# ATTACHMENT G – TMK STORMWATER INVESTIGATIONS

TMK Consulting Engineers

ADELAIDE | MELBOURNE | RIVERLAND

2102002_SMR-D
1 March 2022

# STORMWATER MANAGEMENT REPORT

PROPOSED CODE AMENDMENT
FORMER METCASH SITE
ALLOTMENT 301 in F6069 & ALLOTMENT 401 in D19661
KIDMAN PARK SA 5025

prepared for

FAIRLAND GROUP PTY LTD

Our Ref: 2102002_SMR-D <CAT/bjh>
1 March 2022

Fairland Group Pty Ltd
19 Fullarton Road
KENT TOWN SA 5067

**ATTENTION: SCOTT SEARLE** Email: scotts@fairland.com.au

Dear Scott,

**RE: STORMWATER MANAGEMENT REPORT**
**PROPOSED CODE AMENDMENT**
**FORMER METCASH SITE**
**ALLOTMENT 301 in F6069 & ALLOTMENT 401 in D19661**
**KIDMAN PARK SA 5025**

TMK Consulting Engineers is pleased to present a PDF copy of our Stormwater Management Report for the above project. This report has been prepared to comply with the following relevant SAA Standards and Guides:

- ARRB Special Report 35: *Subsurface drainage of road structures*;
- Australian Rainfall and Runoff, Volumes 1 & 2: *A guide to flood estimation*;
- Australian Runoff Quality: *A guide to water sensitive urban design*;
- Storm Drainage Design in Small Urban Catchments: *A handbook for Australian practice;*
- *Water Sensitive Urban Design (WSUD) Technical manual for the greater Adelaide region*;
- *Urban Stormwater Best Practice Environmental Management Guidelines.*

This report must be read in conjunction with all attachments. Changes to the design or construction must not be made without further written advice from the Engineer.

This report is valid for a period of 24 months, based on current standards and regulations.

If you require further information or clarification regarding any aspect of this report, please do not hesitate to contact the undersigned.

For and on behalf of
**TMK Consulting Engineers**

**CARLO TALLADIRA**
**Senior Associate / Civil Team Leader**

## DISTRIBUTION

| Document Issue | Copy detail | Issued to | Issue date |
|---|---|---|---|
| 2102002_SMR-A | 1 x PDF | Fairland Group Pty Ltd | 4 November 2021 |
| 2102002_SMR-B | 1 x PDF | Fairland Group Pty Ltd | 17 November 2021 |
| 2102002_SMR-C | 1 x PDF | Fairland Group Pty Ltd | 8 February 2022 |
| 2102002_SMR-D | 1 x PDF | Fairland Group Pty Ltd | 1 March 2022 |

# CONTENTS

# 1 INTRODUCTION

This report details the stormwater management strategies for the proposed rezoning (code amendment) located at the former Metcash site & adjoining commercial tenancies at 5 & 7 Valetta Road, Kidman Park ("the Affected Area"). The proposed re-zoning seeks to create a new residential precinct within the subject site including the creation of 227 allotments, several reserves and an internal local road network[1] connecting in with the surrounding area. The stormwater concept plan contained within **Appendix A** of this report has been developed in accordance with the *City of Charles Sturt* (Council) *Land Infrastructure Guidelines*[2] and based on further correspondence with Authorities[3] regarding the subject site.

## 1.1 Overview

Situated on the corner of Valetta Road & Findon Road in Kidman Park, the subject site covers a total area of approximately 12.6ha and was previously being utilized as commercial / industrial land consisting of predominantly impervious roof and sealed asphalt surfaces (refer Figure 1 – Site Aerial View).


**FIGURE 1 - SITE AERIAL VIEW (SOURCE: LOCATIONSAMAPVIEWER)**

## 1.2 Existing Stormwater Drainage Network

In its pre-developed state, the site grades from the south to the north at approximately 0.3%. There are however two distinct catchments draining via an existing internal stormwater network to both the north and to the south. It has been identified from the detail & level survey that there are multiple locations currently accepting stormwater discharge from the site[4].

The existing northern catchment is made up of both pervious and impervious surfaces that are collected by a private internal stormwater network made up of downpipes from roof gutters, surface inlet pits and underground pipes before ultimately discharging via a Ø750 pipe to the existing Council stormwater network located on Valetta Road. It has been identified by Council that the existing network is at capacity[5], hence cannot receive any additional stormwater runoff. The southern catchment is almost entirely impervious and is also collected by a private internal stormwater network made up of downpipes from roof gutters, surface inlet pits and underground pipes before ultimately discharging via multiple Ø450 - Ø900 pipes to the River Torrens.

[1] Proposed Plan of Division – 20A3103CONCEPT(L) (*Alexander Symonds,* October 2021).
[2] City of Charles Sturt Infrastructure Guidelines – Revision 4 (*City of Charles Sturt,* October 2019).
[3] Refer Appendix B – Correspondence
[4] Detail & Level Survey – 20A3103 DETAIL(B) MGA20P (*Alexander Symonds,* June 2021)
[5] Refer Appendix B – *Correspondence* (email dated: 28/10/21 Gronthos,J)

An assessment of Council's floodplain mapping identifies minor flooding (approx. 0.1m) at the north-eastern corner of the site (refer Figure 2 – Floodplain Mapping).


**FIGURE 2 - FLOODPLAIN MAPPING (SOURCE: INTRAMAPS.CHARLESTURT.SA.GOV.AU)**

# 2 STORMWATER OBJECTIVES AND STRATEGIES

## 2.1 Stormwater Objectives

The objective of the report is to demonstrate how stormwater runoff would be captured and conveyed from the subject site safely to the receiving drainage network while considering stormwater quality management and the incorporation of Water Sensitive Urban Design (WSUD) elements.

## 2.2 Stormwater Management Strategies

The stormwater management strategies discussed within this report have been prepared in accordance with *City of Charles Sturt Land Infrastructure Guidelines* and site specific advise provided by Council and *Green Adelaide*[6]. The overarching design requirement is to provide a minor and major drainage system to ensure that post-development flows from the proposed re-zoning (an anticipated likely yield) are captured and conveyed safely to receiving downstream networks.

The minor system will comprise of a conventional underground drainage system connecting directly into Council's existing stormwater drainage network capable of conveying the 1 in 5 year ARI rainfall event. The major system will utilize the road reserve as an overland flow path to safely convey flows that exceed the capacity of the minor system up to and in including the 1 in 100 year ARI rainfall event. Both drainage systems shall ensure that the limit of downstream drainage infrastructure is not exceeded.

In keeping with the current site discharge conditions, it is proposed that future development of the southern catchment utilize the existing outlets to the River Torrens. A condition assessment report would be undertaken during detailed design phase in order to determine the condition of any existing stormwater infrastructure proposed for re-use. If it is deemed by visual and CCTV inspection that the existing infrastructure is not up to current standards and works are required to remediate/replace stormwater infrastructure and/or improve erosion controls then the developer will require a Water Affecting Activity permit from Green Adelaide in order to undertake the works. Additional measures to minimize ongoing maintenance and improve outlet conditions, such as; reducing the amount of outlet locations and improving scour protection measures can be determined once detailed stormwater modelling is undertaken and findings from the condition assessment report are available.

[6] Refer Appendix B – *Correspondence* (email dated: 15/11/21 Stokes,M)

### 2.2.1 The Conventional Underground Drainage System

Stormwater runoff from the proposed development would be routed through a conventional underground drainage system comprising of Side Entry Pits (SEP), Junction Boxes (JB), Grated Sumps (GS), Reinforced Concrete Box Culverts (RCBC), Reinforced Concrete Pipes (RCP), unplasticized PolyVinyl Chloride pipes (uPVC) and Headwalls (HW) in accordance with Council specifications.

### 2.2.2 Flood Management

Flood protection measures including defined overland flow paths are planned to convey any gap flows due to seismic waves and other hydraulic factors including system blockage. Further investigation of the proposed system will be undertaken during the detail design stage of a future land division application once the land is rezoned and the proposed stormwater drainage system would be designed to provide sufficient capacity for both performance levels defined as the minor / major drainage system in accordance with Council design guidelines.

The minor system will be designed to accommodate the 1 in 5 year ARI rainfall event with a minimum freeboard of 150mm maintained between the hydraulic grade level (HGL) in a stormwater pit and the gutter invert level. The major system will be designed, as per Council requirements, so that no inundation of private land occurs as a result of a 1 in 100 year ARI rainfall event and the gap flows are conveyed within defined overland flows paths including roadways and reserves within the development.

### 2.2.3 Diversion Swales and Temporary Sedimentation Basins during Construction

Temporary measures for stormwater pollution and erosion control will be implemented within the development to ensure that pollutants are trapped prior to exiting the site or entering the existing drainage system and to prevent initial contamination of stormwater from roadside pollution during construction. This is achieved through the provision of silt fences, sedimentation basins, hay bale barriers and shaker pads. Soil Erosion and Drainage Management Plans (SEDMP) will be submitted to Council as part of detailed engineering design for each stage of the development.

## 2.3 Water Sensitive Urban Design (WSUD)

At source WSUD elements are proposed to manage the quality of stormwater runoff from the post-developed catchments. The stormwater treatment objectives for this development, as listed below and in accordance with *Environment Protection Authority* (EPA) water quality improvement guidelines are to remove the following percentages of pollutants from the annual urban load:

- 80% reduction of Total Suspended Solids (TSS) from a typical urban annual pollutant load.
- 60% reduction of Total Phosphorus (TP) from a typical urban annual pollutant load.
- 45% reduction of Total Nitrogen (TN) from a typical urban annual pollutant load.
- 90% reduction of litter and Gross Pollutants (GP) from a typical urban annual pollutant load.

WSUD elements proposed to achieve the water quality improvement targets for this development are summarized below. Further details will be provided during detailed engineering design.

### 2.3.1 Bio-filtration Tree Pits

Bio-filtration tree pits are proposed as part of the landscaped streetscape to capture to treat runoff from inconsequential rainfall events (i.e. 1 year ARI) through the bio-filtration process whilst also providing a valuable water source for street trees within the urban environment. Bio-filtration tree pit locations have been shown indicatively on the *Stormwater Concept Plan* to demonstrate typical locations; the exact amount and location of tree pits would ultimately be determined as part of detailed design of the land division and subject to coordination with other services and disciplines (e.g. building envelope plans and landscape streetscape plans) as required to achieve the WSUD reduction targets.

### 2.3.2 Infiltration Zones

In addition to biofiltration tree pits; infiltration tree pits are proposed as part of the landscaped streetscape to capture to treat runoff from inconsequential rainfall events (i.e. 3 month ARI) through the infiltration process. Unlike bio-filtration tree pits; infiltration tree pits retain the captured stormwater runoff providing a valuable water source for street trees within the urban environment. Infiltration zones are a low maintenance alternative and are ideal for street trees that cannot be provided with a bio-filtration tree pit due to spatial requirements or service clashes.

### 2.3.3 Raingardens

Raingardens (bio-retention systems) strategically placed throughout the development are proposed as a secondary treatment measure for the removal of soluble contaminants. Plants species known for their performance in nitrogen removal and bio-filtration applications will be determined as part of detailed design and incorporated into the landscaping design. Raingarden locations have been shown indicatively on the *Stormwater Concept Plan* to demonstrate how they are utilised; the exact amount and location of raingardens would be determined as part of detailed design of the land division and subject to coordination with other services and disciplines (e.g. building envelope plans and landscape streetscape plans) as required to achieve the WSUD reduction targets.

## 2.4 Detention Requirements

Site specific stormwater detention requirements have been identified through correspondence with Council. As the proposed discharge location for the northern catchment on Valetta Road is at capacity, it is a requirement of future development to ensure that post-development flows from the major 1 in 100 year ARI rainfall event are restricted to pre-development 1 in 5 year ARI rates[7]. To facilitate the detention requirements, it is proposed that the volume is detained via an on-site detention basin and oversized pipe network whilst commercial/retail allotments will be responsible for providing on-site detention specific to their build forms to be assessed by Council as part of the individual development applications.

Detention requirements for the southern catchment have been eased[8] due to the proximity to River Torrens and net reduction in stormwater discharge resulting from the reduction in previous area proposed.

## 2.5 Stormwater Concept Plan

A *Stormwater Concept Plan* has been prepared in order to illustrate the stormwater management strategies discussed above. The preliminary stormwater layout has been undertaken to demonstrate functionality of the likely future development once rezoned with respect to the proposed allotment plan and surrounding areas and will be further developed during detailed engineering design considering the location of other services within the proposed development. Refer to **Appendix A** of this report for further details.

# 3 STORMWATER MODELLING AND ASSESSMENT

Total site discharges are modeled as described in *Storm Drainage Design in Small Urban Catchments, a handbook for Australian practice* by John Argue & *Australian Rainfall and Runoff (ARR87) Book Eight - Urban Stormwater Management*. DRAINS ILSAX Hydrological Model was used for the hydrological and hydraulic modeling and analysis of the subject site.

## 3.1 DRAINS

DRAINS is a multi-purpose windows program for designing and analyzing various types of urban stormwater drainage systems and catchments. DRAINS can model drainage systems at all scales, from very small to very large. It simulates the conversion of rainfall patterns to stormwater runoff hydrographs and routes these through networks of pipes, channels and streams integrating;

- Design and analysis tasks,
- Hydrology and hydraulics,
- Closed conduit and open channel systems,
- Culverts and bridges,
- Stormwater detention systems,
- Large scale urban and rural catchments and
- Overflow elements, which provide paths for flows in the stormwater system once the capacity of the pipe system is exceeded.

The ILSAX hydrological model is the main model used to simulate the operation of urban stormwater drainage systems in DRAINS. It comes from the ILSAX program (O'Loughlin, 1993), which in turn was based on ILLUDAS and the TRRL method. This model uses time-area calculations and Herten Infiltration procedures to calculate flow hydrograph and sub-catchments. The various sub-catchments' flows are combined and routed through a pipe and channel system. Calculations are performed at specified times after the start of each storm, using small time intervals, one minute or less. At each time step, a hydraulic grade line analysis is performed throughout the drainage network determining flow and water levels.

[7] Refer Appendix B – *Correspondence* (email dated: 28/10/21 Gronthos,J)
[8] Refer Appendix B – *Correspondence* (email dated: 28/10/21 Gronthos,J)

The DRAINS model parameters selected for use are as follows:

- Residential sub-catchments modeled as 80% impervious / 20% impervious areas directly connected to underground stormwater infrastructure.

- DRAINS ILSAX hydrological loss model parameters have been adopted based on a typical urban environment.
  - Initial losses;
    - Paved = 1mm
    - Grassed = 10mm
  - Soil Type = 3
  - Antecedent Moisture Condition (AMC) = 3

- The stormwater drainage system has been designed using *Bureau of Meteorology* (*BoM*) published rainfall data as a minor / major system to accommodate the 5 / 100 year Average Recurrence Interval (ARI) rainfall events. As *ARR2019* procedures have been adopted the following terminology now applies to design storm events and rainfall occurrences:
  - Minor – 1 in 5 year ARI rainfall event = 0.2 EY average number of exceedances per year (EY)
  - Major – 1 in 100 year ARI rainfall event = 1% annual exceedance probability (AEP)

### 3.2 MUSIC

Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software will be used to determine the treatment potential of the proposed treatment train for the proposed development. MUSIC is Australia's leading tool for water sensitive urban design modeling and assessment and can be used to model a wide range of treatment devices in order to identify the best way to capture and treat stormwater runoff from the built environment.

MUSIC Modelling will be undertaken, as part of detailed engineering design, in accordance with the *Water Sensitive Urban Design Greater Adelaide Region Technical Manual* and typical urban pollutant loading generation from the *Guidelines for Pollutant Export Modeling* found in the MUSIC User Guide in order to simulate developed conditions and treatment train potential for this development.

## 4 RESULTS OF ANALYSIS

### 4.1 Pre-Development Flow Calculations

Pre-development flow rates have been calculated using the *Bransby-Williams Equation* to determine the Time of Concentration and DRAINS in order to determine the existing site discharge rate. A summary of the pre-development discharge flow rates is shown in **Table 1** below.

**TABLE 1: PRE-DEVELOPMENT FLOW RATES**

| **Catchment Area** (ha) | **Time of Concentration** (min) | **Pre-Developed Site Discharge Rate** ($m^3$/sec) | |
|---|---|---|---|
| | | **5 year ARI** | **100 year ARI** |
| **Northern** (3.376) | 10 | **0.323** | **0.858** |
| **Southern** (8.540) | | **1.193** | **2.745** |

Refer to ***Appendix C*** – *DRAINS Model Calculations* for further details.

### 4.2 Post Development Flow Calculations

Post-development flow rates have been calculated using DRAINS in order to determine the detention volume required to mitigate discharge from the post-development 1 in 100 year ARI rainfall event from the northern catchment to pre-development 1 in 5 year ARI rates. A summary of the post-development discharge rates and required detention volume is shown in **Table 2** below.

**TABLE 2: DRAINS MODEL RESULTS SUMMARY**

| **Catchment Area** (ha) | **Post-Development Site Discharge Rate** | | | | |
|---|---|---|---|---|---|
| | **Minor 5 year ARI** ($m^3$/sec) | | **Major 100 year ARI** ($m^3$/sec) | | **Maximum Detention Volume Required to Reduce Undetained Site Discharge Rate** ($m^3$) |
| | **Undetained** | **Detained** | **Undetained** | **Detained** | |
| Northern (3.376) | 0.410 | **0.163** < Pre | 0.991 | **0.323** = Pre | 650 |
| Southern (8.540) | **1.038** < Pre | n/a | **2.507** < Pre | n/a | n/a |

Refer to **Appendix C** – *DRAINS Model Calculations* for further details.

The post-development flow calculations demonstrate that the requirements for future development (once rezoned) can be readily accommodated within the subject site via the use of conventional stormwater infrastructure and best practice engineering methods.

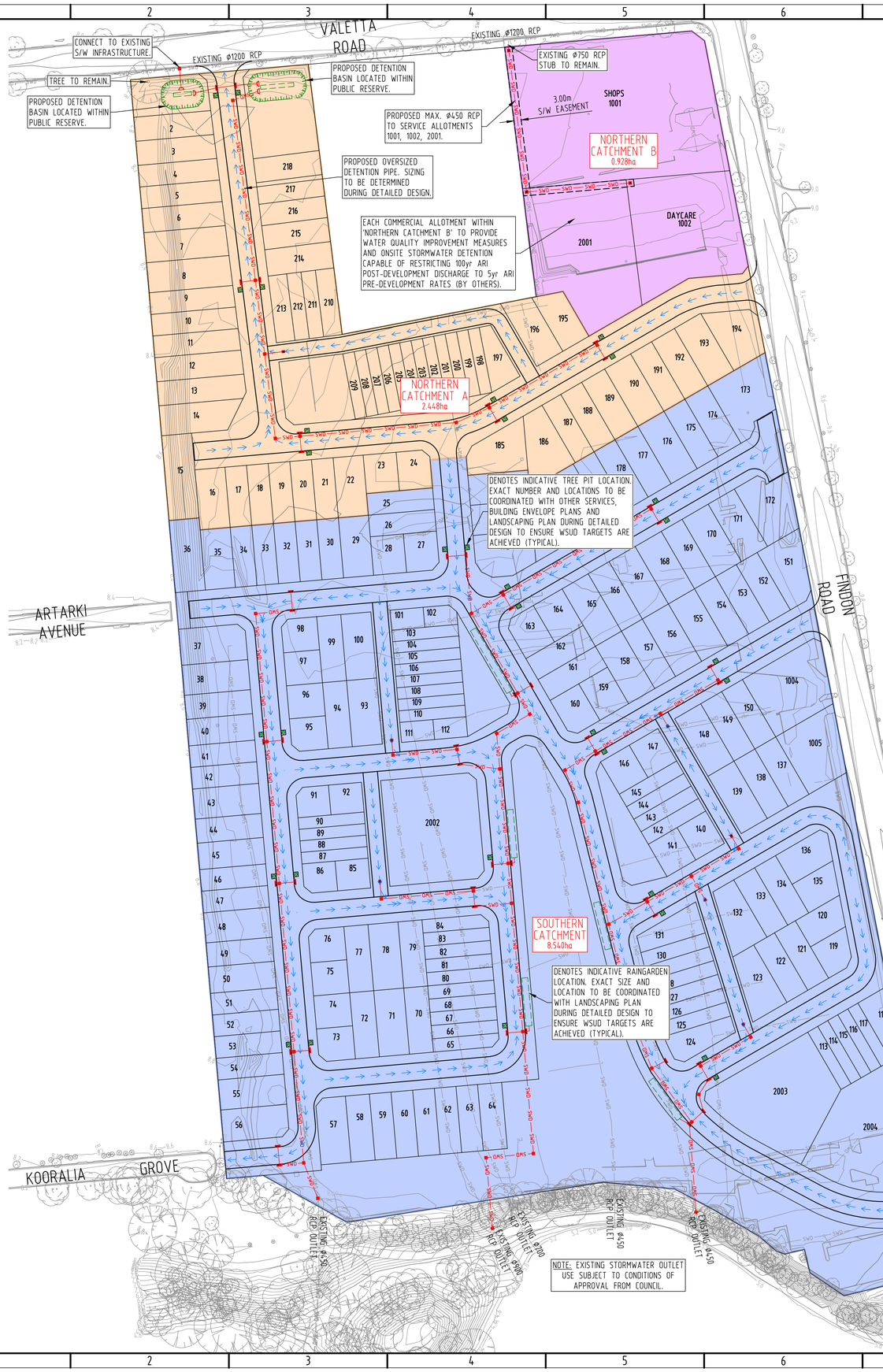
## 5 CONCLUSION

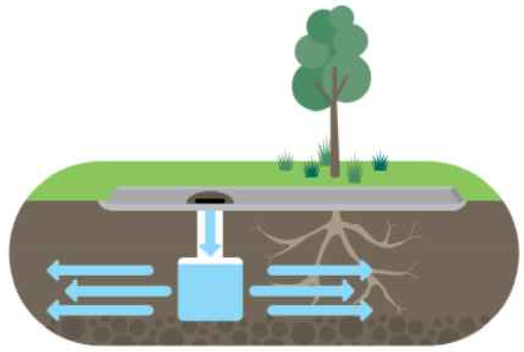
Future development of the rezoned land will in its post-developed state be drained by the construction of a conventional pit and pipe network designed to cater for the minor / major flows generated by stormwater runoff from allotments and road reserves within the site. The proposed drainage network will be located within road reserves and open space reserves before discharging into the existing drainage systems currently servicing the site in accordance with current *Council* & *Green Adelaide* requirements.

Whilst the overall re-development (once rezoned) will result in a net reduction in impervious area it has been identified by *Council* that the existing Valetta Road network is at capacity, hence on-site detention is required to ensure that the post-development site discharge rate for the major 1 in 100 year ARI rainfall event does not exceed the pre-development 1 in 5 year ARI event discharge rate for the portion of the proposed development draining to the north. It is proposed that a combination of an on-site detention basin and oversized pipe network will provide the detention capacity required to reduce the burden on the existing drainage network.

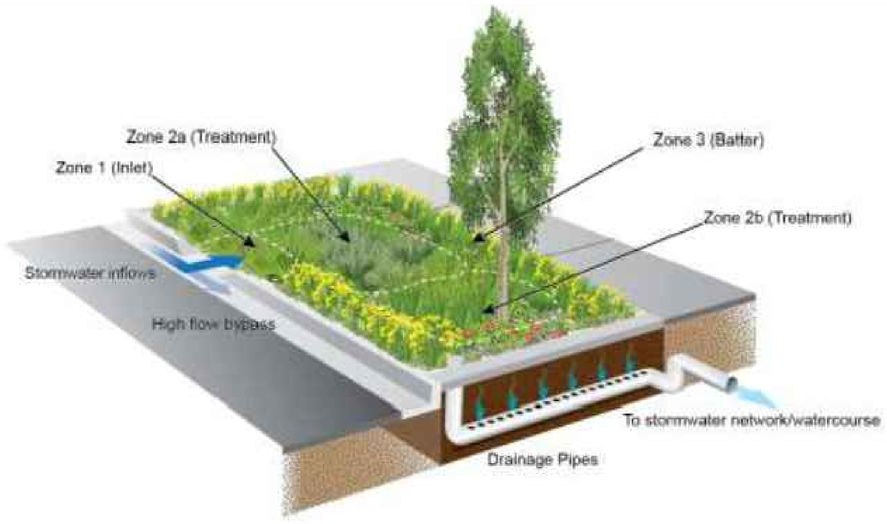
In order to mitigate the environmental impacts of future development, significant WSUD measures will be provided as part of future development for the treatment of stormwater runoff generated by the proposed development in order to achieve *Council, EPA* & *Green Adelaide* water quality improvement targets. Forming part of the streetscaped urban landscape and overall stormwater quality treatment train, biofiltration & infiltration tree pits as well as raingarden bioretention systems will be strategically placed throughout the development to capture and treat at source runoff from the street kerb & gutter before draining clean water back into the underground stormwater network.

# **APPENDIX A:** Stormwater Concept Plan

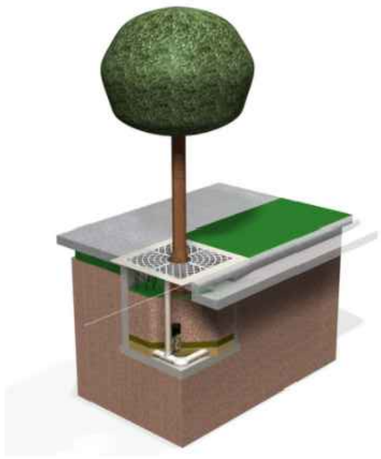


TYPICAL KERB SIDE INLET & SUBSURFACE STREET TREE INFILTRATION LAYOUT




TYPICAL KERB SIDE RAINGARDEN BIO-FILTRATION LAYOUT



TYPICAL KERB SIDE TREE PIT BIO-FILTRATION LAYOUT

## LEGEND

- EXISTING CONTOUR (0.2m INTERVALS)
- SWD — EXISTING STORMWATER PIPE
- SWD — PROPOSED STORMWATER PIPE
- PROPOSED JUNCTION BOX (JB)
- PROPOSED GRATED SUMP (GS)
- PROPOSED HEADWALL (HW)
- PROPOSED SIDE ENTRY PIT (SEP)
- PROPOSED OVERLAND FLOW DIRECTION
- P1-A 808m² — STORMWATER CATCHMENT AREA NO. STORMWATER CATCHMENT AREA
- PROPOSED STORMWATER CATCHMENT BOUNDARY

## GENERAL NOTES:

- DRAWING IS TO BE VIEWED IN CONJUNCTION WITH THE STORMWATER MANAGEMENT REPORT 2102002_SMR-A.
- REFER TO SURVEY FOR ADDITIONAL INFORMATION - A&S DRAWING No. 20A3103 DETAIL(B).
- ROAD LAYOUT & PIT/PIPE NETWORK ARE PRELIMINARY ONLY FOR THE PURPOSES OF PLANNING AND SUBJECT TO FURTHER DETAILED DESIGN ON A STAGED CONSTRUCTION BASIS.

| No. | REVISION | DRAWN | CHE'KD | DATE |
|---|---|---|---|---|
| PB | FOR INFORMATION PURPOSES | BJH | CAT | 08.02.22 |
| PA | FOR INFORMATION PURPOSES | BJH | ST | 04.11.21 |

PROJECT
PROPOSED LAND DIVISION
FORMER METCASH SITE
KIDMAN PARK SA 5025
FOR FAIRLAND GROUP PTY. LTD.
DEVELOPMENT No.

DRAWING TITLE
STORMWATER CONCEPT PLAN

Civil – Geotechnical
Environmental – Structural
Mechanical – Electrical
Fire – Hydraulics
Forensic – Construction Assist
**Level 6, 100 Pirie Street**
**Adelaide SA 5000**
**Telephone 08 8238 4100**
**Facsimilie 08 8410 1405**
**Berri Office: 29 Vaughan Terrace, Berri SA 5343**
ACN 062 965 888 / 008 080 046

| | |
|---|---|
| SCALES | AS SHOWN |
| DRAWN | MMA |
| DATE | OCTOBER 2021 |
| ENGINEER | ST |
| CHECKED | CAT |



DRAWING No.
2102002-C100/PB

1:1000 @ A1
0 10 20 30 40 50m

# **APPENDIX B:** Correspondence

**From:** Jim Gronthos <jgronthos@charlessturt.sa.gov.au>
**Sent:** Thursday, 28 October 2021 7:33 AM
**To:** Zoe Garnaut <zgarnaut@ekistics.com.au>
**Cc:** James Cursaro <jcursaro@charlessturt.sa.gov.au>; Chris Bentick <cbentick@charlessturt.sa.gov.au>
**Subject:** RE: Kidman Park - Preliminary Concept Plan

Hi Zoe,

Preliminary feedback on the concept from Council's Traffic and Stormwater Engineers.

**Stormwater**

- *Stormwater detention can be eased as the site is located adjacent the Torrens.*
- *Require significant WSUD throughout the development.*
- *Seeking improvements to water quality prior to discharge.*
- *Section proposed to drain to Valetta Road, CCS standard detention requirements of post 1 in100 down to pre 1 in 5 must be achieved as the drain in Valetta Road is already at capacity.*

**Traffic**

- *Single access in Valetta Road and 3 accesses in Findon Road are acceptable.*
- *Connection to Kooralla Grove acceptable for existing and future residents – provide greater permeability – gauge feedback through consultation.*
- *Located in a secluded and isolated location that it is likely to be used predominantly by local traffic, particularly if one considers that Kooralla Grove has no road connections to the west of the Office of Recreation and Sport site.*
- *Concerns with the southernmost connection in Findon Road and the likelihood that it will attract cut-through traffic between Findon Road and Valetta Road. Its intersection angle and road alignment almost invites northbound traffic in Findon Road seeking access to Valetta Road to veer left to cut through the Development. Require information from CIRQA to provide travel time analysis on this route vs turning left at the Valetta Road / Findon Road signals, particularly in peak hours.*
- *Assuming traffic volumes through this 'mini collector' reach the upper limits for a local street, then we would like to see an appropriate street design to reduce through traffic speeds to manage the risk associated with these traffic volumes. This means a narrow carriageway, tight intersection geometry and pedestrian priority near retail/cafés, etc. Consider Victoria Terrace in Walkerville as an example for narrow local street between the River Torrens Linear Park and retail sites.*

- *Concerns about the central intersection in Findon Road and the likelihood that it will attract cut-through traffic between Hartley Road, Gerard Road and Valetta Road, as well as the northern intersection in Findon Road and the likelihood that it will attract cut-through traffic between Valetta Road, Gerard Road and Hartley Road. Council will require some travel time analysis based on existing and projected delays at nearby arterial intersections.*
- *Seeking information from CIRQA on what is proposed for the upgrade of the signals at the intersection of Findon Road and Valetta Road as a result of this proposed Code Amendment.*
- *General street layout considered orderly, with generously landscaped local streets and laneways providing rear loading for townhouses.*
- *Streetscape perspective considered legible.*
- *Preference to extend a shared use path connection through the central reserve and then along the western side of the mini collector (or at least a 2m footpath), north to Valetta Road to create a continuous all-ages-and-abilities cycling connection between the River and Valetta Road.*
- *Desire for stairs at the Findon Road end to be a DDA ramp down to the Torrens shared path.*


Thank you and kind regards

Jim Gronthos
Senior Policy Planner
Urban Projects

72 Woodville Road, Woodville
T: (08) 8408 1265 F: (08) 8408 1122
www.charlesturt.sa.gov.au


**Go Green - Think before you print.**
**This initiative forms part of our environmental plan**



**From:** Zoe Garnaut <zgarnaut@ekistics.com.au>
**Sent:** Wednesday, 27 October 2021 3:18 PM
**To:** Jim Gronthos <jgronthos@charlessturt.sa.gov.au>
**Subject:** RE: Kidman Park - Open Space

Hi Jim,

I forgot to mention in our conversation yesterday – was there any update on open space for the Kidman Park Code Amendment as per the email below?

Kind regards,

**Zoë Garnaut**
Associate

ekistics

Level 1, 16 Vardon Avenue, Adelaide SA 5000

**P** 08 7231 0286
**M** 0411 805 528
**W** ekistics.com.au

Please note my office hours are Tuesdays, Wednesdays and Thursdays

**From:** "Stokes, Martin (DEW)" <Martin.Stokes@sa.gov.au>
**Date:** 15 November 2021 at 1:57:20 pm ACDT
**To:** Aleck Whitham <aleckw@fairland.com.au>
**Cc:** "Awbery, Jenny (DEW)" <Jenny.Awbery@sa.gov.au>, "Smith, De-Anne (DEW)" <De-Anne.Smith@sa.gov.au>
**Subject: RE: Kidman Park - residential proposal on industrial land - stormwater into River Torrens question [SEC=OFFICIAL]**

OFFICIAL

Hi Aleck,

As discussed on the telephone, I confirm that no Water Affecting Activity approval is required from Green Adelaide to retain the existing outlets, provided no physical works are proposed at those locations or in the river bed or on the river banks at those discharge points.

As you are working with the EPA regarding the quality of the water prior to discharge, there is no requirement to gain additional approval from Green Adelaide or DEW for this aspect of the proposal.

If at any point in the process physical works are proposed at any of the outlet points, I suggest you make contact with me again to check if any permitting requirements are activated

Regards

**Martin Stokes**
Team Leader Water Allocation Planning
**Green Adelaide**
Department for Environment and Water
**M** 0428 840 898
81-95 Waymouth Street, Adelaide 5000

*Join us to create a cooler, greener, wilder and climate-resilient Adelaide.*

**From:** Stokes, Martin (DEW) <Martin.Stokes@sa.gov.au>
**Sent:** Friday, 12 November, 2021 4:33 PM
**To:** aleckw@fairland.com.au
**Cc:** Awbery, Jenny (DEW) <Jenny.Awbery@sa.gov.au>
**Subject:** Fw: Kidman Park - residential proposal on industrial land - stormwater into River Torrens question [SEC=OFFICIAL]

Hi Aleck.

De-Anne passed your query onto me.

I would like to discuss it with a couple of colleagues early next week to ensure you get thorough feedback re any involvement DEW/Green Adelaide might need to have in the process.

Either myself or one of my colleagues will call you back once we have had the chance to discuss internally.

Regards

**Martin Stokes**
Team Leader Water Allocation Planning
**Green Adelaide**
Department for Environment and Water
**M** 0428 840 898
81-95 Waymouth Street, Adelaide 5000

*Join us to create a cooler, greener, wilder and climate-resilient Adelaide.*

**From:** Aleck Whitham <aleckw@fairland.com.au>
**Sent:** Thursday, 11 November, 2021 9:48 AM
**To:** Smith, De-Anne (DEW) <De-Anne.Smith@sa.gov.au>
**Subject:** Kidman Park - Contact details

Hi De-Anne,

Thanks for taking my phone call.

Our company has recently purchased the old Metcash site in Kidman Park, with the intention to redevelop this site into residential housing. Image below of the site location.


Currently the stormwater from the site is discharged directly into the Karrawirra Parri via a series of stormwater outlets. We plan to retain the existing outlets but will include upstream water quality measures to clean the water prior to discharge as per EPA and council requirements.

Can you please direct me to the suitable person that can confirm that we are able to retain the existing outlets to the river and who we need to coordinate with during this project?

Regards

**Aleck Whitham**
Development Manager

Fairland

**Fairland Group Pty Ltd**
19 Fullarton Road, Kent Town SA 5067

**Direct:** 0408 837 961
**Email:** aleckw@fairland.com.au
**Phone:** (08) 8112 3133
**Web:** https://fairland.com.au/

RLA 274625

# APPENDIX C: DRAINS Model Calculations

| | |
|---|---|
| **JOB NUMBER:** | 2102002 |
| **DATE:** | NOV' 2021 |
| **PAGE:** | CAT NTH |
| **DESIGN:** | BJH |

**Determine Time of Concentration (Tc)**

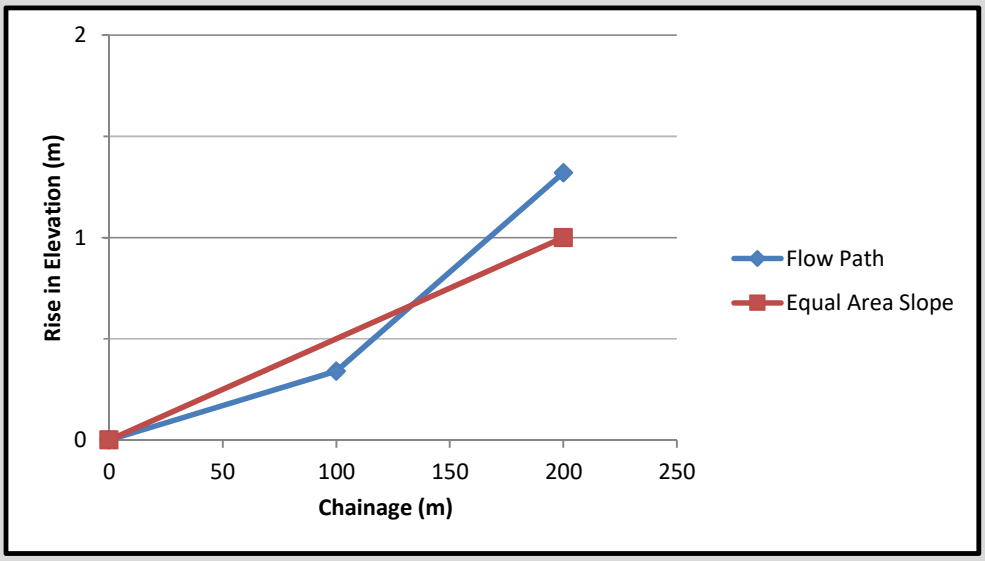
*Bransby-Williams Equation (ARR1987)*

$$T_c = \frac{F \cdot L}{A^{0.1} \cdot S_e^{0.2}}$$

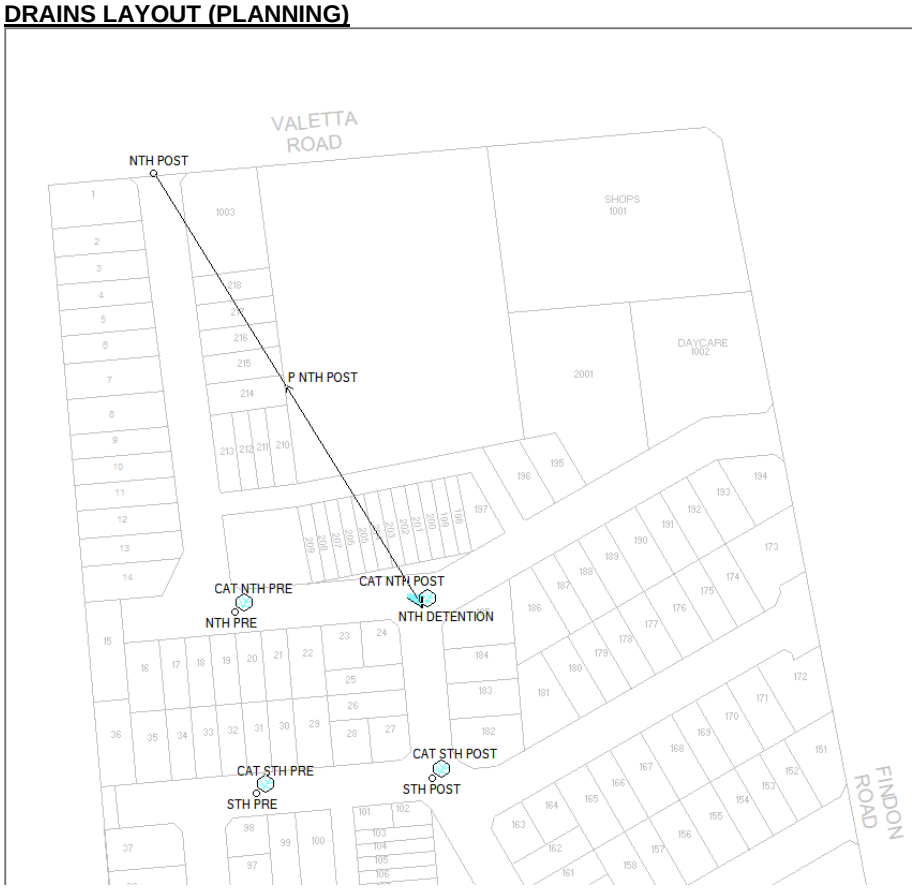
| | | |
|---|---|---|
| **Factor (F) =** | **92.7** | (conversion for ha) |
| **Length (L) =** | **0.2** | km |
| **Area (A) =** | **3.376** | ha |
| **Slope ($S_e$) =** | **5.000** | m/km |
| **Tc =** | **11.9** | min |
| **Adopt Tc:** | **10** | **min** |

**Equal Area Slope ($S_e$)**

| Chainage (m) | Elevation (m) |
|---|---|
| 0 | 8.06 |
| 100 | 8.4 |
| 200 | 9.38 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

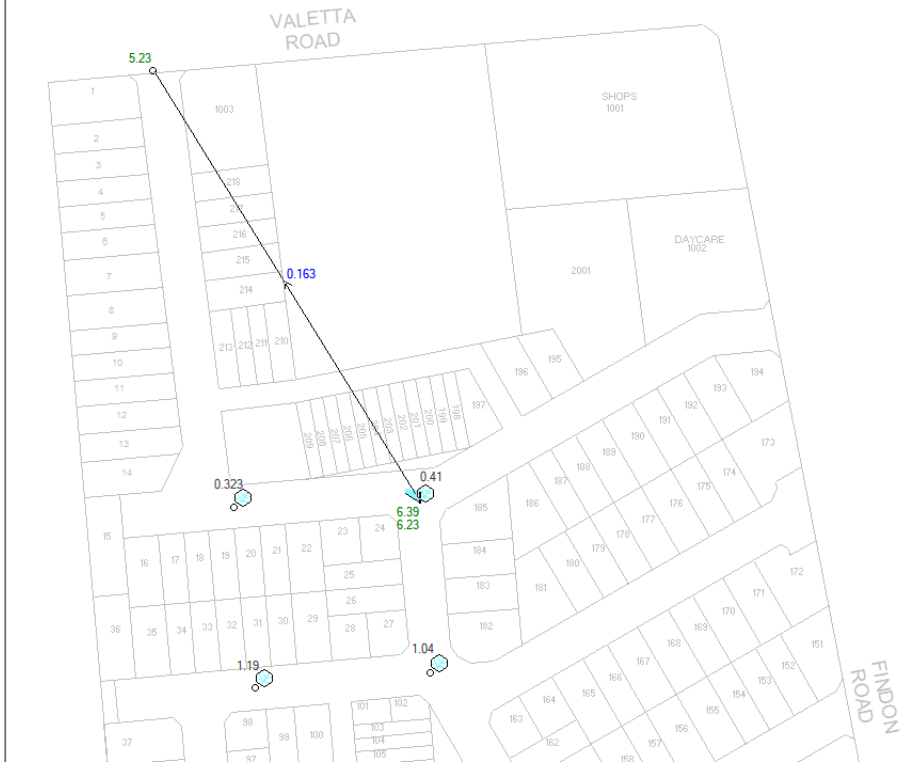


## DRAINS LAYOUT (PLANNING)



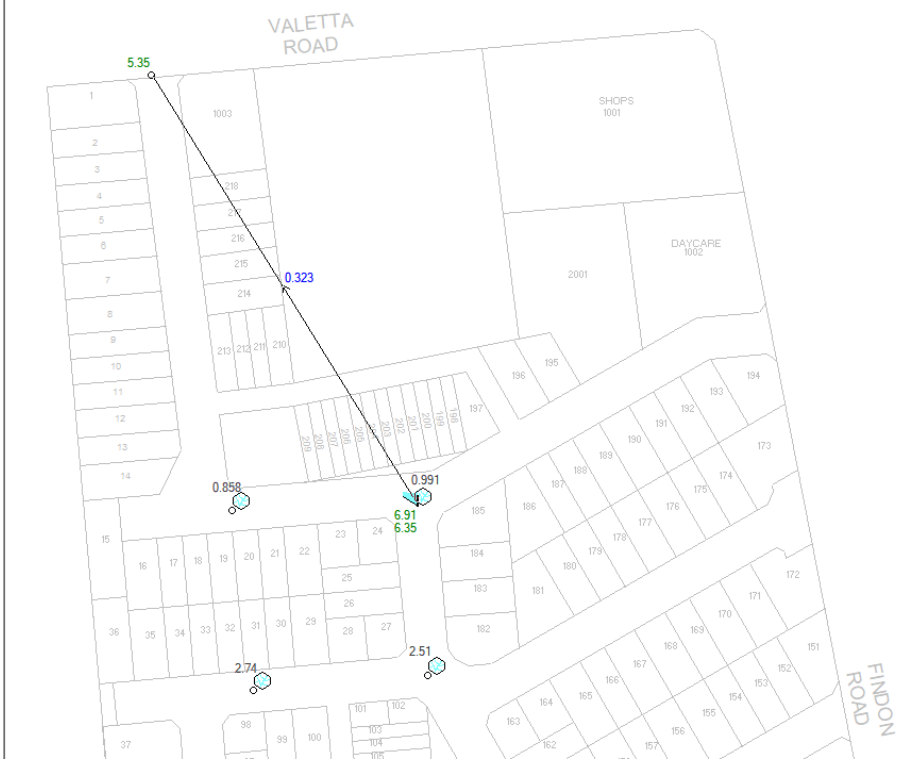

## MINOR RESULTS (PLANNING)

Results for median storm in critical ensembles



## MAJOR RESULTS (PLANNING)

Results for median storm in critical ensembles



**DRAINS RESULTS - MINOR EVENT**

**SUB-CATCHMENT DETAILS**

| Name | Max Flow Q (cu.m/s) | Paved Max Q (cu.m/s) | Grassed Max Q (cu.m/s) | Paved Tc (min) | Grassed Tc (min) | Supp. Tc (min) | Due to Storm |
|---|---|---|---|---|---|---|---|
| CAT STH PRE | 1.193 | 1.193 | 0 | 10 | 10 | 0 | 0.2EY AEP, 15 min burst, Storm 2 |
| CAT STH POST | 1.038 | 1.038 | 0 | 10 | 10 | 0 | 0.2EY AEP, 15 min burst, Storm 2 |
| CAT NTH PRE | 0.323 | 0.323 | 0 | 10 | 10 | 0 | 0.2EY AEP, 15 min burst, Storm 2 |
| CAT NTH POST | 0.41 | 0.41 | 0 | 10 | 10 | 0 | 0.2EY AEP, 15 min burst, Storm 2 |

**PIPE DETAILS**

| Name | Max Q (cu.m/s) | Max V (m/s) | Max U/S HGL (m) | Max D/S HGL (m) | Due to Storm |
|---|---|---|---|---|---|
| P NTH POST | 0.163 | 1.59 | 6.361 | 5.234 | 0.2EY AEP, 45 min burst, Storm 8 |

**DETENTION BASIN DETAILS**

| Name | Max WL | MaxVol | Max Q Total | Max Q Low Level | Max Q High Level |
|---|---|---|---|---|---|
| NTH DETENTION | 6.39 | 276.6 | 0.163 | 0.163 | 0 |

**DRAINS RESULTS - MAJOR EVENT**

**SUB-CATCHMENT DETAILS**

| Name | Max Flow Q (cu.m/s) | Paved Max Q (cu.m/s) | Grassed Max Q (cu.m/s) | Paved Tc (min) | Grassed Tc (min) | Supp. Tc (min) | Due to Storm |
|---|---|---|---|---|---|---|---|
| CAT STH PRE | 2.745 | 2.671 | 0.074 | 10 | 10 | 0 | 1% AEP, 10 min burst, Storm 9 |
| CAT STH POST | 2.507 | 2.323 | 0.184 | 10 | 10 | 0 | 1% AEP, 10 min burst, Storm 5 |
| CAT NTH PRE | 0.858 | 0.723 | 0.135 | 10 | 10 | 0 | 1% AEP, 10 min burst, Storm 3 |
| CAT NTH POST | 0.991 | 0.918 | 0.073 | 10 | 10 | 0 | 1% AEP, 10 min burst, Storm 2 |

**PIPE DETAILS**

| Name | Max Q (cu.m/s) | Max V (m/s) | Max U/S HGL (m) | Max D/S HGL (m) | Due to Storm |
|---|---|---|---|---|---|
| P NTH POST | 0.323 | 1.92 | 6.789 | 5.346 | 1% AEP, 30 min burst, Storm 4 |

**DETENTION BASIN DETAILS**

| Name | Max WL | MaxVol | Max Q Total | Max Q Low Level | Max Q High Level |
|---|---|---|---|---|---|
| NTH DETENTION | 6.91 | 646.5 | 0.323 | 0.323 | 0 |

## ATTACHMENT H – CIRQA TRANSPORT INVESTIGATIONS

# FORMER METCASH SITE, KIDMAN PARK CODE AMENDMENT

## TRANSPORT INVESTIGATIONS REPORT

CIRQA™

## DISCLAIMER



## DOCUMENT CONTROL

| | |
|---|---|
| Report title: | Former Metcash Site, Kidman Park<br>Code Amendment Transport Investigations Report |
| Project number: | 21216 |
| Client: | Fairland |
| Client contact: | Scott Searle |

| Version | Date | Details/status | Prepared by | Approved by |
|---|---|---|---|---|
| Draft | 25 Oct 21 | For review | JJB | BNW |
| V1.0 | 29 Oct 21 | For submission | JJB | BNW |
| V1.1 | 15 Dec 21 | Adjusted yields | JJB | BNW |
| V1.2 | 14 Feb 22 | Council feedback | JJB | BNW |
| V1.3 | 18 Feb 22 | Corrected yields | JJB | BNW |
| V1.03 | 01 Mar 22 | Typographical edits | JJB | BNW |

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# 1. EXECUTIVE SUMMARY

CIRQA has been engaged to undertake transport investigations to inform the Code Amendment for the potential rezoning of the former Metcash site at Findon Road, Kidman Park. This report summarises investigations undertaken in respect to traffic and transport impacts of the proposed rezoning.

Specifically, this report contains advice in respect to the following matters:

- site access – review of the number, location and treatments for site access points;
- external road network impacts – comparative analysis of conditions on the adjacent road network associated with the existing zoning/land uses and the proposed zoning/land uses including analysis of key adjacent intersections on Findon Road;
- public transport – review of public transport provisions for the site; and
- walking and cycling – review of walking and cycling provisions for the site (both internal and external).

Discussions have been held with both the City of Charles Sturt and the Department for Infrastructure and Transport (DIT) in respect to the proposed rezoning. The investigations have taken into account comments provided by both authorities.

High frequency bus services operate adjacent the site on Valetta Road with additional services on Findon Road. These services provide convenient access to/from key destinations including the Adelaide CBD and major retail precincts. There are also strong walking and cycling connections surrounding the site including the River Torrens Linear Trail (a major shared path which provides close and convenient access to/from the CBD and other destinations). These close proximity of these services and facilities will reduce reliance on private motor vehicles and support the higher density apartments proposed within the Affected Area.

The subject transport investigations have included consideration of previous transport investigations undertaken by CIRQA for the Kidman Park North Development Plan Amendment (DPA) and traffic analyses prepared for the City of Charles Sturt in respect to various intersections on Findon Road in the vicinity of the Affected Area. Notably, the forecast yields for the Affected Area are less than those previously assumed for the previous investigations. For the purposes of these transport investigations, it has been assumed that the Affected Area

will accommodate approximately 350 dwellings within the former Metcash site, 40 dwellings on 5-7 Valetta Road plus a small portion of commercial land uses.

The traffic assessment has assumed that primary access to the Affected Area will occur via a single all movements intersection on Valetta Road, and an all-movements intersection and two left-in/left-out intersections on Findon Road (four primary access points in total). Additional access points for both existing and future commercial development in the vicinity of the north-eastern corner of the site has also been assumed (including retention of existing access arrangements for the commercial properties at 5 and 7 Valetta Road).

Traffic volumes have been assessed for the both the existing land uses and those which could be developed if the Affected Area is rezoned as proposed. The assessment indicates that there would be an increase in traffic volumes associated with the site. However, this would be offset by a reduction in the number and size of heavy vehicles associated with the existing land uses (including reduced movements by Semi-Trailers and B-Doubles). Specifically, the redevelopment is (conservatively) forecast to generate 52 am peak hour and 87 pm peak hour additional movements, respectively. Once distributed to the various access points and movements at surrounding intersections, the impact on any one location is relatively low (particularly once considered in the context of reduced commercial vehicle volumes).

SIDRA intersection modelling software has been used to provide the comparative analysis of traffic impacts. The modelling analysis has identified the following key outcomes:

- the intersection of Findon Road/Valetta Road will require an upgrade to accommodate the future traffic volumes associated with the rezoning and redevelopment of the Affected Area;
- the proposal would slightly improve conditions in respect to the Findon Road/Hartley Road intersection. While the intersection is over capacity and an upgrade would be desirable, it is considered that this is associated with existing volumes and not the specifically the proposal;
- the future volumes would result in minimal change in conditions at the intersection of Findon Road/Grange Road (and, for some movements, will improve conditions). As with the Hartley Road intersection, an upgrade would ultimately be desirable but would not be directly required as a result of the rezoning and future redevelopment.

On the basis of the transport investigations, it is considered that adequate access provisions can be implemented for the Affected Area. Additionally, subject to upgrades recommended at the intersection of Findon Road/Valetta Road

being implemented, it is considered that the proposed will either retain similar conditions to the background traffic scenario or improve them.

# 2. BACKGROUND

## 2.1 AFFECTED AREA

The Affected Area comprises the former Metcash site at Kidman Park as well as two additional parcels of land on Valetta Road. Specifically, the Affected Area includes the following land:

- 406-412 Findon Road:
- 414-450 Findon Road;
- 5 Valetta Road; and
- 7 Valetta Road.

Figure 1 illustrates the Affected Area and the adjacent road network.

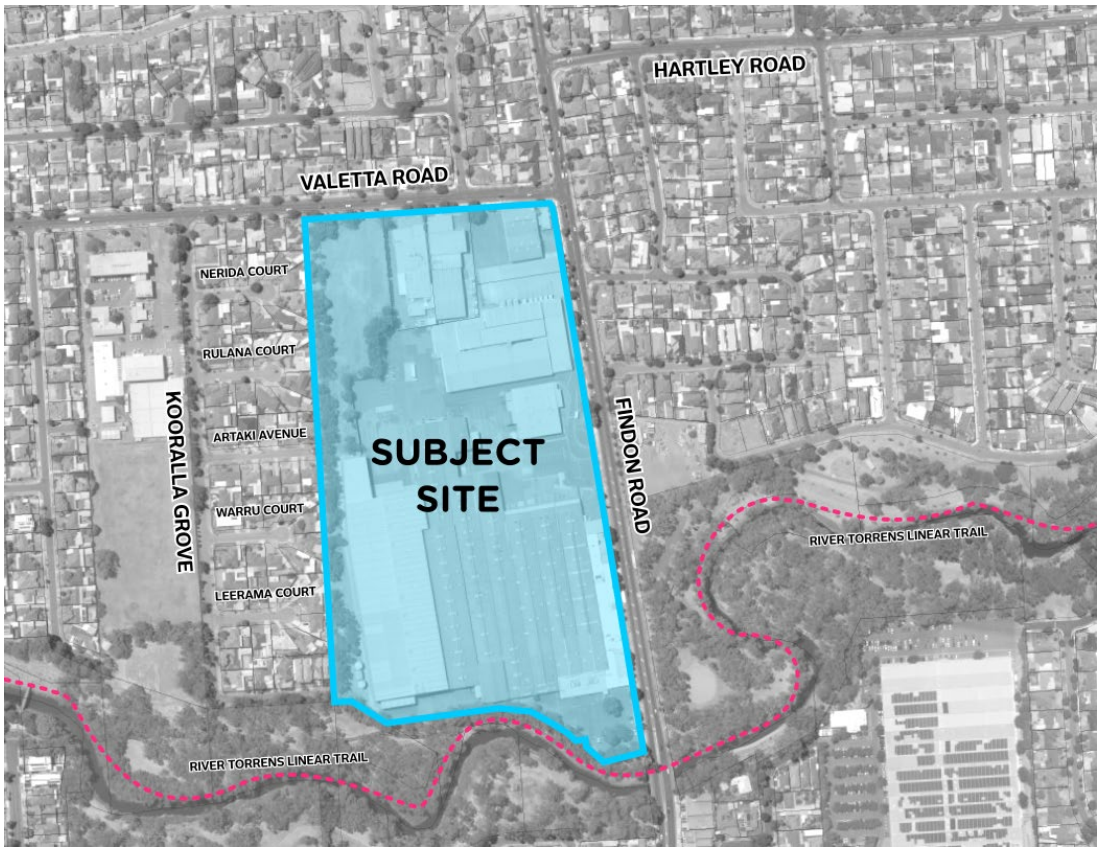


*Figure 1 - The subject site and the adjacent road network*

The Planning and Design Code identifies that the Affected Area is situated within a Strategic Employment Zone and that the following Overlays currently generally apply (some do not apply to the Valetta Road sites):

- Airport Building Heights (Regulated) (All structures over 15 metres);

- Advertising Near Signalised Intersections;
- Building Near Airfields;
- Hazards (Flooding);
- Hazards (Flooding General);
- Prescribed Wells Area;
- Regulated and Significant Tree;
- Traffic Generating Development;
- Urban Transport Routes; and
- Water Resources.

The Affected Area currently comprises industrial land uses (reflective of the current zoning). Notably, the majority of the Affected Area accommodated the Metcash Distribution Centre. Given the nature of the former distribution centre, there would have been a relatively high number of heavy commercial vehicle movements associated with the site (including Semi-Trailers and B-Doubles).

The (former) Metcash Distribution Centre is accessed via ten access points on Findon Road and two access points on Valetta Road. The two other parcels of land fronting Valetta Road (which are separate to the former Metcash site) are accessed via two access points on Valetta Road (one access per site).

## 2.2 ADJACENT ROAD NETWORK

### 2.2.1 KEY ADJACENT ROADS

Findon Road is an arterial road under the care and control of DIT. Adjacent the site, Findon Road generally comprises a single wide traffic lane in each direction separated by a painted median treatment. Traffic data obtained from DIT indicates that this section of Findon Road has an Annual Average Daily Traffic (AADT) volume in the order of 20,500 vehicles per day (vpd). Adjacent the site, a 60 km/h speed limit applies on Findon Road. Adjacent the Affected Area, Findon Road is gazetted for B-Double use to/from the north (the gazettal ceases at the area's southern boundary).

Valetta Road is a distributor road under the care and control of the City of Charles Sturt. Valetta Road comprises a 13.3 m (approximate) wide carriageway with a single traffic lane, a bicycle lane and a parallel parking lane in each direction. A default urban speed limit of 50 km/h applies on Valetta Road. Traffic data recorded by DIT indicates that Valetta Road currently accommodates in the order of 11,500 vpd.

Hartley Road is a collector road under the care and control of the City of Charles Sturt. Hartley Road comprises an 11.8 m (approximate) wide carriageway with a single traffic lane in each direction. A part-time bicycle lane (7:00 am to 9:00 am) and a parallel parking lane are located on the northern side of Hartley Road and a part-time bicycle lane (4:00 pm to 6:00 pm) on the southern side. A default urban speed limit of 50 km/h applies on Hartley Road. Traffic data recorded by DIT indicates that Hartley Road currently accommodates in the order of 4,700 vpd.

Other streets within the vicinity of the Affected Area are general low volume, local (residential) streets. Volumes on these roads would typically be below 1,500 vpd (and mostly well below this level). The general urban speed limit of 50 km/h applies on the surrounding local roads. It is noted that two of the adjacent roads immediately abut the site (namely, Artaki Avenue and Kooralla Grove). These two roads could provide an opportunity for additional connectivity for the subject area and its surrounds (this is discussed further below).

### 2.2.2 KEY ADJACENT INTERSECTIONS

Based on discussions with the City of Charles Sturt and DIT, the intersections which have been considered in this assessment include:

- Findon Road and Valetta Road (signalised intersection);
- Findon Road and Hartley Road (priority-controlled Give Way intersection); and
- Grange Road and Findon Road (signalised intersection).

The signalised intersection of Findon Road and Valetta Road is located immediately adjacent the north-eastern corner of the Affected Area. At the intersection, Findon Road comprises two northbound lanes (one shared with left turns) and a single southbound and dedicated right-turn lane. Valetta Road comprises dedicated left and right-turn lanes and a single egress lane. Pedestrian movements are accommodated on all arms of the intersection. DIT has recently removed the filtered right turn provisions on the northern approach (i.e. right turns from the northern Findon Road approach into Valetta Road are only permitted when a 'green arrow' lantern is displayed). The intersection also includes dedicated cyclist lantern for movements from Valetta Road to Findon Road.

The priority-controlled (Give Way) intersection of Findon Road and Hartley Road is located 765 m south of the Grange Road/Findon Road intersection. At the intersection, Findon Road comprises a single wide traffic lane in each direction. Hartley Road comprises dedicated left and right-turn lanes and a single egress lane. Pedestrian movements across Hartley Road are accommodated by a refuge crossing.

The Grange Road and Findon Road intersection is a four-way signalised intersection. The intersection comprises dual through lanes in each direction and a high-angled left-turn lane and a dedicated right-turn lane on each approach. Pedestrian movements are accommodated within the signalised intersection.

In addition to the above intersections, it is acknowledged that the Rowells Road (continuation of Findon Road) and Pierson Street (signalised) intersection is located approximately 150 m south of the Affected Area. Based upon work previously undertaken by CIRQA for the proposed rezoning of the Westpac Mortgage Centre (which identified a reduction in volumes at the intersection due to the redevelopment of that site), it is anticipated that the Metcash redevelopment is unlikely to have significant impact on intersection (particularly given the reduction in heavy vehicles distributed to/from it as a result of redevelopment of the Affected Area). As such, a detailed assessment of this intersection has not been included.

## 2.3 WALKING AND CYCLING

Sealed/paved footpaths are provided on both sides of the roads bounding and adjacent the Affected Area. These service both pedestrians and cyclists. As noted above, signalised crossing arrangements for such users are provided at the intersections of Findon Road with Valetta Road and Grange Road and a refuge is provided in the vicinity of the intersection with Hartley Road. In addition, a pedestrian/cyclist refuge is provided on Findon Road near the south-eastern corner of the Affected Area.

Bicycle lanes are also provided on Valetta Road and Hartley Road. No on-road facilities are provided on Findon Road (cyclists either share the carriageway with vehicles or the footpaths with pedestrians).

These facilities provide convenient access to the surrounding network and local destinations such as nearby shopping centres (i.e. the nearby shopping centre adjacent the intersection of Grange Road and Findon Road).

The Affected Area is also located immediately north of the River Torren's Linear Park Trail. The Linear Park Trail provides a major shared (pedestrian and cyclist) path facility utilised by both commuter and recreational users. The Trail provides safe and convenient access to/from the CBD (approximately 5 km to the east) as well as various other destinations.

It is noted that there are opportunities to increase and/or improve connections from the Affected Area to the surrounding network. This includes pedestrian and cycling connections to the existing residential development to the west (i.e. Artarki Avenue and Kooralla Grove) and the River Torrens Linear Trail. These

connections would not only benefit the future residents of the Affected Area but also the existing residents to the west of the site.

## 2.4 PUBLIC TRANSPORT

Numerous public transport services operate within close vicinity to the Affected Area. Specifically, regular bus services operate along Findon Road, Valetta Road and Hartley Road.

Bus stops are located immediately adjacent the Affected Area on both Findon Road and Valetta Road. It is noted that buses operate at a high frequency along Valetta Road (Go Zone). Bus routes operating within immediate proximity to the Affected Area include:

- Route 110, 112 – West Lakes to City;
- Route 286, 287 – Henley Beach to City;
- Route 288 – West Lakes Centre Interchange to City;
- Route 652,– Alberton to St Michael's College Primary Campus; and
- Route J7, J8 – West Lakes Centre Interchange to Marion Centre Interchange.

The above bus routes provide easily accessible and convenient access between the Affected Area and the Adelaide CBD as well as key retail centres (i.e. Henley Beach, Westfield West Lakes, Westfield Marion). It is also noted that the above routes provide access to other bus stops and interchanges that increases the connectivity of the Affected Area beyond the destinations listed above.

# 3. POTENTIAL REZONING AND FUTURE DEVELOPMENT

## 3.1 LAND USE AND YIELD

The Affected Area is proposed to be rezoned to accommodate mixed use development including residential and commercial opportunities. For the purposes of these investigations, it has been assumed that the Affected Area will accommodate approximately 350 dwellings within the former Metcash site and 40 dwellings on 5-7 Valetta Road (approximately 390 dwellings in total) plus an 80-place child care centre and a retail development with 1,350 m² gross leasable floor area (it is understood that the planning policy will likely restrict this to 1,000 m², nevertheless the higher area has been adopted for conservatism).

In respect to the mix of residential dwellings, the assessment has assumed the following break-down (based on preliminary concept plans):

- low density residential – 33%;
- medium density residential – 37%;
- high density residential – 30%;

## 3.2 ACCESS ARRANGEMENTS AND INFRASTRUCTURE

Based on initial discussions with DIT and the City of Charles Sturt, anticipated access arrangements for the Affected Area have been identified. This has included consideration of existing access provisions for the subject parcels of land, adjacent access points (such as the Dog Park access) and the initial structure plans for redevelopment of the former Metcash site.

Additionally, based on initial discussions with the City of Charles Sturt, it has been agreed that pedestrian and cyclist connections would desirably be provided to/from Artaki Avenue and Kooralla Grove. Vehicular connection to Artaki Avenue was generally not supported by the City of Charles Sturt, however, it was noted there may be some benefit to provide a vehicle connection to/from Kooralla Grove (noting the existing residents to the west would experience the primary benefit of such a connection rather then the future residents of the Affected Area). Nevertheless, for the purposes of the following traffic impact assessment it has been assumed that all movements will be via Findon Road and/or Valetta Road.

Pedestrian and cyclist connectivity should also be provided between the Affected Area and the River Torrens Trail Linear Path (south of the site) via new internal connections (ensuring treatments adequately address level differences between the site and the Linear Path). Desirably, an additional pedestrian refuge would also be provided on Findon Road in the vicinity of the existing bus stops and opposite dog park/reserve. Accessibility to and from the adjacent public

transport services (particularly the high frequency Go Zone on Valetta Road) should also be supported as part of the design of the road and path networks. This will be particularly important for the high density apartment sites. The central and northern apartment sites will be located in relatively close proximity to the Valetta Road high frequency route. However, the southern apartment sites will be just outside the typical 400 m distance adopted for bus service catchments. However, the additional distance (approximately 60 m) would equate to less than an additional minute of walking time and is also offset by the southern apartment sites' proximity to bus services on Findon Road and immediate proximity to the River Torrens Trail Linear Path. It is considered that the accessibility to/from various 'alternative' transport modes (to private motor vehicle) will appropriately support the proposed density.

Figure 2 illustrates the assumed future access arrangements for the Affected Area. Notably, while there is allowance for direct access to/from Findon Road and Valetta Road for the commercial areas, the majority of direct access points for new developments within the Affected Area will be accommodated via new internal roads. It is noted that the two existing access points (all movements permitted) for the existing commercial developments at 5 and 7 Valetta Road have been retained for the assessment).

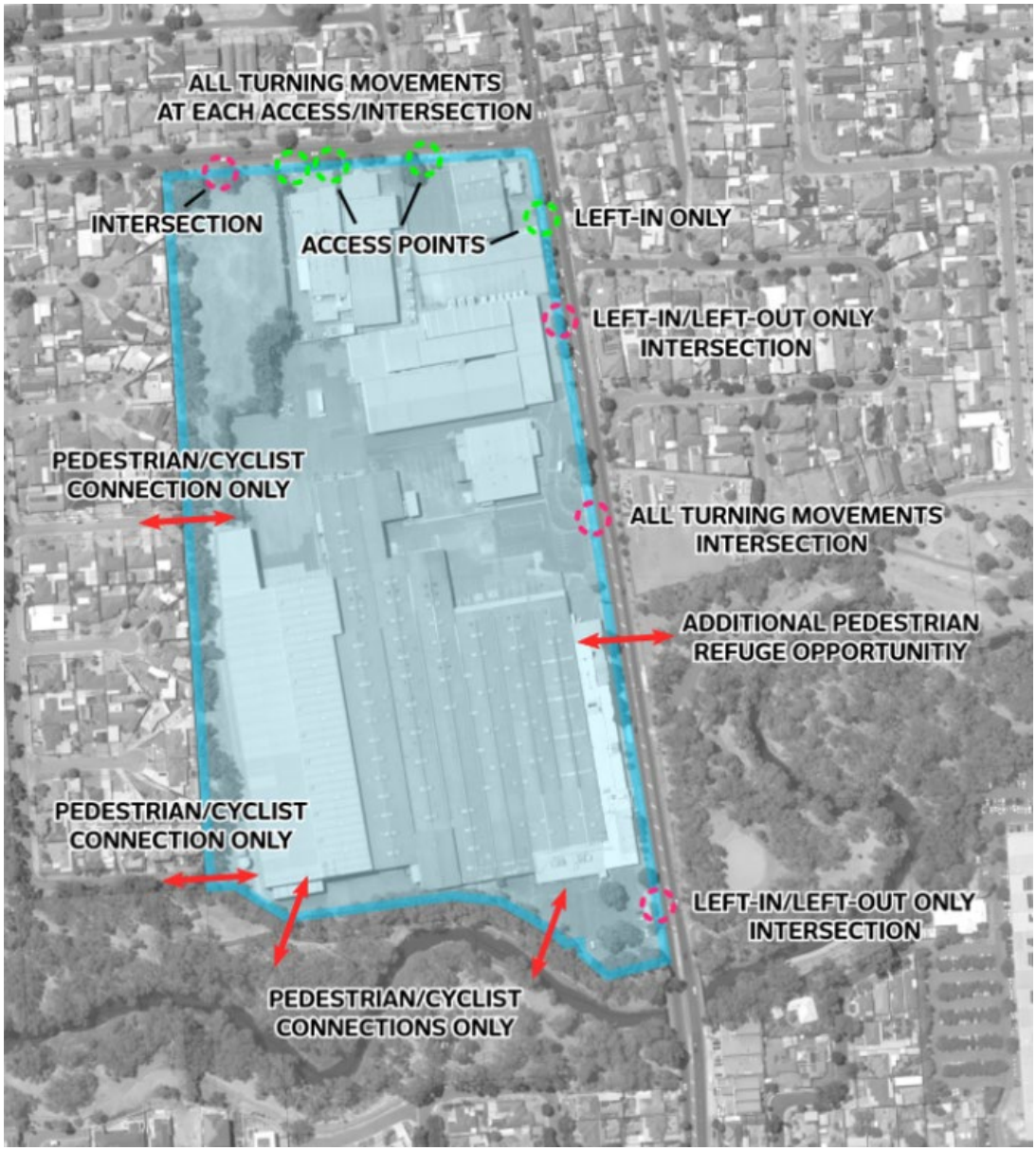


*Figure 2 – Potential access arrangements for the Affected Area*

The northern access points on Findon Road have been recommended to be restricted to left-in and/or left-out movements only to minimise impacts and conflict potential associated with the adjacent intersections of Findon Road with Beltana Street and Valetta Road. The southern access point has also been identified as left-in/left-out (given its proximity to the bridge over the River Torrens restricts available cross section for a right turn lane on Findon Road). If the southern access was located further north, there may be potential for right-in and/or right-out movements to be accommodated.

In order to service the future development of the Affected Area, an internal road network will also be required. The internal road network should provide connectivity between the various intersections. However, the internal road

network design should include appropriate road alignment and, if necessary traffic control devices to reduce vehicle speeds and the attractiveness of these connections for non-local drivers to cut-through between Findon Road and Valetta Road.

The internal road network should be designed in accordance with the City of Charles Sturt's engineering guidelines. In particular, the design of the road network should include consideration of on-street parking provisions, pedestrian and cyclist connectivity, waste collection provisions and appropriate traffic management treatments at all new intersections.

The primary intersection on Findon Road should be treated with a separate right-turn lane. Similarly, traffic volumes on Valetta Road would also warrant a separated right turn lane for the new Valetta Road intersection (albeit this should be discussed further with Council as this would apply to other existing side streets but no such facility is provided and Council may prefer a consistent treatment along Valetta Road).

Additionally, intersection treatments should also seek to improve pedestrian and cyclist safety and connectivity for the associated roads.

## 4. TRAFFIC GENERATION AND DISTRIBUTION

In order to determine the impacts of the proposed rezoning on the adjacent road network, traffic volumes associated with the existing and potential future site (based upon the above yields) have been forecast.

Traffic volumes have generally been forecast using rates adopted from the NSW Roads and Maritime Services' *"Guide to Traffic Generating Developments"* (the RMS Guide) or other rates considered appropriate based on CIRQA's experience. The proportion of heavy vehicle movements assumed for each use has also been identified.

- Low density residential
  - 0.71 am and 0.78 pm peak hour trips per dwelling;
  - 2% of peak hour trips assumed to be commercial vehicles;
  - 70%/30% split of trips to/from the site during the am peak hour and vice versa during the pm peak hour;
- Medium density residential
  - 0.65 am and pm peak hour trips per dwelling;
  - 2% of peak hour trips assumed to be commercial vehicles;
  - 70%/30% split of trips to/from the site during the am peak hour and vice versa during the pm peak hour;
- High density residential
  - 0.65 am and pm peak hour trips per dwelling;
  - 2% of peak hour trips assumed to be commercial vehicles;
  - 70%/30% split of trips to/from the site during the am peak hour and vice versa during the pm peak hour;
- Child Care Centre
  - 0.48 am and 0.42 pm peak hour trips per child;
  - 2% of peak hour trips assumed to be commercial vehicles;
  - 50%/50% split of trips to/from the site during the am and pm peak hours;
- Retail/shop
  - 4.5 am / 9 pm trips per 100 $m^2$ gross leasable floor area (this is likely to be a conservative assessment as the size of the retail area would likely be associated with lower generating types of shops than high volume shopping centres);
  - 2% of trips assumed to be commercial vehicles;
  - 50%/50% split of trips to/from the site during the am and pm peak hours;
- Industry (Business parks and industrial estates)

- 0.52 am and 0.56 pm peak hour trips per 100 $m^2$ of gross floor area;
- 5% of peak hour trips assumed to be commercial vehicles;
- 60%/40% split of trips to/from the site during the am peak hour and vice versa during the pm peak hour;

- Metcash Distribution Centre
  - a peak hour trip rate 0.343 am and pm trips per 100 $m^2$ of gross leasable floor area was adopted. This rate was based off data obtained from the Woolworths distribution centre in Gepps Cross (with the existing Metcash site anticipated to generate traffic in a similar manner);
  - a peak hour commercial vehicle percentage of 40% am and 25% pm was adopted based on the Woolworths distribution centre in Gepps Cross;
  - 60%/40% split of trips to/from the site during the am peak hour and vice versa during the pm peak hour;

Traffic volumes have been distributed to various intersections surrounding the subject site in order to determine the rezoning's potential impact. Intersections which have been considered in this assessment include:

- Findon Road and Valetta Road (signalised intersection);
- Findon Road and Hartley Road (Give Way intersection); and
- Findon Road and Grange Road (signalised intersection).

## 4.1 EXISTING MOVEMENTS

The distribution centre and industry traffic generation rates have been applied to the existing properties within the Affected Area. It is estimated that the uses (when fully operational) generated in the order of 243 am and 246 pm peak hour trips (refer Appendix A). This includes 85 am and 54 pm commercial vehicle trips.

The resulting distribution of am and pm peak hour trips forecast for the existing (previous) uses is provided in Appendix A.

## 4.2 FORECAST MOVEMENTS

Based upon the proposed land uses and the above traffic generation rates, it is forecast that the proposed rezoning and resulting development of the Affected Area will generate in the order of 295 am and 333 pm peak hour trips on the access points and external road network. The rezoning and redevelopment of the Affected Area is therefore forecast to result in additional movements being distributed to the surrounding road network. However, the number and size of commercial vehicle movements would reduce (notably, B-Doubles would no longer be required to access the site nor the adjacent section of Findon Road). Furthermore, the assumption around the extent of retail is understood to be

conservative and the above forecast future volumes would be reduced if the floor area was restricted to 1,000 m² or less. Nevertheless, the adoption of the higher yield provides a conservative assessment.

The distribution of future trips associated with the site has been estimated using demographic data from the 2016 ABS Census and consideration of the local road network. This included demographic data for the City of Charles Sturt in relation to the location of residents' places of work and residential origins of workers within the vicinity of the subject site. Consideration has also been given to the potential for drivers associated with the redevelopment of the Affected Area to utilise Beltana Road and Gerard Road (to avoid delays at the intersections of Findon Road with Valetta Road and Hartley Road). The distribution assumptions are also consistent with those adopted for the previous Development Plan Amendments and Findon Road Intersection Study. Figure 3 illustrates the broad distribution adopted for previous and current assessments.

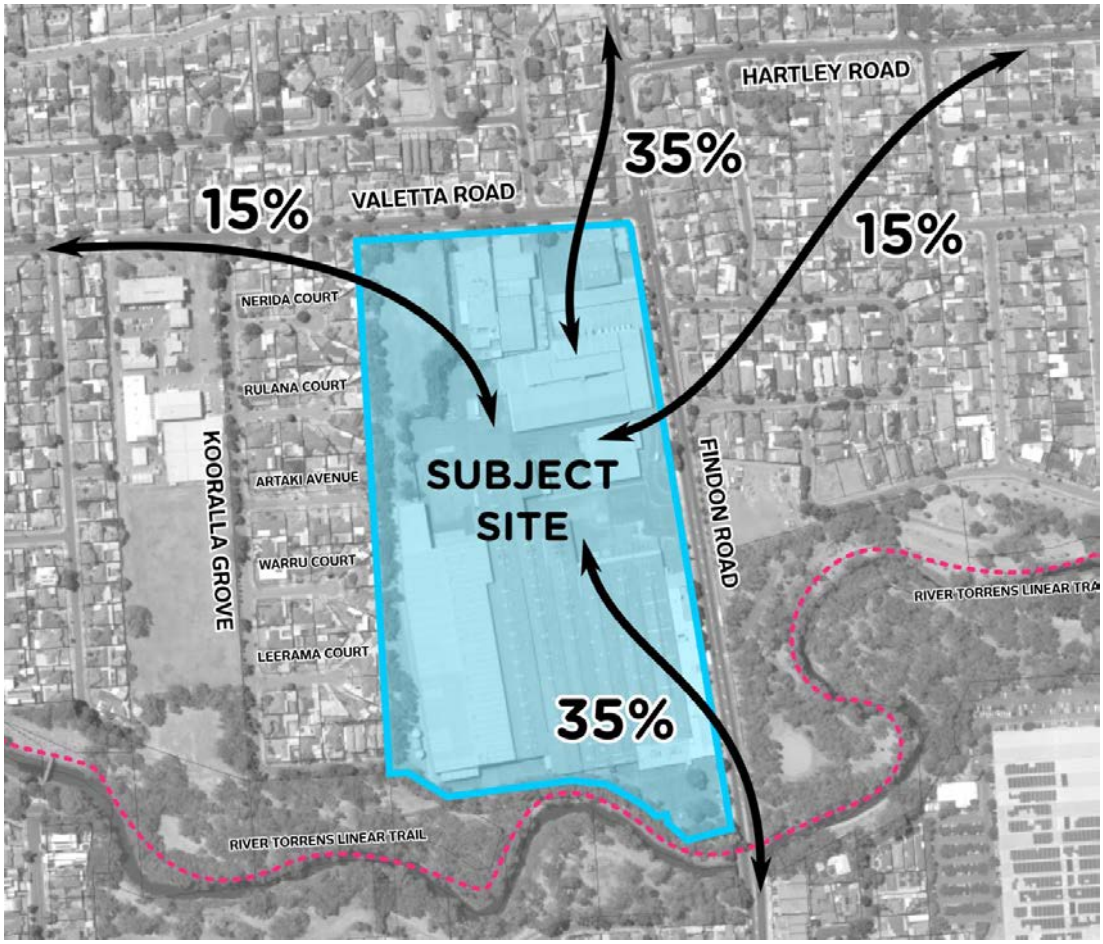


*Figure 3 - Broad distribution of future traffic movements adopted for the assessment*

The resulting traffic distribution and vehicle movements are identified in Appendix B.

## 4.3 KIDMAN PARK NORTH DPA & THE ALDI DEVELOPMENT

In addition to the volumes forecast for the Affected Area, the assessment has also included consideration of volumes previously forecast for the nearby Kidman Park North Development Plan Amendment and the ALDI Development Plan Amendment sites. These forecasts have been detailed in previous assessments prepared by CIRQA (and previously provided to both the City of Charles Sturt and DIT). The previous assessments identified the following peak hour volumes associated with the existing/previous uses for these sites and future forecasts based on the assumed development yields:

- Kidman Park North Site
  - a reduction of 2 am peak hour trips and an increase of 47 pm peak hour trips (notably, the number of commercial vehicles – including B-Doubles – was forecast to be significantly reduced as a result of redevelopment of the site); and
- ALDI Site
  - an addition of 273 am and pm peak hour movements (albeit a proportion of the additional movements would not be distributed via the section of Findon Road within the study area for the Metcash Code Amendment).

## 5. TRAFFIC IMPACT

SIDRA Intersection modelling software (version 9) has been used to assess the impacts of the proposed rezoning and anticipated development on the adjacent road network.

As per discussions with City of Charles Sturt and DIT, SIDRA analysis has been undertaken for the following intersections (as is consistent with previous investigations in the subject area):

- Findon Road/ Valetta Road;
- Findon Road/ Hartley Road; and
- Grange Road/ Findon Road.

It should be noted that all SIDRA Intersection modelling has included consideration of DIT's SIDRA Modelling Guidelines. It is noted that due to the close proximity of the Valetta Road/Findon Road and Hartley Road/Findon Road intersections, network modelling has been undertaken for these two intersections (network modelling combines the individual intersection models into a connected 'network' to allow consideration of interactions between the adjacent intersections).

To assess the impact of the subject rezoning, two scenarios were modelled (noting that analysis of existing volumes has been undertaken for the previous assessments):

- Base Scenario

  Existing traffic volumes were grown by 0.71% per annum (growth rate based on historical data) to the 2036 design year (as was adopted for the previous assessment for key intersections on Findon Road). Additional movements previously forecast for the Kidman Park North DPA (forecast future movements minus existing movements) and the ALDI DPA were added to the 2036 design volumes, producing the Base Scenario of which the impact of the subject rezoning could be assessed against.

- Future Scenario

  Additional movements generated by the subject rezoning (forecast redevelopment volumes minus the existing volumes for the Affected Area) are added to the Base Scenario volumes.

Detailed SIDRA output is included in Appendices C to E with key results and outcomes identified below.

## 5.1 VALETTA ROAD/FINDON ROAD INTERSECTION

Initial modelling of the Valetta Road/Findon Road intersection has indicated that the intersection would be over capacity by 2036 (regardless of the proposed rezoning and redevelopment of the site). The additional traffic volumes associated with the Future Scenario result in a worsening of conditions at the intersection (albeit it is reiterated that the number of commercial vehicle movements will be reduced). The analysis has therefore been utilised to identify the extent of upgrade required at the intersection to retain similar conditions (if not better) to the Base Scenario.

The analysis indicates that the following upgrade would essentially retain the status quo:

- construction of a high-angle entry left turn lane from Findon Road (south) to Valetta Road;
- designation of the kerb-side lane on Valetta Road as a shared left and right turn lane (with associated geometric adjustments to the intersection to accommodate the required vehicle turns); and
- extension of the section of dual lane approaches on Findon Road (south) and Valetta Road.

The key SIDRA results for the Base and Future Scenarios are identified in Table 1 below. The Future Scenario results reflect those associated with the above upgrade.

*Table 1 - Key am and (pm) peak hour results for Valetta Road/Findon Road*

| Approach | Movement | Base Scenario | | | Future Scenario | | |
|---|---|---|---|---|---|---|---|
| | | Volume | Degree of Saturation (v/c) | Level of Service | Volume | Degree of Saturation (v/c) | Level of Service |
| Findon Road (South) | L | 200 (357) | 0.542 (0.512) | C (B) | 201 (356) | 0.400 (0.369) | B (A) |
| | T | 864 (795) | 1.723 (1.581) | F (F) | 876 (747) | 1.272 (1.173) | F (F) |
| Findon Road (North) | T | 889 (1,017) | 0.952 (0.732) | D (A) | 837 (1,013) | 0.722 (0.719) | B (A) |
| | R | 284 (419) | 1.457 (0.927) | F (D) | 296 (456) | 1.187 (1.214) | F (F) |
| Valetta Road (West) | L | 565 (276) | 0.916 (0.323) | D (B) | 582 (292) | 0.921 (0.409) | D (B) |
| | R | 401 (175) | 1.017 (0.677) | F (C) | 416 (195) | 1.309 (0.966) | F (E) |
| Total | | 3,293 (3,039) | 1.723 (1.581) | | 3,208 (3,059) | 1.309 (1.214) | |

The results confirm that the above upgrade would be sufficient to retain similar conditions (and generally better conditions) for the Future Scenario compared to the Base Scenario.

The modelling has indicated that an upgrade of the intersection would be desirable to improve capacity regardless of the rezoning and redevelopment of the Affected Area. However, the modelling indicates that, if the Affected Area were to be rezoned (and redeveloped) as proposed, a high angled left-turn lane on the southern approach of Findon Road and dual right-out movements from Valetta Road (northern lane becomes a shared left and right turn lane) would offset the impact of the proposal. The analysis indicates extension of the dual lanes on the southern approach of Findon Road would also assist (albeit in reality drivers already form two 'lanes' by this point). Figure 4 identifies the upgrade layout identified from the SIDRA modelling. It should be noted that this layout is a concept sketch only and further design interrogation (as well as relevant approvals) would be required to confirm the alignment (particularly any geometric adjustments to accommodate the dual right-out of Valetta Road). The upgrade should also consider opportunities to reinforce and improve Council's cycling route between Valetta Road and Hartley Road (via Findon Road).

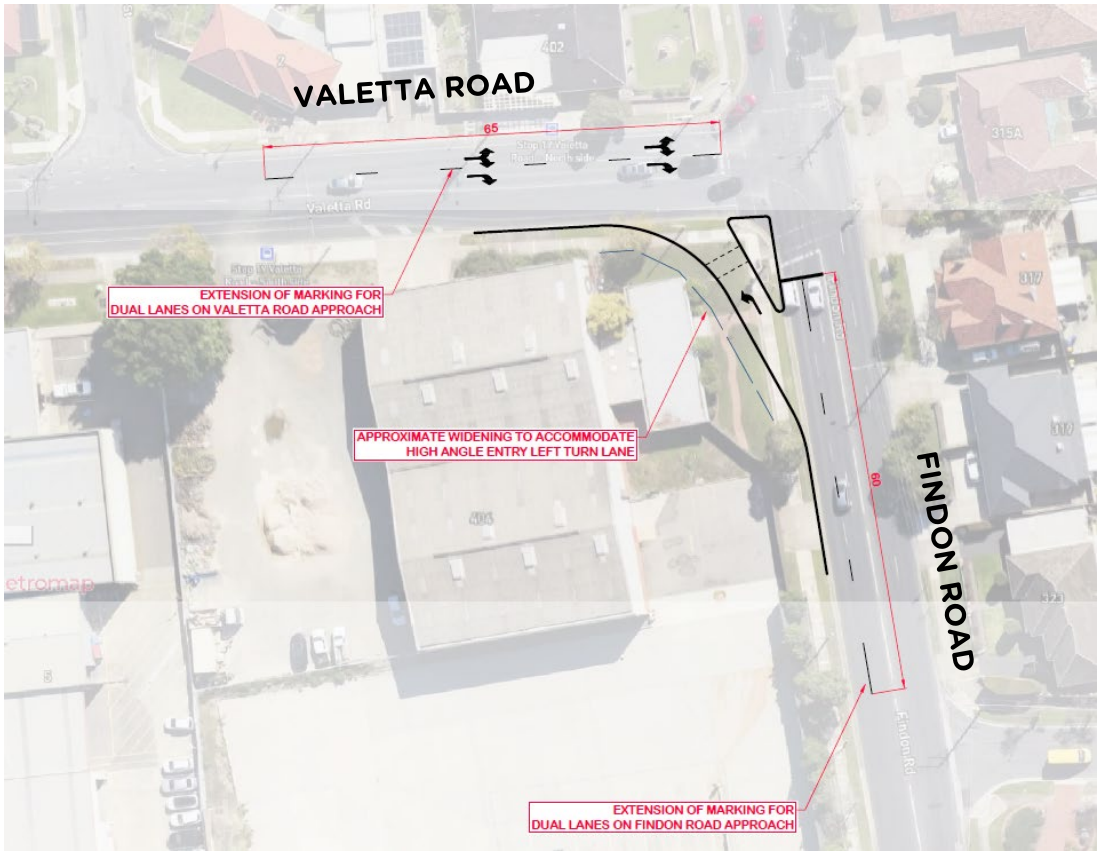


*Figure 4 – Potential upgrade to address additional volumes associated with the rezoning/redevelopment (subject to detailed design and relevant approvals)*

It is also noted that reinstatement of the filtered right turn movement from Findon Road (north) to Valetta Road would provide improved capacity at the intersection (albeit, if considered for reinstatement, would require review of the appropriateness from a safety perspective as well).

## 5.2 FINDON ROAD/HARTLEY ROAD INTERSECTION

The key SIDRA results for the Base and Future Scenarios are identified in Table 2 below (assuming no upgrade to the intersection).

*Table 2 - Key am and (pm) peak hour results for Findon Road/ Hartley Road*

| Approach | Movement | Base Scenario | | | Future Scenario | | |
|---|---|---|---|---|---|---|---|
| | | Volume | Degree of Saturation (v/c) | Level of Service | Volume | Degree of Saturation (v/c) | Level of Service |
| Findon Road (South) | T | 1,149 (936) | 1.006 (0.377) | C (A) | 1,164 (900) | 0.566 (0.443) | A (A) |
| | R | 280 (134) | 0.924 (0.634) | F (E) | 294 (138) | 0.881 (0.815) | E (F) |
| Hartley Road (East) | L | 234 (222) | 1.179 (1.610) | F (F) | 236 (237) | 1.022 (2.561) | F (F) |
| | R | 10 (56) | 0.570 (2.429) | F (F) | 10 (56) | 0.549 (3.226) | F (F) |
| Findon Road (North) | L | 183 (61) | 0.631 (0.942) | A (B) | 183 (61) | 0.591 (0.694) | A (A) |
| | T | 938 (1,213) | 0.631 (0.942) | A (A) | 896 (1,232) | 0.591 (0.694) | A (A) |
| Total | | 2,794 (2,622) | | | 2,783 (2,624) | | |

As has previously been identified, the intersection of Findon Road/Hartley Road is already at capacity. Additional background growth in traffic volumes will continue to increase delays and queues at the intersection (particularly for movements out of Hartley Road). However, the forecast volumes associated with the Future Scenario indicate a reduction in the number of movements distributed to/from the intersection in the am peak hour (11 less trips) and a negligible increase (2 peak hour trips) in the pm peak hour. The proposed rezoning and anticipated redevelopment of the Affected Area would therefore provide a slight benefit in the traffic volumes distributed via the intersection. It is noted that there are relatively high increases in the Degrees of Saturation for movements out of Hartley Road in the pm peak. However, these results are primarily due to the intersection already being at or over capacity and that SIDRA typically generates exponentially increasing results once an intersection is already saturated. In reality, the change in traffic volumes forecast for the intersection (between the two scenarios) are very low and would be within typical daily fluctuations in volumes resulting in negligible difference in actual conditions between the two scenarios. While there may ultimately be a desire to improve capacity by upgrading the intersection, this would be associated existing volumes and other background traffic growth rather than the subject proposal.

## 5.3 FINDON ROAD/GRANGE ROAD INTERSECTION

The key SIDRA results for the Base and Future Scenarios for Findon Road/Grange Road are identified in Table 2, below. As identified as part of the previous assessments undertaken within the subject area, the intersection of Findon Road/Grange Road will be over capacity by 2036.

*Table 3 - Key am and (pm) peak hour results for Findon Road/Grange Road*

| Approach | Movement | Base Scenario | | | Future Scenario | | |
|---|---|---|---|---|---|---|---|
| | | Volume am (pm) | Degree of Saturation (v/c) | Level of Service | Volume am (pm) | Degree of Saturation (v/c) | Level of Service |
| Findon Road (South) | L | 182 (288) | 0.453 (0.438) | D (D) | 184 (282) | 0.444 (0.411) | C (C) |
| | T | 548 (509) | 1.528 (1.478) | F (F) | 543 (475) | 1.497 (1.387) | F (F) |
| | R | 326 (203) | 1.175 (0.746) | F (E) | 344 (206) | 1.226 (0.752) | F (E) |
| Grange Road (East) | L | 184 (285) | 0.842 (1.300) | E (F) | 184 (305) | 0.820 (1.315) | E (F) |
| | T | 543 (980) | 0.842 (1.300) | D (F) | 543 (980) | 0.820 (1.315) | D (F) |
| | R | 173 (314) | 0.630 (0.934) | D (D) | 173 (314) | 0.643 (0.937) | D (D) |
| Findon Road (North) | L | 139 (122) | 0.571 (0.663) | D (E) | 139 (122) | 0.528 (0.656) | D (E) |
| | T | 550 (679) | 1.417 (1.644) | F (F) | 513 (674) | 1.310 (1.628) | F (F) |
| | R | 257 (332) | 0.941 (1.319) | E (F) | 257 (332) | 0.930 (1.318) | E (F) |
| Grange Road (West) | L | 270 (191) | 1.237 (0.873) | F (E) | 270 (191) | 1.237 (0.879) | F (E) |
| | T | 978 (676) | 1.237 (0.873) | F (D) | 978 (676) | 1.237 (0.879) | F (D) |
| | R | 324 (305) | 0.976 (0.976) | D (E) | 318 (307) | 0.935 (0.984) | D (E) |
| Total | | 4,483 (4,484) | 1.528 (1.644) | | 4,446 (4,864) | 1.497 (1.628) | |

The analysis indicates that the rezoning and redevelopment of the Affected Area would slightly improve conditions at the intersection. Notably, all movements at the intersection either have a retained or improved Level of Service between the Base Scenario and the Future Scenario. The proposed rezoning and subsequent redevelopment would therefore provide a positive outcome for the intersection of Findon Road/Grange Road (due to reduced commercial vehicle numbers as well as the redistribution of movements associated with the Affected Area). It is also noted that the intersection performs worse in the am peak hour (than the pm peak hour) when the forecast change in volumes is negligible.

## 5.4 ACCESS POINTS

Based on the forecast future traffic volumes, SIDRA analysis has also been prepared to consider access provisions for the site. Specifically, this has been prepared for the primary (all movement) access point on Findon Road (given all other intersections will be associated with a lower traffic volumes and, in some cases, less turning movements permitted (i.e. the primary access point

represents the 'worst case' for conditions associated with any of the site access points).

The SIDRA analysis has been prepared based on a 'two-stage' right turn out arrangement with a separated right turn lane (essentially retaining the existing arrangement). The detailed SIDRA results are provided in Appendix F. The results identify that the volumes forecast for the primary access point will be adequately accommodated with the following key conditions:

- all through bound movements on Findon Road will have a Level of Service of 'A';
- turning movements will have a worst-case Level of Service of 'D' (for the right-out during the pm peak hour with other movements either having a Level of Service of 'A' (for left-in movements) or 'C' (for left-out and right-in movements);
- the movements at the intersection will have a Degree of Saturation of 0.718 or better (lower); and
- the 95$^{th}$ percentile queues for vehicles turning right from Findon Road into the new road will be one vehicle (rounded) in both the am and pm peak hour; and
- the 95$^{th}$ percentile queues for vehicles turning right out of the new road on to Findon Road will be two vehicles (one in the median opening and one on the new road itself).

It is recommended that the detailed design of the new intersection ensure that two-stage movements for the right turn out are adequately accommodated (i.e. reasonable median storage for a B99 car with additional clearances and associated turn path assessment).

## 5.5 VALETTA ROAD

It is forecast that the redevelopment of the Affected Area would be associated with approximately 450 daily traffic movements on Valetta Road to/from the west of the site. Such an increase would have minimal impact on conditions associated with Valetta Road. Furthermore, this forecast doesn't take into account the previous distribution of traffic associated with the Metcash site and the actual increase would be lower.

## 5.6 INTERNAL LAYOUT

Based on the forecast traffic volumes, the daily traffic volumes on the internal roads will be within the typical range associated with 'local roads' (0 to 1,500 vehicles per day). Specifically, the new road connecting to the primary (central) access point on Findon Road is forecast to accommodate a future volume of

1,000 vpd with other roads connecting to Findon Road and Valetta Road forecast to accommodate in the order of 250 to 500 vpd. These volumes will be somewhat dependent on the ultimate access arrangements achieved and the internal road layout, however, the assessment provides an indicator that the internal road network will generally accommodate relatively low volumes.

It has been noted above that the internal road network should be designed to discourage cut-through movements between Findon Road and Valetta Road. There are two primary potential cut-through routes associated with the site, namely (a) drivers avoiding a left turn from Findon Road to Valetta Road at the signalised intersection and (b) drivers approaching Findon Road from Valetta Road (either seeking to turn right on to Findon Road and head south or seeking to access Hartley Road). The identified upgrade to the Findon Road/Valetta Road intersection will assist in minimising the attractiveness of drivers seeking to avoid the left turn from Findon Road and the right turn from Valetta Road to Findon Road and this could be further strengthened through appropriate road design within the site. In respect to drivers from Valetta Road avoiding the signalised intersection by travelling through the site and then to Hartley Road via Beltana Street and Gerard Road, significant use of this cut-through route is considered unlikely. To undertake such a route would comprise almost twice the travel distance and twice the number of non-priority turns. As above, this can be explored further during detailed design to ensure the road alignments and treatments minimise this potential. It is noted, however, that given the central connection between Findon Road and Valetta Road would have additional capacity, there may be some benefit to accepting a proportion of cut-through movements to reduce traffic loads at the signalised intersection of Findon Road/Valetta Road (albeit there may be associated impacts on residents within the future development if such provisions are overly attractive to non-local drivers). This could be reviewed further as planning and design for the internal site layout progresses.

## 5.7 OTHER EXTERNAL CONSIDERATIONS

In addition to the potential for cut-through movements through the site, it has also been noted that there will likely be a proportion of movements associated with the site that are distributed via Beltana Street and Gerard Road. This has been considered in the above modelling and it is considered that the potential distribution of movements to these roads would result in daily traffic volumes still within their respective capacities (noting that the current volumes on these roads are in the order of 570 vpd for Beltana Road and 430 vpd for Gerard Road). Notably, even if all movements distributed to Hartley Road from the development of the Affected Area utilised Beltana Road and Gerard Road, the increase would only be in the order of 150 vpd and total volumes would remain well within the typical level associated with local roads. In reality, the distributed to these roads would be less than this. Furthermore, the assessment does not consider the

potential for previous Metcash staff (from the site's southern car park) to utilise such a cut-through and, therefore, the increase would be even less.

Similarly, if a direct vehicle connection is provided between the Affected Area and the south-eastern end of Kooralla Grove, there may be potential for cut-through movements. However, this would primarily be associated with existing residents of Kooralla Grove and the five small side streets to its east and the number of movements would be relatively low. There would be some benefit to these residents if the connection was made to provide improved permeability of the road network, however, further consideration would be needed to ensure the connection doesn't encourage movements from the southern left-in on Findon Road to Valetta Road (to bypass the signals). This could be considered further if such a vehicle connection is proposed and the internal road layout of the Affected Area designed accordingly.

# APPENDIX A

## FORECAST MOVEMENTS – BASE SCENARIO EXISTING (PREVIOUS) USES

| TS048 Grange Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 138.88 |
| | | 3 | T | 549.84 |
| | | 4 | R | 256.05 |
| | 2 | 3 | L | 183.32 |
| | | 4 | T | 542.40 |
| | | 1 | R | 172.03 |
| | 3 | 4 | L | 181.61 |
| | | 1 | T | 547.98 |
| | | 2 | R | 325.20 |
| | 4 | 1 | L | 269.77 |
| | | 2 | T | 977.92 |
| | | 3 | R | 323.64 |

| TS048 Grange Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 121.16 |
| | | 3 | T | 678.43 |
| | | 4 | R | 331.50 |
| | 2 | 3 | L | 284.33 |
| | | 4 | T | 979.48 |
| | | 1 | R | 313.20 |
| | 3 | 4 | L | 287.77 |
| | | 1 | T | 508.40 |
| | | 2 | R | 202.89 |
| | 4 | 1 | L | 190.90 |
| | | 2 | T | 675.42 |
| | | 3 | R | 304.77 |

| Hartley Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 182.89 |
| | | 3 | T | 937.84 |
| | 2 | 3 | L | 233.69 |
| | | 1 | R | 9.63 |
| | 3 | 1 | T | 1148.65 |
| | | 2 | R | 279.73 |

| Hartley Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 60.52 |
| | | 3 | T | 1212.94 |
| | 2 | 3 | L | 221.03 |
| | | 1 | R | 55.65 |
| | 3 | 1 | T | 935.97 |
| | | 2 | R | 133.54 |

| TS338 Valetta Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 199.15 |
| | | 3 | T | 863.40 |
| | 2 | 3 | L | 564.98 |
| | | 1 | R | 400.61 |
| | 3 | 1 | T | 888.50 |
| | | 2 | R | 283.04 |

| TS338 Valetta Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 356.86 |
| | | 3 | T | 794.98 |
| | 2 | 3 | L | 275.53 |
| | | 1 | R | 174.98 |
| | 3 | 1 | T | 1016.94 |
| | | 2 | R | 418.03 |

| Valetta Rd Access 1 (West) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 0.00 |
| | | 3 | T | 482.19 |
| | 2 | 3 | L | 0.00 |
| | | 1 | R | 0.00 |
| | 3 | 1 | T | 965.59 |
| | | 2 | R | 0.00 |

| Valetta Rd Access 1 (West) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 0.00 |
| | | 3 | T | 774.89 |
| | 2 | 3 | L | 0.00 |
| | | 1 | R | 0.00 |
| | 3 | 1 | T | 450.50 |
| | | 2 | R | 0.00 |

| Valetta Rd Access 2 (Middle) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 0.00 |
| | | 3 | T | 482.19 |
| | 2 | 3 | L | 0.00 |
| | | 1 | R | 0.00 |
| | 3 | 1 | T | 965.59 |
| | | 2 | R | 0.00 |

| Valetta Rd Access 2 (Middle) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 0.00 |
| | | 3 | T | 774.89 |
| | 2 | 3 | L | 0.00 |
| | | 1 | R | 0.00 |
| | 3 | 1 | T | 450.50 |
| | | 2 | R | 0.00 |

| Valetta Rd Access 3 (East) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 0.00 |
| | | 3 | T | 482.19 |
| | 2 | 3 | L | 0.00 |

| Valetta Rd Access 3 (East) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 0.00 |
| | | 3 | T | 774.89 |
| | 2 | 3 | L | 0.00 |

| | | | | |
|---|---|---|---|---|
| | 2 | 1 | R | 0.00 |
| | 3 | 1 | T | 965.59 |
| | | 2 | R | 0.00 |

| | | | | |
|---|---|---|---|---|
| | 2 | 1 | R | 0.00 |
| | 3 | 1 | T | 450.50 |
| | | 2 | R | 0.00 |

| Findon Rd Access 1 (Commercial) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | T | 1289.10 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 0.00 |
| | | 1 | T | 1062.56 |
| | 3 | 1 | L | 0.00 |
| | | 2 | R | 0.00 |

| Findon Rd Access 1 (Commercial) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | T | 1191.92 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 0.00 |
| | | 1 | T | 1151.85 |
| | 3 | 1 | L | 0.00 |
| | | 2 | R | 0.00 |

| Findon Rd Access 1 (North) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | T | 1289.10 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 0.00 |
| | | 1 | T | 1062.56 |
| | 3 | 1 | L | 0.00 |
| | | 2 | R | 0.00 |

| Findon Rd Access 1 (North) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | T | 1191.92 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 0.00 |
| | | 1 | T | 1151.85 |
| | 3 | 1 | L | 0.00 |
| | | 2 | R | 0.00 |

| Findon Rd Access 2 (Centre) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | T | 1289.10 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 0.00 |
| | | 1 | T | 1062.56 |
| | 3 | 1 | L | 0.00 |
| | | 2 | R | 0.00 |

| Findon Rd Access 2 (Centre) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | T | 1191.92 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 0.00 |
| | | 1 | T | 1151.85 |
| | 3 | 1 | L | 0.00 |
| | | 2 | R | 0.00 |

| Findon Rd Access 3 (South) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | T | 1289.10 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 0.00 |
| | | 1 | T | 1062.56 |
| | 3 | 1 | L | 0.00 |
| | | 2 | R | 0.00 |

| Findon Rd Access 3 (South) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | T | 1191.92 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 0.00 |
| | | 1 | T | 1151.85 |
| | 3 | 1 | L | 0.00 |
| | | 2 | R | 0.00 |

| Beltana St/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 0 |
| | | 3 | T | 1289.10 |
| | 2 | 3 | L | 0.00 |
| | | 1 | R | 0.00 |
| | 3 | 1 | T | 1062.56 |
| | | 2 | R | 0.00 |

| Beltana St/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 0 |
| | | 3 | T | 1191.92 |
| | 2 | 3 | L | 0.00 |
| | | 1 | R | 0.00 |
| | 3 | 1 | T | 1151.85 |
| | | 2 | R | 0.00 |

# APPENDIX B

## FORECAST MOVEMENTS – FUTURE SCENARIO FUTURE USES

| TS048 Grange Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 138.88 |
| | | 3 | T | 512.87 |
| | | 4 | R | 256.05 |
| | 2 | 3 | L | 183.35 |
| | | 4 | T | 542.40 |
| | | 1 | R | 172.03 |
| | 3 | 4 | L | 183.04 |
| | | 1 | T | 542.27 |
| | | 2 | R | 343.49 |
| | 4 | 1 | L | 269.77 |
| | | 2 | T | 977.92 |
| | | 3 | R | 317.65 |

| TS048 Grange Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 121.16 |
| | | 3 | T | 673.75 |
| | | 4 | R | 331.50 |
| | 2 | 3 | L | 304.66 |
| | | 4 | T | 979.48 |
| | | 1 | R | 313.20 |
| | 3 | 4 | L | 281.73 |
| | | 1 | T | 474.28 |
| | | 2 | R | 205.77 |
| | 4 | 1 | L | 190.90 |
| | | 2 | T | 675.42 |
| | | 3 | R | 306.88 |

| Hartley Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 182.89 |
| | | 3 | T | 895.91 |
| | 2 | 3 | L | 235.71 |
| | | 1 | R | 9.63 |
| | 3 | 1 | T | 1163.66 |
| | | 2 | R | 293.59 |

| Hartley Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 60.52 |
| | | 3 | T | 1231.69 |
| | 2 | 3 | L | 236.24 |
| | | 1 | R | 55.65 |
| | 3 | 1 | T | 899.69 |
| | | 2 | R | 137.46 |

| TS338 Valetta Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 200.17 |
| | | 3 | T | 875.21 |
| | 2 | 3 | L | 581.04 |
| | | 1 | R | 415.34 |
| | 3 | 1 | T | 836.21 |
| | | 2 | R | 295.41 |

| TS338 Valetta Rd/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 355.58 |
| | | 3 | T | 746.74 |
| | 2 | 3 | L | 291.41 |
| | | 1 | R | 194.12 |
| | 3 | 1 | T | 1012.57 |
| | | 2 | R | 455.36 |

| Valetta Rd Access 1 (West) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 11.58 |
| | | 3 | T | 497.37 |
| | 2 | 3 | L | 13.11 |
| | | 1 | R | 18.50 |
| | 3 | 1 | T | 973.28 |
| | | 2 | R | 7.34 |

| Valetta Rd Access 1 (West) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 22.41 |
| | | 3 | T | 787.36 |
| | 2 | 3 | L | 5.41 |
| | | 1 | R | 7.44 |
| | 3 | 1 | T | 466.73 |
| | | 2 | R | 14.10 |

| Valetta Rd Access 2 (Middle) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 3.98 |
| | | 3 | T | 507.31 |
| | 2 | 3 | L | 1.64 |
| | | 1 | R | 9.29 |
| | 3 | 1 | T | 991.08 |
| | | 2 | R | 0.70 |

| Valetta Rd Access 2 (Middle) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 9.29 |
| | | 3 | T | 809.06 |
| | 2 | 3 | L | 0.70 |
| | | 1 | R | 3.98 |
| | 3 | 1 | T | 472.52 |
| | | 2 | R | 1.64 |

| Valetta Rd Access 3 (East) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 10.94 |
| | | 3 | T | 507.65 |
| | 2 | 3 | L | 3.65 |
| | | 1 | R | 20.66 |

| Valetta Rd Access 3 (East) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 21.87 |
| | | 3 | T | 811.07 |
| | 2 | 3 | L | 7.29 |
| | | 1 | R | 41.31 |

| | | | | |
|---|---|---|---|---|
| | 3 | 1 | T | 996.72 |
| | | 2 | R | 3.65 |

| | | | | |
|---|---|---|---|---|
| | 3 | 1 | T | 469.22 |
| | | 2 | R | 7.29 |

| Findon Rd Access 1 (Commercial) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | T | 1340.55 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 9.72 |
| | | 1 | T | 1138.38 |
| | 3 | 1 | L | 0.00 |
| | | 2 | R | 0.00 |

| Findon Rd Access 1 (Commercial) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | T | 1271.69 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 19.44 |
| | | 1 | T | 1192.32 |
| | 3 | 1 | L | 0.00 |
| | | 2 | R | 0.00 |

| Findon Rd Access 2 (North) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | T | 1340.68 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 7.55 |
| | | 1 | T | 1113.82 |
| | 3 | 1 | L | 38.83 |
| | | 2 | R | 0.00 |

| Findon Rd Access 2 (North) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | T | 1274.03 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 12.05 |
| | | 1 | T | 1191.67 |
| | 3 | 1 | L | 18.28 |
| | | 2 | R | 0.00 |

| Findon Rd Access 3 (Centre) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | T | 1311.93 |
| | | 3 | R | 28.75 |
| | 2 | 3 | L | 6.65 |
| | | 1 | T | 1094.85 |
| | 3 | 1 | L | 26.52 |
| | | 2 | R | 43.18 |

| Findon Rd Access 3 (Centre) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | T | 1214.78 |
| | | 3 | R | 59.25 |
| | 2 | 3 | L | 14.52 |
| | | 1 | T | 1193.06 |
| | 3 | 1 | L | 10.66 |
| | | 2 | R | 18.86 |

| Findon Rd Access 4 (South) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | T | 1355.11 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 9.34 |
| | | 1 | T | 1088.29 |
| | 3 | 1 | L | 13.22 |
| | | 2 | R | 0.00 |

| Findon Rd Access 4 (South) | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | T | 1233.64 |
| | | 3 | R | 0.00 |
| | 2 | 3 | L | 20.28 |
| | | 1 | T | 1202.32 |
| | 3 | 1 | L | 5.27 |
| | | 2 | R | 0.00 |

| Beltana St/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| AM | 1 | 2 | L | 2.56243 |
| | | 3 | T | 1337.99 |
| | 2 | 3 | L | 2.69 |
| | | 1 | R | 2.32 |
| | 3 | 1 | T | 1145.78 |
| | | 2 | R | 6.87 |

| Beltana St/ Findon Rd | | | | |
|---|---|---|---|---|
| | Arm | Exit Arm | Movement | Total Veh |
| PM | 1 | 2 | L | 2.986995 |
| | | 3 | T | 1268.70 |
| | 2 | 3 | L | 5.33 |
| | | 1 | R | 4.78 |
| | 3 | 1 | T | 1206.98 |
| | | 2 | R | 2.97 |

# APPENDIX C

## FINDON ROAD/VALETTA ROAD SIDRA RESULTS

# APPENDIX C1

## BASE SCENARIO

# MOVEMENT SUMMARY

## Site: TS338 [Valetta/Findon AM Base Scenario (Site Folder: Valetta/Findon)]

## Network: N101 [AM Base Scenario (Network Folder: General)]

Valetta/Findon
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated  Cycle Time = 60 seconds (Site User-Given Phase Times)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | | | | |
| 1 | L2 | 211 | 2.0 | 211 | 2.0 | 0.542 | 21.8 | LOS C | 5.1 | 36.6 | 0.83 | 0.77 | 0.83 | 41.9 |
| 2 | T1 | 909 | 4.1 | 909 | 4.1 | * 1.723 | 574.0 | LOS F | 97.2 | 703.8 | 0.97 | 3.84 | 6.42 | 3.0 |
| Approach | | 1120 | 3.7 | 1120 | 3.7 | 1.723 | 470.2 | LOS F | 97.2 | 703.8 | 0.95 | 3.26 | 5.37 | 4.3 |
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 8 | T1 | 936 | 3.0 | 930 | 3.0 | 0.952 | 42.8 | LOS D | 13.9 | 100.0 | 0.90 | 1.24 | 1.46 | 28.7 |
| 9 | R2 | 299 | 4.9 | 297 | 4.9 | * 1.457 | 446.6 | LOS F | 13.7 | 100.0 | 1.00 | 2.81 | 6.05 | 4.4 |
| Approach | | 1235 | 3.5 | 1227 N1 | 3.5 | 1.457 | 140.6 | LOS F | 13.9 | 100.0 | 0.92 | 1.62 | 2.57 | 12.3 |
| West: Valetta Rd (W) | | | | | | | | | | | | | | |
| 10 | L2 | 595 | 2.5 | 595 | 2.5 | 0.916 | 40.7 | LOS D | 13.5 | 96.3 | 0.86 | 1.07 | 1.36 | 24.5 |
| 12 | R2 | 422 | 0.0 | 422 | 0.0 | * 1.017 | 82.4 | LOS F | 14.8 | 103.7 | 1.00 | 1.44 | 2.28 | 24.0 |
| Approach | | 1017 | 1.4 | 1017 | 1.4 | 1.017 | 58.0 | LOS E | 14.8 | 103.7 | 0.92 | 1.22 | 1.74 | 24.2 |
| All Vehicles | | 3372 | 2.9 | 3364 N1 | 2.9 | 1.723 | 225.4 | LOS F | 97.2 | 703.8 | 0.93 | 2.05 | 3.25 | 8.6 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

**Pedestrian Movement Performance**

| Mov ID | Crossing | Dem. Flow ped/h | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Ped ped | Dist ] m | Prop. Que | Effective Stop Rate | Travel Time sec | Travel Dist. m | Aver. Speed m/sec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | |
| P1 | Full | 53 | 24.4 | LOS C | 0.1 | 0.1 | 0.90 | 0.90 | 50.7 | 34.3 | 0.68 |
| North: Findon Rd (N) | | | | | | | | | | | |
| P3 | Full | 53 | 24.4 | LOS C | 0.1 | 0.1 | 0.90 | 0.90 | 51.5 | 35.3 | 0.69 |
| West: Valetta Rd (W) | | | | | | | | | | | |
| P4 | Full | 53 | 18.4 | LOS B | 0.1 | 0.1 | 0.79 | 0.79 | 43.6 | 32.7 | 0.75 |
| All Pedestrians | | 158 | 22.4 | LOS C | 0.1 | 0.1 | 0.86 | 0.86 | 48.6 | 34.1 | 0.70 |

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: TS338 [Valetta/Findon PM Base Scenario (Site Folder: Valetta/Findon)]

## Network: N101 [PM Base Scenario (Network Folder: General)]

Valetta/Findon
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated  Cycle Time = 60 seconds (Site User-Given Phase Times)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | | | | |
| 1 | L2 | 376 | 0.6 | 376 | 0.6 | 0.512 | 12.1 | LOS B | 3.4 | 24.1 | 0.54 | 0.73 | 0.54 | 45.8 |
| 2 | T1 | 837 | 0.9 | 837 | 0.9 | * 1.581 | 553.5 | LOS F | 95.7 | 675.1 | 1.00 | 4.22 | 6.74 | 3.1 |
| Approach | | 1213 | 0.8 | 1213 | 0.8 | 1.581 | 385.7 | LOS F | 95.7 | 675.1 | 0.86 | 3.14 | 4.82 | 5.6 |
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 8 | T1 | 1071 | 1.2 | 1008 | 1.1 | 0.732 | 7.1 | LOS A | 11.2 | 78.8 | 0.67 | 0.61 | 0.67 | 51.6 |
| 9 | R2 | 441 | 1.4 | 415 | 1.4 | * 0.927 | 47.0 | LOS D | 10.3 | 72.7 | 1.00 | 1.12 | 1.64 | 24.5 |
| Approach | | 1512 | 1.3 | 1423 N1 | 1.2 | 0.927 | 18.7 | LOS B | 11.2 | 78.8 | 0.76 | 0.76 | 0.95 | 39.0 |
| West: Valetta Rd (W) | | | | | | | | | | | | | | |
| 10 | L2 | 291 | 2.2 | 291 | 2.2 | 0.323 | 15.6 | LOS B | 3.1 | 22.4 | 0.63 | 0.73 | 0.63 | 36.1 |
| 12 | R2 | 184 | 1.1 | 184 | 1.1 | * 0.677 | 33.3 | LOS C | 3.4 | 24.2 | 0.99 | 0.86 | 1.12 | 35.7 |
| Approach | | 475 | 1.8 | 475 | 1.8 | 0.677 | 22.5 | LOS C | 3.4 | 24.2 | 0.77 | 0.78 | 0.82 | 35.9 |
| All Vehicles | | 3199 | 1.2 | 3111 N1 | 1.2 | 1.581 | 162.4 | LOS F | 95.7 | 675.1 | 0.80 | 1.69 | 2.44 | 11.4 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

**Pedestrian Movement Performance**

| Mov ID | Crossing | Dem. Flow ped/h | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Ped ped | Dist ] m | Prop. Que | Effective Stop Rate | Travel Time sec | Travel Dist. m | Aver. Speed m/sec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | |
| P1 | Full | 53 | 24.4 | LOS C | 0.1 | 0.1 | 0.90 | 0.90 | 50.7 | 34.3 | 0.68 |
| North: Findon Rd (N) | | | | | | | | | | | |
| P3 | Full | 53 | 24.4 | LOS C | 0.1 | 0.1 | 0.90 | 0.90 | 51.5 | 35.3 | 0.69 |
| West: Valetta Rd (W) | | | | | | | | | | | |
| P4 | Full | 53 | 18.4 | LOS B | 0.1 | 0.1 | 0.79 | 0.79 | 43.6 | 32.7 | 0.75 |
| All Pedestrians | | 158 | 22.4 | LOS C | 0.1 | 0.1 | 0.86 | 0.86 | 48.6 | 34.1 | 0.70 |

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.

# APPENDIX C2
## FUTURE SCENARIO

# MOVEMENT SUMMARY

## Site: TS338 [Valetta/Findon AM Future Scenario - Minor Upgrade (Site Folder: Valetta/Findon)]

## Network: N101 [AM Future Scenario Minor Upgrade (Network Folder: General)]

Valetta/Findon
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated  Cycle Time = 60 seconds (Site User-Given Cycle Time)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | | | | |
| 1 | L2 | 212 | 0.5 | 212 | 0.5 | 0.400 | 12.2 | LOS B | 2.1 | 15.1 | 0.73 | 0.72 | 0.73 | 47.5 |
| 2 | T1 | 922 | 1.8 | 922 | 1.8 | * 1.272 | 249.0 | LOS F | 63.3 | 449.7 | 0.97 | 2.85 | 4.10 | 6.5 |
| Approach | | 1134 | 1.6 | 1134 | 1.6 | 1.272 | 204.8 | LOS F | 63.3 | 449.7 | 0.92 | 2.45 | 3.47 | 8.9 |
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 8 | T1 | 881 | 0.1 | 881 | 0.1 | 0.722 | 10.5 | LOS B | 11.0 | 76.9 | 0.75 | 0.68 | 0.75 | 48.6 |
| 9 | R2 | 312 | 4.7 | 312 | 4.7 | * 1.187 | 211.9 | LOS F | 13.7 | 100.0 | 1.00 | 2.03 | 3.92 | 8.5 |
| Approach | | 1193 | 1.3 | 1193 | 1.3 | 1.187 | 63.1 | LOS E | 13.7 | 100.0 | 0.81 | 1.03 | 1.58 | 21.8 |
| West: Valetta Rd (W) | | | | | | | | | | | | | | |
| 10 | L2 | 613 | 2.4 | 613 | 2.4 | 0.921 | 43.8 | LOS D | 14.5 | 103.5 | 0.92 | 1.10 | 1.44 | 24.0 |
| 12 | R2 | 438 | 0.2 | 438 | 0.2 | * 1.309 | 315.8 | LOS F | 35.6 | 249.6 | 1.00 | 2.63 | 4.92 | 9.3 |
| Approach | | 1051 | 1.5 | 1051 | 1.5 | 1.309 | 157.2 | LOS F | 35.6 | 249.6 | 0.95 | 1.74 | 2.89 | 12.5 |
| All Vehicles | | 3377 | 1.5 | 3377 | 1.5 | 1.309 | 139.9 | LOS F | 63.3 | 449.7 | 0.89 | 1.73 | 2.62 | 12.7 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

**Pedestrian Movement Performance**

| Mov ID | Crossing | Dem. Flow ped/h | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Ped ped | Dist ] m | Prop. Que | Effective Stop Rate | Travel Time sec | Travel Dist. m | Aver. Speed m/sec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | |
| P1 | Full | 53 | 24.4 | LOS C | 0.1 | 0.1 | 0.90 | 0.90 | 50.7 | 34.3 | 0.68 |
| North: Findon Rd (N) | | | | | | | | | | | |
| P3 | Full | 53 | 24.4 | LOS C | 0.1 | 0.1 | 0.90 | 0.90 | 51.5 | 35.3 | 0.69 |
| West: Valetta Rd (W) | | | | | | | | | | | |
| P4 | Full | 53 | 17.7 | LOS B | 0.1 | 0.1 | 0.77 | 0.77 | 42.8 | 32.7 | 0.76 |
| All Pedestrians | | 158 | 22.1 | LOS C | 0.1 | 0.1 | 0.86 | 0.86 | 48.4 | 34.1 | 0.71 |

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: TS338 [Valetta/Findon PM Future Scenario - Minor Upgrade (Site Folder: Valetta/Findon)]

## Network: N101 [PM Future Scenario Minor Upgrade (Network Folder: General)]

Valetta/Findon
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated  Cycle Time = 60 seconds (Site User-Given Cycle Time)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | | | | |
| 1 | L2 | 375 | 0.3 | 375 | 0.3 | 0.369 | 10.0 | LOS A | 2.8 | 19.9 | 0.54 | 0.71 | 0.54 | 47.8 |
| 2 | T1 | 786 | 0.1 | 786 | 0.1 | * 1.173 | 191.7 | LOS F | 48.1 | 337.4 | 0.99 | 2.53 | 3.59 | 8.2 |
| Approach | | 1161 | 0.2 | 1161 | 0.2 | 1.173 | 133.0 | LOS F | 48.1 | 337.4 | 0.85 | 1.94 | 2.60 | 13.7 |
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 8 | T1 | 1066 | 0.1 | 972 | 0.1 | 0.719 | 7.6 | LOS A | 10.9 | 76.1 | 0.67 | 0.62 | 0.67 | 51.1 |
| 9 | R2 | 480 | 1.3 | 436 | 1.0 | * 1.214 | 235.1 | LOS F | 14.2 | 100.0 | 1.00 | 2.13 | 4.11 | 7.8 |
| Approach | | 1546 | 0.5 | 1408 N1 | 0.4 | 1.214 | 78.1 | LOS E | 14.2 | 100.0 | 0.77 | 1.09 | 1.74 | 18.8 |
| West: Valetta Rd (W) | | | | | | | | | | | | | | |
| 10 | L2 | 307 | 2.1 | 307 | 2.1 | 0.409 | 20.0 | LOS B | 3.9 | 28.1 | 0.75 | 0.77 | 0.75 | 33.7 |
| 12 | R2 | 205 | 0.5 | 205 | 0.5 | * 0.966 | 56.7 | LOS E | 5.4 | 38.1 | 1.00 | 1.29 | 2.06 | 29.1 |
| Approach | | 513 | 1.4 | 513 | 1.4 | 0.966 | 34.7 | LOS C | 5.4 | 38.1 | 0.85 | 0.98 | 1.27 | 30.9 |
| All Vehicles | | 3220 | 0.5 | 3082 N1 | 0.5 | 1.214 | 91.6 | LOS F | 48.1 | 337.4 | 0.81 | 1.39 | 1.99 | 17.5 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)
N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

**Pedestrian Movement Performance**

| Mov ID | Crossing | Dem. Flow ped/h | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Ped ped | Dist ] m | Prop. Que | Effective Stop Rate | Travel Time sec | Travel Dist. m | Aver. Speed m/sec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | |
| P1 | Full | 53 | 24.4 | LOS C | 0.1 | 0.1 | 0.90 | 0.90 | 50.7 | 34.3 | 0.68 |
| North: Findon Rd (N) | | | | | | | | | | | |
| P3 | Full | 53 | 24.4 | LOS C | 0.1 | 0.1 | 0.90 | 0.90 | 51.5 | 35.3 | 0.69 |
| West: Valetta Rd (W) | | | | | | | | | | | |
| P4 | Full | 53 | 16.9 | LOS B | 0.1 | 0.1 | 0.75 | 0.75 | 42.1 | 32.7 | 0.78 |
| All Pedestrians | | 158 | 21.9 | LOS C | 0.1 | 0.1 | 0.85 | 0.85 | 48.1 | 34.1 | 0.71 |

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.

# APPENDIX D
## FINDON ROAD/HARTLEY ROAD SIDRA RESULTS

# APPENDIX D1

## BASE SCENARIO

# MOVEMENT SUMMARY

## Site: 101 [Hartley Rd/Findon Rd - AM Base Scenario (Site Folder: Valetta/Findon)]

## Network: N101 [AM Base Scenario (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | | | | |
| 2 | T1 | 1209 | 3.0 | 954 | 2.8 | 1.006 | 16.1 | LOS C | 9.0 | 65.2 | 1.00 | 0.00 | 1.90 | 45.8 |
| 3 | R2 | 295 | 4.6 | 232 | 4.4 | 0.924 | 53.3 | LOS F | 2.5 | 18.1 | 0.99 | 1.46 | 2.82 | 24.2 |
| Approach | | 1504 | 3.3 | 1186 N1 | 3.1 | 1.006 | 23.4 | NA | 9.0 | 65.2 | 1.00 | 0.29 | 2.08 | 40.4 |
| East: Hartley Rd (E) | | | | | | | | | | | | | | |
| 4 | L2 | 246 | 2.6 | 246 | 2.6 | 1.179 | 195.4 | LOS F | 11.1 | 79.6 | 1.00 | 4.33 | 13.37 | 8.1 |
| 6 | R2 | 11 | 20.0 | 11 | 20.0 | 0.570 | 301.1 | LOS F | 0.6 | 5.2 | 0.99 | 1.03 | 1.15 | 12.0 |
| Approach | | 257 | 3.3 | 257 | 3.3 | 1.179 | 199.7 | LOS F | 11.1 | 79.6 | 1.00 | 4.20 | 12.87 | 8.4 |
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 7 | L2 | 193 | 2.7 | 193 | 2.7 | 0.631 | 6.1 | LOS A | 13.0 | 95.4 | 0.00 | 0.10 | 0.00 | 57.3 |
| 8 | T1 | 987 | 3.7 | 987 | 3.7 | 0.631 | 0.6 | LOS A | 13.0 | 95.4 | 0.00 | 0.10 | 0.00 | 58.2 |
| Approach | | 1180 | 3.6 | 1180 | 3.6 | 0.631 | 1.4 | NA | 13.0 | 95.4 | 0.00 | 0.10 | 0.00 | 57.9 |
| All Vehicles | | 2941 | 3.4 | 2623 N1 | 3.8 | 1.179 | 30.8 | NA | 13.0 | 95.4 | 0.55 | 0.58 | 2.20 | 36.4 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.


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# MOVEMENT SUMMARY

## Site: 101 [Hartley Rd/Findon Rd - PM Base Scenario (Site Folder: Valetta/Findon)]

## Network: N101 [PM Base Scenario (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | | | | |
| 2 | T1 | 985 | 0.9 | 716 | 0.9 | 0.377 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 59.8 |
| 3 | R2 | 141 | 3.7 | 103 | 4.1 | 0.634 | 40.5 | LOS E | 0.8 | 5.9 | 0.96 | 1.07 | 1.31 | 28.2 |
| Approach | | 1126 | 1.2 | 819 N1 | 1.3 | 0.634 | 5.1 | NA | 0.8 | 5.9 | 0.12 | 0.13 | 0.16 | 54.1 |
| East: Hartley Rd (E) | | | | | | | | | | | | | | |
| 4 | L2 | 234 | 2.3 | 234 | 2.3 | 1.610 | 581.1 | LOS F | 24.0 | 171.1 | 1.00 | 5.23 | 18.64 | 3.0 |
| 6 | R2 | 59 | 3.6 | 59 | 3.6 | 2.429 | 1437.6 | LOS F | 11.4 | 82.0 | 1.00 | 1.91 | 5.20 | 2.8 |
| Approach | | 293 | 2.5 | 293 | 2.5 | 2.429 | 753.6 | LOS F | 24.0 | 171.1 | 1.00 | 4.56 | 15.93 | 2.9 |
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 7 | L2 | 64 | 0.0 | 64 | 0.0 | 0.942 | 10.9 | LOS B | 0.0 | 0.0 | 0.00 | 0.03 | 0.00 | 52.3 |
| 8 | T1 | 1277 | 0.9 | 1277 | 0.9 | 0.942 | 6.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.03 | 0.00 | 52.9 |
| Approach | | 1341 | 0.9 | 1341 | 0.9 | 0.942 | 6.2 | NA | 0.0 | 0.0 | 0.00 | 0.03 | 0.00 | 52.8 |
| All Vehicles | | 2760 | 1.2 | 2453 N1 | 1.3 | 2.429 | 95.0 | NA | 24.0 | 171.1 | 0.16 | 0.60 | 1.96 | 19.5 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.


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# APPENDIX D2
## FUTURE SCENARIO

# MOVEMENT SUMMARY

## Site: 101 [Hartley Rd/Findon Rd - AM Future Scenario (Site Folder: Valetta/Findon)]

## Network: N101 [AM Future Scenario Minor Upgrade (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | | | | |
| 2 | T1 | 1225 | 1.5 | 1059 | 1.5 | 0.566 | 0.1 | LOS A | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 59.5 |
| 3 | R2 | 309 | 4.1 | 268 | 4.2 | 0.881 | 38.4 | LOS E | 2.2 | 15.8 | 0.98 | 1.37 | 2.42 | 28.9 |
| Approach | | 1535 | 2.0 | 1327 N1 | 2.0 | 0.881 | 7.8 | NA | 2.2 | 15.8 | 0.20 | 0.28 | 0.49 | 51.2 |
| East: Hartley Rd (E) | | | | | | | | | | | | | | |
| 4 | L2 | 248 | 1.3 | 248 | 1.3 | 1.022 | 77.4 | LOS F | 4.6 | 32.2 | 1.00 | 2.50 | 6.40 | 17.1 |
| 6 | R2 | 11 | 20.0 | 11 | 20.0 | 0.549 | 285.2 | LOS F | 0.6 | 5.0 | 0.99 | 1.03 | 1.14 | 12.5 |
| Approach | | 259 | 2.0 | 259 | 2.0 | 1.022 | 85.8 | LOS F | 4.6 | 32.2 | 1.00 | 2.44 | 6.19 | 16.5 |
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 7 | L2 | 193 | 2.7 | 193 | 2.7 | 0.591 | 6.0 | LOS A | 9.6 | 68.2 | 0.00 | 0.10 | 0.00 | 57.4 |
| 8 | T1 | 943 | 1.0 | 943 | 1.0 | 0.591 | 0.5 | LOS A | 9.6 | 68.2 | 0.00 | 0.10 | 0.00 | 58.3 |
| Approach | | 1136 | 1.3 | 1136 | 1.3 | 0.591 | 1.4 | NA | 9.6 | 68.2 | 0.00 | 0.10 | 0.00 | 58.0 |
| All Vehicles | | 2929 | 1.7 | 2721 N1 | 1.9 | 1.022 | 12.5 | NA | 9.6 | 68.2 | 0.19 | 0.41 | 0.83 | 47.2 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.


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# MOVEMENT SUMMARY

## Site: 101 [Hartley Rd/Findon Rd - PM Future Scenario (Site Folder: Valetta/Findon)]

## Network: N101 [PM Future Scenario Minor Upgrade (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | | | | |
| 2 | T1 | 947 | 0.1 | 848 | 0.1 | 0.443 | 0.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 59.7 |
| 3 | R2 | 145 | 2.2 | 130 | 2.4 | 0.815 | 54.2 | LOS F | 1.3 | 9.0 | 0.98 | 1.17 | 1.72 | 24.0 |
| Approach | | 1093 | 0.4 | 979 N1 | 0.4 | 0.815 | 7.2 | NA | 1.3 | 9.0 | 0.13 | 0.16 | 0.23 | 52.0 |
| East: Hartley Rd (E) | | | | | | | | | | | | | | |
| 4 | L2 | 249 | 1.7 | 249 | 1.7 | 2.561 | 1428.2 | LOS F | 39.8 | 282.9 | 1.00 | 7.48 | 28.18 | 1.3 |
| 6 | R2 | 59 | 3.6 | 59 | 3.6 | 3.226 | 2163.6 | LOS F | 13.6 | 98.0 | 1.00 | 1.81 | 4.77 | 1.9 |
| Approach | | 308 | 2.0 | 308 | 2.0 | 3.226 | 1568.7 | LOS F | 39.8 | 282.9 | 1.00 | 6.39 | 23.70 | 1.4 |
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 7 | L2 | 64 | 1.6 | 64 | 1.6 | 0.694 | 6.2 | LOS A | 14.0 | 98.3 | 0.00 | 0.03 | 0.00 | 57.6 |
| 8 | T1 | 1297 | 0.1 | 1297 | 0.1 | 0.694 | 0.7 | LOS A | 14.0 | 98.3 | 0.00 | 0.03 | 0.00 | 58.8 |
| Approach | | 1361 | 0.2 | 1361 | 0.2 | 0.694 | 1.0 | NA | 14.0 | 98.3 | 0.00 | 0.03 | 0.00 | 58.7 |
| All Vehicles | | 2762 | 0.5 | 2648 N1 | 0.5 | 3.226 | 185.9 | NA | 39.8 | 282.9 | 0.16 | 0.82 | 2.85 | 12.0 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.


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# APPENDIX E

## FINDON ROAD/GRANGE ROAD SIDRA RESULTS

# APPENDIX E1

## BASE SCENARIO

# MOVEMENT SUMMARY

## Site: TS048 [Grange Rd / Findon Rd - AM Base Scenario (Site Folder: Valetta/Findon)]

Base Case AM
Site Category: (None)
Signals - Actuated Isolated  Cycle Time = 120 seconds (Site User-Given Phase Times)

**Vehicle Movement Performance**

| Mov ID | Turn | INPUT VOLUMES [ Total veh/h | HV ] veh/h | DEMAND FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | 95% BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Road (S) | | | | | | | | | | | | | | |
| 1 | L2 | 182 | 10 | 192 | 5.5 | 0.453 | 36.0 | LOS D | 9.2 | 67.2 | 0.83 | 0.85 | 0.83 | 37.9 |
| 2 | T1 | 548 | 21 | 577 | 3.8 | * 1.528 | 470.7 | LOS F | 106.5 | 769.8 | 0.98 | 2.44 | 3.40 | 6.7 |
| 3 | R2 | 326 | 14 | 343 | 4.3 | * 1.175 | 220.4 | LOS F | 43.5 | 315.8 | 1.00 | 1.39 | 2.28 | 12.6 |
| Approach | | 1056 | 45 | 1112 | 4.3 | 1.528 | 318.5 | LOS F | 106.5 | 769.8 | 0.96 | 1.84 | 2.61 | 9.4 |
| East: Grange Road (E) | | | | | | | | | | | | | | |
| 4 | L2 | 184 | 12 | 194 | 6.5 | 0.842 | 59.1 | LOS E | 19.0 | 139.3 | 0.99 | 0.98 | 0.99 | 31.5 |
| 5 | T1 | 543 | 22 | 572 | 4.1 | 0.842 | 45.6 | LOS D | 21.0 | 152.5 | 0.95 | 0.86 | 0.96 | 34.1 |
| 6 | R2 | 173 | 5 | 182 | 2.9 | 0.630 | 35.6 | LOS D | 6.6 | 47.1 | 0.96 | 0.79 | 0.96 | 37.3 |
| Approach | | 900 | 39 | 947 | 4.3 | 0.842 | 46.5 | LOS D | 21.0 | 152.5 | 0.96 | 0.87 | 0.96 | 34.1 |
| North: Findon Road (N) | | | | | | | | | | | | | | |
| 7 | L2 | 139 | 4 | 146 | 2.9 | 0.571 | 54.9 | LOS D | 12.9 | 92.7 | 0.91 | 0.93 | 0.91 | 32.1 |
| 8 | T1 | 550 | 20 | 579 | 3.6 | 1.417 | 351.7 | LOS F | 86.4 | 623.8 | 0.98 | 2.08 | 2.85 | 8.6 |
| 9 | R2 | 257 | 12 | 271 | 4.7 | 0.941 | 65.9 | LOS E | 16.9 | 123.4 | 1.00 | 0.90 | 1.14 | 28.5 |
| Approach | | 946 | 36 | 996 | 3.8 | 1.417 | 230.4 | LOS F | 86.4 | 623.8 | 0.98 | 1.59 | 2.10 | 12.3 |
| West: Grange Road (W) | | | | | | | | | | | | | | |
| 10 | L2 | 270 | 8 | 284 | 3.0 | 1.237 | 242.8 | LOS F | 88.1 | 634.0 | 1.00 | 1.54 | 2.57 | 10.7 |
| 11 | T1 | 978 | 34 | 1029 | 3.5 | * 1.237 | 252.8 | LOS F | 89.8 | 647.1 | 1.00 | 1.87 | 2.57 | 10.9 |
| 12 | R2 | 324 | 7 | 341 | 2.2 | * 0.976 | 52.6 | LOS D | 17.6 | 125.5 | 1.00 | 0.96 | 1.26 | 31.8 |
| Approach | | 1572 | 49 | 1655 | 3.1 | 1.237 | 209.8 | LOS F | 89.8 | 647.1 | 1.00 | 1.62 | 2.30 | 12.6 |
| All Vehicles | | 4474 | 169 | 4709 | 3.8 | 1.528 | 207.0 | LOS F | 106.5 | 769.8 | 0.98 | 1.52 | 2.06 | 13.1 |

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

**Pedestrian Movement Performance**

| Mov ID | Crossing | Input Vol. ped/h | Dem. Flow ped/h | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Ped ped | Dist ] m | Prop. Que | Effective Stop Rate | Travel Time sec | Travel Dist. m | Aver. Speed m/sec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Road (S) | | | | | | | | | | | | |
| P1 | Full | 50 | 53 | 40.1 | LOS E | 0.1 | 0.1 | 0.82 | 0.82 | 69.7 | 38.5 | 0.55 |
| East: Grange Road (E) | | | | | | | | | | | | |
| P2 | Full | 50 | 53 | 48.7 | LOS E | 0.2 | 0.2 | 0.90 | 0.90 | 77.6 | 37.6 | 0.48 |
| North: Findon Road (N) | | | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P3 | Full | 50 | 53 | 40.1 | LOS E | 0.1 | 0.1 | 0.82 | 0.82 | 69.9 | 38.7 | 0.55 |
| West: Grange Road (W) | | | | | | | | | | | | |
| P4 | Full | 50 | 53 | 49.6 | LOS E | 0.2 | 0.2 | 0.91 | 0.91 | 79.0 | 38.2 | 0.48 |
| All Pedestrians | | 200 | 211 | 44.6 | LOS E | 0.2 | 0.2 | 0.86 | 0.86 | 74.1 | 38.3 | 0.52 |

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: TS048 [Grange Rd / Findon Rd - PM Base Scenario (Site Folder: Valetta/Findon)]

Base Case PM
Site Category: (None)
Signals - Actuated Isolated  Cycle Time = 120 seconds (Site User-Given Phase Times)

**Vehicle Movement Performance**

| Mov ID | Turn | INPUT VOLUMES [ Total veh/h | HV ] veh/h | DEMAND FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | 95% BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Road (S) | | | | | | | | | | | | | | |
| 1 | L2 | 288 | 4 | 303 | 1.4 | 0.438 | 35.4 | LOS D | 12.6 | 89.5 | 0.76 | 0.87 | 0.76 | 37.8 |
| 2 | T1 | 509 | 4 | 536 | 0.8 | 1.478 | 460.2 | LOS F | 101.5 | 715.3 | 0.99 | 2.46 | 3.43 | 6.8 |
| 3 | R2 | 203 | 3 | 214 | 1.5 | 0.746 | 60.8 | LOS E | 12.3 | 86.9 | 0.98 | 0.82 | 0.98 | 29.7 |
| Approach | | 1000 | 11 | 1053 | 1.1 | 1.478 | 256.8 | LOS F | 101.5 | 715.3 | 0.92 | 1.67 | 2.16 | 11.2 |
| East: Grange Road (E) | | | | | | | | | | | | | | |
| 4 | L2 | 285 | 4 | 300 | 1.4 | 1.300 | 297.5 | LOS F | 107.9 | 765.2 | 1.00 | 1.60 | 2.85 | 9.2 |
| 5 | T1 | 980 | 15 | 1032 | 1.5 | * 1.300 | 306.6 | LOS F | 107.9 | 765.2 | 1.00 | 1.96 | 2.86 | 9.3 |
| 6 | R2 | 314 | 1 | 331 | 0.3 | * 0.934 | 46.3 | LOS D | 15.6 | 109.3 | 1.00 | 0.92 | 1.12 | 33.7 |
| Approach | | 1579 | 20 | 1662 | 1.3 | 1.300 | 253.2 | LOS F | 107.9 | 765.2 | 1.00 | 1.69 | 2.51 | 10.8 |
| North: Findon Road (N) | | | | | | | | | | | | | | |
| 7 | L2 | 122 | 3 | 128 | 2.5 | 0.663 | 55.9 | LOS E | 14.0 | 99.1 | 0.94 | 0.91 | 0.94 | 32.0 |
| 8 | T1 | 679 | 5 | 715 | 0.7 | * 1.644 | 496.7 | LOS F | 124.8 | 878.9 | 0.99 | 2.40 | 3.35 | 6.4 |
| 9 | R2 | 332 | 8 | 349 | 2.4 | * 1.319 | 343.9 | LOS F | 57.0 | 407.3 | 1.00 | 1.68 | 2.93 | 8.7 |
| Approach | | 1133 | 16 | 1193 | 1.4 | 1.644 | 404.4 | LOS F | 124.8 | 878.9 | 0.99 | 2.03 | 2.97 | 7.6 |
| West: Grange Road (W) | | | | | | | | | | | | | | |
| 10 | L2 | 191 | 6 | 201 | 3.1 | 0.873 | 58.3 | LOS E | 24.3 | 173.1 | 1.00 | 0.99 | 1.03 | 31.8 |
| 11 | T1 | 676 | 11 | 712 | 1.6 | 0.873 | 47.2 | LOS D | 26.2 | 186.3 | 0.98 | 0.91 | 1.01 | 33.6 |
| 12 | R2 | 305 | 0 | 321 | 0.0 | 0.976 | 61.4 | LOS E | 18.2 | 127.5 | 1.00 | 0.98 | 1.24 | 29.6 |
| Approach | | 1172 | 17 | 1234 | 1.5 | 0.976 | 52.7 | LOS D | 26.2 | 186.3 | 0.99 | 0.94 | 1.07 | 32.2 |
| All Vehicles | | 4884 | 64 | 5141 | 1.3 | 1.644 | 240.9 | LOS F | 124.8 | 878.9 | 0.98 | 1.59 | 2.20 | 11.6 |

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

**Pedestrian Movement Performance**

| Mov ID | Crossing | Input Vol. ped/h | Dem. Flow ped/h | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Ped ped | Dist ] m | Prop. Que | Effective Stop Rate | Travel Time sec | Travel Dist. m | Aver. Speed m/sec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Road (S) | | | | | | | | | | | | |
| P1 | Full | 50 | 53 | 39.3 | LOS D | 0.1 | 0.1 | 0.81 | 0.81 | 68.9 | 38.5 | 0.56 |
| East: Grange Road (E) | | | | | | | | | | | | |
| P2 | Full | 50 | 53 | 48.7 | LOS E | 0.2 | 0.2 | 0.90 | 0.90 | 77.6 | 37.6 | 0.48 |
| North: Findon Road (N) | | | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P3 | Full | 50 | 53 | 39.3 | LOS D | 0.1 | 0.1 | 0.81 | 0.81 | 69.1 | 38.7 | 0.56 |
| West: Grange Road (W) | | | | | | | | | | | | |
| P4 | Full | 50 | 53 | 49.6 | LOS E | 0.2 | 0.2 | 0.91 | 0.91 | 79.0 | 38.2 | 0.48 |
| All Pedestrians | | 200 | 211 | 44.2 | LOS E | 0.2 | 0.2 | 0.86 | 0.86 | 73.6 | 38.3 | 0.52 |

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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# APPENDIX E2
## FUTURE SCENARIO

# APPENDIX F

## PRIMARY FINDON ROAD ACCESS POINT SIDRA RESULTS

# MOVEMENT SUMMARY

## Site: 101 [Site Access/Findon Rd - Stage 1 - AM Future Scenario (Site Folder: Findon Rd Main Access )]

## Network: N101 [Site Access AM Future Scenario (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | | | | |
| 1 | L2 | 7 | 14.3 | 7 | 14.3 | 0.609 | 6.0 | LOS A | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 57.1 |
| 2 | T1 | 1153 | 3.6 | 1153 | 3.6 | 0.609 | 0.3 | LOS A | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 59.3 |
| Approach | | 1160 | 3.6 | 1160 | 3.6 | 0.609 | 0.4 | NA | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 59.3 |
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 9 | R2 | 31 | 3.4 | 31 | 3.4 | 0.106 | 17.9 | LOS C | 0.1 | 1.0 | 0.85 | 0.94 | 0.85 | 41.5 |
| Approach | | 31 | 3.4 | 31 | 3.4 | 0.106 | 17.9 | NA | 0.1 | 1.0 | 0.85 | 0.94 | 0.85 | 41.5 |
| West: Site Access (W) | | | | | | | | | | | | | | |
| 10 | L2 | 28 | 3.7 | 28 | 3.7 | 0.341 | 21.1 | LOS C | 0.5 | 3.3 | 0.89 | 0.99 | 1.06 | 38.4 |
| 11 | T1 | 46 | 2.3 | 46 | 2.3 | 0.341 | 24.8 | LOS C | 0.5 | 3.3 | 0.89 | 0.99 | 1.06 | 34.1 |
| Approach | | 75 | 2.8 | 75 | 2.8 | 0.341 | 23.4 | LOS C | 0.5 | 3.3 | 0.89 | 0.99 | 1.06 | 36.0 |
| All Vehicles | | 1265 | 3.6 | 1265 | 3.6 | 0.609 | 2.1 | NA | 0.5 | 3.3 | 0.07 | 0.08 | 0.08 | 57.0 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
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 [Site Access/Findon Rd - Stage 2 - AM Future Scenario (Site Folder: Findon Rd Main Access )]

## Network: N101 [Site Access AM Future Scenario (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 8 | T1 | 1381 | 2.1 | 1381 | 2.1 | 0.718 | 0.3 | LOS A | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 59.0 |
| Approach | | 1381 | 2.1 | 1381 | 2.1 | 0.718 | 0.3 | NA | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 59.0 |
| West: Median | | | | | | | | | | | | | | |
| 12 | R2 | 46 | 2.3 | 46 | 2.3 | 0.306 | 26.2 | LOS D | 0.3 | 2.4 | 0.92 | 0.99 | 1.04 | 31.0 |
| Approach | | 46 | 2.3 | 46 | 2.3 | 0.306 | 26.2 | LOS D | 0.3 | 2.4 | 0.92 | 0.99 | 1.04 | 31.0 |
| All Vehicles | | 1427 | 2.1 | 1427 | 2.1 | 0.718 | 1.1 | NA | 0.3 | 2.4 | 0.03 | 0.03 | 0.03 | 57.8 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
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 [Site Access/Findon Rd - Stage 1 - PM Future Scenario (Site Folder: Findon Rd Main Access )]

## Network: N101 [Site Access PM Future Scenario (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South: Findon Rd (S) | | | | | | | | | | | | | | |
| 1 | L2 | 16 | 6.7 | 16 | 6.7 | 0.657 | 5.9 | LOS A | 0.0 | 0.0 | 0.00 | 0.01 | 0.00 | 57.3 |
| 2 | T1 | 1257 | 0.8 | 1257 | 0.8 | 0.657 | 0.4 | LOS A | 0.0 | 0.0 | 0.00 | 0.01 | 0.00 | 59.2 |
| Approach | | 1273 | 0.8 | 1273 | 0.8 | 0.657 | 0.5 | NA | 0.0 | 0.0 | 0.00 | 0.01 | 0.00 | 59.1 |
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 9 | R2 | 63 | 1.7 | 63 | 1.7 | 0.286 | 24.6 | LOS C | 0.4 | 2.8 | 0.91 | 0.99 | 1.03 | 37.6 |
| Approach | | 63 | 1.7 | 63 | 1.7 | 0.286 | 24.6 | NA | 0.4 | 2.8 | 0.91 | 0.99 | 1.03 | 37.6 |
| West: Site Access (W) | | | | | | | | | | | | | | |
| 10 | L2 | 12 | 9.1 | 12 | 9.1 | 0.210 | 24.9 | LOS C | 0.2 | 1.8 | 0.91 | 0.97 | 0.96 | 35.4 |
| 11 | T1 | 20 | 5.3 | 20 | 5.3 | 0.210 | 30.9 | LOS D | 0.2 | 1.8 | 0.91 | 0.97 | 0.96 | 31.1 |
| Approach | | 32 | 6.7 | 32 | 6.7 | 0.210 | 28.7 | LOS D | 0.2 | 1.8 | 0.91 | 0.97 | 0.96 | 32.9 |
| All Vehicles | | 1367 | 1.0 | 1367 | 1.0 | 0.657 | 2.2 | NA | 0.4 | 2.8 | 0.06 | 0.08 | 0.07 | 56.8 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
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 [Site Access/Findon Rd - Stage 2 - PM Future Scenario (Site Folder: Findon Rd Main Access )]

## Network: N101 [Site Access PM Future Scenario (Network Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

**Vehicle Movement Performance**

| Mov ID | Turn | DEMAND FLOWS [ Total veh/h | HV ] % | ARRIVAL FLOWS [ Total veh/h | HV ] % | Deg. Satn v/c | Aver. Delay sec | Level of Service | AVERAGE BACK OF QUEUE [ Veh. veh | Dist ] m | Prop. Que | Effective Stop Rate | Aver. No. Cycles | Aver. Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North: Findon Rd (N) | | | | | | | | | | | | | | |
| 8 | T1 | 1279 | 1.2 | 1279 | 1.2 | 0.661 | 0.2 | LOS A | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 59.2 |
| Approach | | 1279 | 1.2 | 1279 | 1.2 | 0.661 | 0.2 | NA | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 59.2 |
| West: Median | | | | | | | | | | | | | | |
| 12 | R2 | 63 | 3.3 | 63 | 3.3 | 0.295 | 18.9 | LOS C | 0.3 | 2.5 | 0.89 | 0.98 | 1.01 | 35.3 |
| Approach | | 63 | 3.3 | 63 | 3.3 | 0.295 | 18.9 | LOS C | 0.3 | 2.5 | 0.89 | 0.98 | 1.01 | 35.3 |
| All Vehicles | | 1342 | 1.3 | 1342 | 1.3 | 0.661 | 1.1 | NA | 0.3 | 2.5 | 0.04 | 0.05 | 0.05 | 57.9 |

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.