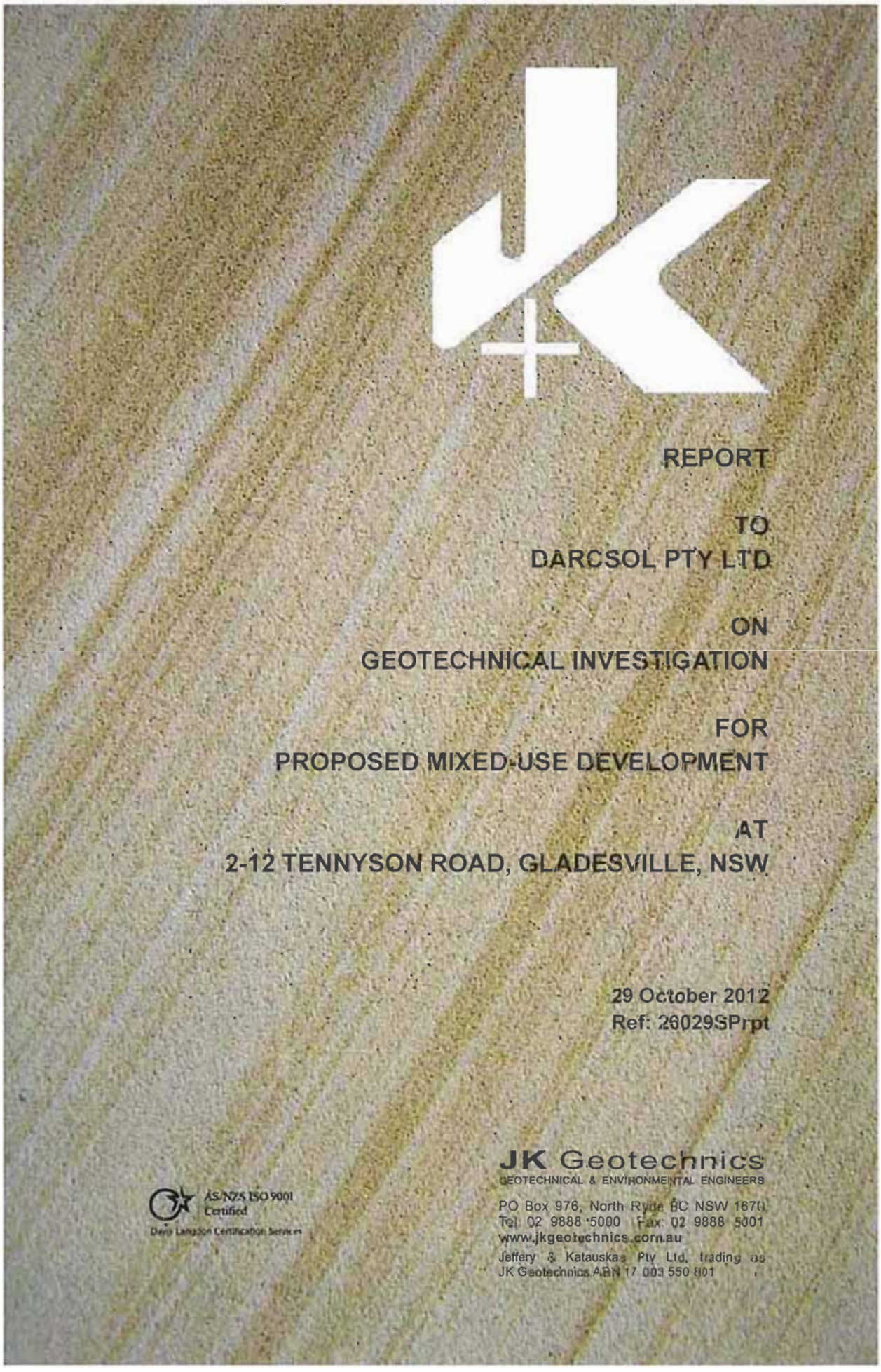
Appendix 9 – Geotechnical Assessment

MECONE


REPORT
TO
DARCSOL PTY LTD
ON
GEOTECHNICAL INVESTIGATION
FOR
PROPOSED MIXED-USE DEVELOPMENT
AT
2-12 TENNYSON ROAD, GLADESVILLE, NSW
29 October 2012
Ref: 26029SPrpt
JK Geotechnics
GEOTECHNICAL & ENVIRONMENTAL ENGINEERS
PO Box 976, North Ryde BC NSW 1670
Tel: 02 9888 5000 Fax: 02 9888 5001
www.jkgeotechnics.com.au
Jeffery & Katauskas Pty Ltd, trading as
JK Geotechnics ABN 17 003 550 801
AS/NZS ISO 9001
Certified
Det Norske Veritas Certification Services

Date: 29 October 2012
Report No: 26029Prpt
Revision No: 0

Report prepared by:

Peter Wright
Senior Associate

Report reviewed by:

Paul Stubbs
Principal

For and on behalf of
JK GEOTECHNICS
PO Box 976
NORTH RYDE BC NSW 1670

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1 INTRODUCTION

This report presents the results of a geotechnical investigation for a proposed mixed use development at 2-12 Tennyson Road, Gladesville, NSW. The investigation was commissioned by Darcsol Pty LTD by return of a signed 'Acceptance of Proposal' form dated 12 September 2012. The investigation was completed in accordance with our proposal P35601Prev1 dated 3 September 2012.

The site is the location of a previous quarry pit, with previous excavations extending to depths of the order of 15m below the surrounding ground levels. While the final development details were not known at the time of reporting, we understand the proposed development will comprise two basement car parking levels with a lower floor level of approximately 30.6-31.2m AHD which will require excavation to depths of about 3m below the floor of the old quarry. There will then be commercial and residential levels constructed in towers above this basement. It is likely that the development will incorporate trimming the existing quarry faces back to the boundary, with long term stabilisation measures required.

The purpose of the investigation was to obtain geotechnical information on the subsurface conditions, and to use this as a basis for comments and recommendations on excavation, retention, footing design and hydrogeological considerations.

Preliminary information was forwarded to Grimshaw Architects by email dated 18 October 2012, and this report confirms and amplifies the preliminary information.

Jeffery and Katauskas Pty Ltd have previously completed reports at this site in 1987 (Reference 4967JS) to inspect the faces following a rock fall, and in 1990 (Reference 7979XS) where comprehensive mapping of the quarry faces was undertaken. The sections of the faces created at that time are attached in Appendix A, and the locations of the sections are provided in Figure 1.

An assessment of the potential contamination of the site soils was undertaken by Environmental Investigation Services (EIS) in conjunction with this report, and the results are provided in their report Reference E26029KPrpt.

2 INVESTIGATION PROCEDURE

The fieldwork for the investigation comprised the auger drilling of 7 boreholes to depths between 0.73m and 4.24m below the existing ground level using our truck mounted JK500 and track mounted JK305 drilling rigs and spiral auger techniques. The boreholes were then extended to depths between 6.85m and 10.19m using NMLC diamond coring techniques and water flush.

The borehole locations, as shown on the attached Figure 1, were set out by taped measurements from the existing buildings. The supplied survey plan by Stutchbury Jaques Pty Ltd (Ref: 5969/05, dated 19/10/05) forms the basis for Figure 1. Surface reduced levels (RL's) were interpolated between spot heights and contour lines on this survey plan and should therefore be considered approximate only.

The fieldwork was completed in the full time presence of a geotechnical engineer who set out the boreholes, nominated the sampling and testing locations and prepared the borehole logs. The borehole logs are attached to this report together with a glossary of terms and symbols used on the logs. The strength of the soil was assessed based on the results of Standard Penetration Test (SPT) 'N' values augmented by hand penetrometer readings on cohesive samples recovered in the SPT split spoon sampler. The strength of the rock in the augered portions of the boreholes was assessed by observation of the resistance to augering with a tungsten carbide drilling bit, and from examination of the recovered rock chips; the assessment of rock strength in such a way is subjective and variations of one strength order should not be unexpected. The strength the bedrock in the cored portions of the boreholes was assessed by inspection of the recovered core and correlation with the results of point load strength index tests completed on the core in the laboratory.

A Senior Engineering Geologist also visited the site to map the jointing observed in the quarry faces. The results of the mapping are provided in Section 3.1.

Selected samples were returned to a NATA registered laboratory, Soil Test Services Pty Ltd (STS), for moisture Atterberg limit, linear shrinkage, standard compaction and soaked CBR tests. The results of these tests are summarised in the attached Tables A and B. Additional samples were delivered to Envirolab Services Pty Ltd, a NATA registered analytical laboratory, for testing for soil pH, sulphate content and chloride content; the results of these tests are provided in the attached Envirolab Services Certificates of Analyses.

The core of the bedrock was also returned to STS where it was colour photographed, and where point load strength index tests were completed. Copies of the photographs are provided with the borehole logs, while the strength test results are summarised in Table C.

For further detail on the investigation procedures used reference should be made to the attached Report Explanation Notes.

3 RESULTS OF INVESTIGATION

3.1 Site Description

The site is located close to the top of a south facing hillside which slopes towards the Parramatta River. The area about the site generally slopes down to the south-west at about 5°.

The site itself is a former quarry which has been cut into the hillside. Shale bedrock is exposed in rock faces up to approximately 15m high along the northern and eastern edges of the site. The condition of these rock faces is described in more detail below. The western excavation face is concealed by an existing office building and vehicle access ramps. The lower southern face comprises a vegetated batter slope of 20° to 25°.

At the time of the fieldwork, the majority of the site was relatively level and was occupied by a single storey metal clad warehouse structure and associated asphaltic concrete driveway and hardstand areas. The north-western end of the site sloped down at between approximately 4° and 10° from the Tennyson Road site boundary. A two storey rectangular, cement rendered brick office building was located on this sloping portion of the site. Both the warehouse and office buildings appeared in good external condition based on a cursory inspection from the exterior. The asphaltic concrete driveway and hardstand areas appeared in poor condition with numerous repaired and delaminated areas observed.

Tennyson Road passes along the north-western site boundary and slopes down to the south-west at about 5°. There are existing hardstand areas with commercial building beyond to the north, east and south of the site. There are also numerous medium to tall trees around the toe and crest of the quarry faces.

Quarry Face Description

From assessment of the shale cuts surrounding the site both from our previous works in 1990 and from our current inspection, there are six major joint sets and three faults as detailed below.

Description	Dip	Dip Direction
Joint Set A	80° - 90°	290° - 300° / 110° - 120°
Joint Set B	80° - 85°	230° - 250°
Joint Set C	40° - 70°	025° - 040°
Joint Set D	85° - 90°	160°
Joint Set E	65°	140° - 160°
Joint Set G	35° - 50°	100° - 120°
Fault Plane F1	40° - 45 °	210° - 220°
Fault Plane F2	45°	285°
Fault Plane F3 (similar to JS C)	35° - 45°	020° - 030°

During the recent inspection of the face, we were unable to detect the previously mapped Joint Set G, as the two areas where it was picked up originally were very overgrown. However, as shown in the original Section 4 (7676XS, Fig 3), this is most likely at a similar dip/gradient to the scree slope locally.

The shale in the cut faces appeared to be predominantly of medium strength, and the faces ranged in height between 4m and 16m. During the recent inspection, there had been further degradation/spalling of the face since 1990 with a near continual scree pile of shale at the base of the cliff now being present. Less spalling was noted along the north-western portion of cliff, however seepage through bedding/jointing was noted in this area.

From the car park, up to the base of the cliff are old scree deposits or fill from clearing the lower portion of the site prior to construction. These slopes ranged in gradient between 25° - 50°, and up to 10 to 12m wide in places.

The 'large slide debris' noted in the 1987 report appeared to have been removed from site.

Approximately 50m section of the north-eastern shale cut/cliff face has been formed by a continuous joint belonging to Joint Set B, with the exposed portion of the joint being up to about 15m high. This joint was intersected by many joints belonging to Joint Set A along the majority of the face. At the south-eastern end of this exposed portion of joint, the cut face curves and the rock in front of the joint has separated from joint by about 100mm to 120mm.

Overhangs of the cliff face were up to 3m, and typically at the top of the cliff faces near the soil/rock interface. With undercutting of the cliff face quite prevalent to the eastern and north-western faces where undercuts were mostly 1m to 1.5m deep.

At north-western corner of the quarry there was a large detached block 4m × 6m about mid-height of the face, with trees growing behind the block.

3.2 Subsurface Conditions

In general terms, the investigation has disclosed a relatively thin layer of residual soil at the crest of the cut faces, with fractured shale forming the majority of the previous quarry cuts. The conditions encountered in the boreholes drilled in the floor of the quarry comprise concrete and asphaltic concrete pavements over a thin layer of fill which overlies high and very high strength sandstone bedrock; the bedrock also contains minor bands of interbedded sandstone and shale. The exception was in BH7 which was drilled in an elevated vehicle access area where deeper fill was encountered.

Some of the characteristic features of the strata encountered are described below. For further details of the conditions encountered at each location, reference should be made to the borehole logs. A graphical summary of the strata encountered in the boreholes is presented in Figure 2.

Pavements

The boreholes were drilled through pavements comprising up to 100mm of concrete, or 40mm to 60mm of asphaltic concrete. No crushed igneous rock roadbase was encountered in these pavements. The exception was BH3 where there was no pavement.

Fill

The pavements were overlying fill comprising sandy gravel (comprising crushed shale gravel) and gravelly silty clay of generally medium and high plasticity. The fill extended to depths ranging between 0.3m and 1.1m, with the exception of BH7 which was drilled in an elevated area and contained fill to a depth of 3.5m. The fill assessed as being moderately to well compacted.

Bedrock

The shale bedrock in the excavation faces is assessed as being moderately weathered and of medium strength, though the faces themselves are relatively fractured. The bedrock below the floor of the quarry comprises fine and medium grained sandstone, generally slightly weathered or fresh, with strengths ranging from high to very high, with sometimes a thin capping of low to medium strength rock. The sandstone contains bands which are interbedded with shale. There were very few defects encountered in the cored boreholes, and these were mostly near horizontal

bedding partings and crushed seams; there were also several joints with inclinations of between 45° and subvertical, and these were within the upper 3m of the boreholes.

Laboratory Test Results

The moisture content test results correlated well with the field logging assessments of rock strength, and the Atterberg limits tests showed the samples tested to be of low to medium plasticity, correlating with a low to moderate for shrink-swell movements with changes in moisture content. The soaked CBR values were 3% and 8%, indicating the subgrade is fair.

The samples of the weathered shale tested were found to be slightly alkaline with pH ranging from 8.1 to 9.2, and very low sulphate and chloride contents with all results less than 150mg/kg.

The point load strength tests completed on the recovered core showed the sandstone and shale to have strengths generally of high and very high strength, with correlated UCS ranging between 12MPa and greater than 112MPa, with an average value of 50MPa.

4 COMMENTS AND RECOMMENDATIONS

4.1 Project Overview

The majority of this project will be relatively standard in terms of the geotechnical issues. The excavation for the floor of the quarry will require the use of large equipment and maybe require sawing due to the strength of the rock likely to be encountered, and some stabilisation of new rock cuts such as by rock bolts will be required to stabilise wedges formed by the inclined joints encountered in the upper portions of the boreholes. We expect conventional pad and strip footings will be suitable due to the very high quality of the rock encountered.

By far the most difficult part of this project will be the safe excavation and support of the shale faces where it is proposed to excavate the site back to the boundaries. These activities will require careful consideration during the design process, and possibly significant geotechnical review during the construction phase.

4.2 Excavation of Quarry Faces

The excavation of the existing quarry faces back to the boundary will extend through the upper residual soils, and through shale bedrock which is likely to be of medium strength. This is likely to require moderate ripping with tracked excavators of say 30 tonne size. However gaining access

to the excavation area will be difficult and will require the placement of a large fill platform against the existing cut faces.

It will also be difficult to undertake this excavation in a safe manner as it will be necessary to protect the existing properties, infrastructure and buildings beyond the site boundary. The shale faces currently expose relatively major continuous joints which are inclined, and if these daylight in the final excavation face, they could collapse into the excavation unless properly restrained. Some concepts for appropriate restraint are provided below, though it is likely that there will be additional information required by the structural engineers when the general concept of the shoring has been decided.

Anchored Shotcrete Facing Approach

We expect the preferred way to undertake this excavation and shoring would be to progressively excavate and install an anchored reinforced shotcrete facing to the batters. The shotcrete facing could then be used both in the short term and long term, provided the reinforcement is designed to suit both cases. In the short term, the shotcrete would need to be designed to span between the anchor locations, while in the long term, it would need to span between the floor slabs and/or shear walls in the adjacent building.

We expect that it would be advantageous to use large excavator mounted rock grinders to grind the shale face following the bulk excavation of each lift to provide a shotcrete facing of relatively uniform thickness and geometry.

The soils and weathered shale to low strength should be excavated in vertical lifts not exceeding 1.5m, with anchors in the upper 2.5m (but in any case to the bottom of any low strength shale) not being spaced more than 1.5m vertical height apart. Where the excavation is in shale of medium strength or greater, it would be suitable to undertake the excavation in 2.5m vertical lifts with anchors at no more than 2.5m vertical centres.

The temporary anchors would extend through to the outside face of the shotcrete to allow them to be de-stressed following the bracing of the walls by the structures. These anchors should have a bond zone entirely behind a line drawn upward at 1V in 1H from the toe of the proposed excavation, and the bond length may provisionally be designed for an allowable bond of 150kPa in shale of at least low strength and 250kPa in shale of at least medium strength. All anchors should then be proof loaded to at least 130% of their working load, and 50% of anchors subjected to lift off tests approximately three days after lock-off to confirm the anchors are holding their load.

If any of these anchors show a load loss of more than 10% from their lock-off load, then all anchors should be lifted-off. It will be necessary to obtain permission from the owners of the adjacent properties prior to the installation of anchors beyond the boundary. It is normal practice for anchors to be a design and construct package so that the risk of anchor failure is balanced against the cost of drilling and replacing any anchors that fail load tests.

Soldier Pile Wall

An alternative excavation support system would be to install soldier piles around the site perimeter prior to the commencement of excavation. These would then be restrained with multi-level temporary anchors installed progressively with the excavation. Following approximately each 1.0m of vertical excavation in the residual soils and shale of extremely and very low strength, and each 2.5m of vertical excavation in the shale of low strength or stronger, reinforced shotcrete panels should be sprayed between the soldier piles to prevent localised collapse resulting from small scale joints and wedges.

The installation of the piles themselves would be problematic as they will either require the use of a piling rig in the adjacent properties which is unlikely to be possible, or the installation of a high working platform to provide safe access to the work site. The piling rig would also need to be large to be able to reach the required founding depth, and drill through the shale which is expected to be of medium or higher strength. It is also likely there would be some degree of wander in such long piles, and so these may cut into the proposed basement area. The likelihood of wander may be able to be reduced by using large diameter down-hole hammers for the piling, though we note their use is not common at this point in time.

Design Pressures

If no other investigation work is done, the shoring should be designed for a semi-trapezoidal lateral earth pressure with a maximum magnitude of 7H kPa (where H is the depth of excavation in metres) applying over the lower 75% of the face, tapering to zero at the crest. .

These pressures are relatively conservative, and it is likely that they could be reduced following further detailed investigation of the perimeter conditions to prove that any jointing is relatively step (about 75° from the horizontal) rather than being closer to 55° which causes the highest shoring loads. It would then be likely to be able to reduce the pressures to say the same pressure distribution but with a maximum pressure of about 5H. Such investigation would likely be completed following removal of vegetation and cleaning debris from the face, and involve inspecting the faces from a boom lift, combined with drilling some inclined cored boreholes from

the toe of the existing cut to look for defects which dip at around 55° which may not be evident in the face. The investigation could not be undertaken with a fixed scope as the program would need to be amended based upon the results obtained during the fieldwork.

The above pressures are based upon the rock mass stabilisation only, and appropriate surcharge loads and hydrostatic pressures should also be taken into account in the design.

Drainage

Irrespective of the retention system used, drainage must be installed behind the facing to allow the permanent dissipation of the pore water pressures.

4.3 Excavation Below Quarry Floor

It appears that it will be necessary to excavate to a depth of about 3m below the floor of the quarry to achieve the required basement levels. This excavation will be through the pavements and fill, and into the sandstone bedrock of up to very high strength.

The removal of the concrete pavements will require the use of rock hammer attachments to hydraulic excavators for effective excavation. The fill below would then be readily excavated using buckets on tracked excavators.

Some of the upper rock in the boreholes has strength ranging from extremely low to low to medium strength. Any sandstone to low strength and shale to medium is likely to be rippable using ripping tynes on large (say 30 tonne or larger) tracked excavators.

Higher strength rock will require the use of rock breaker attachments to the excavators, and even then productivity may be very low due to the high and very high strength of the rock. It may be necessary to saw cut the sandstone and break blocks of rock from the excavation. The use of an impact ripper on a heavy (D10 or D11 sized) tractor should also be considered.

There is the potential for inclined defects to form wedges of rock in the excavation faces which could be unstable. Therefore the excavation faces should be inspected following each 1.5m vertical lift of excavation to assess the presence of any such features, If these features are present, it is likely that stabilisation will be required, such as by the installation of rock bolts.

Provided the sandstone can be appropriately crushed, it is likely to produce an ideal engineered fill material.

If there is any rock of less than low strength exposed at the perimeter of the excavation, this should be supported by a reinforced shotcrete panel, which could be laterally restrained by rock bolts in the short term, and by bracing from the structure in the long term.

4.4 Footing Design

It is likely that sandstone and shale of high and very high strength will be encountered at the bulk excavation levels, and so pad and strip footings would be considered to be feasible. Footings founded with an embedment of at least 0.5m below the surrounding ground level in the shale or sandstone of high or very high strength may be designed for an allowable bearing pressure of 3,500kPa based upon visual inspection of each footing excavation by a geotechnical engineer. Undertaking spoon testing in one in three footing excavations and visually inspecting the remainder would allow the adoption of an allowable bearing pressure of 6,000kPa.

It may in fat be feasible to use even higher bearing pressures, possibly to 10,000 kPa, though this will require significant additional diamond coring, and we do not expect that such pressures would be advantageous for the proposed development.

4.5 Subgrade Preparation

It is expected that the subgrade to the proposed lower basement floor slabs will comprise high and very high strength sandstone and shale bedrock. Therefore, unless there is significant excavation below the proposed floor slabs such as for the installation of services etc, detailed preparation of the subgrade is unlikely to be required. We recommend the placement of a crushed rock separation layer between the rock and the concrete floor slabs to prevent curling of slabs associated with concrete shrinkage where the underside of the slabs has a rough contact with the rock and to permit drainage.

Where such excavation of the rock occurs, or if pavements are deleted such that the existing soils form the subgrade, the pavements should be provisionally designed for a soaked CBR value of 3.0%. This may well be a conservative, and should be confirmed by geotechnical inspection and possibly additional testing when final development details are known.

When details of the proposed development have been finalised, further advice should be obtained with regard to subgrade preparation, as it may be necessary to excavate some of the fill soils from site and rework it as engineered fill placed and compacted in layers.

4.6 Hydrogeological Considerations

Seepage is currently occurring at least through the north-western portion of the quarry face. Also, the total excavation depth will be relatively deep, and it will be necessary to incorporate drainage into the proposed retaining walls and below the lower basement floor slab. This could comprise vertical lengths of strip drain installed behind retaining wall elements, combined with a subsoil drain around the perimeter of the lower basement level, and also either a gravel drainage blanket or a grid of subsoil drains below the proposed lower basement floor slabs.

4.7 Soil Aggression

The weathered shale is alkaline, and has very low sulphate and chloride contents. These conditions must be taken into account in the design of metal or reinforced concrete elements in contact with the shale.

5 GENERAL COMMENTS

The recommendations presented in this report include specific issues to be addressed during the construction phase of the project. As an example, geotechnical inspection of the footing excavations prior to pouring, etc. In the event that any of the construction phase recommendations presented in this report are not implemented, the general recommendations may become inapplicable and JK Geotechnics accept no responsibility whatsoever for the performance of the structure where recommendations are not implemented in full and properly tested, inspected and documented.

Occasionally, the subsurface conditions between the completed boreholes may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact this office.

This report provides advice on geotechnical aspects for the proposed civil and structural design. As part of the documentation stage of this project, Contract Documents and Specifications may be prepared based on our report. However, there may be design features we are not aware of or have not commented on for a variety of reasons. The designers should satisfy themselves that all the necessary advice has been obtained. If required, we could be commissioned to review the geotechnical aspects of contract documents to confirm the intent of our recommendations has been correctly implemented.

If there is any change in the proposed development described in this report then all recommendations should be reviewed.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. Copyright in this report is the property of JK Geotechnics. We have used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report. The report shall not be reproduced except in full.

115 Wicks Road
Macquarie Park, NSW 2113
PO Box 976
North Ryde, BC 1670
Telephone: 02 9888 5000
Facsimile: 02 9888 5001

SOIL TEST SERVICES
ABN 43 002 145 173

TABLE A
MOISTURE CONTENT, ATTERBERG LIMITS AND LINEAR SHRINKAGE TEST REPORT

Client:	JK Geotechnics	**Ref No:**	26029SP
Project:	Proposed Development	**Report:**	A
Location:	2-12 Tennyson Road, Gladesville	**Report Date:**	10/10/2012
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AS 1289	TEST METHOD	2.1.1	3.1.2	3.2.1	3.3.1	3.4.1
BOREHOLE NUMBER	DEPTH m	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX %	LINEAR SHRINKAGE %
1	0.60-0.78	1.5				
2	0.30-0.50	14.6				
2	0.60-0.73	2.6				
3	0.00-0.20	7.9	33	16	17	7.5
3	0.50-0.65	13.5				
4	0.50-0.90	14.6				
4	1.10-1.28	2.7				
5	0.60-0.80	1.7				
6	0.85-0.95	9.0				
6	1.35-1.55	4.1				
7	0.70-0.95	13.9				
7	1.30-1.50	15.8				
7	1.70-1.95	19.7				
7	3.00-3.45	10.4	28	19	9	5.0
7	4.00-4.24	6.3				

Notes:
- The test sample for liquid and plastic limit was air-dried & dry-sieved
- The linear shrinkage mould was 125mm
- Refer to appropriate notes for soil descriptions
- Date of receipt of sample: 24/09/2012

115 Wicks Road
Macquarie Park, NSW 2113
PO Box 976
North Ryde, Bc 1670
Telephone: 02 9888 5000
Facsimile: 02 9888 5001

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TABLE B
FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

Client:	JK Geotechnics	**Ref No:**	26029SP
Project:	Proposed Development	**Report:**	B
Location:	2-12 Tennyson Road, Gladesville	**Report Date:**	10/10/2012
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BOREHOLE NUMBER	3	4
DEPTH (m)	0.00 - 0.50	0.10 - 0.90
Surcharge (kg)	9.0	9.0
Maximum Dry Density (t/m^3)	1.89 STD	1.93 STD
Optimum Moisture Content (%)	12.3	12.6
Moulded Dry Density (t/m^3)	1.86	1.89
Sample Density Ratio (%)	98	98
Sample Moisture Ratio (%)	102	102
Moisture Contents		
Insitu (%)	11.8	13.5
Moulded (%)	12.5	12.8
After soaking and		
After Test, Top 30mm(%)	19.7	16.0
Remaining Depth (%)	15.8	13.7
Material Retained on 19mm Sieve (%)	0	0
Swell (%)	2.5	0.0
C.B.R. value: @2.5mm penetration		8
@5.0mm penetration	3.0	

NOTES:

- Refer to appropriate notes for soil descriptions
- Test Methods :
  - (a) Soaked C.B.R. : AS 1289 6.1.1
  - (b) Standard Compaction : AS 1289 5.1.1
  - (c) Moisture Content : AS 1289 2.1.1
- Date of receipt of sample: 24/09/2012

NATA Accredited Laboratory Number:1327

Authorised Signature / Date
(A. Talkondal) 10/10/12

115 Wicks Road
Macquarie Park, NSW 2113
PO Box 976
North Ryde, BC 1670
Telephone: 02 9888 5000
Facsimile: 02 9888 5001

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TABLE C
POINT LOAD STRENGTH INDEX TEST REPORT

Client:	JK Geotechnics	**Ref No:**	26029SP
Project:	Proposed Development	**Report:**	C
Location:	2-12 Tennyson Road, Gladesville	**Report Date:**	
		Page 1 of 4	

BOREHOLE NUMBER	DEPTH m	$I_{S(50)}$ MPa	ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (MPa)
1	0.81-0.85	2.4	48
	1.38-1.41	2.6	52
	2.10-2.14	2.2	44
	2.90-2.93	3.9	78
	3.51-3.54	2.4	48
	4.21-4.25	3.4	>68
	4.89-4.92	3.8	76
	5.53-5.58	0.9	18
	6.18-6.21	1.4	28
	6.78-6.82	1.0	20
2	1.05-1.08	3.4	68
	1.73-1.75	3.7	74
	2.39-2.42	4.2	84
	3.05-3.07	3.4	68
	3.77-3.80	1.7	34
	4.40-4.42	2.4	48
	5.04-5.08	2.0	40
	5.70-5.74	1.1	22
	5.56-5.60	0.9	18
3	0.81-0.84	0.6	12
	0.84-0.87	0.6	12
	1.47-1.51	3.5	>70
	1.96-1.99	3.3	66
	2.58-2.61	3.5	70
	3.20-3.22	4.7	94

NOTES: See Page 4 of 4

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TABLE C
POINT LOAD STRENGTH INDEX TEST REPORT

Client:	JK Geotechnics	**Ref No:**	26029SP
Project:	Proposed Development	**Report No:**	C
Location:	2-12 Tennyson Road, Gladesville	**Report Date:**	
		Page 2 of 4	

BOREHOLE NUMBER	DEPTH m	$I_{S(50)}$ MPa	ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (MPa)
3	3.86-3.89	2.9	58
	4.54-4.57	1.8	36
	5.09-5.12	1.7	34
	5.81-5.84	2.2	44
	6.59-6.62	0.9	18
4	1.47-1.51	1.0	20
	2.17-2.21	3.7	>74
	2.84-2.87	3.0	60
	3.51-3.55	4.1	>82
	4.18-4.20	4.2	84
	4.92-4.95	5.4	108
	5.50-5.53	2.7	54
	6.15-6.19	3.3	66
	6.81-6.84	0.9	18
	7.35-7.40	1.1	22
	8.04-8.07	1.3	26
	8.70-8.73	1.5	30
	8.73-8.76	0.6	12
5	0.87-0.91	1.5	30
	1.55-1.58	1.3	26
	2.19-2.23	0.9	18
	2.86-2.89	1.5	30
	3.52-3.56	3.7	74
	4.24-4.27	3.2	64
	4.96-4.99	4.6	>92

NOTES: See Page 4 of 4

115 Wicks Road
Macquarie Park, NSW 2113
PO Box 976
North Ryde, BC 1670
Telephone: 02 9888 5000
Facsimile: 02 9888 5001

SOIL TEST SERVICES
ABN 43 002 145 173

TABLE C
POINT LOAD STRENGTH INDEX TEST REPORT

Client:	JK Geotechnics	**Ref No:**	26029SP
Project:	Proposed Development	**Report No:**	C
Location:	2-12 Tennyson Road, Gladesville	**Report Date:**	
		Page 3 of 4	

BOREHOLE NUMBER	DEPTH m	$I_{S(50)}$ MPa	ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (MPa)
5	5.62-5.65	5.1	>102
	6.31-6.33	5.0	100
	7.02-7.06	2.2	44
	7.71-7.74	1.2	24
	8.40-8.44	1.4	28
	9.03-9.06	1.2	24
6	2.13-2.16	4.5	90
	2.83-2.86	4.2	84
	3.50-3.53	4.2	84
	4.15-4.17	1.9	38
	4.80-4.83	5.6	>112
	5.45-5.48	3.5	70
	6.07-6.09	1.2	24
	6.69-6.73	1.4	28
	7.43-7.46	0.9	18
	8.07-8.10	1.3	26
	8.74-8.78	1.6	32
	9.52-9.55	1.1	22
7	4.31-4.34	4.1	82
	4.97-5.00	2.4	48
	5.64-5.68	2.8	56
	6.29-6.32	2.1	42
	6.97-7.00	2.5	50
	7.68-7.72	3.0	60
	8.32-8.34	1.9	38

NOTES: See Page 4 of 4

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SOIL TEST SERVICES
ABN 43 002 145 173

TABLE C
POINT LOAD STRENGTH INDEX TEST REPORT

Client:	JK Geotechnics	**Ref No:**	26029SP
Project:	Proposed Development	**Report No:**	C
Location:	2-12 Tennyson Road, Gladesville	**Report Date:**	
		Page 4 of 4	

BOREHOLE NUMBER	DEPTH m	$I_{S(50)}$ MPa	ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (MPa)
7	9.00-9.03	1.8	36
	9.78-9.82	1.1	22

NOTES:

1. In the above table testing was completed in the Axial direction.
2. The above strength tests were completed at the 'as received' moisture content.
3. Test Method: RTA T223.
4. The Estimated Unconfined Compressive Strength was calculated from the point load Strength Index by the following approximate relationship and rounded off to the nearest whole number :
   U.C.S. = 20 $I_{S(50)}$

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 79191-A

Client:
Jeffery & Katauskas Pty Ltd
PO Box 976
North Ryde BC
NSW 1670

Attention: Rob Cater

Sample log in details:

Your Reference:	**E26029KP, Gladesville**
No. of samples:	Additional testing on 2 soils
Date samples received / completed instructions received	21/09/2012 / 25/09/12

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	3/10/12 / 3/10/12
Date of Preliminary Report:	Not issued

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Results Approved By:

Nick Sarlamis
Inorganics Supervisor

Client Reference: E26029KP, Gladesville

Miscellaneous Inorg - soil			
Our Reference:	UNITS	79191-A-4	79191-A-11
Your Reference	----------	BH2	BH5
Depth	----------	0.6-0.73	0.4-0.6
Date Sampled		19/09/2012	19/09/2012
Type of sample		Soil	Soil
Date prepared	-	27/09/2012	27/09/2012
Date analysed	-	27/09/2012	27/09/2012
pH 1:5 soil:water	pH Units	8.9	9.2
Chloride, Cl 1:5 soil:water	mg/kg	50	31
Sulphate, SO4 1:5 soil:water	mg/kg	87	94

Client Reference: E26029KP, Gladesville

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 22nd ED, 4110 -B.

Client Reference: E26029KP, Gladesville

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			27/09/2012	[NT]	[NT]	LCS-1	27/09/2012
Date analysed	-			27/09/2012	[NT]	[NT]	LCS-1	27/09/2012
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	LCS-1	102%
Chloride, Cl 1:5 soil:water	mg/kg	2	Inorg-081	<2	[NT]	[NT]	LCS-1	116%
Sulphate, SO4 1:5 soil:water	mg/kg	2	Inorg-081	<2	[NT]	[NT]	LCS-1	119%

Client Reference: **E26029KP, Gladesville**

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

Aileen Hie

From: Brendan Page [bpage@jkgroup.net.au]
Sent: Tuesday, 25 September 2012 1:56 PM
To: Aileen Hie
Cc: 'Robert Cater'; 'Peter Wright'
Subject: Additional Analysis 79306 and 79191

Hi Aileen,

Could you please schedule the following additional analysis on the samples in Envirolabs custody (please issue as separate 'A' reports):

79306-5 (BH7 4-4.25): pH, sulfate and chloride
79191-4 (BH2 0.6-0.73): pH, sulfate and chloride
79191-11 (BH5 0.4-0.6): pH, sulfate and chloride

Note sure if its possible, however, could you arrange for this **additional analysis to be invoiced under JK project reference 26029SP** and attention it to Rob Cater.

The invoice for the remaining analysis can come to me.

Give me a buzz if there are any issues.

79191 A
std TAT
due 3/10

Regards,

Brendan Page
Senior Environmental Scientist

EIS Environmental Investigation Services
CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS
Tel: 02 9888 5000 PO Box 976 115 Wicks Road
Fax: 02 9888 5001 North Ryde BC NSW 1670 Macquarie Park NSW 2113
bpage@jkgroup.net.au
www.jkgeotechnics.com.au

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 79306-A

Client:
Jeffery & Katauskas Pty Ltd
PO Box 976
North Ryde BC
NSW 1670

Attention: Rob Cater

Sample log in details:

Your Reference:	**E26029KP, Gladesville**
No. of samples:	Additional testing on 1 soil
Date samples received / completed instructions received	24/09/2012 / 25/09/2012

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	3/10/12 / 3/10/12
Date of Preliminary Report:	Not issued

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Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Nick Sarlamis
Inorganics Supervisor

Client Reference: E26029KP, Gladesville

Miscellaneous Inorg - soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	 79306-A-5 BH7 4-4.25 24/09/2012 Soil
Date prepared	-	27/09/2012
Date analysed	-	27/09/2012
pH 1:5 soil:water	pH Units	8.1
Chloride, Cl 1:5 soil:water	mg/kg	93
Sulphate, SO4 1:5 soil:water	mg/kg	140

Client Reference: E26029KP, Gladesville

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 22nd ED, 4110 -B.

Client Reference: E26029KP, Gladesville

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			27/09/2012	[NT]	[NT]	LCS-1	27/09/2012
Date analysed	-			27/09/2012	[NT]	[NT]	LCS-1	27/09/2012
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	LCS-1	102%
Chloride, Cl 1:5 soil:water	mg/kg	2	Inorg-081	<2	[NT]	[NT]	LCS-1	116%
Sulphate, SO4 1:5 soil:water	mg/kg	2	Inorg-081	<2	[NT]	[NT]	LCS-1	120%

Client Reference: **E26029KP, Gladesville**

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

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Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

Aileen Hie

From: Brendan Page [bpage@jkgroup.net.au]
Sent: Tuesday, 25 September 2012 1:56 PM
To: Aileen Hie
Cc: 'Robert Cater'; 'Peter Wright'
Subject: Additional Analysis 79306 and 79191

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79306-5 (BH7 4-4.25): pH, sulfate and chloride
79191-4 (BH2 0.6-0.73): pH, sulfate and chloride
79191-11 (BH5 0.4-0.6): pH, sulfate and chloride

Note sure if its possible, however, could you arrange for this **additional analysis to be invoiced under JK project reference 26029SP** and attention it to Rob Cater.

The invoice for the remaining analysis can come to me.

Give me a buzz if there are any issues.

79306 A
std = 1A
due 3/10

Regards,

Brendan Page
Senior Environmental Scientist

EIS Environmental Investigation Services
CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Tel: 02 9888 5000 PO Box 976 115 Wicks Road
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bpage@jkgroup.net.au
www.jkgeotechnics.com.au

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No. 1 1/2

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

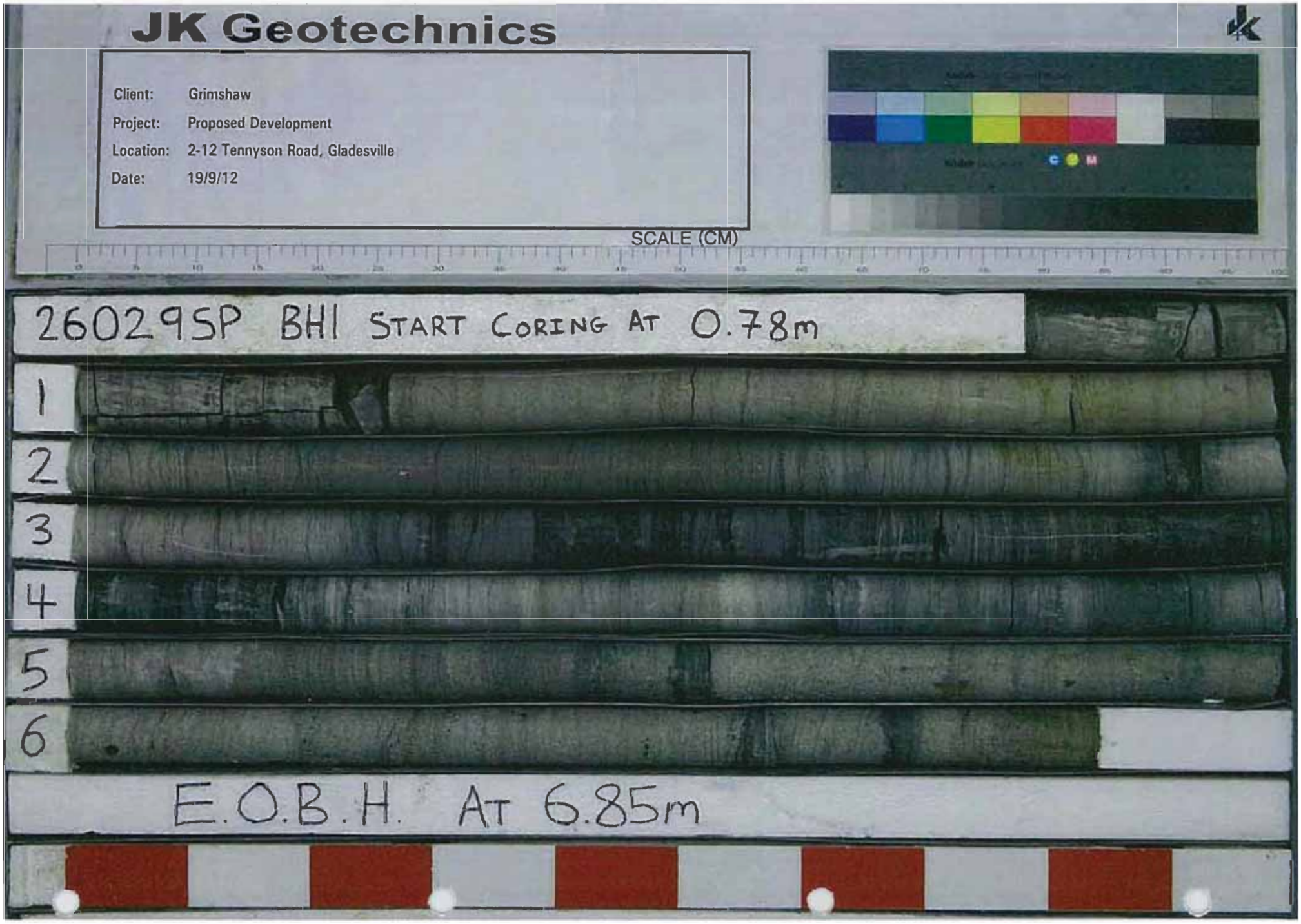
Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Method:** SPIRAL AUGER JK500 **R.L. Surface:** ≈ 33.4m

Date: 19-9-12 **Datum:** AHD

Logged/Checked by: R.V.C./P.W.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGER-ING	■			■		0		-	CONCRETE: 100mm.t				10mm DIA. REINFORCEMENT
								-	FILL: Sandy gravel, fine to coarse grained crushed shale, fine to medium grained sand, trace of silt.	W			
									SHALE: dark grey.	DW	L-M		BANDED LOW TO MODERATE 'TC' BIT RESISTANCE
						1			REFER TO CORED BOREHOLE LOG				
						2							
						3							
						4							
						5							
						6							
						7							


JK Geotechnics
Client: Grimshaw
Project: Proposed Development
Location: 2-12 Tennyson Road, Gladesville
Date: 19/9/12
SCALE (CM)
260295P BH1 START CORING AT 0.78m
1
2
3
4
5
6
E.O.B.H. AT 6.85m

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

CORED BOREHOLE LOG

Borehole No. 1 2/2

Client: Darcsol Ltd Pty
Project: PROPOSED DEVELOPMENT
Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Core Size:** NMLC **R.L. Surface:** ≈ 33.4m
Date: 19-9-12 **Inclination:** VERTICAL **Datum:** AHD
Drill Type: JK500 **Bearing:** - **Logged/Checked by:** R.V.C./P.W.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ (VL, L, M, H, VH, EH)	DEFECT DETAILS: DEFECT SPACING (mm) (500, 300, 100, 50, 30, 10)	DEFECT DETAILS: DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		0		START CORING AT 0.78m					
		1		SHALE: dark grey.	FR	H			- J, 85°, P, R, IS, 345mm.t
				SANDSTONE: fine grained, light grey, with dark grey laminae, bedded at 0-10°.					
		2							
		3				H-VH			
FULL RET-URN				INTERBEDDED SANDSTONE: fine grained, light grey, and SHALE: dark grey, bedded at 0-10°.					
		4		SANDSTONE: fine to medium grained, light grey, with dark grey laminae, bedded at 0-10°.					- Be, 0°, 4mm.t
		5				H			
		6		SANDSTONE: medium grained, light grey, bedded at 0-10°.					
		7		END OF BOREHOLE AT 6.85m					

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No. 2 1/2

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Method:** SPIRAL AUGER JK500 **R.L. Surface:** ≈ 33.1m

Date: 19-9-12 **Datum:** AHD

Logged/Checked by: R.V.C./P.W.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGER-ING	■			■		0		-	ASPHALTIC CONCRETE: 60mm.t	M			
									FILL: Sandy gravel, fine to coarse grained crushed shale gravel and fine to medium grained sand, trace of silt and clay.	MC>PL			
				■	SPT 4/100mm REFUSAL			-		DW	M-H		MODERATE TO HIGH 'TC' BIT RESISTANCE
						1			FILL: Gravelly silty clay, low to medium plasticity, dark grey, fine to coarse grained shale gravel, trace of fine grained sand.				'TC' BIT REFUSAL
									SHALE: dark grey.				
									REFER TO CORED BOREHOLE LOG				
						2							
						3							
						4							
						5							
						6							
						7							


Client: Grimshaw
Project: Proposed Development
Location: 2-12 Tennyson Road, Gladesville
Date: 19/9/12
26029SP BH2 START CORING AT 0.73m
1
2
3
4
5
6
E.O.B.H. AT 6.87m

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

CORED BOREHOLE LOG

Borehole No. **2** 2/2

Client: Darcsol Ltd Pty
Project: PROPOSED DEVELOPMENT
Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Core Size:** NMLC **R.L. Surface:** ≈ 33.1m
Date: 19-9-12 **Inclination:** VERTICAL **Datum:** AHD
Drill Type: JK500 **Bearing:** - **Logged/Checked by:** R.V.C./P.W.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, structure, minor components.)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$	DEFECT DETAILS: DEFECT SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Type, inclination, thickness, planarity, roughness, coating.) Specific / General
		0		START CORING AT 0.73m					
		1		SHALE: dark grey.	FR	VH			- Cr, 25mm.t, IS
				SANDSTONE: fine grained, light grey, with dark grey laminae, bedded at 0-10°.					
		2							
		3		INTERBEDDED SANDSTONE: light grey, and SHALE: dark grey, bedded at 0°.		H			
FULL RET-URN		4		SANDSTONE: fine to medium grained, light grey, with occasional dark grey laminae, bedded at 0-10°.					
				as above, but cross bedded at 20°.					
		5							
				SANDSTONE: medium grained, light grey, bedded at 0-10°.					
		6							
				END OF BOREHOLE AT 6.87m					
		7							

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No. 3 1/2

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

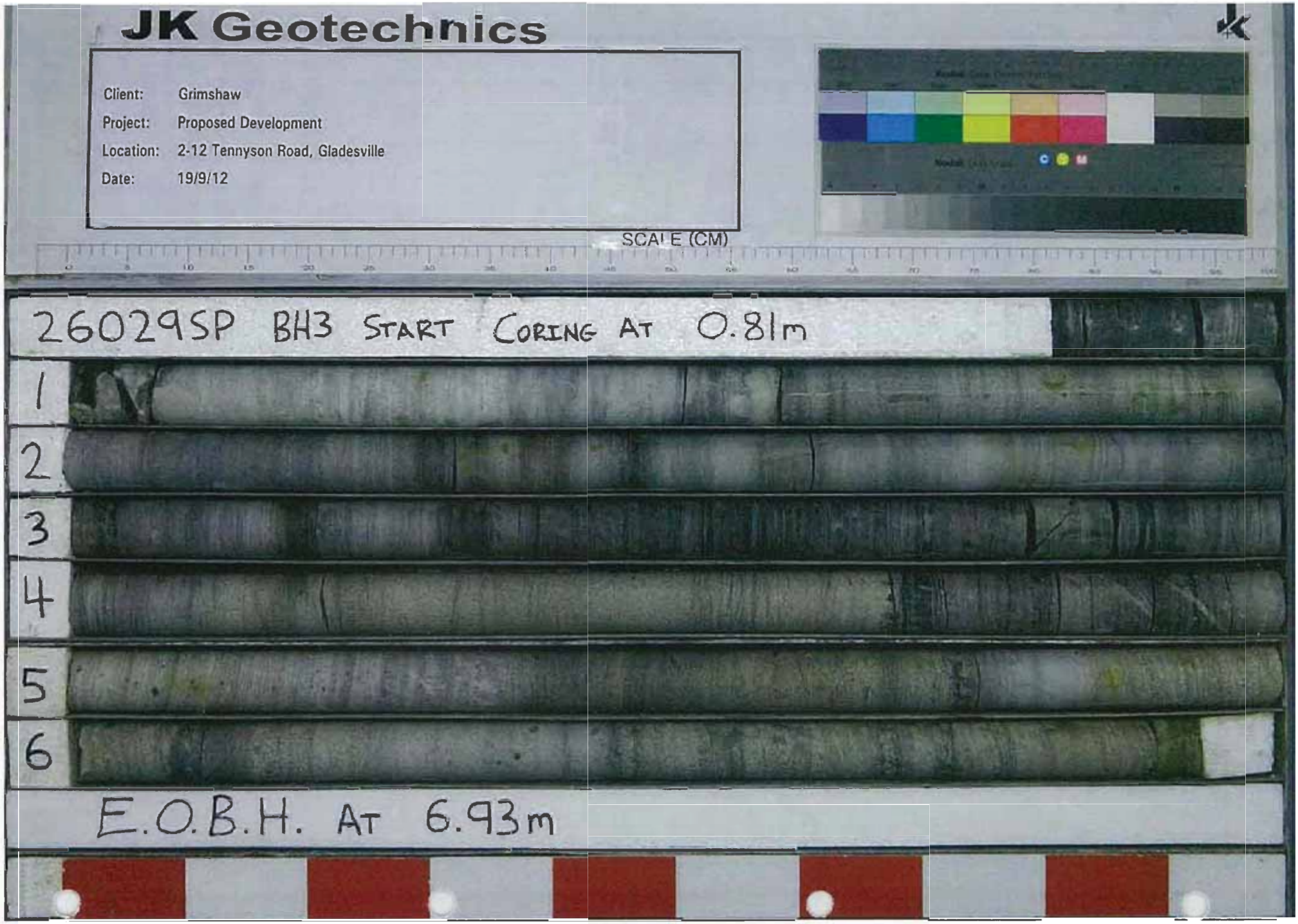
Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Method:** SPIRAL AUGER JK500 **R.L. Surface:** ≈ 32.7m

Date: 19-9-12 **Datum:** AHD

Logged/Checked by: R.V.C./P.W.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGERING					N > 13 3,13/50mm REFUSAL	0			FILL: Gravelly silty clay, low to medium plasticity, brown and grey, fine to coarse grained shale and ironstone gravel.	MC<PL	(H)		
								-	SHALE: dark grey.	DW	M	400 520 460	
						1			REFER TO CORED BOREHOLE LOG				
						2							
						3							
						4							
						5							
						6							
						7							


JK Geotechnics
Client: Grimshaw
Project: Proposed Development
Location: 2-12 Tennyson Road, Gladesville
Date: 19/9/12
SCALE (CM)
26029SP BH3 START CORING AT 0.81m
1
2
3
4
5
6
E.O.B.H. AT 6.93m

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

CORED BOREHOLE LOG

Borehole No. 3 2/2

Client: Darcsol Ltd Pty **Project** PRO POSED DEVELOPMENT
Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW
Job No. 26029SP **Core Size:** NMLC **R.L. Surface:** ≈ 32.7m
Date: 19-9-12 **Inclination:** VERTICAL **Datum:** AHD
Drill Type: JK500 **Bearing:** - **Logged/Checked by:** R.V.C./P.W.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ (EL VL L M H VH EH)	DEFECT DETAILS: DEFECT SPACING (mm) (500 300 100 50 30 10)	DESCRIPTION: Type, inclination, thickness, planarity, roughness, coating. Specific	General
		0		START CORING AT 0.81m						
		1		SHALE: dark grey, bedded at 0°.	DW	M				- Cr, 34mm.t, IS
				SANDSTONE: fine grained, light grey, bedded at 0-5°.	FR	VH				
		2								
		3		INTERBEDDED SANDSTONE: fine grained, light grey, and SHALE: dark grey, bedded at 0-5°.		H				
FULL RET URN		4		SANDSTONE: fine to medium grained, light grey.						- Cr, 4mm.t
		5		INTERBEDDED SANDSTONE: fine grained, light grey, and SHALE: dark grey, bedded at 0-5°.						
				SANDSTONE: fine to medium grained, light grey, bedded at 5-15°.						
		6		END OF BOREHOLE AT 6.93m						

JK Geotechnics
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No. **4** 1/3

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

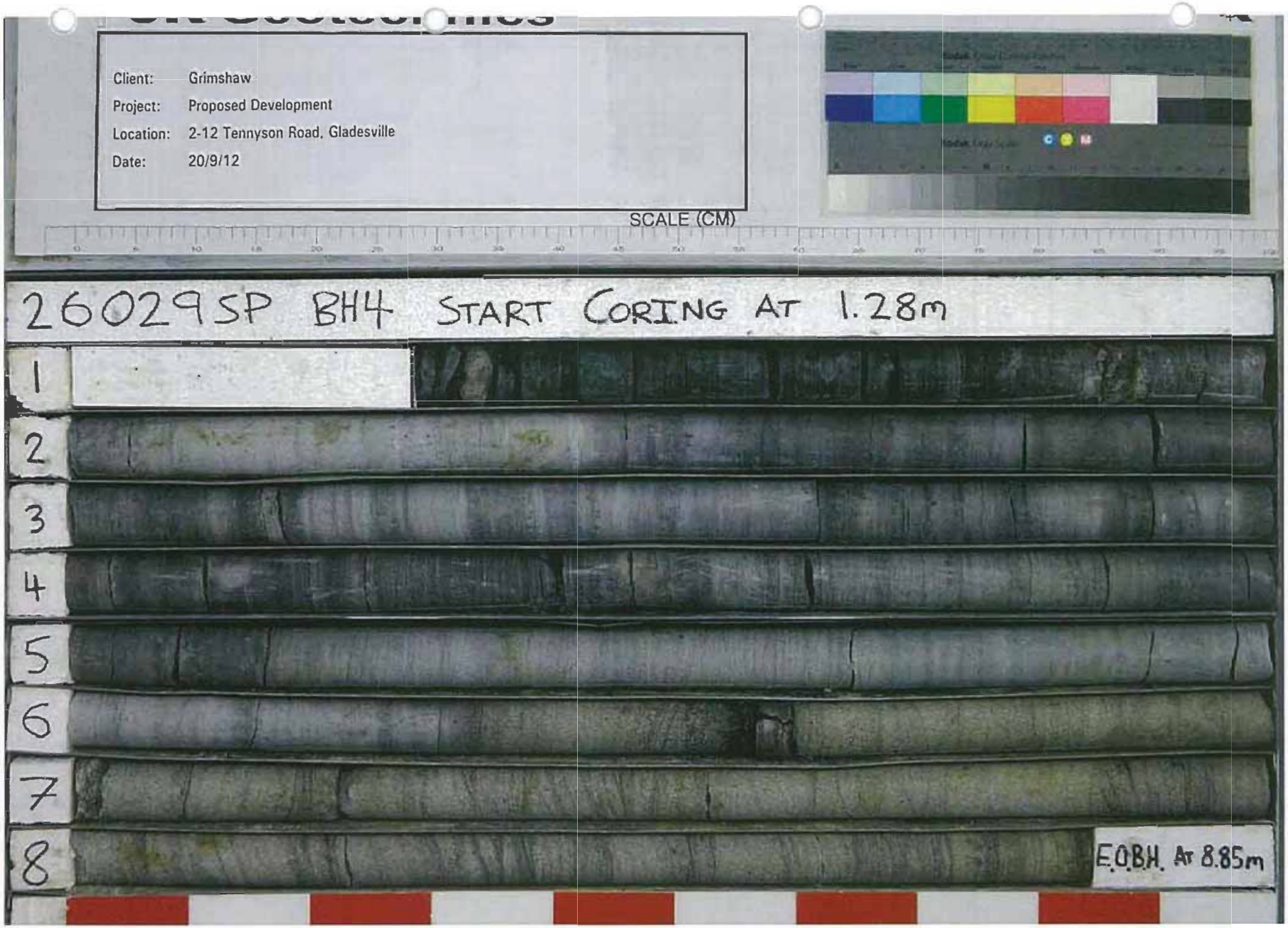
Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Method:** SPIRAL AUGER JK500 **R.L. Surface:** ≈ 32.7m

Date: 20-9-12 **Datum:** AHD

Logged/Checked by: R.V.C./P.W.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGER-ING					N = 11 3,4,7	0		-	ASPHALTIC CONCRETE: 60mm.t FILL: Gravelly silty clay, medium plasticity, dark grey, grey and orange brown, fine to coarse grained crushed shale gravel.	MC>PL		240 210 220	APPEARS MODERATELY COMPACTED
						1		-	SHALE: dark grey.	DW	L-M		LOW 'TC' BIT RESISTANCE
									REFER TO CORED BOREHOLE LOG				MODERATE TO HIGH RESISTANCE
						2							
						3							
						4							
						5							
						6							
						7							


Client: Grimshaw
Project: Proposed Development
Location: 2-12 Tennyson Road, Gladesville
Date: 20/9/12
SCALE (CM)
26029SP BH4 START CORING AT 1.28m
1
2
3
4
5
6
7
8
E.O.B.H. AT 8.85m

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

CORED BOREHOLE LOG

Borehole No. **4** 2/3

Client: Darcsol Ltd Pty Project: PROPOSED DEVELOPMENT
Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Core Size:** NMLC **R.L. Surface:** ≈ 32.7m
Date: 20-9-12 **Inclination:** VERTICAL **Datum:** AHD
Drill Type: JK500 **Bearing:** - **Logged/Checked by:** R.V.C./P.W.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ (EL VL L M H VH EH)	DEFECT SPACING (mm) (500 300 100 50 30 10)	DEFECT DETAILS: DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		1		START CORING AT 1.28m					
				SHALE: dark grey.	FR	H			- HIGHLY FRACTURED ZONE, 136mm.t
		2		SANDSTONE: fine grained, light grey, with dark grey laminae.		VH			- Cr, 30mm.t DEFECTS NOT INDIVIDUALLY DESCRIBED ARE Be, 0°, P, S
		3							
		4		INTERBEDDED SANDSTONE: fine grained, light grey, and SHALE: dark grey, bedded at 0-5°.					- Cr, 17mm.t
FULL RET-URN		5		SANDSTONE: fine to medium grained, light grey, with dark grey laminae, bedded at 0-5°.					
		6							
				SANDSTONE: medium grained, light grey, with dark grey laminae, bedded at 0-10°.		H			- Be, 4°, 3mm.t, P, S
		7		as above, but cross bedded at 15-20°.					
		8							

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

CORED BOREHOLE LOG

Borehole No. 4 3/3

Client: Darcsol Ltd Pty
Project: PROPOSED DEVELOPMENT
Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP | **Core Size:** NMLC | **R.L. Surface:** ≈ 32.7m
Date: 20-9-12 | **Inclination:** VERTICAL | **Datum:** AHD
Drill Type: JK500 | **Bearing:** - | **Logged/Checked by:** R.V.C./P.W.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ (EL VL L M H VH EH)	DEFECT DETAILS: DEFECT SPACING (mm) (100 50 30 10)	DESCRIPTION: Type, inclination, thickness, planarity, roughness, coating. Specific / General
				SANDSTONE: medium grained, light grey, with dark grey laminae, bedded at 0-10°.	FR	H			
		9		END OF BOREHOLE AT 8.85m					
		10							
		11							
		12							
		13							
		14							

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BOREHOLE LOG

Borehole No. 5 1/3

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

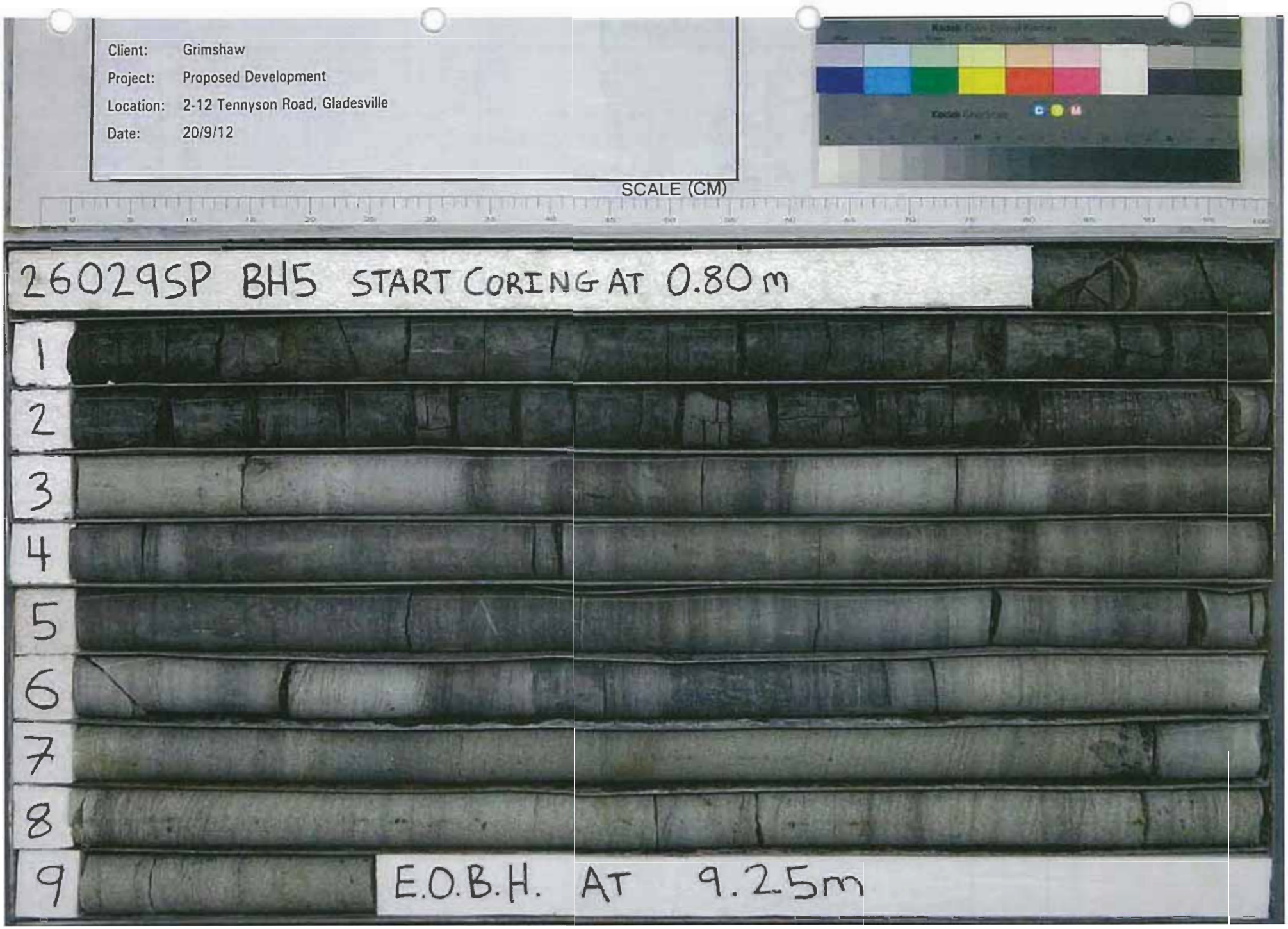
Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Method:** SPIRAL AUGER JK500 **R.L. Surface:** ≈ 32.7m

Date: 20-9-12 **Datum:** AHD

Logged/Checked by: R.V.C./P.W.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGERING						0		-	ASPHALTIC CONCRETE: 40mm.t over CONCRETE: 70mm.t				6mm DIA. REINFORCEMENT
								-	FILL: Clayey gravel, fine to coarse grained crushed shale.	SW	H		MODERATE TO HIGH 'TC' BIT RESISTANCE
									SHALE: dark grey.				
									REFER TO CORED BOREHOLE LOG				
						1							
						2							
						3							
						4							
						5							
						6							
						7							


Client: Grimshaw
Project: Proposed Development
Location: 2-12 Tennyson Road, Gladesville
Date: 20/9/12
SCALE (CM)
26029SP BH5 START CORING AT 0.80 m
1
2
3
4
5
6
7
8
9
E.O.B.H. AT 9.25m

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

CORED BOREHOLE LOG

Borehole No. 5 2/3

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Core Size:** NMLC **R.L. Surface:** ≈ 32.7m

Date: 20-9-12 **Inclination:** VERTICAL **Datum:** AHD

Drill Type: JK500 **Bearing:** - **Logged/Checked by:** R.V.C./P.W.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, structure, minor components.)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ (VL, L, M, H, VH, EH)	DEFECT DETAILS: DEFECT SPACING (mm) (500, 300, 100, 50, 30, 10)	DEFECT DETAILS: DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		0		START CORING AT 0.80m					
80% RET-URN		1		SHALE: dark grey, bedded at 0°.	FR	H			- J, 60°, P, S, IS - J, 45°, P, S, IS - J, 70°, P, S, IS - J, 80°, P, S, IS
		2		as above, but with numerous crushed seams between 35mm and 160mm spacing.					
				SHALE: dark grey.					
		3		SANDSTONE: fine grained, light grey, with dark grey laminae, bedded at 0-10°.		VH			
		4							
		5		INTERBEDDED SANDSTONE: fine grained, light grey, and SHALE: dark grey, bedded at 0-5°.					
		6		SANDSTONE: fine to medium grained, light grey, with dark grey laminae, bedded at 0-5°.					
		7				H			

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CORED BOREHOLE LOG

Borehole No. 5 3/3

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Core Size:** NMLC **R.L. Surface:** ≈ 32.7m

Date: 20-9-12 **Inclination:** VERTICAL **Datum:** AHD

Drill Type: JK500 **Bearing:** - **Logged/Checked by:** R.V.C./P.W.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$	DEFECT DETAILS DEFECT SPACING (mm)	DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		8		SANDSTONE: fine to medium grained, light grey, with dark grey laminae, bedded at 0-5°	FR	H			
		9		SANDSTONE: medium grained, light grey, with dark grey laminae, bedded at 0-10°.					
				END OF BOREHOLE AT 9.25m					
		10							
		11							
		12							
		13							
		14							

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No. 6 1/3

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Method:** SPIRAL AUGER JK500 **R.L. Surface:** ≈ 32.9m

Date: 20-9-12 **Datum:** AHD

Logged/Checked by: R.V.C./P.W.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGER-ING						0			ASPHALTIC CONCRETE: 60mm.t				
								-	FILL: Silty sandy gravel, fine to coarse grained crushed shale, dark grey, fine grained sand.	M			
					N = 18 4,7,11				FILL: Gravelly silty clay, medium plasticity, orange brown, grey and dark grey, fine to coarse grained shale and ironstone gravel.	MC<PL		440 550 600	HP READINGS AFFECTED BY GRAVEL
						1		-	SHALE: dark grey.	DW	L-M		LOW 'TC' BIT RESISTANCE
									REFER TO CORED BOREHOLE LOG				
						2							
						3							
						4							
						5							
						6							
						7							


Client: Grimshaw
Project: Proposed Development
Location: 2-12 Tennyson Road, Gladesville
Date: 20/9/12
SCALE (CM)
26029SP BH6 START CORING AT 1.55m
CORE LOSS 0.16m
2
3
4
5
6
7
8
9
E.O.B.H. AT 9.68m

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CORED BOREHOLE LOG

Borehole No. 6 2/3

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Core Size:** NMLC **R.L. Surface:** ≈ 32.9m

Date: 20-9-12 **Inclination:** VERTICAL **Datum:** AHD

Drill Type: JK500 **Bearing:** - **Logged/Checked by:** R.V.C./P.W.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, structure, minor components.)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ (VL L M H VH EH)	DEFECT DETAILS: DEFECT SPACING (mm) (500 300 100 50 30 10)	DEFECT DETAILS: DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		1		START CORING AT 1.55m					
		2		SHALE: dark grey and orange brown, highly weathered and fractured.	XW-DW	EL-VL			FRAGMENTED TO 2.15m DEPTH
				SANDSTONE: fine grained, light grey, with orange brown staining.	DW	VH			- J, 70-90°, UN, R, IS
		3		as above, but light grey, with dark grey laminae.	FR				
				INTERBEDDED SANDSTONE: fine grained, light grey, and SHALE: dark grey, bedded at 0-10°.					
		4							
		5		SANDSTONE: fine to medium grained, light grey, with dark grey laminae, bedded at 0-10°. Shale band, 0.2m.t.		H			
		6							
		7		SANDSTONE: medium grained, light grey, with dark grey laminae, bedded at 10-15°.					
		8							

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

CORED BOREHOLE LOG

Borehole No. 6 3/3

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Core Size:** NMLC **R.L. Surface:** ≈ 32.9m

Date: 20-9-12 **Inclination:** VERTICAL **Datum:** AHD

Drill Type: JK500 **Bearing:** - **Logged/Checked by:** R.V.C./P.W.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ VL L M H VH EH	DEFECT DETAILS DEFECT SPACING (mm) 500 300 100 50 30 10	DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		9		SANDSTONE: medium grained, light grey, with dark grey laminae, bedded at 10-15°.	FR	H			
		10		END OF BOREHOLE AT 9.68m					
		11							
		12							
		13							
		14							

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No. 7 1/2

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

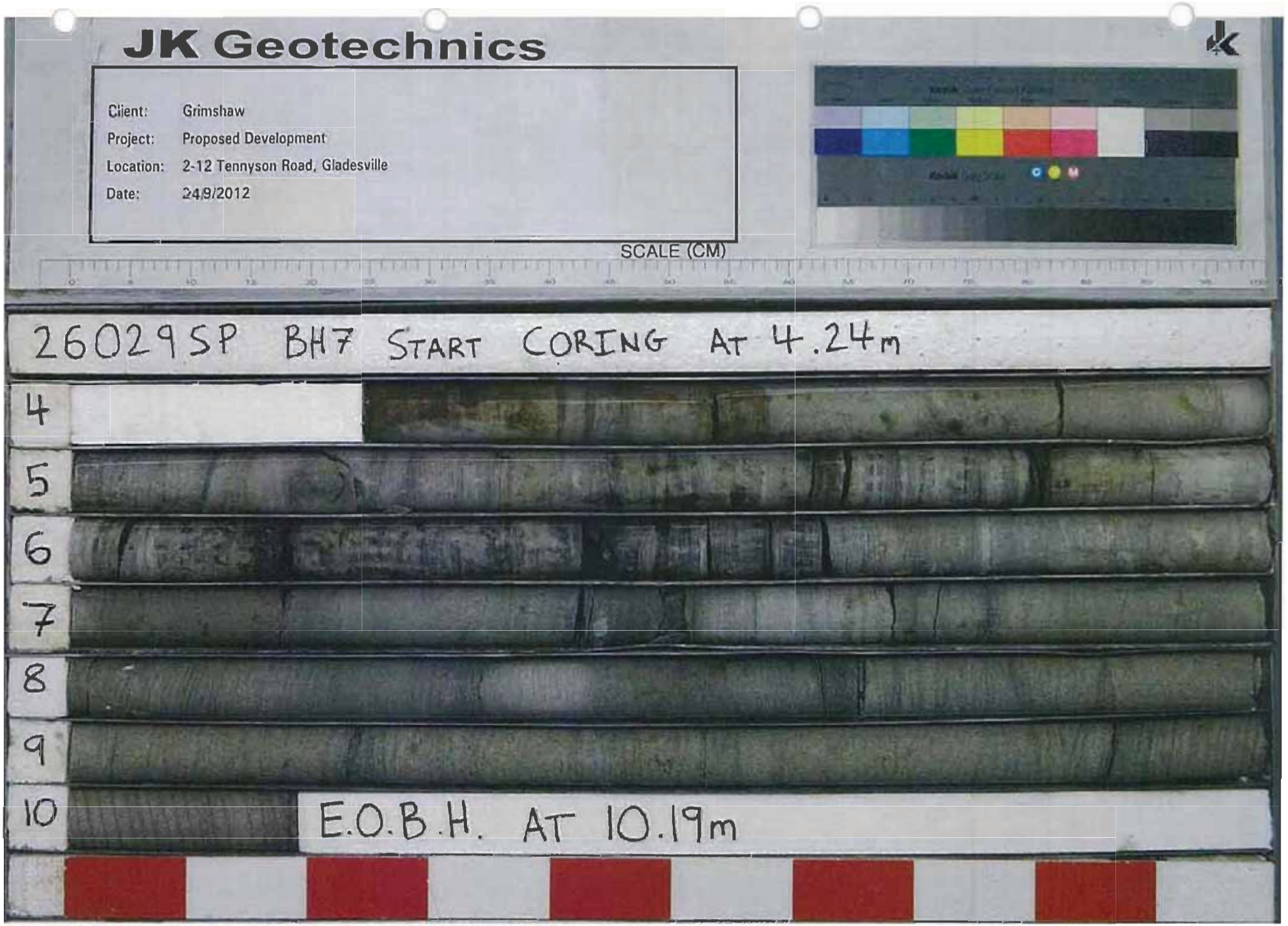
Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

Job No. 26029SP **Method:** SPIRAL AUGER JK305 **R.L. Surface:** ≈ 35.1m

Date: 24-9-12 **Datum:** AHD

Logged/Checked by: R.V.C./P.W.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGERING						0			ASPHALTIC CONCRETE: 60mm.t				
									FILL: Gravelly silty sand, fine to medium grained, grey brown, fine to medium grained shale and sandstone gravel.	M			
					N = 16 7,8,8					MC<PL		280 350 280	APPEARS MODERATELY TO WELL COMPACTED
						1			FILL: Silty clay, medium to high plasticity, grey and orange brown, with fine to coarse grained shale and ironstone gravel.	MC>PL			
									as above, but dark brown, grey and red brown.				
					N = 16 6,7,9	2						240 400 310	
										MC<PL			
					N = 26 7,14,12	3						390 290 280	
						4		-	SHALE: dark grey.	DW	L-M		BANDED LOW 'TC' BIT RESISTANCE
									REFER TO CORED BOREHOLE LOG				
						5							
						6							
						7							


JK Geotechnics
Client: Grimshaw
Project: Proposed Development
Location: 2-12 Tennyson Road, Gladesville
Date: 24/9/2012
SCALE (CM)
26029SP BH7 START CORING AT 4.24m
4
5
6
7
8
9
10
E.O.B.H. AT 10.19m

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

CORED BOREHOLE LOG

Borehole No. 7 2/2

Client: Darcsol Ltd Pty

Project: PROPOSED DEVELOPMENT

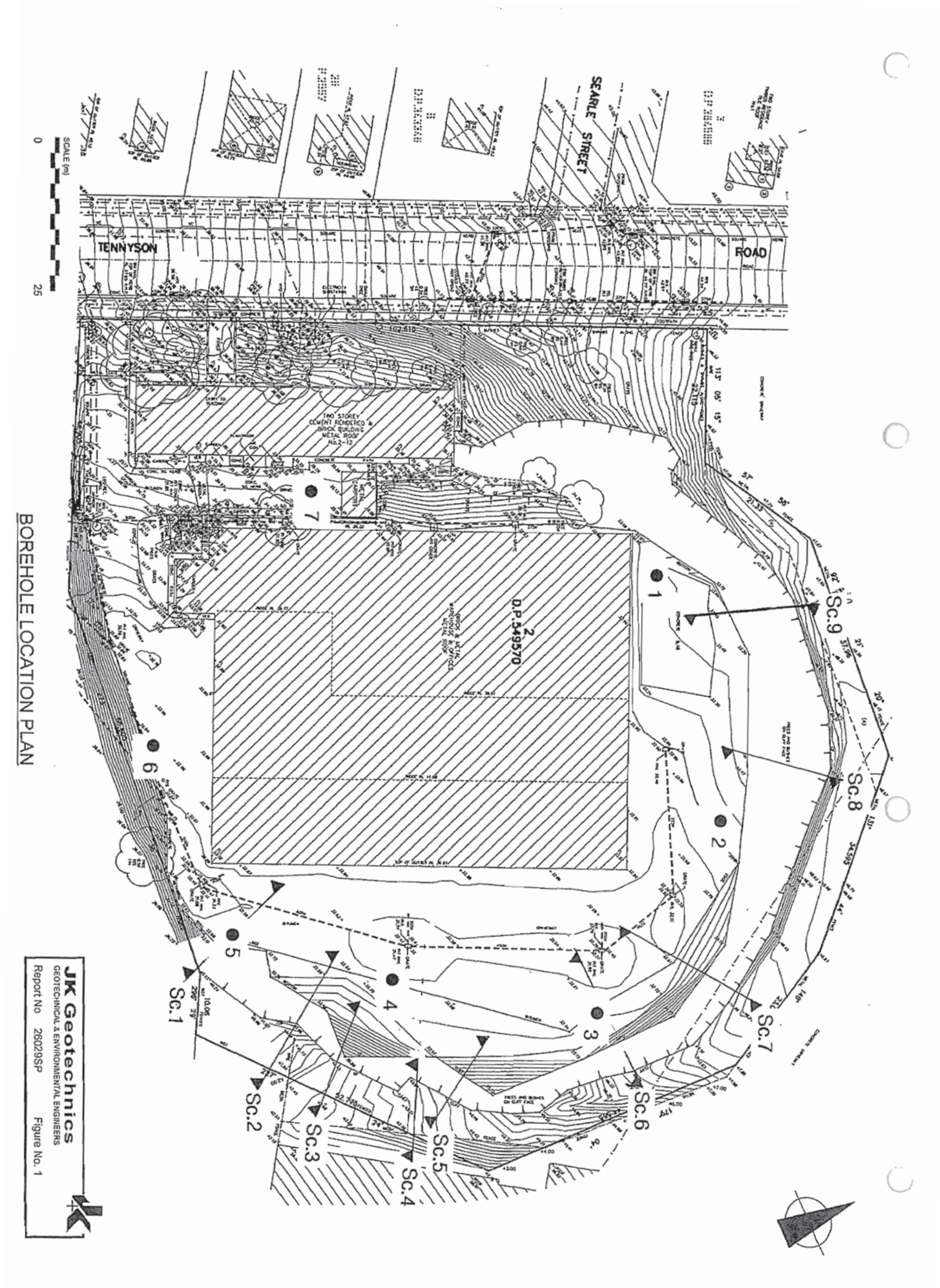
Location: 2-12 TENNYSON ROAD, GLADESVILLE, NSW

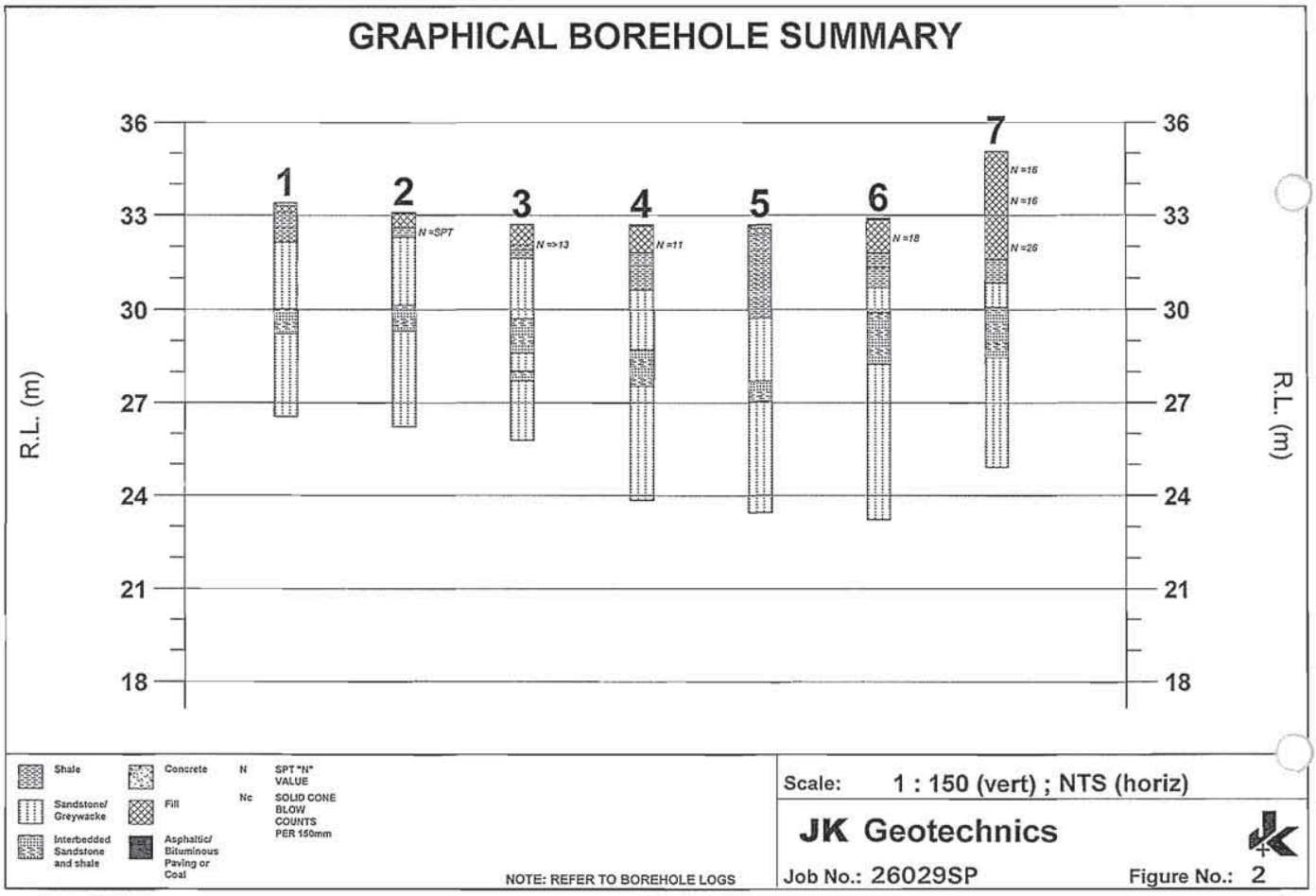
Job No. 26029SP **Core Size:** NMLC **R.L. Surface:** ≈ 35.1m

Date: 20-9-12 **Inclination:** VERTICAL **Datum:** AHD

Drill Type: JK350 **Bearing:** - **Logged/Checked by:** R.V.C./P.W.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, structure, minor components.)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ (VL L M H VH EH)	DEFECT SPACING (mm) (500 300 100 50 30 10)	DEFECT DETAILS DESCRIPTION (Type, inclination, thickness, planarity, roughness, coating.) Specific / General
		4		START CORING AT 4.24m					
				SANDSTONE: fine grained, light grey, with dark grey laminae, bedded at 0-10°.	SW / FR	H-VH			
		5		INTERBEDDED SANDSTONE: fine grained, light grey, and SHALE: dark grey, bedded at 0-10°.					- Be, 10°, 5mm.t, Un, S, IS - XWS, 0°, 13mm.t, P, S
		6							- Cr, 15mm.t
FULL RET-URN		7		SANDSTONE: fine grained, light grey, with dark grey laminae, bedded at 0-10°.					
		8				H			
		9							- XWS, 0°, 4mm.t
		10							
				END OF BOREHOLE AT 10.19m					


BOREHOLE LOCATION PLAN
SCALE (m)
0
25
SEARLE STREET
TENNYSON
ROAD
TWO STOREY CEMENT RENDERED & BRICK BUILDING METAL ROOF No.2-12
D.P.549570
1
2
3
4
5
6
7
Sc.1
Sc.2
Sc.3
Sc.4
Sc.5
Sc.6
Sc.7
Sc.8
Sc.9
JK Geotechnics
GEOTECHNICAL & ENVIRONMENTAL ENGINEERS
Report No 26029SP
Figure No. 1


GRAPHICAL BOREHOLE SUMMARY
R.L. (m)
36
33
30
27
24
21
18
1
2
N =SPT
3
N =13
4
N =11
5
6
N =18
7
N =16
N =16
N =26
Shale
Sandstone/ Greywacke
Interbedded Sandstone and shale
Concrete
Fill
Asphaltic/ Bituminous Paving or Coal
N SPT "N" VALUE
Nc SOLID CONE BLOW COUNTS PER 150mm
NOTE: REFER TO BOREHOLE LOGS
Scale: 1 : 150 (vert) ; NTS (horiz)
JK Geotechnics
Job No.: 26029SP
Figure No.: 2

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GEOTECHNICAL & ENVIRONMENTAL ENGINEERS

REPORT EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the geotechnical report in regard to classification methods, field procedures and certain matters relating to the Comments and Recommendations section. Not all notes are necessarily relevant to all reports.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Geotechnical engineering involves gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, the SAA Site Investigation Code. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geotechnical practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached Unified Soil Classification Table qualified by the grading of other particles present (eg sandy clay) as set out below:

Soil Classification	Particle Size
Clay	less than 0.002mm
Silt	0.002 to 0.06mm
Sand	0.06 to 2mm
Gravel	2 to 60mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose	less than 4
Loose	4 – 10
Medium dense	10 – 30
Dense	30 – 50
Very Dense	greater than 50

Cohesive soils are classified on the basis of strength (consistency) either by use of hand penetrometer, laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength kPa
Very Soft	less than 25
Soft	25 – 50
Firm	50 – 100
Stiff	100 – 200
Very Stiff	200 – 400
Hard	Greater than 400
Friable	Strength not attainable – soil crumbles

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'Shale' is used to describe thinly bedded to laminated siltstone.

SAMPLING

Sampling is carried out during drilling or from other excavations to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on plasticity, grain size, colour, moisture content, minor constituents and, depending upon the degree of disturbance, some information on strength and structure. Bulk samples are similar but of greater volume required for some test procedures.

Undisturbed samples are taken by pushing a thin-walled sample tube, usually 50mm diameter (known as a U50), into the soil and withdrawing it with a sample of the soil contained in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling used are given on the attached logs.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All except test pits, hand auger drilling and portable dynamic cone penetrometers require the use of a mechanical drilling rig which is commonly mounted on a truck chassis.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for an excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Premature refusal of the hand augers can occur on a variety of materials such as hard clay, gravel or ironstone, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock fragments. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, an NMLC triple tube core barrel, which gives a core of about 50mm diameter, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as CORE LOSS. The location of losses are determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the top end of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" – Test F3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of, say, 4, 6 and 7 blows, as

  N = 13
  4, 6, 7

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as

  N>30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

Occasionally, the drop hammer is used to drive 50mm diameter thin walled sample tubes (U50) in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

A modification to the SPT test is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as "N_c" on the borehole logs, together with the number of blows per 150mm penetration.

Static Cone Penetrometer Testing and Interpretation: Cone penetrometer testing (sometimes referred to as a Dutch Cone) described in this report has been carried out using an Electronic Friction Cone Penetrometer (EFCP). The test is described in Australian Standard 1289, Test F5.1.

In the tests, a 35mm diameter rod with a conical tip is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the frictional resistance on a separate 134mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are electrically connected by wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20mm per second) the information is output as incremental digital records every 10mm. The results given in this report have been plotted from the digital data.

The information provided on the charts comprise:

- Cone resistance – the actual end bearing force divided by the cross sectional area of the cone – expressed in MPa.
- Sleeve friction – the frictional force on the sleeve divided by the surface area – expressed in kPa.
- Friction ratio – the ratio of sleeve friction to cone resistance, expressed as a percentage.

  The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and occasionally very soft clays, rising to 4% to 10% in stiff clays and peats. Soil descriptions based on cone resistance and friction ratios are only inferred and must not be considered as exact.

Correlations between EFCP and SPT values can be developed for both sands and clays but may be site specific.

Interpretation of EFCP values can be made to empirically derive modulus or compressibility values to allow calculation of foundation settlements.

Stratification can be inferred from the cone and friction traces and from experience and information from nearby boreholes etc. Where shown, this information is presented for general guidance, but must be regarded as interpretive. The test method provides a continuous profile of engineering properties but, where precise information on soil classification is required, direct drilling and sampling may be preferable.

Portable Dynamic Cone Penetrometers: Portable Dynamic Cone Penetrometer (DCP) tests are carried out by driving a rod into the ground with a sliding hammer and counting the blows for successive 100mm increments of penetration.

Two relatively similar tests are used:

- Cone penetrometer (commonly known as the Scala Penetrometer) – a 16mm rod with a 20mm diameter cone end is driven with a 9kg hammer dropping 510mm (AS1289, Test F3.2). The test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various Road Authorities.
- Perth sand penetrometer – a 16mm diameter flat ended rod is driven with a 9kg hammer, dropping 600mm (AS1289, Test F3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.

LOGS

The borehole or test pit logs presented herein are an engineering and/or geological interpretation of the sub-surface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment, but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The attached explanatory notes define the terms and symbols used in preparation of the logs.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than "straight line" variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

Where groundwater levels are measured in boreholes, there are several potential problems:

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after stabilising at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg bricks, steel etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably determine the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse engineering characteristics or behaviour. If the volume and quality of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing is normally carried out in accordance with Australian Standard 1289 *'Methods of Testing Soil for Engineering Purposes'*. Details of the test procedure used are given on the individual report forms.

ENGINEERING REPORTS

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building) the information and interpretation may not be relevant if the design proposal is changed (eg to a twenty storey building). If this happens, the company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions – the potential for this will be partially dependent on borehole spacing and sampling frequency as well as investigation technique.
- Changes in policy or interpretation of policy by statutory authorities.
- The actions of persons or contractors responding to commercial pressures.

If these occur, the company will be pleased to assist with investigation or advice to resolve any problems occurring.

SITE ANOMALIES

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed that at some later stage, well after the event.

REPRODUCTION OF INFORMATION FOR CONTRACTUAL PURPOSES

Attention is drawn to the document *'Guidelines for the Provision of Geotechnical Information in Tender Documents'*, published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Copyright in all documents (such as drawings, borehole or test pit logs, reports and specifications) provided by the Company shall remain the property of Jeffery and Katauskas Pty Ltd. Subject to the payment of all fees due, the Client alone shall have a licence to use the documents provided for the sole purpose of completing the project to which they relate. License to use the documents may be revoked without notice if the Client is in breach of any objection to make a payment to us.

REVIEW OF DESIGN

Where major civil or structural developments are proposed or where only a limited investigation has been completed or where the geotechnical conditions/ constraints are quite complex, it is prudent to have a joint design review which involves a senior geotechnical engineer.

SITE INSPECTION

The company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related.

Requirements could range from:

i) a site visit to confirm that conditions exposed are no worse than those interpreted, to

ii) a visit to assist the contractor or other site personnel in identifying various soil/rock types such as appropriate footing or pier founding depths, or

iii) full time engineering presence on site.

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GRAPHIC LOG SYMBOLS FOR SOILS AND ROCKS

SOIL


FILL


TOPSOIL


CLAY (CL, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CH)


SILTY CLAY (CL, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML)


PEAT AND ORGANIC SOILS

ROCK


CONGLOMERATE


SANDSTONE


SHALE


SILTSTONE, MUDSTONE, CLAYSTONE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

DEFECTS AND INCLUSIONS


CLAY SEAM


SHEARED OR CRUSHED SEAM


BRECCIATED OR SHATTERED SEAM/ZONE


IRONSTONE GRAVEL


ORGANIC MATERIAL

OTHER MATERIALS


CONCRETE


BITUMINOUS CONCRETE, COAL


COLLUVIUM

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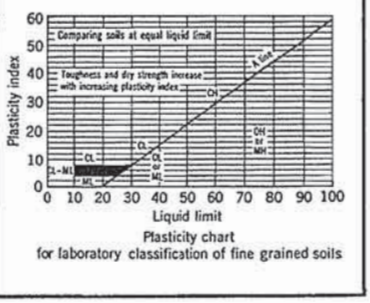
Field Identification Procedures (Excluding particles larger than 75 μm and basing fractions on estimated weights)						Group Symbols [a]	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria
Coarse-grained soils: More than half of material is larger than 75 μm sieve size [b] (The 75 μm sieve size is about the smallest particle visible to naked eye)	Gravels: More than half of coarse fraction is larger than 4 mm sieve size	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			GW	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel; maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty sand*, gravelly; about 20% hard, angular gravel particles 12 mm maximum size; rounded and subangular sand grains coarse to fine, about 15% non-plastic fines with low dry strength; well compacted and moist in place; alluvial sand; (*SM*)	Use grain size curve in identifying the fractions as given under field identification Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than 75 μm sieve size) coarse grained soils are classified as follows: Less than 5% — *GW, GP, SW, SP* More than 12% — *GM, GC, SM, SC* 5% to 12% — *Borderline* cases requiring use of dual symbols $C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all gradation requirements for *GW* Atterberg limits below "A" line, or *PI* less than 4 — Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols Atterberg limits above "A" line, with *PI* greater than 7
		Gravels with fines (appreciable amount of fines)	Predominantly one size or a range of sizes with some intermediate sizes missing			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		
			Nonplastic fines (for identification procedures see *ML* below)			GM	Silty gravels, poorly graded gravel-sand-silt mixtures		
			Plastic fines (for identification procedures, see *CL* below)			GC	Clayey gravels, poorly graded gravel-sand-clay mixtures		
	Sands: More than half of coarse fraction is smaller than 4 mm sieve size	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes			SW	Well graded sands, gravelly sands, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all gradation requirements for *SW* Atterberg limits below "A" line or *PI* less than 5 — Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols Atterberg limits below "A" line with *PI* greater than 7
			Predominantly one size or a range of sizes with some intermediate sizes missing			SP	Poorly graded sands, gravelly sands, little or no fines		
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see *ML* below)			SM	Silty sands, poorly graded sand-silt mixtures		
			Plastic fines (for identification procedures, see *CL* below)			SC	Clayey sands, poorly graded sand-clay mixtures		
Fine-grained soils: More than half of material is smaller than 75 μm sieve size (The 75 μm sieve size is about the smallest particle visible to naked eye)	Identification Procedures on Fraction Smaller than 380 μm Sieve Size								
	Silts and clays: liquid limit less than 50		Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)				
			None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (*ML*)	
			Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			Slight to medium	Slow	Slight	OL	Organic silts and organic silty-clays of low plasticity		
	Silts and clays: liquid limit greater than 50		Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays		
			Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity		
Highly Organic Soils			Readily identified by colour, odour, spongy feel and frequently by fibrous texture			Pt	Peat and other highly organic soils		



Plasticity chart
for laboratory classification of fine grained soils

Note: 1 Soils possessing characteristics of two groups are designated by combinations of group symbols (eg. GW-GC, well graded gravel-sand mixture with clay fines).
2 Soils with liquid limits of the order of 35 to 50 may be visually classified as being of medium plasticity.

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LOG SYMBOLS

LOG COLUMN	SYMBOL	DEFINITION
Groundwater Record	▼	Standing water level. Time delay following completion of drilling may be shown.
	C	Extent of borehole collapse shortly after drilling.
	▶	Groundwater seepage into borehole or excavation noted during drilling or excavation.
Samples	ES	Soil sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos screening.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'R' as noted below.
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60 degree solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25	Vane shear reading in kPa of Undrained Shear Strength.
	PID = 100	Photoionisation detector reading in ppm (Soil sample headspace test).
Moisture Condition (Cohesive Soils)	MC>PL	Moisture content estimated to be greater than plastic limit.
	MC≈PL	Moisture content estimated to be approximately equal to plastic limit.
	MC<PL	Moisture content estimated to be less than plastic limit.
(Cohesionless Soils)	D	DRY – Runs freely through fingers.
	M	MOIST – Does not run freely but no free water visible on soil surface.
	W	WET – Free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS	VERY SOFT – Unconfined compressive strength less than 25kPa
	S	SOFT – Unconfined compressive strength 25-50kPa
	F	FIRM – Unconfined compressive strength 50-100kPa
	St	STIFF – Unconfined compressive strength 100-200kPa
	VSt	VERY STIFF – Unconfined compressive strength 200-400kPa
	H	HARD – Unconfined compressive strength greater than 400kPa
	( )	Bracketed symbol indicates estimated consistency based on tactile examination or other tests.
Density Index/ Relative Density (Cohesionless Soils)		**Density Index (I_D) Range (%)** / **SPT 'N' Value Range (Blows/300mm)**
	VL	Very Loose <15 0-4
	L	Loose 15-35 4-10
	MD	Medium Dense 35-65 10-30
	D	Dense 65-85 30-50
	VD	Very Dense >85 >50
	( )	Bracketed symbol indicates estimated density based on ease of drilling or other tests.
Hand Penetrometer Readings	300 250	Numbers indicate individual test results in kPa on representative undisturbed material unless noted otherwise.
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Tungsten carbide wing bit.
	T 60	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.

LOG SYMBOLS continued

ROCK MATERIAL WEATHERING CLASSIFICATION

TERM	SYMBOL	DEFINITION
Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely weathered rock	XW	Rock is weathered to such an extent that it has "soil" properties, ie it either disintegrates or can be remoulded, in water.
Distinctly weathered rock	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by ironstaining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Slightly weathered rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh rock	FR	Rock shows no sign of decomposition or staining.

ROCK STRENGTH

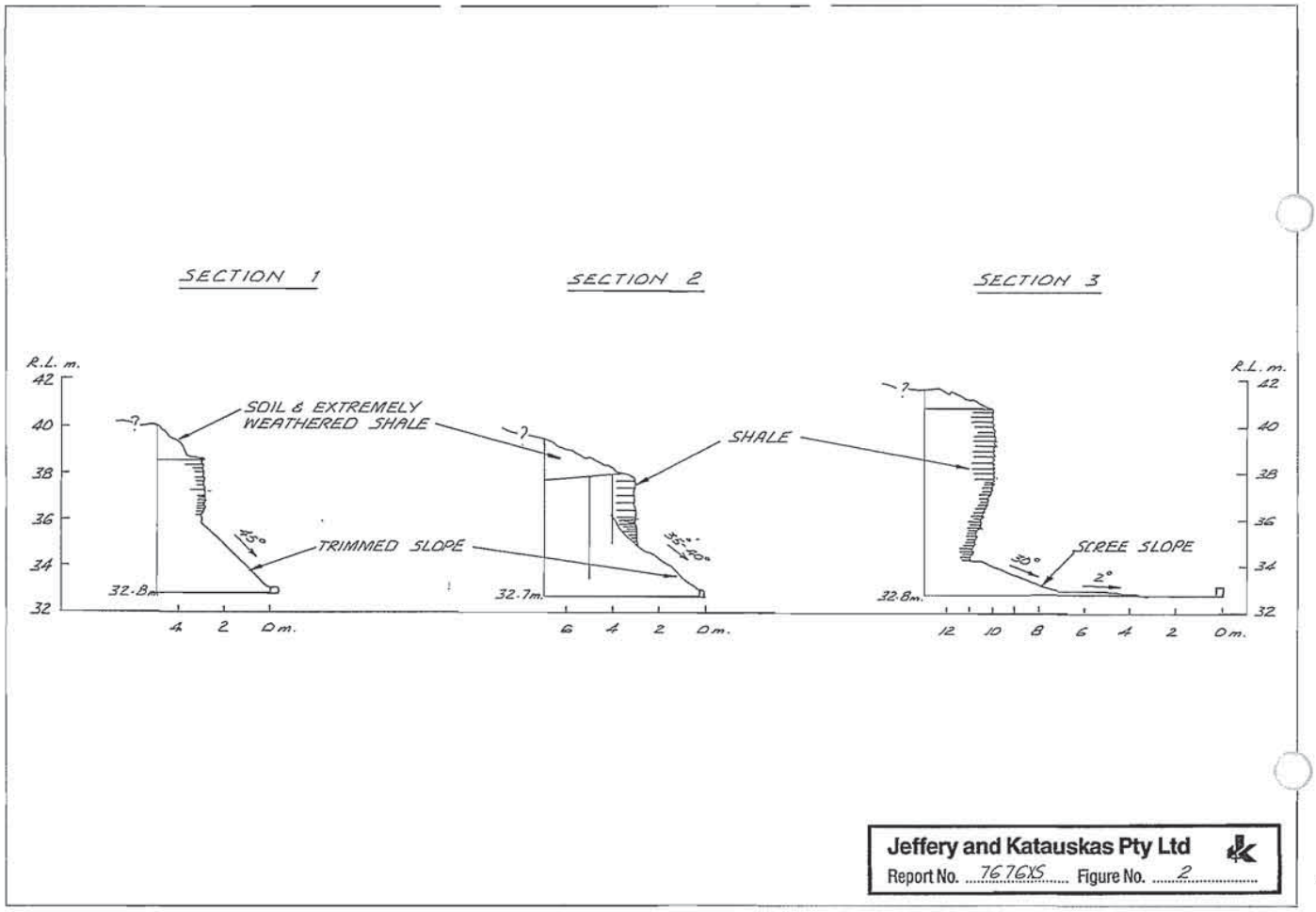
Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the bedding. The test procedure is described by the International Journal of Rock Mechanics, Mining, Science and Geomechanics. Abstract Volume 22, No 2, 1985.

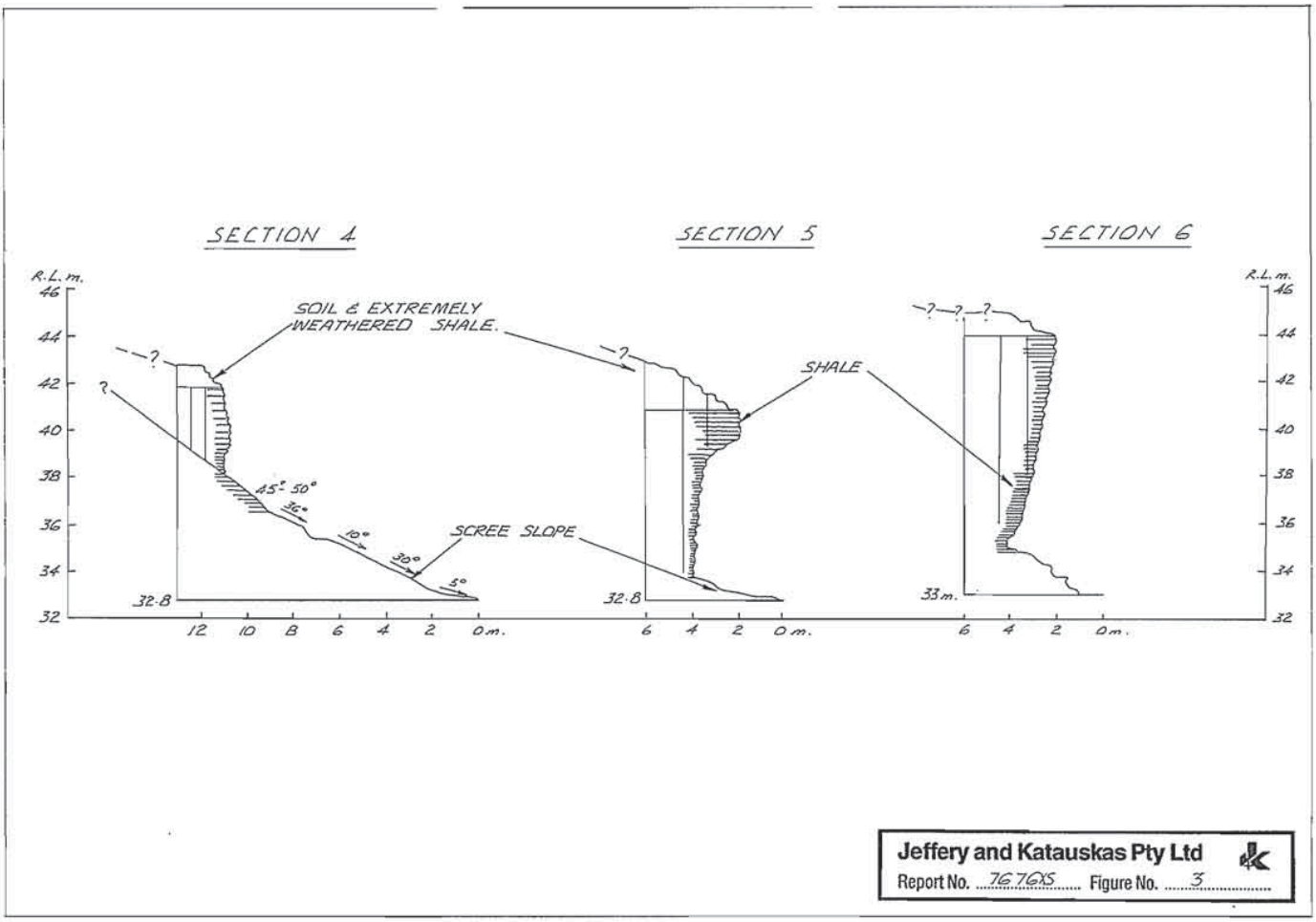
TERM	SYMBOL	Is (50) MPa	FIELD GUIDE
Extremely Low:	EL		Easily remoulded by hand to a material with soil properties.
----------	----------	0.03	
Very Low:	VL		May be crumbled in the hand. Sandstone is "sugary" and friable.
----------	----------	0.1	
Low:	L		A piece of core 150mm long x 50mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
----------	----------	0.3	
Medium Strength:	M		A piece of core 150mm long x 50mm dia. can be broken by hand with difficulty. Readily scored with knife.
----------	----------	1	
High:	H		A piece of core 150mm long x 50mm dia. core cannot be broken by hand, can be slightly scratched or scored with knife; rock rings under hammer.
----------	----------	3	
Very High:	VH		A piece of core 150mm long x 50mm dia. may be broken with hand-held pick after more than one blow. Cannot be scratched with pen knife; rock rings under hammer.
----------	----------	10	
Extremely High:	EH		A piece of core 150mm long x 50mm dia. is very difficult to break with hand-held hammer. Rings when struck with a hammer.

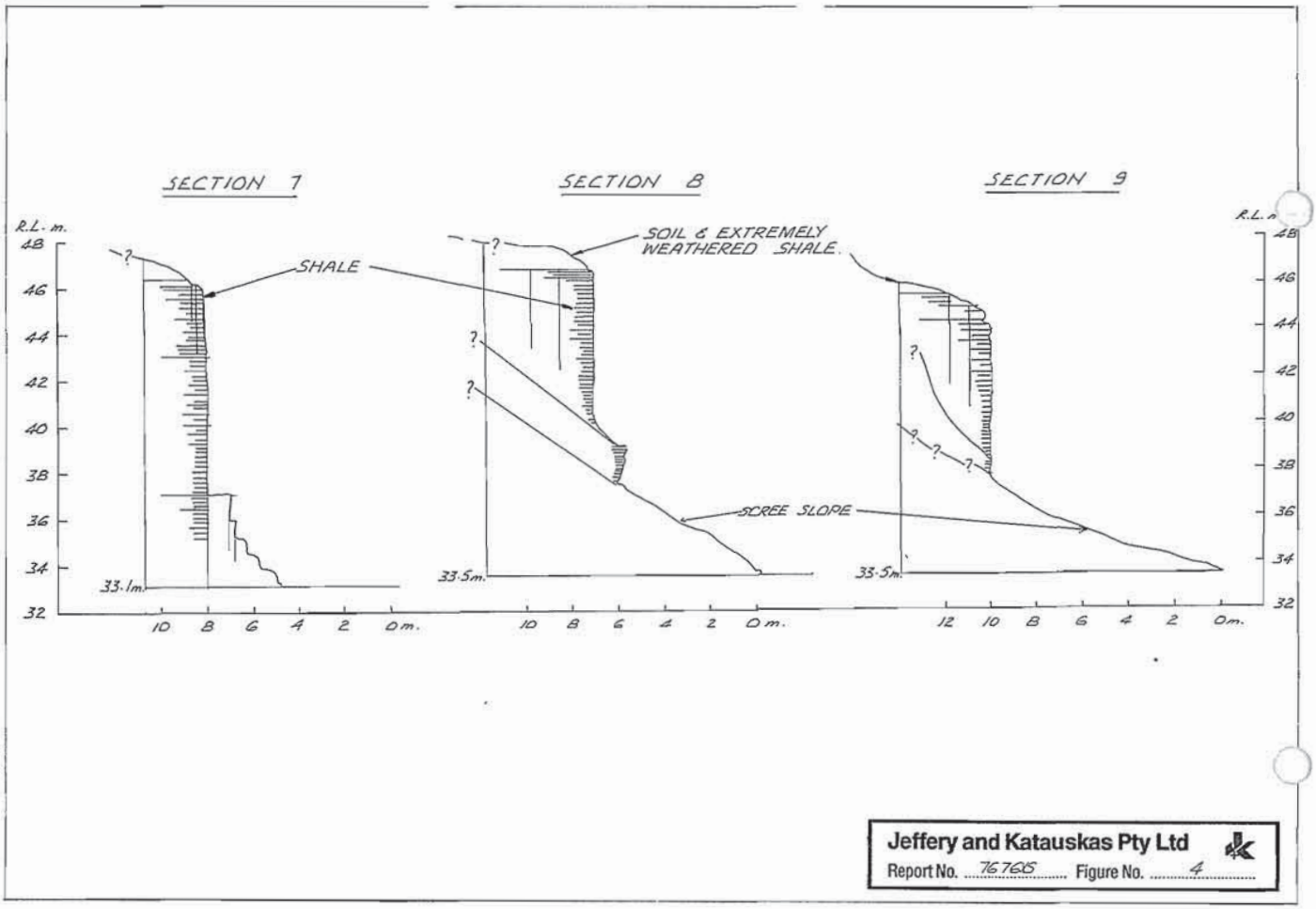
ABBREVIATIONS USED IN DEFECT DESCRIPTION

ABBREVIATION	DESCRIPTION	NOTES
Be	Bedding Plane Parting	Defect orientations measured relative to the normal to the long core axis (ie relative to horizontal for vertical holes)
CS	Clay Seam	
J	Joint	
P	Planar	
Un	Undulating	
S	Smooth	
R	Rough	
IS	Ironstained	
XWS	Extremely Weathered Seam	
Cr	Crushed Seam	
60t	Thickness of defect in millimetres	

APPENDIX A

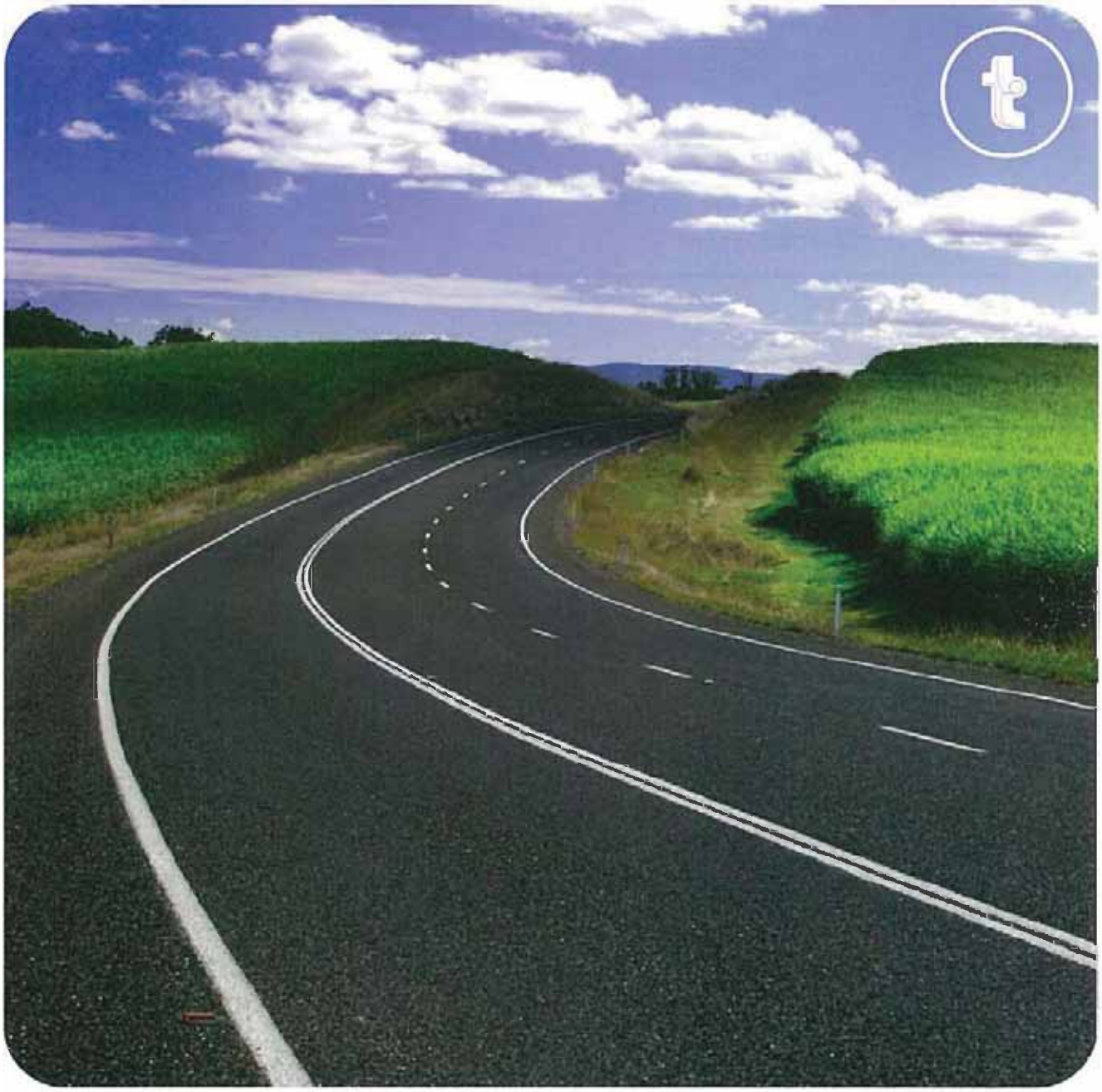

SECTION 1
SECTION 2
SECTION 3
R.L. m.
42
40
38
36
34
32
SOIL & EXTREMELY WEATHERED SHALE
TRIMMED SLOPE
45°
32.8m.
4 2 0m.
SHALE
35°-40°
32.7m.
6 4 2 0m.
SCREE SLOPE
30°
2°
32.8m.
12 10 8 6 4 2 0m.
Jeffery and Katauskas Pty Ltd
Report No. 7676XS Figure No. 2


SECTION 4
SECTION 5
SECTION 6
R.L.m.
46
44
42
40
38
36
34
32
SOIL & EXTREMELY WEATHERED SHALE.
SHALE
SCREE SLOPE
45°-50°
32°
10°
30°
5°
32·8
33m.
12 10 8 6 4 2 0m.
6 4 2 0m.
Jeffery and Katauskas Pty Ltd
Report No. 7676XS Figure No. 3


SECTION 7
SECTION 8
SECTION 9
R.L. m.
SHALE
SOIL & EXTREMELY WEATHERED SHALE.
SCREE SLOPE
33.1m.
33.5m.
33.5m.
48
46
44
42
40
38
36
34
32
10 8 6 4 2 0m.
10 8 6 4 2 0m.
12 10 8 6 4 2 0m.
Jeffery and Katauskas Pty Ltd
Report No. 76765 Figure No. 4

Appendix 10 – Traffic Impact Assessment

MECONE



Traffic Impact Assessment

Tennyson Village, 2-12 and 14 Tennyson Road, Gladesville
Planning Proposal

traffix
traffic & transport planners

po box 1061
potts point nsw 1335
t: +61 2 8324 8700
f: +61 2 9380 4481
w: www.traffix.com.au
abn: 66065132961

Ref: 13.182r01v4 TRAFFIX Tennyson Village, Planning Proposal, Issue IV

Document Verification

Job Number:	13.182
Project:	Tennyson Village, 2-12 and 14 Tennyson Road, Gladesville - Planning Proposal
Client:	Darcsol Pty Ltd

Revision		Initials	Date	Signature
13.182r01v1 TRAFFIX Tennyson Village, Planning Proposal, Draft	Prepared by:	PT	8th Aug. 2013	
	Checked by:	GP	8th Aug. 2013	
	Approved by:	GP	8th Aug. 2013	
13.182r01v2 TRAFFIX Tennyson Village, Planning Proposal, Draft2	Prepared by:	JM	29th Aug. 2013	
	Checked by:	GP	29th Aug. 2013	
	Approved by:	GP	29th Aug. 2013	
13.182r01v3 TRAFFIX Tennyson Village, Planning Proposal, Issue III	Prepared by:	PT	16th Sep. 2013	
	Checked by:	GP	16th Sep. 2013	
	Approved by:	GP	16th Sep. 2013	
13.182r01v4 TRAFFIX Tennyson Village, Planning Proposal, Issue IV	Prepared by:	PT	9th Oct. 2013	
	Checked by:	PT	9th Oct. 2013	
	Approved by:	PT	9th Oct. 2013	

Contents

1. Introduction

TRAFFIX has been commissioned by Darcsol Pty Ltd to undertake a Traffic Impact Assessment (TIA) in support of a Planning Proposal for the proposed Tennyson Village development. The planning proposal seeks to rezone the light industrial site to mixed residential, commercial and retail uses with a view to accommodating growth in the region.

The site is located within the Ryde Council LGA and has been assessed under the relevant Council controls. This report documents the findings of our investigations and should be read in the context of the Planning Proposal, prepared separately by Mecone.

The objective of this report is to test the traffic impacts of the concept plan that has been adopted for assessment purposes. In this regard, further detailed investigations will be undertaken at the future development application stage, at which time changes to the land use mix and intensity would be reasonably expected.

The report is structured as follows:

- Section 2: Describes the site and its location;
- Section 3: Documents existing traffic conditions;
- Section 4: Describes the proposed development;
- Section 5: Discusses the parking requirements;
- Section 6: Assesses traffic impacts;
- Section 7: Discusses access and internal design aspects; and
- Section 8: Presents the overall study conclusions.

2. Location and Site

The site is located within the Gladesville business area and adjoins Gladesville Town Centre to the east and southeast of the site. It is located to the east side of Tennyson Road generally opposite Searle Street. The site currently comprises two separate Lots known as 2-12 Tennyson Road and 14 Tennyson Road. These Lots currently comprise light industrial, warehouse and commercial land uses with a total combined site area of 23,710m^2.

The site has an irregular configuration with a northern boundary of approximately 296 metres to a neighbouring commercial development, a southern boundary of approximately 169 metres to multiple residential developments, an eastern boundary of approximately 66 metres to multiple residential developments and a western frontage of approximately 140 metres to Tennyson Road.

There are currently two driveway crossings serving the site located immediately adjacent one another approximately 35 metres north of the Tennyson Road intersection with Potts Street. The northern driveway is 6.5 metres wide and currently serves the Lot 2-12 Tennyson Road and the southern driveway is 6.5 metres wide and serves the Lot 14 Tennyson Road.

A Location Plan is presented in **Figure 1**, with a Site Plan presented in **Figure 2**. Reference should also be made to the Photographic Record presented in **Appendix A**, which provides an appreciation of the general character of roads and other key attributes in proximity to the site.

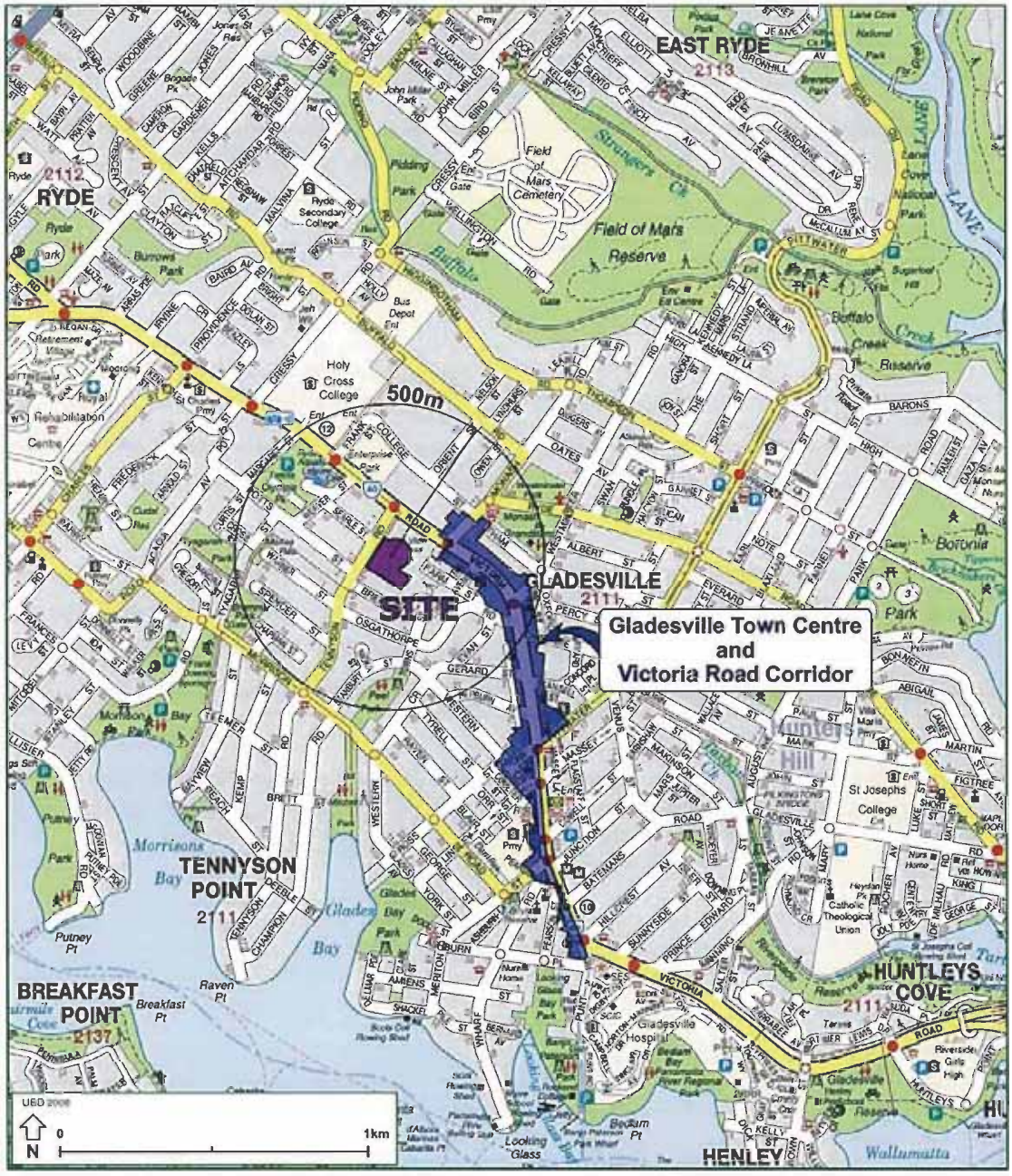


Figure 1: Location Plan

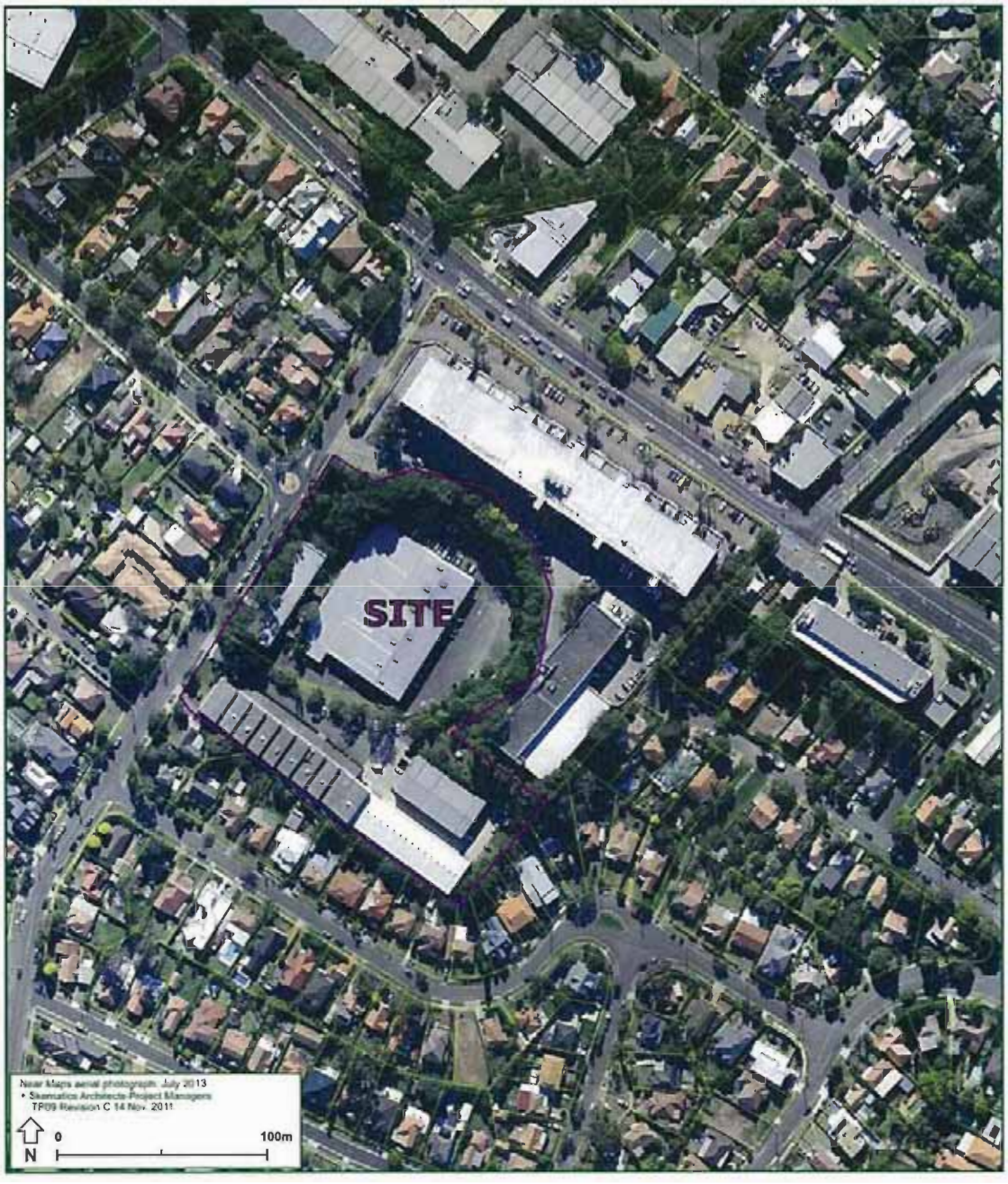


Figure 2 : Site Plan

3. Existing Traffic Conditions

3.1 Road Hierarchy

The road hierarchy in the locality is shown in **Figure 3** with the following roads of particular interest:

- Victoria Road: an RMS Main Road (MR 165) that generally runs in an east-west direction between Parramatta in the west and Pyrmont and the Western Distributor in the east. Victoria Road is subject to clearway restrictions and does not provide any on-street parking. In the vicinity of the site Victoria Road is subject to a 60km/h speed zoning and generally carries two lanes of traffic within a divided carriageway.

- Tennyson Road: a local collector road that generally runs in a north-south direction from Victoria Road in the north to its termination just to the south of its intersection with Champion Road. It generally permits unrestricted kerbside parallel parking and is subject to a 50km/h speed zoning. Tennyson Road carries a single lane of traffic in either direction along an undivided carriageway. Access to the subject site is provided via Tennyson Road.

- Searle Street: a local road that runs in an east-west direction between Tennyson Road in the east and Weaver Street in the west. Searle Street is subject to a 50km/h speed zoning and carries a single lane of traffic in either direction.

- Morrison Road: a local collector road that generally runs in an east-west direction between Church Street in the west and Pyrmont and Victoria Road in the east. Morrison Road intersects with Tennyson Road in the form of a roundabout about 500 metres southwest of the subject site. In the vicinity of the roundabout, Morrison Road is subject to a 50km/h speed zoning, carries two lanes of traffic (one in each direction) and provides unrestricted parking on both sides.

It can be seen from **Figure 3** that the site is conveniently located with respect to the arterial and local road systems serving the region, in particular the Victoria Road corridor to the north of the site and the

Morrison Road corridor to the south of the site. It is therefore able to effectively distribute traffic onto the wider road network, minimising traffic impacts.

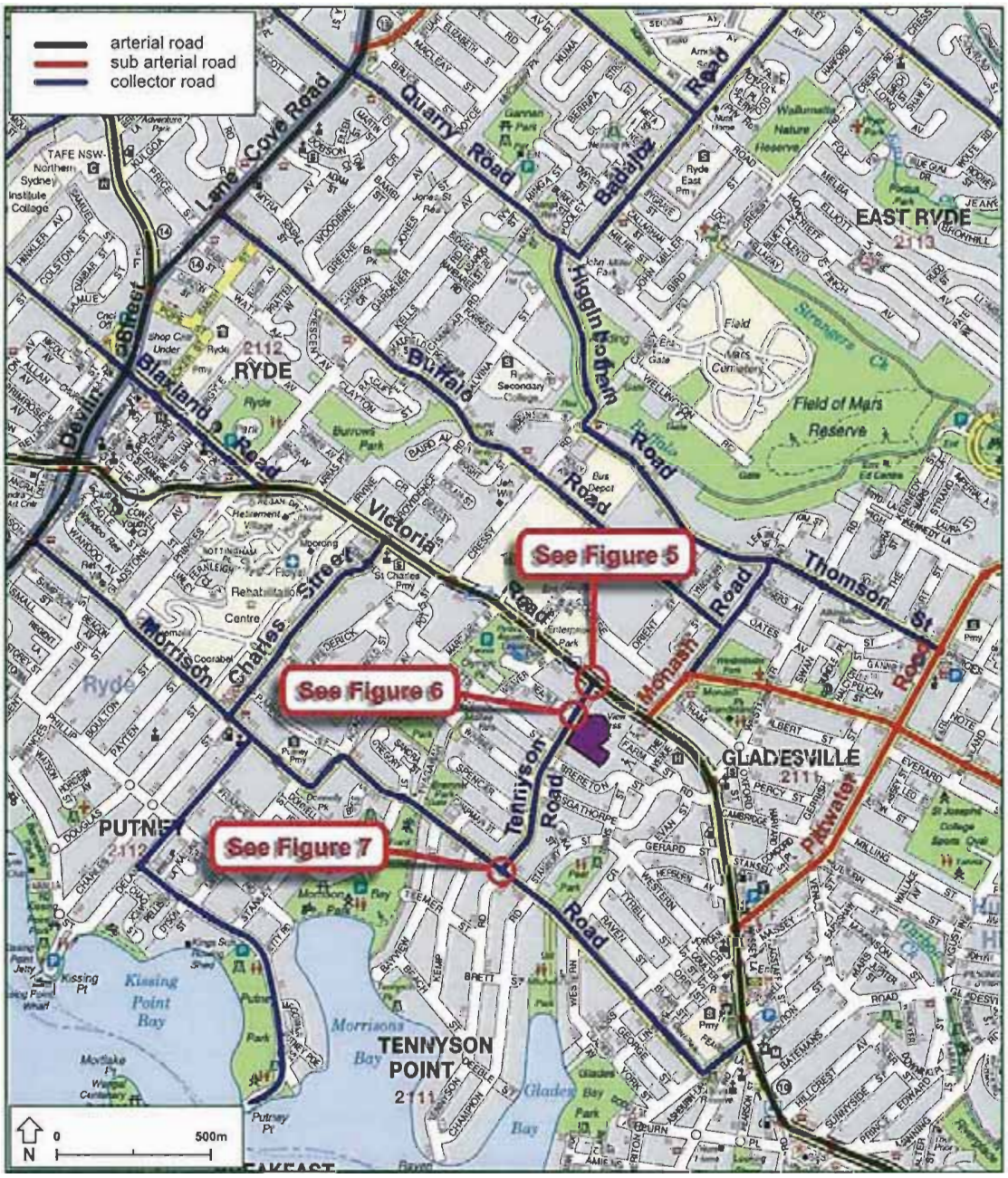


Figure 3: Surrounding Road Hierarchy

3.2 Public Transport

3.2.1 Bus Services

Numerous bus services operate along Victoria Road as shown on **Figure 4**. It is noteworthy that the target walking distance to bus stops is 400 metres. In this regard, two bus stops (one in each direction) are located within this 400 metre target walking distance as shown on Figure 4. Bus routes servicing these stops are summarised as follows:

- M52 – Metrobus Parramatta to Circular Quay via Drummoyne;
- x00,500 – Ryde to City;
- 501, 510, 515 – Ryde to City;
- 507, X18, 518 – Macquarie University to City;
- 520 – Parramatta to City via West Ryde.

The weekday frequencies of the more significant services are summarised in **Table 1**.

Table 1: Bus Service Frequencies

Route Number	via	AM Peak Hour	Off-Peak Hour	PM Peak Hour
M52	Victoria Road	12	8	12
X,00,500	Victoria Road	4	1	2
501	Victoria Road	7	3	3
510	Victoria Road	13	0	5
515	Victoria Road	2	2	2
X18,518	Victoria Road	4	2	2
520	Victoria Road	2	1	0

Table 1 shows that the site is well serviced by buses along Victoria Road, with (on average) more than one bus service every two (2) minutes during the morning peak hour.

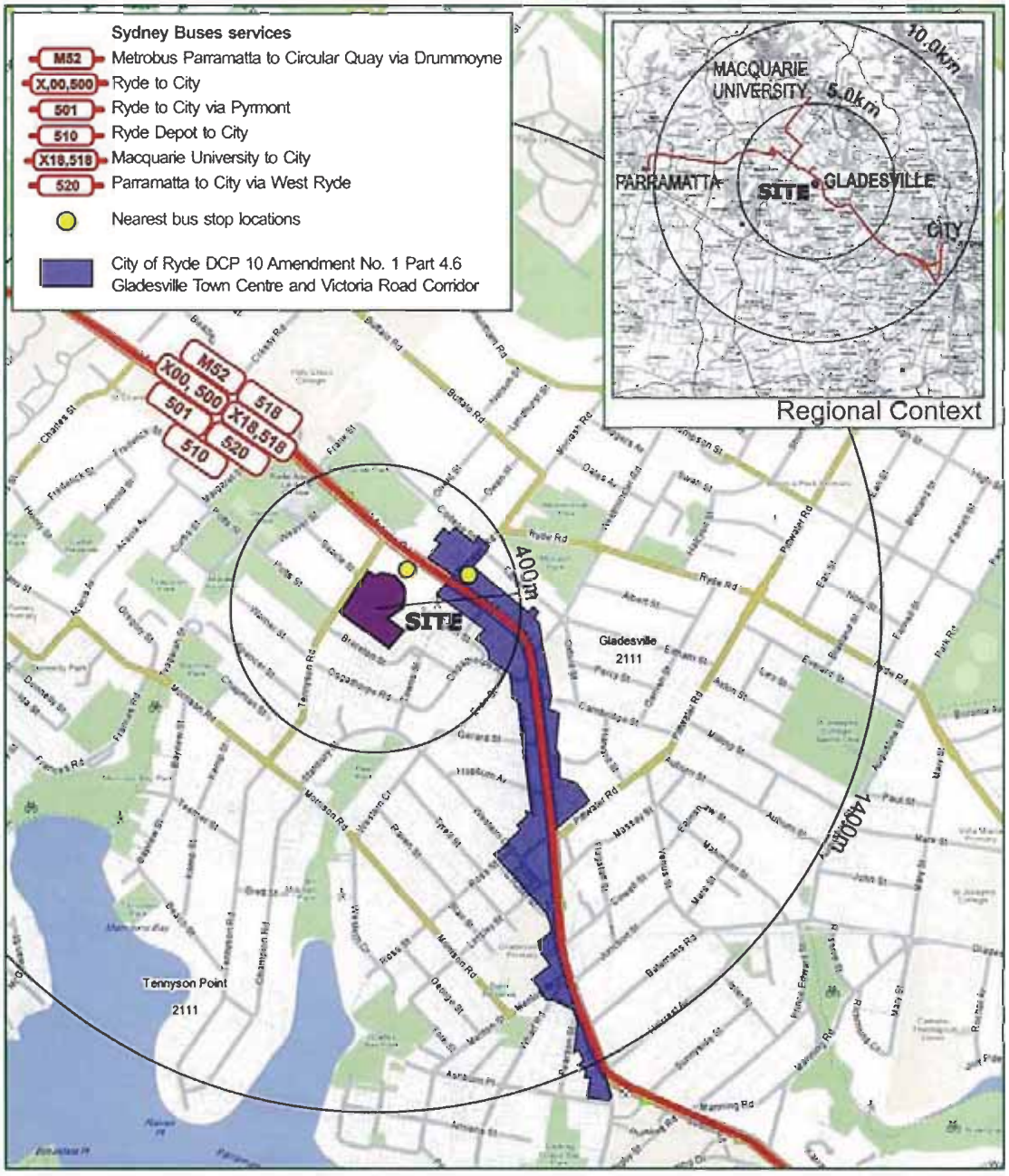


Figure 4 : Public Transport

3.3 Walking and Cycling

The site is located just on the outskirts of the Gladesville town centre footprint which itself is a growing retail and commercial centre. Its close proximity to the town centre means walking and cycling are viable forms of transport for commuting purposes. The nearest marked on-street cycling route is located to the south of the site along Morrison Road this links into the larger cycleway network providing routes to the Sydney CBD and Parramatta in the west. Footpaths are provided along both sides of Tennyson and Victoria Road providing safe pedestrian travel corridors.

3.4 Key Intersections

The key intersections in the vicinity of the site are shown below and provide an understanding of the existing road geometry and alignment:

Figure 5: Intersection of Victoria Road & Tennyson Road

It can be seen from **Figure 5** that Victoria Road carries two lanes of traffic in either direction and an additional bus lane in either direction in the vicinity of the site. Tennyson Road forms a 'T' intersection with Victoria Road, providing adequate sightlines in both directions. Pedestrian crossings are provided on all approaches except the Victoria Road east approach.

Figure 6: Intersection of Tennyson Road & Searle Street

It can be seen from **Figure 6** that Searle Street forms a roundabout intersection with Tennyson Road which is located immediately adjacent the subject site. Both Morrison Road and Tennyson Road carry a single lane of traffic in either direction.

Figure 7: Intersection of Tennyson Road & Morrison Road

It can be seen from **Figure 7** that Morrison Road forms a roundabout intersection with Tennyson Road which is located approximately 450 metres from the subject site. It is evident from the above figure that both Morrison and Tennyson Road carry a single lane of traffic in either direction.

3.5 Existing Intersection Performances

It is generally agreed that the 'critical' peak hour for developments with significant retail components is the evening peak hour as this is when the retail uses are busiest. This is supported by preliminary traffic generation analysis for the Tennyson Village development which indicates that the morning peak hour would generate only one-third of the traffic volumes anticipated for the evening peak hour. Therefore, the traffic generation analysis within this report focuses on the evening peak hour.

For the purposes of assessing the traffic impacts of the proposed rezoning, traffic surveys were undertaken at the following intersections during a typical evening peak period:

- The signalised intersection of Victoria Road with Tennyson Road;
- The roundabout intersection of Tennyson Road with Searle Street; and
- The existing site accesses to 2-12 Tennyson Road and 14 Tennyson Road.
- The priority controlled roundabout intersection of Tennyson Road with Morrison Road.

The surveyed traffic flows are presented in **Figure 8**. These turning counts were analysed using the SIDRA computer program to determine their performance characteristics under existing traffic conditions. The SIDRA model produces a range of outputs, the most useful of which are the Degree of Saturation (DOS) and Average Vehicle Delay per vehicle (AVD). The AVD is in turn related to a level of service (LOS) criteria. These performance measures can be interpreted using the following explanations:

DOS – the DOS is a measure of the operational performance of individual intersections. As both queue length and delay increase rapidly as DOS approaches 1, it is usual to attempt to keep DOS to less than 0.9. When DOS exceeds 0.9 residual queues can be anticipated, as occurs at many major intersections throughout the metropolitan area during peak periods. In this regard, a practical limit at 1.1 can be assumed. For intersections controlled by roundabout or give way/stop control, satisfactory intersection operation is generally indicated by a DOS of 0.8 or less.

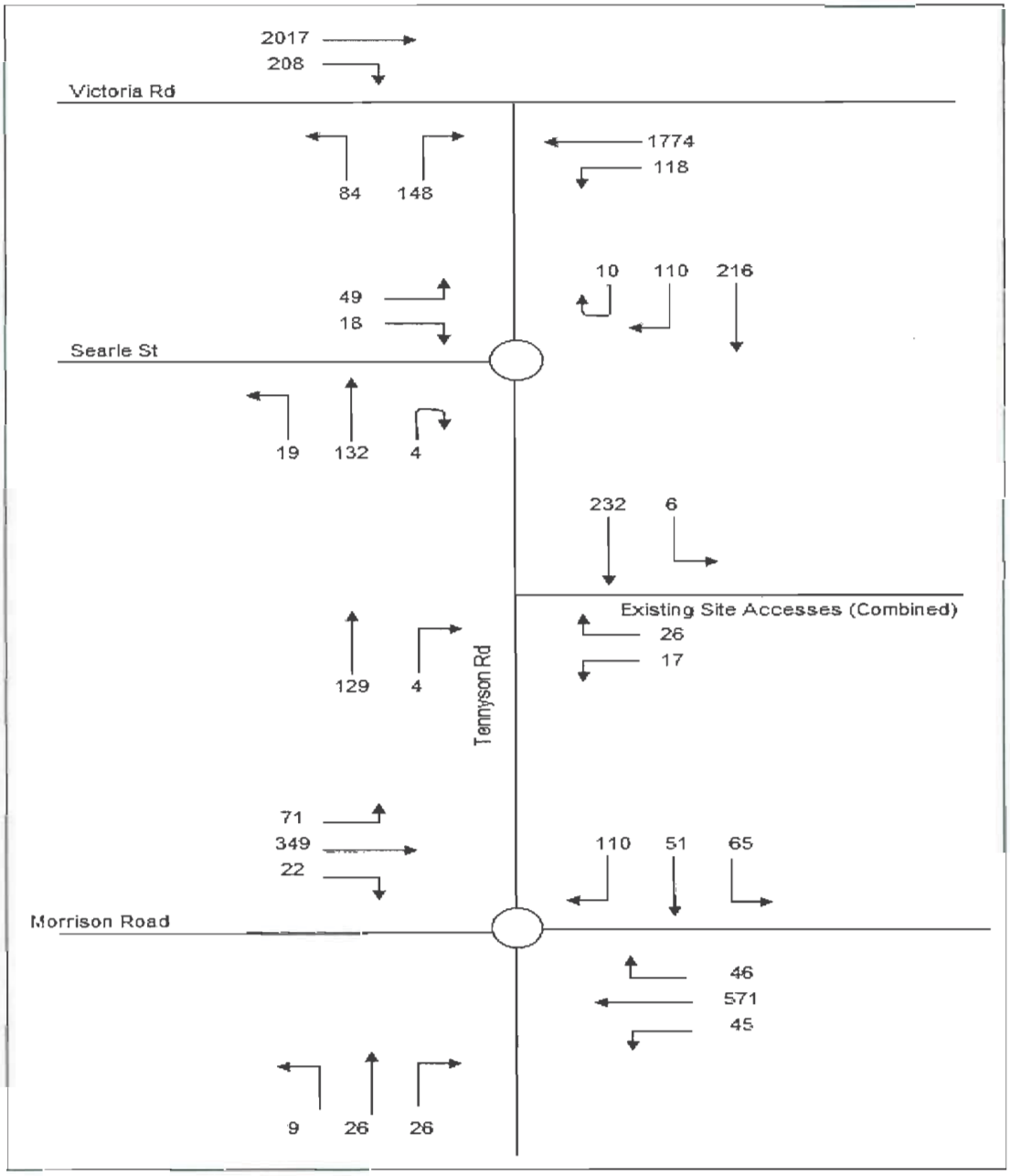


Figure 8: Existing Surveyed Traffic Counts

AVD – the AVD for individual intersections provides a measure of the operational performance of an intersection. In general, levels of acceptability of AVD for individual intersections depend on the time of day (motorists generally accept higher delays during peak commuter periods) and the road system being modelled (motorists are more likely to accept longer delays on side streets than on the main road system).

LOS – this is a comparative measure which provides an indication of the operating performance of an intersection as shown below:

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode	At capacity and requires other control mode
F	More than 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires other control mode or major treatment.

A summary of the modelled results are provided in **Table 2**. Reference should also be made to the SIDRA outputs attached at **Appendix B** which provide detailed results for all approaches.

Table 2: Existing Intersection Performance

Intersection Description	Control Type	Degree of Saturation (DOS)	Average Delay (sec)	Level of Service
Victoria Rd x Tennyson Rd	Signalised	0.786	8.8	A
Tennyson Rd x Searle St	Roundabout	0.239	9.8	A
Tennyson Rd x Morrison Rd	Roundabout	0.620	13.3	A

The results in Table 2 show that in terms of delays, all intersections currently operate well with a Level of Service of A.

However, it is noteworthy that in addition to delays, the other main consideration of RMS at signalised intersections on main arterial corridors (such as Victoria Road) is queuing on right-turn movements. Accordingly, **Table 3** presents the detailed SIDRA lane results for the two right-turn movements at the signalised intersection of Victoria Road with Tennyson Road.

Table 3: Victoria Rd with Tennyson Rd, Existing Operation – Detailed Lane Results

Approach	Lane	95th Percentile Queue (m)	Queue Storage (m)	Queue > Storage (Yes/No)	Probability of Blocking (%)
Tennyson Rd (S)	Right-turn	78.2	105	No	-
Victoria Rd (W)	Right-turn	96.4	70	Yes	34.1

It can be seen from Table 3 that the right-turn movement from Victoria Road currently experiences queuing issues that result in queues extending out of the existing 70 metre right-turn bay in to the eastbound through traffic lanes.

3.6 Existing Site Traffic Generation

The survey results presented in Figure 8 show that a total of 57 vehicle movements were recorded at the existing site accesses to 2-12 Tennyson Road and 14 Tennyson Road during the surveyed evening peak hour.

3.7 Committed Future Baseline with Approved Bunnings Development

It is understood that the site located at 461 – 495 Victoria Road, referred to as the Enterprise Park, is to have a Bunnings 'Large Format Retail' store developed on the site. Part of this proposal includes the introduction of a northern approach to the existing signalised intersection of Victoria Road with Tennyson Road to provide access to the Bunnings store.

To assess the impacts of the Bunnings proposal, relevant data has been extracted from the Transport and Traffic Planning Associates (TTPA) report, *Proposed Rezoning for Bulky Goods Development, Victoria Road, Gladesville – Assessment of Traffic and Parking Implications* (Revision B, June 2012). **Figure 9** shows the forecast traffic volumes following completion of the Bunnings store.

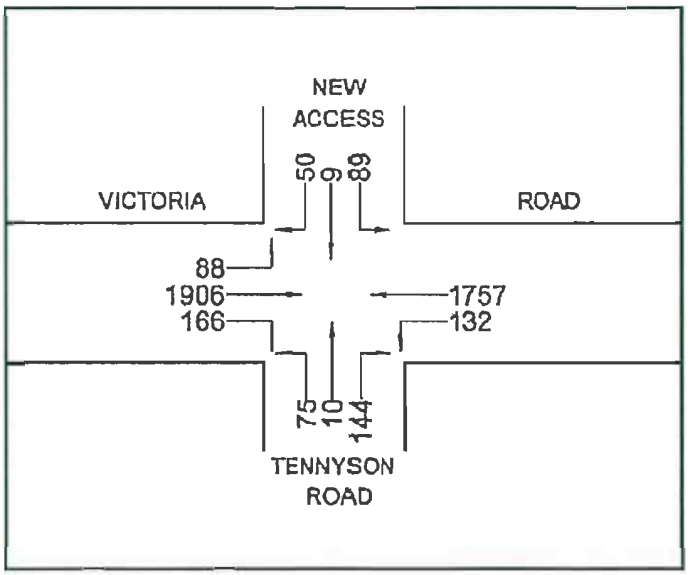


Figure 9: Future Committed (with Bunnings) Evening Peak Hour Traffic Flows

In addition, relevant plans have been extracted from the report, which show the proposed modifications to the intersection of Victoria Road with Tennyson Road, comprising:

- Dedication and road widening along the northern side of Victoria Road;
- Provision of continuous BUS LANES along both sides of Victoria Road;
- Extended right turn lane into Tennyson Road (from 70 metres to about 105 metres);
- Provision of an access road connecting at the Tennyson Road intersection; and
- Modification of the intersection signals.

Copies of these plans are attached at **Appendix C**.

The above forecasted traffic volumes at the proposed intersection of Victoria Road with Tennyson Road and the new Bunnings site access have been modelled using SIDRA. A summary of the modelled results are provided in **Table 4**. Reference should also be made to the SIDRA outputs attached at Appendix B which provide detailed results for all approaches.

Table 4: Future Committed (with Bunnings) Intersection Performance

Intersection Description	Control Type	Degree of Saturation (DOS)	Average Delay (sec)	Level of Service
Victoria Rd x Tennyson Rd x Bunnings Access	Signalised	0.971	35.9	C

The results in Table 4 show that in terms of delays, the proposed intersection is forecast to operate satisfactorily with a Level of Service of C. It is noteworthy that the TTPA study that supported the Bunnings proposal tested the Victoria Road intersection with Tennyson Road using SCATES modelling software; thereby, assessing the intersection as part of a network including the Victoria Road intersections with Frank Street to the west and the intersection with Monash Road to the east. The modelling of the evening peak hour (based on the exact same traffic flows and future road geometry assessed by the SIDRA modelling above) returned results of an average delay of 17.2 seconds per vehicle equating to a Level of Service of B.

It is noted that whilst SIDRA-5 assessment (the software used for this study) makes some allowance for coordination, the software essentially models the performance of an intersection in isolation; whilst software (like SCATES) takes a more realistic account of the benefits of coordination. Accordingly, the SCATES results are preferred and an assessment based on SIDRA would provide a very conservative assessment. In this context, the SIDRA analysis within this report similarly results in a conservative assessment and may be regarded as a worst case scenario.

With regard to queuing of right-turn movements, **Table 5** presents the detailed SIDRA lane results for the three right-turn movements at the proposed signalised intersection of Victoria Road with Tennyson Road and the Bunnings site access.

Table 5: Victoria Rd with Tennyson Rd (with Bunnings) – Detailed Lane Results

Approach	Lane	95th Percentile Queue (m)	Queue Storage (m)	Queue > Storage (Yes/No)	Probability of Blocking (%)
Tennyson Rd (S)	Right-turn	90.9	105	No	-
Bunnings Access (N)	Right-turn	25.1	100	No	-
Victoria Rd (W)	Right-turn	114.0	105	Yes	12.4

The analysis indicates that right-turn queuing on Tennyson Road and the new Bunnings site access would be accommodated within the available storage. However, queues extending out of the right-turn bay to Tennyson Road are still forecast to occur. In this regard, it is noteworthy that the SIDRA modelling of the existing 2013 traffic conditions indicate that queuing out the right-turn bay exceeds available queue storage by 26.4 metres and blocks the adjacent eastbound through traffic lane 34.1% of the peak hour. By comparison, the approved extension of the right-turn bay by 35 metres from 70 metres to 105 metres would reduce the queue 'overflow' to just nine (9) metres and reduce the incidence of blocking to 12.4%.

In summary, the approved improvements maintain a satisfactory performance level at the intersection of Victoria Road with Tennyson Road and the extension of the right-turn bay improves current queuing issues with this movement.

4. Description of Proposed Development

4.1 Development Schedule

Approval from Ryde Council is sought for the rezoning of the 'Tennyson Village' precinct from light industrial to mixed use zoning. The application will require an amendment to Ryde LEP 2010. A detailed description of the proposal is provided in the Planning Proposal prepared separately by Mecone. The key aspects are summarised below:

- To rezone the land from light industrial to mixed residential, commercial and retail uses.
- To establish for site 2-12 Tennyson Road a mixed use development comprising:
  - 269 residential units, consisting of:
    - 45 one-bed units;
    - 224 two-bed units;
  - 5,800m^2 of Retail Gross Floor Area (GFA) providing supermarket, mini-major and specialty retail and equating to about;
    - 4,640m^2 of Retail Gross Leasable Floor Area (GLFA);
  - 200m^2 of Commercial (office) GFA;
  - 300m^2 of Community Use GFA, proposed for use as a
    - 60-place Child Care Centre with 6 staff;
- To establish for site 14 Tennyson Road a mixed use development comprising:
  - 400m^2 of Retail/Commercial GFA; assumed
    - 200m^2 of retail GFA (160m^2 GLFA); and
    - 200m^2 commercial GFA;

- 149 Seniors Housing units (providing 245 beds), consisting of:
  - 20 studio units
  - 51 one-bed units;
  - 60 two-bed units; and
  - 18 three-bed units.

The proposal is shown indicatively in **Figure 10**. Reference should also be made to the architectural plans issued separately and attached to this report at reduced scale in **Appendix D**.

Figure 10: Proposed Tennyson Village Development

4.2 Vehicular Access

The proposed site access arrangement has been based on the two-Lot site being developed in one stage. Under this scenario, two accesses would be constructed; these would be defined as follows:

- Northern Site Access – consisting of a new fourth arm on to the existing roundabout of Tennyson Road with Searle Street, this direct access in to 2-12 Tennyson Road would provide access solely to the residential car park for the 269 dwellings proposed on the site;
- Southern Site Access – connecting to the road network via a priority (Give Way) T-intersection with Tennyson Road, this access would be located generally on the boundary of Lot 2-12 and Lot 14 Tennyson Road and would provide access to the car parks for all the remaining development within the combined site.

An alternative access arrangement has also been developed should the two Lots be developed independently. Under this scenario the northern access would remain generally as it is proposed above; however, the southern access would be split in to two accesses, one to provide access for the remaining development on the 2-12 Tennyson Road Lot and another to provide access to all development proposed for the 14 Tennyson Road Lot. These two accesses would be generally in the same location as the existing site accesses.

5. Parking Requirement

All car parking is to be provided in accordance with Ryde Council's draft Development Control Plan (DCP) 2011, which is currently on exhibition. It is noteworthy that with regard to the subject land uses, the draft rates are consistent with the rates in the adopted DCP 2010.

In summary, the proposed parking provision would be 667 – 752 parking spaces comprising the following:

- 283 – 368 Residential parking spaces for 269 units, consisting of:
  - 27 – 45 spaces for one-bed units (45 units @ 0.6 – 1.0 spaces per unit);
  - 202 – 269 spaces for two-bed units (224 units @ 0.9 – 1.2 spaces per unit);
  - 54 spaces for visitors (269 units @ 1.0 space per 5 units);
- 240 Retail parking spaces ($6,000m^2$ GFA @ 1.0 space per $25m^2$ GFA);
- 10 Commercial parking spaces ($400m^2$ GFA @ 1.0 space per $40m^2$ GFA);
- 11 Child Care Centre parking spaces, consisting of:
  - 8 spaces for drop-off/collection (60 children @ 1.0 spaces per child);
  - 3 spaces for staff (6 staff @ 1.0 spaces per 2 staff);
- 123 Senior Housing parking spaces (245 beds @ 0.5 spaces per bed).

Within the context of the separate accesses, the amount of parking that would be accessed via the northern site access and the southern site access would be as follows:

- Northern Site Access car park – 283 - 368 parking spaces for residential use; and
- Southern Site Access car park – 384 parking spaces.

6. Traffic Impacts

6.1 Trip Generation

6.1.1 RMS Guide to Traffic Generating Developments – Updated Traffic Surveys

The Roads & Maritime Services (RMS) *Guide to Traffic Generating Developments* was first released in 1991. It provides guidance on a number of matters that relate to traffic impacts, in particular, advice on traffic generation and parking demand. The guide was revised in 2001 and it is currently in the process of further revisions with a view to providing advice that reflects current travel characteristics.

As part of this latest revision process, in May 2013 RMS released Technical Direction TDT 2013/04, which provided revised trip generation advice for a number of land uses based on survey data obtained since 2009. TDT 2013/04 consists of two parts: an initial summary of the results presenting average trip rates and tables summarising the raw survey data.

Except for the proposed Child Care Centre, the land uses covered by TDT 2013/04 include all the land uses proposed for the subject planning proposal. Accordingly, the following traffic generation assumptions have been largely developed on the basis of this data with a view to providing traffic generation forecasts that are based on current advice and therefore better reflect what can be anticipated under present day travel conditions.

As previously mentioned, it is generally agreed that the 'critical' peak hour for developments with significant retail components is the evening peak hour as this is when the retail uses are busiest. This is supported by preliminary traffic generation analysis for the Tennyson Village development which indicates that the morning peak hour would generate only one-third of the traffic volumes anticipated for the evening peak hour. Therefore, the following traffic generation analysis focuses on the evening peak hour.

6.1.2 Residential, Commercial and Senior Housing Trip Generation

The following presents the traffic generation forecasts for the above uses based on the current advice from TDT 2013/04.

- 40 Residential trips (269 units @ 0.15 trips per unit)
  (Based on the Sydney average evening peak hour trip rate for high density residential flat dwellings)
- 5 Commercial trips (400m^2 GFA @ 1.2 trips per 100m^2 GFA)
- 21 Senior Housing trips (149 units @ 0.14 trips per unit);
  (Based on the Sydney Metropolitan Area – average evening network peak hour trip rate derived from the survey data tables)

6.1.3 Child Care Centre Trip Generation

The following presents the evening peak hour traffic generation forecast for the Child Care Centre based on the advice for the October 2002, Version 2.2 of the RMS *Guide to Traffic Generating Development*.

- 21 Child Care Centre trips (60 children @ 0.35 trips per child)

6.1.4 Retail Trip Generation

6.1.4.1 Parking Turnover Calculation based on TDT 2013/04

Recognising that the subject development would provide supermarket, mini-major and specialty retail uses, the overall retail area of 6,000m^2 would effectively function as a small shopping centre. However, the Sydney metropolitan shopping centre surveys that informed the revised trips rates in TDT 2013/04 were all of centres significantly larger than that proposed, ranging from about 22,000m^2 to above 90,000m^2.

In order to use the current data, a parking space trip rate has been developed, using the information from the survey data tables. This rate has in turn been applied to the proposed retail parking provision of 240 parking spaces based on Council's DCP requirements. A summary assessment of the table data indicated that the shopping centres on average generated 0.84 trips per parking space. However, it is recognised that parking turnover decreases as shopping centre size increases as patrons spend more time at larger centres and a shorter time at smaller centres.

Therefore, to account for the smaller size of the proposed retail centre, a linear regression model was developed which forecast the likely parking space trip rate for a retail centre with a GFA of 6,000m^2 (equivalent about 4,800m^2 of GLFA, noting that RMS data present the scale of the surveyed centres in GLFA). The model is presented graphically in **Figure 11**; the model predicts that the subject retail centre would generate traffic at 1.27 trips per parking space.

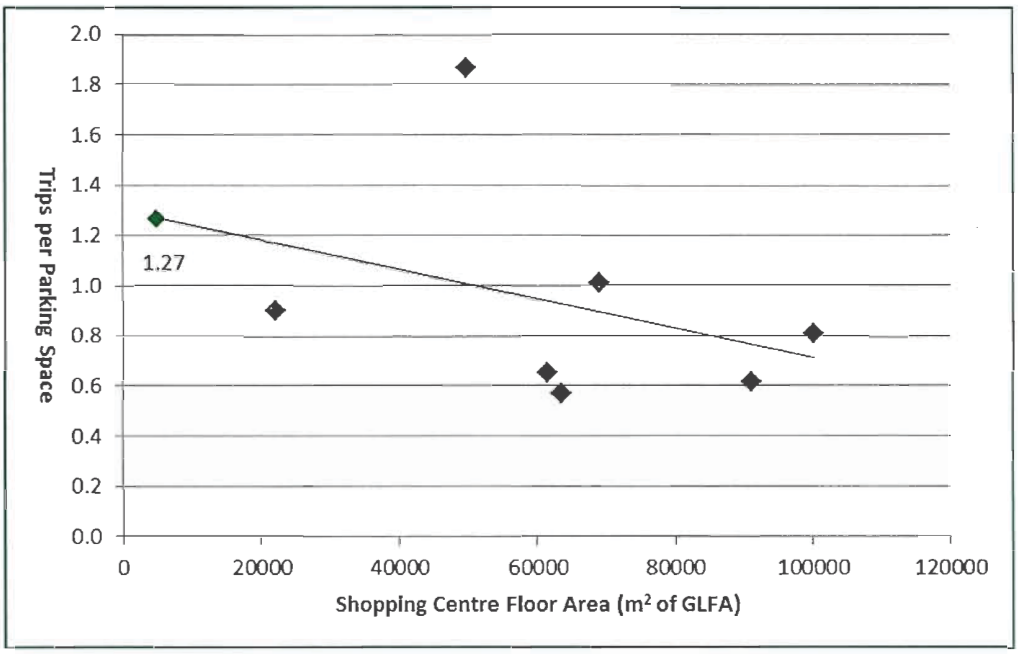


Figure 11: Parking Space Trip Rate Regression Model

The following presents the evening peak hour traffic generation forecast for the retail land uses adopting the parking space trip rate developed above, based on the current TDT 2013/04 data.

- 305 Retail trips (240 parking spaces @ 1.27 trips per space)

6.1.4.2 Multi-Purpose Trips

A multi-purpose trip is a trip where more than one shop or facility (such as the Child Care Centre in the subject case) is visited. RMS guidance recommends a multi-purpose trip factor of 20%, which would equate to 61 trips. In summary, the analysis indicates that the retail use generates overall on average five (5) trips per minute (i.e. 305 trips per peak hour); however, one (1) of these trips (per

minute) would also have visited the other developments within Tennyson Village (the child care centre, offices, senior housing or residential building). This assumption is considered reasonable and therefore whilst 305 trips would be generated internal to the site by the retail uses, this would equate to just 244 retail trips at the site access and on the surrounding road network.

6.1.4.3 Linked Trips

A linked (or 'pass-by') trip is a trip taken as a 'side-track' from another trip, for example, a person visiting the retail centre on their commute home. Standard practise is to assume a linked trip proportion of 20%, which again equates to 61 trips. It is noteworthy that as opposed to multi-purpose trips, linked trips are not fully deducted from the surrounding network, but rather provide a 50% 'discount' at the junction where the existing trip side-tracks to the site from its present course. In other words, whilst all visits to the retail centre (including linked) consist of two (2) trips on the surrounding road network (one arrival trip and one departure trip) a linked trip occurs at the expense of one existing (usually passing) trip. Therefore, at the junction where the side-track occurs, the net increase in traffic is just one (1) trip.

Linked trips are drawn predominantly from traffic passing directly adjacent to the site, Tennyson Road in the case of the subject site. However, having consideration for its proximity to the site and the volume of traffic it carries, it is likely that linked trips would also be drawn from Victoria Road. For the purpose of this study it is assumed that linked trips would be drawn equally from existing traffic on Tennyson Road and Victoria Road.

6.1.4.4 Summary of Retail Trip Generation

In summary, the retail component of the Tennyson Village development is forecast to have the following traffic generation characteristics:

- 305 retail trips based on the likely turnover of retail parking spaces;
- 244 new retail trips on the surrounding road network accounting for the retail trips that will be drawn from traffic visiting other developments within the overall site; and
- 61 retail trips to be drawn from existing traffic on Tennyson Road and Victoria Road.

6.1.5 Summary of Tennyson Village Traffic Generation

In summary, the Tennyson Village development is forecast to have the following traffic generation characteristics:

- 392 total trips;
- 331 new trips on the surrounding road network accounting for the retail trips that would be drawn from traffic visiting other developments within the overall site; and
- 61 trips to be drawn from existing traffic on Tennyson Road and Victoria Road.

Therefore, the above analysis indicates that the Tennyson Village development would generate up to 331 new trips on the surrounding road network. More importantly, accounting for the existing peak hour traffic generation of 53 trips for the subject site under its current light industrial use, it can be determined that the proposed Tennyson Village would generate:

- 278 net additional trips on the surrounding road network.

6.2 Arrival - Departure Splits and Trip Distribution

The split between arrival and departure traffic for proposed land uses on site are shown below:

278 total trips	**167 inbound trips**	**111 outbound trips**
• 40 Residential trips	32 inbound trips (80%)	8 outbound trips (20%)
• 5 Commercial trips	1 inbound trips (20%)	5 outbound trips (80%)
• 21 Senior Housing trips	13 inbound trips (60%)	8 outbound trips (40%)
• 21 Child Care Centre trips	10 inbound trips (50%)	11 outbound trips (50%)
• 244 Retail trips	122 inbound trips (50%)	122 outbound trips (50%)
• (-) 53 existing trips	(-) 11 inbound trips	(-) 42 outbound trips

Within the context of the separate accesses (and recognising that the above accounts for the existing traffic generated by the combined site), the forecasted additional traffic volumes using the northern site access and the southern site access would be as follows:

- Northern Site Access:
  - 40 total trips 32 inbound trips 8 outbound trips
- Southern Site Access:
  - 238 total trips 135 inbound trips 103 outbound trips

6.3 Traffic Distribution

As previously mentioned (and with reference to Figure 3), the subject site is conveniently located with respect to the arterial and local road systems serving the region, in particular the Victoria Road corridor to the north of the site and the Morrison Road corridor to the south of the site. Having regard for these two corridors and consideration for the majority of arrivals to the site arriving from the east (city direction) and departing to the west, the following traffic distribution assumptions have been applied to the development traffic:

- 60% to/from the Victoria Road corridor: consisting of:
  - 20% from and 40% to Victoria Road West;
  - 40% from and 20% to Victoria Road East; and
- 40% to/from the Morrison Road corridor all of which would use Tennyson Road.

Application of this traffic distribution to the traffic generation assumptions above, results in the development traffic network demand flows presented in **Figure 12**, which includes the linked trips that would be drawn from passing traffic on Tennyson Road and Victoria Road. It is noteworthy that the network plan shown includes the proposed access to the committed Bunnings development.

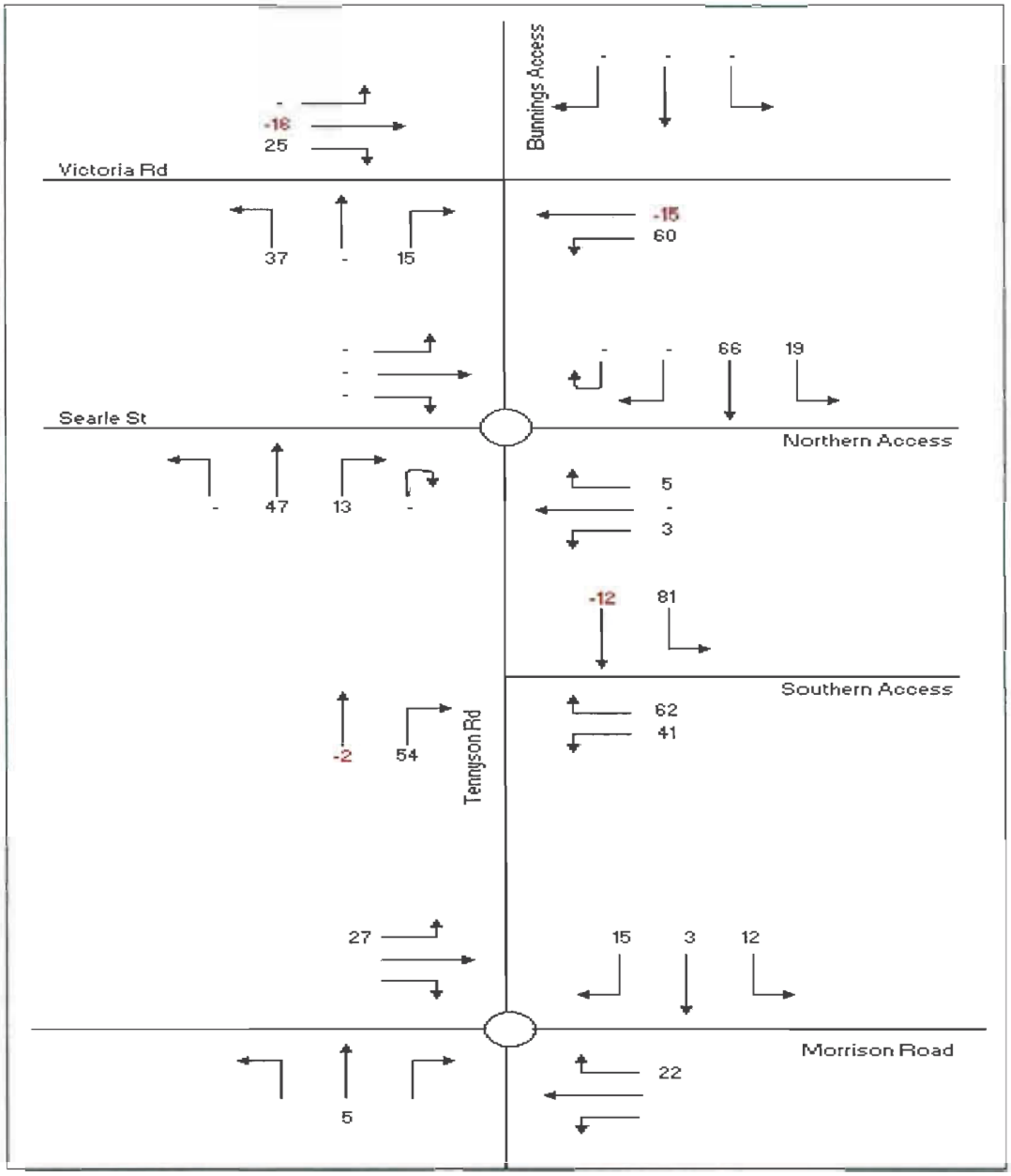


Figure 12: Net Subject Development Traffic Flows

6.4 Future Network Performance

Forecast future traffic volumes for the study network have been derived from the existing 2013 traffic flow data, the traffic flow data from the TTPA study (to account for the Bunnings proposal) and the subject development traffic flows presented in Figure 12. The resulting future traffic flows are presented in **Figure 13**.

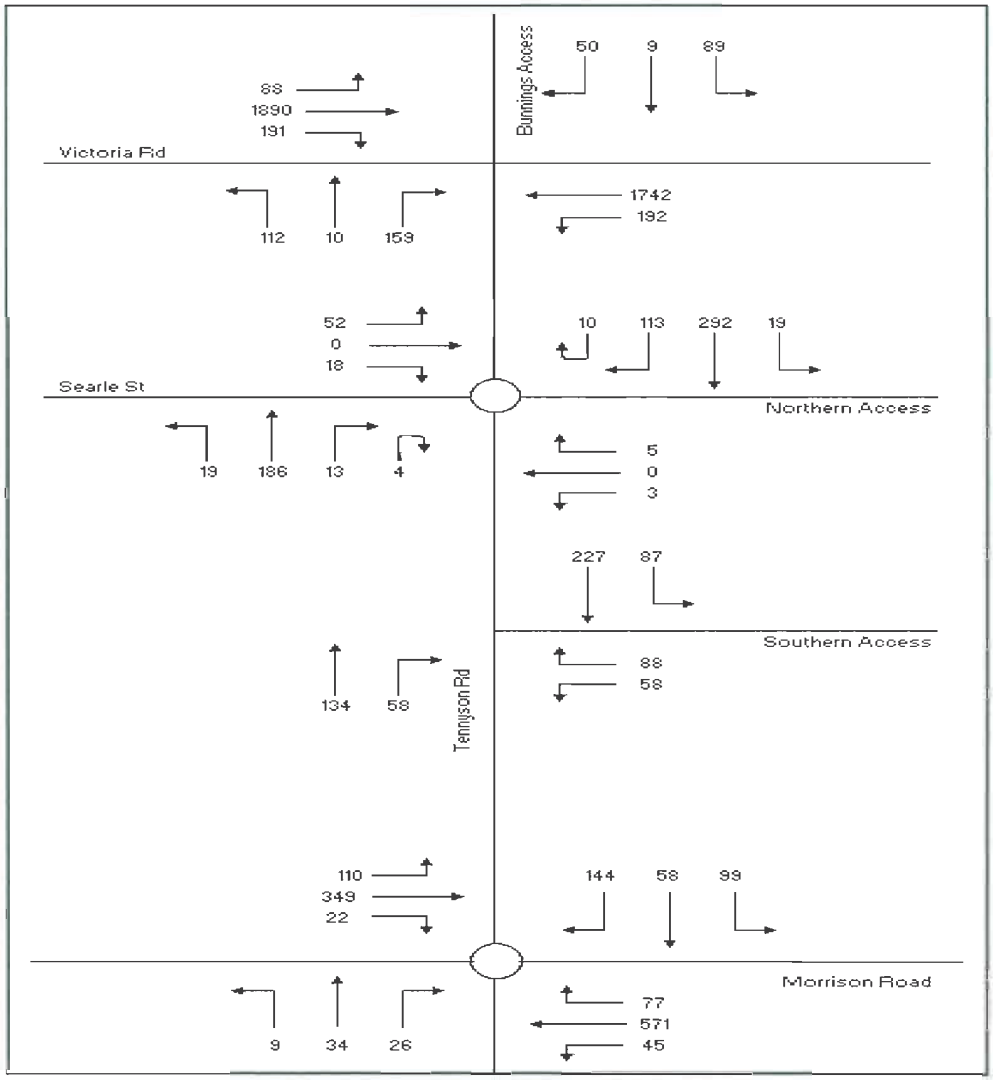


Figure 13: Future (with Subject Development) Evening Peak Hour Traffic Flows

The above forecasted traffic volumes have been modelled using SIDRA. A summary of the modelled results are provided in **Table 6**. Reference should also be made to the SIDRA outputs provided in Appendix B which provide detailed results of all approaches.

Table 6: Future (with Subject Development) Intersection Performance

Intersection Description	Scenario	Degree of Saturation (DOS)	Average Delay (sec)	Level of Service
Victoria Rd x Tennyson Rd x Bunnings Access	Future Committed	0.971	35.9	C
	With Development	**1.045**	**55.8**	**D**
Tennyson Rd x Searle St	2013 Existing	0.239	9.8	A
	With Development	**0.319**	**11.5**	**A**
Tennyson Rd x Southern Site Access	2013 Existing	-	-	-
	With Development	**0.275**	**11.6**	**A**
Tennyson Rd x Morrison Rd	2013 Existing	0.620	13.3	A
	With Development	**0.686**	**14.1**	**A**

Where relevant, the results in Table 6 include the results of the 2013 existing or future committed (with Bunnings) SIDRA analysis results. The results show that the proposed Tennyson Road roundabout with Searle Street and the northern site access would continue to operate well with a Level of Service of A. The modelling results for Tennyson Road with Morrison Road demonstrate that the intersection will continue to operate at Level of Service A in the future scenario also. In addition, the proposed southern site access intersection with Tennyson Road is also anticipated to operate well with a Level of Service of A.

The intersection of Victoria Road with Tennyson Road is anticipated to operate during the evening peak hour with a Level of Service of D. This indicates that the proposed intersection would operate with some spare capacity under these forecast future conditions. However, as stated earlier, the SIDRA analysis within this report should be considered a worst case scenario and whilst it indicates acceptable performance, it is recommended that future traffic modelling associated with subsequent development applications use software that accounts for coordination benefits, which (in all likelihood) would return a Level of Service that is an improvement upon the D above.

With regard to queuing of right-turn movements, **Table 7** presents the detailed SIDRA lane results for the three right-turn movements at the proposed signalised intersection of Victoria Road with Tennyson Road and the Bunnings site access.

Table 7: Victoria Rd with Tennyson Rd (with Subject Development) – Detailed Lane Results

Right-turn Movement	Scenario	95th Percentile Queue (m)	Queue Storage (m)	Queue > Storage (Yes/No)	Probability of Blocking (%)
Tennyson Rd (S)	2013 Existing	78.2	110	No	-
	Future Committed	90.9	110	No	-
	With Development	**107.9**	**110**	No	-
Bunnings Access (N)	2013 Existing	-	-	-	-
	Future Committed	25.1	100	No	-
	With Development	**24.0**	**100**	No	-
Victoria Rd (W)	2013 Existing	96.4	70	Yes	34.1
	Future Committed	114.0	105	Yes	12.4
	With Development	**138.6**	**105**	Yes	**30.3**

Where relevant, the results in Table 7 include the results of the 2013 existing and future committed (with Bunnings) SIDRA analysis results. The results indicate that for the Tennyson Road and Bunnings access approaches, the right-turn queuing would be accommodated within the available storage for all scenarios assessed. However, the results also indicate that queuing on the right-turn to Tennyson Road from Victoria Road would continue to extend out of the turn bay. In this regard, whilst the 'overflow' queue forecast for the 'with development' scenario is expected to be about 33.6 metres (compared with 26.4 metres under the 2013 existing scenario and 9 metres for the 'with Bunnings' scenario), the probability of queues extending out of the turn-bay is less than the probability indicated for present day operation (30.3% versus 34.1%).

In summary, the intersection following development of the subject site is forecast to operate with acceptable delays and queuing issues on the right-turn movement from Victoria Road to Tennyson Road is anticipated to remain generally unchanged from current conditions.

7. Access & Internal Design

7.1 Access Requirements

7.1.1 Northern Access

The Northern Access would provide a connection to the northern car park for the residential uses on the 2-12 Tennyson Road Lot. This car park would provide up to 368 parking spaces. The proposed access requires a Category 3 Driveway under AS2890.1 (2004), providing an entry driveway of width 6.0 metres, an exit driveway of width 4.0 to 6.0 metres and a median separation of 1.0 to 3.0 metres. In response, the development will provide a driveway with access to Tennyson Road which would satisfy the minimum requirements of AS2890.1.

7.1.2 Southern Access

The Southern Access would provide a connection to the southern car parks for retail, commercial, child care and senior housing uses, accommodating 384 parking spaces. The proposed access requires a Category 4 Driveway under AS2890.1, providing an entry driveway of width 6.0 to 8.0 metres, an exit driveway of width 6.0 to 8.0 metres and a median separation of 1.0 to 3.0 metres. In response, the development will provide a driveway with access to Tennyson Road which would satisfy the minimum requirements of AS2890.1.

7.2 Internal Road Design

7.2.1 Relevant Australian Standards

The internal basement car park will be designed in accordance with the Australian Standard requirements of AS2890.1 (2004) *Part 1: Off-street car parking*, AS2890.2 (2002) *Part 2: Off-street commercial vehicle facilities,* AS2890.6 (2009) *Part 6: Off-street parking for people with disabilities* and AS4299 (1995) *Adaptable housing*. The following characteristics are noteworthy:

7.2.2 Parking Modules

- All residential and senior housing parking spaces would be designed in accordance with a Class 1A user and provided with a minimum space length of 5.4m a minimum width of 2.4m and a minimum aisle width of 5.8m;
- All retail parking spaces would be designed in accordance with a Class 3 user and provided with a minimum space length of 5.4m a minimum width of 2.6m and a minimum aisle width of 5.8m;
- All commercial parking spaces would be designed in accordance with a Class 1 user and provided with a minimum space length of 5.4m a minimum width of 2.4m and a minimum aisle width of 6.2m;
- All child care parking spaces would be designed in accordance with a Class 3A user and provided with a minimum space length of 5.4m a minimum width of 2.6m and a minimum aisle width of 6.6m;
- All spaces located adjacent to obstructions of greater than 150mm in height would be provided with an additional width of 300mm;
- Dead-end aisles would be provided with the required 1.0m aisle extension in accordance with Figure 2.3 of AS2890.1;
- All disabled parking spaces would be designed in accordance with AS2890.6. Spaces would be provided with a clear width of 2.4m and located adjacent to a minimum shared area of 2.4m;
- All adaptable parking spaces would be designed in accordance with AS4299. Spaces would be provided with a minimum space length of 5.4m a minimum width of 3.8m.

7.2.3 Ramps

- All ramps would have a maximum gradient of 20% (1 in 5) with transitions that satisfy AS2890.1.

7.2.4 Clear Head heights

- A minimum clear head height of 2.2m would be provided for all areas within the basement car park as required by AS2890.1. A clear head height of 2.5m would be provided above all disabled spaces as required by AS2890.6 and AS4299.

7.2.5 Other Considerations

- All columns are required to be located outside of the parking space design envelope shown in Figure 5.2 of AS2890.1;
- Appropriate visual splays are to be provided in accordance with the requirements of Figure 3.3 of AS2890.1 at all accesses;
- The internal design will comply with the Section 3.4 of AS2890.1 with appropriate queuing areas provided. Furthermore the max gradient of 1:10 for not less than 80% of the queuing length will also be achieved;

7.2.6 Service Area Design

- The internal design of all service areas would be undertaken in accordance with the requirements of AS28090.2 for the maximum vehicle expected at each of the service area;
- A minimum clear head height of 4.5m would be provided within the service areas;
- All ramps would be designed in accordance with Table 3.2 of AS2890.2 with a maximum grade not in excess of 1:6.5 (15.4%) and maximum rate of change of 1:16 (6.25%) in 10 metres of travel.
- A minimum bay width of 3.5m would be provided for all service bays.

7.2.7 Summary of Internal Design

In summary, the internal configuration of the basement car park and loading areas will be designed in accordance with AS2890.1, AS2890.2, AS2890.6 and AS4299, the details of which will be provided at subsequent development application stages.

8. Conclusions

The following conclusions are noteworthy:

- Vehicular Access
  - Northern Site Access – consisting of a new fourth arm on to the existing roundabout of Tennyson Road with Searle Street, this direct access in to 2-12 Tennyson Road would provide access solely to the residential car park for the 269 dwellings proposed on the site. In accordance with AS2890.1 (2004), access would be provided in the form of a Category 3 Driveway, providing an entry driveway of width 6.0 metres, an exit driveway of width 4.0 to 6.0 metres and a median separation of 1.0 to 3.0 metres;
  - Southern Site Access – connecting to the road network via a priority (Give Way) T-intersection with Tennyson Road, this access would be located generally on the boundary of Lot 2-12 and Lot 14 Tennyson Road and would provide access to the car parks for all the remaining development within the combined site. In accordance with AS2890.1 (2004), access would be provided in the form of a Category 4 Driveway, providing an entry driveway of width 6.0 to 8.0 metres, an exit driveway of width 6.0 to 8.0 metres and a median separation of 1.0 to 3.0 metres;
  - Alternative Access Arrangement – should the two Lots be developed independently, the southern access would be split in to two accesses, one to provide access for the remaining development on the 2-12 Tennyson Road Lot (excluding the residential component) and another to provide access to all development proposed for the 14 Tennyson Road Lot;
- Parking
  - 667 – 752 parking spaces are to be provided in accordance with Ryde Council's draft Development Control Plan (DCP) 2011, which is currently on exhibition. It is noteworthy that with regard to the subject land uses, the draft rates are consistent with the rates in the adopted DCP 2010;
- Traffic Generation
  - Based on the latest RMS Guidance, the development is forecast to generate an additional 278 trips on the surrounding road network, 61 trips of which will be drawn from existing passing traffic on Tennyson Road and Victoria Road;

- Network Performance Testing
  - Intersection of Victoria Road with Tennyson Road:
    - Under all scenarios tested, the intersection is forecast to operate with an acceptable delays and Levels of Service of D or better;
    - Under all scenarios, queues on the eastbound right-turn bay of Victoria Road (to Tennyson Road) extend beyond the available queue storage provided; however, the operation following completion of the subject development is anticipated to remain generally unchanged from current conditions;
  - Tennyson Road / Searle Street Roundabout:
    - Under all scenarios tested, the roundabout is forecast to operate well with a Levels of Service of A;
  - Tennyson Road / Morrison Road Roundabout:
    - Under all scenarios tested, the roundabout is forecast to operate well with a Levels of Service of A;
  - Intersection of Tennyson Road with Southern Site Access:
    - Under the future (with subject development) scenario the intersection is forecast to operate well with a Levels of Service of A;
- Internal Design
  - The internal access arrangements, including car parking ,will be designed in accordance with the Australian Standard requirements of AS2890.1 (2004) *Part 1: Off-street car parking*, AS2890.2 (2002) *Part 2: Off-street commercial vehicle facilities,* AS2890.6 (2009) *Part 6: Off-street parking for people with disabilities* and AS4299 (1995) *Adaptable housing*.

This report demonstrates that the proposed rezoning is supportable on traffic planning grounds, based on the concept plan that has been adopted for assessment purposes, recognising that further detailed investigations will be undertaken at the future development application stage.

Appendix A

Photographic Record

View looking east towards the site at the current site accesses to 2-12 Tennyson Road and 14 Tennyson Road

View looking south along Tennyson Road from the proposed southern site access location

View looking north along Tennyson Road from the proposed southern site access location

View looking north along Tennyson Road towards its roundabout intersection with Searle Street

View looking south along Tennyson Road towards its roundabout intersection with Searle Street

View looking north along Tennyson Road towards its signalised intersection with Victoria Road

View looking west along Victoria Road towards its signalised intersection with Tennyson Road

View looking east along Victoria Road towards its signalised intersection with Tennyson Road

Appendix B

SIDRA Outputs

LANE SUMMARY

Site: Existing (PM Peak)

INT: Victoria x Tennyson
SCENARIO: 2013 Existing Traffic (Existing Layout)
PERIOD: Evening Peak Hour
Signals - Fixed Time Cycle Time = 145 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Tennyson Rd																
Lane 1	88	0	0	88	2.0	190[1]	0.465	100	55.1	LOS D	5.0	35.7	50	Parking	0.0	0.0
Lane 2	0	0	156	156	2.0	224	0.696	100	75.4	LOS F	11.0	78.2	110	–	0.0	0.0
Approach	88	0	156	244	2.0		0.696		68.1	LOS E	11.0	78.2				
East: Victoria Rd																
Lane 1	124	870	0	994	5.0	1265	0.786	100	5.9	LOS A	20.0	146.3	190	–	0.0	0.0
Lane 2	0	998	0	998	5.0	1269	0.786	100	5.4	LOS A	21.8	159.1	190	–	0.0	0.0
Approach	124	1867	0	1992	5.0		0.786		5.6	LOS A	21.8	159.1				
West: Victoria Rd																
Lane 1	0	1062	0	1062	5.0	1460	0.727	100	2.1	LOS A	11.8	86.5	240	–	0.0	0.0
Lane 2	0	1062	0	1062	5.0	1460	0.727	100	2.1	LOS A	11.8	86.5	240	–	0.0	0.0
Lane 3	0	0	219	219	5.0	283	0.774	100	33.7	LOS C	13.2	96.4	70	Turn Bay	0.0	34.1
Approach	0	2123	219	2342	5.0		0.774		5.1	LOS A	13.2	96.4				
Intersection				4578	4.8		0.786		8.7	LOS A	21.8	159.1				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model used.

1 Reduced capacity due to a short lane effect

MOVEMENT SUMMARY

Site: Existing (PM Peak)

INT: Tennyson x Searle
SCENARIO: 2013 Existing Traffic (Existing Layout)
PERIOD: Evening Peak Hour
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
North East: Tennyson Rd (North)											
25	T	227	2.0	0.239	5.0	LOS A	1.2	8.8	0.10	0.45	44.2
26	R	126	2.0	0.239	9.2	LOS A	1.2	8.8	0.10	0.78	41.1
Approach		354	2.0	0.239	6.5	LOS A	1.2	8.8	0.10	0.57	43.1
North West: Searle (West)											
27	L	52	2.0	0.064	6.6	LOS A	0.3	2.3	0.32	0.55	42.5
29	R	19	2.0	0.064	9.8	LOS A	0.3	2.3	0.32	0.68	40.6
Approach		71	2.0	0.064	7.5	LOS A	0.3	2.3	0.32	0.59	42.0
South West: Tennyson Rd (South)											
30	L	20	2.0	0.140	6.6	LOS A	0.8	5.8	0.30	0.58	42.9
31	T	143	2.0	0.140	5.7	LOS A	0.8	5.8	0.30	0.49	43.3
Approach		163	2.0	0.140	5.8	LOS A	0.8	5.8	0.30	0.50	43.2
All Vehicles		587	2.0	0.239	6.4	LOS A	1.2	8.8	0.18	0.55	43.0

Level of Service (LOS) Method: Delay (RTA NSW).
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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

LANE SUMMARY

Site: Future Committed (PM Peak)

INT: Victoria x Tennyson x Bunnings Access
SCENARIO: Future Committed (with Bunnings)
PERIOD: Evening Peak Hour
Signals - Fixed Time Cycle Time = 145 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Tennyson Rd																
Lane 1	79	11	0	89	2.0	255[1]	0.350	100	45.1	LOS D	4.5	32.4	50	Parking	0.0	0.0
Lane 2	0	0	152	152	2.0	162	0.937	100	98.9	LOS F	12.8	90.9	110	–	0.0	0.0
Approach	79	11	152	241	2.0		0.937		78.9	LOS F	12.8	90.9				
East: Victoria Rd																
Lane 1	139	854	0	992	5.0	1022	0.971	100	51.7	LOS D	81.8	597.3	190	–	0.0	100.0
Lane 2	0	996	0	996	5.0	1026	0.971	100	49.9	LOS D	82.4	601.2	190	–	0.0	100.0
Approach	139	1849	0	1988	5.0		0.971		50.8	LOS D	82.4	601.2				
North: Bunnings Access																
Lane 1	94	9	0	103	0.0	232	0.446	100	71.2	LOS F	6.9	48.3	100	–	0.0	0.0
Lane 2	0	0	53	53	0.0	167	0.316	100	75.5	LOS F	3.6	25.1	100	–	0.0	0.0
Approach	94	9	53	156	0.0		0.446		72.6	LOS F	6.9	48.3				
West: Victoria Rd																
Lane 1	93	0	0	93	5.0	1283[1]	0.072	100	7.0	LOS A	0.2	1.3	41	Turn Bay	0.0	0.0
Lane 2	0	1003	0	1003	5.0	1219	0.823	100	7.7	LOS A	29.8	217.9	240	–	0.0	0.0
Lane 3	0	1003	0	1003	5.0	1219	0.823	100	7.7	LOS A	29.8	217.9	240	–	0.0	0.0
Lane 4	0	0	175	175	5.0	181	0.965	100	114.4	LOS F	15.6	114.0	105	Turn Bay	0.0	12.4
Approach	93	2006	175	2274	5.0		0.965		15.8	LOS B	29.8	217.9				
Intersection				4659	4.7		0.971		35.9	LOS C	82.4	601.2				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model used.

1 Reduced capacity due to a short lane effect

LANE SUMMARY

Site: Future Proposed (PM Peak)

INT: Victoria x Tennyson x Bunnings Access
SCENARIO: Future Proposed (with Bunnings & 2-14 Tennyson Rd)
PERIOD: Evening Peak Hour
Signals - Fixed Time Cycle Time = 139 seconds (Optimum Cycle Time - Minimum Degree of Saturation)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Tennyson Rd																
Lane 1	118	11	0	128	2.0	269[1]	0.477	100	42.1	LOS C	6.2	43.9	50	Parking	0.0	0.0
Lane 2	0	0	167	167	2.0	169	0.992	100	115.1	LOS F	15.1	107.9	110	–	0.0	3.2
Approach	118	11	167	296	2.0		0.992		83.4	LOS F	15.1	107.9				
East: Victoria Rd																
Lane 1	202	814	0	1016	5.0	973	1.045	100	91.6	LOS F	95.5	697.1	190	–	0.0	100.0
Lane 2	0	1020	0	1020	5.0	976	1.045	100	99.2	LOS F	107.4	783.9	190	–	0.0	100.0
Approach	202	1834	0	2036	5.0		1.045		95.4	LOS F	107.4	783.9				
North: Bunnings Access																
Lane 1	94	9	0	103	0.0	242	0.427	100	67.7	LOS E	6.6	46.0	100	–	0.0	0.0
Lane 2	0	0	53	53	0.0	174	0.303	100	72.1	LOS F	3.4	24.0	100	–	0.0	0.0
Approach	94	9	53	156	0.0		0.427		69.2	LOS E	6.6	46.0				
West: Victoria Rd																
Lane 1	93	0	0	93	5.0	1296[1]	0.071	100	7.0	LOS A	0.2	1.2	41	Turn Bay	0.0	0.0
Lane 2	0	995	0	995	5.0	1192	0.835	100	8.9	LOS A	32.4	236.5	240	–	0.0	3.7
Lane 3	0	995	0	995	5.0	1192	0.835	100	8.9	LOS A	32.4	236.5	240	–	0.0	3.7
Lane 4	0	0	201	201	5.0	195	1.031	100	89.6	LOS F	19.0	138.6	105	Turn Bay	0.0	30.3
Approach	93	1989	201	2283	5.0		1.031		15.9	LOS B	32.4	236.5				
Intersection				4771	4.7		1.045		55.8	LOS D	107.4	783.9				

Level of Service (LOS) Method: Delay (RTA NSW).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model used.

1 Reduced capacity due to a short lane effect

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Future (PM Peak)

INT: Tennyson x Searle
SCENARIO: Future (w Development) Traffic (w Site Access)
PERIOD: Evening Peak Hour
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Northern Site Access											
21	L	3	2.0	0.009	8.4	LOS A	0.1	0.4	0.54	0.54	41.5
22	T	1	2.0	0.009	7.4	LOS A	0.1	0.4	0.54	0.49	41.8
23	R	4	2.0	0.009	11.5	LOS A	0.1	0.4	0.54	0.63	39.5
Approach		8	2.0	0.009	9.8	LOS A	0.1	0.4	0.54	0.58	40.5
North East: Tennyson Rd (North)											
24	L	21	2.0	0.319	6.0	LOS A	1.8	12.7	0.14	0.56	43.4
25	T	308	2.0	0.319	5.1	LOS A	1.8	12.7	0.14	0.45	44.0
26	R	129	2.0	0.319	9.3	LOS A	1.8	12.7	0.14	0.77	41.1
Approach		459	2.0	0.319	6.3	LOS A	1.8	12.7	0.14	0.55	43.1
North West: Searle (West)											
27	L	55	2.0	0.072	7.0	LOS A	0.4	2.6	0.40	0.58	42.3
28	T	1	2.0	0.072	6.0	LOS A	0.4	2.6	0.40	0.51	42.5
29	R	19	2.0	0.072	10.2	LOS A	0.4	2.6	0.40	0.70	40.5
Approach		75	2.0	0.072	7.8	LOS A	0.4	2.6	0.40	0.61	41.8
South West: Tennyson Rd (South)											
30	L	20	2.0	0.199	6.6	LOS A	1.2	8.7	0.33	0.58	42.8
31	T	196	2.0	0.199	5.7	LOS A	1.2	8.7	0.33	0.49	43.2
32	R	18	2.0	0.199	10.1	LOS A	1.2	8.7	0.33	0.77	40.8
Approach		234	2.0	0.199	6.1	LOS A	1.2	8.7	0.33	0.52	42.9
All Vehicles		776	2.0	0.319	6.4	LOS A	1.8	12.7	0.23	0.55	42.9

Level of Service (LOS) Method: Delay (RTA NSW).
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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Future (PM Peak)

INT: Tennyson x Southern Access
SCENARIO: Future (with Development) Traffic
Period: Evening Peak Hour
Giveway / Yield (Two-Way)

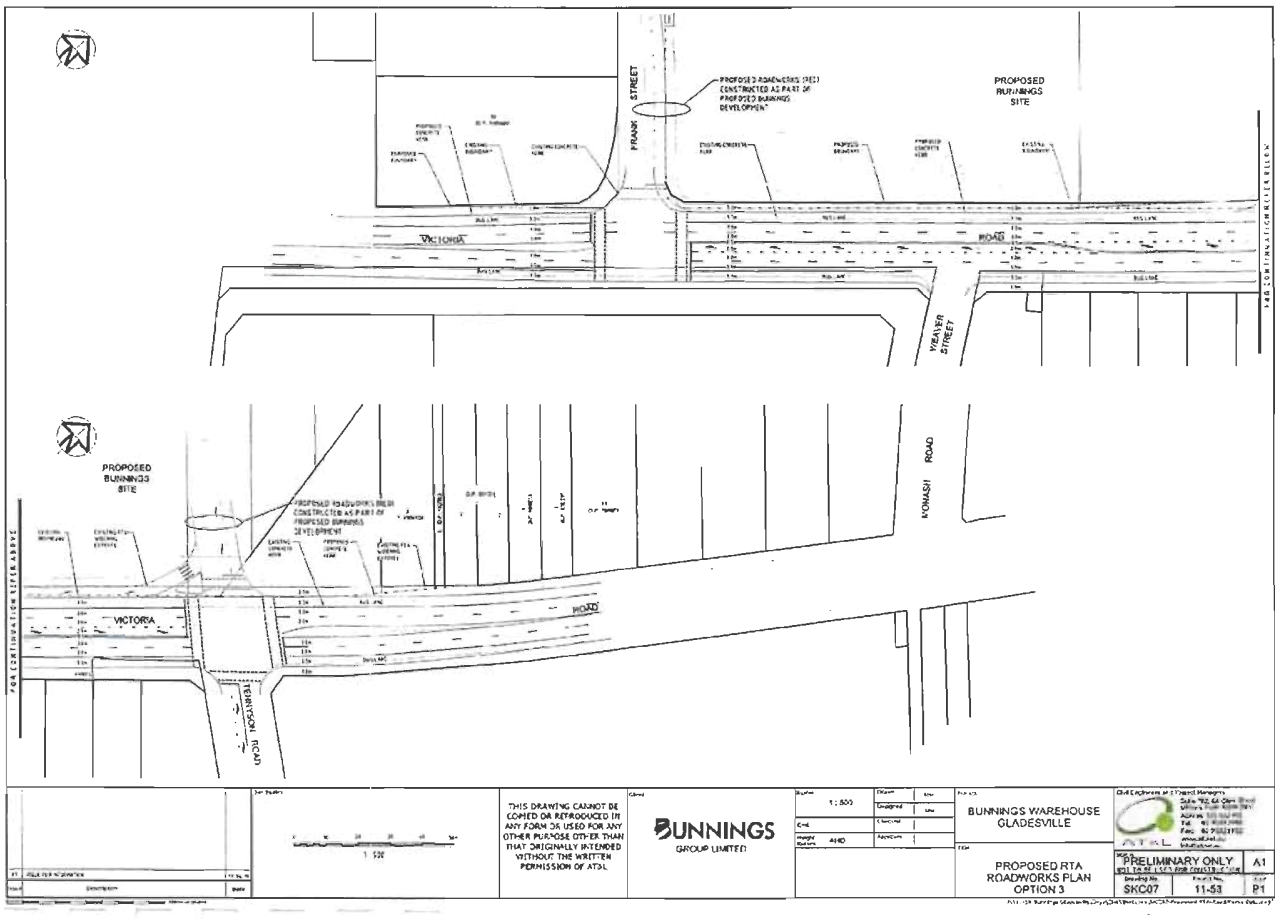
Movement Performance - Vehicles

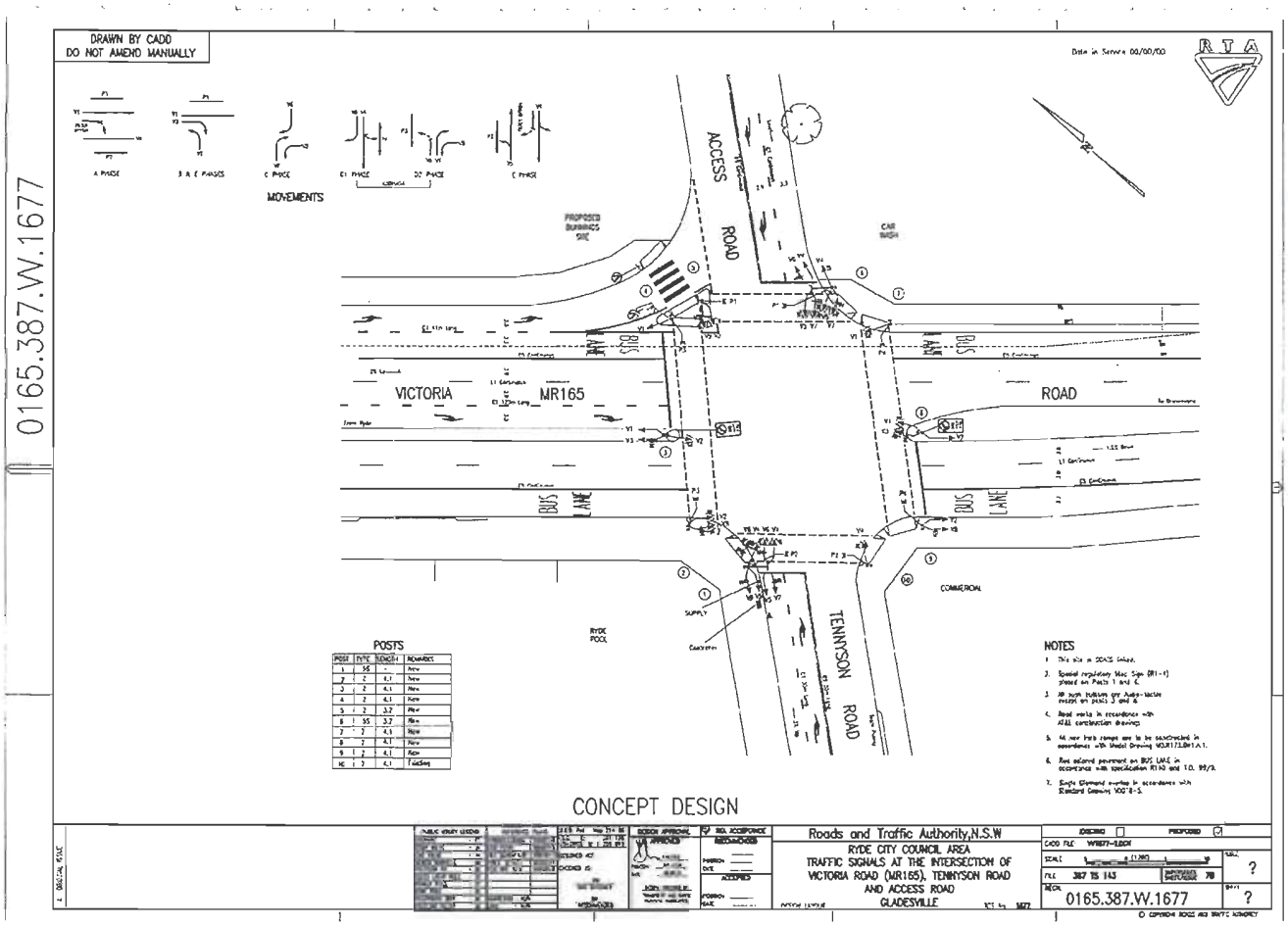
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Southern Site Access											
21	L	61	2.0	0.275	11.3	LOS A	1.2	8.6	0.54	0.69	39.2
23	R	93	2.0	0.275	11.6	LOS A	1.2	8.6	0.54	0.85	39.1
Approach		154	2.0	0.275	11.5	LOS A	1.2	8.6	0.54	0.79	39.2
North East: Tennyson Rd (North)											
24	L	93	2.0	0.175	6.5	LOS A	0.0	0.0	0.00	0.80	43.3
25	T	239	2.0	0.175	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		332	2.0	0.175	1.8	NA	0.0	0.0	0.00	0.22	47.9
South West: Tennyson Rd (South)											
31	T	141	2.0	0.182	4.3	LOS A	1.6	11.7	0.59	0.00	42.8
32	R	61	2.0	0.182	11.1	LOS A	1.6	11.7	0.59	0.87	40.6
Approach		202	2.0	0.182	6.4	NA	1.6	11.7	0.59	0.26	42.1
All Vehicles		687	2.0	0.275	5.3	NA	1.6	11.7	0.29	0.36	43.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

Appendix C

Transport and Traffic Planning Associates Report, Relevant Plans


FRANK STREET
PROPOSED BUNNINGS SITE
VICTORIA ROAD
YEALER STREET
PROPOSED BUNNINGS SITE
MONASH ROAD
VICTORIA ROAD
THIS DRAWING CANNOT BE COPIED OR REPRODUCED IN ANY FORM OR USED FOR ANY OTHER PURPOSE OTHER THAN THAT ORIGINALLY INTENDED WITHOUT THE WRITTEN PERMISSION OF ATSL
BUNNINGS
GROUP LIMITED
1:500
BUNNINGS WAREHOUSE GLADESVILLE
PROPOSED RTA ROADWORKS PLAN OPTION 3
PRELIMINARY ONLY
SKC07
11-53
P1
A1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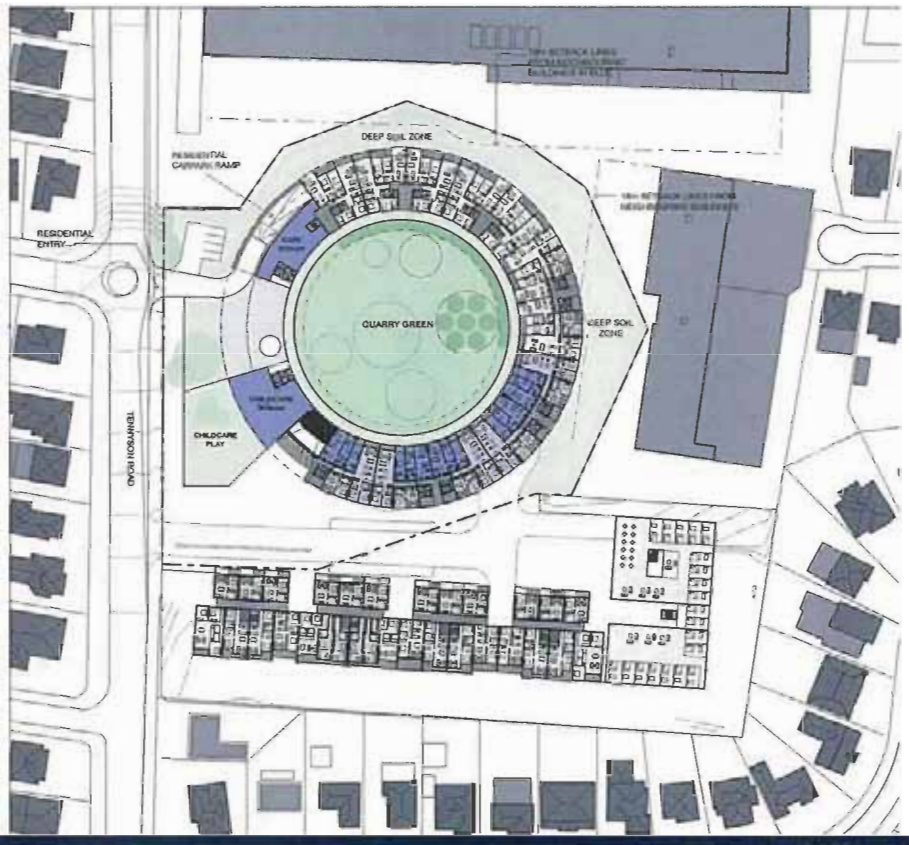
DO NOT AMEND MANUALLY
0165.387.W.1677
ACCESS ROAD
VICTORIA MR165
BUS LANE
TENNYSON ROAD
MOVEMENTS
POSTS
NOTES
CONCEPT DESIGN
Roads and Traffic Authority, N.S.W
RYDE CITY COUNCIL AREA
TRAFFIC SIGNALS AT THE INTERSECTION OF VICTORIA ROAD (MR165), TENNYSON ROAD AND ACCESS ROAD
GLADESVILLE
0165.387.W.1677

Appendix D

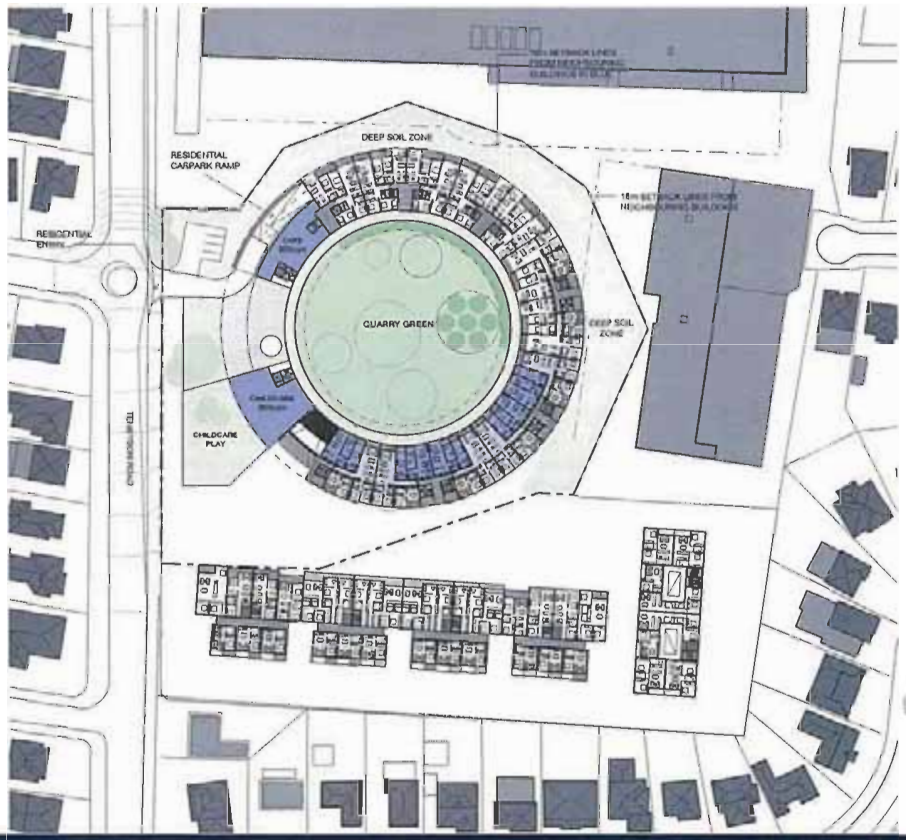
Reduced Plans

6.9 GROUND PLANE



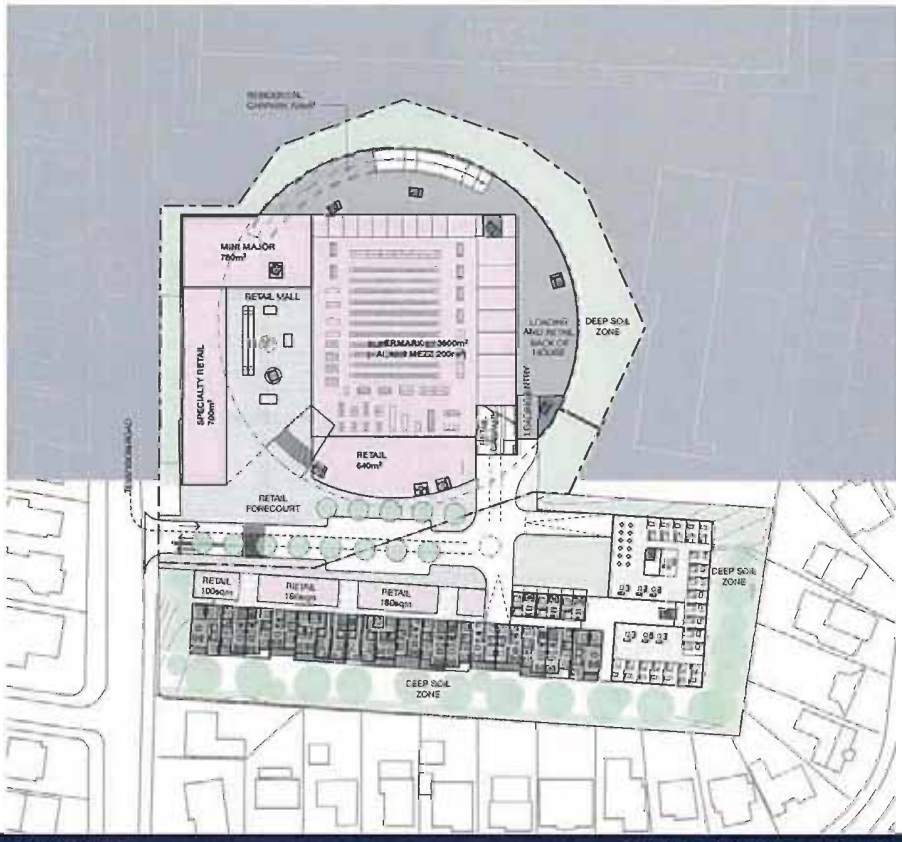
6.9 GROUND PLANE

14 Tennyson Road as Residental Uses only



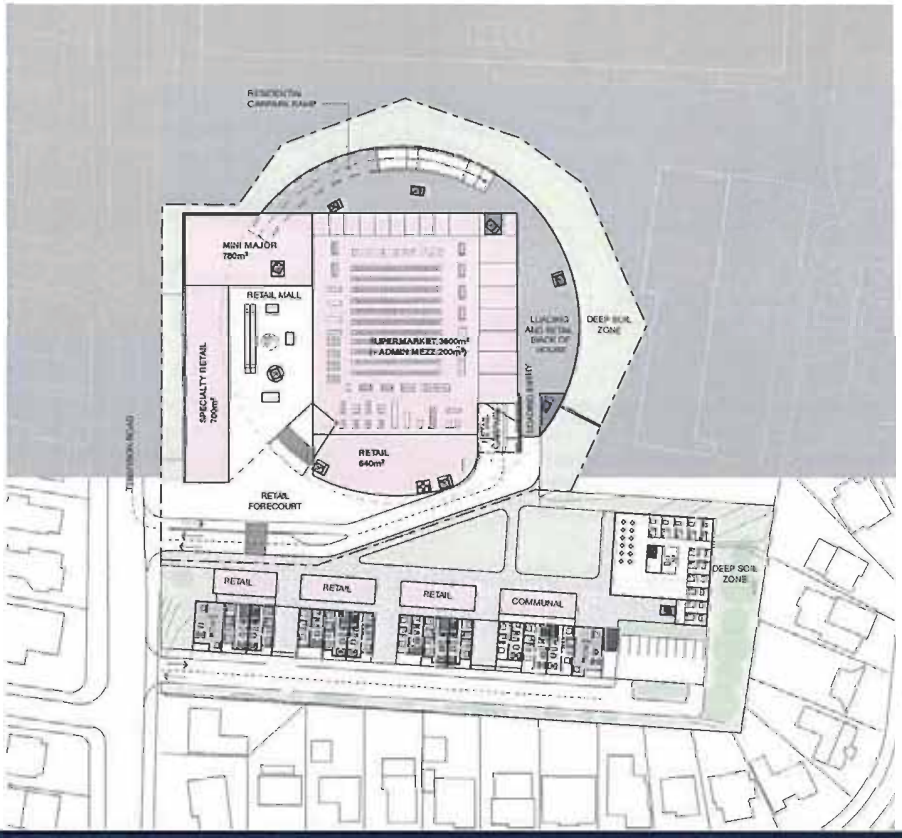
6.10 RETAIL

Scenario A
Combined Access for 2-12 and 14 Tennyson Road



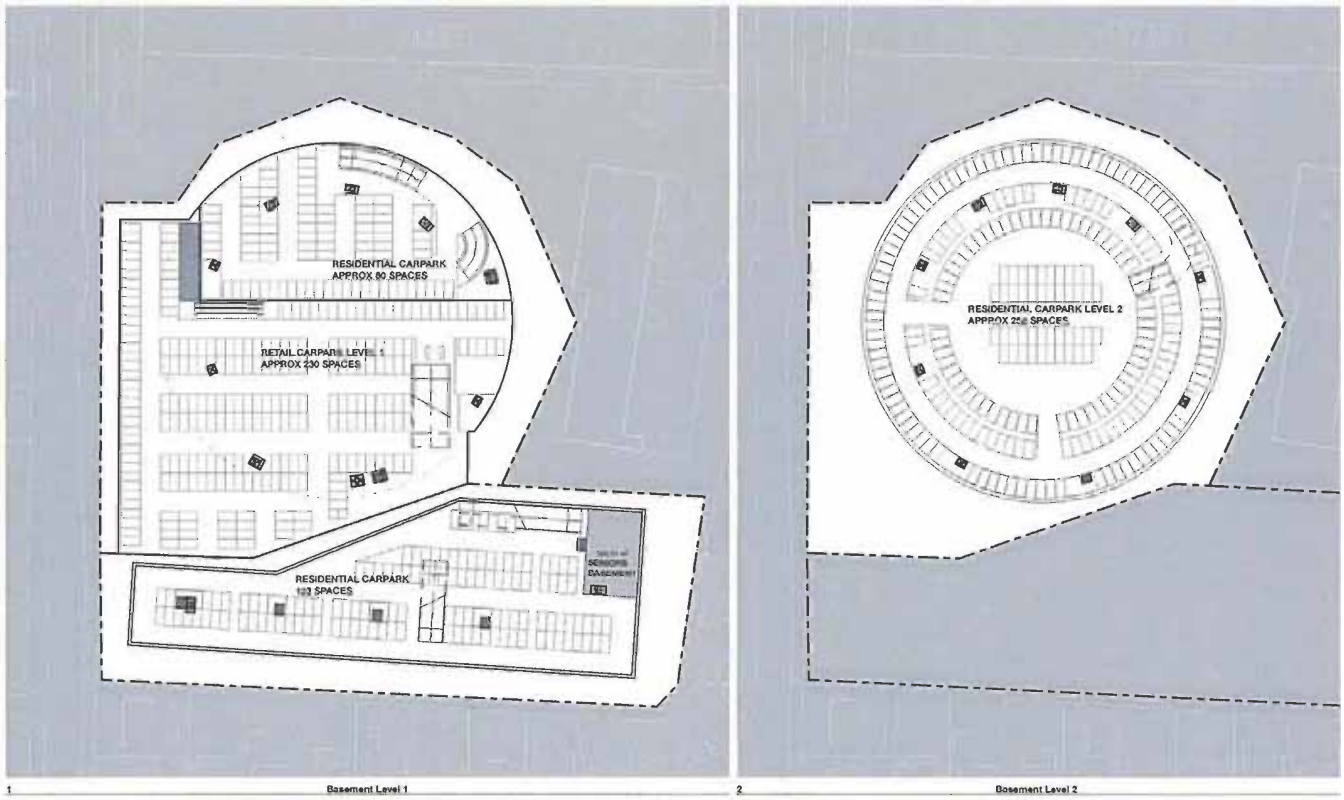
6.10 RETAIL

Scenario B
Seperate Access for 2-12 and 14 Tennyson Road



ARCHITECTURE DESIGN REPORT - GATEWAY REZONING APPLICATION DARCSOL PTY LTD | GRIMSHAW

6.12 CARPARKING



Appendix 11 – Stormwater Management Plan

MECONE

Civil

TaylorThomsonWhitting

Stormwater Management Plan 2-12 & 14 Tennyson Road, Gladesville

for Darcsol Pty Ltd

22 April 2013

121409

Taylor Thomson Whitting (NSW) Pty Ltd Consulting Engineers ACN 113 578 377

48 Chandos Street St Leonards NSW 2065 PO Box 738 Crows Nest 1585

T 61 2 9439 7288 F 61 2 9439 3146 ttwsyd@ttw.com.au www.ttw.com.au

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1.0 INTRODUCTION

This stormwater management plan is submitted by Engineering Consultancy firm Taylor Thomson Whitting (TTW) who have been engaged by Darcsol Pty Ltd to investigate and design the storm water for the redevelopment of sites 2-12 & 14 Tennyson Road, Gladesville. The purpose of this plan is to satisfy council requirements so that future development will not have an adverse impact on stormwater runoff for the existing site and the downstream catchment.

2.0 DEVELOPMENT SITE

The sites are located on the east side of Tennyson Road in Gladesville, Sydney. The sites are bounded by commercial buildings in the north and east, and with residential properties on the southern side. The sites are currently occupied with a number of commercial buildings, factories, car parking, roads and landscaping with a total combined area of approximately 2.4ha. An aerial image of the site is shown below in Figure 1.

Figure 1. Development Site

3.0 LOCAL TOPOGRAPHY

The local topography slopes from north to south. The intersection of Victoria and Monash Roads is roughly where the crest exists. Contours of the land can be seen in Figure 2. Site 2-12 is a former quarry. It is lower than the surrounding properties of about 5m to 15m. As site 2-12 is lower than all surrounding properties it has no overland flow path for stormwater.

Site 14 sits higher than property 2-12 and the residential properties on the east and southern sides. Site 14 has overland flow which falls to the rear of the residential properties.

Figure 2. Topography

4.0 EXISTING STORMWATER

The existing stormwater on the development site drains existing buildings, car parks and roads. There are two sub catchment areas. The first sub catchment relates to site 2-12 and includes the south western part of site 14. The second sub catchment relates to the northern and eastern parts of site 14.

Site 2-12 drains under site 14 to the council system on western section of Brereton Street. Site 2-12 does not have any water attenuation tanks.

Site 14 discharges to the council system from two connections. The first connection drains east through residential properties to council's stormwater system in Brereton Street. The second is assumed to connect to the same line from site 2-12.

Site 14 has at least one water attenuation tank with storage volume of about 80m^3. This tank discharges to council stormwater system located on the east side of the property on Brereton Street.

A plan showing outfall locations and existing sub catchment areas are shown in Figure 3 below.

Figure 3. Existing Catchments and Outfall Locations

5.0 PROPOSED DEVELOPMENT

The proposed redevelopment of the site includes; demolition of existing buildings with construction of buildings, roadways, landscaping and includes a below ground carpark. The proposed site plan is shown in Figure 4 below. The proposed building will be multi-storey with a combination of commercial, residential and industrial.

The design of the stormwater system will ensure that the development does not lead to;

- An increase in stormwater runoff from the site
- An increase in the risk of downstream flooding
- An increase in the risk of on-site flooding

In accordance with Ryde Council's stormwater policy (DCP10 8-2-1) peak flow for storms 5 year up to the 100 year are not to increase for all storm durations.

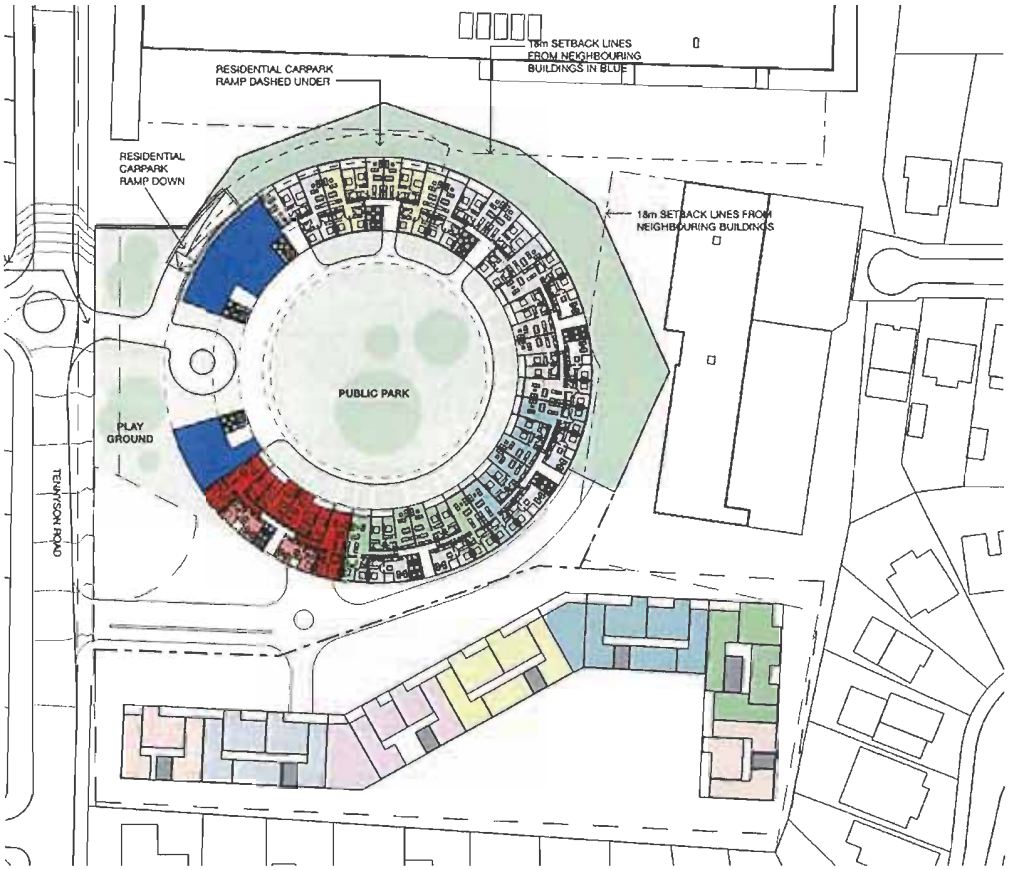


Figure 4. Proposed Site Plan

6.0 PROPOSED CATCHMENTS

The proposed development will alter the existing catchment characteristics. The characteristics that will change include the total area of impervious surfaces and type of surface. As a result of these changes the proposed stormwater system will ensure that the development does not have a negative impact on the runoff as detailed in section 5 above.

Catchments Comparison

A comparison of the pre and post-development catchments has been made to ensure that any impacts from runoff are addressed as part of the stormwater management.

The proposed development will not change the site's total catchment area however there will be an overall increase in impermeable area. After the development is constructed, the catchments will change in the following ways:

- Catchment for site 2-12 increases in impermeable area by 27%
- Catchment for site 14 has a decrease in impermeable area by 18%.
- As mentioned in section 5 there must be no increase in runoff. Therefore due to the increase in impermeable area on-site detention is required.

7.0 STORMWATER RUNOFF ANALYSIS

Site 2-12

The stormwater runoff has been analysed using DRAINS for the 5, 10, 20, 50 and 100 year ARI's, with multiple storm durations between 5 and 120 minutes. The proposed storm water design for the development ensures that the piped system for the whole development does not surcharge up to the 100 year ARI. This site has no overland flow path possible as it is significantly lower than the surrounding properties. If the piped systems blocks there will be ponding on the proposed site.

Preliminary DRAINS analysis indicates that 270m^3 of detention storage will be required for site 2-12.

Site 14

14 Tennyson Road has a reduction in impervious area and from this no increase in on-site detention is required. However, due to the proposed building footprint and road works, the existing tanks may need to be reconstructed to suit the proposed works.

The stormwater runoff for 14 Tennyson Road has been analysed using DRAINS for the 5, 10, 20, 50 and 100 year ARI's, with multiple storm durations between 5 and 120 minutes. The proposed stormwater design for the development ensures that the piped system for the whole development does not surcharge up to the 100 year ARI.

Preliminary DRAINS analysis indicates that 135m^3 of detention storage will be required for the property.

The existing tank on eastern side of the site has a volume of about 80m^3.

The design will ensure that during the 100 year ARI storm event, overland flow is directed away from buildings.

Connection to existing stormwater system

The new stormwater system within site 2-12 will maintain the existing connection under site 14 down to Brereton Road. It is assumed that this pipe has no capacity issues and is able to take the existing flow (and future) without surcharge.

The new stormwater system within 14 Tennyson Road will maintain the two existing connections. Both pipes connect to Brereton Road – one pipe connects in the east and the other in south western. It is assumed that these pipes have no capacity issues and is able to take the existing flow (and future) without surcharge.

Refer to **Appendix A** for Stormwater Concept plan.

8.0 SUMMARY OF DEVELOPMENT IMPACT

The proposed development alters the catchment characteristics and increases the impervious areas of the site. This results in an increase in surface water runoff from the site that could potentially lead to an increase in the risk of downstream flooding. The implementation of stormwater management controls will ensure that;

- The peak runoff from the site is not increased
- The risk of downstream and on-site flooding is reduced
- The quality of the stormwater runoff is improved
- Risk of stormwater inundation on the proposed development is minimised

The overland flow routes from site 14 will be maintained, whereas site 2 – 12 will continue to have no overland flow path due to being several metres lower than the surrounding properties.

Prepared by:
TAYLOR THOMSON WHITTING (NSW) PTY LTD

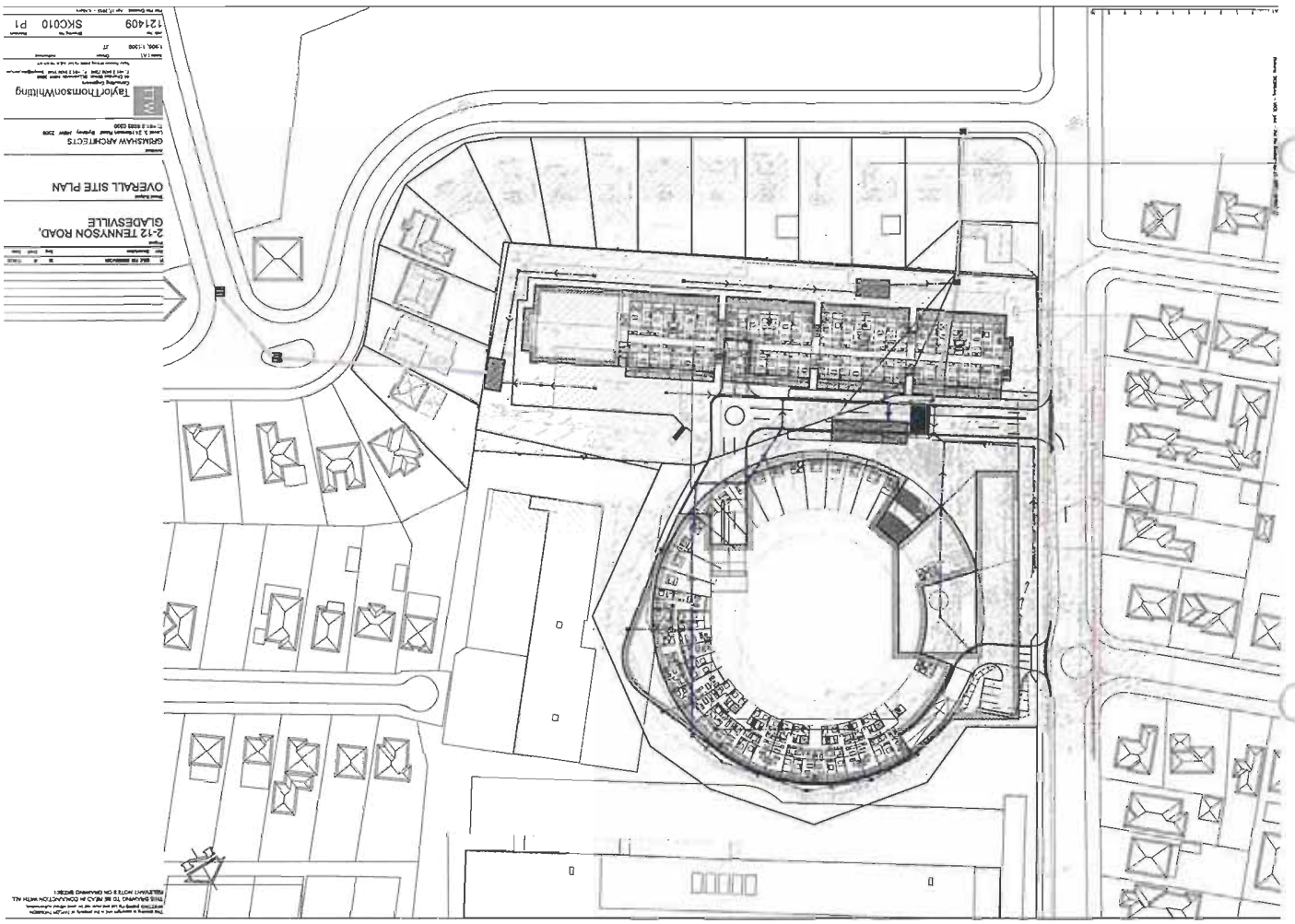
Kelvin Holey
Senior Civil Engineer

Authorised by:
TAYLOR THOMSON WHITTING (NSW) PTY LTD

Stephen Brain
Technical Director

P:\2012\1214\121409\Reports\TTW\Civil\20130322_Stormwater Management Plan-14 + 2-12.doc

APPENDIX A – STORMWATER CONCEPT PLANS


OVERALL SITE PLAN
2-12 TENNYSON ROAD,
GLADESVILLE
GBUSHAW ARCHITECTS
TaylorThomsonWhiting
SKC010
P1
12140

Michael Woodland Consulting Pty Ltd

Independent review

Planning proposal

2-14 Tennyson Road, Gladesville

prepared for the City of Ryde Council

February 2014

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1. Executive summary

Purpose of the report

Michael Woodland Consulting Pty Ltd has been engaged by the City of Ryde Council (Council) to undertake an independent review of a planning proposal (the proposal) at 2-14 Tennyson Road, Gladesville (the site). The proposal seeks to rezone the land from an industrial zoning to a mixed-use zone to enable retail, residential and seniors living uses on the site.

This report undertakes a comprehensive analysis of the proposal under the relevant planning legislation and guidelines and makes recommendations to Council on whether it should proceed to a Gateway determination.

The site

The site is located on the edge of the Gladesville Town Centre within the Gladesville Industrial Area within the Ryde local government area (LGA). The site is located to the south of Victoria Road, 100 metres south of the intersection of Tennyson and Victoria Roads, Gladesville.

The site comprises of 2 adjoining parcels of land known as 2-12 Tennyson Road (Lot 2 DP 549570) and 14 Tennyson Road (Lot 1 DP 549570) under separate ownership. The site includes a former quarry and is currently used for warehousing/office uses. The total site area is 2.2 ha.

The site is currently zoned IN2 Light Industrial under the provisions of the *Ryde Local Environmental Plan 2010* (LEP 2010). Council has finalised the *Draft Ryde Local Environmental Plan 2011* (draft LEP) for the LGA, which is currently with the Department of Planning and Infrastructure (DP&I) for consideration.

The proposal

On 12 March 2013, Council resolved that a planning proposal be accepted and considered for the site. The proposal seeks to:

- Rezone the land from IN2 Light Industrial land uses to B4 Mixed use, with a concept plan for a mixed use development;
- Set the maximum height of buildings from 10 metres to an RL control that varies across the site and permits up to 8 storeys and 26 metres; and
- Increase the maximum floor space ratio from 1:1 to 2.5:1 for part of the site and 1.5:1 for the remainder.

The proposal includes specialised reports, draft Local Environmental Plan (LEP) and Development Control Plan (DCP) for the site. It includes a preferred concept plan across both sites consisting of:

- 404 residential units (including approximately 269 residential units, 135 seniors living units and an assisted living facility of 3,300m^2);
- 2 levels of basement parking for 670 car spaces, loading and unloading areas;
- 2 options for shared or separate vehicular access to both sites from Tennyson Road;
- podium level with 5,800m^2 retail space (including a 4,000m^2 supermarket);
- childcare centre, approx 600m2 of commercial uses; open space and landscaping.

In summary, the applicant argues the proposal should be supported as it is: consistent with relevant strategic planning policies; well serviced by public transport and services; provides additional employment to match Ryde's employment profile; and provides improved public domain and open space.

Key issues

This report reviewed the proposal, including the specialist reports and included consultation with senior Council and the DP&I staff. The report considers that the key issues relating to the proposal are as follows:

- Government's strategic planning framework and s117 Directions
- Strategic direction for industrial lands in the Ryde LGA
- Relationship to the Gladesville Town Centre and LEP
- Proposed retail uses on the site
- Appropriateness of high density residential/mixed use
- Potential development outcomes including traffic impacts and built form controls

Government's strategic planning framework and S117 Directions

The Draft Metropolitan Strategy encourages new major residential development within centres, to make use of existing infrastructure and encourage diverse and active centres.

This policy direction both supports centre development and protects the existing character of established low density residential areas by limiting the adverse impacts including height, bulk and scale and traffic issues.

There are 2 fundamental issues to consider in relation to this proposal:

- Should the current industrial land be retained for industrial and employment purposes?
- If not, is a mixed use zoning to allow a major residential and retail development up to 8 storeys with floor space ratios of up to 2.5:1 appropriate in this location?

First, both former and current State Government policies acknowledge the need to protect industrial and employment lands. The Draft Strategy accepts that industrial land, particularly in established urban areas can be under pressure to be rezoned for other uses. In response, it provides a checklist for planning authorities to consider when dealing with a rezoning of industrial land. An assessment against the checklist in this report concluded the proposal does not fully meet the criteria.

Second, major residential and mixed use development is generally encouraged to be located within existing centres and strategic corridors to utilise existing infrastructure and reduce impacts on surrounding established residential areas.

Further, the Draft Inner North Subregional Strategy states (our emphasis):

… In view of continued demand for Employment Lands, conversion of existing Employment Lands within the subregion should be highly restricted and existing precincts (Artarmon, Lane Cove West, East Chatswood, Gore Cove, West Ryde, ***Gladesville*** *and the former ADI site)* ***should be retained****…* (Draft Inner North Subregional Strategy; page 27)

Finally, the proposal is located outside of the Gladesville Town Centre, which is identified as a Village in the Ryde LGA centre hierarchy and is considered to be inconsistent with the policies of protecting existing industrial/employment lands and suitable location of future major mixed use development.

In this regard, the proposal is considered to be inconsistent with the objectives and provisions of Section 117 Direction 1.1 – Business and Industrial zones as it:

- does not protect industrial land;
- is located outside of an identified centre; and
- is not considered to be consistent with an identified strategy.

Strategic direction for industrial land in the Ryde LGA

The proposal is considered to be inconsistent with Council's strategic direction for industrial lands and the location of major mixed-use retail and residential development on this site.

There is 27.93ha (Gladesville and West Ryde industrial areas excluding waterfront industrial) of industrial land remaining in the Ryde, representing only 2.78% of all employment land in the LGA. The proposal (if rezoned to a mixed use zone) would see the erosion of part of the last remaining industrial land in the Ryde LGA. In relation to industrial land, Council's adopted Local Planning Strategy states (our emphasis):

> *…The overall demand for industrial uses is likely to reduce then stabilise. However, the* ***retention of the City's industrial land is vital****, as these areas continue to provide for a range of industrial activities that meet local and regional needs.*
>
> *Such areas also provide premises that are often affordable to purchase or rent and such spaces support emerging businesses. Areas in the City that also provide this opportunity are along Victoria Road adjoining the edge of town centres…* (City of Ryde Local Planning Study Employment; page 7-25)

The Gladesville Industrial Area is recognised by state and local planning studies & reports as a vital cluster of industrial land that provides valuable urban services to the LGA and region. Industrial lands and uses play an important part in the economic well being of the Ryde LGA. The Gladesville Industrial Area is considered to provide a valuable cluster of automotive and construction based uses that service both the local and broader community.

In addition, recent demographic analysis indicates the nature of industrial lands is changing with a more educated and skilled workforce to better reflect the employment profile of the City of Ryde and is highly valuable to the economy of LGA and should be retained for future employment uses.

Supporting the Gladesville Town Centre

In 2010, the Gladesville Town Centre and Victoria Corridor LEP was made to revitalise the Gladesville village and encourage employment uses along the Victoria Road corridor.

The LEP followed an extensive master planning exercise and community consultation process. The LEP adopted fundamental planning principles of supporting new dwellings and employment in identified centres. Since that time significant development activity is occurring in the Gladesville area. The site was not included in this planning work, remaining as industrial land, which is still considered appropriate.

The proposal indicates that if approved the retail impact on the Gladesville Town Centre will be in the range of $6.6m or 6.1% loss of trade in 2016. Further specialist advice is required to fully address this issue. However, following the recent planning work to re-invigorate the Town Centre and Corridor through the Gladesville LEP, Council should seriously consider the potential impact on this centre and others in the locality.

Impacts on the surrounding local neighbourhood

The site is not considered to be an appropriate location for high density residential development given its interface with the low density residential locality, in particular the likely traffic impacts on the surrounding road network. The proposed built form controls are not considered to enable future buildings to transition to the low density scale of the surrounding residential areas, in particular in relation to height controls. Given the recommendations in the this report, particularly related to strategic planning and traffic grounds, a detailed consideration of the proposed controls in the Draft DCP provided by the applicant was not undertaken.

Council can meet its residential and employment targets without eroding industrial land

The Local Planning Strategy indicates that Council can deliver its housing and employment targets set by the State Government without rezoning this site. The Strategy also recommends concentrating housing and employment within Macquarie Park and its Town Centres, in particular large apartment buildings and mixed use developments. The study identifies up to 1,100 new dwellings within the Gladesville Town Centre.

Council has recently undertaken further analysis of future dwelling projections for the LGA, which indicate a significant increase in previous estimates. The Draft Subregional Strategy set a target of 12,000 additional dwellings in the LGA by 2031. The Local Strategy estimated a total of 15,751 additional dwellings between 2004-2031. A review of dwelling numbers has seen this estimate increase to 34,467 during this period, with 27,753 additional dwellings between 2014 and 2031.

Conclusion

The review concludes that the proposal is inconsistent with Council's strategic direction for the site and is likely to result in adverse impacts on the immediate locality.

However, given the difficulties faced by some landowners of industrial sites, it is appropriate for Council to continue to discuss alternative employment uses as part of a broader study of industrial lands as recommended in the Ryde Local Planning Strategy.

This work should build on the additional uses Council has proposed in the Draft LEP 2011 and subsequent *housekeeping* draft LEP for the IN2 Light Industrial zone to encourage a wider range of employment uses. These discussions should also take into account the recent demographic and economic data and include consultation with landowners, community and industry groups.

Recommendation

The report makes the following recommendation:

A. That the planning proposal for 2-14 Tennyson Road, Gladesville not proceed to a gateway determination for the following reasons:

    1. The proposal is inconsistent with strategic direction of the Ryde Local Planning Strategy 2010, Ryde Draft LEP 2011 and Draft Subregional Strategy in relation to retention of industrial lands.
    2. The proposal is inconsistent with the Draft Metropolitan Strategy and does not meet the criteria under the Industrial Lands Strategic Assessment Checklist for rezoning of existing industrial land to other uses.
    3. The proposal is inconsistent with s117 Direction 1.1 – Business and Industrial zones and 7.1 – Implementation of the Metropolitan Plan for Sydney 2036.
    4. The proposal is likely to lead to adverse impacts on the amenity of the surrounding locality, particularly relating to traffic impacts on the surrounding road network.
    5. The proposed built form controls are generally not considered appropriate in this locality due to the impacts on the adjoining low density residential areas.

B. That Council give further consideration to additional employment uses specifically for the site in addition to the uses identified in the Draft LEP 2011 in consultation with the landowners.

C. That Council undertake a further study of the industrial areas within the Ryde LGA to develop strategies and recommendations to maintain these areas as viable employment lands in accordance with Recommendation 7.2 of the Ryde Local Planning Strategy in consultation with landowners, the community and relevant industry groups.

2. Introduction

Michael Woodland Consulting Pty Ltd has been engaged by the City of Ryde Council (Council) to undertake an independent review of a planning proposal (the proposal) at 2-14 Tennyson Road, Gladesville (the site). The proposal seeks to rezone the land from an industrial zoning to a mixed-use zone to enable retail, commercial, residential and seniors living uses on the site.

This report provides an independent planning consideration of the proposal, which is seeking a Gateway determination to proceed to the next stage of the planning process to public exhibition. This report undertakes a comprehensive analysis of the proposal under the relevant planning legislation and guidelines and makes recommendations to Council on whether it should proceed to a Gateway determination.

The site is located on the edge of the Gladesville Town Centre within the Gladesville Industrial Area, one of 2 remaining industrial areas within the Ryde local government area (LGA). The site is located to the south of Victoria Road, approximately 100 metres south of the intersection of Tennyson Road and Victoria Road, Gladesville.

The site comprises of 2 adjoining parcels of land known as 2-12 Tennyson Road (Lot 2 DP 549570) and 14 Tennyson Road (Lot 1 DP 549570) under separate ownership. The site includes a former quarry and is currently used for warehousing/office uses. The total site area is 2.2 ha.

The site is currently zoned IN2 Light Industrial under the provisions of the *Ryde Local Environmental Plan 2010* (LEP 2010). Council has finalised the *Draft Ryde Local Environmental Plan 2011* (draft LEP) for the LGA, which is currently with the DP&I for consideration.

On 12 March 2013, (following a community workshop) Council resolved that a planning proposal be accepted and considered for the site. The proposal seeks to rezone land to B4 mixed use and allowing a mixed use development; set maximum height controls up to 8 storeys and increase the FSR to 2.5:1 and 1.5:1 across the site.

This report concludes that the proposal should not be supported due to the loss of industrial and employment lands and resultant impacts on the surrounding area in terms of amenity and traffic issues. The proposal (if rezoned to a mixed use zone) results in the erosion of the last remaining industrial land in Ryde.

The Gladesville Industrial Area serves as an important cluster of industrial land and is considered to provide valuable employment uses and urban services to the LGA and region.

3. Planning proposals and gateway process

In 2009, the State Government made changes to how land is rezoned across NSW.

The Government introduced a Gateway Process to provide greater certainty in the rezoning process. Through a Gateway determination, the Minister for Planning (or delegate) determines which planning proposals will proceed to the next stage in the planning process. This allows councils and agencies to provide early input and tailors the level of assessment needed to match the complexity of the proposed rezoning.

The planning proposal is the first stage in the LEP rezoning process. The planning proposal sets out the intended outcomes for a future rezoning on the land and provides strategic justification for making the plan. A council, landowner or developer who wishes to rezone a particular site may make a planning proposal.

However, only the Relevant Planning Authority (RPA) (in most cases council) can forward a planning proposal for a Gateway Determination. The RPA is responsible for ensuring that the planning proposal has sufficient information to enable a Gateway determination to allow the proposal to proceed to the next stage to the public consultation.

In November 2012, the Government introduced review mechanisms to this process – pre-Gateway and Gateway Reviews. This allows a proponent to seek a review should the council not support a planning proposal (or not make a decision within 90 days), or review the decision of the Gateway determination.

A Joint Regional Planning Panel and/or the NSW Planning Assessment Commission informs these reviews.

4. The site

The site is located within the Gladesville Industrial Area on the southern side of Victoria Road, Gladesville. The site is located between the existing industrial land that fronts Victoria Road and low density residential land to the east, west and south. The Ryde Aquatic Leisure Centre is located to the west of the site. The site is well located to the Victoria Road Corridor and in close proximity to the Gladesville Town Centre (Figures 1 & 2).

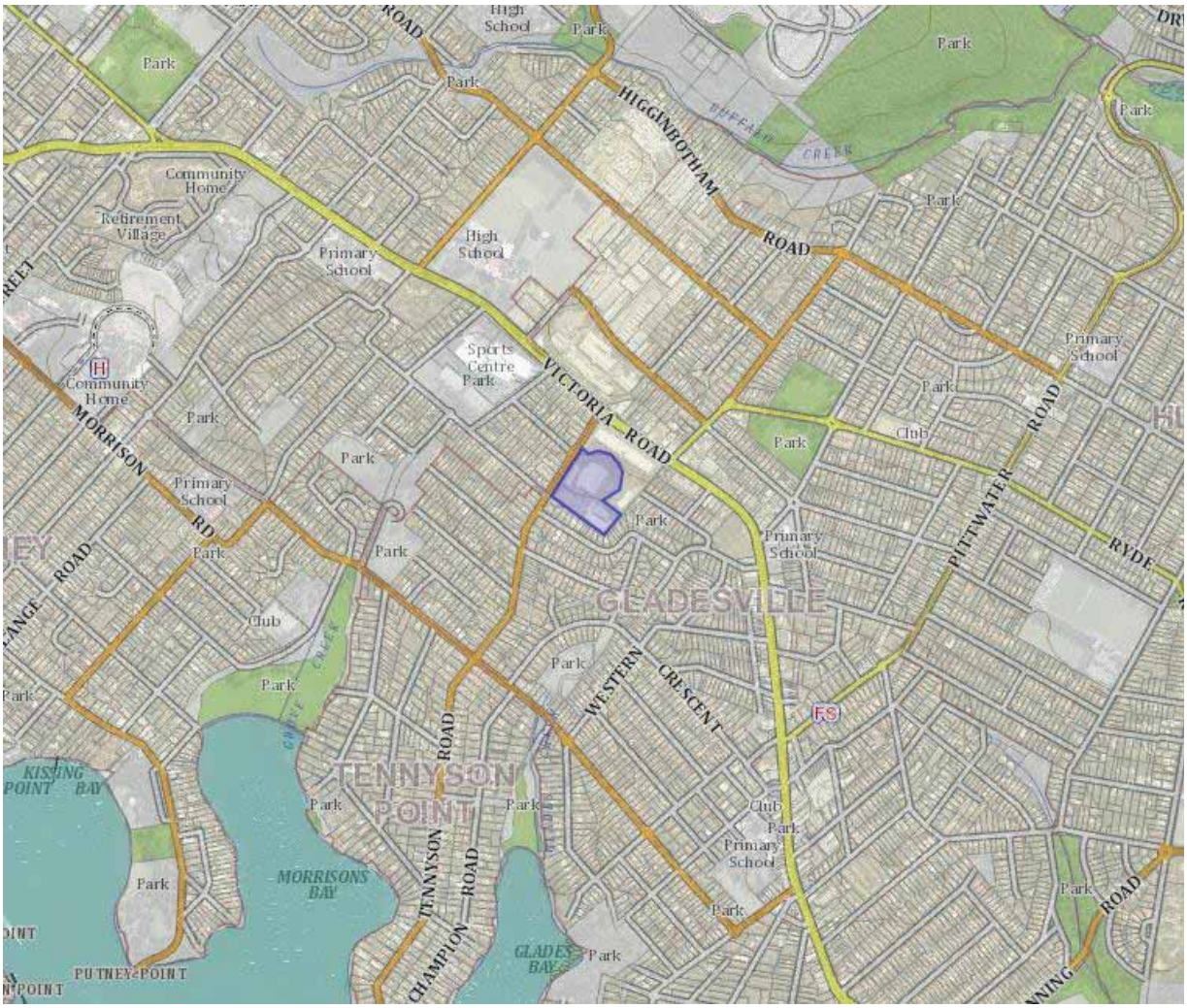


Figure 1: Local context (Source: LPI SIX viewer)

Figure 2: The site (Source: LPI SIX viewer)

4.1 Site description

The site is located to the south of Victoria Road, approximately 100 metres south of the intersection of Tennyson Road and Victoria Road, Gladesville. The site comprises of 2 adjoining parcels of land known as 2-12 Tennyson Road (Lot 2 DP 549570) and 14 Tennyson Road (Lot 1 DP 549570), described as Sites A & B respectively under separate ownership. The total site area as advised by the applicant is 2.2 ha (Figure 3).

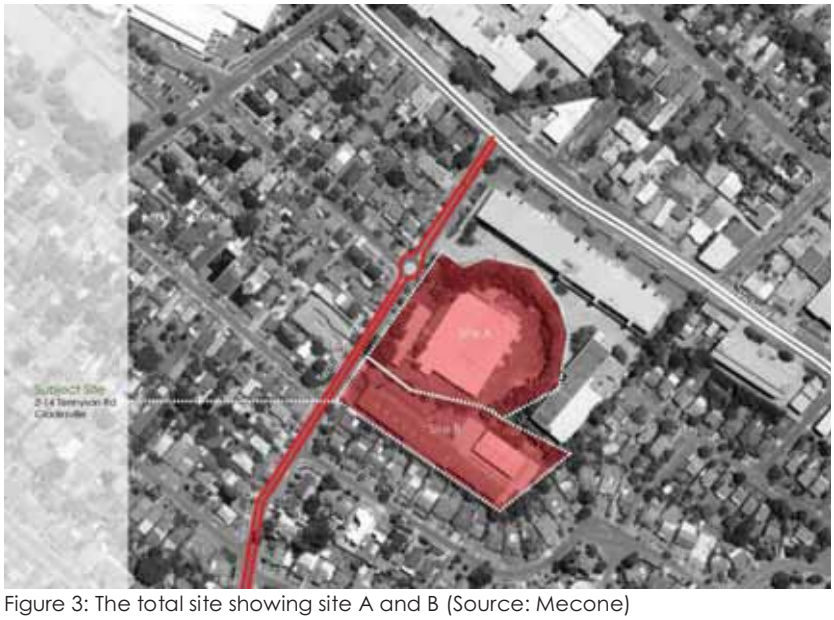


Figure 3: The total site showing site A and B (Source: Mecone)

Site A is 1.4 ha is size and is a former quarry site, characterised by an existing circular shaped cutting, with a change in level of approx 13 metres from the adjoining site to the north at Victoria Road. The site is occupied by a warehouse building located in the centre of the site with a 2-storey office building fronting Tennyson Road (Figures 4, 5 & 6). Vehicular access is gained from Tennyson Road.

Figure 4: Existing warehouse located on Site A looking south
(Source: Michael Woodland 2013)


Figure 5: Rear of 2 storey office building on Site A
(Source: Michael Woodland 2013)


Figure 6: Site A frontage along Tennyson Road
(Source: Michael Woodland 2013)

Site B is 0.8 ha is size and immediately adjoins Site A to the south. An existing 2 storey industrial building currently used as an office and warehouse occupies the site. The site gains access from Tennyson Road (Figure 7).

Figure 7: Site A and Site B frontage along Tennyson Road
(Source: Michael Woodland 2013)

4.2 Surrounding development

The site is part of the Gladesville Industrial Area bisected by Victoria Road. To the immediate north and north-east of the site is characterised by large commercial/industrial buildings, known as the Dexus Development. This development contains office and warehouse facilities, with its main frontage to Victoria Road and vehicular from Tennyson Road to the north of the site (Figure 8).

Figure 8: Adjoining development to the north featuring the
rear of the Dexus Building (Source: Michael Woodland 2013)

The land to the east, west and south of the site is characterised by low density 1 - 2 storey residential uses (Figures 9 -12).

Figure 9: Adjoining dwellings in Brereton Street looking north (Source: Michael Woodland 2013)

Figure 10: Residential villas opposite the site on Tennyson Road (Source: Michael Woodland 2013)

Figure 11: Existing residential dwellings in Brereton Street (Source: Michael Woodland 2013)

Figure 12: Existing residential dwellings in Brereton Street (Source: Michael Woodland 2013)

5. Strategic planning context

The strategic planning context and related planning documents include:

- Draft Metropolitan Strategy for Sydney 2031 / Metropolitan Plan 2036
- NSW Transport Long term Masterplan
- Draft Inner North Subregional Strategy
- Employment Lands Development Program
- Ryde Local Planning Strategy 2010

5.1. Draft Metropolitan Strategy for Sydney 2031 / Metropolitan Plan 2036

The current Draft Metropolitan Strategy for Sydney and existing the Metropolitan Plan both provide key strategic direction for the growth of Sydney as a strong global city that provides benefits to NSW as well functioning as a local liveable city for its residents, businesses and visitors.

Both Strategies recognise the need to protect existing industrial lands and to focus future development around identified centres – which are the 2 fundamental issues central to this proposal.

The existing Metropolitan Plan and Subregional Strategy categorised the site as employment uses to be retained recommending its protection and continued use for employment purposes. The draft Strategy also recognises the importance of industrial/employment lands but also seeks to provide further certainty for investment in the city, providing housing choice and protecting the amenity and sustainability of existing areas.

The draft Strategy has a number of objectives, which are then supplemented by key policy directions and actions. The most relevant policy directions to the proposal are Objectives 13 and 15 relating to industrial land as follows:

Objective 13: *Productivity and Prosperity: Provide a well located supply of industrial lands* – recognises the importance of industrial lands as well as the pressure faced by land within existing areas to be rezoned for other uses. It provides an Industrial Lands Strategic Assessment Checklist for proposals seeking to rezone existing industrial lands in these circumstances.

Objective 15: *Productivity and Prosperity:* Provide for a good supply of retail space – supports existing centres as the primary location of retail, at a scale reflecting the level of public transport accessibility. It supports clusters of bulky goods/warehouse outlets in clusters and seeks to limit retail uses in industrial areas to support industrial uses.

Other objectives and directions relating to retail and residential development are detailed below:

Objective 2: *Balanced Growth* - seeks to strengthen and grow Sydney's Centres to support business, provide affordable housing and utilise existing infrastructure.

Objective 5, 7 and 8: *a Liveable City* - promotes a proactive approach to housing delivery by providing new housing with greater choice linked to existing infrastructure and supported by existing and new centres.

Objectives 24 and 26: *Accessibility and connectivity* – promote future employment and housing development to be integrated with transport corridors to promote sustainable transport choices and improve connectivity for existing and planned centres.

5.2. NSW Transport Long Term Masterplan

The NSW Transport Long Term Masterplan outlines a number of strategies to integrate transport and land use planning. It identifies Victoria Road as of the most constrained strategic transport corridors in the network (Figure 15).

The Masterplan outlines a number of long-term bus priority measures to improve this corridor as well as a commitment to investigate the corridor for potential bus rapid transit (BRT) and light rail.

The Masterplan also identifies this corridor for potential future long-term urban renewal where increased population could support improved transport services.

Figure 15: Parramatta to the CBD via Ryde constrained corridor
(Source TfNSW)

5.3. Draft Inner North Subregional Strategy

Employment lands

The Draft Inner North Subregional Strategy was prepared to support the previous Metropolitan Plan. The Strategy sets a target of 21,000 new jobs to be created within Ryde LGA by 2031. The Strategy also identifies Strategic Employment Lands in the sub region, noting there is a relatively limited supply with a total of 194 hectares of zoned land, concentrated mainly within Willoughby (94 hectares) and Lane Cove (63 hectares) LGAs.

The Strategy further identifies 7 Employment Land Precincts of strategic importance and worthy of retention for industrial uses, including the site as part of the Gladesville Industrial Area. It identifies this area as follows:

> *Gladesville (Local Industry) is located along Victoria Road and is a suburban industrial area (23 hectares) servicing the local population, including automotive businesses and trade supplies* (Draft Inner North Subregional Strategy; page 26*)*.

The Strategy also notes that the sub-region is well established with scarce areas of under utilised land. It observes that the sub-region has experienced one of the highest rates of re-zonings of employment lands to other uses, namely changes at Macquarie Park from an industrial area to a specialised centre and the Meadowbank area.

The Strategy recommends that due to demand for local services and the changing nature of employment lands that further conversion of existing employment lands should be highly restricted and existing precincts (including Gladesville Industrial Area) be retained as detailed below:

… In view of continued demand for Employment Lands, conversion of existing Employment Lands within the subregion should be highly restricted and existing precincts (Artarmon, Lane Cove West, East Chatswood, Gore Cove, West Ryde, Gladesville and the former ADI site) should be retained…(Draft Inner North Subregional Strategy; page 27*)*.

Housing

The Strategy sets a housing target of 30,000 additional new dwellings by 2031 for the sub region, with an additional 12,000 new dwellings within the Ryde LGA. Following the direction from the Metropolitan Strategy, residential development is focussed within strategic and local centres and corridors with access to public transport and services.

A key policy is also the renewal of existing centres, including the Gladesville Village and Victoria Road Corridor revitalisation, which resulted in the new LEP for the Town Centre in 2010.

Enterprise Corridor

The Strategy also identifies Victoria Road as a potential *Enterprise Corridor* for local services and employment. The Strategy envisages that the corridor can include spaces for small firms, retailers and light industrial activities such as auto repairs to support local economic development.

5.4. Employment Lands Development Program

The Employment Lands Development Program (ELDP) monitors industrial land supply including strategy-identified land, undeveloped zoned (not serviced) land and undeveloped zoned and serviced land. It is prepared on a regional and sub-regional basis and provides a regional overview, rather than on a site-by-site basis. However, it does identify and monitor the Gladesville Industrial Area, which includes the site.

The program provides an overview of the trends for employment lands across Sydney. In the latest 2011 Update Report, it notes that demand for industrial space in Sydney is expected to grow in the short to medium term. In terms of supply, it notes that the vast majority of employment lands is located within western Sydney, with inadequate stocks of undeveloped and serviced land.

5.5. Ryde Local Planning Strategy 2010

The Ryde Local Planning Strategy was prepared to:

- guide the future growth of Ryde through a range of planning initiatives and strategies;
- inform the Draft Ryde LEP 2011; and
- review and respond to directions from the State Government as identified in the Metropolitan Strategy for Sydney and the Draft Inner North Subregional Strategy, particularly relating to hosing ad employment targets.

The Strategy is informed by a number of comprehensive studies reflecting the structure and direction of the Metropolitan Strategy. The Strategy is underpinned by these studies to achieve the future vision for the City of Ryde. The studies most relevant to this proposal are:

- Centres and Corridors
- Housing
- Employment
- Strategic Directions

In relation to the key issue of industrial lands, the Strategy makes the following relevant comments:

…The overall demand for industrial uses is likely to reduce then stabilise. However, the retention of the City's industrial land is vital, as these areas continue to provide for a range of industrial activities that meet local and regional needs.

Such areas also provide premises that are often affordable to purchase or rent and such spaces support emerging businesses. Areas in the City that also provide this opportunity are along Victoria Road adjoining the edge of town centres…(City of Ryde Local Planning Strategy, Employment ;page 7-25)

5.6. Summary of key strategic policies

In summary, the above polices generally support both the growth of identified centres within the LGA and the retention of existing industrial lands. This strategic planning framework provides for major retail and high density housing to be located in identified centres close to existing public transport and related infrastructure.

The Draft Subregional Strategy specifically identifies the Gladesville Industrial Area (which includes the site) for retention due to its critical role in providing local and regional services. Council's adopted Local Planning Strategy also concludes that the protection of its remaining Industrial Land within the LGA is vital.

The Local Planning Strategy also supports the revitalisation of the Gladesville Town Centre and Victoria Road Corridor for future retail and major development in the locality. The Strategy notes that Council can meet with housing and employment targets and sufficiently address retail demand within identified centres and other specialised locations.

6. Statutory planning controls

The site is currently zoned under the provisions of the Ryde Local Environmental Plan (LEP) 2010. The site is also covered by the Ryde Draft LEP 2011, which is currently being finalised by DP&I.

6.1. Ryde LEP 2010

The relevant provisions in the Ryde LEP 2010 are zoning and floorspace ratio. There are no height controls for the site under the current LEP.

6.1.1. Land use zoning

The site is zoned IN2 Light Industrial under the Ryde LEP 2010. An extract of the current zoning map is shown in Figure 16 below. The objectives and permissible uses of the IN2 Light Industrial zoning are as follows:

1. Objectives of zone

- *To provide a wide range of light industrial, warehouse and related land uses.*
- *To encourage employment opportunities and to support the viability of centres.*
- *To minimise any adverse effect of industry on other land uses.*
- *To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area.*
- *To support and protect industrial land for industrial uses.*
- *To enhance the amenity of local areas through better building design, reduced hard-paved surfaces and landscaping.*

2. Permitted without consent

Home occupations

3. Permitted with consent

Business identification signs; Car parks; Child care centres; Community facilities; Depots; Industrial retail outlets; Industrial training facilities; Light industries; Neighbourhood shops; Public administration buildings; Pubs; Recreation areas; Research stations; Respite day care centres; Roads; Service stations; Sex services premises; Transport depots; Vehicle body repair workshops; Vehicle repair stations; Warehouse or distribution centres; Waste or resource management facilities; Water recycling facilities

4. Prohibited

Any development not specified in item 2 or 3

Figure 16: Extract from the Ryde LEP 2010 – Zoning Map

6.1.2. *Floorspace ratio*

The Floorspace ration for the site is 1:1 under the Ryde LEP 2010. An extract of the current Floorspace ratio map is shown in Figure 17 below.

Figure 17: Extract from the Ryde LEP 2010 – FSR Map

6.2. Ryde DCP 2010

The Ryde DCP 2010 provides for a number of environmental, engineering, stormwater and waste minimisation controls for the site relating to its industrial use. These controls are generally considered to be more relevant at the development application stage rather than the rezoning process for this site.

The proposal has been forwarded to Council's traffic, engineering and environmental sections to provide comments on the traffic, contamination, geotechnical and stormwater issues.

6.3. Ryde Draft LEP 2011

The Ryde Draft LEP 2011 was submitted to the DP&I on 21 March 2013 and is currently being finalised. The Draft LEP maintains the IN2 Light Industrial zoning for the site.

The objectives of this zone have remained largely unchanged from the current LEP 2010. The landuse table has been reviewed to clarify the number of uses prohibited in the zone, which includes residential development.

A number of additional uses are proposed including funeral homes, hardware and building supplies, landscaping material supplies and storage premises. In addition, commercial uses and bulky goods retailing have also been permitted on specific sites fronting the Victoria Road corridor.

The Floorspace ratio controls for the site also remain unchanged at 1:1 for the site. A maximum height control of 10 metres has been introduced considering the typical industrial built form existing and desired in this zone.

Council has also proposed additional uses for the IN2 Light Industrial Zone in a current planning proposal to amend the Draft LEP. These include recreational uses and wholesale supplies to provide further employment opportunities for land in light industrial areas such as this site.

7. The proposal

7.1. Overview

The proposal is for a standard instrument based LEP and a DCP for the site to enable a mixed use development with the capacity to deliver approx 404 residential units (including seniors living), retail, commercial and community uses. The proposal seeks to rezone the site to a B4 mixed use zone with additional uses to permit high density residential uses up to 8 storeys.

The proposed zoning and controls for the site (if made) would then be reflected in the new Draft LEP for the Ryde LGA. The proposal also includes a site specific DCP for the site to respond to its unique topographical characteristics as a former quarry.

The proposal is also accompanied by a comprehensive architectural study that outlines a number of development options (and preferred Concept Plan) for the site forming the basis and justification for the proposed planning controls across both sites.

7.2. Objectives and intended outcomes

The planning proposal states the objectives of the proposal as follows:

- *To encourage employment generation on site that increases the number of employees and provides jobs that better match Ryde's employment profile;*
- *To facilitate redevelopment of the site in a prime location in close proximity to a range of services and public transport options, which is currently being underutilised;*
- *To provide high quality residential development, incorporating a range of*
- *housing types, including seniors housing, for the Ryde and Gladesville locality; and*
- *To provide an innovative village hub with a range of commercial and*
- *retail employment activities which are compatible with the residential uses in the area.*

The planning proposal seeks to achieve the above objectives by allowing the redevelopment of the site as mixed-use development with a range of residential, retail, commercial, and community uses.

In this regard, the intended outcomes of the planning proposal are to:

- *Address the lack of housing availability within the locality;*
- *Provide appropriate services and employment opportunities that suit the resident profile in the area;*
- *Allow for a proposal that will complement and support the existing Gladesville Town Centre; and*
- *Allow for public domain upgrading works.*

7.3. Description of the proposal

The proposal seeks to:

- rezone the land from IN2 Light Industrial land uses to B4 Mixed use;
- set the maximum height of buildings from 10 metres to an RL control that varies across the site and permits up to 8 storeys; and
- increase the maximum floor space ratio from 1:1 to 2.5:1 for part of the site and 1.5:1 for the remainder of the site.

The preferred development option involves a consolidated development across both Sites A and B and includes (Figures 13 & 14):

- 2 levels of basement parking for 670 car spaces, loading and unloading areas
- 2 options for shared or separate vehicular access to both sites from Tennyson Road
- podium level with 5,800m^2 retail space (including a 4,000m^2 supermarket)
- childcare centre (300m^2)
- 600m2 of non-retail, commercial uses
- 404 residential units (including 135 seniors living units, an assisted living facility of 3,300m^2)
- public space within the site and associated landscaping

In addition, the applicant has provided the following indicative breakdown for each site:

Site A (2–12 Tennyson Road)
- Approximately 269 apartments
- 5,800m^2 of retail/commercial including supermarket, specialty retail and café or similar use
- Childcare centre

Site B (14 Tennyson Road)
- Approximately 135 apartments (intended to be seniors living apartments)
- 3,300m^2 of assisted living (ie Residential Aged Care Facility)
- 400m^2 of retail/commercial

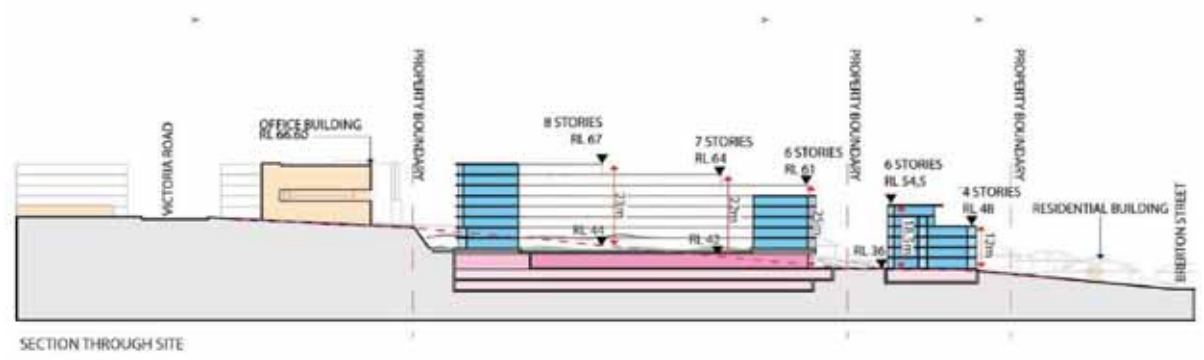


Figure 13: Indicative section of preferred development option (Source: Grimshaw Architects)

Figure 14: Preferred development option (Source: Grimshaw Architects)

7.4. Explanation of provisions

The proposal seeks the mandatory planning controls as required by the standard instrument as outlined in Table 1. The current built form controls for industrial land rely on an FSR control only. These are no current height controls on the site. The proposal seeks new FSR and height controls for the site based on architectural study prepared for the proposal.

The proposal also seeks a number of standard optional provisions and local provisions as a separate LEP for the site. It is noted that a number of these proposed provisions have not been adopted in the Ryde LEP 2010 including architectural roof features. It is noted that all amendments should be made as an amendment to the Ryde LEP 2010 rather than stand alone LEP for the site.

Control	Ryde LEP 2010	Draft Ryde LEP 2011	Proposed controls
Zoning	IN2 – Light Industrial	IN2 – Light Industrial	B4 - Mixed use
Floor space ratio	1:1	1:1	2.5:1 – Site A 1.5:1 – Site B
Height of building	-	10 metres	RL controls / up to 8 storeys / Max 26 metres

Table 1: Proposed LEP provisions

7.5. Planning justification and implementation

The applicant's planning justification is largely based on the utilisation of the site to provide additional jobs and housing for the locality than provided by the current industrial uses on the site. The proposal argues that the changing nature of industrial land, employment profile of Ryde LGA justify a mixed development on the site.

The planning justification is supported by a number of specialist reports including the architectural study, economic assessment, traffic assessment and environmental reports. The proposal also addresses the DP&I's Industrial Lands Strategic Assessment checklist, concluding that the proposal is consistent with the Draft Metropolitan Strategy for Sydney. Relevant extracts, summarising the key aspects of the planning justification is provided below:

Industrial land assessment

- *In accordance with the findings of Mecone's Employment and Centres Study 2009 and Hill PDA's economic impact assessment of the area, the following conclusions are made in regards to industrial trends in the Ryde LGA:*
- *Employment generation on industrial land is declining due to rationalisation with advanced technology allowing the same employment functions to be performed with a reduced number of workers;*
- *A comparison between the census data and industrial demand forecast indicates that actual ratio of resident blue collar workers is lower than those identified in the Employment and Centres Study forecasts;*
- *It is acknowledged that the Gladesville Industrial area plays an important role in providing urban support services such as auto repairs, light manufacturing, catering and sporting uses and vital services that support local residents and businesses in the area. However, the subject site is separated from this area with a residential interface and therefore struggles to meet this role;*
- *A certain 'critical mass' is usually considered necessary for successful operation of industrial and commercial uses. The site is segregated from the main Gladesville Industrial Area and is subject to vulnerabilities of a small business base;*
- *It is understood that the existing industrial business on site A (2-12 Tennyson Rd) currently employs 20 staff (refer to Table 8 above). Compared to the employment rate benchmark of 1 job per 80m2 of leasable space as identified by Hill PDA, it is considered that the land is being underutilized and does not play a significant role in employment generation within the area. Further, it is noted that the adjoining Dexus building has a high vacancy rate; and*
- *As shown in table 8 above mixed use development on site can potentially generate a net increase of up to approximately 294 employees. As such, the proposal will result in a significantly higher employment generation rate for the site.*

Retail assessment

- *Hill PDA concludes that the site can be redeveloped without jeopardising the role or function of Gladesville or any other existing centre. The report identifies existing demand for an additional approximately 5,000m2 of retail space on the subject site, including approximately 3,000m2 of supermarket and 2,000m2 of specialties (around 15-20) out of which three or four would be non-retail commercial services.*
- *During the preliminary discussions, both Coles and Woolworths have expressed interest in a supermarket of around 3,200m2 in the area.*

The proposal also undertook various site-specific investigations at the potential development outcomes resulting from the proposal. This includes traffic, geotechnical, contamination and stormwater studies. These studies conclude that the proposed B4 mixed use zoning will not lead to significant adverse environmental or amenity impacts on the adjoining properties or immediate locality.

7.6. Mapping

The proposal includes a series of maps to accompany the Draft LEP as follows:

- Land Zoning;
- Height of Buildings; and
- Floor Space Ratio.

The proposal has also includes a draft site specific DCP with the following maps:

- DCP Application;
- Setback Area;
- Access;
- Building Height (number of storeys); and
- Open Space.

7.7. Community consultation

A key part of the planning proposal and gateway process is community consultation and engagement.

Should the proposal proceed through the Gateway determination to public exhibition, the community will be provided with an opportunity to be advised of the application and be able to provide comment.

The proposal does not include any additional community engagement strategies beyond the minimum statutory requirements at this stage in the planning process including notification on Council's website and newspapers and to adjoining neighbours.

7.8. Supporting documentation

The proposal is accompanied by the following specialist reports:

- Planning proposal prepared by Mecone dated October 2013
- Architectural Design Report prepared by Grimshaw Architects
- Drafting Instructions and LEP Maps prepared by Mecone dated October 2013
- Draft DCP prepared by Mecone dated October 2013
- Net Community Benefit Test prepared by Hill PDA dated August 2013
- Economic Impact Assessment prepared by Hill PDA dated August 2013
- Environmental Site Assessment prepared by EIS dated October 2012
- Geotechnical Assessment prepared by JK Geotechnics dated October 2012
- Traffic Impact Assessment prepared by Traffix October 2013
- Stormwater Management Plan prepared by TTW dated April 2013

8. Review of the planning proposal and key issues

This section undertakes an analysis and review of the proposal, including adequacy of the application, planning justification and key planning issues. The following issues are considered to be of strategic planning importance when reviewing the proposal and planning justification:

- Consistency with the Government's strategic planning framework
- Consistency with Council's Strategic Direction (local planning strategy and DLEP 2011)
- Loss of industrial lands
- Role of the Gladesville Town Centre and Victoria Road Corridor
- Retail uses on the site
- Appropriateness of high density residential development
- Other planning approvals in the locality
- Traffic issues

An analysis is also undertaken in the context of the State strategic planning framework, in particular the Strategic Lands Assessment Checklist set out in the Draft Metropolitan Strategy.

Given the recommendations in this report particular, in relation to strategic planning and traffic impacts, a detailed consideration of the proposed controls in the Draft DCP provided by the applicant was not undertaken.

8.1. Adequacy review

Section 55 of the *Environmental Planning and Assessment Act 1979* (the Act) set outs the requirements for planning proposals. The relevant DP&I guidelines to determine the adequacy of a planning proposal are:

- *Guide to preparing local environmental plans (April 2013)*
- *Guide to preparing planning proposals (October 2012)*

The *Guide to preparing planning proposals* outlines matters that should be included in a planning proposal to satisfy the requirements of the Act. The proposal has been reviewed against the provisions of the Act and DP&I guidelines. This section is not a merit analysis but a review of the adequacy of the application in response to the information required to address the Guidelines.

Overall the application is considered adequate to enable Council to determine whether the proposal should be submitted for a Gateway determination. An overview is provided at Attachment 1 to this Report.

8.2. Consistency with the Government's strategic planning framework

The planning justification is one of the most critical parts of the planning proposal. It should provide sufficient evidence that the proposed change of landuse or rezoning is justified in terms of the broader planning framework and the Council's future strategic direction for the

locality. The current proposal is considered to be adequate for the purposes of a gateway determination. Notwithstanding the high quality of the architectural studies, the proposal is considered to be flawed in the following 3 key areas:

- inconsistency with key state planning policies/directions in relation to industrial lands and centres policy;
- inconsistency with Council's strategic direction for the future of industrial land in the Ryde LGA and the general locality; and
- the resultant development outcome is considered inappropriate for the site.

There are 2 fundamental issues to consider in relation to this proposal:

- Should the current industrial land be retained for industrial and employment purposes?
- If not, is a mixed use zoning to allow a major residential and retail development up to 8 storeys with floor space ratios of up to 2.5:1 appropriate in this location?

The Government's strategic planning framework broadly addresses both of these issues. First, both former and current State Government policies acknowledge the need to protect industrial and employment lands. Although, the current Draft Strategy does accept that these lands, particularly within well-established urban areas can be under pressure to be rezoned for other (namely residential and mixed use) uses. In this regard, it provides a checklist for planning authorities to consider when dealing with a rezoning of industrial land.

Second, major residential and mixed use development is generally encouraged to be located within existing centres and strategic corridors to utilise existing infrastructure to take the burden off Sydney's urban fringe and reduce impacts on established areas.

There are also a number of Ministerial Directions (s117 Directions) that provide guidance on the protection of business and industrial lands and other matters on the rezoning process.

Although, the proposal has merit in relation to the proposed seniors living development and community uses, on balance, it is considered inappropriate for this site. In this regard, it is appropriate to consider the proposal against the following policies as detailed below:

- Draft Metropolitan Strategy 2013 and Metropolitan Plan 2036
- State environmental planning policies (as relevant)
- S117 Directions (as relevant)
- Draft Subregional Strategy

Draft Metropolitan Strategy 2013 and Metropolitan Plan 2036

The Draft Metropolitan Strategy is a high level strategic document to guide the future development of Sydney. In this regard, it provides broad policy direction on many complex and inter-related landuse issues. These directions should not necessarily be related to a specific site, but rather on a precinct, centre or regional basis.

The proposal is located outside of the Gladesville Town Centre, which is identified as a Village in the Ryde LGA centre hierarchy. The Centre has been subject to an extensive master planning exercise, which resulted in a new LEP in 2010. A number of applications have since been submitted and approved within the Centre to support this function. Any future residential mixed use development of this scale should ideally be located within this centre.
The Draft Metropolitan Strategy also encourages new major residential development within Centres, to make use of existing infrastructure and encourage diverse and active centres.

This policy direction both supports centre development and protects the existing character of established low density residential areas by limiting the adverse impacts including height, bulk and scale and traffic issues.

The Draft Strategy also seeks to protect existing industrial lands, noting that by exception, consideration to rezone these lands may be undertaken subject to a strategic assessment.
The Draft Strategy does promote future housing and employment to be integrated within transport corridors. In this regard, Victoria Road is classified as strategic transport corridor. As a result, it is considered that the site be retained primarily for employment uses for the following key reasons:

- To protect the limited industrial land remaining in the LGA
- Development should be located in centres to support the recent planning undertaken to revitalise the Gladesville Town Centre and Victoria Road Corridor
- The resultant impacts of the proposal on the interface with the residential areas will be unacceptable in relation to traffic

It is also noted that the locality has been previously identified for Enterprise Zone to promote alternative employment uses. It is considered that this should provide a basis for further investigation for alternative employment uses for the site should the existing industrial zone not deliver sufficient employment uses.

Strategic assessment of Industrial lands

In relation to the loss of existing industrial lands, the Draft Metropolitan Strategy notes:

> *… Existing industrial lands, especially in established areas, are under pressure to be rezoned to other uses, despite the clear need for them in the future. Latest data also reveals a noticeable increase in rezoning of employment lands to non-industrial and wider employment uses…*

In response, the Draft Strategy provides a Checklist, which outlines 6 critical questions that should be considered by planning authorities when considering whether to allow industrial lands to be rezoned for other uses (Figure 18).

Criteria Table 1: Industrial Lands Strategic Assessment Checklist for rezoning of existing industrial land to other uses

- Is the proposed rezoning consistent with State and/or council strategies on the future role of industrial lands?
- Is the site:
  - near or within direct access to key economic infrastructure?
  - contributing to a significant industry cluster?
- How would the proposed rezoning impact the industrial land stocks in the subregion or region and the ability to meet future demand for industrial land activity?
- How would the proposed rezoning impact on the achievement of the subregion/region and LGA employment capacity targets and employment objectives?
- Is there a compelling argument that the industrial land cannot be used for an industrial purpose now or in the foreseeable future and what opportunities may exist to redevelop the land to support new forms of industrial land uses such as high-tech or creative industries?
- Is the site critical to meeting the need for land for an alternative purpose identified in other NSW Government or endorsed council planning strategies?

Figure 18: Industrial Lands Strategic Assessment Checklist
(Source: Draft Metropolitan Strategy)

The proposal provides a summary analysis against the checklist both in the planning report prepared by Mecone and the Net Community Benefit Test prepared by Hill PDA. The proposal is not considered to satisfactorily address the checklist as detailed below:

- *Consistency with a Strategy*

The proposal is clearly inconsistent with Council's local strategy of retaining the remaining areas of industrial land within the Ryde LGA. This is reflected in the Local Planning Strategy, which resulted in retaining the sites' IN2 light Industrial zoning in the Draft LEP 2011. The proposal is also considered to be inconsistent with both the Draft Metropolitan Strategy and Draft Subregional Strategy as detailed in Sections 5.3, 8.2.1 and 8.2.4 of this report.

The proposal argues that by providing additional employment to current uses, combined with broad changes to the current employment profile is sufficient to satisfy this provision. This is considered simplistic and does not address he underlying role of the site as part of an urban services cluster of industrial uses to support other businesses in the Ryde LGA.

Further, recent demographic data indicates that generally industrial uses are catering for the current employment profile of the LGA.

- *Proximity to infrastructure*

The site is well located to Victoria Road for industrial uses, which has been identified as a both a strategic transport corridor and tertiary freight corridor in the Government's Long Term Transport Masterplan and Freight and Ports Strategy. The site is considered to be generally well located to the Precinct, with Victoria Road acting as a key transport corridor to service both sides of the Precinct.

- *Impact on existing stocks and demand*

The Gladesville Industrial Precinct is approx. 21.27 ha (excluding the bus depot). This represents over 75% of the remaining IN2 Industrial Land in the LGA with only 2.12% of all employment land within the LGA. Given the very limited remaining industrial land within the LGA, the rezoning of the site is considered to have an impact on existing industrial land stocks.

The proposal argues that the site is not well connected to the remaining part of the Gladesville Industrial Area and combined with changing nature of the Ryde employment profile to 'white collar' jobs therefore should be rezoned. It is acknowledged that the site may not be currently contributing to the industry cluster of the Precinct, however in isolation this is not considered sufficient to support the application.

- *Impact on ability to meet targets*

Ryde LGA is currently on track to meet its employment targets without the redevelopment of this site. The applicant argues that a mixed-use development will provide a higher number of jobs – which may be the case.

However, it is the type of jobs and role and function of the site, which it critical. The redevelopment of the Top Ryde Shopping Centre and recent initiatives to rezone the Gladesville Town Centre are likely to provide sufficient retail jobs for the LGA as outlined in the Ryde Local Planning Strategy.

- *Compelling argument that the site cannot provide other industrial uses*

It is considered that the proposal has not provided a compelling argument on this issue. There has been little analysis of the existing role and function of the Gladesville Industrial Area or consideration of viable alternative industrial/employment generating uses for the site.

- *Critical to meet the need of Strategy*

The site has been identified for retention in an endorsed local strategy. In this regard, Council's Local Planning Strategy recommends retention of the site for industrial uses, noting the existing industrial areas are vital to meet local and regional needs in affordable locations, such as Victoria Road on the edge of identified centres. Similarly, the Draft Subregional Strategy also recommends that the industrial land be preserved (Section 5.3, 8.2.4 and 8.3 and 8.4.4)

8.2.1. State environmental planning policies

The SEPPs relevant to the proposal are generally applied at the development application stage, with the exception of *State environmental planning policy 55 - Remediation of Land*.

In relation to this SEPP, when considering a planning proposal, Council must:

- consider whether the land is contaminated, and
- if the land is contaminated, be satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for proposed uses, and
- be satisfied that the land will be remediated before the land is used for that purpose.

The application is accompanied by a Preliminary Stage 1 Report to address potential contamination issues from the previous industrial uses. This report has been referred to the relevant Council officers, who conclude that although there is insufficient information and the reports only covering one of the 2 sites, they raise no objection to further investigation of the site. Given the recommendation of this report, it is not considered appropriate to request further information at this time.

Should Council support to progress the planning proposal; it is recommended that Council seek further information from the applicant in order to satisfy the requirements of SEPP 55.

A high level assessment of the proposal has taken into consideration *SEPP 65 – Design Quality of Residential Flat Development* as detailed in Section 10.3 of this report.

8.2.2. Section 117 Directions

The proposal is considered to be inconsistent with a number of s117 Directions including loss of industrial lands, site specific provisions and consistency within the Metropolitan Strategy as detailed below at Table 2.

Ministerial Directions	Comment
1.1 Business and Industrial zones	• The applicant maintains that the proposal is consistent with the Direction, as it will continue to provide for business operations. • The proposal does provide for a continuation and potentially an increase of employment uses. However, it is considered inconsistent with the

Ministerial Directions	Comment
	objectives and provisions of the Direction as it: • does not protect industrial land; • is located outside of an identified centre; and • is not considered to be consistent with an identified strategy.
3.1 Residential zones	• This Direction encourages housing choice within existing urban areas to minimise impacts on the urban fringe. • The proposal is considered to be consistent with this Direction.
3.4 Integrating land use and transport	• The proposal is located in close proximity to a major transport corridor (Victoria Road) and existing public transport and therefore partially satisfies the Direction. • However, given the potential traffic issues identified in the Independent Council's traffic report, it will have adverse impacts on the local road network, including the intersection at Tennyson Road and Victoria Road (which has been identified as a strategic bus corridor and arterial road and tertiary freight corridor).
4.1 Acid Sulfate Soils	• The site is has not been identified as affected by Council's Acid Sulfate Soils Map. • Notwithstanding, the proposal has committed to manage any impacts in accordance with the relevant guidelines. • The proposal is considered to be capable of being consistent with this Direction.
6.1 Approval and Referral Requirements	• The proposal does not include any referral provisions. It is noted that the ISEPP 2007 requires consultation with the RMS in relation to traffic generating developments, which is likely to be required should the proposal proceed to a rezoning. • The proposal is considered to be consistent with this Direction.
6.3 Site Specific Provisions	• The proposal seeks a B4 Mixed use zone with additional uses and objectives that are not permitted including high-density residential uses. It also proposes specific height controls based on the concept masterplan. • The proposal is considered inconsistent with this Direction due to the proposed height controls that are specifically related to the proposed development outcome.
7.1 Implementation of Metropolitan Plan for Sydney 2036	• The proposal seeks to rezone Employment Lands, which is inconsistent with the current Metropolitan Plan. • The Draft Metropolitan Strategy also seeks to retain industrial land, however recognises the pressure to rezone these lands to other uses, including residential uses. The Strategy provides a framework to assess these proposals – Industrial Lands Strategic Assessment Checklist. • The applicant's assessment under this framework is not supported and therefore the proposal is considered to be inconsistent with this Direction.

Table 2: Consideration of S117 Directions

8.2.3. Draft Subregional Strategy

Council has demonstrated that it can exceed both the housing and employment targets set by the Draft Strategy in existing and identified centres, without the need to rezone additional land within the Ryde LGA. Generally, the proposal is considered to be inconsistent with the Strategy in terms of retention of industrial land and location of mixed-use development in this location. This issue is detailed in the analysis in Section 8.3 of this report below.

As identified in both the Draft Metropolitan Strategy and Draft Subregional Strategy, existing industrial land in established areas is limited. Should areas such as Gladesville Industrial Area be rezoned, this is likely to impact on the supply of these industrial and employment uses, in particular urban services to service local and regional communities.

8.3. Consistency with Ryde Local Planning Strategy and Draft LEP 2011

The Ryde Local Planning Study informs the Draft LEP 2011. The proposal is considered to be inconsistent with the Draft LEP, which retains the site's Light Industrial zone for future employment and industrial uses. An analysis of the key directions of the Strategy relevant to the proposal is detailed below:

Centres and Corridors

- The study builds on Council's Urban Village Strategy 1998, which identifies Gladesville Town Centre as a Village and supports the new LEP to strengthen its role for employment and housing. The study identifies the site as part of the Gladesville Industrial Area located within the Victoria Road Corridor.

- The study recognises the current issues faced by industrial lands and makes recommendations to include other employment uses to facilitate growth and encourage retention of employment uses of these areas. The study concludes that Ryde can deliver its housing and employment targets in its existing centres without relying on this site.

- The Study recognises the Victoria Road Economic Corridor as providing low cost accommodation for a range of local and regional services, including start-up offices, light industrial, showrooms, building supplies and retail. As a key corridor detailed in the Centres and Corridors Study, the Victoria Road Corridor runs through West Ryde, Gladesville and two industrial precincts identified as strategic employment lands in the Inner North Subregional Strategy.

  The proposal is considered to be inconsistent with this objective of retaining the industrial and employment opportunities within this corridor location.

Housing

- The study demonstrates that Council can deliver its housing targets set by the State Government, which have been increased in the Draft Metropolitan Strategy. The study recommends concentrating housing within Macquarie Park and its Town Centres, in particular large apartment buildings and mixed use developments within identified centres. The study identifies up to 1,100 new dwellings within the Gladesville Town Centre.

- Council has recently undertaken further analysis of dwelling numbers for the LGA, which indicate a significant increase in previous future dwelling estimates. The Draft Inner North Subregional Strategy set a target of 12,000 additional dwellings in the LGA by 2031.

- The Ryde Local Strategy estimated a total of 15,751 additional dwellings between 2004-2031. A review of dwelling numbers has seen this estimate increase to 34,467 during this period (Table 4), with 27,753 additional dwellings between 2014 and 2031. Council advise that this increase is due to the following:

  - Numerous major project approvals (Part 3A) in Macquarie Park and Meadowbank issued by the State Government
  - North Ryde Station Precinct
  - Revised dual occupancy numbers based proposed subdivision provisions
  - Upzoning of Eastwood and Ryde

- Herring Road Urban Activation Precinct

Time period	Estimated additional dwelling numbers (excluding Herring Road UAP areas within Macquarie University)
Subregional Strategy (2004 – 2031)	12,000
Ryde Local Planning Study (2004 – 2031)	15,751
Revised Estimate (2014 – 2031)	27,753
Revised Estimate (2004 – 2031)	**34,467**

Table 4: Revised dwelling numbers for Ryde LGA (Source: Ryde City Council)

- The study also identifies residential transition areas located on the edge of centres consisting of small apartment buildings, town houses, villas and houses. Notwithstanding the importance of retaining the site's industrial uses, the proposal is not considered to have demonstrated an appropriate built form response as a transition area in this location.

Employment

- The Inner North Draft Sub Regional Strategy requires the LGA to cater for an additional 21,000 workers by 2031. The Strategy outlines that the LGA will exceed this figure by providing over 28,600 jobs will be provided in the City as a result of development within the Centres and industrial areas. The Strategy makes the following comment:

  … In 2007 Macro Plan, a planning consultancy undertook an assessment of jobs growth in the City, as part of the employment lands assessment undertaken for the Meadowbank Master plan. This assessment indicated that the growth of the commercial /office sector between 2004 - 2031 would result in the creation of 39,000 jobs.
  The main growth area would be the Macquarie Park Corridor. Considering of both set of figures it is apparent that the City will meet the target of 21,000 additional jobs by 2031… (City of Ryde Local Planning Study Employment; Page 7-29)

- The study also recognises the changing nature of industrial land and undertakes a high level analysis of supply and demand of the remaining industrial land in the LGA.

- The study concludes that with changes to Meadowbank and Macquarie Park, the retention of existing industrial land within the Gladesville Industrial Area is vital to service for local and regional needs.

- It also finds that the LGA exceeds its retail supply for the region, which will only grow with the development of Top Ryde and Macquarie Centre. It also identifies Victoria Road Corridor in this location for future employment potential as an enterprise corridor.

Strategic Direction

- The study protects existing employment Lands by maintaining the IN2 Light Industrial Zone (including the site) but introducing height controls and additional issues, including bulky goods and commercial uses for other specific sites along Victoria Road.

- The Study recommends that Council undertake further investigations of industrial areas within the LGA to develop strategies to maintain these areas as viable employment lands.

Summary

The proposal is considered to be generally inconsistent with the intention and directions of the Local Planning Strategy. This is primarily in terms of the retention of industrial land and location of major housing and retail development outside of an identified centre. The Strategy indicates that the LGA can meet its housing and employment targets without relying on future dwellings or employment from this proposal.

The Strategy recognises the difficulties faced by industrial lands and recommends Council undertaken further investigation to expanding employment uses to address this issue.

The Strategy also identifies the Gladesville Town Centre and Victoria Road corridor as the primary place of new retail and major residential development in this location, supporting the development of the Centre, which is reflected in the recent LEP 2010 and subsequent development activity.

8.4. Loss of industrial lands

This report does not contain a detailed economic or demographic analysis. It provides planning consideration of key issues in consultation with Council staff and Council's independent demographic and employment experts. It undertakes an analysis of key issues in the context of the relevant planning strategies and policy and makes observations and recommendations based on key demographic and employment data provided by economy id (economic profile / data tool).

The City of Ryde has rezoned a number of industrial lands for residential and commercial uses, namely Meadowbank and Macquarie Park. Both of these areas have been subject to targeted and comprehensive planning studies, which saw the transformation of these areas from industrial uses to mixed uses and specialised centres.

As noted in the Ryde Local Strategy, the transformation for Meadowbank was pursued for a number of reasons:

> *The Meadowbank Employment Area began its transformation from an industrial area comprising manufacturing/auto activities to a residential/commercial area in the late 1990s. The transition occurred as a result of a new set of planning controls that reflected the emergence of the Parramatta River as a residential and commercial corridor - a development trend that was occurring in Rhodes, Cabarita and elsewhere along the river. The transition of the areas was a reaction to the relocation, down scaling and closure of heavy industrial activities within the inner ring suburbs* (City of Ryde Local Planning Study, Employment; page 7-15*).*

The Draft Metropolitan Strategy specifically identifies Macquarie Park as a Specialised Centre and part of the Global Economic Corridor, which has been recently supported by significant investment and planning including major commercial and residential developments and integrated transport such as heavy rail lines.

Although there are some parallels with these sites and the current Industrial areas, they are not considered to be comparable to the current site and have been part of broader master planning responding to both market issues with broad Government and Council support.

8.4.1. Existing Industrial Lands in Ryde LGA

The loss of industrial lands is the central strategic planning issue in the consideration of the proposal.

The Gladesville Industrial Area is one of the last two remaining industrial areas in the Ryde LGA (the other is the West Ryde Industrial Area), following the rezoning of the Meadowbank Employment Area and ongoing transformation of Macquarie Park as a Specialised Centre (Figures 19 & 20). This issue is recognised in both the Draft Subregional Strategy and Ryde Planning Strategy.

Combined, both precincts represent a very limited area nominated for these type of employment uses in the LGA, in fact representing less than 2.8% of the total employment land in the LGA and 0.69% of the total area of the LGA. Details of these areas are outlined in Table 3 below.

Figure 19: West Ryde Industrial Area (Source: Ryde LEP 2010)

Figure 20: Gladesville Industrial Area (Source: Ryde LEP 2010)

IN2 Industrial Precinct	Predominate use	Size (ha)	% employment land in Ryde LGA	% total land in Ryde LGA
Gladesville	Local industry – automotive, construction and support services	21.27ha	2.12%	0.52%
West Ryde	Local industry – automotive, construction and support services	6.66ha	0.66%	0.16%
Total		**27.93ha**	**2.78% (1002.89ha)**	**0.69% (40.651 km2)**

Table 3: Light Industrial Areas in Ryde LGA

8.4.2. Role of Gladesville Industrial Area

The Gladesville Industrial Area plays an important role of providing local and regional services to the community. A recent audit undertaken by Council officers reveals a number of automotive, construction and businesses that provide a local and regional service role to both the public and other businesses in Ryde LGA. It is considered that these businesses provide a critical role as urban support services for other major employment areas in the LGA including Macquarie Park and other major centres such as Top Ryde.

This Industrial Area can be categorised as containing a cluster of long-standing automotive uses, which is evolving to construction and other urban services.

As part of Draft LEP 2011, Council proposes a number of additional uses in the zone including funeral homes, hardware and building supplies, landscaping material supplies and storage premises. In addition, commercial uses and bulky goods retailing have also been permitted on specific sites fronting the Victoria Road corridor. Council advises that these uses were permitted due to the location of the site with direct access to Victoria Road, size and configuration and characteristics of the site.

8.4.3. Applicant's argument

The proposal includes a net community benefit test and analysis of the loss of industrial lands based on the DP&I's Draft Centres Policy 2009. This draft policy was placed on exhibition in April 2009 as a consultation draft – not Government policy under the former State Government and has not been endorsed.

The DP&I has advised that this policy (and the Draft Competition SEPP) is not being actively progressed at present and that the issues that they seek to address are more likely to be examined in the development of the new State Planning Policies as part of the new planning system. The Draft Metropolitan Strategy and the Ryde Local Planning Strategy are considered the appropriate strategic documents in this instance.

Notwithstanding, the applicant's argument to address the loss of industrial lands can be summarised as follows:

- The demand for industrial land has decreased in the LGA, through broader market conditions and the growth of Macquarie Park as a specialised centre, also identified in the Ryde Local Planning Strategy
- The employment profile of the LGA has reduced blue collar workers
- Industrial land in the LGA has difficulties competing with western Sydney
- Council have recently identified additional land uses within the Gladesville Industrial Area demonstrating evidence of struggling traditional industrial uses
- The site is currently underutilised with low employment yields
- The proposal will provide for higher employment yields on the site
- The site is disconnected from the main part of the Gladesville Industrial Area and does not have critical mass for the successful operation of industrial uses.

8.4.4. Response and assessment

Importance of industrial land to the LGA

The site forms part of one of the last remaining light industrial areas within the Ryde LGA. Notwithstanding the pressure to rezone this and other industrial sites, the preservation of this land for future light industrial and employment uses has been encouraged and recommended by the relevant planning strategies and policies, namely the Ryde Local Planning Strategy which provides the strategic direction of the LGA.

Similarly, the Draft Inner North Subregional Strategy clearly identifies this site for retention on a regional basis due to the limited supply of industrial lands in the region.

On a broader scale, the Employment Lands Development Program (ELDP) 2011 report notes that the demand for industrial land will increase and notes a limited supply of undeveloped and serviced land across Sydney. The ELDP 2010 Inner North Subregion report also specifically identifies the Gladesville Industrial Area as having the second highest job densities in the region.

Industrial uses are important to the LGA and surrounding region. Industrial uses are a dominant job, revenue and wealth generator for both the LGA and many surrounding areas[1]. Manufacturing and wholesale trade have been used as examples to illustrate this issue.

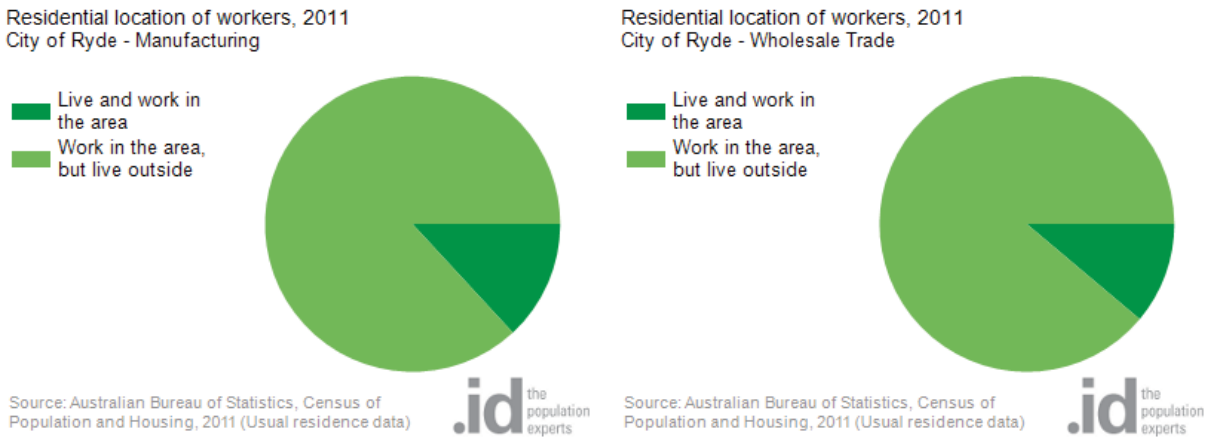


Figure 21: Location of workers in manufacturing and wholesale trade indicating importance to the region (Source: economy id 2013)

The following extract from economy id illustrates that manufacturing and wholesale trade represent the largest single employer in the LGA:

Dominant groups

An analysis of the jobs held by the full-time equivalent workforce in City of Ryde in 2011/12 shows the four largest industries were:

- *Professional, Scientific and Technical Services (12,900 FTEs or 15.4%)*
- *Information Media and Telecommunications (11,333 FTEs or 13.6%)*

[1] Sources: economy.id, labour force region map, employment capacity, ABS journey to work, FTE Employment

- *Wholesale Trade (10,847 FTEs or 13.0%)*
- *Manufacturing (7,723 FTEs or 9.2%)*
- *Retail Trade (5,540 FTEs or 6.5%)*

In 2011/12, retail consisted of 4,670 jobs making up 5.6% of the workforce, whilst wholesaling and manufacturing accounted for 18,570 jobs and 22.2% of the workforce.

It is acknowledged that (in particular manufacturing), Macquarie Park and other locations contribute to these statistics. However, these are landuses that are permissible on the site and can be used for future employers.

It should be noted that wholesale trade (as defined by the ABS) includes: basic material wholesaling, machinery and motor vehicle wholesaling and personal and household good wholesaling. Although these landuses are currently prohibited in the IN2 Light Industrial Zone, in order to provide additional employment opportunities, Council is recommending that wholesale supplies be added as a permitted use in this zone. This additional landuse is part of a planning proposal to the Ryde LEP, which is currently with the DP&I for a gateway determination. In this regard, it is considered relevant to consider this landuse to demonstrate the importance these types of industrial uses to the LGA, particularly compared with retail uses.

Significant growth in industrial activities

A number of industrial uses are growing, in particular wholesaling and manufacturing. High Tech industries such as computer and telecoms rely upon wholesaling and small manufacturing support industries[2]

The following extract from economics id illustrate that manufacturing and wholesale trade are growing, while the retail sector indicates little growth in full time equivalent (FTE) workers:

Emerging groups

The number of people in the full-time equivalent workforce in the City of Ryde increased by 17,518 between 2005/06 and 2011/12. The largest changes in the jobs held by the full-time equivalent workforce between 2005/06 and 2011/12 in the City of Ryde were for those employed in:

- *Information Media and Telecommunications (+7,792 FTEs)*
- *Professional, Scientific and Technical Services (+3,100 FTEs)*
- *Manufacturing (+1,900 FTEs)*
- *Wholesale Trade (+1,603 FTEs)*
- *Retail (+142 FTEs)*

Industrial land is well suited to the new residential workforce in Ryde

Ryde's workforce is evolving, with a higher number of educated workers compared to Greater Sydney (Figure 22). This can be seen to match some industrial uses with the workforce profile indicating Manufacturing and Wholesale Trade in Ryde with higher rates of highly educated, productive, young, and professional workers than Greater Sydney[3].

[2] Sources: economy.id, NIEIR – employment, output, value-add, productivity, industry Sector Analysis

[3] Sources: profile.id, ABS qualifications by industry, ABS occupations by industry, ABS income quartiles

In summary, it is considered that industrial lands and uses play an important part in the economic well being of the Ryde LGA. They contribute to the economy for both local residents and broader region and can respond to the changing employment profile for Ryde. In relation to the Gladesville Industrial Area, it is considered to provide a valuable cluster of automotive and construction based uses that service both the local and broader community.

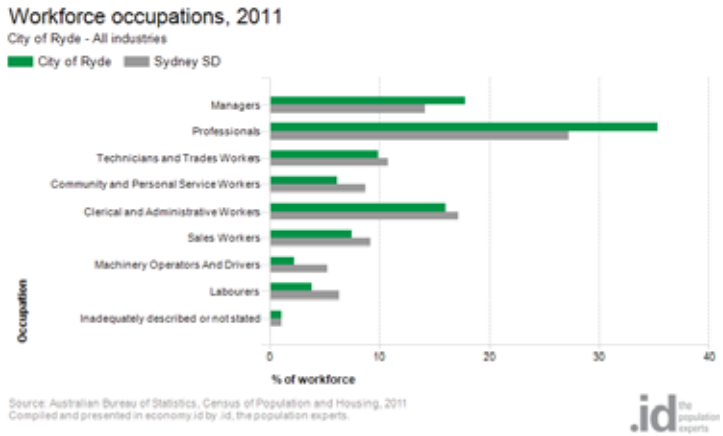


Figure 22: Workforce occupations in Ryde LGA (Source: economy id 2013)

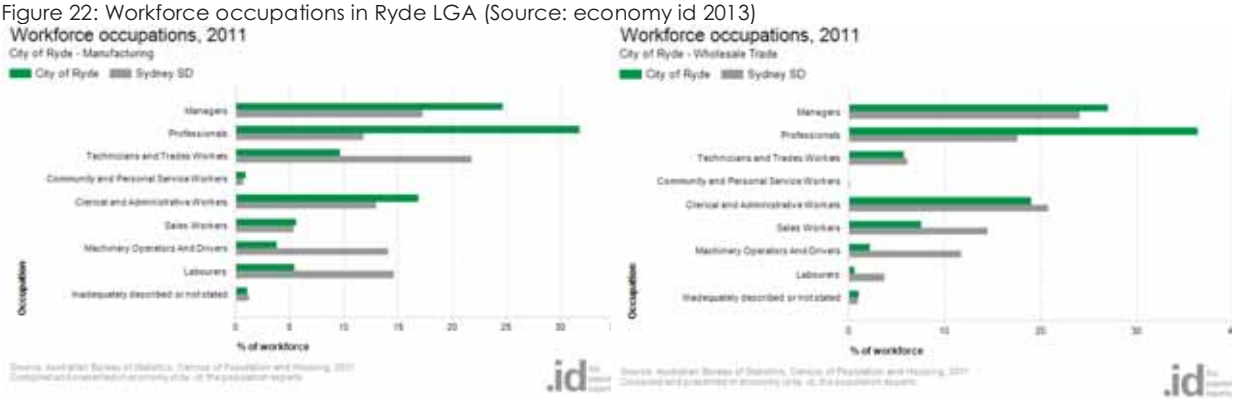


Figure 23: Workforce occupations of manufacturing and wholesale trade demonstrating catering to new workforce in the Ryde LGA (Source: economy id 2013)

Current uses and future employment yields

It is acknowledged that the current operations may not provide the optimal employment numbers for the site, compared with a mixed use retail scheme. However as detailed above, given the importance of industrial lands to the LGA, the site should be retained for industrial/employment purposes.

However, it has been acknowledged by Council in its Local Planning Strategy that there is a need to assist landowners to consider additional employment uses on industrial lands. In this regard, Council has expanded the uses in this zone to respond to this issue and recognition that securing viable tenants can be challenging.

Council has advised that under draft LEP 2013 a number of additional land uses are proposed to be permitted with consent including funeral homes, hardware and building supplies, landscaping material supplies and storage premises. In addition, wholesale supplies and recreation facility (indoor) will also be permitted with consent in the IN2 zone through a separate draft LEP (currently awaiting Gateway Determination).

Given the demographic and economic work recently undertaken by Council, it is considered reasonable for Council to work with the landowners to investigate additional uses for the site for future employment and industrial uses. These future uses should support other major industries in the LGA and provide employment for both the local workforce and also continue to act as an attractor for workers outside of the LGA.

Site disconnected to the Industrial Area by Victoria Road

The locality and indeed many parts of the Ryde LGA are characterised by precincts that are bisected by major transport corridors, including roads and rail. This is not considered a valid reason to rezone the land to enable a mixed use development. To the contrary, the site's location in proximity to a major transport corridor and identified tertiary freight route is considered appropriate to support future employment uses.

Summary

The applicant's arguments are not accepted in relation to the loss of industrial land on this site. Recent data indicates that industrial uses are responding to the employment profile of the LGA and are a valuable contributor to the economy. These uses provide urban services to support other businesses in Ryde and also jobs for a number of workers outside of the LGA. This report identifies scope for further investigation of these uses on a site by site basis, similar to recent amendments to land along Victoria Road in this locality to respond to existing site conditions and characteristics, access/traffic issues and impacts on the surrounding locality.

8.5. Role of Gladesville Town Centre and Victoria Road Corridor

The relevant state and local strategic planning polices encourage the development of centres to support future high-density housing, mixed use and employment uses. Council has supported the growth of the centres within the LGA for many years.

The Ryde Urban Village Strategy 1998 commenced this work, which has been carried through in the Ryde Local Planning Strategy, new LEP for Gladesville Town Centre and other work in centres across the LGA.

The Strategy identifies Gladesville as a Village within the Ryde Centres network and the desired future character as:

> *Gladesville will service a local community, with increased community services and facilities (e.g. urban parks and plazas) and a safe, convenient pedestrian network that connects local destinations* (City of Ryde Local Planning Study, Centres and Corridors; 2-35).

The new LEP is based on a Masterplan for the Town Centre that adopts a precinct based approach, each with different roles and functions – Monash Road, North Gladesville, Gladesville Village and South Gladesville. The site adjoins the Monash Road Precinct, with a desired future character as identified in the Strategy below:

> *Land use: Without competing with Gladesville Town Centre, Monash Road Precinct will provide a mix of convenience retail and services to local residents and workers in addition to specialist goods and services for the wider community.*

Built Form: Gateway site five stories, retain heritage item
Public domain: strip shopping character format – outdoor dining street activation
(City of Ryde Local Planning Study, Centres and Corridors; 2-131)

The LEP addresses anomalies for certain sites adjoining the corridor and town centre. This involved amending the zoning, height and FSR development standards in the LEP and the DCP. The new LEP provided further opportunities for mixed land use zones and development potential to create a transition between the higher density on Victoria Road and adjoining land uses.

The Study identifies that the Gladesville Town Centre and Victoria Road Corridor serves an important function in the LGA by providing cheaper, flexible accommodation that will support start up and small businesses to contribute to the employment diversity of the LGA. The new LEP is expected to provide for an additional 1,100 jobs.
The Strategy makes the following key recommendations in relation to the Gladesville Town Centre:

Being close to city (20mins) with good public transport, 360 views, leisure and sporting facilities, Gladesville, Primrose Hill and Monash Road will offer exceptional live-work environments. The potential for growth is therefore strong.

Gladesville town centre will spread towards Monash Road and the Gladesville Industrial precinct. The master plan and DCP aim to maintain the two as distinctive centres and create different less intensive urban development in between. It will be important to concentrate retail development in the two centres rather than dilute it.
(City of Ryde Local Planning Study, Centres and Corridors; 2-132)

Summary

Council (in consultation with the community) undertook planning work for Gladesville Town Centre and Victoria Road Corridor that commenced with high-level strategies, followed by a Masterplan and finally delivery through a new LEP for the area. The LEP did not extend to the site and covered land located within the Victoria Road transport corridor in recognition of:

- existing business areas that required revitalisation;
- the availability numerous of sites within the area for redevelopment; and
- the need to protect existing industrial and employment lands.

The aims and objectives of the LEP are now evident in a number of development proposals within this area. The Centre and corridor have been planned as the most appropriate location to contain a major mixed use development.

8.6. Retail uses on the site

This report does not contain a detailed retail assessment or economic analysis. It provides planning consideration of key issues in consultation with Council staff and Council's independent demographic and employment experts. It undertakes an analysis of key issues in the context of the relevant planning strategies and policy and makes observations and recommendations based on key demographic and employment data provided by economy id (economic profile / data tool).

The proposal includes a significant amount of retail and other commercial uses on the site including a full line supermarket. The application includes an economic analysis that concludes retail uses is justified on the site due to:

- Demand within an identified main trade area
- Retail impact assessment on other centres
- Residential impact assessment
- Other economic benefits

Importance of industrial versus retail uses

The analysis of the demographic and economic data indicates that some industrial activity in Ryde is more valuable to the economy than retail uses (Figures 24 & 25). For example, the data indicates that *manufacturing* and *wholesale trade* significantly outperform *retail* in terms of employment numbers (more than 3 times), output (more than 12 times), value-add (more than 8 times - $3.06 billion compared to $363 million), exports ($5.8 billion compared to $19.8 million) and worker productivity[4].

This does not suggest that retail is not important to the community, but seeks to illustrate the relative importance of some industrial uses to the LGA. This should also be considered in the context of major retail centres being completed at Top Ryde and Macquarie Centre, which when combined with other centres are identified by Council's Local Strategy as able to cater for retail demand in the LGA.

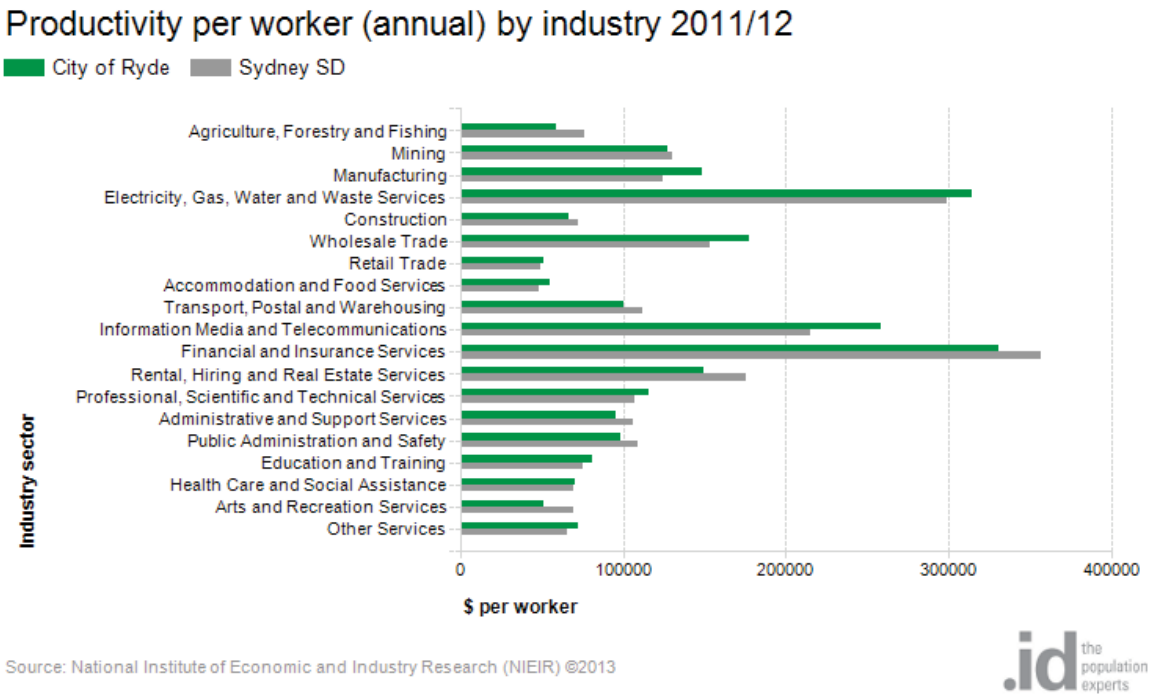


Figure 24: Productivity per worker by industry in the Ryde LGA (Source: economy id 2013)

[4] Sources: economy id, NIEIR – FTE Employment, Output, Value-add, Exports, and Productivity

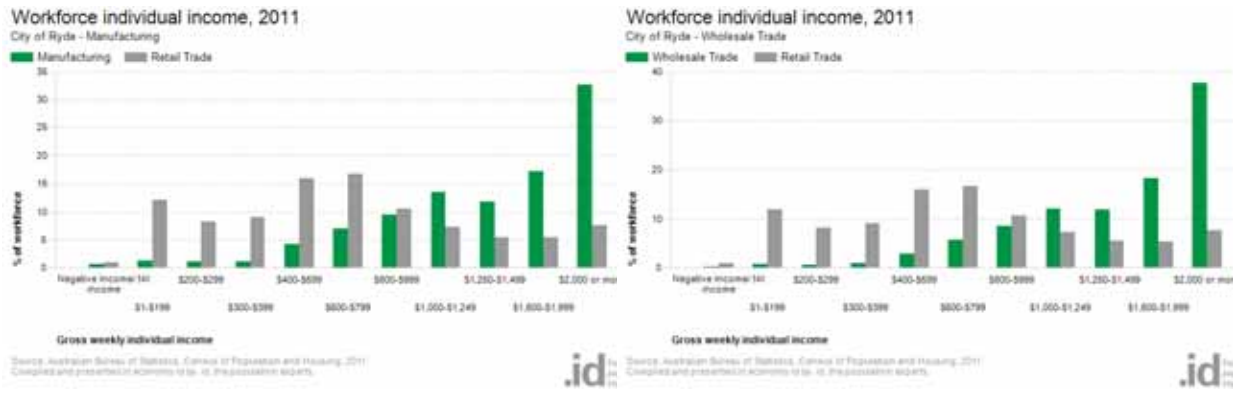


Figure 25: Workforce comparing industrial uses to retail indicating than industrial uses cater to Ryde's workforce (Source: economy id 2013)

Retail demand and supply

Council's Local Planning Strategy concludes that it can meet its employment targets within identified centres. In relation to retail floorspace, the Strategy undertakes a review and analysis of its major centres and villages.

Relevant extracts from the strategy illustrating this work follows (our emphasis):

> *… with regard to retail floor space, Ryde is well served by a mix of Major Regional, Regional and Sub-regional centres. These centres are in addition to the usual supply of local and neighbourhood centres. The total supply of retail floor space in Ryde is appropriate with regard to the needs of residents …*
>
> *... Ryde's 100,000 residents will create demand for approximately 170,000m2 of retail Floor space in the City of Ryde. In 2007, there is approximately 176,000m2 of retail Floor space supplied within Eastwood, Top Ryde, West Ryde, Gladesville and Macquarie Centre.*
>
> *With further expansions expected at Top Ryde and Macquarie Centre, this assessment shows that there is an* ***adequate supply of retail floor space offer at the major-regional and regional retail hierarchy in the City of Ryde relative to the resident expenditure pool****…*(City of Ryde Local Planning Study, Centres and Corridors; 2-29)

Based on the above, it appears that the site is not required to meet the LGA's retail needs. Notwithstanding, the proposal maintains there is unmet retail demand of 8,200m^2 in the Gladesville Shopping Village. A specialist study is required to refute these claims, however it is unclear whether this assessment has taken into account the current developments in the locality detailed in Section 8.8 of this Report.

Impact on other centres

An analysis of the impact on existing centres formed part of the proposal's retail assessment. The results of this analysis are detailed in Figure 26 below.

Table 9 - Redirection of Expenditure from Existing Centres ($m2009)

1	2	3	4	5	6	7	8	9	10
Retail Centre	Time Travel from Subject Site in minutes*	Approx. Retail Floor Space (sqm)**	Turn-over in 2011 ($m)	Turnover in 2016 without Proposal ($m)	Turnover in 2016 with Proposal ($m)	Immediate Shift in Turnover ($m)	% Shift in Turnover in 2016	Shift in turnover from 2011 to 2016 ($m)	% Shift in turn-over 2011 to 2016
Proposed Centre					50	50			
Macquarie Park	11.5	115,150	482.9	576.3	569.8	-6.5	-1.1%	86.9	18.0%
Top Ryde	5.5	60,000	325.7	370.3	359.5	-10.7	-2.9%	33.9	10.4%
Lane Cove	11.0	16,950	106.7	115.6	112.3	-3.2	-2.8%	5.6	5.2%
Gladesville***	4.0	15,050	94.0	106.8	100.2	-6.6	-6.2%	6.3	6.7%
Boronia Park	5.0	1,000	8.8	9.7	9.1	-0.6	-6.1%	0.4	4.2%
Putney	3.0	1,000	8.0	9.1	8.3	-0.8	-8.3%	0.3	4.3%
Pittwater Road	5.0	500	2.8	3.1	3.1	0.0	0.0%	0.3	9.9%
Rhodes	8.0	26,000	171.0	208.0	203.5	-4.6	-2.2%	32.5	19.0%
Eastwood	12.0	47,250	243.5	275.5	271.3	-4.2	-1.5%	27.8	11.4%
West Ryde	9.0	26,000	178.7	197.3	192.0	-5.3	-2.7%	13.3	7.4%
Meadowbank	9.5	5,500	44.0	49.1	46.9	-2.1	-4.3%	2.9	6.7%
Other Localities						-5.0			
TOTAL		314,400	1,666.0	1,920.8	1,925.7	0.0	0.3%	259.7	15.6%

* Drive-time (minutes) based on Googlemaps (average to and from)
** Excludes non-retail commercial uses and vacant spaces
*** Includes permitted development at 297-307 Victoria Road

Figure 26: Re-direction of turnover from existing centres (Source: Hill PDA 2013)

The above table indicates that the proposal would re-direct turnover from a range of existing centres in the locality. The greatest impacts in 2016 are on Gladesville Village ($6.6m or 6.2% immediate loss of trade), Top Ryde ($10.7m or 2.9% loss of trade), Boronia Park ($0.6m or 6.1% loss of trade) and Putney (0.8m or 8.3% loss of trade). In response to this issue, the proposal advises that:

> *There are no universal measures of significance of economic impact. There are references in various consultancy reports and statements in the NSW Land & Environment Court, which suggest that a loss of trade below 5% is considered insignificant. In broad terms impacts of below 10% are considered to be within the normal competitive range. The above impacts are all below 10% and are therefore considered to be insignificant to moderate and within normal competitive range* (Hill PDA Report).

Further specialist advice is required to fully address this issue. Although (based on Hill PDA advice) impacts between 5 -10% are accepted industry practice, the impact on Gladesville Town Centre following the recent planning work to re-invigorate the area through the LEP should be seriously considered by Council when considering major retail development outside of the Gladesville Town Centre.

Summary

The above data illustrates that a range of industrial uses are highly valuable to the economy, in some cases more than retail jobs. In terms of supply and demand, based on Council's previous work, it appears that retail demand can be met within existing centres and the negative impacts on the Gladesville Town Centre and other surrounding smaller centres can be avoided.

8.7. Appropriateness of high density residential development on the site

Notwithstanding the loss of industrial land, a key issue for this proposal is the appropriateness of a high density residential mixed use development on the site.

The applicant argues that the proposal can be supported due to the high demand for residential housing; local employment profile and changes to industrial lands; and retail demand. The applicant argues that the proposal will assist in meeting residential targets for the LGA. The applicant also argues that the built form resulting from the proposal acts as a good transition between the adjoining buildings on Victoria Road down to the low scale residential landuses in the surrounding area.

As detailed in this Report, issues relating to employment, industrial and retail uses have been considered and the applicant's position is not supported (Sections 8.3 & 8.6).

The assessment of the appropriateness of this site for high density residential development should consider the following 3 key questions:

- Does this site enable an appropriate level of amenity for future residents of the site?
- Will a residential development on this site impact on the surrounding neighbourhood and locality?
- Is the site required to meet residential targets and should it be retained for industrial and other employment uses?

First, Council's urban designer has raised issue with the design in terms of amenity for future residents. Given the nature of the site, it is generally considered to be more suited to a light industrial use that provides for employment uses that do not require the levels of amenity demanded by residential uses.

Figures 27 & 28 demonstrate the dramatic change in levels within the site. Future residents on this part of the site will be directly adjoined by industrial uses on 2 sides with lower apartments receiving reduced amenity.

Figure 27: Site A looking north (Photo: Michael Woodland 2013)

Figure 28: Site A looking north east (Photo: Michael Woodland 2013)

Second, in relation to impacts on the surrounding neighbourhood and locality, it is acknowledged that the architectural studies have provided an indicative built form that both

transitions (in part) in height from Victoria Road and responds to the unique topographical features of the site.

Similarly, the proposed built form controls in the draft LEP/DCP provide a proposed framework for future development. It is considered that these controls (in particular height and FSR) do not provide an appropriate transition to adjoining low density residential development. It is also noted that the proposed scheme outlined in the architectural studies proposes an FSR of 2:1 for the 2-12 Tennyson Road Site, which is less than the 2.5:1. Although this is an indicative scheme, Council should give close consideration to the proposed FSR for the site and resultant development outcomes and likelihood on adverse environmental impacts on the surrounding locality.

However, the current transition to the adjoining residential dwellings is not considered to be appropriate on this site. Notwithstanding the proposed setbacks to adjoining properties and relative high architectural treatment of the indicative development outcomes, high density residential uses on this site do not provide an appropriate interface to the low density area and is considered to impact on the character and general amenity of the locality. In particular, the likely impact of traffic on the surrounding road network resulting from the proposal is considered to adversely impact the amenity of the area.

Third, the site should be generally retained for industrial / employment purposes. Council has indicated that it can exceed residential and employment targets in identified centres and other major approvals throughout the LGA. Council has recently revised its dwelling targets and estimates that due to a number of major development approvals and urban activation areas, it will likely exceed the 12,000 target for the LGA by the Subregional Strategy by providing over 34,467 additional dwellings.

Summary

Council's Planning Strategy encourages this type of development to be located in an identified centre within the LGA. It also should be noted that this is a planning proposal across 2 separate sites - not a development application. The architectural studies provide an indication of what **may** be achieved on the site resulting from relatively high levels of design and site planning.

In this regard, Council should carefully consider the proposed zoning, built form controls and details in the proposed LEP and DCP in relation to the appropriateness of high density residential uses on this site.

8.8. Other recent planning approvals in the locality

An increased amount of development activity is evident in the Gladesville Town Centre and Victoria Road Corridor following the making of the new LEP in 2010 (Figure 29). This demand was identified in the Local Planning Strategy. It is reasonable, in part, to attribute these outcomes from the new LEP and its initiatives in landuse planning and built form controls.

In addition, there are other major developments in the locality namely the Bunnings development on the opposite side of Victoria Road and major development at Ryde Aquatic Centre.

As identified in the Local Planning Strategy, Council can meet its residential and employment targets within its identified centres. The development activity detailed below indicates a level of investor confidence in the area and ability to deliver on these targets.

It is important that the proposal be considered in the context of these developments, which for the most part are delivering the aims and objectives of the new LEP for the Town Centre and Victoria Road Corridor. It is also acknowledged the need to diversify the employment uses at some strategic sites within the Gladesville Industrial Area along Victoria Road.

In this regard, although the proposal is not supported in its current form, it is reasonable to consider other employment generating uses that may be appropriate on the site.

8.9. Traffic

Traffic and associated issues are considered to be a critical issue in the consideration of the proposal. Any rezoning of the site to a mixed use development will likely lead to increased traffic from the site and impacts on the surrounding road network.

The proposal includes a traffic report in support of the rezoning. Council has obtained an independent review of the traffic impact assessment as part of the consideration of the proposal.

In particular, the traffic consultant was requested to carefully review the following aspects of the traffic report:

- Relevant assumptions and modeling used in the assessment
- Impacts on existing intersections, Victoria Road Corridor and local road network
- Accumulative impacts from other development in the surrounding locality
- Impact on the local road network and surrounding low density residential area
- Any traffic mitigation works required

It is acknowledged that any redevelopment of the site may result in additional traffic, however the impact on the local road network and the Victoria Road corridor from a mixed use proposal of this scale is a critical consideration. In particular, the impact on the both the local road network and surrounding low density residential areas and the intersection between Tennyson Road and Victoria Road are key considerations when assessing any rezoning for the site.

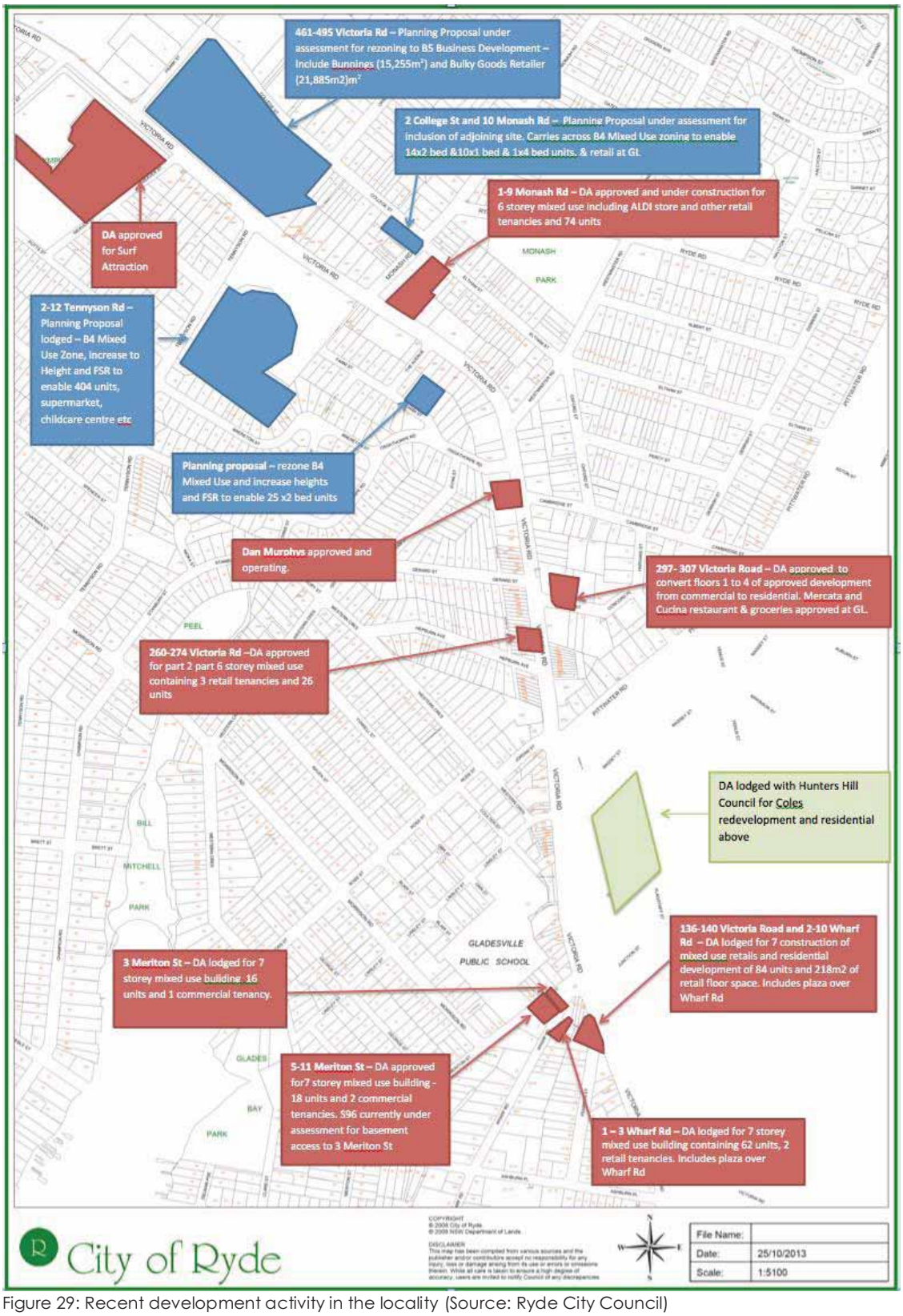


Figure 29: Recent development activity in the locality (Source: Ryde City Council)

9. Potential development outcomes (concept plan)

This Section of the report provides a high level analysis of the potential development outcomes identified as the preferred concept plan in the proposal, informed by the relevant Council officers.

It should be noted that as a planning proposal, this provides an indicative outcomes, which may be amended and will ultimately be subject to a separate development application.

In addition (as recognised in the architectural studies) the site consists of 2 separate parcels of land, which **may or may not** be developed as a single scheme.

9.1. Traffic

The proposed development options indicate potential for 2 levels of basement parking for 670 car spaces, loading and unloading areas across the Site. Vehicular access to the site is proposed via Tennyson Road, with options for a shared or separate vehicular access.

The planning proposal includes a traffic report in support of the proposal. In response to this issue, Council commissioned an independent review of the traffic impact assessment as part of the consideration of the proposal. In particular, the traffic consultant was requested to carefully review the following aspects of the traffic report:

- Relevant assumptions and modeling used in the assessment
- Impacts on existing intersections, Victoria Road Corridor and local road network
- Accumulative impacts from other development in the surrounding locality
- Impact on the local road network and surrounding low density residential area
- Any traffic mitigation works required

Following a review of the proposal, the independent traffic consultant (Attachment 2) has raised serious issues with the application on traffic grounds as detailed below:

Traffic generation

- The trip generation used by the applicant is significantly underestimated, which proposes 310 trips per hour compared with the RMS Guidelines of 678 trips. This is due to assumptions for retail shopping and multi-purpose trip discounts. Traffic generation should also consider whether the seniors living component were to be developed as residential uses. This is summarised in the report as follows:

  > *The proponents estimate traffic generation is at least 368 vehicle trips less than those recommended in the RMS Guidelines. Traffic surveys should be used to justify the variation from the published rates. This is largely attributable to the assumptions for the retail shopping rates and the discounts for multi-purpose trips* (Bitizios Report; page 9).

Intersection performance (Tennyson Road and Victoria Road)

- The key intersection analysed in Tennyson Road and Victoria Road. The report finds that when taking into account the Bunnings development on the opposite side of Victoria Road, the development will impact on this intersection as detailed below:

The results indicate that with the Bunnings development the intersection performance will drop from level of service A to C and with the proposed development, a further drop from C to D….

…The modelling for the Bunnings development at the Tennyson Road / Victoria Road intersection indicates that the Degree of Saturation would be 0.971 which is close to capacity. With the proponent's development traffic in addition, the Degree of Saturation would be greater than 1, which indicates the intersection is over capacity.

Traffix has argued that the results are for isolated intersection operation and that in reality there would be benefits of the signal coordination along Victoria Road which would create bunching of vehicles and reduced delays. This is true, and signalised intersections are located some 250m either side of Tennyson Road.

Notwithstanding the above, the results presented in the Traffix report do not demonstrate acceptable intersection operation as a result of the development…. (Bitzios Report; page 9)

Queuing in Tennyson Road

- The Report finds that queuing in Tennyson Road as a result of the development is likely to exceed 107m, which will impact on the surrounding local road network. This is considered unacceptable, given it likely to lead to adverse impacts on the general amenity of the surrounding residential locality, in particular adjacent residential streets as detailed below:

  With the proposed development and the Bunnings development, the Sidra model indicated a queue of 107m which would extend almost to the Searle Street roundabout. However, the degree of saturation at the Victoria / Tennyson intersection was predicted to be greater than 1, indicating the intersection was over capacity and therefore it is highly likely that the queues would be significantly longer than 107m on a regular basis.

  If the queue were to extend through the Searle Street roundabout this would have significant impacts on traffic leaving the development as well as on general road congestion. Once a roundabout is blocked, other (generally light) traffic movements are significantly delayed. This would impact traffic entering and leaving Searle Street, in all directions. In turn, this could lead to more traffic filtering though adjacent residential streets like Potts Street and Weaver Street (Bitzios Report; page 10).

Impact on adjacent low density residential areas

- A key consideration in relation to traffic impacts is the potential impact from the proposal in the context of other major developments in the locality such as the Bunnings re-development and other recent approvals (Section 8.8). The Traffic review identifies as number of areas that are likely to be impacted by the development as detailed below:

  In addition to the likely impacts at the Searle Street roundabout (as outlined in Section 4.8), the predicted additional 111 vehicle trips to Morrison Road would pass by the low density residences on Tennyson Road and would need to be accommodated at the Morrison Road / Tennyson Road roundabout. We note that Spencer Street and Warner Street are cul-de-sac. Brereton Street and Osgathorpe Road do not facilitate eastbound access to Victoria Road (for outbound trips), and we are aware that Council intends to install traffic management devices to discourage excessive

through traffic in these roads. These measures would discourage inbound trips to the development site (Bitzios Report; page 10).

Adjacent developments

- The review also notes that any consideration of a development of this scale should take into account other development in the locality. This includes a number of developments recently approved as part of the Gladesville Town Centre and Victoria Road Corridor LEP 2010 (Section 8.8). This indicates that when combined with these developments, the proposal is likely to increase impacts on Victoria Road, which in turn impact the adjoining road network as detailed in the review.

  From our previous reviews of developments in the area, it is estimated that the cumulative effects of these other developments could increase the background traffic growth in the area by some 5 to 10 % in the peak traffic periods. Further, the Gladesville DCP allows for higher density developments along the Victoria Road corridor. This would have a significant effect on the operation of traffic on Victoria Road in peak periods and should be considered in the context of this development (Bitzios Report; page 13).

In conclusion, the Traffic Review does not agree with the conclusions in the Traffix Report accompanying the proposal as detailed below:

Bitzios Consulting has reviewed the traffic report of the planning proposal for 2 – 14 Tennyson Road, Gladesville. From our review we conclude that:

- *Traffic generation has been significantly underestimated without adequate justification;*
- *Discounting for linked and multi-purpose trips has not been adequately substantiated and therefore should not be used for new standalone developments;*
- *The modelling shows unacceptable increases in delays; and*
- *The Victoria Road / Tennyson Road intersection would be over capacity according to the Sidra results.*

Should the estimated traffic generation be increased then the intersection average delay is likely to be higher than that reported in the Traffix report. No road improvements have been proposed in the report to ameliorate the issues.

We therefore do not agree with the conclusions of the Traffix report and consider the likely traffic impacts to be greater than those reported. It is concluded that the proposed development would significantly increase traffic congestion (Bitzios Report; page 17).

9.2. Impacts on the surrounding locality

The proposal represents a bold departure from the current urban context of the industrial/commercial buildings on Victoria Road and the low-density residential development to the west.

Should the proposal be approved based on the proposed zoning and built form controls in the proposed LEP/DCP, it is considered that any future development is likely to lead to the following impacts on the surrounding locality:

- Increased traffic issues resulting in traffic congestion and delays at both Victoria Road and on the surrounding local road network
- Impact on the Gladesville Town Centre and set an undesirable precedent for use of employment lands in this locality
- Amenity issues for the adjoining residential properties in Brereton Street and Tennyson Road in terms of privacy, bulk and scale.

In view of the above, the site is considered to be more appropriate for employment uses in its role as part of the Gladesville Industrial Area. This cluster of urban services can also provide support for existing centres in the LGA. The proposed development options are considered to be out of character with the desired future character of both the adjoining residential area and the adjoining Monash Road Precinct (as part of the Gladesville Town Centre and Victoria Road Corridor Masterplan).

9.3. Built form, amenity and urban design

The application is a planning proposal and therefore due consideration should be given to the proposed key built form controls that would be incorporated into any new LEP covering the site, namely height and FSR controls. Other controls such as landscaped area and setbacks can be included in any future DCP for the site. Given the findings and recommendations in this report, particularly related to strategic planning and traffic grounds, a detailed consideration of the proposed controls in the Draft DCP provided by the applicant was not undertaken.

As detailed in Section 8.7 of this report, it is considered that this site is not suited to high density residential development of this scale and height and does not provide an appropriate transition to adjoining low density residential development. The resultant development based on controls of 2.5:1 has been found to lead to unacceptable traffic impacts on the local road network. Council should give close consideration to the proposed height and FSR for the site and resultant development outcomes and likelihood on adverse environmental impacts on the surrounding locality.

The site has unique topographical characteristics resulting from its previous use as a quarry and requires an appropriate design response. The proposal has responded to these site constraints in a scheme that is directly influenced from the circular cutting of the former quarry. In this regard, the location of the retail uses at the lower levels of the podium makes the best use of areas where future levels of acceptable residential amenity will be more difficult to achieve on the site.

Council's urban designer has undertaken a high level review of the proposal in terms of architectural and urban design issues. This analysis is generally supportive of the proposal and its response to the site. However, a number of design issues are raised including potential poor amenity of proposed lower units, streetscape on Tennyson Road and proposed open space.

Council's urban designer advises that the complete enclosure of the proposed open space within Site A is not supported as it is considered to lead to amenity impacts for lower residential apartments and impacts on the open space as a public area. In terms of streetscape, it is recommended that the area be further activated with retail uses.

Notwithstanding the above, the proposed height and FSR controls and likely resultant built form is not considered to be an appropriate to transition from the Victoria Road Corridor to

the low density residential development to the south. The proposed heights and FSR controls for the site are considered to result in a development that:

- does not respond as an appropriate transition zone;
- is out of character with the adjoining low density residential area in terms of scale, density and height; and
- is likely to lead have impacts on adjoining properties in terms of traffic issues.

9.4. Environmental issues

The application was referred to Council's environmental and engineering section for comment.

Contamination and environment

The site has potential contamination, geotechnical and flooding issues. In addition, the issue of stormwater is a relevant consideration, given the potential impacts on adjoining residential properties. Council officers have reviewed the proposal in relation to these issues, in particular the provisions of SEPP 55 and Councils' Contaminated Land Policy and make the following comments:

> *… The site has a long history of industry and quarrying activities. Note the Preliminary (Stage 1) Environmental Site Assessment Report prepared by EIS –Environmental Investigation Services only covers the site 2-12 Tennyson Road, and there is no investigation of 14 Tennyson Road.*
>
> *The report has numerous limitations, including the data gaps identified in the report:*
> - *no groundwater investigation,*
> - *no sampling possible under existing buildings,*
> - *no targeted investigation regarding the suspected UST,*
> - *detailed investigation for asbestos contamination under paved areas and in deeper filled areas.*
>
> *Overall the results of the sampling carried out indicted that the levels of most metals, hydrocarbons and other typical contaminates were generally below the soil assessment criteria.*
>
> *The Report recommends additional investigation be carried out and in the opinion of EIS "the site could be made suitable for the proposed mixed-use development provided that the recommendations detailed in Section **10.6** of this report are suitably addressed." (Note this conclusion only covers 2 -12 Tennyson Road) …*
>
> *… Council has had issues in the past with stormwater from 14 Tennyson Road flooding the properties at the rear, and while this has been addressed, extensive development of the sites will need to ensure that this does not occur again. At this stage of the proposal Environmental Health do not object to the further investigation for the potential re-zoning of the sites.*

In addition, Council undertook a high-level environmental sustainability review of the proposal. This review focussed on building design sustainability, sustainable transport and water cycle management.

Council noted a number of inconsistencies with the Draft DCP between the objectives and the controls relating to building design and integrated water cycle management.

Geotechnical

Council's Engineer has undertaken a high level review of geotechnical issues. In general, Council has advises that excavation of the site to the boundary on the northern and eastern side of the lot appears difficult to achieve without imposing on the neighbouring properties (eg installation of rock anchors/ soldier piles). Council advises that the Geotechnical Assessment Report accompanying the application does not quantify the current stability/ risk of the exposed face, however it would appear there is ongoing erosion which would need to be stabilised by similar methods in the future.

Council advises that it is technically feasible to excavate the face further to the boundary under the full supervision of a geotechnical engineer however it would be prudent to have a setback of approx 2 metres to allow for any anomalies and reduced imposition on neighbouring properties in terms of construction logistics.

Stormwater

Council's Infrastructure Integration Team has undertaken a high level review of the proposal. Council advises that the site at 2-12 is subject to low to medium risk flooding. Council's advice is summarised below:

- The proposed density of the development is not directly related to stormwater designs. In this regard there will be no impact if the site is not filled and On Site Detention Storages are provided to compensate for the increased impervious areas.
- Underground basement car park may not be feasible. This is the critical issue that should be reviewed prior to any development.
- The developer is required to demonstrate how the drainage will be discharged from the site (2-12 Tennyson Rd) to the street before any future Development Application. This could be a major issue.
- There is currently a stormwater easement through 14 Tennyson Road property. The easement can be maintained or moved to cater for the proposed stormwater drainage design. Any existing flooding (ponding) on site should be addressed before any future Development application is lodged. The other stormwater matters can be dealt in the DA stage provided the site (2-12 Tennyson Rd) is not filled.

Conclusion

Generally it is considered that these issues may be resolved through an amendment to the Draft DCP or through the development application process. Based on the above comments, it is considered that further information is required to fully establish the environmental impacts of the proposal. However, given the broader strategic issues relating to landuse, traffic and built form it is not considered appropriate to further investigate these issues as part of this report.

10. Conclusion

The retention of industrial and employment lands in the Greater Sydney Metropolitan Area is a complex planning issue covering a range of planning, economic, social and environmental areas. While most contemporary planning policy seeks to focus major employment and residential development in centres, there is a legitimate need to review existing industrial sites, particularly within established urban areas.

These sites are often under pressure for changes to landuse, which in the current economic climate represents mixed use high density residential development.

The site forms part of the Gladesville Industrial Area, one of 2 remaining industrial areas in the Ryde LGA. Although this area represents 2.12% of the total employment area, these industrial lands have been recognised as being vitally important to the LGA as an automotive and construction based cluster of uses.

Although the proposal is accompanied by an interesting design response to a unique site, fundamentally it is not considered to be consistent with the future strategic direction as outlined in the Ryde Local Planning Strategy and other Government strategies due to the loss of industrial and employment lands.

Further, the proposal is inconsistent with the Ryde Draft Local Environmental Plan 2011, which seeks to retain the Light Industrial Zoning for the site. The site is not considered to be an appropriate location for high density residential development given its interface with the low density residential locality, in particular the likely traffic impacts on the surrounding road network.

The proposal is also considered to be inconsistent with a number of areas in the Draft Metropolitan Strategy and Ministerial Directions in relation to the retention of industrial and employment lands.

Council has demonstrated that it can meet its residential and employment targets for the LGA as set by the Draft Inner North Subregional Strategy without the need to rezone this site.

It is considered that the applicant has not justified the proposed built form controls for the site, with a resultant future development likely to lead to adverse impacts on the surrounding locality in terms of height, bulk and scale and traffic issues.

However, given the recognition of the difficulties faced by some landowners in Industrial Lands, it is considered reasonable for Council to continue to discuss alternative uses for other employment lands as part of a broader study of industrial lands as recommended in the Ryde Local Planning Strategy. This work should build on the additional uses Council has proposed in the Draft LEP 2011 and subsequent *housekeeping* draft LEP for the IN2 Light Industrial zone to encourage a wider range of employment uses.

11. Recommendation

A. That the planning proposal for 2-14 Tennyson Road, Gladesville not proceed to a gateway determination for the following reasons:

1. The planning proposal is inconsistent with strategic direction of the Ryde Local Planning Strategy 2010, Ryde Draft LEP 2011 and Draft Subregional Strategy in relation to retention of industrial lands.

2. The planning proposal is inconsistent with the Draft Metropolitan Strategy and does not met the criteria under the Industrial Lands Strategic Assessment Checklist for rezoning of existing industrial land to other uses.

3. The planning proposal is inconsistent with s117 Direction 1.1 – Business and Industrial zones and 7.1 – Implementation of the Metropolitan Plan for Sydney 2036.

4. The planning proposal is likely to lead to adverse impacts on the amenity of the surrounding locality, particularly relating to traffic impacts on the surrounding road network.

5. The proposed built form controls are generally not considered appropriate in this locality in relation to the adjoining low density residential areas.

B. That Council give further consideration to additional employment uses specifically for the site in addition to the uses identified in the Draft LEP 2011 in consultation with the landowners.

C. That Council undertake a further study of the industrial areas within the Ryde LGA to develop strategies and recommendations to maintain these areas as viable employment lands in accordance with Recommendation 7.2 of the Ryde Local Planning Strategy in consultation with landowners, the community and relevant industry groups.

Issue History

File Name	Prepared by	Reviewed by	Issued by	Date	Issued to
P1524 001T 2-14 Tennyson Road.doc	S.Read	A.Finlay	S.Read	19/12/2013	Gilbert Ortiz – City of Ryde
P1524 002T 2-14 Tennyson Road.doc	S.Read F.Lau	A.Finlay	S.Read	24/01/2013	Gilbert Ortiz – City of Ryde
P1524 003T 2-14 Tennyson Road.doc	S Read F Lau	A Finlay	S Read	7/02/2014	Gilbert Ortiz – City of Ryde

Technical Note Title

1. INTRODUCTION

Location	2-14 Tennyson Road
Application for	Planning Proposal for a mixed residential, retail and aged care development

Bitzios Consulting has been commissioned by the City of Ryde as an independent reviewer of the planning proposal for a mixed use development at the above address. This technical document summarises our review of the traffic aspects of the planning proposal.

In particular this technical note has reviewed:

- reliability of baseline data;
- traffic generation;
- use of traffic discounts;
- traffic distribution;
- investigation of extensive queuing in Tennyson Rd affecting the local road network and the efficacy of the roundabout;
- parking provision;
- access and egress;
- SIDRA input, assumptions and outputs;
- recommendations for traffic mitigation measures;
- any other relevant issues in the planning report identified by the consultant; and
- high level assessment of the cumulative traffic impacts within the context of the developments in Gladesville.

2. APPRECIATION OF THE APPLICATION

2.1 BACKGROUND

The planning proposal seeks to allow the rezoning of a light industrial site for a mixed use residential and retail development including a supermarket and speciality shops. The development is also to include:

- 269 Residential units;
- 5800m^2 of retail GFA or 4640 GLFA;
- 400m^2 of retail / commercial GFA;
- 149 Seniors Housing units.

2.2 DEVELOPMENT CONTEXT

The development is in context of some major developments in the area as shown in Figure 2.1 below. Significantly there is a proposed Bunnings Hardware store whose main access is proposed at the existing Tennyson Road / Victoria Road intersection. Other developments include:

- Aldi Supermarket in Monash Road; and
- Medium density residential developments.

Further there are a number of known developments in the Gladesville area and the current DCP allows for higher density developments along the Victoria Road Corridor in Gladesville.

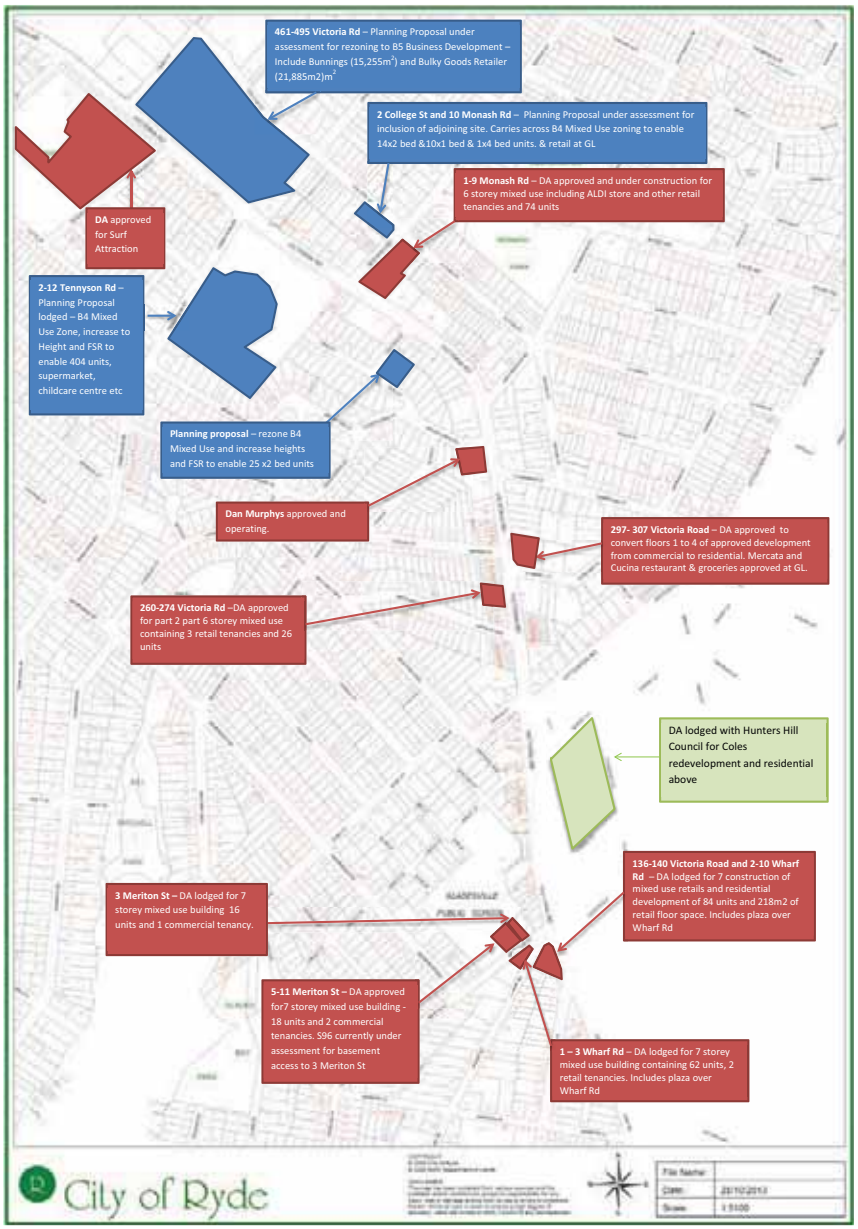


Figure 2.1: Future Developments

3. DOCUMENTS REVIEWED

The primary documents and information supplied by the City of Ryde were:

- (Appendix 10) Traffic Impact Assessment, Tennyson Village 2-12 and 14 Tennyson Road, Gladesville Planning Proposal, Traffix, 9 October 2013.
- 2-14 Tennyson Road, Gladesville, Planning Proposal for a Mixed Use Development

4. REVIEW

4.1 TRAFFIC DATA

Evening Peak Traffic Data was presented Figure 8 of the report (see Figure 4.1). The volumes surveyed appear to be reasonable. No date or source was provided for the traffic surveys. Without further evidence from where the data was sourced it is assumed that the data was accurately surveyed. Further, traffic data supplied by Council indicates that the traffic volumes are reasonably consistent with counts from November 2012.

The report suggests that the existing access was surveyed (see Section 3.6 of the Traffix report). The data (Figure 8) shows almost exactly 60% to and from Victoria Road and 40% to and from Morrison Road, as well as a split of 80% from the site and 20% to the site. It is noted that these values are used consistently in the study.

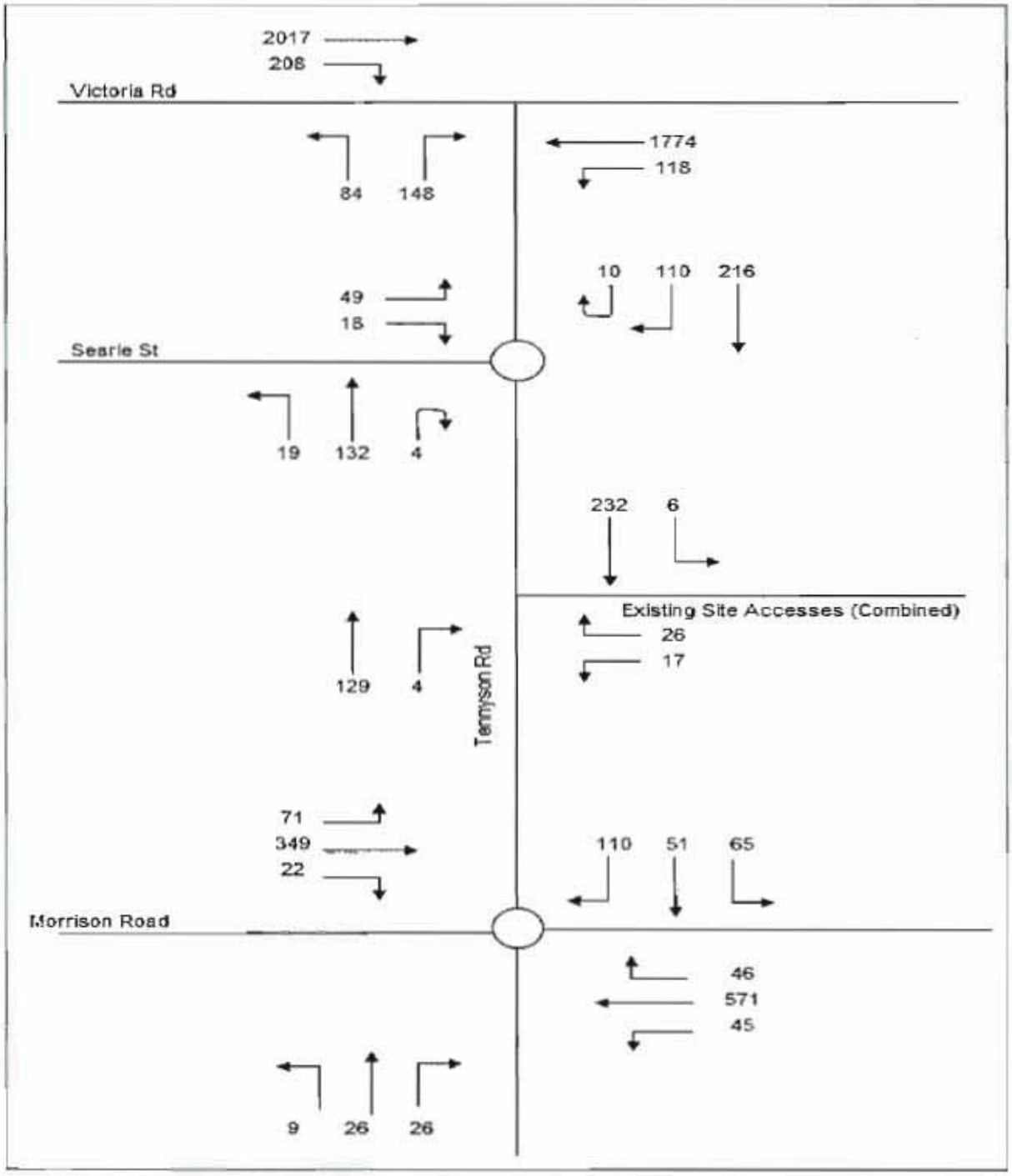
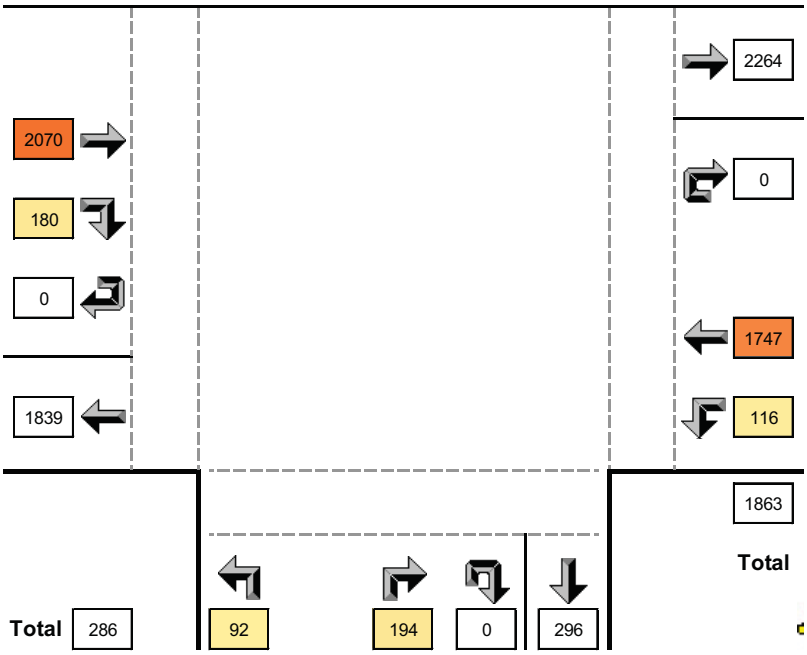


Figure 4.1: Traffic Report Figure 8 Existing PM Peak



Source: City of Ryde Traffic Data collected by TTM November 2012

Figure 2: TTM PM Peak November 2012

The report also references traffic forecast predictions for the Bunnings Development, which is part of the Bunnings Development traffic report produced by TTPA.

4.2 TRAFFIC GENERATION

The following assesses the traffic generation calculations and assumptions used in the report.

4.2.1 Residential:

- Rate applied: 0.15 trips per unit (RMS TDT 2013 /04)

This rate is consistent with the average of Sydney, based on the latest surveys indicated in the RMS technical direction. However, given that:

- the site, although near to public buses, is not close to a train station; and
- the site is not located in an existing high density town centre;.

the traffic generation rate that would be expected would be much higher. Seven of the eight developments that were surveyed and from which the rates are derived, are located within walking distance of a train station or within walking distance of the Sydney CBD. The proposed development is on a bus route and is not near a major city centre.

Therefore our professional opinion is that a more conservative rate of say 0.30 trips per dwelling would be more realistic for this location.

4.2.2 Commercial

- Rate applied 1.2 trips per 100m^2

This rate is consistent with the RMS Technical Direction.

4.2.3 Seniors Housing Trips

- Rate applied 0.14 trips per unit (derived from the survey data tables in TDT 2013/04)

This rate is consistent with the RMS Guidelines.

It should be noted that the Seniors Housing rate (0.14) is approximately half of the more reasonable Residential rate (0.3, as explained in Section 4.2.1 above). If the eventual development did not include Seniors Housing but rather normal Residential, the number of trips from this component would be more than doubled.

4.2.4 Childcare

- Rate Applied 0.35 trips per child

It is unclear how this rate was derived from the *RTA Guide to Traffic Generating Developments*. Our reading of the relevant table indicates there should be a peak of 0.7 trips per child per hour.

Table 3.6
Traffic generation rates

Centre Type	Peak Vehicle Trips / Child		
	7.00-9.00am	2.30-4.00pm	4.00-6.00pm
Pre-school	1.4	0.8	-
Long-day care	0.8	0.3	0.7
Before/after care	0.5	0.2	0.7

Source: RTA Guide to Traffic Generating Developments.

4.2.5 Retail Trip Generation

- Rate Applied 1.27 trips per car parking space;
- 20% linked trips; and
- 20% Multi-purpose trips.

The trip rates that have been applied are interpolated from the RMS survey data. Traffix's basis for this methodology is that:

- Only the latest survey data should be used;
- The latest survey data only applies to very large shopping centres and cannot be directly applied to this development;
- There is a linear relationship between trips per car space and floor area.

It is unclear that there is a linear relationship between the number of car spaces and the trip rate, which is one of the key assumptions. The previous data indicates that trip rates increase exponentially with the reduction in GLFA.

Our professional opinion is that the RMS rates should still be applied unless traffic surveys of similar developments can justify the difference. Further the major tenant, a supermarket, would most likely attract much higher traffic generation than a general shopping centre.

Applying the rates from the TDT 2013/04 would result in 590 vehicle trips per hour as opposed to 305 vehicle trips as calculated in the Traffix report.

The assumption that there are some multi-purpose trips is reasonable given that many of the residents would use the supermarket within the building. But there is no evidence provided for the 20% rate used. *RTA Guide to Traffic Generating Developments* does not provide guidance for 'new free standing' centres and these discounts have not been adequately substantiated (see below). It is more than likely that the surveys of shopping centres would already account for multi-purpose trips and therefore no discount should be applied.

> The incidence of linked and multi-purpose trips can reduce overall trip generation rates. A linked trip is a trip taken as a side-track from another trip, for example, a person calling in to the centre on the way home from work. A multi-purpose trip is where more than one shop or facility is visited. Any trip discounts would apply differently in new free-standing centres and for new shops within existing centres. Discounts in the former case vary depending on the nature of the adjacent road network. With the latter case, an average discount of about 20% is suggested, with this figure reducing with increasing centre size, with rates of 25% (less than 10,000 m^2 GLFA), 20% (10,000-30,000 m^2 GLFA) and 15% (over 30,000 m^2 GLFA) indicative. Note that these discounts apply to trip generation but not to parking demand. Discounts of this nature should not apply without adequate substantiation.

Source: RTA Guide to Traffic Generating Developments

In addition, the 20% of the retail trips (61 veh/hr) that has been applied equates to 70% of trips for all other uses. This seems an unreasonable amount without justification.

Linked trips have also been assumed at 20% of the generated traffic to and from Victoria Road. Concessions for passing trade are commonly used for retail developments and this is a reasonable assumption. Again this discount should be substantiated, given the site is not on Victoria Road directly.

4.3 SUMMARY

The following Table 4.1 summarises the trip generation rates as discussed previously.

Table 4.1: Summary of Trip Generation

Use	Proponent Traffic Generation Rate		RMS Guidelines (TDT 2013/04)		Comment
	Rate	Trips Veh /hour	Rate	Trips	
Residential	0.15 per dwelling	40	0.15 per dwelling	40	Site is not close to a train station but has better access to public transport than Liberty Grove, therefore a 0.30 trips per dwelling resulting in 80 trips is considered more appropriate.
Commercial Trips	1.2 per trips per 100m^2 GFA	5	1.2 per trips per 100m^2 GFA	5 trips	No Comment
Seniors Housing	0.14 per unit	21	0.14 per unit	21 45	The peak generation for seniors housing would occur outside the normal commuter peak. This rate is derived from published survey data from RMS. If normal residential replaced Seniors Housing, trips would be 45 – see Section 4.2.3.
Child Care	0.35 trips per child	21	0.7 trips per child	42	RTA guide rate is 0.7 trips per child. No justification for the changed rate has been given
Retail	1.27 trips per space	305	12.3 trips per 100m^2 GLFA	570	Significantly lower than the published rates.
Discounting (multi purpose)		244		570*	No discounting should be applied to new shopping centres unless it can be substantiated.
Total		310		678	Difference of 368 vehicle trips if RMS guidelines were used. There could be a

					difference of 408 vehicles/hour if a more realistic residential component was used, or 432 if Seniors Housing was replaced by normal Residential.

The proponents estimate traffic generation is at least 368 vehicle trips less than those recommended in the RMS Guidelines. Traffic surveys should be used to justify the variation from the published rates. This is largely attributable to the assumptions for the retail shopping rates and the discounts for multi-purpose trips.

4.4 TRAFFIC ASSIGNMENT / DISTRIBUTION

The proportion of trips into the site and out of the site appears to be reasonable in the absence of other data.

The traffic has been distributed 40% to Morrison Road and 60% to Victoria Road. This is consistent with the traffic data presented in Figure 8 of the report. It is noted that these proportions are remarkably round numbers for observed data.

The proponent estimates an additional 111 vehicle trips per hour to Morrison Road and 168 trips to Victoria Road. (With more defendable traffic generation rates, these volumes would be double.)

These assumptions on traffic distribution appear to be reasonable and consistent with the proportions from the traffic data. The road network configuration would also support these assumptions.

4.5 CAR PARKING

The range of car parking rates used is directly consistent with the City of Ryde DCP.

4.6 INTERSECTION PERFORMANCE

The key intersections were modelled in Sidra. The priority and roundabout intersections appear to be performing at an acceptable level of service. The results for the key intersection of Tennyson Road and Victoria Road are summarised in the Table 4.2 below.

Table 4.2: Tennyson Road / Victoria Road Intersection Analysis

	Average Delay (Sec)	Level of Service (LoS)	Degree of Saturation (DoS)
Existing	8.8	A	0.786
Future Committed	35.9	C	0.971
Future Committed + Development	55.8	D	1.045

Source: Traffix 2013

The results indicate that with the Bunnings development the intersection performance will drop from level of service A to C and with the proposed development, a further drop from C to D. It should be noted that Level of Service is based on bands of Average Delay. The Average Delay for the future committed (36 seconds) is in the middle of the band for LoS C (29 to 42 seconds). However, for the 'with development' scenario the average delay is 56 seconds which is the upper limit of Level of Service D (43 to 56 seconds). The next band, Level of Service E, is considered an unacceptable level of delay.

The models also showed high Degrees of Saturation (DoS). Degree of Saturation is the comparison of the theoretical capacity to the proposed traffic flows. When the Degree of Saturation is greater than 0.9, this could indicate that the intersection may be unstable with large queues sometimes appearing. The modelling for the Bunnings development at the Tennyson Road / Victoria Road intersection indicates that the Degree of Saturation would be 0.971 which is close to capacity. With the proponent's development traffic in addition, the Degree of Saturation would be greater than 1, which indicates the intersection is over capacity.

Traffix has argued that the results are for isolated intersection operation and that in reality there would be benefits of the signal coordination along Victoria Road which would create bunching of vehicles and reduced delays. This is true, and signalised intersections are located some 250m either side of Tennyson Road.

Notwithstanding the above, the results presented in the Traffix report do not demonstrate acceptable intersection operation as a result of the development. The Sidra models have made allowance for favourable arrival patterns (see Section 4.9 below).

4.7 SITE ACCESS

The site accesses proposed in the report have been based on two separate accesses, one opposite Searle Street and the other closer to Potts Street. A second access arrangement has been developed that would separate the access for 14 Tennyson Road and provide a total of three access points for the development.

Car parking for each access is divided relatively evenly between the two access points under the preferred scheme.

Given the existing traffic volumes on Tennyson Road and results of the Sidra analysis, these proposed access points appear to be reasonable.

4.8 QUEUING IN TENNYSON ROAD

Queuing has not been observed on site as the timing of this review was not during normal traffic conditions. Based on the Sidra modelling in the Traffix report, the queues on Tennyson Road are predicted to be 78m under existing conditions.

With the proposed development and the Bunnings development, the Sidra model indicated a queue of 107m which would extend almost to the Searle Street roundabout. However, the degree of saturation at the Victoria / Tennyson intersection was predicted to be greater than 1, indicating the intersection was over capacity and therefore it is highly likely that the queues would be significantly longer than 107m on a regular basis.

If the queue were to extend through the Searle Street roundabout this would have significant impacts on traffic leaving the development as well as on general road congestion. Once a roundabout is blocked, other (generally light) traffic movements are significantly delayed. This would impact traffic entering and leaving Searle Street, in all directions. In turn, this could lead to more traffic filtering though adjacent residential streets like Potts Street and Weaver Street.

4.9 IMPACTS ON ADJACENT LOW DENSITY RESIDENTIAL AREAS

In addition to the likely impacts at the Searle Street roundabout (as outlined in Section 4.8), the predicted additional 111 vehicle trips to Morrison Road would pass by the low density residences on Tennyson Road and would need to be accommodated at the Morrison Road / Tennyson Road roundabout. We note that Spencer Street and Warner Street are culs-de-sac. Brereton Street and Osgathorpe Road do not facilitate eastbound access to Victoria Road (for outbound trips), and we are aware that Council intends to install traffic management devices to discourage excessive through traffic in these roads. These measures would discourage inbound trips to the development site.

4.10 SIDRA TRAFFIC MODELS

Sidra models were supplied by Traffix. The inputs of the models were assessed and are summarised in Table 4.9.

Table 4.9: Sidra Inputs

Item	Approach	Comments	Acceptability
General Layout	Overall	The kerb side lane citybound on Victoria Road has not been modelled. This lane is a bus lane in the AM peak but a clearway open to general traffic in the PM peak. While this would affect the model outputs in terms of average delays it may not affect the degree of saturation. The future outbound bus lanes have also been ignored in the future models. This may have been done to model the lower utilisation of the bus lane and is considered an acceptable solution. A preferred solution would be to model the correct number of lanes but apply lane utilisation factors to the kerbside lanes.	No
Model Geometry	Widths	*a) Victoria Road/Tennyson Road* The model indicates that Victoria Road width used was 3m and Tennyson Road 3.3m. *b) Tennyson Road/Searle Street* Lane width in the model is 4m. Appropriate for roundabouts. *c) Tennyson Road/Southern Access (New Intersection)* Lane width in the model is 3.3m. Appropriate for this type of intersection. *d) Tennyson Road/Morrison Road* Lane width appear to be consistent with Google Map Aerials	Yes
	Lengths	*a) Victoria Road/Tennyson Road* Short left turn lane on Tennyson Road modelled as 50m, actual measurement is approximately 40m. *b) Tennyson Road/Searle Street* Appear to be consistent with Google Map Aerials *c) Tennyson Road/Southern Access (New Intersection)* Appear to be consistent with Google Map Aerials *d) Tennyson Road/Morrison Road* Appear to be consistent with Google Map Aerials	Yes
	Grades	*a) Victoria Road/Tennyson Road* Grade settings were applied to the intersection. 1.5% and 2% grade on Victoria Road east and west approach respectively and 3% on Tennyson Road. *b) Tennyson Road/Searle Street* No grade settings were applied to the intersection. *c) Tennyson Road/Southern Access (New Intersection)* No grade settings were applied to the intersection. *d) Tennyson Road/Morrison Road* No grade settings were applied to the intersection.	Yes
Movements	Overall	*a) Victoria Road/Tennyson Road* Movement settings are consistent, Victoria Road is signal coordinated with arrival type being favourable. *b) Tennyson Road/Searle Street* Default settings were used. *c) Tennyson Road/Southern Access (New Intersection)* Default settings were used. *d) Tennyson Road/Morrison Road* Default settings were used.	Yes

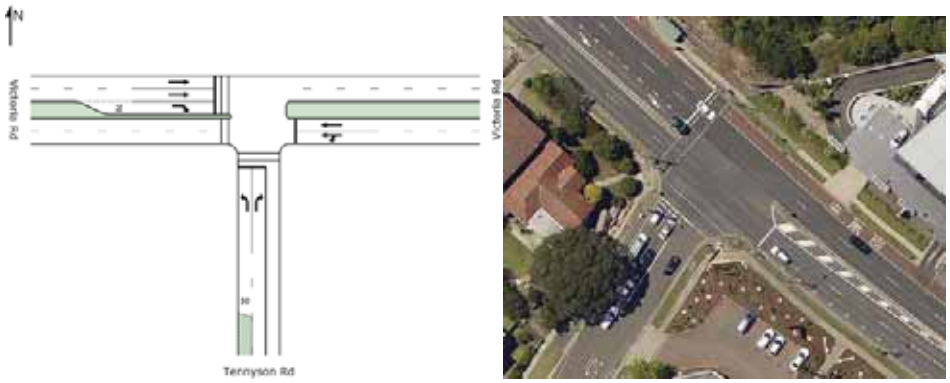
Approach Lane Data	Overall	*a) Victoria Road/Tennyson Road* Bunching on Victoria Road was used for Victoria Road, both 20% and 15% for east and west of Victoria Road as recommended. Default settings were used for saturation flow capacity adjustment. *b) Tennyson Road/Searle Street* Default settings were used. *c) Tennyson Road/Southern Access (New Intersection)* Default settings were used. *d) Tennyson Road/Morrison Road* Default settings were used.	Yes
Volumes	Overall	All modes appear to be consistent with the schematic diagram in the report	Yes
	Heavy Vehicles	*a) Victoria Road/Tennyson Road* 2% on Tennyson Road, 5% on Victoria Road (Consistent with traffic counts) *b) Tennyson Road/Searle Street* In the model, 2% heavy vehicles on Searle Street. Vehicles 3t and over are not allowed on Searle Street. *c) Tennyson Road/Southern Access (New Intersection)* *2% heavy vehicle on all approaches.* *d) Tennyson Road/Morrison Road* *2% heavy vehicle on all approaches.*	Yes
Peak flow factor (%)	Overall	Adopted 95% (default settings). Consistent over all models	Yes
Speed Environment	Overall	*a) Victoria Road/Tennyson Road* 60km/h Victoria Road, 50km/h Tennyson Road *b) Tennyson Road/Searle Street* 50km/h Tennyson Road, 50km/h Searle Street *c) Tennyson Road/Southern Access (New Intersection)* 50km/h on all approaches. *d) Tennyson Road/Morrison Road* 50km/h on all approaches.	Yes
Phasing		*Victoria Road/Tennyson Road* Undetected movements were applied to some left turns.	Yes
Gap Acceptance		Default settings were used in all models	Yes
Pedestrian Effects	Overall	No pedestrian effect adopted. While minimum clearance times would be maintained, the delays to turning vehicles caused by pedestrians have not been applied.	No
Modelling Method	Overall	RTA Delay Method	Yes

The Sidra models inputs were found to be generally acceptable but the following deficiencies were noted:

- A city-bound lane on Victoria Road was not modelled (see Figure 3 below);
- Delays to left turning traffic due to pedestrians were not applied;

The net effect of these deficiencies may slightly improve the results in terms of average delay butit is unlikely to improve the degree of saturation since it does not affect the critical movements.

The outputs from the models supplied were consistent with those in the Traffix Report.



Sidra Nearmap

Figure 3: Missing Lane on Victoria Road

5. ADJACENT DEVELOPMENTS

The proposed development should be considered in the context of adjacent developments (see Figure 5.1). It is noted that Traffix has adopted the predicted traffic volumes from the Bunnings Development. As shown in Figure 5.1 there are a number of other developments that would generate additional traffic in the future, including medium to high density housing developments and a supermarket on Monash Road.

From our previous reviews of developments in the area, it is estimated that the cumulative effects of these other developments could increase the background traffic growth in the area by some 5 to 10 % in the peak traffic periods. Further, the Gladesville DCP allows for higher density developments along the Victoria Road corridor. This would have a significant effect on the operation of traffic on Victoria Road in peak periods and should be considered in the context of this development.

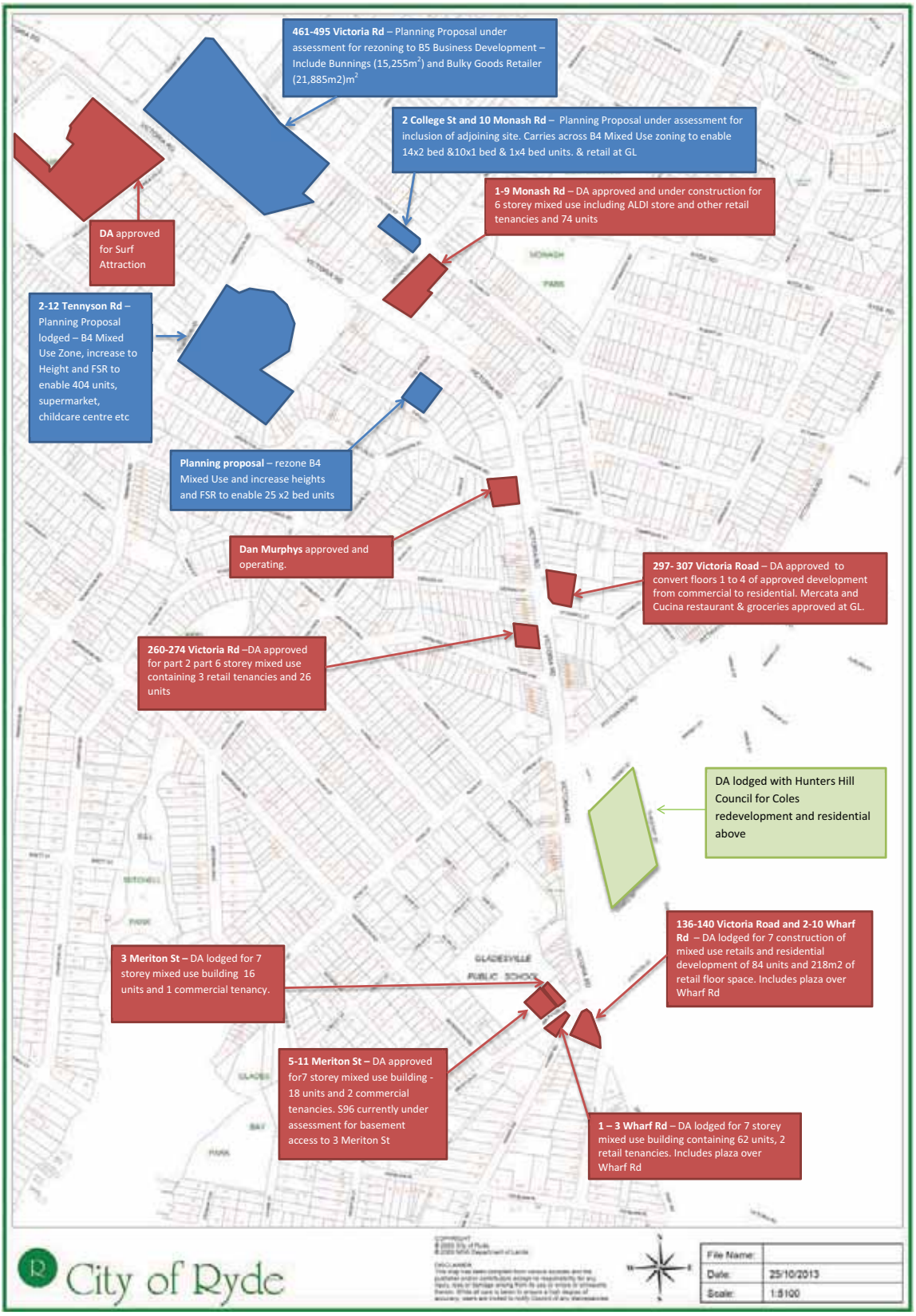


Figure 5.1: Future Development

6. ASSESSMENT

A summary of our review is shown in Table 6.1 below.

Table 6.1: Summary of Assessment

Issue	Comment
Reliability of Baseline data	The traffic data provided for the Tennyson Road / Victoria Road intersection appears consistent with other data. It is noted that the report does not reference the source of the data or when the surveys were undertaken.
Traffic Generation	The traffic generation appears to have been underestimated, without adequate justification for diverging from the RMS Guidelines. - Residential generation has used rates more applicable to developments near train stations and in city centres; - Child care traffic generation rates appear to be half those in the *RTA Guide to Traffic Generating Developments*; - Retail traffic is based on a linear relationship between trips per car space and floor area, which has not been adequately justified.
Traffic Distribution	The traffic distribution is consistent with the data purported to be observed. However, we note that the distribution between Morrison Road and Victoria Road fits neatly as round numbers of 40% and 60%. That said, given the road network layout these proportions are considered reasonable.
Use of traffic discounts	The assumption of multipurpose trips, while reasonable in principle, appears to have been overestimated the extent. No justification was given for the 20% reduction. The *RTA Guide to Traffic Generating Developments* does not provide guidance for new freestanding developments. The assumption that there are some linked trips is reasonable but again it has not been substantiated with any evidence other than 'common practice'.
Queuing in Tennyson Road	The Victoria Road / Tennyson Road intersection is predicted to be over capacity and queues on Tennyson Road from Victoria Road may extend past the Searle Street roundabout on a regular basis.
Parking Provision	The parking provisions are consistent with the City of Ryde DCPs
Access and Egress	The location of the proposed driveways appears to be reasonable.
Sidra Results	The Sidra modelling indicates the Tennyson Road / Victoria Road intersection would be over capacity and the average delay some 56 seconds, which is the upper limit of Level of Service D. LoS E is considered unacceptable. The models do not demonstrate that the proposed development will not have adverse effects on the road network.

Sidra inputs and assumptions	A city bound lane on Victoria Road was not modelled. If modelled correctly, this would improve the average delay for all scenarios. Delays due to vehicles turning though a pedestrian crossing were not applied. If applied this would increase the delays to some left turning movements in the models. Overall the models were considered to be acceptable but could have been made more accurate.

Our assessment of the traffic impacts of the proposed development, based on the information provided in the Traffix report and other planning documents, is that:

- The traffic generation has been underestimated;
- Discounts as a result of linked trips have been over estimated;
- The predicted intersection operation is not acceptable and would have higher delays were less generous traffic generation assumptions used.

It is therefore considered that the proposed development would most likely significantly increase the traffic delays at the Tennyson Road / Victoria Road intersection.

7. CONCLUSION

Bitzios Consulting has reviewed the traffic report of the planning proposal for 2 – 14 Tennyson Road, Gladesville. From our review we conclude that:

- Traffic generation has been significantly underestimated without adequate justification;
- Discounting for linked and multi-purpose trips has not been adequately substantiated and therefore should not be used for new standalone developments;
- The modelling shows unacceptable increases in delays; and
- The Victoria Road / Tennyson Road intersection would be over capacity according to the Sidra results.

Should the estimated traffic generation be increased then the intersection average delay is likely to be higher than that reported in the Traffix report. No road improvements have been proposed in the report to ameliorate the issues.

We therefore do not agree with the conclusions of the Traffix report and consider the likely traffic impacts to be greater than those reported. It is concluded that the proposed development would significantly increase traffic congestion.