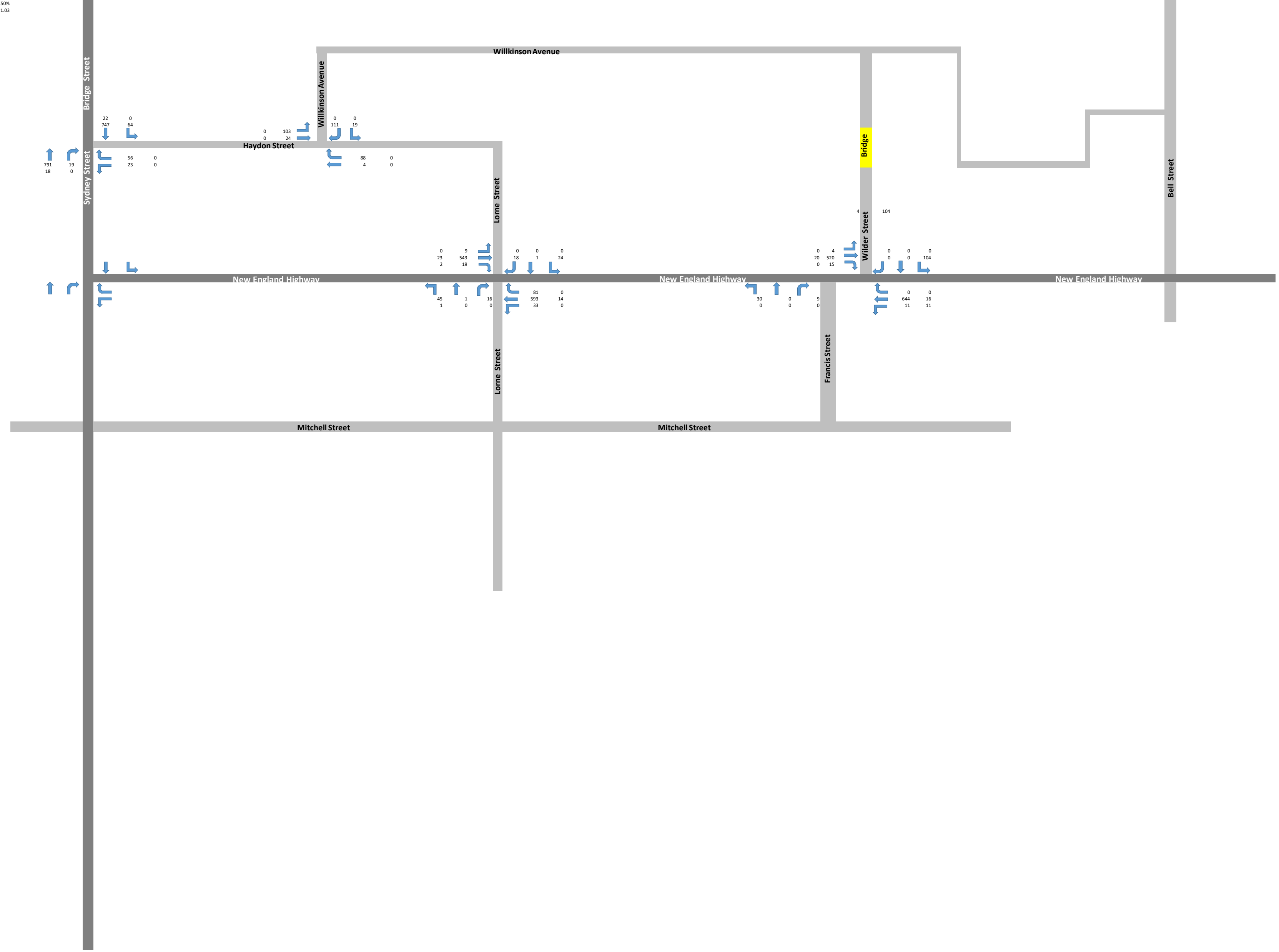
Years	12
Growth Rate	1.50%
Factor	1.18

2031 PM With Bridge All Movement



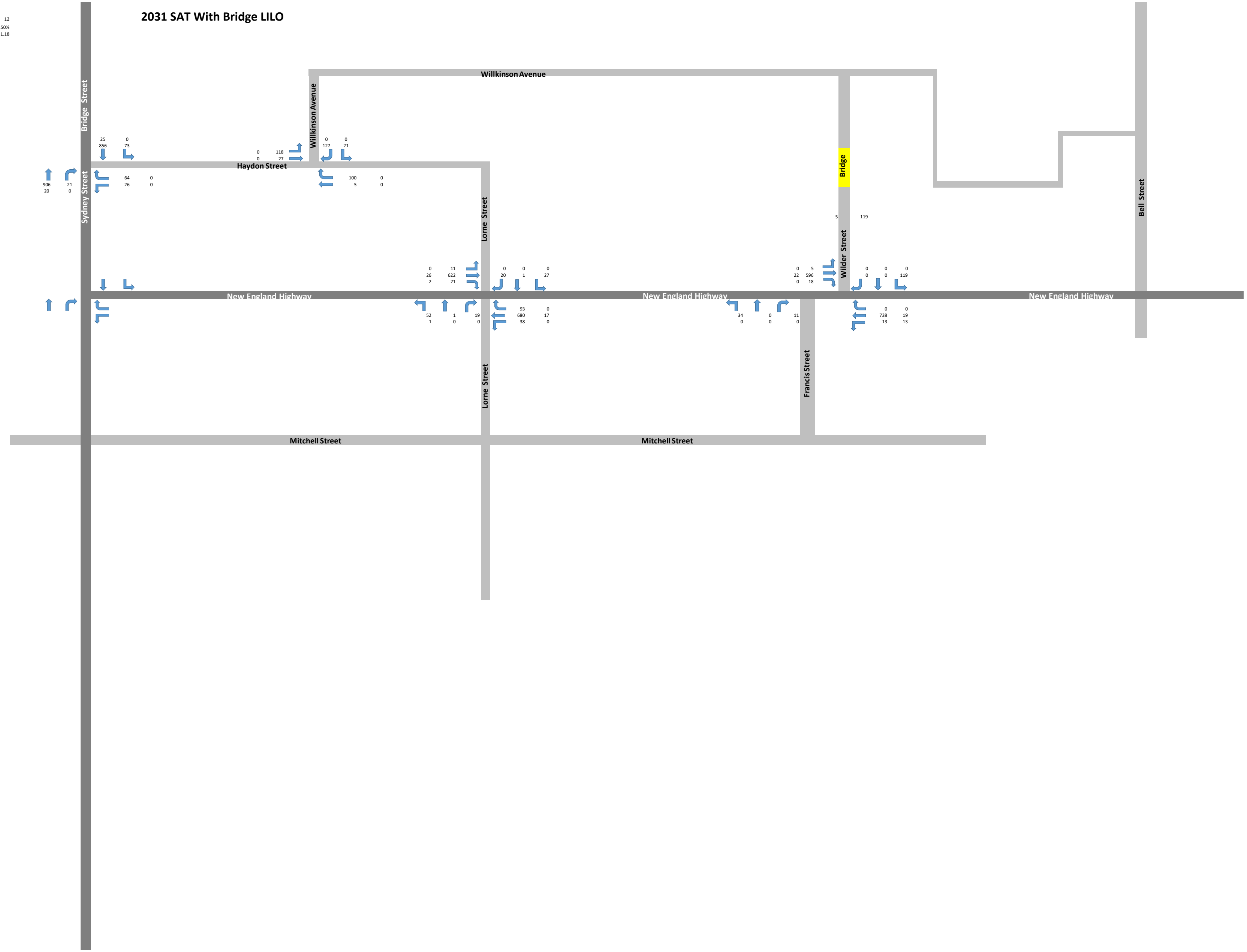
Years	2
Growth Rate	1.50%
Factor	1.03

2021 SAT With Bridge LILO



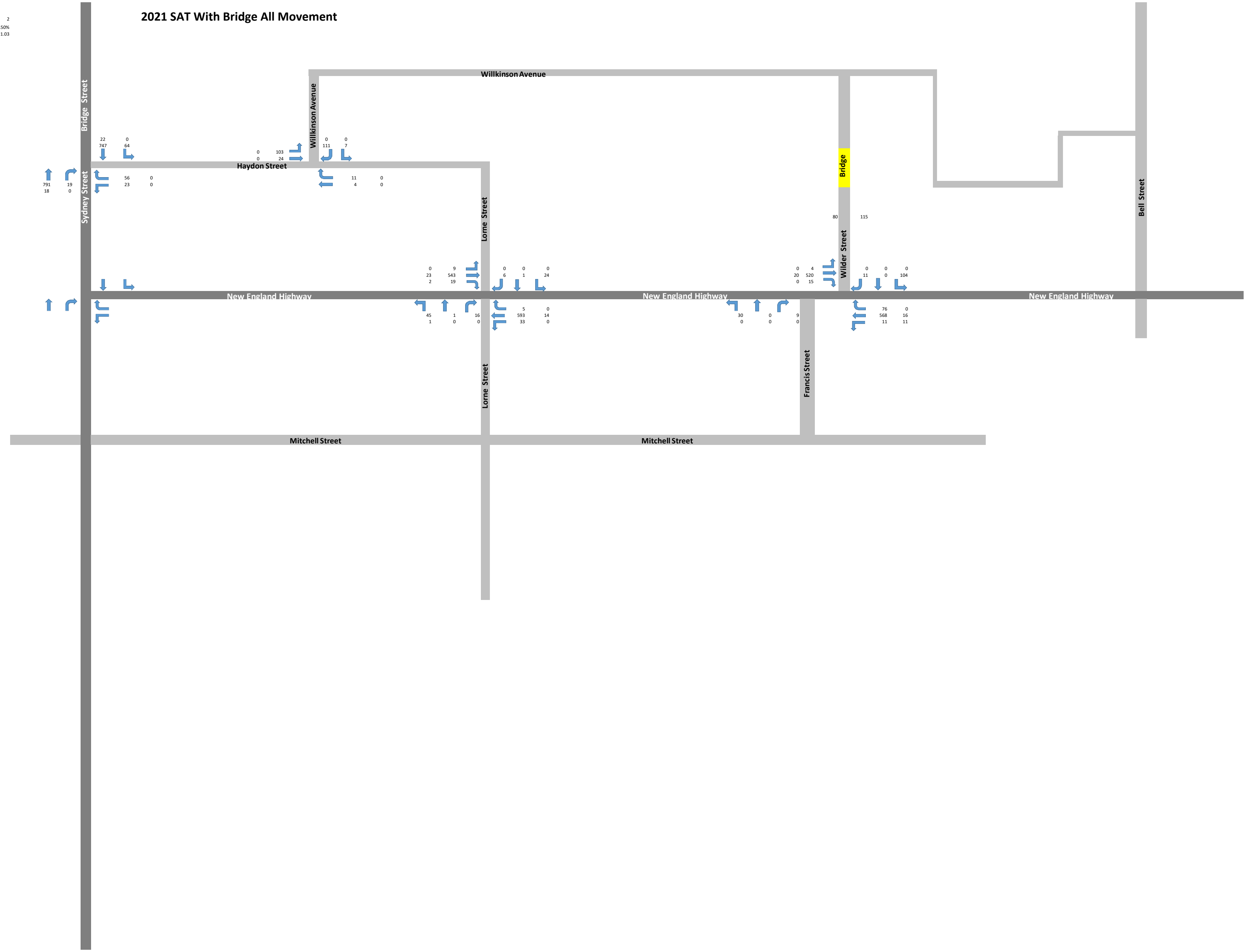
Years	12
Growth Rate	1.50%
Factor	1.18

2031 SAT With Bridge LILO



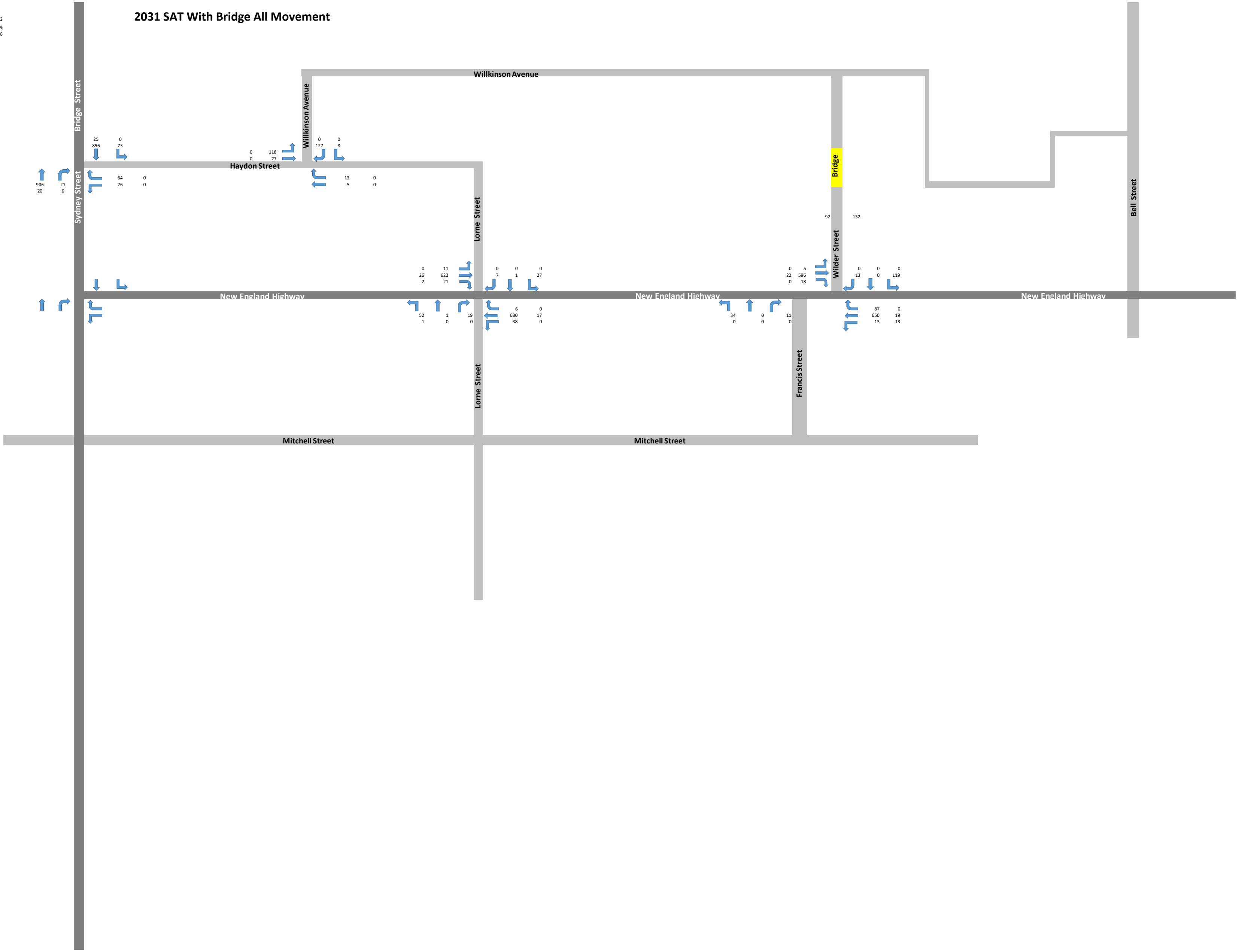
Years	2
Growth Rate	1.50%
Factor	1.03

2021 SAT With Bridge All Movement



Years	12
Growth Rate	1.50%
Factor	1.18

2031 SAT With Bridge All Movement



APPENDIX

C

SIDRA RESULTS 2019 BASE

MOVEMENT SUMMARY

Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	15	0.0	0.423	14.4	LOS A	1.3	9.2	0.92	1.02	1.14	33.6
3a	R1	45	0.0	0.423	41.6	LOS C	1.3	9.2	0.92	1.02	1.14	33.4
Approach		60	0.0	0.423	34.9	LOS C	1.3	9.2	0.92	1.02	1.14	33.5
NorthEast: Bridge St												
24a	L1	60	0.0	0.422	4.5	LOS A	3.0	21.7	0.06	0.50	0.06	46.3
26a	R1	681	4.8	0.422	4.1	LOS A	3.0	21.7	0.06	0.50	0.06	46.4
Approach		741	4.4	0.422	4.2	NA	3.0	21.7	0.06	0.50	0.06	46.4
West: Sydney St												
10a	L1	949	4.9	0.518	4.5	LOS A	0.1	0.6	0.00	0.55	0.00	46.2
12	R2	7	0.0	0.518	4.9	LOS A	0.1	0.6	0.00	0.55	0.00	46.2
Approach		957	4.8	0.518	4.5	NA	0.1	0.6	0.00	0.55	0.00	46.2
All Vehicles		1758	4.5	0.518	5.4	NA	3.0	21.7	0.06	0.54	0.07	45.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	23	0.0	0.463	15.1	LOS B	1.5	10.8	0.91	1.04	1.19	35.0
3a	R1	57	0.0	0.463	36.9	LOS C	1.5	10.8	0.91	1.04	1.19	34.8
Approach		80	0.0	0.463	30.6	LOS C	1.5	10.8	0.91	1.04	1.19	34.9
NorthEast: Bridge St												
24a	L1	65	0.0	0.484	4.5	LOS A	3.7	26.6	0.12	0.49	0.12	46.2
26a	R1	785	2.8	0.484	4.2	LOS A	3.7	26.6	0.12	0.49	0.12	46.3
Approach		851	2.6	0.484	4.2	NA	3.7	26.6	0.12	0.49	0.12	46.3
West: Sydney St												
10a	L1	826	2.2	0.450	4.5	LOS A	0.2	1.3	0.01	0.54	0.01	46.2
12	R2	19	0.0	0.450	4.9	LOS A	0.2	1.3	0.01	0.54	0.01	46.2
Approach		845	2.1	0.450	4.5	NA	0.2	1.3	0.01	0.54	0.01	46.2
All Vehicles		1776	2.3	0.484	5.5	NA	3.7	26.6	0.11	0.54	0.12	45.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [New England Hwy/ Lorne St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles													
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	34	0.0	0.219	4.6	LOS A	0.0	0.0	0.00	0.04	0.00	49.2
2	T1	621	2.4	0.219	0.7	LOS A	1.1	7.5	0.14	0.09	0.14	49.0
3	R2	75	0.0	0.219	8.4	LOS A	1.1	7.5	0.37	0.17	0.37	47.1
Approach		729	2.0	0.219	1.7	NA	1.1	7.5	0.16	0.10	0.16	48.8
NorthEast: Lorne St												
4	L2	125	0.0	0.205	6.1	LOS A	0.7	5.1	0.49	0.66	0.49	44.5
5	T1	1	0.0	0.205	37.1	LOS C	0.7	5.1	0.49	0.66	0.49	44.8
6	R2	6	0.0	0.205	49.5	LOS D	0.7	5.1	0.49	0.66	0.49	44.3
Approach		133	0.0	0.205	8.4	LOS A	0.7	5.1	0.49	0.66	0.49	44.4
NorthWest: New England Hwy												
7	L2	11	10.0	0.172	4.7	LOS A	0.0	0.0	0.00	0.02	0.00	49.2
8	T1	578	4.0	0.172	0.4	LOS A	0.4	3.1	0.07	0.03	0.07	49.5
9	R2	21	10.0	0.172	9.6	LOS A	0.4	3.1	0.15	0.05	0.15	48.2
Approach		609	4.3	0.172	0.8	NA	0.4	3.1	0.07	0.03	0.07	49.4
SouthWest: Lorne St												
10	L2	47	2.2	0.285	8.4	LOS A	1.0	7.1	0.71	0.85	0.82	38.2
11	T1	1	0.0	0.285	35.8	LOS C	1.0	7.1	0.71	0.85	0.82	38.5
12	R2	17	0.0	0.285	58.2	LOS E	1.0	7.1	0.71	0.85	0.82	38.1
Approach		65	1.6	0.285	21.7	LOS B	1.0	7.1	0.71	0.85	0.82	38.2
All Vehicles		1537	2.7	0.285	2.7	NA	1.1	7.5	0.17	0.15	0.18	48.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [New England Hwy/ Lorne St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	48	2.2	0.186	4.6	LOS A	0.0	0.0	0.00	0.08	0.00	49.0
2	T1	576	6.6	0.186	0.3	LOS A	0.4	3.2	0.07	0.07	0.07	49.3
3	R2	31	0.0	0.186	7.7	LOS A	0.4	3.2	0.15	0.06	0.15	48.4
Approach		655	5.9	0.186	1.0	NA	0.4	3.2	0.07	0.07	0.07	49.3
NorthEast: Lorne St												
4	L2	55	3.8	0.085	6.0	LOS A	0.3	2.1	0.45	0.62	0.45	44.8
5	T1	3	0.0	0.085	27.5	LOS B	0.3	2.1	0.45	0.62	0.45	45.2
6	R2	1	0.0	0.085	34.5	LOS C	0.3	2.1	0.45	0.62	0.45	44.7
Approach		59	3.6	0.085	7.7	LOS A	0.3	2.1	0.45	0.62	0.45	44.8
NorthWest: New England Hwy												
7	L2	9	0.0	0.170	4.6	LOS A	0.0	0.0	0.00	0.02	0.00	49.4
8	T1	493	10.3	0.170	0.6	LOS A	0.7	5.4	0.12	0.07	0.12	49.1
9	R2	48	0.0	0.170	8.6	LOS A	0.7	5.4	0.32	0.14	0.32	47.3
Approach		551	9.2	0.170	1.4	NA	0.7	5.4	0.14	0.07	0.14	49.0
SouthWest: Lorne St												
10	L2	36	2.9	0.214	6.0	LOS A	0.7	4.9	0.65	0.75	0.65	40.1
11	T1	2	0.0	0.214	26.4	LOS B	0.7	4.9	0.65	0.75	0.65	40.4
12	R2	19	0.0	0.214	37.4	LOS C	0.7	4.9	0.65	0.75	0.65	40.0
Approach		57	1.9	0.214	17.2	LOS B	0.7	4.9	0.65	0.75	0.65	40.1
All Vehicles		1321	7.0	0.214	2.1	NA	0.7	5.4	0.14	0.12	0.14	48.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	20	0.0	0.223	4.6	LOS A	0.0	0.0	0.00	0.04	0.00	49.7
2	T1	625	6.2	0.223	1.4	LOS A	1.4	11.3	0.13	0.04	0.13	48.9
3	R2	37	94.3	0.223	14.3	LOS A	1.4	11.3	0.35	0.05	0.36	45.1
Approach		682	10.8	0.223	2.2	NA	1.4	11.3	0.14	0.04	0.14	48.7
NorthEast: Wilder St												
4	L2	6	0.0	0.065	5.7	LOS A	0.2	1.4	0.70	0.75	0.70	38.5
5	T1	1	0.0	0.065	30.6	LOS C	0.2	1.4	0.70	0.75	0.70	40.9
6	R2	5	0.0	0.065	38.9	LOS C	0.2	1.4	0.70	0.75	0.70	38.4
Approach		13	0.0	0.065	21.6	LOS B	0.2	1.4	0.70	0.75	0.70	38.6
NorthWest: New England Hwy												
7	L2	15	64.3	0.163	5.1	LOS A	0.0	0.0	0.00	0.03	0.00	48.4
8	T1	527	8.2	0.163	0.3	LOS A	0.3	2.6	0.06	0.04	0.06	49.7
9	R2	20	0.0	0.163	9.8	LOS A	0.3	2.6	0.14	0.05	0.14	52.2
Approach		562	9.4	0.163	0.8	NA	0.3	2.6	0.07	0.04	0.07	49.7
SouthWest: Francis Street												
10	L2	28	0.0	0.174	7.4	LOS A	0.6	3.9	0.70	0.80	0.70	44.5
11	T1	1	0.0	0.174	31.8	LOS C	0.6	3.9	0.70	0.80	0.70	44.8
12	R2	13	8.3	0.174	45.6	LOS D	0.6	3.9	0.70	0.80	0.70	44.1
Approach		42	2.5	0.174	19.5	LOS B	0.6	3.9	0.70	0.80	0.70	44.4
All Vehicles		1299	9.8	0.223	2.3	NA	1.4	11.3	0.13	0.07	0.13	48.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	23	50.0	0.188	5.1	LOS A	0.0	0.0	0.00	0.05	0.00	49.0
2	T1	666	2.5	0.188	0.2	LOS A	0.2	1.1	0.02	0.03	0.02	49.9
3	R2	8	0.0	0.188	9.0	LOS A	0.2	1.1	0.05	0.01	0.05	49.0
Approach		698	4.1	0.188	0.4	NA	0.2	1.1	0.02	0.03	0.02	49.9
NorthEast: Wilder St												
4	L2	5	0.0	0.144	6.1	LOS A	0.4	3.0	0.84	0.88	0.84	34.4
5	T1	1	0.0	0.144	34.8	LOS C	0.4	3.0	0.84	0.88	0.84	36.3
6	R2	12	0.0	0.144	44.8	LOS D	0.4	3.0	0.84	0.88	0.84	34.3
Approach		18	0.0	0.144	32.8	LOS C	0.4	3.0	0.84	0.88	0.84	34.4
NorthWest: New England Hwy												
7	L2	4	0.0	0.184	4.6	LOS A	0.0	0.0	0.00	0.01	0.00	49.4
8	T1	653	3.1	0.184	0.3	LOS A	0.3	2.2	0.05	0.02	0.05	49.8
9	R2	16	0.0	0.184	10.3	LOS A	0.3	2.2	0.10	0.03	0.10	52.4
Approach		673	3.0	0.184	0.5	NA	0.3	2.2	0.05	0.02	0.05	49.8
SouthWest: Francis Street												
10	L2	31	0.0	0.143	7.0	LOS A	0.4	3.1	0.64	0.74	0.64	46.1
11	T1	1	0.0	0.143	35.0	LOS C	0.4	3.1	0.64	0.74	0.64	46.5
12	R2	9	0.0	0.143	45.7	LOS D	0.4	3.1	0.64	0.74	0.64	45.9
Approach		41	0.0	0.143	16.6	LOS B	0.4	3.1	0.64	0.74	0.64	46.1
All Vehicles		1429	3.4	0.188	1.3	NA	0.4	3.1	0.06	0.06	0.06	49.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	4	0.0	0.053	0.4	LOS A	0.2	1.7	0.24	0.50	0.24	46.7
3	R2	81	0.0	0.053	4.9	LOS A	0.2	1.7	0.24	0.50	0.24	45.8
Approach		85	0.0	0.053	4.7	NA	0.2	1.7	0.24	0.50	0.24	45.9
East: Wilkinson Ave												
4	L2	108	0.0	0.169	4.6	LOS A	0.7	4.7	0.09	0.53	0.09	46.4
6	R2	114	0.0	0.169	5.2	LOS A	0.7	4.7	0.09	0.53	0.09	46.0
Approach		222	0.0	0.169	4.9	LOS A	0.7	4.7	0.09	0.53	0.09	46.2
North: Haydon St												
7	L2	105	0.0	0.069	4.6	LOS A	0.0	0.0	0.00	0.43	0.00	47.1
8	T1	24	0.0	0.069	0.0	LOS A	0.0	0.0	0.00	0.43	0.00	47.6
Approach		129	0.0	0.069	3.7	NA	0.0	0.0	0.00	0.43	0.00	47.2
All Vehicles		437	0.0	0.169	4.5	NA	0.7	4.7	0.09	0.50	0.09	46.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	12	0.0	0.024	0.2	LOS A	0.1	0.8	0.15	0.38	0.15	47.5
3	R2	31	0.0	0.024	4.7	LOS A	0.1	0.8	0.15	0.38	0.15	46.6
Approach		42	0.0	0.024	3.5	NA	0.1	0.8	0.15	0.38	0.15	46.8
East: Wilkinson Ave												
4	L2	47	4.4	0.072	4.6	LOS A	0.3	1.9	0.05	0.53	0.05	46.4
6	R2	51	0.0	0.072	4.8	LOS A	0.3	1.9	0.05	0.53	0.05	46.1
Approach		98	2.2	0.072	4.7	LOS A	0.3	1.9	0.05	0.53	0.05	46.3
North: Haydon St												
7	L2	54	0.0	0.035	4.6	LOS A	0.0	0.0	0.00	0.44	0.00	47.1
8	T1	12	0.0	0.035	0.0	LOS A	0.0	0.0	0.00	0.44	0.00	47.6
Approach		65	0.0	0.035	3.8	NA	0.0	0.0	0.00	0.44	0.00	47.2
All Vehicles		205	1.0	0.072	4.2	NA	0.3	1.9	0.06	0.47	0.06	46.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX

D

SIDRA RESULTS 2021 BASE

MOVEMENT SUMMARY

▽ Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	24	0.0	0.536	18.5	LOS B	1.8	12.8	0.93	1.07	1.29	33.2
3a	R1	59	0.0	0.536	43.5	LOS D	1.8	12.8	0.93	1.07	1.29	33.0
Approach		83	0.0	0.536	36.2	LOS C	1.8	12.8	0.93	1.07	1.29	33.1
NorthEast: Bridge St												
24a	L1	67	0.0	0.500	4.5	LOS A	3.9	28.1	0.13	0.49	0.13	46.2
26a	R1	809	2.9	0.500	4.2	LOS A	3.9	28.1	0.13	0.49	0.13	46.3
Approach		877	2.6	0.500	4.2	NA	3.9	28.1	0.13	0.49	0.13	46.3
West: Sydney St												
10a	L1	852	2.2	0.464	4.5	LOS A	0.2	1.4	0.01	0.54	0.01	46.2
12	R2	20	0.0	0.464	4.9	LOS A	0.2	1.4	0.01	0.54	0.01	46.2
Approach		872	2.2	0.464	4.5	NA	0.2	1.4	0.01	0.54	0.01	46.2
All Vehicles		1832	2.3	0.536	5.8	NA	3.9	28.1	0.11	0.54	0.13	45.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	15	0.0	0.488	17.9	LOS B	1.5	10.7	0.93	1.05	1.21	31.6
3a	R1	46	0.0	0.488	49.1	LOS D	1.5	10.7	0.93	1.05	1.21	31.5
Approach		61	0.0	0.488	41.5	LOS C	1.5	10.7	0.93	1.05	1.21	31.5
NorthEast: Bridge St												
24a	L1	62	0.0	0.435	4.5	LOS A	3.1	22.8	0.07	0.50	0.07	46.3
26a	R1	701	4.8	0.435	4.1	LOS A	3.1	22.8	0.07	0.50	0.07	46.4
Approach		763	4.4	0.435	4.2	NA	3.1	22.8	0.07	0.50	0.07	46.4
West: Sydney St												
10a	L1	978	4.8	0.533	4.5	LOS A	0.1	0.6	0.00	0.55	0.00	46.2
12	R2	7	0.0	0.533	4.9	LOS A	0.1	0.6	0.00	0.55	0.00	46.2
Approach		985	4.8	0.533	4.5	NA	0.1	0.6	0.00	0.55	0.00	46.2
All Vehicles		1809	4.5	0.533	5.6	NA	3.1	22.8	0.06	0.54	0.07	45.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	49	2.1	0.038	9.7	LOS A	0.8	5.8	0.31	0.61	0.31	43.7
2	T1	593	6.6	0.241	5.3	LOS A	6.0	44.3	0.34	0.32	0.34	46.5
3	R2	32	0.0	0.241	10.0	LOS A	5.4	39.6	0.35	0.34	0.35	45.8
Approach		674	5.9	0.241	5.8	LOS A	6.0	44.3	0.34	0.34	0.34	46.2
NorthEast: Lorne St												
4	L2	57	3.7	0.236	55.8	LOS D	3.0	22.0	0.93	0.75	0.93	28.2
5	T1	3	0.0	0.015	45.7	LOS D	0.2	1.4	0.87	0.59	0.87	30.5
6	R2	1	0.0	0.015	50.2	LOS D	0.2	1.4	0.87	0.59	0.87	30.4
Approach		61	3.4	0.236	55.1	LOS D	3.0	22.0	0.93	0.74	0.93	28.3
NorthWest: New England Hwy												
7	L2	9	0.0	0.007	9.6	LOS A	0.2	1.1	0.29	0.58	0.29	43.8
8	T1	507	10.2	0.235	5.3	LOS A	5.7	43.3	0.34	0.33	0.34	46.4
9	R2	49	0.0	0.235	10.3	LOS A	4.5	34.0	0.35	0.38	0.35	45.3
Approach		566	9.1	0.235	5.9	LOS A	5.7	43.3	0.34	0.34	0.34	46.2
SouthWest: Lorne St												
10	L2	37	2.9	0.152	55.0	LOS D	1.9	13.9	0.92	0.73	0.92	28.4
11	T1	2	0.0	0.127	52.7	LOS D	1.2	8.4	0.93	0.71	0.93	28.1
12	R2	20	0.0	0.127	57.3	LOS E	1.2	8.4	0.93	0.71	0.93	28.0
Approach		59	1.8	0.152	55.7	LOS D	1.9	13.9	0.92	0.72	0.92	28.2
All Vehicles		1360	7.0	0.241	10.2	LOS A	6.0	44.3	0.39	0.37	0.39	43.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion - Import]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	35	0.0	0.030	13.1	LOS A	0.7	5.2	0.39	0.62	0.39	42.0
2	T1	639	2.3	0.337	10.1	LOS A	10.6	75.8	0.48	0.45	0.48	43.7
3	R2	77	0.0	0.337	15.9	LOS B	8.0	57.1	0.51	0.52	0.51	42.3
Approach		751	2.0	0.337	10.8	LOS A	10.6	75.8	0.48	0.47	0.48	43.5
NorthEast: Lorne St												
4	L2	129	0.0	0.331	47.5	LOS D	6.4	45.0	0.89	0.78	0.89	30.1
5	T1	1	0.0	0.022	38.7	LOS C	0.3	2.3	0.80	0.64	0.80	31.6
6	R2	6	0.0	0.022	43.3	LOS D	0.3	2.3	0.80	0.64	0.80	31.4
Approach		137	0.0	0.331	47.2	LOS D	6.4	45.0	0.88	0.77	0.88	30.2
NorthWest: New England Hwy												
7	L2	9	0.0	0.008	13.0	LOS A	0.2	1.4	0.38	0.60	0.38	42.1
8	T1	596	4.1	0.267	9.3	LOS A	7.9	57.3	0.45	0.40	0.45	44.3
9	R2	22	9.5	0.267	14.5	LOS A	7.1	51.4	0.46	0.42	0.46	43.4
Approach		627	4.2	0.267	9.6	LOS A	7.9	57.3	0.45	0.41	0.45	44.2
SouthWest: Lorne St												
10	L2	48	2.2	0.122	45.3	LOS D	2.3	16.3	0.84	0.72	0.84	30.7
11	T1	1	0.0	0.065	43.1	LOS D	0.9	6.1	0.85	0.69	0.85	30.4
12	R2	17	0.0	0.065	47.6	LOS D	0.9	6.1	0.85	0.69	0.85	30.2
Approach		66	1.6	0.122	45.9	LOS D	2.3	16.3	0.84	0.71	0.84	30.6
All Vehicles		1581	2.7	0.337	14.9	LOS B	10.6	75.8	0.52	0.48	0.52	41.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 28 July 2020 1:49:03 PM
Project: \\cardno.corp\apac_collab\Projects\2304\Projects_AWE\FY20\NE30034_Olympic_Park_Precinct_REF\5_DES_AN\10_Traffic\SIDRA \Musswellbrook 2021 SAT.sip8

MOVEMENT SUMMARY

▽ Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	21	0.0	0.231	4.6	LOS A	0.0	0.0	0.00	0.04	0.00	49.7
2	T1	644	6.2	0.231	1.5	LOS A	1.5	12.4	0.13	0.04	0.14	48.9
3	R2	38	94.4	0.231	14.8	LOS B	1.5	12.4	0.36	0.05	0.39	44.9
Approach		703	10.8	0.231	2.3	NA	1.5	12.4	0.14	0.04	0.15	48.7
NorthEast: Wilder St												
4	L2	6	0.0	0.070	5.8	LOS A	0.2	1.5	0.72	0.76	0.72	37.9
5	T1	1	0.0	0.070	32.9	LOS C	0.2	1.5	0.72	0.76	0.72	40.2
6	R2	5	0.0	0.070	42.2	LOS C	0.2	1.5	0.72	0.76	0.72	37.7
Approach		13	0.0	0.070	23.2	LOS B	0.2	1.5	0.72	0.76	0.72	38.0
NorthWest: New England Hwy												
7	L2	15	64.3	0.168	5.1	LOS A	0.0	0.0	0.00	0.03	0.00	48.4
8	T1	543	8.1	0.168	0.4	LOS A	0.4	2.8	0.07	0.04	0.07	49.6
9	R2	21	0.0	0.168	10.1	LOS A	0.4	2.8	0.14	0.05	0.14	52.2
Approach		579	9.3	0.168	0.8	NA	0.4	2.8	0.07	0.04	0.07	49.7
SouthWest: Francis Street												
10	L2	29	0.0	0.189	7.5	LOS A	0.6	4.3	0.72	0.82	0.72	44.0
11	T1	1	0.0	0.189	34.3	LOS C	0.6	4.3	0.72	0.82	0.72	44.3
12	R2	13	8.3	0.189	49.6	LOS D	0.6	4.3	0.72	0.82	0.72	43.6
Approach		43	2.4	0.189	20.5	LOS B	0.6	4.3	0.72	0.82	0.72	43.9
All Vehicles		1338	9.8	0.231	2.4	NA	1.5	12.4	0.13	0.07	0.14	48.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	23	50.0	0.193	5.1	LOS A	0.0	0.0	0.00	0.05	0.00	49.0
2	T1	686	2.5	0.193	0.2	LOS A	0.2	1.2	0.02	0.03	0.02	49.9
3	R2	8	0.0	0.193	9.3	LOS A	0.2	1.2	0.05	0.01	0.05	49.0
Approach		718	4.0	0.193	0.4	NA	0.2	1.2	0.02	0.03	0.02	49.9
NorthEast: Wilder St												
4	L2	5	0.0	0.157	6.1	LOS A	0.5	3.3	0.86	0.89	0.86	33.5
5	T1	1	0.0	0.157	37.4	LOS C	0.5	3.3	0.86	0.89	0.86	35.4
6	R2	12	0.0	0.157	48.6	LOS D	0.5	3.3	0.86	0.89	0.86	33.4
Approach		18	0.0	0.157	35.5	LOS C	0.5	3.3	0.86	0.89	0.86	33.6
NorthWest: New England Hwy												
7	L2	4	0.0	0.189	4.6	LOS A	0.0	0.0	0.00	0.01	0.00	49.4
8	T1	673	3.1	0.189	0.3	LOS A	0.3	2.3	0.05	0.02	0.05	49.7
9	R2	16	0.0	0.189	10.5	LOS A	0.3	2.3	0.10	0.03	0.10	52.4
Approach		693	3.0	0.189	0.5	NA	0.3	2.3	0.05	0.02	0.05	49.8
SouthWest: Francis Street												
10	L2	32	0.0	0.154	7.0	LOS A	0.5	3.4	0.65	0.75	0.65	45.7
11	T1	1	0.0	0.154	37.7	LOS C	0.5	3.4	0.65	0.75	0.65	46.0
12	R2	9	0.0	0.154	49.5	LOS D	0.5	3.4	0.65	0.75	0.65	45.5
Approach		42	0.0	0.154	17.4	LOS B	0.5	3.4	0.65	0.75	0.65	45.7
All Vehicles		1471	3.4	0.193	1.4	NA	0.5	3.4	0.06	0.06	0.06	49.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	12	0.0	0.025	0.2	LOS A	0.1	0.8	0.16	0.38	0.16	47.4
3	R2	32	0.0	0.025	4.7	LOS A	0.1	0.8	0.16	0.38	0.16	46.6
Approach		43	0.0	0.025	3.5	NA	0.1	0.8	0.16	0.38	0.16	46.8
East: Wilkinson Ave												
4	L2	48	4.3	0.073	4.6	LOS A	0.3	1.9	0.05	0.53	0.05	46.4
6	R2	52	0.0	0.073	4.8	LOS A	0.3	1.9	0.05	0.53	0.05	46.1
Approach		100	2.1	0.073	4.7	LOS A	0.3	1.9	0.05	0.53	0.05	46.3
North: Haydon St												
7	L2	56	0.0	0.036	4.6	LOS A	0.0	0.0	0.00	0.44	0.00	47.1
8	T1	12	0.0	0.036	0.0	LOS A	0.0	0.0	0.00	0.44	0.00	47.5
Approach		67	0.0	0.036	3.8	NA	0.0	0.0	0.00	0.44	0.00	47.2
All Vehicles		211	1.0	0.073	4.2	NA	0.3	1.9	0.06	0.47	0.06	46.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	4	0.0	0.054	0.4	LOS A	0.2	1.7	0.24	0.50	0.24	46.7
3	R2	83	0.0	0.054	5.0	LOS A	0.2	1.7	0.24	0.50	0.24	45.8
Approach		87	0.0	0.054	4.7	NA	0.2	1.7	0.24	0.50	0.24	45.8
East: Wilkinson Ave												
4	L2	112	0.0	0.174	4.6	LOS A	0.7	4.9	0.09	0.53	0.09	46.4
6	R2	117	0.0	0.174	5.2	LOS A	0.7	4.9	0.09	0.53	0.09	46.0
Approach		228	0.0	0.174	4.9	LOS A	0.7	4.9	0.09	0.53	0.09	46.2
North: Haydon St												
7	L2	108	0.0	0.071	4.6	LOS A	0.0	0.0	0.00	0.43	0.00	47.1
8	T1	25	0.0	0.071	0.0	LOS A	0.0	0.0	0.00	0.43	0.00	47.6
Approach		134	0.0	0.071	3.7	NA	0.0	0.0	0.00	0.43	0.00	47.2
All Vehicles		449	0.0	0.174	4.5	NA	0.7	4.9	0.09	0.50	0.09	46.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX

E

SIDRA RESULTS 2021 WITH BRIDGE

MOVEMENT SUMMARY

Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	15	0.0	0.488	17.9	LOS B	1.5	10.7	0.93	1.05	1.21	31.6
3a	R1	46	0.0	0.488	49.1	LOS D	1.5	10.7	0.93	1.05	1.21	31.5
Approach		61	0.0	0.488	41.5	LOS C	1.5	10.7	0.93	1.05	1.21	31.5
NorthEast: Bridge St												
24a	L1	62	0.0	0.435	4.5	LOS A	3.1	22.8	0.07	0.50	0.07	46.3
26a	R1	701	4.8	0.435	4.1	LOS A	3.1	22.8	0.07	0.50	0.07	46.4
Approach		763	4.4	0.435	4.2	NA	3.1	22.8	0.07	0.50	0.07	46.4
West: Sydney St												
10a	L1	978	4.8	0.533	4.5	LOS A	0.1	0.6	0.00	0.55	0.00	46.2
12	R2	7	0.0	0.533	4.9	LOS A	0.1	0.6	0.00	0.55	0.00	46.2
Approach		985	4.8	0.533	4.5	NA	0.1	0.6	0.00	0.55	0.00	46.2
All Vehicles		1809	4.5	0.533	5.6	NA	3.1	22.8	0.06	0.54	0.07	45.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	24	0.0	0.536	18.5	LOS B	1.8	12.8	0.93	1.07	1.29	33.2
3a	R1	59	0.0	0.536	43.5	LOS D	1.8	12.8	0.93	1.07	1.29	33.0
Approach		83	0.0	0.536	36.2	LOS C	1.8	12.8	0.93	1.07	1.29	33.1
NorthEast: Bridge St												
24a	L1	67	0.0	0.500	4.5	LOS A	3.9	28.1	0.13	0.49	0.13	46.2
26a	R1	809	2.9	0.500	4.2	LOS A	3.9	28.1	0.13	0.49	0.13	46.3
Approach		877	2.6	0.500	4.2	NA	3.9	28.1	0.13	0.49	0.13	46.3
West: Sydney St												
10a	L1	852	2.2	0.464	4.5	LOS A	0.2	1.4	0.01	0.54	0.01	46.2
12	R2	20	0.0	0.464	4.9	LOS A	0.2	1.4	0.01	0.54	0.01	46.2
Approach		872	2.2	0.464	4.5	NA	0.2	1.4	0.01	0.54	0.01	46.2
All Vehicles		1832	2.3	0.536	5.8	NA	3.9	28.1	0.11	0.54	0.13	45.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion]

New Site
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	49	2.1	0.036	8.6	LOS A	0.7	5.1	0.27	0.60	0.27	44.3
2	T1	593	6.6	0.213	3.8	LOS A	4.7	35.1	0.29	0.26	0.29	47.5
3	R2	11	0.0	0.213	8.4	LOS A	4.5	33.4	0.29	0.27	0.29	47.0
Approach		653	6.1	0.213	4.3	LOS A	4.7	35.1	0.29	0.28	0.29	47.2
NorthEast: Lorne St												
4	L2	11	20.0	0.065	58.7	LOS E	0.6	4.7	0.93	0.68	0.93	27.5
5	T1	3	0.0	0.020	49.9	LOS D	0.2	1.5	0.90	0.60	0.90	29.5
6	R2	1	0.0	0.020	54.4	LOS D	0.2	1.5	0.90	0.60	0.90	29.3
Approach		15	14.3	0.065	56.5	LOS E	0.6	4.7	0.92	0.66	0.92	28.0
NorthWest: New England Hwy												
7	L2	9	0.0	0.007	8.5	LOS A	0.1	0.9	0.26	0.57	0.26	44.4
8	T1	507	10.2	0.224	4.0	LOS A	4.9	37.5	0.30	0.29	0.30	47.2
9	R2	49	0.0	0.224	8.7	LOS A	3.9	29.0	0.30	0.34	0.30	46.2
Approach		566	9.1	0.224	4.5	LOS A	4.9	37.5	0.30	0.30	0.30	47.1
SouthWest: Lorne St												
10	L2	37	2.9	0.202	59.6	LOS E	2.0	14.7	0.95	0.73	0.95	27.4
11	T1	2	0.0	0.121	51.4	LOS D	1.2	8.2	0.92	0.70	0.92	28.4
12	R2	20	0.0	0.121	56.0	LOS D	1.2	8.2	0.92	0.70	0.92	28.3
Approach		59	1.8	0.202	58.1	LOS E	2.0	14.7	0.94	0.72	0.94	27.7
All Vehicles		1293	7.3	0.224	7.4	LOS A	4.9	37.5	0.33	0.31	0.33	45.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Project: \\cardno.corp\apac_collab\Projects\2304\Projects_AWE\FY20\NE30034_Olympic_Park_Precinct_REF\5_DES_AN\10_Traffic\SIDRA
\Musswellbrook 2021 PM -With Bridge All Movement.sip8

MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion - Import]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	35	0.0	0.026	9.1	LOS A	0.5	3.7	0.28	0.60	0.28	44.1
2	T1	639	2.3	0.224	4.4	LOS A	5.4	38.7	0.31	0.28	0.31	47.1
3	R2	5	0.0	0.224	9.0	LOS A	5.3	37.7	0.31	0.28	0.31	46.6
Approach		679	2.2	0.224	4.7	LOS A	5.4	38.7	0.31	0.29	0.31	46.9
NorthEast: Lorne St												
4	L2	25	0.0	0.117	56.6	LOS E	1.3	9.4	0.93	0.71	0.93	28.0
5	T1	1	0.0	0.046	52.8	LOS D	0.4	2.8	0.92	0.66	0.92	28.2
6	R2	6	0.0	0.046	57.4	LOS E	0.4	2.8	0.92	0.66	0.92	28.0
Approach		33	0.0	0.117	56.6	LOS E	1.3	9.4	0.93	0.70	0.93	28.0
NorthWest: New England Hwy												
7	L2	9	0.0	0.007	9.0	LOS A	0.1	1.0	0.28	0.58	0.28	44.1
8	T1	596	4.1	0.229	4.5	LOS A	5.5	39.9	0.31	0.29	0.31	47.0
9	R2	22	9.5	0.229	9.1	LOS A	4.8	35.0	0.31	0.30	0.31	46.3
Approach		627	4.2	0.229	4.7	LOS A	5.5	39.9	0.31	0.29	0.31	47.0
SouthWest: Lorne St												
10	L2	48	2.2	0.227	57.7	LOS E	2.6	18.8	0.94	0.74	0.94	27.8
11	T1	1	0.0	0.082	49.0	LOS D	0.9	6.5	0.90	0.69	0.90	28.9
12	R2	17	0.0	0.082	53.5	LOS D	0.9	6.5	0.90	0.69	0.90	28.8
Approach		66	1.6	0.227	56.5	LOS D	2.6	18.8	0.93	0.73	0.93	28.1
All Vehicles		1405	3.0	0.229	8.3	LOS A	5.5	39.9	0.36	0.32	0.36	44.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

▽ Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	21	0.0	0.232	4.6	LOS A	0.0	0.0	0.00	0.04	0.00	49.7
2	T1	623	6.4	0.232	1.1	LOS A	1.4	11.3	0.14	0.06	0.14	49.0
3	R2	59	60.7	0.232	11.2	LOS A	1.4	11.3	0.40	0.11	0.41	45.6
Approach		703	10.8	0.232	2.1	NA	1.4	11.3	0.15	0.07	0.16	48.8
NorthEast: Wilder St												
4	L2	52	0.0	0.101	5.7	LOS A	0.3	2.4	0.47	0.62	0.47	44.1
6	R2	5	0.0	0.101	41.2	LOS C	0.3	2.4	0.47	0.62	0.47	44.0
Approach		57	0.0	0.101	9.0	LOS A	0.3	2.4	0.47	0.62	0.47	44.1
NorthWest: New England Hwy												
7	L2	15	64.3	0.156	5.1	LOS A	0.0	0.0	0.00	0.03	0.00	48.4
8	T1	498	8.9	0.156	0.4	LOS A	0.4	2.7	0.07	0.04	0.07	49.6
9	R2	21	0.0	0.156	9.8	LOS A	0.4	2.7	0.15	0.06	0.15	52.2
Approach		534	10.1	0.156	0.9	NA	0.4	2.7	0.07	0.04	0.07	49.7
SouthWest: Francis Street												
10	L2	29	0.0	0.194	7.5	LOS A	0.6	4.3	0.72	0.82	0.72	43.8
12	R2	14	7.7	0.194	49.6	LOS D	0.6	4.3	0.72	0.82	0.72	43.4
Approach		43	2.4	0.194	20.9	LOS B	0.6	4.3	0.72	0.82	0.72	43.7
All Vehicles		1337	9.8	0.232	2.5	NA	1.4	11.3	0.15	0.10	0.16	48.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 28 July 2020 3:53:40 PM
Project: \\cardno.corp\apac_collab\Projects\2304\Projects_AWE\FY20\NE30034_Olympic_Park_Precinct_REF\5_DES_AN\10_Traffic\SIDRA \Musswellbrook 2021 PM -With Bridge All Movement.sip8

MOVEMENT SUMMARY

Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	23	50.0	0.219	5.1	LOS A	0.0	0.0	0.00	0.04	0.00	49.0
2	T1	615	2.7	0.219	0.7	LOS A	1.1	7.7	0.14	0.10	0.14	49.2
3	R2	80	0.0	0.219	8.2	LOS A	1.1	7.7	0.38	0.19	0.38	47.1
Approach		718	4.0	0.219	1.7	NA	1.1	7.7	0.16	0.10	0.16	48.9
NorthEast: Wilder St												
4	L2	109	0.0	0.227	6.0	LOS A	0.8	5.5	0.53	0.68	0.53	43.7
6	R2	12	0.0	0.227	45.6	LOS D	0.8	5.5	0.53	0.68	0.53	43.5
Approach		121	0.0	0.227	9.8	LOS A	0.8	5.5	0.53	0.68	0.53	43.7
NorthWest: New England Hwy												
7	L2	4	0.0	0.162	4.6	LOS A	0.0	0.0	0.00	0.01	0.00	49.4
8	T1	568	3.7	0.162	0.2	LOS A	0.3	2.0	0.05	0.02	0.05	49.8
9	R2	16	0.0	0.162	9.7	LOS A	0.3	2.0	0.10	0.04	0.10	52.4
Approach		588	3.6	0.162	0.5	NA	0.3	2.0	0.05	0.02	0.05	49.8
SouthWest: Francis Street												
10	L2	32	0.0	0.152	7.3	LOS A	0.5	3.3	0.67	0.78	0.67	45.6
12	R2	9	0.0	0.152	51.7	LOS D	0.5	3.3	0.67	0.78	0.67	45.4
Approach		41	0.0	0.152	17.6	LOS B	0.5	3.3	0.67	0.78	0.67	45.5
All Vehicles		1468	3.4	0.227	2.3	NA	1.1	7.7	0.16	0.14	0.16	48.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	12	0.0	0.012	0.1	LOS A	0.0	0.3	0.13	0.25	0.13	48.2
3	R2	11	0.0	0.012	4.7	LOS A	0.0	0.3	0.13	0.25	0.13	47.3
Approach		22	0.0	0.012	2.3	NA	0.0	0.3	0.13	0.25	0.13	47.8
East: Wilkinson Ave												
4	L2	3	66.7	0.045	5.2	LOS A	0.1	1.1	0.11	0.53	0.11	45.4
6	R2	52	0.0	0.045	4.8	LOS A	0.1	1.1	0.11	0.53	0.11	46.0
Approach		55	3.8	0.045	4.8	LOS A	0.1	1.1	0.11	0.53	0.11	45.9
North: Haydon St												
7	L2	56	0.0	0.036	4.6	LOS A	0.0	0.0	0.00	0.44	0.00	47.1
8	T1	12	0.0	0.036	0.0	LOS A	0.0	0.0	0.00	0.44	0.00	47.5
Approach		67	0.0	0.036	3.8	NA	0.0	0.0	0.00	0.44	0.00	47.2
All Vehicles		144	1.5	0.045	3.9	NA	0.1	1.1	0.06	0.45	0.06	46.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	4	0.0	0.009	0.3	LOS A	0.0	0.3	0.23	0.38	0.23	47.3
3	R2	12	0.0	0.009	4.9	LOS A	0.0	0.3	0.23	0.38	0.23	46.4
Approach		16	0.0	0.009	3.7	NA	0.0	0.3	0.23	0.38	0.23	46.6
East: Wilkinson Ave												
4	L2	7	0.0	0.103	4.6	LOS A	0.4	2.5	0.16	0.54	0.16	46.3
6	R2	117	0.0	0.103	4.9	LOS A	0.4	2.5	0.16	0.54	0.16	45.9
Approach		124	0.0	0.103	4.9	LOS A	0.4	2.5	0.16	0.54	0.16	45.9
North: Haydon St												
7	L2	108	0.0	0.071	4.6	LOS A	0.0	0.0	0.00	0.43	0.00	47.1
8	T1	25	0.0	0.071	0.0	LOS A	0.0	0.0	0.00	0.43	0.00	47.6
Approach		134	0.0	0.071	3.7	NA	0.0	0.0	0.00	0.43	0.00	47.2
All Vehicles		274	0.0	0.103	4.2	NA	0.4	2.5	0.08	0.48	0.08	46.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX

F

SIDRA RESULTS 2021 WITH BRIDGE LILO

MOVEMENT SUMMARY

Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	15	0.0	0.488	17.9	LOS B	1.5	10.7	0.93	1.05	1.21	31.6
3a	R1	46	0.0	0.488	49.1	LOS D	1.5	10.7	0.93	1.05	1.21	31.5
Approach		61	0.0	0.488	41.5	LOS C	1.5	10.7	0.93	1.05	1.21	31.5
NorthEast: Bridge St												
24a	L1	62	0.0	0.435	4.5	LOS A	3.1	22.8	0.07	0.50	0.07	46.3
26a	R1	701	4.8	0.435	4.1	LOS A	3.1	22.8	0.07	0.50	0.07	46.4
Approach		763	4.4	0.435	4.2	NA	3.1	22.8	0.07	0.50	0.07	46.4
West: Sydney St												
10a	L1	978	4.8	0.533	4.5	LOS A	0.1	0.6	0.00	0.55	0.00	46.2
12	R2	7	0.0	0.533	4.9	LOS A	0.1	0.6	0.00	0.55	0.00	46.2
Approach		985	4.8	0.533	4.5	NA	0.1	0.6	0.00	0.55	0.00	46.2
All Vehicles		1809	4.5	0.533	5.6	NA	3.1	22.8	0.06	0.54	0.07	45.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	24	0.0	0.536	18.5	LOS B	1.8	12.8	0.93	1.07	1.29	33.2
3a	R1	59	0.0	0.536	43.5	LOS D	1.8	12.8	0.93	1.07	1.29	33.0
Approach		83	0.0	0.536	36.2	LOS C	1.8	12.8	0.93	1.07	1.29	33.1
NorthEast: Bridge St												
24a	L1	67	0.0	0.500	4.5	LOS A	3.9	28.1	0.13	0.49	0.13	46.2
26a	R1	809	2.9	0.500	4.2	LOS A	3.9	28.1	0.13	0.49	0.13	46.3
Approach		877	2.6	0.500	4.2	NA	3.9	28.1	0.13	0.49	0.13	46.3
West: Sydney St												
10a	L1	852	2.2	0.464	4.5	LOS A	0.2	1.4	0.01	0.54	0.01	46.2
12	R2	20	0.0	0.464	4.9	LOS A	0.2	1.4	0.01	0.54	0.01	46.2
Approach		872	2.2	0.464	4.5	NA	0.2	1.4	0.01	0.54	0.01	46.2
All Vehicles		1832	2.3	0.536	5.8	NA	3.9	28.1	0.11	0.54	0.13	45.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion]

New Site
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	49	2.1	0.036	8.6	LOS A	0.7	5.1	0.27	0.60	0.27	44.3
2	T1	593	6.6	0.283	4.3	LOS A	6.8	50.0	0.32	0.31	0.32	47.1
3	R2	69	51.5	0.283	9.8	LOS A	4.5	36.4	0.33	0.39	0.33	45.3
Approach		712	10.7	0.283	5.1	LOS A	6.8	50.0	0.31	0.34	0.31	46.7
NorthEast: Lorne St												
4	L2	11	20.0	0.065	58.7	LOS E	0.6	4.7	0.93	0.68	0.93	27.5
5	T1	3	0.0	0.062	55.0	LOS D	0.5	3.6	0.94	0.66	0.94	27.9
6	R2	6	0.0	0.062	59.6	LOS E	0.5	3.6	0.94	0.66	0.94	27.8
Approach		20	10.5	0.065	58.4	LOS E	0.6	4.7	0.94	0.67	0.94	27.6
NorthWest: New England Hwy												
7	L2	9	0.0	0.007	8.5	LOS A	0.1	0.9	0.26	0.57	0.26	44.4
8	T1	507	10.2	0.226	4.1	LOS A	5.0	37.9	0.30	0.29	0.30	47.1
9	R2	49	0.0	0.226	9.0	LOS A	4.0	29.7	0.31	0.35	0.31	46.1
Approach		566	9.1	0.226	4.6	LOS A	5.0	37.9	0.30	0.30	0.30	47.0
SouthWest: Lorne St												
10	L2	37	2.9	0.202	59.6	LOS E	2.0	14.7	0.95	0.73	0.95	27.4
11	T1	2	0.0	0.110	51.3	LOS D	1.2	8.2	0.92	0.70	0.92	28.5
12	R2	20	0.0	0.110	55.8	LOS D	1.2	8.2	0.92	0.70	0.92	28.3
Approach		59	1.8	0.202	58.1	LOS E	2.0	14.7	0.94	0.72	0.94	27.7
All Vehicles		1357	9.6	0.283	8.0	LOS A	6.8	50.0	0.34	0.34	0.34	45.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 28 July 2020 4:47:06 PM
Project: \\cardno.corp\apac_collab\Projects\2304\Projects_AWE\FY20\NE30034_Olympic_Park_Precinct_REF\5_DES_AN\10_Traffic\SIDRA
\Musswellbrook 2021 PM -With Bridge LILO.sip8

MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion - Import]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	35	0.0	0.025	8.5	LOS A	0.5	3.5	0.27	0.59	0.27	44.4
2	T1	639	2.3	0.289	4.3	LOS A	7.1	50.8	0.32	0.32	0.32	46.9
3	R2	85	0.0	0.289	9.3	LOS A	5.2	37.2	0.33	0.40	0.33	45.7
Approach		759	1.9	0.289	5.1	LOS A	7.1	50.8	0.32	0.34	0.32	46.7
NorthEast: Lorne St												
4	L2	25	0.0	0.136	59.0	LOS E	1.4	9.7	0.94	0.71	0.94	27.5
5	T1	1	0.0	0.149	56.4	LOS D	1.1	7.9	0.95	0.71	0.95	27.3
6	R2	19	0.0	0.149	60.9	LOS E	1.1	7.9	0.95	0.71	0.95	27.2
Approach		45	0.0	0.149	59.7	LOS E	1.4	9.7	0.95	0.71	0.95	27.4
NorthWest: New England Hwy												
7	L2	9	0.0	0.007	8.5	LOS A	0.1	0.9	0.26	0.57	0.26	44.4
8	T1	596	4.1	0.225	4.0	LOS A	5.2	37.3	0.30	0.27	0.30	47.3
9	R2	22	9.5	0.225	8.8	LOS A	4.6	33.6	0.30	0.29	0.30	46.5
Approach		627	4.2	0.225	4.2	LOS A	5.2	37.3	0.30	0.28	0.30	47.2
SouthWest: Lorne St												
10	L2	48	2.2	0.265	60.1	LOS E	2.7	19.3	0.96	0.74	0.96	27.3
11	T1	1	0.0	0.092	51.1	LOS D	0.9	6.6	0.92	0.70	0.92	28.5
12	R2	17	0.0	0.092	55.7	LOS D	0.9	6.6	0.92	0.70	0.92	28.3
Approach		66	1.6	0.265	58.9	LOS E	2.7	19.3	0.95	0.73	0.95	27.6
All Vehicles		1498	2.8	0.289	8.8	LOS A	7.1	50.8	0.36	0.34	0.36	44.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 28 July 2020 4:52:32 PM
Project: \\cardno.corp\apac_collab\Projects\2304\Projects_AWE\FY20\NE30034_Olympic_Park_Precinct_REF\5_DES_AN\10_Traffic\SIDRA \Musswellbrook 2021 SAT - With Bridge LILO.sip8

MOVEMENT SUMMARY

Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	21	0.0	0.193	4.6	LOS A	0.0	0.0	0.00	0.05	0.00	49.8
2	T1	682	11.1	0.193	0.1	LOS A	0.0	0.0	0.00	0.02	0.00	50.0
Approach		703	10.8	0.193	0.2	NA	0.0	0.0	0.00	0.02	0.00	50.0
NorthEast: Wilder St												
4	L2	52	0.0	0.051	5.7	LOS A	0.2	1.3	0.35	0.57	0.35	45.8
Approach		52	0.0	0.051	5.7	LOS A	0.2	1.3	0.35	0.57	0.35	45.8
NorthWest: New England Hwy												
7	L2	15	64.3	0.157	5.1	LOS A	0.0	0.0	0.00	0.03	0.00	48.4
8	T1	498	8.9	0.157	0.4	LOS A	0.4	3.0	0.08	0.04	0.08	49.6
9	R2	21	0.0	0.157	10.4	LOS A	0.4	3.0	0.16	0.06	0.16	52.0
Approach		534	10.1	0.157	1.0	NA	0.4	3.0	0.08	0.04	0.08	49.6
SouthWest: Francis Street												
10	L2	29	0.0	0.175	7.1	LOS A	0.5	3.9	0.68	0.77	0.68	44.6
12	R2	13	8.3	0.175	48.1	LOS D	0.5	3.9	0.68	0.77	0.68	44.2
Approach		42	2.5	0.175	19.4	LOS B	0.5	3.9	0.68	0.77	0.68	44.5
All Vehicles		1331	9.8	0.193	1.3	NA	0.5	3.9	0.07	0.08	0.07	49.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	23	50.0	0.189	5.1	LOS A	0.0	0.0	0.00	0.05	0.00	49.0
2	T1	695	2.4	0.189	0.1	LOS A	0.0	0.0	0.00	0.02	0.00	50.1
Approach		718	4.0	0.189	0.2	NA	0.0	0.0	0.00	0.02	0.00	50.0
NorthEast: Wilder St												
4	L2	109	0.0	0.111	6.0	LOS A	0.4	2.9	0.38	0.61	0.38	45.7
Approach		109	0.0	0.111	6.0	LOS A	0.4	2.9	0.38	0.61	0.38	45.7
NorthWest: New England Hwy												
7	L2	4	0.0	0.162	4.6	LOS A	0.0	0.0	0.00	0.01	0.00	49.4
8	T1	568	3.7	0.162	0.3	LOS A	0.3	2.3	0.05	0.02	0.05	49.7
9	R2	16	0.0	0.162	10.4	LOS A	0.3	2.3	0.11	0.04	0.11	52.3
Approach		588	3.6	0.162	0.6	NA	0.3	2.3	0.05	0.02	0.05	49.8
SouthWest: Francis Street												
10	L2	32	0.0	0.148	7.0	LOS A	0.5	3.2	0.65	0.74	0.65	45.9
12	R2	9	0.0	0.148	50.5	LOS D	0.5	3.2	0.65	0.74	0.65	45.7
Approach		41	0.0	0.148	17.0	LOS B	0.5	3.2	0.65	0.74	0.65	45.8
All Vehicles		1457	3.4	0.189	1.3	NA	0.5	3.2	0.07	0.09	0.07	49.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	12	0.0	0.060	0.3	LOS A	0.3	2.7	0.19	0.44	0.19	47.3
3	R2	69	51.5	0.060	5.4	LOS A	0.3	2.7	0.19	0.44	0.19	45.6
Approach		81	44.2	0.060	4.6	NA	0.3	2.7	0.19	0.44	0.19	45.9
East: Wilkinson Ave												
4	L2	8	25.0	0.051	4.8	LOS A	0.2	1.2	0.10	0.55	0.10	46.0
6	R2	52	0.0	0.051	5.0	LOS A	0.2	1.2	0.10	0.55	0.10	45.9
Approach		60	3.5	0.051	5.0	LOS A	0.2	1.2	0.10	0.55	0.10	46.0
North: Haydon St												
7	L2	56	0.0	0.036	4.6	LOS A	0.0	0.0	0.00	0.44	0.00	47.1
8	T1	12	0.0	0.036	0.0	LOS A	0.0	0.0	0.00	0.44	0.00	47.5
Approach		67	0.0	0.036	3.8	NA	0.0	0.0	0.00	0.44	0.00	47.2
All Vehicles		208	18.2	0.060	4.5	NA	0.3	2.7	0.10	0.47	0.10	46.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	4	0.0	0.060	0.4	LOS A	0.3	1.9	0.24	0.51	0.24	46.6
3	R2	93	0.0	0.060	5.0	LOS A	0.3	1.9	0.24	0.51	0.24	45.8
Approach		97	0.0	0.060	4.8	NA	0.3	1.9	0.24	0.51	0.24	45.8
East: Wilkinson Ave												
4	L2	20	0.0	0.118	4.6	LOS A	0.4	2.9	0.15	0.55	0.15	46.3
6	R2	117	0.0	0.118	5.2	LOS A	0.4	2.9	0.15	0.55	0.15	45.8
Approach		137	0.0	0.118	5.1	LOS A	0.4	2.9	0.15	0.55	0.15	45.9
North: Haydon St												
7	L2	108	0.0	0.071	4.6	LOS A	0.0	0.0	0.00	0.43	0.00	47.1
8	T1	25	0.0	0.071	0.0	LOS A	0.0	0.0	0.00	0.43	0.00	47.6
Approach		134	0.0	0.071	3.7	NA	0.0	0.0	0.00	0.43	0.00	47.2
All Vehicles		367	0.0	0.118	4.5	NA	0.4	2.9	0.12	0.50	0.12	46.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX

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SIDRA RESULTS 2031 BASE

MOVEMENT SUMMARY

Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	18	0.0	1.141	232.7	LOS F	9.9	69.6	1.00	1.85	4.17	10.2
3a	R1	54	0.0	1.141	291.1	LOS F	9.9	69.6	1.00	1.85	4.17	10.2
Approach		72	0.0	1.141	276.5	LOS F	9.9	69.6	1.00	1.85	4.17	10.2
NorthEast: Bridge St												
24a	L1	71	0.0	0.499	4.5	LOS A	4.0	28.7	0.08	0.50	0.08	46.3
26a	R1	804	4.8	0.499	4.2	LOS A	4.0	28.7	0.08	0.50	0.08	46.4
Approach		875	4.5	0.499	4.2	NA	4.0	28.7	0.08	0.50	0.08	46.4
West: Sydney St												
10a	L1	1120	4.9	0.611	4.5	LOS A	0.1	0.8	0.01	0.55	0.01	46.2
12	R2	8	0.0	0.611	5.1	LOS A	0.1	0.8	0.01	0.55	0.01	46.2
Approach		1128	4.9	0.611	4.5	NA	0.1	0.8	0.01	0.55	0.01	46.2
All Vehicles		2075	4.5	1.141	13.7	NA	9.9	69.6	0.07	0.57	0.18	41.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	27	0.0	1.102	184.3	LOS F	10.5	73.8	1.00	1.94	4.48	12.4
3a	R1	67	0.0	1.102	228.8	LOS F	10.5	73.8	1.00	1.94	4.48	12.4
Approach		95	0.0	1.102	216.0	LOS F	10.5	73.8	1.00	1.94	4.48	12.4
NorthEast: Bridge St												
24a	L1	77	0.0	0.573	4.6	LOS A	5.1	36.3	0.15	0.48	0.15	46.1
26a	R1	927	2.8	0.573	4.2	LOS A	5.1	36.3	0.15	0.48	0.15	46.2
Approach		1004	2.6	0.573	4.3	NA	5.1	36.3	0.15	0.48	0.15	46.2
West: Sydney St												
10a	L1	975	2.2	0.531	4.5	LOS A	0.2	1.8	0.02	0.54	0.02	46.2
12	R2	22	0.0	0.531	5.0	LOS A	0.2	1.8	0.02	0.54	0.02	46.2
Approach		997	2.1	0.531	4.5	NA	0.2	1.8	0.02	0.54	0.02	46.2
All Vehicles		2096	2.3	1.102	13.9	NA	10.5	73.8	0.13	0.57	0.28	41.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion - Import]

New Site
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles													
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	57	1.9	0.043	9.8	LOS A	0.9	6.7	0.31	0.61	0.31	43.7
2	T1	679	6.5	0.279	5.5	LOS A	7.2	53.2	0.35	0.33	0.35	46.4
3	R2	36	0.0	0.279	10.2	LOS A	6.3	46.3	0.36	0.35	0.36	45.7
Approach		772	5.9	0.279	6.0	LOS A	7.2	53.2	0.35	0.35	0.35	46.1
NorthEast: Lorne St												
4	L2	64	3.3	0.265	56.0	LOS D	3.5	24.9	0.94	0.75	0.94	28.1
5	T1	4	0.0	0.019	45.7	LOS D	0.3	1.8	0.87	0.59	0.87	30.6
6	R2	1	0.0	0.019	50.3	LOS D	0.3	1.8	0.87	0.59	0.87	30.4
Approach		69	3.0	0.265	55.3	LOS D	3.5	24.9	0.93	0.74	0.93	28.3
NorthWest: New England Hwy												
7	L2	12	0.0	0.009	9.6	LOS A	0.2	1.3	0.30	0.58	0.30	43.8
8	T1	582	10.3	0.276	5.7	LOS A	7.0	53.0	0.36	0.34	0.36	46.2
9	R2	57	0.0	0.276	10.9	LOS A	5.4	40.3	0.38	0.40	0.38	45.0
Approach		651	9.2	0.276	6.2	LOS A	7.0	53.0	0.36	0.35	0.36	46.0
SouthWest: Lorne St												
10	L2	42	2.5	0.173	55.2	LOS D	2.2	15.9	0.92	0.73	0.92	28.3
11	T1	2	0.0	0.144	53.0	LOS D	1.3	9.2	0.93	0.71	0.93	28.1
12	R2	22	0.0	0.144	57.5	LOS E	1.3	9.2	0.93	0.71	0.93	27.9
Approach		66	1.6	0.173	55.9	LOS D	2.2	15.9	0.93	0.72	0.93	28.2
All Vehicles		1558	7.0	0.279	10.4	LOS A	7.2	53.2	0.41	0.38	0.41	43.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 28 July 2020 2:10:45 PM
Project: \\cardno.corp\apac_collab\Projects\2304\Projects_AWE\FY20\NE30034_Olympic_Park_Precinct_REF\5_DES_AN\10_Traffic\SIDRA
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MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion]

New Site
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	40	0.0	0.034	12.8	LOS A	0.8	5.8	0.38	0.62	0.38	42.2
2	T1	734	2.4	0.399	10.4	LOS A	12.9	92.1	0.50	0.47	0.50	43.5
3	R2	88	0.0	0.399	17.0	LOS B	9.5	67.7	0.55	0.55	0.55	41.7
Approach		862	2.1	0.399	11.2	LOS A	12.9	92.1	0.50	0.49	0.50	43.3
NorthEast: Lorne St												
4	L2	147	0.0	0.394	48.9	LOS D	7.5	52.4	0.91	0.79	0.91	29.8
5	T1	1	0.0	0.027	40.6	LOS C	0.4	2.7	0.82	0.65	0.82	31.1
6	R2	7	0.0	0.027	45.1	LOS D	0.4	2.7	0.82	0.65	0.82	30.9
Approach		156	0.0	0.394	48.7	LOS D	7.5	52.4	0.90	0.78	0.90	29.8
NorthWest: New England Hwy												
7	L2	12	0.0	0.010	12.6	LOS A	0.2	1.7	0.37	0.60	0.37	42.3
8	T1	682	4.0	0.305	9.4	LOS A	9.2	66.8	0.46	0.42	0.46	44.2
9	R2	24	8.7	0.305	14.8	LOS B	8.2	59.7	0.48	0.44	0.48	43.2
Approach		718	4.1	0.305	9.6	LOS A	9.2	66.8	0.46	0.42	0.46	44.2
SouthWest: Lorne St												
10	L2	56	1.9	0.146	46.4	LOS D	2.7	19.0	0.85	0.73	0.85	30.4
11	T1	1	0.0	0.084	45.2	LOS D	1.0	7.3	0.87	0.70	0.87	29.8
12	R2	20	0.0	0.084	49.8	LOS D	1.0	7.3	0.87	0.70	0.87	29.7
Approach		77	1.4	0.146	47.3	LOS D	2.7	19.0	0.86	0.72	0.86	30.2
All Vehicles		1813	2.7	0.399	15.3	LOS B	12.9	92.1	0.54	0.49	0.54	41.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

▽ Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	23	0.0	0.274	4.6	LOS A	0.0	0.0	0.00	0.03	0.00	49.7
2	T1	738	6.3	0.274	2.1	LOS A	2.3	18.6	0.15	0.04	0.18	48.4
3	R2	43	95.1	0.274	18.0	LOS B	2.3	18.6	0.46	0.05	0.54	43.6
Approach		804	10.9	0.274	3.0	NA	2.3	18.6	0.16	0.04	0.20	48.2
NorthEast: Wilder St												
4	L2	7	0.0	0.128	6.0	LOS A	0.4	2.6	0.82	0.83	0.82	33.9
5	T1	1	0.0	0.128	48.8	LOS D	0.4	2.6	0.82	0.83	0.82	35.7
6	R2	6	0.0	0.128	65.5	LOS E	0.4	2.6	0.82	0.83	0.82	33.8
Approach		15	0.0	0.128	34.6	LOS C	0.4	2.6	0.82	0.83	0.82	33.9
NorthWest: New England Hwy												
7	L2	18	64.7	0.195	5.2	LOS A	0.0	0.0	0.00	0.03	0.00	48.4
8	T1	622	8.1	0.195	0.5	LOS A	0.5	3.8	0.08	0.04	0.08	49.5
9	R2	23	0.0	0.195	11.5	LOS A	0.5	3.8	0.17	0.05	0.17	51.9
Approach		663	9.4	0.195	1.0	NA	0.5	3.8	0.08	0.04	0.08	49.6
SouthWest: Francis Street												
10	L2	34	0.0	0.329	13.4	LOS A	1.1	8.0	0.83	0.98	1.00	37.6
11	T1	1	0.0	0.329	56.3	LOS D	1.1	8.0	0.83	0.98	1.00	37.9
12	R2	15	7.1	0.329	81.2	LOS F	1.1	8.0	0.83	0.98	1.00	37.4
Approach		49	2.1	0.329	34.5	LOS C	1.1	8.0	0.83	0.98	1.00	37.6
All Vehicles		1532	9.8	0.329	3.5	NA	2.3	18.6	0.16	0.08	0.18	48.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles													
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	27	50.0	0.223	5.1	LOS A	0.0	0.0	0.00	0.05	0.00	49.0
2	T1	786	2.5	0.223	0.2	LOS A	0.2	1.7	0.03	0.03	0.03	49.9
3	R2	9	0.0	0.223	10.7	LOS A	0.2	1.7	0.06	0.01	0.06	48.9
Approach		823	4.1	0.223	0.5	NA	0.2	1.7	0.03	0.03	0.03	49.8
NorthEast: Wilder St												
4	L2	6	0.0	0.292	15.3	LOS B	0.9	6.2	0.92	0.97	1.02	26.8
5	T1	1	0.0	0.292	64.5	LOS E	0.9	6.2	0.92	0.97	1.02	28.0
6	R2	14	0.0	0.292	84.5	LOS F	0.9	6.2	0.92	0.97	1.02	26.8
Approach		21	0.0	0.292	62.7	LOS E	0.9	6.2	0.92	0.97	1.02	26.8
NorthWest: New England Hwy												
7	L2	5	0.0	0.219	4.6	LOS A	0.0	0.0	0.00	0.01	0.00	49.4
8	T1	769	3.0	0.219	0.4	LOS A	0.5	3.5	0.06	0.02	0.06	49.6
9	R2	19	0.0	0.219	12.1	LOS A	0.5	3.5	0.13	0.03	0.13	52.1
Approach		794	2.9	0.219	0.7	NA	0.5	3.5	0.06	0.02	0.06	49.7
SouthWest: Francis Street												
10	L2	36	0.0	0.273	9.8	LOS A	0.9	6.2	0.75	0.86	0.84	40.7
11	T1	1	0.0	0.273	58.5	LOS E	0.9	6.2	0.75	0.86	0.84	40.9
12	R2	12	0.0	0.273	78.5	LOS F	0.9	6.2	0.75	0.86	0.84	40.5
Approach		48	0.0	0.273	27.3	LOS B	0.9	6.2	0.75	0.86	0.84	40.6
All Vehicles		1686	3.4	0.292	2.1	NA	0.9	6.2	0.08	0.06	0.08	48.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	14	0.0	0.029	0.2	LOS A	0.1	0.9	0.17	0.38	0.17	47.4
3	R2	36	0.0	0.029	4.8	LOS A	0.1	0.9	0.17	0.38	0.17	46.6
Approach		49	0.0	0.029	3.5	NA	0.1	0.9	0.17	0.38	0.17	46.8
East: Wilkinson Ave												
4	L2	56	3.8	0.086	4.6	LOS A	0.3	2.3	0.06	0.53	0.06	46.4
6	R2	60	0.0	0.086	4.9	LOS A	0.3	2.3	0.06	0.53	0.06	46.1
Approach		116	1.8	0.086	4.8	LOS A	0.3	2.3	0.06	0.53	0.06	46.2
North: Haydon St												
7	L2	63	0.0	0.041	4.6	LOS A	0.0	0.0	0.00	0.44	0.00	47.1
8	T1	14	0.0	0.041	0.0	LOS A	0.0	0.0	0.00	0.44	0.00	47.6
Approach		77	0.0	0.041	3.8	NA	0.0	0.0	0.00	0.44	0.00	47.2
All Vehicles		242	0.9	0.086	4.2	NA	0.3	2.3	0.06	0.47	0.06	46.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	5	0.0	0.064	0.5	LOS A	0.3	2.1	0.26	0.51	0.26	46.6
3	R2	96	0.0	0.064	5.0	LOS A	0.3	2.1	0.26	0.51	0.26	45.8
Approach		101	0.0	0.064	4.8	NA	0.3	2.1	0.26	0.51	0.26	45.8
East: Wilkinson Ave												
4	L2	128	0.0	0.203	4.7	LOS A	0.8	5.8	0.10	0.54	0.10	46.3
6	R2	134	0.0	0.203	5.4	LOS A	0.8	5.8	0.10	0.54	0.10	45.9
Approach		262	0.0	0.203	5.0	LOS A	0.8	5.8	0.10	0.54	0.10	46.1
North: Haydon St												
7	L2	124	0.0	0.081	4.6	LOS A	0.0	0.0	0.00	0.43	0.00	47.1
8	T1	28	0.0	0.081	0.0	LOS A	0.0	0.0	0.00	0.43	0.00	47.6
Approach		153	0.0	0.081	3.7	NA	0.0	0.0	0.00	0.43	0.00	47.2
All Vehicles		516	0.0	0.203	4.6	NA	0.8	5.8	0.10	0.50	0.10	46.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX

H

SIDRA RESULTS 2031 WITH BRIDGE

MOVEMENT SUMMARY

Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	18	0.0	1.141	232.7	LOS F	9.9	69.6	1.00	1.85	4.17	10.2
3a	R1	54	0.0	1.141	291.1	LOS F	9.9	69.6	1.00	1.85	4.17	10.2
Approach		72	0.0	1.141	276.5	LOS F	9.9	69.6	1.00	1.85	4.17	10.2
NorthEast: Bridge St												
24a	L1	71	0.0	0.499	4.5	LOS A	4.0	28.7	0.08	0.50	0.08	46.3
26a	R1	804	4.8	0.499	4.2	LOS A	4.0	28.7	0.08	0.50	0.08	46.4
Approach		875	4.5	0.499	4.2	NA	4.0	28.7	0.08	0.50	0.08	46.4
West: Sydney St												
10a	L1	1120	4.9	0.611	4.5	LOS A	0.1	0.8	0.01	0.55	0.01	46.2
12	R2	8	0.0	0.611	5.1	LOS A	0.1	0.8	0.01	0.55	0.01	46.2
Approach		1128	4.9	0.611	4.5	NA	0.1	0.8	0.01	0.55	0.01	46.2
All Vehicles		2075	4.5	1.141	13.7	NA	9.9	69.6	0.07	0.57	0.18	41.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	27	0.0	1.102	184.3	LOS F	10.5	73.8	1.00	1.94	4.48	12.4
3a	R1	67	0.0	1.102	228.8	LOS F	10.5	73.8	1.00	1.94	4.48	12.4
Approach		95	0.0	1.102	216.0	LOS F	10.5	73.8	1.00	1.94	4.48	12.4
NorthEast: Bridge St												
24a	L1	77	0.0	0.573	4.6	LOS A	5.1	36.3	0.15	0.48	0.15	46.1
26a	R1	927	2.8	0.573	4.2	LOS A	5.1	36.3	0.15	0.48	0.15	46.2
Approach		1004	2.6	0.573	4.3	NA	5.1	36.3	0.15	0.48	0.15	46.2
West: Sydney St												
10a	L1	975	2.2	0.531	4.5	LOS A	0.2	1.8	0.02	0.54	0.02	46.2
12	R2	22	0.0	0.531	5.0	LOS A	0.2	1.8	0.02	0.54	0.02	46.2
Approach		997	2.1	0.531	4.5	NA	0.2	1.8	0.02	0.54	0.02	46.2
All Vehicles		2096	2.3	1.102	13.9	NA	10.5	73.8	0.13	0.57	0.28	41.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion - Import]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles													
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	57	1.9	0.041	8.6	LOS A	0.8	5.9	0.27	0.60	0.27	44.3
2	T1	679	6.5	0.245	3.9	LOS A	5.6	41.7	0.30	0.27	0.30	47.4
3	R2	13	0.0	0.245	8.5	LOS A	5.3	39.3	0.30	0.28	0.30	46.9
Approach		748	6.0	0.245	4.4	LOS A	5.6	41.7	0.30	0.29	0.30	47.1
NorthEast: Lorne St												
4	L2	12	18.2	0.070	58.8	LOS E	0.6	5.1	0.93	0.68	0.93	27.5
5	T1	4	0.0	0.025	49.9	LOS D	0.3	1.9	0.90	0.61	0.90	29.5
6	R2	1	0.0	0.025	54.5	LOS D	0.3	1.9	0.90	0.61	0.90	29.4
Approach		17	12.5	0.070	56.3	LOS D	0.6	5.1	0.92	0.66	0.92	28.1
NorthWest: New England Hwy												
7	L2	12	0.0	0.008	8.5	LOS A	0.2	1.1	0.26	0.58	0.26	44.4
8	T1	582	10.3	0.263	4.2	LOS A	6.0	45.8	0.31	0.30	0.31	47.0
9	R2	57	0.0	0.263	9.2	LOS A	4.6	34.7	0.32	0.36	0.32	45.9
Approach		651	9.2	0.263	4.7	LOS A	6.0	45.8	0.31	0.31	0.31	46.9
SouthWest: Lorne St												
10	L2	42	2.5	0.231	59.9	LOS E	2.3	16.8	0.96	0.74	0.96	27.3
11	T1	2	0.0	0.141	52.8	LOS D	1.3	9.2	0.93	0.71	0.93	28.1
12	R2	22	0.0	0.141	57.3	LOS E	1.3	9.2	0.93	0.71	0.93	28.0
Approach		66	1.6	0.231	58.8	LOS E	2.3	16.8	0.95	0.73	0.95	27.6
All Vehicles		1482	7.3	0.263	7.6	LOS A	6.0	45.8	0.34	0.33	0.34	45.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 28 July 2020 4:09:47 PM
Project: \\cardno.corp\apac_collab\Projects\2304\Projects_AWE\FY20\NE30034_Olympic_Park_Precinct_REF\5_DES_AN\10_Traffic\SIDRA
\Musswellbrook 2031 PM - With Bridge All Movement.sip8

MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion]

New Site
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	40	0.0	0.029	9.1	LOS A	0.6	4.3	0.29	0.60	0.29	44.1
2	T1	734	2.4	0.258	4.6	LOS A	6.4	46.1	0.32	0.29	0.32	47.0
3	R2	6	0.0	0.258	9.1	LOS A	6.2	44.6	0.32	0.29	0.32	46.6
Approach		780	2.3	0.258	4.8	LOS A	6.4	46.1	0.32	0.30	0.32	46.9
NorthEast: Lorne St												
4	L2	28	0.0	0.131	56.8	LOS E	1.5	10.7	0.93	0.71	0.93	28.0
5	T1	1	0.0	0.053	54.0	LOS D	0.5	3.2	0.93	0.67	0.93	27.9
6	R2	7	0.0	0.053	58.6	LOS E	0.5	3.2	0.93	0.67	0.93	27.8
Approach		37	0.0	0.131	57.0	LOS E	1.5	10.7	0.93	0.70	0.93	27.9
NorthWest: New England Hwy												
7	L2	12	0.0	0.009	9.0	LOS A	0.2	1.2	0.28	0.58	0.28	44.1
8	T1	682	4.0	0.264	4.7	LOS A	6.6	47.6	0.33	0.30	0.33	46.9
9	R2	24	8.7	0.264	9.6	LOS A	5.8	42.2	0.33	0.32	0.33	46.1
Approach		718	4.1	0.264	5.0	LOS A	6.6	47.6	0.33	0.31	0.33	46.8
SouthWest: Lorne St												
10	L2	56	1.9	0.261	58.0	LOS E	3.1	21.7	0.95	0.75	0.95	27.7
11	T1	1	0.0	0.098	49.2	LOS D	1.1	7.7	0.90	0.70	0.90	28.9
12	R2	20	0.0	0.098	53.7	LOS D	1.1	7.7	0.90	0.70	0.90	28.7
Approach		77	1.4	0.261	56.7	LOS E	3.1	21.7	0.94	0.74	0.94	28.0
All Vehicles		1612	3.0	0.264	8.6	LOS A	6.6	47.6	0.37	0.34	0.37	44.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	23	0.0	0.275	4.6	LOS A	0.0	0.0	0.00	0.03	0.00	49.7
2	T1	715	6.5	0.275	1.5	LOS A	2.0	16.3	0.15	0.06	0.18	48.8
3	R2	67	60.9	0.275	13.1	LOS A	2.0	16.3	0.48	0.12	0.56	44.7
Approach		805	10.8	0.275	2.6	NA	2.0	16.3	0.18	0.07	0.20	48.4
NorthEast: Wilder St												
4	L2	60	0.0	0.157	6.0	LOS A	0.5	3.5	0.57	0.68	0.57	42.9
6	R2	6	0.0	0.157	62.9	LOS E	0.5	3.5	0.57	0.68	0.57	42.7
Approach		66	0.0	0.157	11.4	LOS A	0.5	3.5	0.57	0.68	0.57	42.9
NorthWest: New England Hwy												
7	L2	18	64.7	0.181	5.2	LOS A	0.0	0.0	0.00	0.03	0.00	48.4
8	T1	569	8.9	0.181	0.5	LOS A	0.5	3.6	0.08	0.04	0.08	49.5
9	R2	23	0.0	0.181	11.1	LOS A	0.5	3.6	0.17	0.06	0.17	51.9
Approach		611	10.2	0.181	1.0	NA	0.5	3.6	0.08	0.04	0.08	49.6
SouthWest: Francis Street												
10	L2	34	0.0	0.337	13.8	LOS A	1.2	8.2	0.83	0.98	1.01	37.3
12	R2	16	6.7	0.337	81.6	LOS F	1.2	8.2	0.83	0.98	1.01	37.0
Approach		49	2.1	0.337	35.5	LOS C	1.2	8.2	0.83	0.98	1.01	37.2
All Vehicles		1532	9.8	0.337	3.4	NA	2.0	16.3	0.18	0.11	0.20	48.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	27	50.0	0.259	5.1	LOS A	0.0	0.0	0.00	0.04	0.00	49.0
2	T1	704	2.8	0.259	1.0	LOS A	1.5	10.6	0.15	0.10	0.16	49.0
3	R2	92	0.0	0.259	9.2	LOS A	1.5	10.6	0.43	0.21	0.47	46.5
Approach		823	4.1	0.259	2.0	NA	1.5	10.6	0.18	0.11	0.19	48.7
NorthEast: Wilder St												
4	L2	125	0.0	0.350	8.0	LOS A	1.5	10.3	0.63	0.83	0.79	41.5
6	R2	14	0.0	0.350	72.1	LOS F	1.5	10.3	0.63	0.83	0.79	41.3
Approach		139	0.0	0.350	14.3	LOS A	1.5	10.3	0.63	0.83	0.79	41.5
NorthWest: New England Hwy												
7	L2	5	0.0	0.187	4.6	LOS A	0.0	0.0	0.00	0.01	0.00	49.4
8	T1	651	3.6	0.187	0.4	LOS A	0.4	2.9	0.06	0.02	0.06	49.7
9	R2	19	0.0	0.187	11.0	LOS A	0.4	2.9	0.13	0.04	0.13	52.2
Approach		675	3.4	0.187	0.7	NA	0.4	2.9	0.06	0.02	0.06	49.7
SouthWest: Francis Street												
10	L2	36	0.0	0.280	10.7	LOS A	0.9	6.4	0.78	0.91	0.89	39.9
12	R2	12	0.0	0.280	85.1	LOS F	0.9	6.4	0.78	0.91	0.89	39.8
Approach		47	0.0	0.280	28.9	LOS C	0.9	6.4	0.78	0.91	0.89	39.9
All Vehicles		1684	3.4	0.350	3.3	NA	1.5	10.6	0.19	0.16	0.21	48.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	14	0.0	0.015	0.1	LOS A	0.1	0.4	0.14	0.25	0.14	48.2
3	R2	13	0.0	0.015	4.8	LOS A	0.1	0.4	0.14	0.25	0.14	47.3
Approach		26	0.0	0.015	2.4	NA	0.1	0.4	0.14	0.25	0.14	47.7
East: Wilkinson Ave												
4	L2	3	66.7	0.052	5.2	LOS A	0.2	1.2	0.12	0.54	0.12	45.4
6	R2	60	0.0	0.052	4.8	LOS A	0.2	1.2	0.12	0.54	0.12	45.9
Approach		63	3.3	0.052	4.8	LOS A	0.2	1.2	0.12	0.54	0.12	45.9
North: Haydon St												
7	L2	63	0.0	0.041	4.6	LOS A	0.0	0.0	0.00	0.44	0.00	47.1
8	T1	14	0.0	0.041	0.0	LOS A	0.0	0.0	0.00	0.44	0.00	47.6
Approach		77	0.0	0.041	3.8	NA	0.0	0.0	0.00	0.44	0.00	47.2
All Vehicles		166	1.3	0.052	3.9	NA	0.2	1.2	0.07	0.45	0.07	46.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles													
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	5	0.0	0.011	0.4	LOS A	0.1	0.4	0.25	0.38	0.25	47.3
3	R2	14	0.0	0.011	5.0	LOS A	0.1	0.4	0.25	0.38	0.25	46.4
Approach		19	0.0	0.011	3.7	NA	0.1	0.4	0.25	0.38	0.25	46.6
East: Wilkinson Ave												
4	L2	8	0.0	0.119	4.6	LOS A	0.4	2.9	0.17	0.54	0.17	46.2
6	R2	134	0.0	0.119	5.0	LOS A	0.4	2.9	0.17	0.54	0.17	45.8
Approach		142	0.0	0.119	4.9	LOS A	0.4	2.9	0.17	0.54	0.17	45.8
North: Haydon St												
7	L2	124	0.0	0.081	4.6	LOS A	0.0	0.0	0.00	0.43	0.00	47.1
8	T1	28	0.0	0.081	0.0	LOS A	0.0	0.0	0.00	0.43	0.00	47.6
Approach		153	0.0	0.081	3.7	NA	0.0	0.0	0.00	0.43	0.00	47.2
All Vehicles		314	0.0	0.119	4.3	NA	0.4	2.9	0.09	0.48	0.09	46.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX

I

SIDRA RESULTS 2031 WITH BRIDGE LILO

MOVEMENT SUMMARY

Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	27	0.0	1.102	184.3	LOS F	10.5	73.8	1.00	1.94	4.48	12.4
3a	R1	67	0.0	1.102	228.8	LOS F	10.5	73.8	1.00	1.94	4.48	12.4
Approach		95	0.0	1.102	216.0	LOS F	10.5	73.8	1.00	1.94	4.48	12.4
NorthEast: Bridge St												
24a	L1	77	0.0	0.573	4.6	LOS A	5.1	36.3	0.15	0.48	0.15	46.1
26a	R1	927	2.8	0.573	4.2	LOS A	5.1	36.3	0.15	0.48	0.15	46.2
Approach		1004	2.6	0.573	4.3	NA	5.1	36.3	0.15	0.48	0.15	46.2
West: Sydney St												
10a	L1	975	2.2	0.531	4.5	LOS A	0.2	1.8	0.02	0.54	0.02	46.2
12	R2	22	0.0	0.531	5.0	LOS A	0.2	1.8	0.02	0.54	0.02	46.2
Approach		997	2.1	0.531	4.5	NA	0.2	1.8	0.02	0.54	0.02	46.2
All Vehicles		2096	2.3	1.102	13.9	NA	10.5	73.8	0.13	0.57	0.28	41.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Sydney St/Bridge St/Haydon St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
1	L2	18	0.0	1.141	232.7	LOS F	9.9	69.6	1.00	1.85	4.17	10.2
3a	R1	54	0.0	1.141	291.1	LOS F	9.9	69.6	1.00	1.85	4.17	10.2
Approach		72	0.0	1.141	276.5	LOS F	9.9	69.6	1.00	1.85	4.17	10.2
NorthEast: Bridge St												
24a	L1	71	0.0	0.499	4.5	LOS A	4.0	28.7	0.08	0.50	0.08	46.3
26a	R1	804	4.8	0.499	4.2	LOS A	4.0	28.7	0.08	0.50	0.08	46.4
Approach		875	4.5	0.499	4.2	NA	4.0	28.7	0.08	0.50	0.08	46.4
West: Sydney St												
10a	L1	1120	4.9	0.611	4.5	LOS A	0.1	0.8	0.01	0.55	0.01	46.2
12	R2	8	0.0	0.611	5.1	LOS A	0.1	0.8	0.01	0.55	0.01	46.2
Approach		1128	4.9	0.611	4.5	NA	0.1	0.8	0.01	0.55	0.01	46.2
All Vehicles		2075	4.5	1.141	13.7	NA	9.9	69.6	0.07	0.57	0.18	41.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	40	0.0	0.029	8.5	LOS A	0.6	4.0	0.27	0.59	0.27	44.4
2	T1	734	2.4	0.342	4.7	LOS A	8.9	63.6	0.34	0.34	0.34	46.7
3	R2	98	0.0	0.342	9.9	LOS A	6.3	44.5	0.36	0.43	0.36	45.3
Approach		872	2.1	0.342	5.4	LOS A	8.9	63.6	0.34	0.36	0.34	46.5
NorthEast: Lorne St												
4	L2	28	0.0	0.153	59.1	LOS E	1.6	10.9	0.95	0.72	0.95	27.5
5	T1	1	0.0	0.159	56.3	LOS D	1.2	8.7	0.95	0.71	0.95	27.4
6	R2	21	0.0	0.159	60.8	LOS E	1.2	8.7	0.95	0.71	0.95	27.2
Approach		51	0.0	0.159	59.8	LOS E	1.6	10.9	0.95	0.71	0.95	27.4
NorthWest: New England Hwy												
7	L2	12	0.0	0.008	8.5	LOS A	0.2	1.1	0.26	0.58	0.26	44.4
8	T1	682	4.0	0.260	4.1	LOS A	6.2	44.6	0.31	0.28	0.31	47.2
9	R2	24	8.7	0.260	8.9	LOS A	5.4	39.2	0.31	0.30	0.31	46.4
Approach		718	4.1	0.260	4.4	LOS A	6.2	44.6	0.31	0.29	0.31	47.2
SouthWest: Lorne St												
10	L2	56	1.9	0.304	60.4	LOS E	3.1	22.3	0.97	0.75	0.97	27.2
11	T1	1	0.0	0.110	51.4	LOS D	1.1	7.8	0.92	0.70	0.92	28.4
12	R2	20	0.0	0.110	55.9	LOS D	1.1	7.8	0.92	0.70	0.92	28.3
Approach		77	1.4	0.304	59.1	LOS E	3.1	22.3	0.95	0.74	0.95	27.5
All Vehicles		1717	2.8	0.342	9.0	LOS A	8.9	63.6	0.37	0.36	0.37	44.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101v [New England Hwy/ Lorne St - Conversion - Import]

New Site
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	57	1.9	0.041	8.6	LOS A	0.8	5.9	0.27	0.60	0.27	44.3
2	T1	679	6.5	0.338	4.7	LOS A	8.5	63.0	0.34	0.33	0.34	46.8
3	R2	80	51.3	0.338	10.7	LOS A	5.4	44.1	0.37	0.43	0.37	44.8
Approach		816	10.6	0.338	5.6	LOS A	8.5	63.0	0.34	0.36	0.34	46.4
NorthEast: Lorne St												
4	L2	12	18.2	0.070	58.8	LOS E	0.6	5.1	0.93	0.68	0.93	27.5
5	T1	4	0.0	0.076	55.2	LOS D	0.6	4.5	0.94	0.67	0.94	27.9
6	R2	7	0.0	0.076	59.8	LOS E	0.6	4.5	0.94	0.67	0.94	27.7
Approach		23	9.1	0.076	58.5	LOS E	0.6	5.1	0.94	0.68	0.94	27.7
NorthWest: New England Hwy												
7	L2	12	0.0	0.008	8.5	LOS A	0.2	1.1	0.26	0.58	0.26	44.4
8	T1	582	10.3	0.267	4.5	LOS A	6.1	46.6	0.32	0.31	0.32	46.9
9	R2	57	0.0	0.267	9.9	LOS A	4.8	36.3	0.35	0.38	0.35	45.6
Approach		651	9.2	0.267	5.0	LOS A	6.1	46.6	0.32	0.32	0.32	46.7
SouthWest: Lorne St												
10	L2	42	2.5	0.231	59.9	LOS E	2.3	16.8	0.96	0.74	0.96	27.3
11	T1	2	0.0	0.121	51.4	LOS D	1.3	9.0	0.92	0.71	0.92	28.4
12	R2	22	0.0	0.121	56.0	LOS D	1.3	9.0	0.92	0.71	0.92	28.3
Approach		66	1.6	0.231	58.3	LOS E	2.3	16.8	0.94	0.73	0.94	27.7
All Vehicles		1556	9.6	0.338	8.4	LOS A	8.5	63.0	0.37	0.36	0.37	44.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	SouthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P2	NorthEast Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P3	NorthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
P4	SouthWest Full Crossing	53	54.3	LOS E	0.2	0.2	0.95	0.95
All Pedestrians		211	54.3	LOS E			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: CARDNO (QLD) PTY LTD | Processed: Tuesday, 28 July 2020 5:04:58 PM
Project: \\cardno.corp\apac_collab\Projects\2304\Projects_AWE\FY20\NE30034_Olympic_Park_Precinct_REF\5_DES_AN\10_Traffic\SIDRA
\Musswellbrook 2031 PM - With Bridge LILO.sip8

MOVEMENT SUMMARY

▽ Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	23	0.0	0.221	4.6	LOS A	0.0	0.0	0.00	0.04	0.00	49.8
2	T1	782	11.2	0.221	0.1	LOS A	0.0	0.0	0.00	0.02	0.00	50.0
Approach		805	10.8	0.221	0.2	NA	0.0	0.0	0.00	0.02	0.00	50.0
NorthEast: Wilder St												
4	L2	60	0.0	0.062	6.0	LOS A	0.2	1.5	0.38	0.60	0.38	45.7
Approach		60	0.0	0.062	6.0	LOS A	0.2	1.5	0.38	0.60	0.38	45.7
NorthWest: New England Hwy												
7	L2	18	64.7	0.182	5.2	LOS A	0.0	0.0	0.00	0.03	0.00	48.4
8	T1	569	8.9	0.182	0.6	LOS A	0.5	4.1	0.09	0.04	0.09	49.5
9	R2	23	0.0	0.182	11.9	LOS A	0.5	4.1	0.19	0.06	0.19	51.7
Approach		611	10.2	0.182	1.1	NA	0.5	4.1	0.09	0.04	0.09	49.5
SouthWest: Francis Street												
10	L2	34	0.0	0.312	11.8	LOS A	1.1	7.5	0.78	0.91	0.93	38.6
12	R2	16	6.7	0.312	75.1	LOS F	1.1	7.5	0.78	0.91	0.93	38.4
Approach		49	2.1	0.312	32.0	LOS C	1.1	7.5	0.78	0.91	0.93	38.5
All Vehicles		1525	9.9	0.312	1.8	NA	1.1	7.5	0.08	0.08	0.08	49.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [New England Hwy/ Wilder St]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: New England Hwy												
1	L2	27	50.0	0.218	5.1	LOS A	0.0	0.0	0.00	0.05	0.00	49.1
2	T1	797	2.5	0.218	0.1	LOS A	0.0	0.0	0.00	0.02	0.00	50.1
Approach		824	4.1	0.218	0.2	NA	0.0	0.0	0.00	0.02	0.00	50.0
NorthEast: Wilder St												
4	L2	125	0.0	0.134	6.3	LOS A	0.5	3.5	0.42	0.64	0.42	45.6
Approach		125	0.0	0.134	6.3	LOS A	0.5	3.5	0.42	0.64	0.42	45.6
NorthWest: New England Hwy												
7	L2	5	0.0	0.189	4.6	LOS A	0.0	0.0	0.00	0.01	0.00	49.4
8	T1	651	3.6	0.189	0.4	LOS A	0.5	3.3	0.07	0.02	0.07	49.6
9	R2	19	0.0	0.189	11.9	LOS A	0.5	3.3	0.15	0.04	0.15	52.0
Approach		675	3.4	0.189	0.8	NA	0.5	3.3	0.07	0.02	0.07	49.6
SouthWest: Francis Street												
10	L2	36	0.0	0.267	9.4	LOS A	0.9	6.0	0.74	0.85	0.82	40.9
12	R2	12	0.0	0.267	80.4	LOS F	0.9	6.0	0.74	0.85	0.82	40.8
Approach		47	0.0	0.267	26.8	LOS B	0.9	6.0	0.74	0.85	0.82	40.9
All Vehicles		1672	3.4	0.267	1.7	NA	0.9	6.0	0.08	0.09	0.08	49.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	14	0.0	0.070	0.4	LOS A	0.3	3.2	0.20	0.44	0.20	47.3
3	R2	80	51.3	0.070	5.4	LOS A	0.3	3.2	0.20	0.44	0.20	45.6
Approach		94	43.8	0.070	4.7	NA	0.3	3.2	0.20	0.44	0.20	45.8
East: Wilkinson Ave												
4	L2	9	22.2	0.060	4.8	LOS A	0.2	1.4	0.11	0.55	0.11	46.0
6	R2	60	0.0	0.060	5.1	LOS A	0.2	1.4	0.11	0.55	0.11	45.9
Approach		69	3.0	0.060	5.1	LOS A	0.2	1.4	0.11	0.55	0.11	45.9
North: Haydon St												
7	L2	63	0.0	0.041	4.6	LOS A	0.0	0.0	0.00	0.44	0.00	47.1
8	T1	14	0.0	0.041	0.0	LOS A	0.0	0.0	0.00	0.44	0.00	47.6
Approach		77	0.0	0.041	3.8	NA	0.0	0.0	0.00	0.44	0.00	47.2
All Vehicles		240	18.0	0.070	4.5	NA	0.3	3.2	0.11	0.47	0.11	46.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [Haydon St/ Wilkinson Ave]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Haydon St												
2	T1	5	0.0	0.070	0.5	LOS A	0.3	2.3	0.26	0.51	0.26	46.6
3	R2	105	0.0	0.070	5.0	LOS A	0.3	2.3	0.26	0.51	0.26	45.8
Approach		111	0.0	0.070	4.8	NA	0.3	2.3	0.26	0.51	0.26	45.8
East: Wilkinson Ave												
4	L2	22	0.0	0.137	4.6	LOS A	0.5	3.4	0.17	0.56	0.17	46.2
6	R2	134	0.0	0.137	5.4	LOS A	0.5	3.4	0.17	0.56	0.17	45.8
Approach		156	0.0	0.137	5.3	LOS A	0.5	3.4	0.17	0.56	0.17	45.8
North: Haydon St												
7	L2	124	0.0	0.081	4.6	LOS A	0.0	0.0	0.00	0.43	0.00	47.1
8	T1	28	0.0	0.081	0.0	LOS A	0.0	0.0	0.00	0.43	0.00	47.6
Approach		153	0.0	0.081	3.7	NA	0.0	0.0	0.00	0.43	0.00	47.2
All Vehicles		419	0.0	0.137	4.6	NA	0.5	3.4	0.13	0.50	0.13	46.3

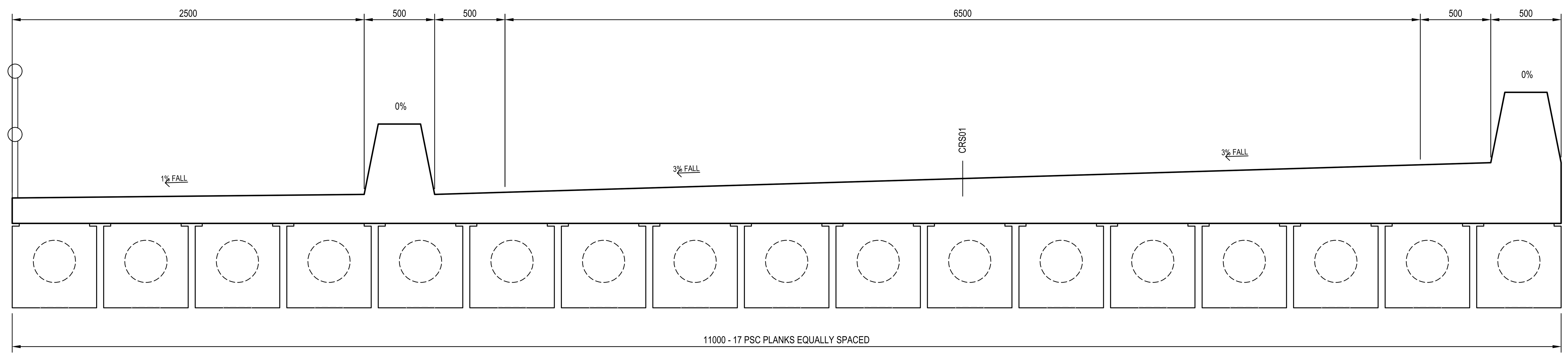
Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX

E

MUSCLE CREEK CONCEPT DESIGN

BRIDGE PLAN
SCALE 1:250



SECTION 1
SCALE 1:20

Rev.	Date	Description	Des.	Verif.	Appd.
1	08.02.19	CONCEPT DESIGN ISSUE	DS	-	-

SCALE 1:250 @A1 (0, 5, 10, 15, 20, 25m)

SCALE 1:20 @A1 (0, 0.5, 1, 1.5, 2m)

Cardno Shaping the Future

Cardno (NSW/ACT) Pty Ltd | ABN 95 001 145 035
34/205-207 Albany Street North
Gosford, NSW 2250
Tel: 02 4323 2558 Fax: 02 4324 3251
Web: www.cardno.com.au

Drawn	JLJ	Date 07.02.19
Checked	DS	Date 07.02.19
Designed	DS	Date 07.02.19
Verified	-	Date -
Approved	-	Date -

Client: MUSWELLBROOK COUNCIL

Project: BRIDGE OVER MUSCLE CREEK
WILDER STREET, MUSWELLBROOK
STRUCTURAL ENGINEERING CONCEPT

Title: BRIDGE GENERAL ARRANGEMENT

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Datum	Register	Scale	Size
AHD	-		A1

Drawing Number: 81019014-ST-105
Revision: 1

CTB File: Grp_Cardno_Full.ctb DEVICE NAME: GRP_PDF.pc3
SAVE DATE: 7-Feb-19 7:13:30 PM BY: Jessica.Jordan DATE PLOTTED: 8-Feb-19 9:55:47 AM BY: JESSICA.JORDAN
XREF's: x80519014 A1Title; x80519014 Alignment; x80519014 Map; x80519014 Civil; x80519014 Survey; x80519014-Bridge; x80519014-Bridge Details
CAD File: \\cardno.corp\global\AU\NSW\DirectoryStructure\Projects\805\FY19\81019014_MUSCLE CREEK BRIDGE\Drawings\Build\Structural\81019014-ST-105 [1] GA.dwg

Datum RL 133.0

DEPTH	1.533	1.670	1.731	1.744	1.758	1.826	3.276	5.841	6.041	1.370	0.032	0.020	0.084
DESIGN LEVELS	145.693	145.682	145.690	145.694	145.698	145.748	145.798	145.848	145.898	145.948	145.969	145.993	146.001
EXISTING LEVELS	144.160	144.013	143.960	143.950	143.941	143.923	142.522	140.007	139.857	144.578	145.938	145.972	145.917
CONTROL CHAINAGE	50.000	54.484	58.350	59.172	60.000	70.000	80.000	90.000	100.000	110.000	114.172	120.000	123.481

BRIDGE LONGITUDINAL SECTION

SCALE 1:100

Rev.	Date	Description	Des.	Verif.	Appd.
1	08.02.19	CONCEPT DESIGN ISSUE	DS	-	-

0 1 2 4 6 8 10m
SCALE 1:100 @A1

Cardno
Shaping the Future

Cardno (NSW/ACT) Pty Ltd | ABN 95 001 145 035
34/205-207 Albany Street North
Gosford, NSW 2250
Tel: 02 4323 2558 Fax: 02 4324 3251
Web: www.cardno.com.au

		Date
Drawn	JLJ	07.02.19
Checked	DS	07.02.19
Designed	DS	07.02.19
Verified	-	-
Approved	-	-

Client: MUSWELLBROOK COUNCIL

Project: BRIDGE OVER MUSCLE CREEK
WILDER STREET, MUSWELLBROOK
STRUCTURAL ENGINEERING CONCEPT

Title: BRIDGE LONG SECTION

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Datum	Register	Scale	Size
AHD	-		A1

Drawing Number: 81019014-ST-110
Revision: 1

APPENDIX

F

CONSULTATION

From:	Scott Carter
To:	Jennifer Cornell
Subject:	Re: Muscle Creek concept design
Date:	Thursday, 20 August 2020 3:18:24 PM
Attachments:	image001.png

Jennifer

Thankyou for contacting the Department in relation to the proposed bridge to be constructed over Muscle Creek.

The concept design for the bridge appears adequate.
The Departments only comment would be that the piers be removed from the waterway, however it is understandable that to do so would require a significant change to the construction type for the centre span that would be prohibitively expensive.

With the design as it is, a permit to dredge and reclaim would be required to install the piers and caps and scour protection. For further information please contact me.

regards

Scott Carter
Senior Fisheries Manager Coastal Systems
NSW Department of Primary Industries | Fisheries
Port Stephens Fisheries Institute| Taylors Beach | NSW 2316
T: +61 2 4916 3931 | E: scott.carter@dpi.nsw.gov.au

ALL MAIL TO: DPI Fisheries, Attn: R. Philps,1243 Bruxner Hwy, Wollongbar NSW 2477

From: Jennifer Cornell
To: "ahp.central@dpi.nsw.gov.au"
Cc: Nadine Caff
Subject: REF Consultation - Muswellbrook Olympic Park Precinct
Date: Wednesday, 12 August 2020 11:23:29 AM
Attachments: Muscle Creek Bridge Concept Design.pdf
Fisheries - Consultation Letter.pdf
image001.png
image002.png
image003.png
image004.png
image005.png
image006.png

Good morning,

Please find attached a consultation letter inviting DPI Fisheries to provide comment regarding the proposed upgrades to the Olympic Park Precinct at Muswellbrook.

It would be appreciated if you could provide any comments about this proposal by 2 September 2020.

Regards,

Jennifer Cornell
ENVIRONMENTAL ENGINEER
CARDNO

Phone +61 2 9496 7700 Fax +61 2 9439 5170 Direct +61 2 9024 7036
Address Level 9, The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia
Postal PO Box 19, St Leonards NSW 1590
Email jennifer.cornell@cardno.com.au Web www.cardno.com
CONNECT WITH CARDNO

Our Ref: NE30034:JC
Contact: Jennifer Cornell

Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

1/10 Denney Street
Broadmeadow NSW 2292
Australia

Phone +61 2 4231 9600
Fax +61 2 4228 6811

www.cardno.com

12 August 2020

Department of Primary Industries - Fisheries
Email: ahp.central@dpi.nsw.gov.au

MUSWELLBROOK – Muscle Creek Bridge

Dear Sir/Madam,

Muswellbrook Council has engaged Cardno (NSW/ACT) Pty Ltd to undertake the environmental assessment for components of the Olympic Park Masterplan upgrades. In accordance with Division 5.1 of the *NSW Environmental Planning and Assessment Act 1979*, Cardno is preparing a Review of Environmental Factors (REF) to satisfy the requirements for environmental assessment for the project.

We are writing to invite your comments on the proposed bridge over Muscle Creek connecting Olympic Park (Wilkinson Avenue) to Wilder Street. The concept design for the bridge is attached for your reference.

Instream works will be required during construction, Muscle Creek is a fifth order (Strahler) stream. Cardno are currently undertaking detailed design and the environmental assessment of the bridge and are hoping to receive any comments or requirements from DPI as to any matters to be considered in the development of the proposal, including confirmation of the need for a Fisheries permit.

If you would like any further information please contact Jennifer Cornell (contact details below). For this preliminary consultation we respectfully request your response by 2 September, 2020.

Yours sincerely,

Jennifer Cornell
Environmental Engineer
for Cardno
Direct Line: +61 2 9024 7036
Email: Jennifer.cornell@cardno.com.au

Attachments:

1. Figure 1: Proposed Master Plan upgrades for Olympic Park Precinct
2. Concept Design for bridge over Muscle Creek

From: NSW SES Risk Reduction
To: Jennifer Cornell; NSW SES Risk Reduction
Cc: Nadine Caff
Subject: RE: Infrastructure SEPP Consultation - Muswellbrook Olympic Park Precinct REF
Date: Thursday, 13 August 2020 9:55:49 AM
Attachments: image007.jpg
image008.jpg
image009.jpg
image010.png
image011.jpg
image012.jpg
image013.png
image014.png
image015.png
image016.png
image017.png
image018.png

Thank you for your referral.

Your referral has been received and filed in the register – Reference ID 1204.
Unfortunately NSW SES currently do not have any staff working in the land use planning space. I am unable to provide any indication of when that is likely to change.

Regards
Leanne

Leanne Cooper
Program Support Officer NSW State Emergency Service
M 0408969400 E leanne.cooper1@one.ses.nsw.gov.au

---

www.ses.nsw.gov.au

MISSION - NSW SES SAVING LIVES AND PROTECTING COMMUNITIES

VISION - BE THE BEST VOLUNTEER EMERGENCY SERVICE IN AUSTRALIA

FOR EMERGENCY HELP IN FLOODS AND STORMS CALL THE NSW SES ON 132 500

From: Jennifer Cornell [mailto:Jennifer.Cornell@cardno.com.au]
Sent: Monday, 10 August 2020 11:51 AM
To: NSW SES Risk Reduction <rra@ses.nsw.gov.au>
Cc: Nadine Caff <nadine.caff@cardno.com.au>
Subject: Infrastructure SEPP Consultation - Muswellbrook Olympic Park Precinct REF

Good morning,

Please find attached a consultation letter inviting SES to provide comment regarding the proposed upgrades to the Olympic Park Precinct at Muswellbrook.

It would be appreciated if you could provide any comments about this proposal by 31 August 2020.

Regards,

Jennifer Cornell
ENVIRONMENTAL ENGINEER
CARDNO

Phone +61 2 9496 7700 Fax +61 2 9439 5170 Direct +61 2 9024 7036
Address Level 9, The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia
Postal PO Box 19, St Leonards NSW 1590
Email jennifer.cornell@cardno.com.au Web www.cardno.com
CONNECT WITH CARDNO

From:	Jennifer Cornell
To:	"nswses.riskreduction@ses.nsw.gov.au"
Cc:	Nadine Caff
Subject:	Infrastructure SEPP Consultation - Muswellbrook Olympic Park Precinct REF
Date:	Monday, 10 August 2020 11:51:05 AM
Attachments:	SES - Consultation Letter.pdf Muscle Creek Bridge Concept Design.pdf image001.png image002.png image003.png image004.png image005.png image006.png

---

Good morning,

Please find attached a consultation letter inviting SES to provide comment regarding the proposed upgrades to the Olympic Park Precinct at Muswellbrook.

It would be appreciated if you could provide any comments about this proposal by 31 August 2020.

Regards,

Jennifer Cornell
ENVIRONMENTAL ENGINEER
CARDNO

Phone +61 2 9496 7700 Fax +61 2 9439 5170 Direct +61 2 9024 7036
Address Level 9, The Forum, 203 Pacific Highway, St Leonards, New South Wales 2065 Australia
Postal PO Box 19, St Leonards NSW 1590
Email jennifer.cornell@cardno.com.au Web www.cardno.com
CONNECT WITH CARDNO

Our Ref: NE30034:JC
Contact: Jennifer Cornell

10 August 2020

NSW State Emergency Services (SES)

nswses.riskreduction@ses.nsw.gov.au

Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

1/10 Denney Street
Broadmeadow NSW 2292
Australia

Phone +61 2 4231 9600
Fax +61 2 4228 6811

www.cardno.com

MUSWELLBROOK – Olympic Park Precinct

Dear Sir/Madam,

Muswellbrook Council has engaged Cardno (NSW/ACT) Pty Ltd to undertake the environmental assessment for parts of the Olympic Park Masterplan upgrades. In accordance with Division 5.1 of the *NSW Environmental Planning and Assessment Act 1979*, Cardno is preparing a Review of Environmental Factors (REF) to satisfy the requirements for environmental assessment for the project.

We are writing to invite your comments on the proposed upgrades for the Olympic Park Precinct and the proposed bridge over Muscle Creek connecting the venue (Wilkinson Avenue) to Wilder Street. The proposed upgrades are shown on Figure 1 and the concept design for bridge is attached for your reference.

The purpose of this email is to notify the SES of the proposed development as required under the *State Environmental Planning Policy (Infrastructure) 2007* and seek comment. For your reference, Figure 2 attached shows the flood hazard profile for the 0.2% AEP event from the Muscle Creek Flood Study.

If you would like any further information please contact Jennifer Cornell (contact details below). For this preliminary consultation we respectfully request your response by 31 August 2020.

Yours sincerely,

Jennifer Cornell
Environmental Engineer
for Cardno
Direct Line: +61 2 9024 7036
Email: Jennifer.cornell@cardno.com.au

Attachments:

1. Figure 1: Proposed Master Plan upgrades for Olympic Park Precinct
2. Figure 2: Extent of Inundation Concept Design for Muscle Creek Bridge
3. Concept Design for bridge over Muscle Creek

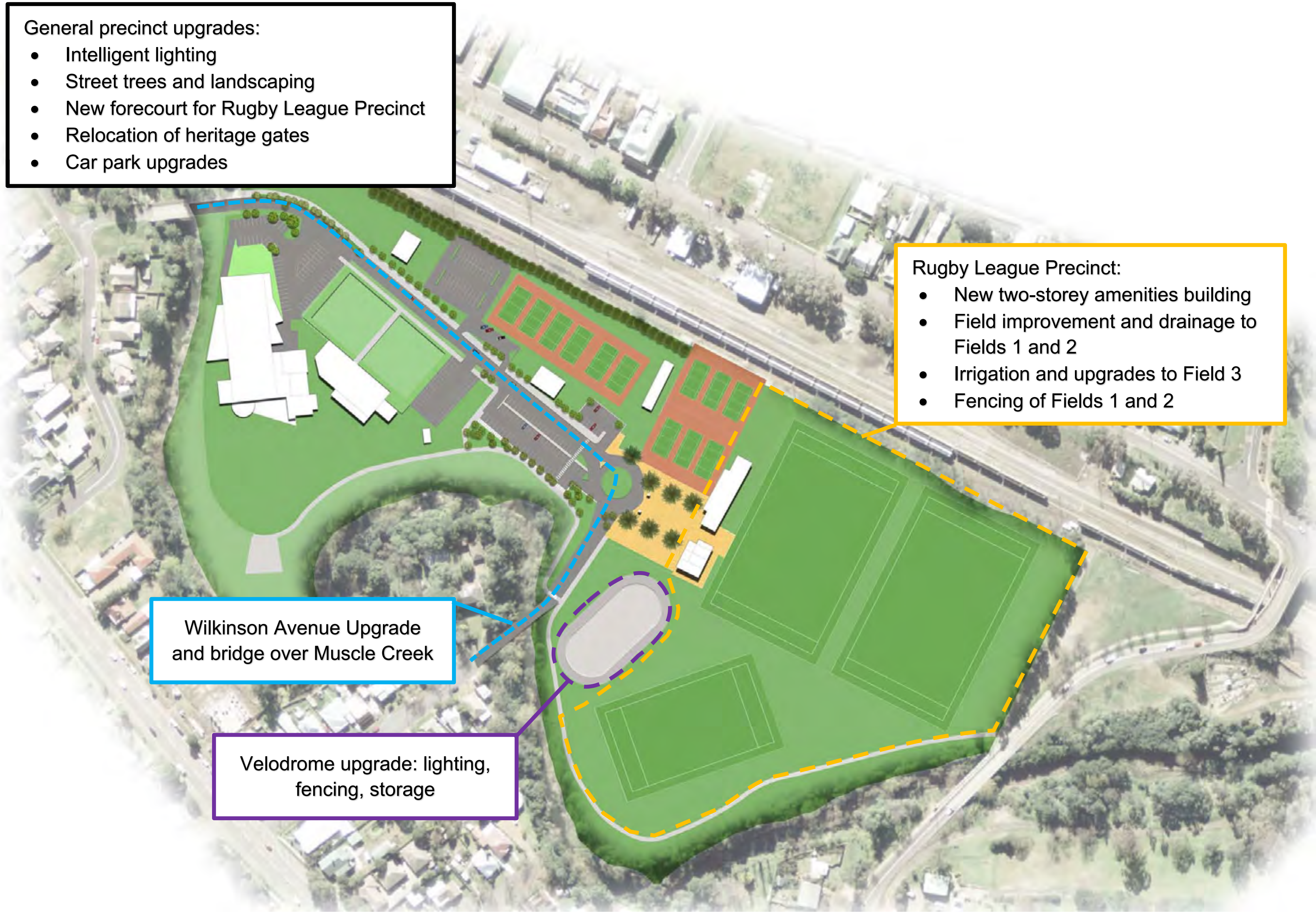


Figure 1: Proposed Master Plan upgrades to Olympic Park Precinct

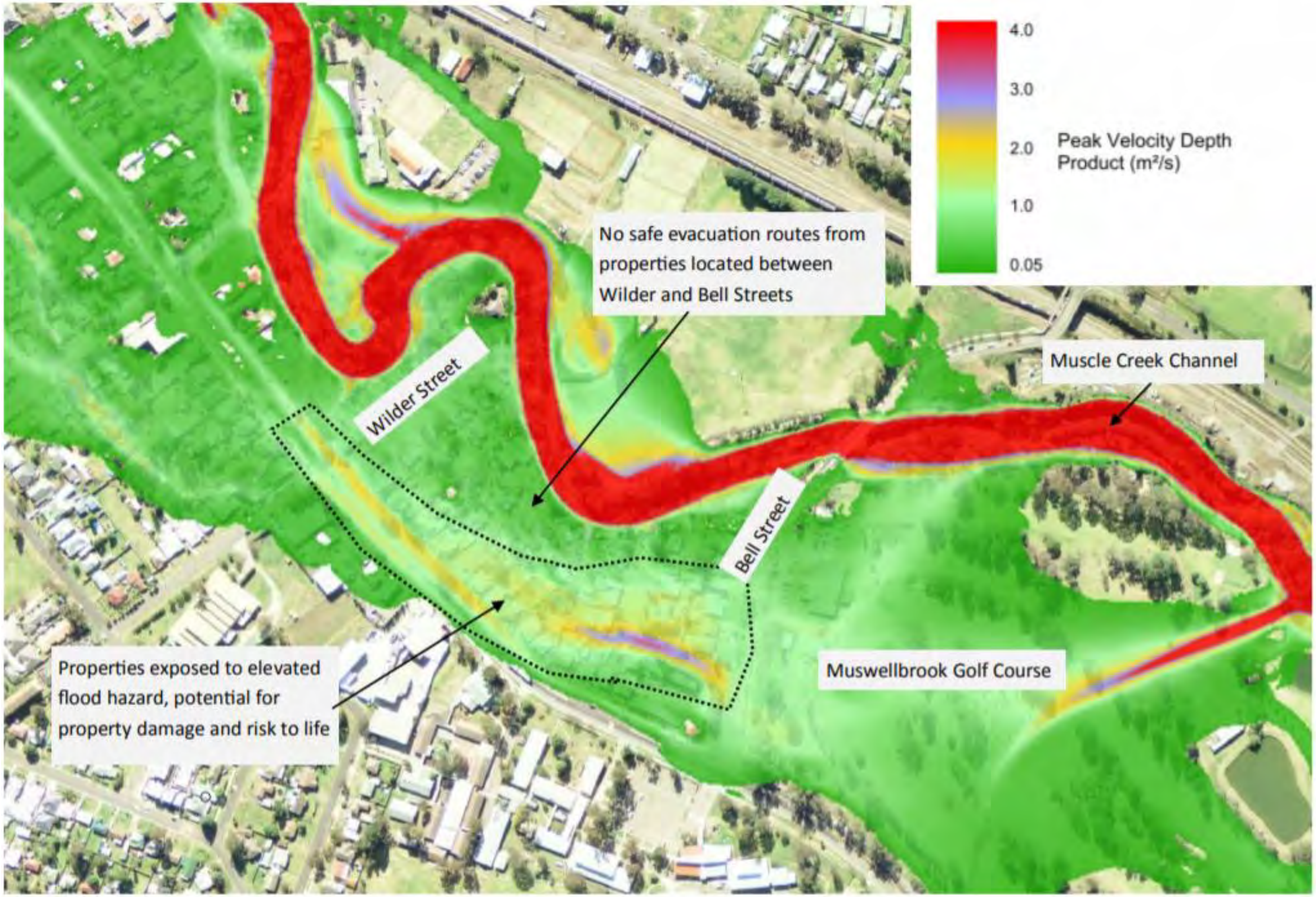


***Plate 5-1** – Flood Hazard Profile for the 0.2% AEP event*

Figure 2: Flood hazard profile for the 0.2% AEP event (Muscle Creek Flood study)

NSW STATE EMERGENCY SERVICE

Our Ref: ID 1204
Your Ref: NE30034:JC

25th September 2020

Ms Jennifer Cornell
Cardno
1/10 Denney Street
Broadmeadow NSW 2292

Via email: Jennifer.cornell@cardno.com.au

Dear Ms Cornell,

Notification under clause 15AA of the State Environmental Planning Policy (Infrastructure) 2007 in relation to the proposed Muswellbrook - Olympic Park Precinct Upgrade

Thank you for the notification under clause 15AA of the *State Environmental Planning Policy (Infrastructure) 2007* in relation to the proposed Olympic Park Precinct Upgrade, Muswellbrook.

The NSW State Emergency Service (NSW SES) has reviewed the proposed upgrade using the information provided with the proposal and the flood risk information (e.g. local flood Plan, flood studies etc.) available to the NSW SES.

Based on this review the proposed works appear to have minimal risk to NSW SES response operations.

Please feel free to contact me on 0458 737 188 or via email at maria.frazer1@one.ses.nsw.gov.au should you wish to discuss any of the matters raised in this correspondence.

Yours sincerely,

mK Frazer

Maria Frazer
Coordinator Planning
NSW State Emergency Service

NSW GOVERNMENT

STATE HEADQUARTERS
6-8 Regent Street, Wollongong NSW 2500
PO Box 6126, Wollongong DC NSW 2500
P (02) 4251 6111
F (02) 4251 6190
www.ses.nsw.gov.au
ABN: 88 712 649 015