



Note: The following Compliance Statement should be read in conjunction with the SEPP 65 Compliance Table and the Statement of Environmental Effects.

Design Quality Principle 1: Context

“Good design responds and contributes to its context. Context can be defined as the key natural and built features of an area. Responding to context involves identifying the desirable elements of a location’s current character or, in the case of precincts undergoing a transition, the desired future character as stated in planning and design policies. New buildings will thereby contribute to the quality and identity of the area.”

Compliance Statement

The site is located within Gosford Town Centre and is subject to an ongoing Development Consent No. DA 19775/2003 which was granted in Feb 2004.

The proposed development is consistent with the planning framework for its immediate locality and complies with all relevant Gosford LEP and DCP provisions except for building height. The creation of new residential stock on the subject property is considered highly desirable given its location in close proximity to the Gosford Town Centre and the adjacent Rumbalara Reserve offers excellent open space for the recreation and amenity of the residents. At street level the proposed development provides a range of residential apartment types combined with the three street level residential lobbies which will provide an active and vibrant street edge to the development site as well and providing excellent levels of street activation and passive surveillance. These aspects combined with the site’s proximity to numerous public transport and other services offered within the nearby Town Centre will positively contribute to the vibrancy and social infrastructure of the Town Centre area.

The site’s main pedestrian and vehicular access is off John Whiteway Drive. Four multi-storey residential tower blocks to the east were completed in 2003 As part of the original Development Consent for the combined development site which has subsequently been sub-divided. The existing context creates a mix of residential styles with a predominance of high and low rise residential development in the local precinct within which the proposed development sits comfortably.

The proposed development has been set back from John Whiteway Drive in line with the requirements of the Gosford DCP and the siting design of the original Development Consent in order to facilitate the creation of an attractive public realm along the John Whiteway Drive frontage. In conjunction with the proposed street planting and landscaping treatments, the street presentation along the John Whiteway Drive frontage will provide safe and pedestrian and accessible grade friendly linkages to the development and the surrounding neighbourhood as well as an excellent level of visual integration into the surrounding precinct.

The proposed design also creates the opportunity for an improved pedestrian and emergency vehicle linkage into the Rumbalara Reserve via the extension of Georgiana Terrace and improved pedestrian access along the John Whiteway Drive frontage. These new linkages provide convenient, safe and well activated pedestrian routes from both the Gosford Town Centre to the site and from within the site and surrounding areas to the Rumbalara Reserve for the emergency service personnel, the public and residents.

Therefore, the proposed development is considered to be compatible with the site’s surrounding land use and future desired character. It is also considered appropriate given the site’s close proximity to day-to-day services, and availability of public transport within the nearby Gosford Town Centre. Furthermore, the similarity of the development in scale, built form, and architectural and landscape treatment with that of the surrounding context is considered to contribute positively towards the character, quality and identity of the locality.



Design Quality Principle 2: Scale

“Good design provides an appropriate scale in terms of the bulk and height that suits the scale of the street and the surrounding buildings. Establishing an appropriate scale requires a considered response to the scale of existing development. In precincts undergoing a transition, proposed bulk and height needs to achieve the scale identified for the desired future character of the area.”

Compliance Statement

The proposed redevelopment respects and responds to the scale of the surrounding buildings and the established built form character of the surrounding residential precinct. The existing residential apartment buildings to the east are larger in height and scale, while the proposed design responds respectfully to minimise impact on solar access, cross ventilation and privacy to surrounding buildings. The proposed building form also provides a transition of scale from the taller existing residential apartment blocks down to the adjacent Rumbalara reserve and the John Whiteway Drive streetscape.

The proposed residential apartment building articulation, the site setbacks provided and the stepped curved roof form elements allow the development to reduce the apparent bulk and scale and draw attention to the site's heavily landscaped open spaces at ground and streetscape level.

The external treatment to the buildings also give consideration to the interface between the public and private domains, e.g. the articulation of the base or lower levels of the buildings with smaller more humanised-scaled elements and warmer textured materials ensures a better, more sensitive response to the public streetscape domain and character for the development. The proposed ground level landscape treatments provide a superior level of public and private realm amenity for the residential and public open space components of the development.

Architectural design features have been used to give a horizontal emphasis to the building and to tie the building elements of base, middle and top together in order to create a cohesive whole and an integrated approach to the architectural expression of the development. Entry areas have been designed to provide visual linkages between the surrounding public streetscape spaces and provide for a sense of progression through the site through the use of visual permeability.

Design Quality Principle 3: Built Form

“Good design achieves an appropriate built form for a site and the building's purpose, in terms of building alignments, proportions, building type and the manipulation of building elements. Appropriate built form defines the public domain, contributes to the character of streetscapes and parks, including their views and vistas, and provides internal amenity and outlook.”

Compliance Statement

The building form and footprint have been carefully arranged to facilitate a logical site configuration, maximisation of solar access and cross ventilation to apartments, and minimisation of overshadowing impacts to public / private open space and adjacent buildings.

The building has also been carefully positioned on the site to achieve good integration, connectivity, safety, passive surveillance, street activity and good amenity in terms of communal and public open spaces. The communal open spaces created by the proposed design are integrated into the building design to ensure there are no left over unusable spaces.

The site enjoys short and long distance views. The proposal creates a number of short distance views to open spaces within the site while the site enjoys elevated long distance views to the east, north and south direction including to the adjoining Rumbalara Reserve and the Brisbane Waters Basin. The landscape treatments along the John Whiteway Drive frontage Boundary help define the boundary and aids in providing a visual screen as well as visual interest to the streetscape.

Pedestrian routes within the site have been provided to allow pedestrian and visual permeability into and through the development. The pathways themselves have been placed in a set hierarchy in order to define usage.

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The design of the John Whiteway Drive frontage has been articulated to specifically address and make a positive contribution to the streetscape whilst achieving acceptable amenity for residents particularly in terms of visual and acoustic privacy. Legibility is achieved through the emphasis of residential lobbies both vertically and at street level and the differentiation of street level public spaces from residential and private open space terrace and balcony spaces.

Design Quality Principle 4: Density

“Good design has a density appropriate for a site and its context, in terms of floor space yields (or number of units or residents). Appropriate densities are sustainable and consistent with the existing density in an area or, in precincts undergoing a transition, are consistent with the stated desired future density. Sustainable densities respond to the regional context, availability of infrastructure, public transport, community facilities and environmental quality.”

Compliance Statement

The site has been nominated in Gosford Council's LEP as part of zone **R1 General Residential** with an allowable FSR of 1.5:1. The site forms an important part of the Gosford Town Centre's residential precinct. The site fronts the western side of Rumbalara Reserve one of Gosford's major public open space areas and is positioned within walking distance to the town centre. The site is currently designated for medium density residential development supporting the renewed policy emphasis to accommodate targeted housing growth in Gosford's town centre precinct in a sustainable manner. As such this site is ideally positioned to accommodate the density provisions outlined in Council's LEP.

The proposed development has a site density within the permissible maximum permitted within this particular development as stipulated within Council's LEP. The development has a total of 75 apartments ranging in size from 46 sqm to 108 sqm. The development provides a series of one, two and three bedroom apartments designed to accommodate the local community's changing household mix requirements and local residents' desire to down size from family homes in the area while maintaining access to the areas nearby facilities and transport.

Design Quality Principle 5: Resource, energy and water efficiency

“Good design makes efficient use of natural resources, energy and water throughout its full life cycle, including construction. Sustainability is integral to the design process. Aspects include demolition of existing structures, recycling of materials, selection of appropriate and sustainable materials, adaptability and reuse of buildings, layouts and built form, passive solar design principles, efficient appliances and mechanical services, soil zones for vegetation and reuse of water.”

Compliance Statement

The proposed development meets or exceeds the requirements of the relevant DCP provisions for the site in terms of solar access and cross ventilation. A current Development Consent exists for a similar scaled development on the site which adopted a similar range of stormwater management, capture and re-use provisions as those envisaged for the proposed development. The subject site has been partially cleared and remediated to a point where it is now ready for new development.

The design of the apartments, corridors and orientation of the buildings ensures that daylight access and natural ventilation is provided as required.

On-site detention will be provided to Council's engineering requirements and rainwater tanks have also been introduced for water reuse for communal toilet flushing and landscape irrigation. Individual instantaneous hot water systems are proposed to ensure more environmentally sustainable energy & water consumption. Refer to Basix reports for details.

Design Quality Principle 6: Landscape

“Good design recognises that together landscape and buildings operate as an integrated and sustainable system, resulting in greater aesthetic quality and amenity for both occupants and the adjoining public domain.”



Landscape design builds on the existing site's natural and cultural features in responsible and creative ways. It enhances the development's natural environmental performance by co-ordinating water and soil management, solar access, micro-climate, tree canopy and habitat values. It contributes to the positive image and contextual fit of development through respect for streetscape and neighbourhood character, or desired future character. Landscape design should optimise useability, privacy and social opportunity, equitable access and respect for neighbours' amenity, and provide for practical establishment and long term management."

Compliance Statement

The landscape is structured with trees, hedging plants, borders, accents and groundcovers. Low water demand plants have been used for most of the landscape areas and communal open spaces.

The site is characterised by a steep topography and is cliff like in nature. Careful consideration of existing site levels has been undertaken to minimise site excavation but due to the site's steep grades some excavation and benching will be required to accommodate basement car parks and site boundary interfaces. All proposed levels have been developed to ensure that equitable access is provided and that there are paths to main entries that are accessible. All paths to communal open space areas and private open space will adhere to AS 1428 to provide disabled access.

Open space has been designed to provide a hierarchy of areas and to provide privacy for residents, whilst maintaining an open area with clear sight lines within the communal areas.

The principal private open space to ground floor apartments is a minimum of 25m² and in most cases has been orientated to maximise the sunlight between 9am and 3pm in winter. The proposed private open space areas also lead directly from the living areas of the apartments. Each ground floor terrace area is defined by landscape screening and fences to create delineation between public, common or communal open space areas. Planting is used to define open space zones and direct pedestrian movement. The fencing of the private open space at grade is proposed to be light weight and when combined with landscape screening will maintain privacy to individual courtyards and balconies.

A communal toilet, spa pool, pool terrace and BBQ facilities are provided as the main communal area on the eastern side of the building overlooking the Rumbalara Reserve and Brisbane Waters basin. Planters and screen walls have been provided to allow for screen planting between communal open space and residential apartments. These walls are a minimum of 600 mm high and generally 1000mm high, to allow for low height courtyard trees.

Design Quality Principle 7: **Amenity**

"Good design provides amenity through the physical, spatial and environmental quality of a development. Optimising amenity requires appropriate room dimensions and shapes, access to sunlight, natural ventilation, visual and acoustic privacy, storage, indoor and outdoor space, efficient layouts and service areas, outlook and ease of access for all age groups and degrees of mobility."

Compliance Statement

The proposed development has been designed with consideration for responsible environment planning. Fundamental urban design principles of passive surveillance, integrated and unified street character, good visual and open space amenity and building comfort have been adopted when siting and orientating the building. Spacing and orientation of the building components allows for excellent solar access, natural ventilation and access to community open spaces.

Multiple lift cores are centrally located on each floor within each of the 3 main apartment clusters so as to minimise the distance to travel from the lift to each apartment. Each apartment cluster demonstrates a high level of amenity for common lobbies, corridors and apartments with natural ventilation, outlook and solar access achieved to all lobbies and common corridors. Solar access and cross flow ventilation to the apartments comply with the requirements of DCP and SEPP65.

The design of the apartments and orientation of the building ensures that a minimum of 3 hours of solar access during the winter solstice hours of 9am to 3pm is received by at least 70% of the total number of

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apartments as pursuant to the requirements of Council's DCP and SEPP65. The apartments have also been designed to maximise cross ventilation through the dwellings. Over 60% of apartments have been designed to provide natural cross flow ventilation while 25% of apartments enjoy natural ventilation to their kitchens through adjoining window or skylight ventilator. Please refer to SEPP 65 and DCP compliance schedules for details.

Each apartment's balconies and private open space has been sized to comply with DCP and SEPP 65 requirements in order to allow for an outdoor furniture setting. The internal rooms have been sized to allow for maximum flexibility when furnishing each apartment.

Storage requirements for each apartment have been provided both within the apartment and within the secure basement. The storage provided meets the requirements of SEPP 65 in all cases.

The three apartment clusters are appropriately separated to ensure visual privacy and suitable air flow between the units as well as providing the opportunity for landscaped open space, hence creating visual amenity for the residents. The network of landscaped communal open spaces within the development also provides a desirable recreational amenity for the residents.

Adaptable apartments have been provided in accordance with the code requirements in order to meet the need of the society as it ages in place while the visitable requirements have been included for the amenity of those visiting residents within the proposal.

Design Quality Principle 8: Safety and Security

“Good design optimises safety and security, both internal to the development and for the public domain. This is achieved by maximising overlooking of public and communal spaces while maintaining internal privacy, avoiding dark and non-visible areas, maximising activity on streets, providing clear, safe access points, providing quality public spaces that cater for desired recreational uses, providing lighting appropriate to the location and desired activities, and clear definition between public and private spaces.”

Compliance Statement

The principle of passive surveillance has been incorporated into the development. Passive surveillance is ensured by way of positioning building entries with direct access off the John Whiteway Drive street network and private open spaces that enables visual interaction with the public domain.

The provision a new pedestrian footpath treatment to the site's John Whiteway Drive frontage provides for passive surveillance of the open spaces while the design and location of the balcony elements allows for passive surveillance of the site's internal pathways and site's street frontage.

Visual privacy has been considered and allowed by way of acceptable building separation, differentiation in levels between the public and private zones, landscape screening, adjustable louvres and careful planning of the typical floor layout for the apartment buildings pursuant to the provisions of Council's DCP and SEPP 65.

High quality communal open spaces are provided with the primary communal open spaces incorporating, excellent outlook, landscaping, sunshine, privacy, spa pool and pool terrace, covered seating areas, BBQ and communal w/c facilities.

Design Quality Principle 9: Social dimensions

“Good design responds to the social context and needs of the local community in terms of lifestyles, affordability, and access to social facilities. New developments should optimise the provision of housing to suit the social mix and needs in the neighbourhood or, in the case of precincts undergoing transition, provide for the desired future community.”

Compliance Statement

The proposed development positively contributes to the Gosford Town Centre precinct by providing residential dwellings catering to the needs of the area. The proposal sits within the Gosford town centre and is hence ideally located within walking distance to shops, public open spaces and transport routes.



The Vision for the development is to create a community focused environment that delivers housing choice and promotes a sense of community. The overall planning for the proposed design encompasses the fundamental Urban Design principles of integration, connectivity, permeability, legibility, safety and comfort.

The proposed development will increase the supply and improve the quality and range of housing for people wishing to down size, key workers and investors in the locality.

In addition, the proposed development will further strengthen demand for existing local community facilities and for added retail and employment opportunities allowing for a stronger local economy and social network.

The proposed development addresses the need for more one bedroom and two bedroom stock to meet the needs of existing Hurstville residents throughout the housing life cycle, particularly for younger people leaving home and older residents who can no longer maintain large houses and large gardens.

Design Quality Principle 10: Aesthetics

“Quality aesthetics require the appropriate composition of building elements, textures, materials and colours and reflect the use, internal design and structure of the development. Aesthetics should respond to the environment and context, particularly to desirable elements of the existing streetscape or, in precincts undergoing transition, contribute to the desired future character of the area.”

Compliance Statement

The proposed development is articulated using defined geometrical forms and contrast of light and shade. A careful selection of contemporary and muted earthy materials and colours has been adopted that complements the existing context and adjoining bushland setting. Materials and colours selected are appropriate to the building types and use, and in keeping with the surrounding built form typology.

The composition of blade walls, balconies / terraces and privacy screens with the practical and efficient floor layout of the buildings all go to delivering an architecture that is liveable, comfortable, safe, functional and environmentally sensitive, complemented by the complimentary landscape design and careful plant selection, form, colour and scale.

The overall building mass has been broken down into 3 residential apartment clusters and the building design adopts a defined base, middle and top in order to reduce the appearance of bulk and provide a simple and low scale expression. The use of feature vertical elements and areas of contrasting colour at main entry points assist in tying each of the previously described components together to create cohesion within the development while enforcing the developments overall aesthetic and appeal. The careful planning of each residential cluster layout in terms of common circulation spaces, apartment positioning within the building and internal planning draws the development together as a whole and has allowed the elevational treatment to be set as a simple and effective aesthetic benchmark for the site as a whole.

The building has been broken down with the expression of the lobby areas creating a visual break in each building's facade. The play of shadow and light in these elements reduces the buildings apparent length while creating points of interest that will naturally draw pedestrians towards the three main points of entry. The lobbies act as a legible point of entry while providing visual connection from inside to outside. This visual connection enriches the passive surveillance of the John Whiteway Drive streetscape and creates a positive level of interest in the building's external expression due to the recognisable activity and lighting within each entry space. Each entry lobby area will be naturally ventilated and naturally lit providing further amenity to the space.

The overall building envelope has been formulated through detailed shadow & visual impact analysis studies and provides sufficient separation from existing Residential Tower blocks on the eastern side of the proposed development.

While a common language of architectural elements has been established, the building facade has been designed to respond to climatic factors such as solar access, natural ventilation and outlook.

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Common corridor, lobby spaces and vertical circulation areas have been deliberately kept simple to facilitate legibility and avoid unsafe hidden corners and places of concealment.

The development responds positively to its surroundings neighbourhood via the creation of a unique yet sympathetic architectural expression and use of compatible colours and materials. The scale and proportions of the proposed development is in keeping with the surrounding residential apartment buildings whilst not merely mimicking their expression and style. The outcome is an attractive residential development, which is in keeping with its local context and the desired future character of the Gosford Town Centre.

Design Verification

We confirm that DEM (Aust) Pty Ltd are the designers of the proposed development at 70 John Whiteway Drive, Gosford. DEM (Aust) Pty Ltd are registered as Architects in accordance with the Architects Act 2003 and are suitably qualified in the design of high quality residential flat housing.

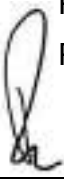
We confirm that the proposed residential flat development at 70 John Whiteway Drive Gosford has been designed in accordance with the design quality principles set out in State Environmental Planning Policy No. 65 – Design Quality of Residential Flat Development.

Name of Design Practice: DEM (Aust) Pty Limited

Address: PO Box 5036, West Chatswood, NSW 1515

Contact Details: Tel - 02 8966 6000

Fax - 02 8966 6111

Contact Architect:  Rudi Valla - Registered Architect 6582

Signature: _____

**PROPOSED RESIDENTIAL
DEVELOPMENT**

70 JOHN WHITEWAY DRIVE, GOSFORD

***Assessment of Traffic and
Parking Implications***

January 2015
(Rev C)

Reference 14298

TRANSPORT AND TRAFFIC PLANNING ASSOCIATES
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APPENDIX A
APPENDIX B

DEVELOPMENT PLANS
TURNING PATHS ASSESSMENT

LIST OF ILLUSTRATIONS

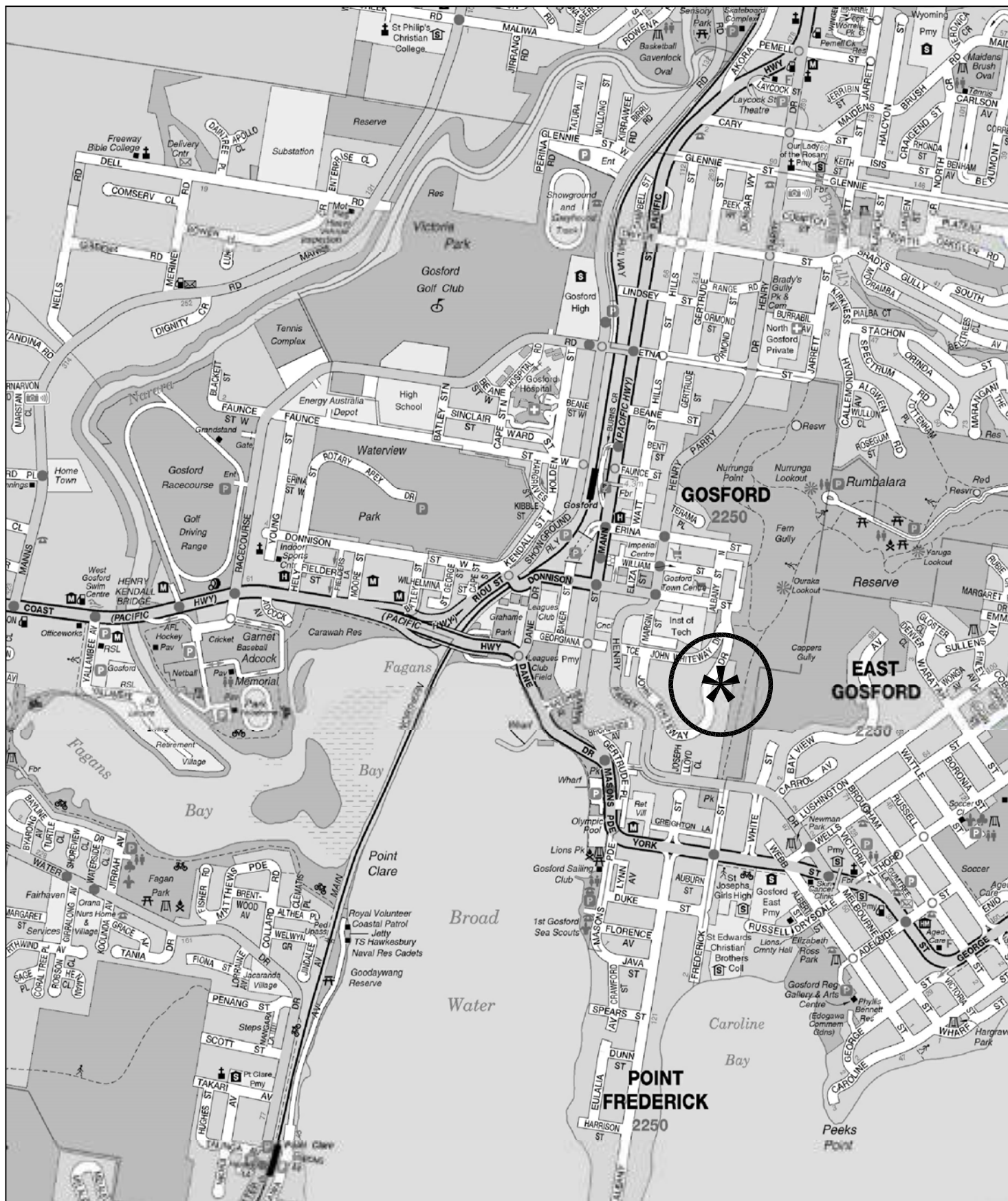
FIGURE 1	LOCATION
FIGURE 2	SITE
FIGURE 3	ROAD NETWORK
FIGURE 4	TRAFFIC CONTROLS

1. INTRODUCTION

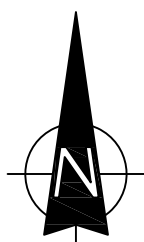
This report has been prepared to accompany a Development Application to Gosford City Council for a proposed residential apartment development on a site with an extensive frontage to John Whiteway Drive at Gosford (Figure 1).

The elevated lands adjoining and enclosing Gosford Town Centre provide extensive open outlooks amongst parkland areas and Brisbane Water. Residential apartment development in the area is advantaged by the close proximity to the CBD, with its employment, shopping, entertainment and public transport facilities. As a result of these circumstances the area is subject to ongoing development activity as part of the urban consolidation process.

The proposed development comprises 75 apartments with basement carparking and the purpose of this report is to provide an assessment of the traffic, transport and parking implications of the development scheme.



LEGEND



LOCATION

FIG 1

2. PROPOSED DEVELOPMENT SCHEME

2.1 SITE, CONTEXT AND CURRENT USE

The site (Figure 2) is Lot 100 in DP1066540 which occupies an elongated irregular shaped area of some 4,776m². The site, which has an extensive frontage to the eastern side of John Whiteway Drive, falls away steeply to the east as indicated on the survey plan overleaf.

The site, which is vacant and heavily treed, is adjoined to the east by multi-level apartment buildings and to the north by the Rumbalarla Reserve bushlands. There are other apartment buildings to the west and south while Gosford Town Centre is located just to the north.

2.2 PROPOSED DEVELOPMENT

It is proposed to clear and excavate the site to construct of a 4/5-level building over basement carparking.

The proposed development will comprise:

Residential

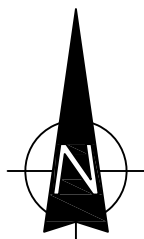
- 13 x one-bedroom apartments
- 52 x two-bedroom apartments
- 10 x three-bedroom apartments
- Total 75 apartments**

A total of 106 parking spaces will be provided in basement levels with vehicle access on the Georgiana Terrace a new cul-de-sac roadway connecting to Whiteway Drive.

Details of the development scheme are provided in the plans prepared by dem Architects which accompany the Development Application and are reproduced in part in Appendix A.

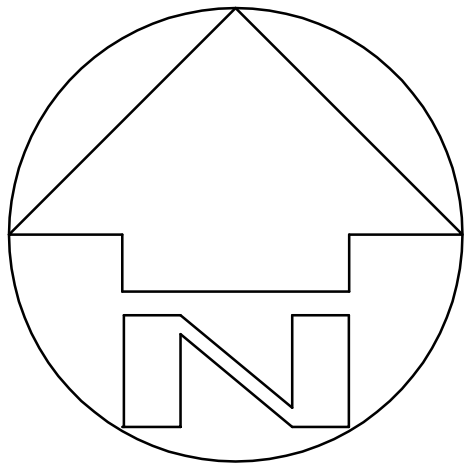


LEGEND



SITE

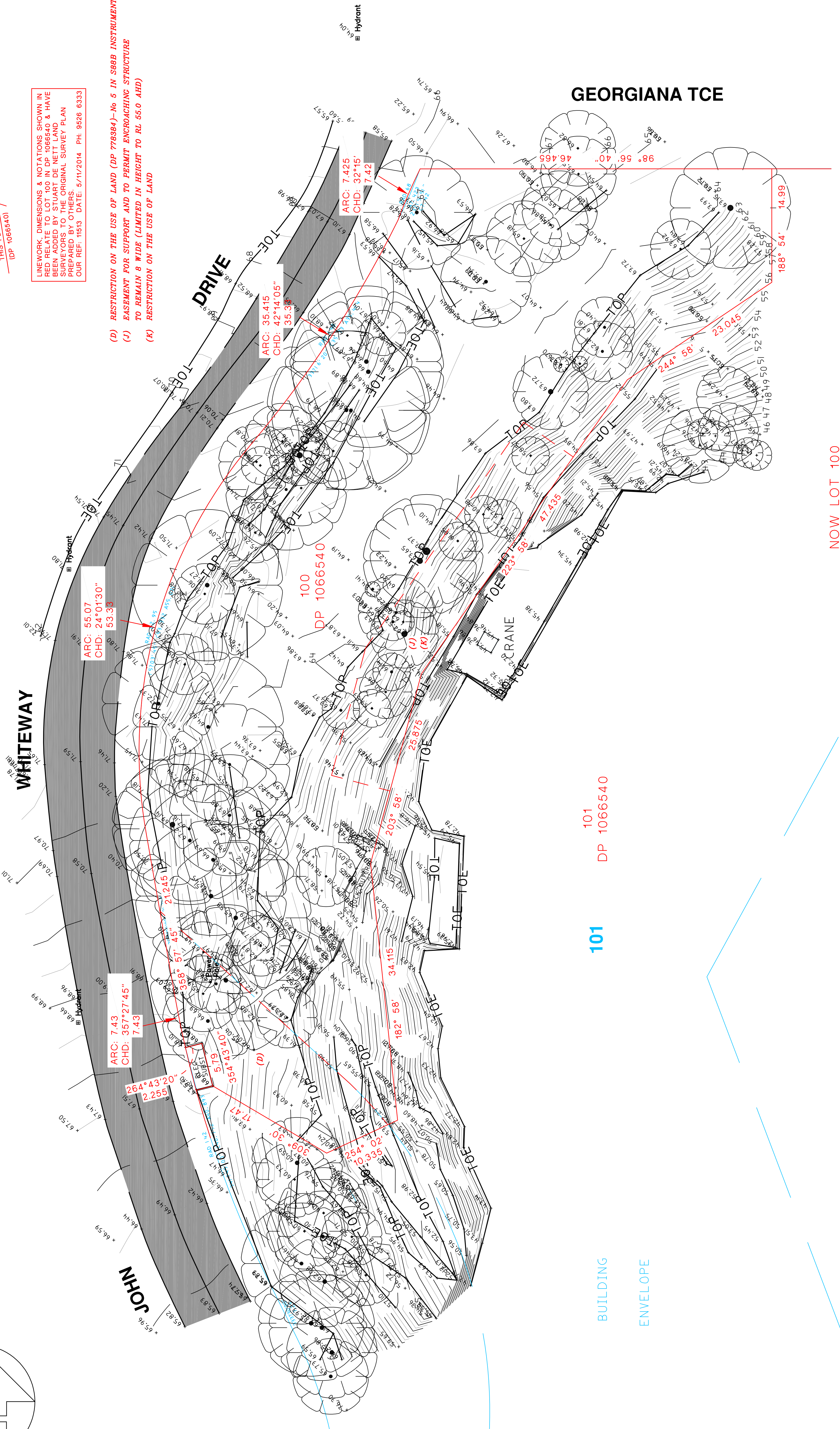
FIG 2



APPROX.  THIS PLAN 
(DP 1066540)

LINEWORK DIMENSIONS & NOTATIONS SHOWN IN RED RELATE TO LOT 100 IN DP 1066540 & HAVE BEEN ADDED BY STUART DE NETT LAND SURVEYORS TO THE ORIGINAL SURVEY PLAN PREPARED BY OTHERS.
OUR REF: 11513 DATE: 5/11/2014 PH: 9526 6333

WHITEWAY



JOHN

DRIVE

101
DP 1066540

BUILDING
ENVELOPE

GEORGIANA TCE

NOW LOT 100
IN DP 1066540

No.	Date:	Amendment

L:\0R13-SUP\STDDWGS\pbgp-logo.bmp

TITLE:
PLAN SHOWING DETAIL,
CONTOURS AND LEVELS OVER
~~PART LOT 2 D.P. 778384 AT~~
JOHN WHITEWAY DRIVE AT
GOSFORD

WORK TO FIGURED DIMENSIONS ONLY
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DRAWING 4881DET4.DWG	DATA FILE: 4881G2.DAT
DATE: A.H.D.	DATE: 11/4/2003
DRAWN: S.J.B.	DESIGNED/SURVEYED: /M.N.S.
REFERENCE No: S4681	PLAN No:
SHEET NUMBER 1	OF 1
SHEETS A1	

3. ROAD NETWORK AND TRAFFIC CONDITIONS

3.1 ROAD NETWORK

The road network serving the site (Figure 3) comprises:

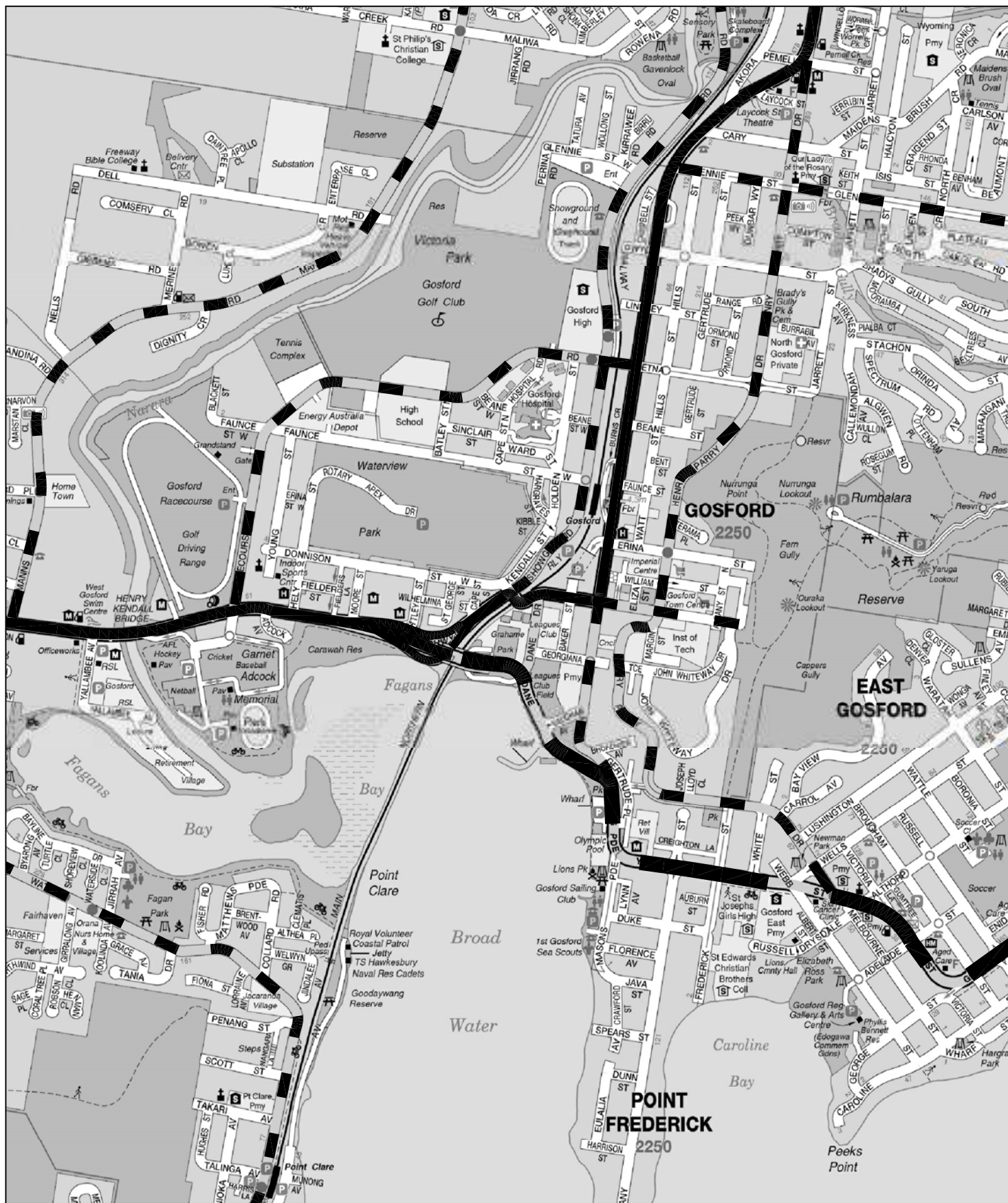
- * *Pacific Highway/Central Coast Highway* - a State Road and arterial route connecting between Sydney and Newcastle
- * *Dane Drive/Masons Pde/York Street* - a State Road and part of a sub-arterial route connecting between Gosford and Terrigal
- * *Henry Parry Drive* - a collector road running to the east of Pacific Highway and through the CBD
- * *Donnison Street and Erina Street* - collector roads connecting through the CBD to the Highway
- * John Whiteway Drive – a local access road

John Whiteway Drive has one traffic lane in each direction with a curvilinear alignment.

3.2 TRAFFIC CONTROLS

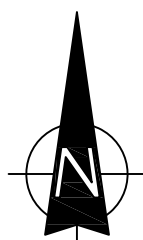
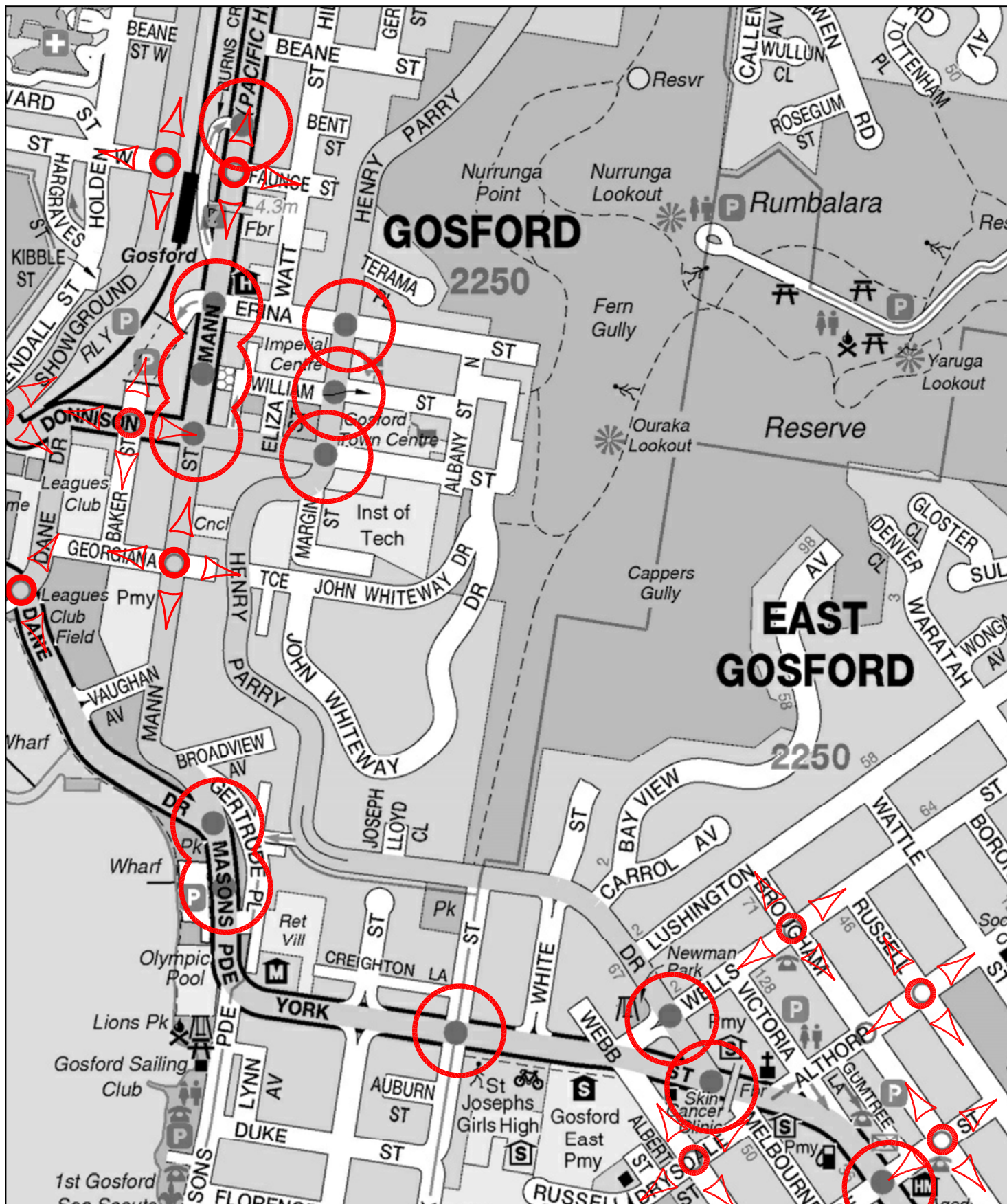
The traffic controls which have been applied to the road system in the vicinity of the site (Figure 4) comprise:

- * the traffic signals located along the Pacific Highway/Mann Street at the Donnison Street, Erina Street and Erina Street intersections
- * the roundabouts along Racecourse Road/Erina Street at the Showground Road and Hill Street intersections



ROAD NETWORK

FIG 3



TRAFFIC CONTROLS

FIG 4

- * the give way sign controls at the Mann/Lindsey Streets and Mann/Dwyer Streets intersections
- * the 50 kmph 'local area' speed restrictions along Mann Street, Hills Street, Gertrude Street and Beane Street
- * the peak period No Stopping restrictions along Mann Street near the site frontage and kerbside parking during off peak periods

3.3 TRAFFIC CONDITIONS

An indication of the prevailing traffic conditions on the road system serving the site is provided by data published by the RMS which is expressed in terms of Annual Average Daily Traffic (AADT) and flows in the vicinity include:

LOCATION	AADT
Henry Parry Drive, south of Erina Street	18,558

John Whiteway Drive (southern arm) south of Donnison Street carries some 100 to 200 vph being largely limited to local access movements and service vehicle etc.

Traffic conditions in the surrounding area are relatively satisfactory, with vehicle delays being generally moderate and associated with the operation of traffic signals as well as driveway access movements.

3.4 TRANSPORT SERVICES

The site is well served by public transport services which comprise:

- * Gosford Railway Station some 600 metres to the south with the connection it provided within the regional rail system

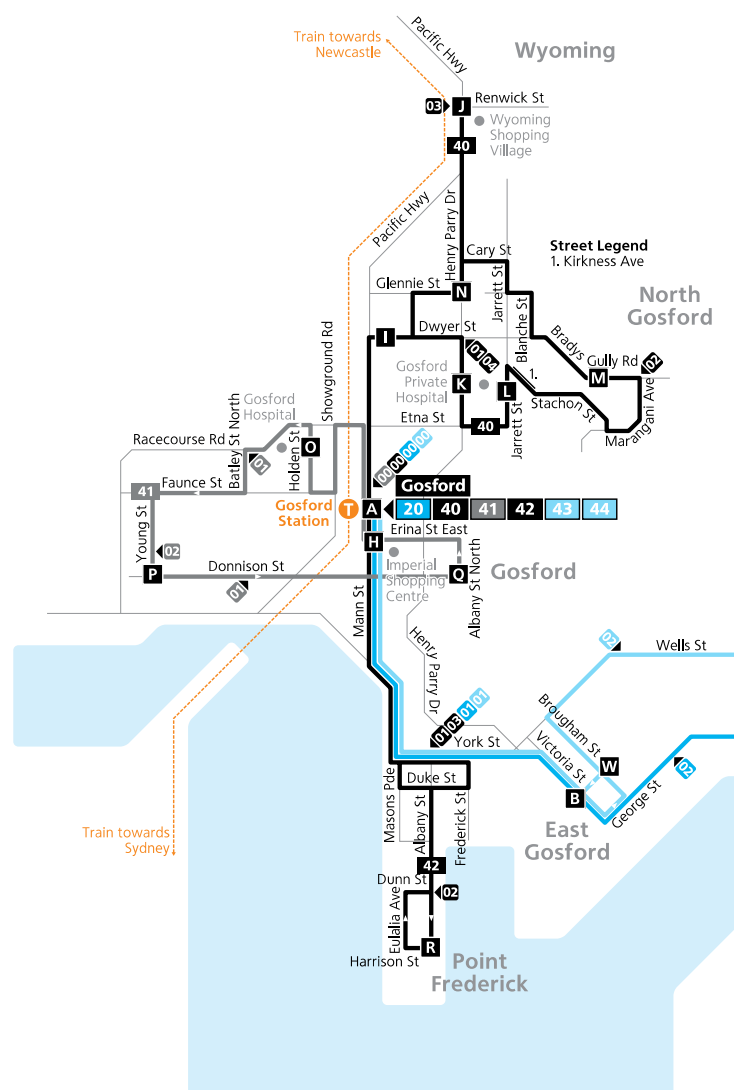
- * Bus routes connecting to the Bus/Rail Interchange which run along Mann Street and Henry Parry Drive (where the closest stops are located some 300 metres south of the site) with destinations throughout the Gosford City area.

Details of the Gosford bus routes are provided overleaf.

Timing Points

- T** Gosford Station train from Sydney arrives
- T** Gosford Station train from Newcastle arrives
- A** Gosford Station
- B** Central Coast Highway & Adelaide Street
- C** Thames Drive & Severn Close
- D** Erina Fair Shopping Centre
- E** Wattle Tree Road & Pollard Close
- F** End of Oak Road
- G** Matcham Road & Wambina Road
- T** Gosford Station train to Sydney departs
- T** Gosford Station train to Newcastle departs
- H** Mann Street & Erina Street
- H** Erina Street Mall
- I** Hill Street & Dwyer Street
- J** Wyoming Medical Centre
- K** Gosford Private Hospital Henry Parry Drive
- L** Gosford Private Hospital Jarrett Street
- M** Bradys Gully Drive & Belltrees Close
- N** Glennie Street & Henry Parry Drive
- O** Gosford Hospital Holden Street
- P** Donnison Street & Young Street
- Q** Donnison Street & Albany Street
- R** Albany Street & Harrison Street
- S** Barralong Road & Lingi Street
- S** Barralong Road & Aston Street
- T** Sherwood Drive & Willow Road
- T** Wells Street & Sherwood Drive
- U** Marana Street & Springfield Road
- V** Wells Street & Springfield Road
- W** Brougham Street & Adelaide Street

Bus route map



Legend

- Bus route
- 20 Bus route number
- 04 Section point
- A Timing point
- T Train line/station



Interchange Guides (cont...)

Woy Woy



Route	Stand	Route	Stand
50 Umina Beach	2	58 Phegans Bay	5
53 Booker Bay	3	59 Wagstaffe	4
54 Umina/Patonga	5	64 Woy Woy	4
55 Gosford	1	70 Gosford	1
57 Umina West	5	70 Ettalong Beach	3

Erina Fair



Route	Stand	Route	Stand
19 Wyong	E	63 Davistown	A
20 Gosford	A	63 Gosford	C
20 Matcham	G	64 Woy Woy	C
20 Gosford	A	64 Gosford	A
21 The Entrance North	E	65 Wagstaffe	C
21 Gosford	A	65 Gosford	A
22 The Entrance	E	66A Avoca Beach	C
22 Gosford	A	66A Gosford	A
23 The Entrance	E	66C Copacabana	C
23 Gosford	A	66C Gosford	A
28 The Entrance	E	67 North Avoca	F
28 Gosford	A	67 Gosford	A
44 Gosford	A	68 Terrigal	F
		68 Gosford	A

Lake Haven



Route	Stand	Route	Stand
11 Tuggerah	4	90 Budgewoi	6
29 Wyong Hospital	4	91 Norah Head	6
29 Bay Village	4	92 Budgewoi	5
78 Tuggerah	1	95 Morisset	3
79 Tuggerah	1	95X Wyee	3
80 Tuggerah	1	97 Wyee	3
81 Tuggerah	2	98 Chain Valley Bay	3
82 Tuggerah	2	99 Charlestown	3

See other side for Gosford, Wyong and Tuggerah

4. PARKING

Council's requirements in respect of car parking in the Gosford Town Centre are specified in the Gosford DCP 2013 document which indicates the following requirements:

Residential

1 Bed apartment	1 space
2 Bed apartment	1.2 spaces
3 Bed apartment	1.5 spaces
Visitors	1 space per 5 apartments

Application of this criteria to the proposed development would indicate the following provision:

Residential

13 x 1 Bed apartments	13 spaces
52 x 2 Bed apartments	62.4 spaces
10 x 3 Bed apartment	15 spaces
Visitors (75 apartments)	15 spaces
Total:	105.4 spaces

It is proposed to provide 106 spaces in the basement levels including 12 adaptable spaces in compliance with the DCP.

Provision is also made in the basement for 5 motorcycle spaces and 25 bicycle spaces for residents and 7 for visitors in satisfaction of the DCP controls.

5. TRAFFIC

The RMS Development Guidelines specify a peak hour traffic generation rate for high density residential development (i.e a building comprising 20 or more units) of 0.29 vtpd per unit although the more recent TDT2013-4b indicates 9 lower rates for sites with access to rail and bus services.

Application of the above criteria to the proposed 75 apartments would indicate projected peak traffic generation of some 22 vtpd. The projected traffic movements are likely to be distributed as follows:

AM		PM	
IN	OUT	IN	OUT
5	17	17	5

Traffic movements of this minor magnitude will not present any adverse traffic capacity, safety or traffic related environmental related consequences and it is apparent that the proposed development will not have adverse traffic/safety implications on the existing road network.

¹ Guide to Traffic Generating Developments
RTA of NSW 2002

6. ACCESS, INTERNAL CIRCULATION AND SERVICING

ACCESS

Vehicle access for the basement carpark will comprise two 5.5 metre wide combined ingress/egress driveways located on the new Georgina Terrace cul-de-sac. The new driveways will be located where suitable sight distances are available.

The design of the access driveways will accord with the requirements of AS 2890.1.

INTERNAL CIRCULATION

Generous ramp grades/widths, aisle widths and parking bay dimensions are provided for in the carpark design. The two-way circulation system will have satisfactory provisions for manoeuvring and will comply with the requirements of AS 2890.1 & 6 as indicated on the turning path diagrams provided in Appendix B.

SERVICING

Refuse will be removed from the street in the indented area across the access driveways by Council's refuse vehicle as indicated in the turning path diagram in Appendix B.

Service personnel and maintenance vehicles etc will be able to use the visitor parking spaces while any occasional requirements for large delivery vehicles (eg furniture pantechnicons) will be reliant on the available on-street parking in the area as is normal for a residential apartment development of this nature.

7. CONCLUSION

The development site occupies a prominent site near the Gosford City Centre and represents a valuable opportunity for a new residential apartment development taking advantage of the scenic outlook that the site provides. The traffic, transport and parking assessment provided in this report indicates that the development will:

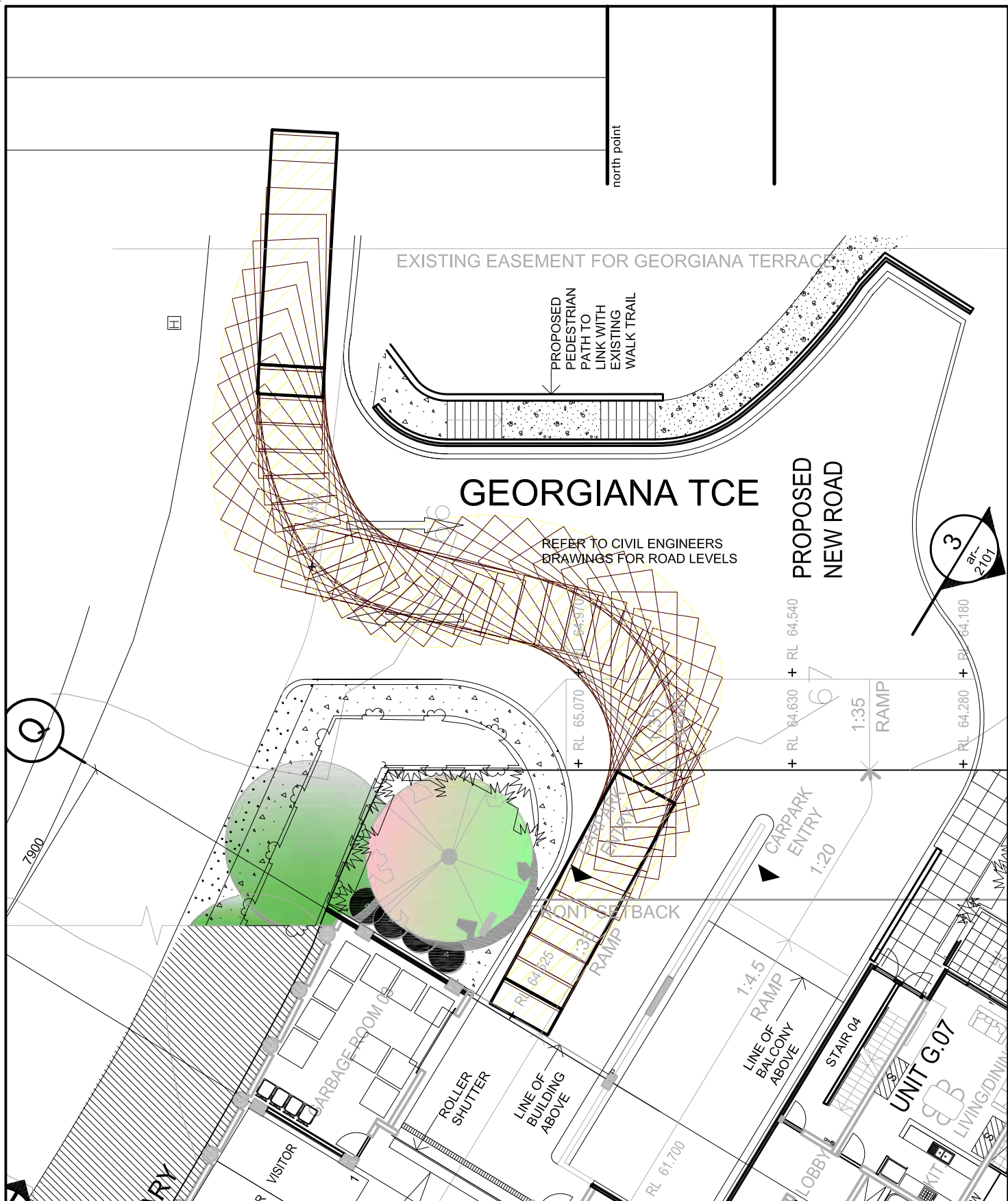
- * not present any unsatisfactory traffic capacity, safety or environmental related implications
- * incorporate a suitable and appropriate parking provision for the proposed nature of uses
- * incorporate suitable vehicle access, internal circulation and servicing arrangements

Appendix A

DEVELOPMENT PLANS

Appendix B

TURNING PATH ASSESSMENT



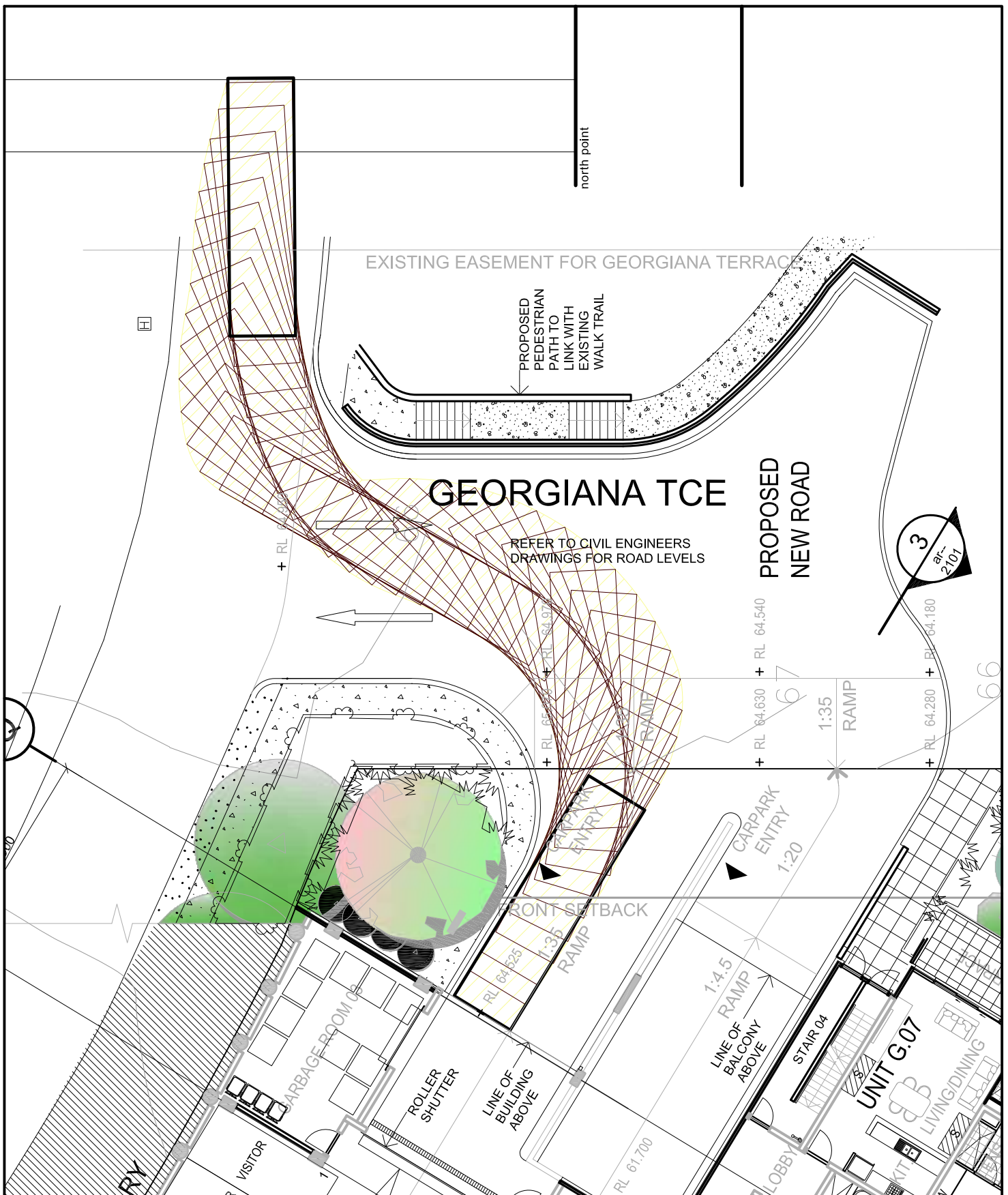
LEGEND

This drawing has been prepared using vehicle modelling computer software AutoTrack V9.21 in conjunction with AutoCAD 2013. The vehicle used is based upon vehicle data provided by Austroads and incorporates a reasonable degree of tolerance. However, it is not possible to account for all vehicle types/characteristics and/or driver ability.



**SWEPT PATH ANALYSIS
OF A 10.2m REFUSE VEHICLE
EXITING THE SITE**

SP 2



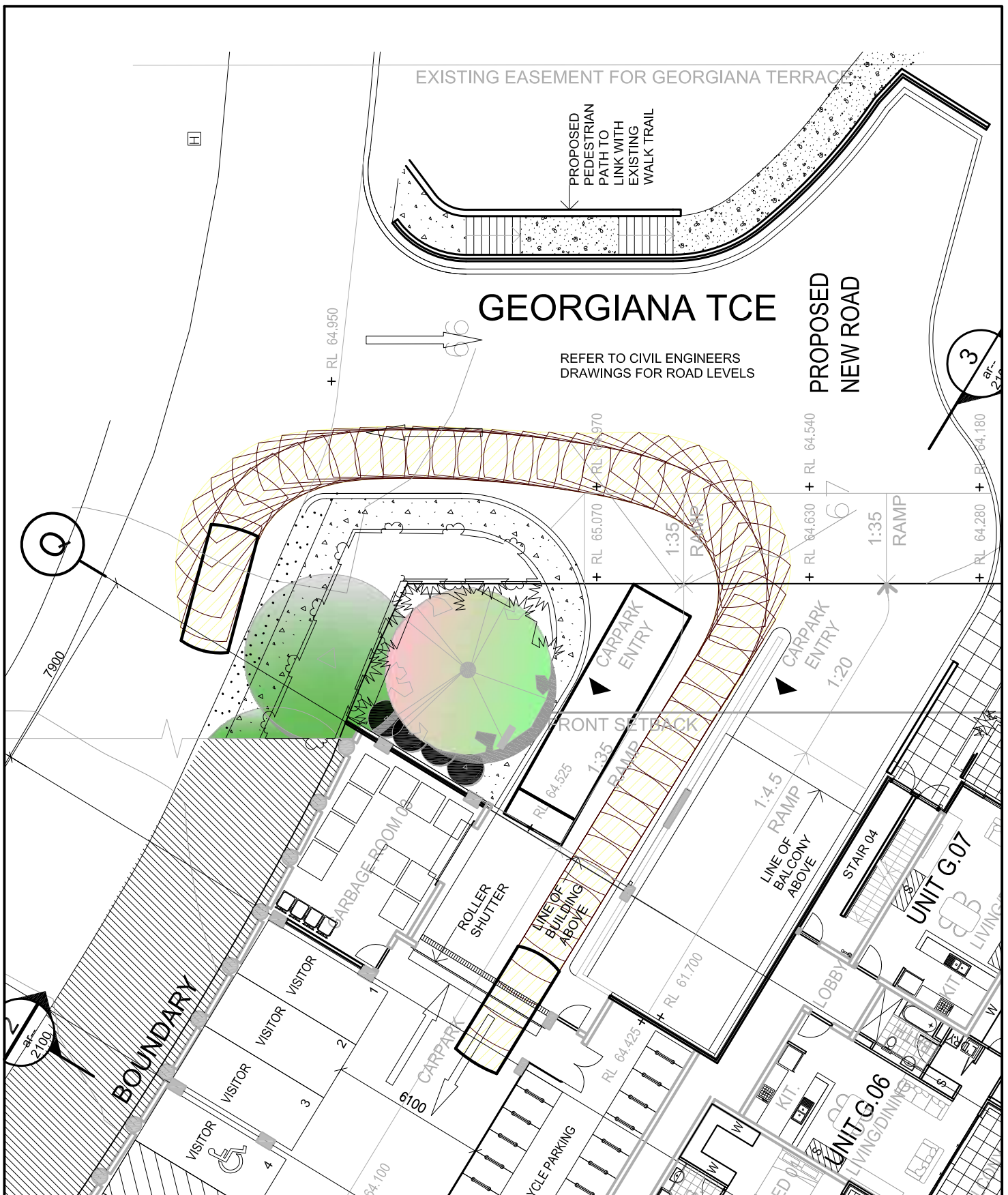
LEGEND

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**SWEPT PATH ANALYSIS
OF A 10m RIGID VEHICLE
EXITING THE SITE**

SP 4



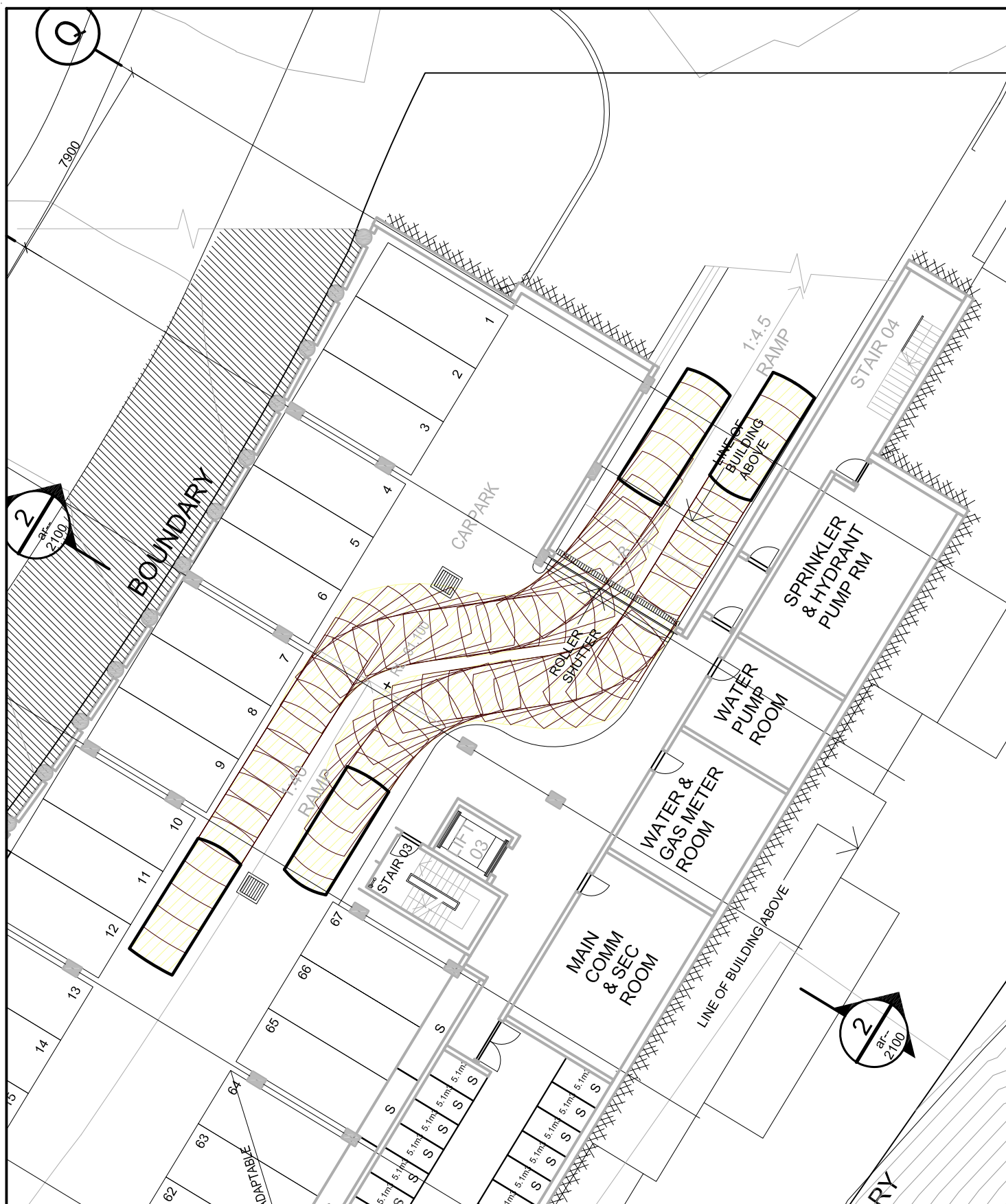
LEGEND

This drawing has been prepared using vehicle modelling computer software AutoTrack V9.21 in conjunction with AutoCAD 2013. The vehicle used is based upon vehicle data provided by Austroads and incorporates a reasonable degree of tolerance. However, it is not possible to account for all vehicle types/characteristics and/or driver ability.



**SWEPT PATH ANALYSIS
OF AN 85th PERCENTILE
AROUND A PARKED 10.2m
REFUSE TRUCK**

SP 5



LEGEND

This drawing has been prepared using vehicle modelling computer software AutoTrack V9.21 in conjunction with AutoCAD 2013. The vehicle used is based upon vehicle data provided by Austroads and incorporates a reasonable degree of tolerance. However, it is not possible to account for all vehicle types/characteristics and/or driver ability.



SWEPT PATH ANALYSIS OF AN 85th AND A 99th PERCENTILE VEHICLE ENTERING AND EXITING THE SITE

SP 6



RESIDENTIAL DEVELOPMENT

Lot 100 No. 70 John Whiteway Drive, Gosford

Visual Impact Assessment Report

January 2015

Project no. 4366-00

DEM (Aust) Pty Ltd
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Issue Register

Date of Issue	Reason for Issue	Prepared by	Checked by	Signed
12.12.14	Draft for Information	JH	JP	
16.12.14	Draft for Information	JH	JP	
27.01.15	Issue for DA	JH / RV / AB	JP	

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1 Introduction

Integral Financial P/L proposes to construct a new residential development at 70 John Whiteway Drive, Gosford. An approved DA (No. 19775/2003) exists for the site for a four storey 48 unit apartment building which has established the general building footprint for the new development. Approval is now being sought to increase the total number of units from 48 to approximately 75 by changing the unit mix and by providing one additional residential floor and one additional level of basement car park within the current approved building footprint.

This Visual Impact Assessment Report has been prepared by DEM (Aust) Pty Ltd as part of the revised Development Application submission for the site.

The report provides an assessment of the visual impacts of the proposal in the context of the existing environment and identifies building and design measures to mitigate adverse visual impacts and ensure the proposal complements the visual character of its setting.

1.1 Project Overview

The proposal site is located within Gosford City Centre and lies to the south-east of the city's commercial core. John Whiteway Drive adjoins the site's western boundary and an unformed access road – Georgiana Terrace – is located to the north of the site. The Sanctuary at Rumbalara residential high-rise apartment development is located to the east of the site and to the north is the Rumbalara Reserve.

Located on a south-east facing hillside below a ridgeline, the site incorporates steeply sloping land and a central terraced area. Vegetation along the western and eastern boundaries incorporates mature trees and shrubs while the central level section, which was previously cleared, incorporates small regrowth vegetation.

The proposed development will have similar building massing, setbacks and landscape treatments to that of the currently approved DA design with the exception of the additional above ground storey. It will present as a 3-4 storey building to the John Whiteway Drive frontage and a 4-5 storey building to the eastern and northern boundaries.

To integrate the building with its surrounds, materials and colours of the proposal are to complement the Sanctuary at Rumbalara residential towers and nearby bushland. The building is also to be modulated and articulated to reduce its overall scale.

2 Site Analysis

2.1 Site Location and Context

The site is known as Lot 100 in DP 1066540, No. 70 John Whiteway Drive, and is located within Gosford Town Centre, approximately 400m from the CBD. The land is zoned R1 “General Residential” under Gosford LEP 2014. It is bounded by John Whiteway Drive to the west and the Sanctuary at Rumbalara apartment complex to the east. The Rumbalara Reserve is located in close proximity to the site to the north and east. Residential areas lie to the south and west of the site.



Source: Google Maps



Figure 2.1.1 - Location of Proposal Site

2.2 Site Conditions

The site is approximately 4776m² and located on elevated land with a high point of approximately R.L.73.0. The site slopes steeply away from John Whiteway Drive in a south-easterly direction and also slopes steeply along the eastern boundary adjacent to The Sanctuary at Rumbalara. Sections of the steep embankment adjacent to the eastern boundary have been stabilised with shotcrete. The site also incorporates rock outcrops and a central level area with regrowth vegetation.

The site is extensively covered with native vegetation including trees to approximately 20 metres clustered along the John Whiteway Drive frontage and the northern boundary.

The Sanctuary at Rumbalara residential development adjoins the south-east boundary of the site. The development comprises four 10 storey apartments arranged along an access spine over a landscaped two storey carpark podium.

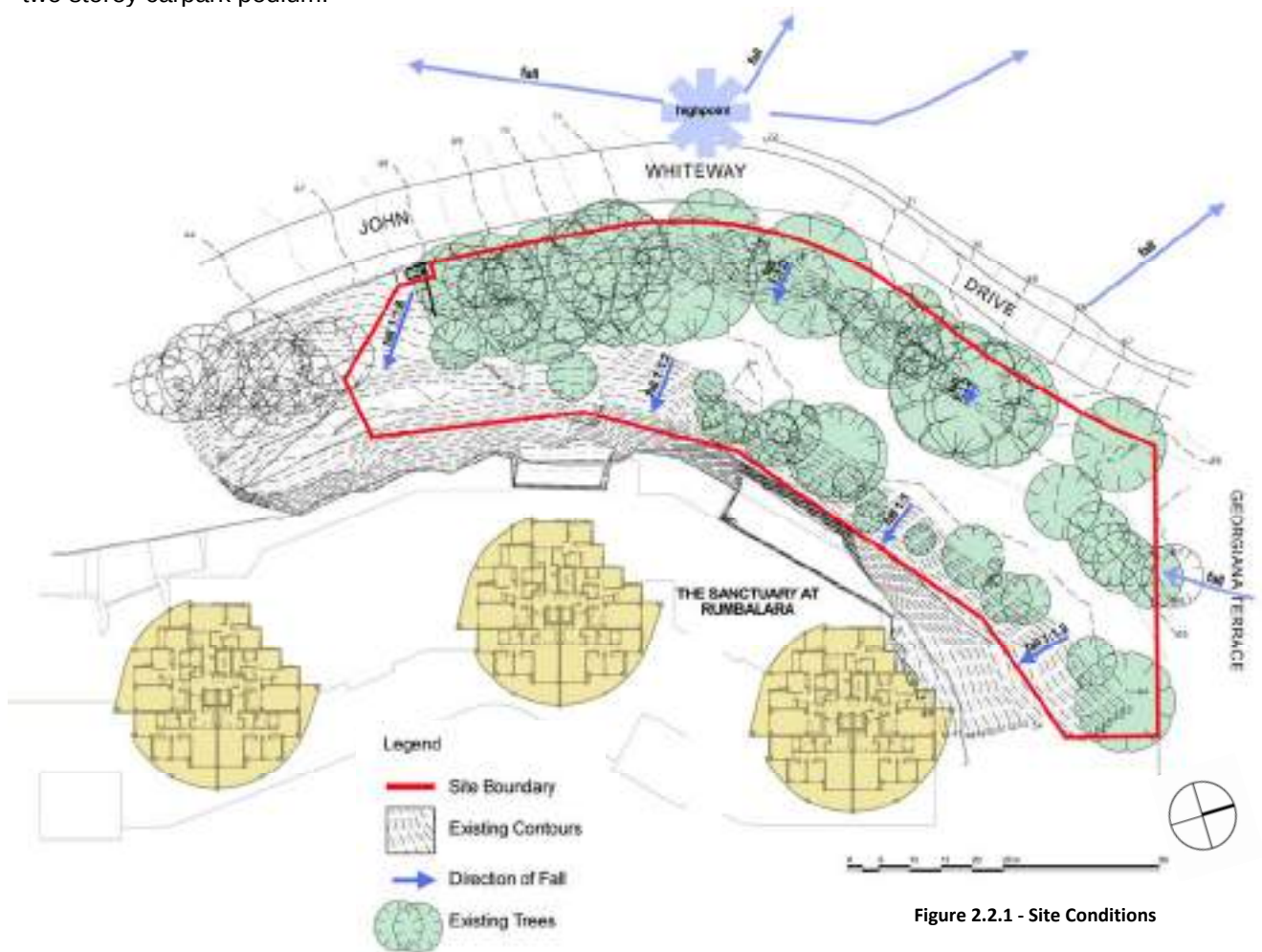


Figure 2.2.1 - Site Conditions



Figure 2.2.2
John Whiteway Drive frontage



Figure 2.2.3
Site vegetation and Sanctuary at Rumbalara tower

3 The Proposal

3.1 Proposed Building

The proposed development is a reconfiguration of approved DA (No. 19775/2003) which encompasses a four storey 48 unit apartment building with one basement level of parking. The proposed development now seeks to increase the total number of residential units from 48 to approximately 75 by changing the unit mix and by providing one additional residential floor and one additional level of basement car park within the current approved building footprint. The new resultant building envelop will consist of 5 residential apartment storeys above ground and two basement storeys below ground containing carparking, storage and services.

The proposed development will have similar building massing, setbacks and landscape treatments to that of the currently approved DA design for the site with the exception that the new design contains one additional above ground storey. Due to the site's topography the proposed new development is able to be tucked into the hillside and will present a 3-4 storey building to the western John Whiteway Drive frontage of the site and a 4-5 storey building presentation to the eastern and northern bushland frontages of the site.

The design of the proposed development seeks to blend the building into the surrounding bushland setting via the use of a muted warm grey and neutral colour palette reflective of the surrounding eucalypt bushland setting and similar to the external colour and materials palette treatment successfully employed in the nearby Sanctuary at Rumbalara residential towers high rise apartment development. Subtle wall banding has been employed to give the building a horizontal rather than vertical feel. The building mass has been highly modulated and broken down via a series of stepped building facades and an undulating, shallow curved roofline. The apparent scale of the building has been further reduced via the introduction of recessed glazed building entries which are differentiated by the use contrasting darker grey masonry and more expansive areas of glazing. This also provides the building with a superior level of legibility and greatly enhances passive surveillance and security of the surrounding streetscape and neighbourhood.

3.2 Proposed Landscaping

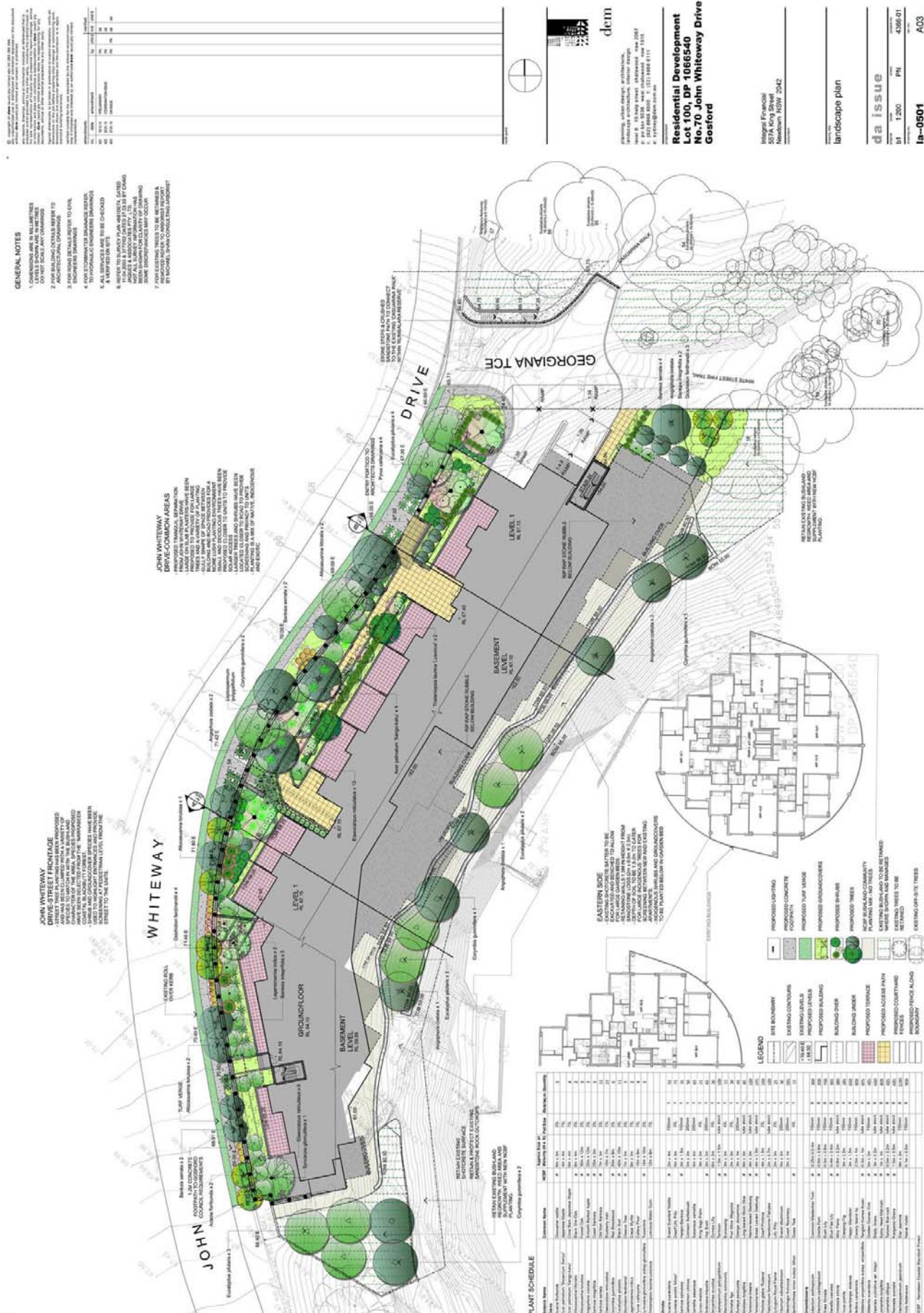
The proposed landscape design provides a tranquil, soft and green entry off John Whiteway Drive to the proposed units. It is a sunken landscape situated up to 6m below the road level between the building and piling wall. The landscape design will be planted in raised planters up to 1.2 metres deep to allow for a few large indigenous trees, a variety of small native evergreen and deciduous trees, shrubs and groundcovers. The design aims to screen the street from the lower courtyard and middle level apartments with large and medium sized trees close to the street. Small deciduous trees are proposed close to the units to provide shade in summer and light during the winter months. The design and shape of the area is characteristic of a gorge / gully, therefore plants have been selected to be tolerant of the shady areas at the base of the wall along John Whiteway Drive. Climbers and trellis structures have been proposed to cover the wall along John Whiteway Drive.

Street tree planting within the road verge on John Whiteway Drive has been designed to imitate the bushland surrounding the site and existing character. A mix of small to large indigenous trees has been selected and grouped in clumps as opposed to a singular avenue of one species. The planting has been positioned to the site side of the path due to the current parking arrangements and roll over style kerb. Mixes of indigenous shrubs and groundcovers have been used below to add to this bushland character.

Few existing trees will be retained on site as they fall within the footprint of the building. Small areas of regrowth bushland to the south and north-east will be protected during construction, weeded, supplemented and maintained. Indigenous planting species to be used on site have been selected from

the Narrabeen Coastal Blackbutt Forest which was sourced the Gosford City Council's website vegetation mapping page. Pocket garden beds have been proposed along the top of the steep batters below the eastern side of the building. Plants will be indigenous low and trailing species. The shotcreted batters are proposed to be retained with existing native planting to be retained where not impacted by the building.





3D Images



Figure 3.3 - Aerial view of proposed building from the south-west



Figure 3.4 - Aerial view of proposed building from the north-east



Figure 3.5 - View of proposed building from John Whiteway Drive looking north-east



Figure 3.6 - View of proposed building from John Whiteway Drive looking south-east

Elevations



Figure 3.7 - Northern Elevation



Figure 3.8 - Eastern Elevation



Figure 3.9 - Western Elevation

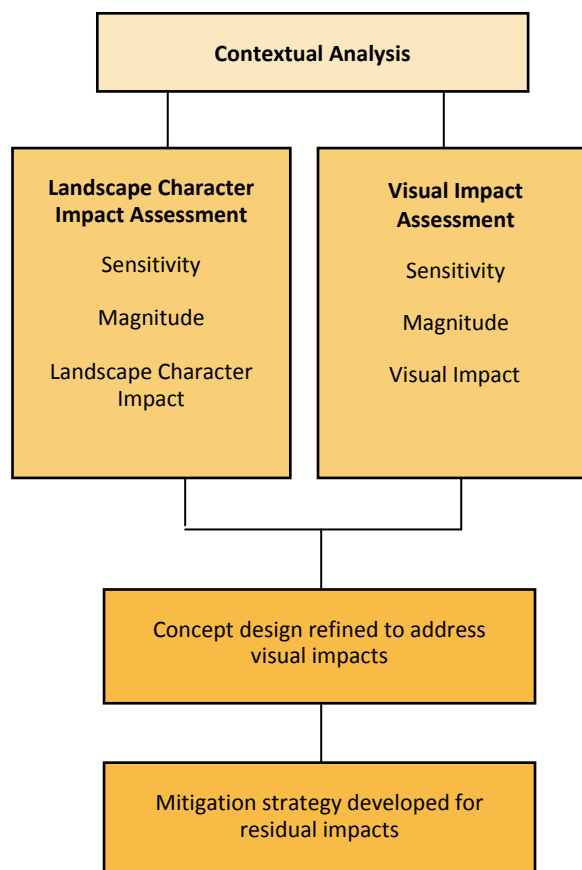
4 Landscape and Visual Amenity Analysis

A landscape and visual amenity assessment has been undertaken to determine the visibility of the proposal from surrounding areas and the potential visual impact. The analysis also identifies building design and landscape mitigation measures to reduce any adverse visual impacts and ensure the proposal complements the visual character of its setting.

4.1 Assessment Methodology

This visual amenity assessment is based on the methodology outlined in **Guidelines for Landscape and Visual Impact Assessment** second edition prepared by the Landscape Institute (UK) and the Institute of Environmental Management and Assessment, published by Spon Press and the **Environmental Impact Assessment Practice Note - Guideline for Landscape Character and Visual Impact Assessment** prepared by the RMS, 2013.

The assessment evaluates the landscape character of the site, the current visual amenity from selected viewpoints and the significance of change to the views based on the degree to which the view is changing and its visual sensitivity.



4.2 Landscape Character Impact Assessment

Landscape character refers to the built, natural and cultural aspects of an area. Impact assessment is made by addressing the **sensitivity of character zones** within the study area and the **magnitude of landscape effects**.

Sensitivity of the Character Zone

The degree to which a particular landscape type or area can accommodate change without detrimental effect on its character. Sensitivity varies with landuse, topography, vegetation, spatial qualities and scope for mitigation.

Magnitude of Landscape Effects

Nature and scale of changes to elements within the landscape and the consequential effect on landscape character.

The landscape character assessment below is based on the site analysis – refer to section 2.

Landuse	Open space zoned R1 – General Residential.
Topography	Steeply sloping, partly terraced and with rock outcrops. Embankment along the eastern boundary part stabilised with shotcrete.
Drainage	Follows general fall from north-west to south-east across the site.
Vegetation	Native tree, shrub and groundcover planting. Regrowth vegetation in the central flat section of the site.
Spatial Qualities	Enclosed by a ridgeline to the west and north-west; open to the east and south-east with The Sanctuary at Rumbalara towers providing an intermittent built form edge.
Built Form Environment	Four 10 storey apartment buildings, over a two storey carpark podium, are located adjacent to the site. John Whiteway Drive runs along the western boundary.

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High Impact	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
	Low	Moderate	Moderate-Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Figure 4.2.1 Landscape Character Impact Grading Matrix

The character of the existing site would be impacted by:

- removal of existing vegetation;
- excavation and terracing of the site; and
- change of landscape character from open space to medium density residential.

LANDSCAPE CHARACTER IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	The additional building floor will not change the sensitivity or magnitude rating in relation to the landscape character impact of the site.
--	--

4.3 Visual Impact Assessment

Assessment of visual impact upon views is based on visual sensitivity and the magnitude of visual effects and follows the following process.

1 Identify areas from which the proposal is visible	
Zone of Visual Influence	The area within which the proposed development may have an effect on visual amenity. Areas from which the site is clearly visible.
Key Viewpoints	Nominated viewpoints from within the zone of visual influence representing a typical view experienced by the visual receptors.
2 Describe the existing view from each key viewpoint	
Visual Amenity	The value of a particular area or view in terms of what is currently seen. The existing nature of the site and its context.
3 Determine the sensitivity of the view	
Visual Sensitivity	The degree to which a landscape can absorb change of a particular type and scale without significant adverse effects in relation to its location or visual receptors. The sensitivity of visual receptors and views is dependent on: - the location and context of the viewpoint; - the expectation or activity of the receptor; and - the duration of the view. Receptor sensitivity may be categorised as: - High - likely from residential properties affected by a development where duration of the view is long and is experienced frequently. - Moderate - experienced in the public realm where duration of the view is temporary e.g. pedestrians and from vehicles. - Low sensitivity - from places of work, or similar, where attention is expected to be focussed on an activity rather than a view.
4 Determine how much the view is changing	
Magnitude of Visual Effects	The degree of change in the composition of the view established by assessing: - loss or addition of features in the view; - the degree of contrast or integration of changes in relation to such factors as form, scale and colour; - extent the view would be occupied by the development; and - distance of the viewpoint from the proposed development which determines whether the development would be a focus or form one element in a panoramic view.
5 Evaluate the significance of the change	
Visual Impact	The significance of change based on the sensitivity of the location or receptor and the scale or magnitude of the effect. Greater impact is generally associated with large-scale effects and effects on sensitive or high value receptors. The visual impact may be positive (beneficial) or negative (adverse).
6 Identify measures to reduce visual impacts or enhance visual quality	
Mitigation Strategy	Recommended built form design or landscape design measures to enhance visual quality or reduce, remedy or compensate for adverse visual impacts.

4.3.1 Zone of Visual Influence and Key Viewpoints

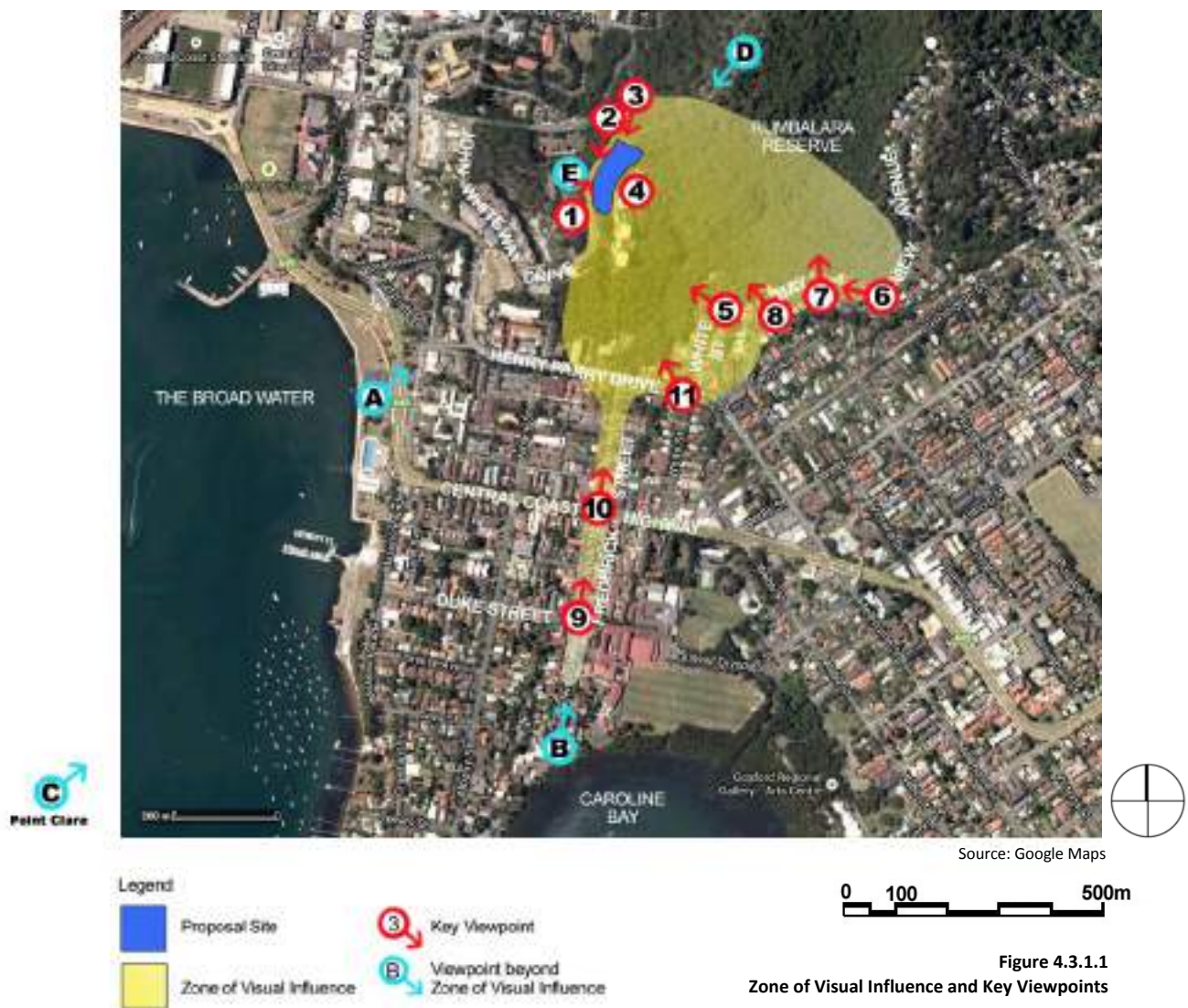
The Zone of Visual Influence encompasses the areas from which the site is clearly visible and from where the proposal may have an effect on visual amenity. The proposed apartment building will be visible from:

- John Whiteway Drive – which adjoins the western boundary of the site.
- The Sanctuary at Rumbalara residential development to the east of the site.
- Residential areas and the public realm along White Street and Bay View Avenue to the south-east of the site.
- Frederick Street – along which there is a view corridor which terminates on the site and adjoining Sanctuary at Rumbalara apartment buildings.

The proposal may be visible from additional areas however the effect on visual amenity would be low due to the distance from the site, reduced visibility due to the location of existing buildings and / or vegetation screening, and the small number of visual receptors.

The Zone of Visual Influence is constrained by landform, vegetation and distance from the site as seen from viewpoints A to E shown below in Figure 4.3.1.1 and illustrated overleaf.

The impact of the proposal on views from key viewpoints 1 to 11 within the Zone of Visual Influence is described on the following pages.



Viewpoints from key locations within Gosford where visibility of the site is constrained by landform, vegetation and distance from the site.



VIEWPOINT A

from The Broad Water foreshore, near the Gosford Olympic Swimming Pool

There are no direct views of the site from The Broad Water foreshore due to topography and vegetation. Medium density housing is visible in the middle distance on elevated land.



VIEWPOINT B

from the southern end of Frederick Street adjacent to Caroline Bay

The site is not visible from Caroline Bay foreshore.



VIEWPOINT C

view across The Broad Water toward Gosford from Point Clare foreshore

Views of The Sanctuary at Rumbalara residential towers and the site are substantially limited by vegetation and topography.



VIEWPOINT D

view towards the site from Ouraka Lookout in the Rumbalara Reserve

Dense bushland in Rumbalara Reserve blocks views to the site from Ouraka Lookout.



VIEWPOINT E

western side of John Whiteway Drive

The site is separated by a ridgeline from residential areas to the west of the site and is not visible due to topography and vegetation.

4.3.2 Visual Impact Assessment from Key Viewpoints

VIEWPOINT 1

View north-east
along John
Whiteway Drive



VISUAL AMENITY	Native vegetation screens views to both sides of John Whiteway Drive. Existing Sanctuary at Rumbalara apartment buildings are partially visible in the middle distance. Land falls abruptly from road level toward the existing apartments. Rumbalara Reserve is visible in the distance.		
VISUAL SENSITIVITY	RECEPTOR TYPE	Public realm	RECEPTOR SENSITIVITY moderate
	DURATION	Short / temporary	
	The duration of the view would be brief as it would be experienced from vehicles and by pedestrians, however the proposed building will be in close proximity to the road and approximately 3 – 4 storeys will be above road level. Apartment buildings are currently visible from John Whiteway Drive.		
MAGNITUDE OF VISUAL EFFECTS	DEGREE OF CHANGE	High	MAGNITUDE OF CHANGE high
	DISTANCE OF VIEWPOINT	Short	
	There would be significant change to the composition of the view with the removal of existing vegetation adjacent to the road and with the addition of the apartment building a short distance from the viewing point. The apartment building will be the focus of the view from John Whiteway Drive.		
VISUAL IMPACT	The change to the view would have moderate significance given the proximity of the proposed building to the road and removal of existing vegetation. The view, however, is from the public realm and temporary, and an apartment building is currently visible from this viewpoint.		negative
MITIGATION STRATEGY	To mitigate negative impacts the building would be designed to include the following: Built form – selection of finishes and a colour palette to complement the existing apartment buildings and bushland; articulation of the the new building to reduce its overall scale; and provision of an undulating, shallow curved roofline and a roof material with low reflectivity. Landscape design – provision of indigenous tree, shrub and groundcover planting along the street frontage.		
VISUAL IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	The additional building floor would not effect the visual sensitivity rating or magnitude of visual effects rating and therefore would not significantly change the overall visual impact of the view from this location.		

VIEWPOINT 2

View south-east
along John
Whiteway Drive



VISUAL AMENITY	Native vegetation screens views to both sides of John Whiteway Drive including the existing Sanctuary at Rumbalara apartment buildings. Land falls abruptly from road level.		
VISUAL SENSITIVITY	RECEPTOR TYPE	Public realm	RECEPTOR SENSITIVITY moderate
	DURATION	Short / temporary	
	The duration of the view would be brief as it would be experienced from vehicles and by pedestrians, however the proposed building will be in close proximity to the road and approximately 3 - 4 storeys will be above road level.		
MAGNITUDE OF VISUAL EFFECTS	DEGREE OF CHANGE	High	MAGNITUDE OF CHANGE high
	DISTANCE OF VIEWPOINT	Short	
	There would be significant changes to the composition of the view with the removal of existing vegetation adjacent to the road and the addition of the apartment building a short distance from the viewing point. The apartment building will be the focus of the view from John Whiteway Drive.		
VISUAL IMPACT	The change to the view would have moderate significance given the proximity of the proposed building to the road and removal of existing vegetation. The view, however, is from the public realm and temporary.		negative
MITIGATION STRATEGY	To mitigate negative impacts the building would be designed to include the following: Built form – selection of finishes and a colour palette to complement the existing apartment buildings and bushland; articulation of the the new building to reduce its overall scale; and provision of an undulating, shallow curved roofline and a roof material with low reflectivity. Landscape design – provision of tree, shrub and groundcover planting along the street frontage.		
VISUAL IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	The additional building floor would not effect the visual sensitivity rating or magnitude of visual effects rating and therefore would not significantly change the overall visual impact of the view from this location.		

VIEWPOINT 3

View south-east at intersection of John Whiteway Drive and Georgiana Terrace



VISUAL AMENITY	Native vegetation screens views to the eastern side of John Whiteway Drive. An existing Sanctuary at Rumbalara apartment building is partially visible in the middle distance. Land falls abruptly from road level toward the existing apartments.		
VISUAL SENSITIVITY	RECEPTOR TYPE	Public realm	RECEPTOR SENSITIVITY moderate
	DURATION	Short / temporary	
	The duration of the view would be brief as it would be experienced from vehicles and by pedestrians, however the proposed building will be in close proximity to the road and approximately 3 – 4 storeys will be above road level. Apartment buildings are currently visible from John Whiteway Drive.		
MAGNITUDE OF VISUAL EFFECTS	DEGREE OF CHANGE	High	MAGNITUDE OF CHANGE high
	DISTANCE OF VIEWPOINT	Short	
	There would be significant changes to the composition of the view with the removal of existing vegetation adjacent to the road and the addition of the apartment building a short distance from the viewing point. The apartment building will be the focus of the view from John Whiteway Drive.		
VISUAL IMPACT	The change to the view would have moderate significance given the proximity of the proposed building to the road and removal of existing vegetation. The view, however, is from the public realm and temporary, and an apartment building is currently visible from this viewpoint.		negative
MITIGATION STRATEGY	To mitigate negative impacts the building would be designed to include the following: Built form – selection of finishes and a colour palette to complement the existing apartment buildings and bushland; articulation of the the new building to reduce its overall scale; and provision of an undulating, shallow curved roofline and a roof material with low reflectivity. Landscape design – provision of tree, shrub and groundcover planting along the street frontage.		
VISUAL IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	The additional building floor would not effect the visual sensitivity rating or magnitude of visual effects rating and therefore would not significantly change the overall visual impact of the view from this location.		

VIEWPOINT 4

Views from
Sanctuary at
Rumbalara
apartments



VISUAL AMENITY	Views north-west from the two northernmost Sanctuary at Rumbalara apartment buildings adjoining the site are currently of a shotcrete batter, native vegetation in the short and middle distance, and John Whiteway Drive.		
VISUAL SENSITIVITY	RECEPTOR TYPE	Residential	RECEPTOR SENSITIVITY high
	DURATION	Long	
	The proposal would be highly visible when viewed from within apartments and from western facing balconies. The apartments, however, have generally been oriented to the east to capture valley views as well as distant Brisbane Water views.		
MAGNITUDE OF VISUAL EFFECTS	DEGREE OF CHANGE	High	MAGNITUDE OF CHANGE high
	DISTANCE OF VIEWPOINT	Short	
	The composition of the views to the north-west would significantly change with addition of the proposed building. Due to its scale and proximity, the new building would dominate views to the north-west and existing vegetation would be removed.		
VISUAL IMPACT	From the apartment buildings the significance of change to views would be high and the sense of openness reduced.		negative
MITIGATION STRATEGY	To mitigate negative impacts the building would be designed to include the following: Built form – selection of finishes and a colour palette to complement the existing apartment buildings and bushland; articulation of the the new building to reduce its overall scale; and provision of an undulating, shallow curved roofline and a roof material with low reflectivity. Landscape design – Retention of existing indigenous planting to the north-east and south. Trailing plants to soften existing shotcrete.		
VISUAL IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	The visual sensitivity rating, magnitude of visual effects rating and significance of change to the view would remain high with the addition of the building floor.		

VIEWPOINT 5

Views from residences at the northern end of White Street



VISUAL AMENITY	Views from residences are predominantly of dense bushland extending from the foreground to the middle distance. The towers of The Sanctuary at Rumbalara are partially visible on the ridgeline to the north- west of the lots, through the vegetation.		
VISUAL SENSITIVITY	RECEPTOR TYPE	Residential	RECEPTOR SENSITIVITY moderate
	DURATION	Long	
	Views of the proposed building would be limited by landform and vegetation cover. In addition, as lots are oriented east to west, views from the rear of the dwellings would be predominantly to the west rather than north-west toward the site. The new building would also be incorporated behind existing medium density residential buildings.		
MAGNITUDE OF VISUAL EFFECTS	DEGREE OF CHANGE	Low	MAGNITUDE OF CHANGE low
	DISTANCE OF VIEWPOINT	Medium	
	Changes to the composition of the views would be low with the addition of the proposed building, given the topography, screening afforded by vegetation and the location of the existing apartment buildings which would block views of the new building.		
VISUAL IMPACT	The significance of change to the views would be low. To ensure the new building would not be visually prominent, proposed colours and finishes would need to complement the existing residential towers and surrounding bushland.		negative
MITIGATION STRATEGY	To mitigate negative impacts the building would be designed to include the following: Built form – selection of finishes and a colour palette to complement the existing apartment buildings and bushland; articulation of the the new building to reduce its overall scale; and provision of an undulating, shallow curved roofline and a roof material with low reflectivity.		
VISUAL IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	The additional building floor would not effect the visual sensitivity rating or magnitude of visual effects rating and therefore would not significantly change the overall visual impact of the view from this location.		

VIEWPOINT 6

View from
Bay View Avenue
public realm



VISUAL AMENITY	The site is visible from Bay View Avenue approximately 0.5km south-east of the site. The panoramic view from this location incorporates residences in the foreground, The Broad Water in the middle distance and a backdrop of forested hills against which The Sanctuary at Rumbalara towers are visible.		
VISUAL SENSITIVITY	RECEPTOR TYPE	Public realm	RECEPTOR SENSITIVITY moderate
	DURATION	Short / temporary	
	The duration of the view would be brief as it would be experienced from vehicles travelling along the road. The distance of the observer from the site and the visibility of the existing apartment buildings would reduce the visual prominence of the new building.		
MAGNITUDE OF VISUAL EFFECTS	DEGREE OF CHANGE	Low	MAGNITUDE OF CHANGE low
	DISTANCE OF VIEWPOINT	Medium	
	Given the distance of the viewpoint from the site, the proposed building would form only part of the overall view and changes to the composition of the view would be small. However, the addition of the apartment building would increase the extent of large-scale built form visible in the middle distance and there would be removal of vegetation behind the existing apartment buildings.		
VISUAL IMPACT	The significance of change would be low. To ensure the new building would not be visually prominent, proposed colours and finishes would need to complement the existing residential towers and surrounding bushland.		negative
MITIGATION STRATEGY	To mitigate negative impacts the building would be designed to include the following: Built form – selection of finishes and a colour palette to complement the existing apartment buildings and bushland; articulation of the the new building to reduce its overall scale; and provision of an undulating, shallow curved roofline and a roof material with low reflectivity.		
VISUAL IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	The additional building floor would not effect the visual sensitivity rating or magnitude of visual effects rating and therefore would not significantly change the overall visual impact of the view from this location.		

VIEWPOINT 7

Views from
Bay View Avenue
residences –
north to south lot
orientation



VISUAL AMENITY	Properties are oriented north to south and from the rear of properties on the western side of Bay View Avenue, views are primarily to dense bushland in the Rumbalara Reserve. To the north-west, the elevated towers of The Sanctuary at Rumbalara are partially visible in the middle distance against a backdrop of native vegetation. Views of the towers are screened by vegetation within lots and the Reserve.		
VISUAL SENSITIVITY	RECEPTOR TYPE	Residential	RECEPTOR SENSITIVITY high
	DURATION	Long	
	The proposal would be visible in the middle distance behind the existing residential towers. The prominent direction of views from the dwellings however, is not towards the proposal site.		
MAGNITUDE OF VISUAL EFFECTS	DEGREE OF CHANGE	Moderate	MAGNITUDE OF CHANGE moderate
	DISTANCE OF VIEWPOINT	Medium	
	The proposed building would form only one of a number of elements in the overall view however there would be moderate change to the composition of the views with the addition of the new building which would result in removal of existing vegetation and an increase the extent of large-scale built form visible in the middle distance. Existing vegetation in front of the buildings would partially screen the proposed building.		
VISUAL IMPACT	The significance of change would be moderate. To ensure the new building would not be visually prominent, proposed colours and finishes would need to complement the existing residential towers and surrounding bushland.		negative
MITIGATION STRATEGY	To mitigate negative impacts the building would be designed to include the following: Built form – selection of finishes and a colour palette to complement the existing apartment buildings and bushland; articulation of the the new building to reduce its overall scale; and provision of an undulating, shallow curved roofline and a roof material with low reflectivity.		
VISUAL IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	While the extent of large-scale built form would increase in the middle distance, the roofline of the proposal would not project above the ridgeline. The additional building floor would not effect the visual sensitivity rating or magnitude of visual effects rating and therefore would not significantly change the overall visual impact of the view from this location.		

VIEWPOINT 8

Views from
Bay View Avenue
residences –
north-west to south-
east lot orientation



VISUAL AMENITY	Views from residences are predominantly of dense bushland in the foreground with the towers of The Sanctuary at Rumbalara partially visible on the ridgeline in the middle distance through the vegetation.		
VISUAL SENSITIVITY	RECEPTOR TYPE	Residential	RECEPTOR SENSITIVITY high
	DURATION	Long	
	The proposal would be visible in the middle distance behind the existing residential towers. Vegetation would partially screen the new residential building.		
MAGNITUDE OF VISUAL EFFECTS	DEGREE OF CHANGE	Moderate	MAGNITUDE OF CHANGE moderate
	DISTANCE OF VIEWPOINT	Medium	
	There would be low - moderate changes to the composition of the views with the addition of the new building. The extent of large-scale built form visible in the middle distance would increase. Existing vegetation would screen the proposed building.		
VISUAL IMPACT	The significance of change would be moderate. To ensure the new building would not be visually prominent, proposed colours and finishes would need to complement the existing residential towers and surrounding bushland.		negative
MITIGATION STRATEGY	To mitigate negative impacts the building would be designed to include the following: Built form – selection of finishes and a colour palette to complement the existing apartment buildings and bushland; articulation of the the new building to reduce its overall scale; and provision of an undulating, shallow curved roofline and a roof material with low reflectivity.		
VISUAL IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	The additional building floor would not effect the visual sensitivity rating or magnitude of visual effects rating and therefore would not significantly change the overall visual impact of the view from this location.		

VIEWPOINT 9

View from the intersection of Frederick Street and Duke Street



VISUAL AMENITY	The view along Frederick Street is dominated by street trees in the foreground and a forested hillside in the distance. The upper floors of the southernmost tower of The Sanctuary at Rumbalara are visible from this viewpoint, against a backdrop of native vegetation.		
VISUAL SENSITIVITY	RECEPTOR TYPE	Public realm	RECEPTOR SENSITIVITY low - moderate
	DURATION	Short / temporary	
	The duration of the view would be brief as it would be experienced from vehicles travelling along the road. The distance of the observer from the site, vegetation cover and the existing apartment building would limit visibility of the proposal.		
MAGNITUDE OF VISUAL EFFECTS	DEGREE OF CHANGE	Low	MAGNITUDE OF CHANGE low
	DISTANCE OF VIEWPOINT	Medium	
	Given the distance of this viewpoint from the site, vegetation cover and the position of the new building behind the existing residential tower, changes to composition of the view would be minimal.		
VISUAL IMPACT	The significance of change would be low. To ensure the new building would not be visually prominent, proposed colours and finishes would need to complement the existing residential towers and surrounding bushland.		negative
MITIGATION STRATEGY	To mitigate negative impacts the building would be designed to include the following: Built form – selection of finishes and a colour palette to complement the existing apartment buildings and bushland; articulation of the the new building to reduce its overall scale; and provision of an undulating, shallow curved roofline and a roof material with low reflectivity.		
VISUAL IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	The additional building floor would not effect the visual sensitivity rating or magnitude of visual effects rating and therefore would not significantly change the overall visual impact of the view from this location.		

VIEWPOINT 10

View from the intersection of Frederick Street and the Central Coast Highway



VISUAL AMENITY	The view along the Frederick Street visual corridor terminates on the southernmost apartment building of The Sanctuary at Rumbalara. The apartment building projects above the canopy line of native vegetation.		
VISUAL SENSITIVITY	RECEPTOR TYPE	Public realm	RECEPTOR SENSITIVITY moderate
	DURATION	Short / temporary	
	The duration of the view would be brief as it would be experienced from vehicles travelling along the road. The public are accustomed to the presence of the existing residential tower which projects above the ridgeline.		
MAGNITUDE OF VISUAL EFFECTS	DEGREE OF CHANGE	Low	MAGNITUDE OF CHANGE low
	DISTANCE OF VIEWPOINT	Medium	
	There would be minimal changes to the composition of the view. Existing vegetation would significantly screen the proposed building.		
VISUAL IMPACT	The visual impact would be negative however the change to the view would be low as the existing apartment building would partially block the view of the proposed building and it would also be screened by vegetation. To ensure the new building would not be visually prominent, proposed colours and finishes would need to complement the existing residential towers and surrounding bushland.		negative
MITIGATION STRATEGY	To mitigate negative impacts the building would be designed to include the following: Built form – selection of finishes and a colour palette to complement the existing apartment buildings and bushland; articulation of the the new building to reduce its overall scale; and provision of an undulating, shallow curved roofline and a roof material with low reflectivity.		
VISUAL IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	The additional building floor would not effect the visual sensitivity rating or magnitude of visual effects rating and therefore would not significantly change the overall visual impact of the view from this location.		

VIEWPOINT 11

View from the intersection of White Street and Henry Parry Drive



VISUAL AMENITY	Native vegetation within the Rumbalara Reserve dominates views from the intersection of White Street and Henry Parry Drive. The Sanctuary at Rumbalara apartment buildings are visible in the distance above the vegetation canopy line.		
VISUAL SENSITIVITY	RECEPTOR TYPE	Public realm	RECEPTOR SENSITIVITY moderate
	DURATION	Short / temporary	
	The duration of the view would be brief as it would be experienced from vehicles travelling along the road. The public are accustomed to the presence of the existing residential towers which project above the ridgeline.		
MAGNITUDE OF VISUAL EFFECTS	DEGREE OF CHANGE	Low	MAGNITUDE OF CHANGE low
	DISTANCE OF VIEWPOINT	Medium	
	Changes to the composition of the view would be low with the addition of the proposed building. The new building would be substantially screened by vegetation and the existing apartment buildings.		
VISUAL IMPACT	The visual impact would be negative however the change to the view would have low significance as views of the proposed building would be substantially blocked by the existing buildings and screened by vegetation. To ensure the new building would not be visually prominent, proposed colours and finishes would need to complement the existing residential towers and surrounding bushland.		negligible
MITIGATION STRATEGY	To mitigate negative impacts the building would be designed to include the following: Built form – selection of finishes and a colour palette to complement the existing apartment buildings and bushland; articulation of the the new building to reduce its overall scale; and provision of an undulating, shallow curved roofline and a roof material with low reflectivity.		
VISUAL IMPACT OF THE ADDITIONAL FLOOR TO THE APPROVED DA	The additional building floor would not effect the visual sensitivity rating or magnitude of visual effects rating and therefore would not significantly change the overall visual impact of the view from this location.		

5 Proposals for Mitigation of Visual Impacts

5.1 Building Design

In order to ensure the proposal is visually integrated with the existing locality and to reduce any adverse visual impacts, design of the new residential development is to incorporate the following measures:

- Use of a muted warm grey and neutral colour palette reflective of the surrounding eucalypt bushland setting and similar to the external colour and materials palette treatment successfully employed in the nearby Sanctuary at Rumbalara residential towers high-rise apartment development.
- Walls are to be a combination of banded split face blockwork and clear glazing with metallic framing to reflect the surrounding vegetation colours.
- Subtle wall banding is to be employed to give the building a horizontal rather than vertical feel.
- The roof is to be a low pitched curved undulating form with low reflectivity and a warm mid grey colour which blends in with the surrounding tree canopy.
- The building mass has been highly modulated and broken down via a series of stepped building facades and an undulating shallow curved roofline.
- The apparent scale of the building has been further reduced via the introduction of recessed glazed building entries which are differentiated by the use of contrasting darker grey masonry and more expansive areas of glazing. This also provides the building with a superior level of legibility and greatly enhances passive surveillance and security of the surrounding streetscape and neighbourhood.
- Benching the site for the proposed development at a level which will result in the new building being below existing ground level along its western frontage, thereby reducing its scale and visibility.

These measures are illustrated in the photomontages in Section 5.3.

5.2 Landscape Design

In order to ensure the proposal is integrated into the surrounding landscape, a planted buffer is proposed along John Whiteway Drive. The proposed boundary planting will soften the building over time and enhance the streetscape.

Planting is to include native trees, shrubs and groundcovers with low maintenance and low water requirements and species appropriate for the sites soil and climatic conditions.

5.2.1 Landscape Management and Maintenance

Planting Establishment Maintenance is to be undertaken for 12 months after Practical Completion. These works will be the responsibility of the construction contractor who installs the works. The minimum standards for maintenance during this time will be:

- Watering carried out to maintain the best possible condition and growth rate of plants particularly in the first month of planting. The frequency and volume of water to reflect conditions at the time of planting. All watering is to comply with any applicable water restrictions.
- Removal of weed growth preferably by hand to minimise the use of herbicides.
- Replacement of plants that have died or show significant loss of vigour (a loss of 50% of normal foliage cover). 85% of initially installed plants are to be in place and healthy at all times. No area greater than 1 metre x 1 metre is to be left unplanted at any time.

- Regular fertilisation with proprietary balanced fertilisers selected according to chemical composition of the soil, physical soil structure and plant type.
- Control of pests and diseases that may affect the plants.
- Rectification of any impacts from external influences.
- Maintenance of mulch levels and replacement of mulch in bare areas.
- Removal of rubbish from planted areas.

5.3 Photomontages



Figure 5.3.1 View from John Whiteway Drive

The proposed building incorporates colours and finishes that complement the existing residential towers and it is articulated to reduce its overall scale. Planting provides a visual buffer and enhances the streetscape.



Figure 5.3.2 View from Bay View Avenue

Colours and finishes of the proposed building assist in integration of the building and its setting.

Photomontages



Figure 5.3.3 View from the intersection of Frederick Street and the Central Coast Highway

The proposed building is largely screened by existing vegetation and incorporates colours and finishes that complement the existing residential towers and surrounding bushland.

6 Conclusion

The proposal is to be located south-east of Gosford's CBD and in close proximity to Rumbalara Reserve. While the hillside on which the site is located is predominantly bushland, the high-rise towers of The Sanctuary at Rumbalara, that adjoin the site, exist as visually prominent elements that contrast with the surrounding landscape.

The proposed building would be highly visible from John Whiteway Drive and from the adjoining apartment buildings. From the road, views would be temporary and from the public realm and the additional floor would not significantly alter the overall visual impact of the currently approved building. The proposed building would also complement the visual character of its setting through built form and landscape design mitigation measures.

Views from The Sanctuary at Rumbalara development will be negatively impacted by the proposed building due to its location and scale and as a result of the removal of existing vegetation. The proposed residential floor will have marginal additional impact on the overall view. While the distance between the existing and proposed buildings exceeds building separation requirements, the proposal would incorporate building design measures to mitigate the negative visual impact. These measures would include use of colours and finishes that complement the existing towers and reflect the surrounding bushland; modulation and articulation of the new building to reduce its overall scale; and provision of an undulating, shallow curved roof with low reflectivity.

The proposal would also be visible from residential areas to the south and east of the site. Key viewpoints would be from Frederick Street, for a distance of up to approximately 850m, and from White Street and Bay View Street, for a distance of up to approximately 600m from the site. Visual impacts from both the public and private realms in these locations would be limited by the distance of the site from the viewing points and from screening provided by vegetation and The Sanctuary at Rumbalara towers. Integration of the proposed building with its surrounds would also limit negative visual impacts.

This Study concludes that the additional residential floor will not significantly increase the overall visual impacts of the building beyond those of the 4 storey apartment building currently approved for the site.



STORMWATER MANAGEMENT PLAN

FOR

**70 JOHN WHITEWAY DRIVE,
GOSFORD**

PROPOSED RESIDENTIAL APARTMENTS

**REPORT NO. R01328-WQ
REVISION B**

JANUARY 2015

PROJECT DETAILS

Property Address: 70 John Whiteway Drive, Gosford

Development Proposal: Proposed Residential Apartments

REPORT CERTIFICATION

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DOCUMENT CONTROL

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APPENDIX B DRAINS MODEL LAYOUT AND SUMMARY

APPENDIX C MUSIC MODEL LAYOUT

APPENDIX D VORTECHS OPERATIONS & MAINTENANCE

APPENDIX E STORMFILTER OPERATIONS & MAINTENANCE

1. INTRODUCTION

This report has been prepared to support the Development Application for the proposed residential development at 70 John Whiteway Drive, Gosford.

The scope of this report includes a comprehensive assessment of the requirements for stormwater management for the development of the site. Accordingly, this report includes findings of the assessment and proposes a strategy for the best practice of stormwater management for the proposed subdivision of the site.

The report describes the principles and operation of the proposed stormwater systems as well as the primary components of the drainage system. As the assessment is required under the conditions of consent, the final form of layout may need to be revised during its assessment for the future Construction Certificate Application for the subdivision.

The following information and documents were used for this investigation:

- Concept Civil Engineering Drawings for the Development Application submission prepared by C&M Consulting Engineers;
- Gosford Development Control Plan (DCP) 2013
- “Australian Runoff Quality – A Guide to Water Sensitive Urban Design”, Engineers Australia (2006)
- “Australian Rainfall and Runoff – A Guide to Flood Estimation”, Institute of Engineers, Australia (1987)

2. STORMWATER MANAGEMENT

2.1 Background

The objective is to provide stormwater controls, which ensure that the proposed development does not adversely impact on the stormwater flows and water quality of flow paths within, adjacent and downstream of the site.

Increased impervious surfaces and alteration of the natural topography due to land development has the potential to increase peak storm flows and tend to concentrate these flows. This has the potential to impact on flood regimes and erosion of the downstream drainage system.

To avoid any adverse impact on the downstream drainage systems, the site stormwater system is required to be planned correctly to ensure safe conveyance of flows through the site and within the capacity of the downstream trunk drainage systems.

2.2 Key Issues

The key issues and the mitigating measures to be employed within the proposed development site are:

- **Water Quantity** – Increased impervious surfaces (such as roofs, driveways, etc) have the potential to increase the stormwater flows from the site during storm events. To avoid impacting on the downstream drainage system, the site stormwater system has been planned to safely convey the flows through the site and within the capacity of the downstream system.
- **Water Quality** – Urban developments have the potential to increase gross pollutants, sediments and nutrient concentrations in storm water runoff. To limit impact on the downstream water quality, pollution control measures will be provided at each storm water outlet prior to discharging to the downstream drainage system.

2.1 The Site

The site is located at 70 John Whiteway Drive, Gosford. It is bounded by John Whiteway Drive to the west, and residential complexes to the east. The site is currently undeveloped with a majority of the site being pervious. (Refer to **Figure 1**).



Figure 1 - Aerial Photo of Existing Site
(Source: <https://maps.six.nsw.gov.au/>)

The land generally falls to the east of the site away from John Whiteway Drive.

The proposed development includes residential apartment blocks, over basement carparking.

2.2 Design Guidelines

The site based stormwater management and planning elements are to be designed and constructed in accordance with the following:

Water Quantity

Guidelines: Gosford City Council DCP – Section 6.7.7.2, 6.7.7.4

The proposed development increases the total impervious area of the existing area and therefore may increase the flow and discharge rate of flow to the downstream waterway. Therefore, on-site detention (OSD) is required to maintain the existing discharge flows.

Water Quality

Guidelines: Gosford City Council DCP – Section 6.7.7.3

The main objective for stormwater quality is to minimise the impacts on downstream water bodies.

Gosford City Council has adopted a stormwater management policy that incorporates “best practice” principles of Water Sensitive Urban. The site specific council water quality targets are outlined in Table 1 below:

Table 1 - Water Quality Reduction Targets

PARAMETERS	CRITERIA
Gross Pollutants	80% reduction of the average annual load
Suspended Solids	80% reduction of the average annual load
Total Phosphorus	45% reduction of the average annual load
Total Nitrogen	45% reduction of the average annual load

2.3 Objectives and Targets

Compatible with the legislation, policy and requirements, the objectives and targets for stormwater management are as provided in Table 2.

Table 2 - Stormwater Management Objectives

STORMWATER MANAGEMENT	OBJECTIVES	TARGET
Quantity	▪ The existing runoff flow regimes for the full storm events should be maintained, and provide safe conveyance system for the major storm events.	▪ Limit post development flow from the proposed development site to less than or equal to predevelopment flows for all storm events up to and including the 1% AEP storm event.
Quality	▪ The full range of typical urban stormwater pollutants shall meet Council requirements	▪ Runoff from site to achieve minimum reductions in total pollutant loads by 80% in solids and 45% in nutrients.

2.4 Overall Strategies

The proposed stormwater management strategies to manage runoff to ensure no detriment to the receiving environments have been divided into both short and long term strategies as summarised in Table 3.

Table 3 - Stormwater Management Strategies

STRATEGY	DESCRIPTION
Short Term Strategies	Short term strategies generally refer to control of soil and water erosion control during the construction phase. The primary risk occurs while soils are exposed during construction works when suspended sediment and associated pollutants can be washed into downstream waterways. The strategies to prevent this potential degradation include adequate provision of sediment and erosion control measures that should be documented prior to commencement of the works in a Soil and Water Management Plan (SWMP). The controls will limit movement of sediment in disturbed areas, and will be designed to remove sediment from runoff prior to discharge from site.
Long Term Strategies	Long term strategies to maintain stormwater quality discharged from the site include utilisation of a number of permanent treatment measures to remove litter, suspended solids, and nutrients effectively. The main measures to be implemented include rainwater tanks to collect roof water for water re-use, a gross pollutant traps (such as a Vortechs), and filter cartridges.

This report addresses the long term impacts of the development. For short term effects (i.e. during the construction phase) water quality control is achieved by implementing the measures in the Sedimentation & Erosion Control Plans to be included with the Construction Certificate Application.

3. STORMWATER QUANTITY CONTROL

3.1 Introduction

The main criterion for the stormwater quantity control is to ensure that the post-developed peak flows do not cause detriment to the downstream waterways.

3.2 Proposed Drainage System

The drainage system for the proposed development will be designed to collect the majority of concentrated flows from impermeable surfaces such as access ways, parking areas and buildings. Where possible (and practical), runoff from pervious areas will also be collected.

The drainage system proposed for the development includes:

- A pipe network system to collect minor storm runoff from areas;
- Overland flow paths to carry major storms through the site;
- An on-site detention (OSD) storage tank with orifice control;
- A rainwater tank with overflow into the OSD

3.2.1 Rainwater Retention Requirements

The rainwater retention requirements are outlined in section 6.7.7.2 of the Gosford Development Control Plan. It is proposed that a rainwater tank be provided and connected for landscape irrigation and toilet flushing. Note that whilst cold water laundry was initially considered to be connected to the rainwater tanks, it is a national plumbing requirement that a potable water tap always be provided. Typically householders will prefer to use potable water over rainwater for washing clothes, making the infrastructure required to plumb rainwater to laundry redundant. As such, rainwater reuse is only assumed to be provided in line with BASIX requirements, irrigation and toilet flushing.

The retention target required based on site area and fraction impervious was calculated to be 138m³. Due to the provision of a rainwater connected to landscape irrigation and toilet flushing, the reduction to the retention target based on roof area was calculated to be 35m³, resulting in a total retention volume of 103m³.

This volume was then split down into a rainwater tank of 23m³ and an on-site detention tank of 80m³.

3.2.2 On-Site Stormwater Detention Requirements

On-site stormwater detention (OSD) is required for this development site as per section 6.7.7.4. The OSD was sized using the runoff routing software DRAINS. The predevelopment catchment for the site was assumed to be 100% pervious. Due to the steep nature of the site towards the eastern boundary, capturing 100% of the site runoff is near impossible. As such, a maximum of 30% of the site was modelled as a pervious OSD bypass with the remaining site area being modelled as 90% impervious as a conservative figure. The total site discharge was then limited to the predevelopment flow for all storm events up to and including the 1% AEP storm event. The DRAINS model set up model and inputs (01328_DRAINS_FINAL.drn) can be found in Appendix B.

For the proposed apartment development, it is recommend that OSD shall be provided in the form of a detention tank with orifice and weir control. It is proposed to provide a minimum volume of 80m³ as a detention tank located below the ground floor access ramp of the development.

3.2.3 Overland Flow Paths

Due to the steep topography of the site, overland flows will be directed around and away from the building footprint. Flows will be directed into Georgiana Terrace at the North Western site boundary or be collected by the proposed catch drain.

4. WATER QUALITY CONTROL

4.1 Introduction

The quality of runoff from a catchment depends upon many factors such as land use, degree of urbanisation, population density, sanitation and waste disposal practices, landform, soil types, and climate. Pollutants typically transported by runoff include litter, sediment, nutrients, oil, grease, and heavy metals. Whilst these pollutants have deleterious impact on receiving water quality, the suspended solids and nutrients are the most detrimental impact on the environment. Litter, oils, and other surfactants have an aesthetic impact.

Activity within a catchment during urbanisation includes the disturbance of vegetation, removal of topsoil, land shaping, road construction, installation of services, and building works. It is during this phase that the sediment movement is greatest and is estimated that the sediment production levels may be up to 6 times higher than under the existing conditions. However, once development is completed, the sediment loading may return to the existing level or remain at a higher level depending on land management practices.

As with all development projects, soil erosion during the construction phase presents a potential risk to water quality. The primary risk occurs while soils are exposed during earthworks when suspended sediment and associated pollutants can be washed into downstream watercourses.

This section of the report addresses the long term impacts of the development on water quality. For short term effects (i.e. during the construction phase) water quality control is achieved by implementing the measures in the Sedimentation & Erosion Control Plans to be included with future Construction Certificate submissions.

4.2 Water Quality Control Measures

There are number of measures that can reduce pollutant loadings, however, each different type has its own effectiveness in reducing pollutant loadings that depends on land use type, topography and the target control.

The adopted Treatment Train will provide the most efficient and manageable measures, suited to the subject development setting, surrounded by residential environmentally sensitive areas.

The measures proposed for the redevelopment are summarised in Table 44.

Table 4 - Water Quality Control Measures

MEASURES	DESCRIPTIONS
Hydrodynamic Separator	- The Vortechs system is a hydrodynamic separator designed to enhance the separation of materials in stormwater flows. - The VX1000 device has been chosen for its ability to remove sediments, fines, oils and hydrocarbons.
Rainwater Tank	- Rainwater tanks are effective in removal of pollutant loads at source. The pollutant removal process is by harvesting runoff for reuse, thereby limiting the nutrients discharging to the waterways. - It is proposed to provide one 23,000L rainwater tank for the development.
Filter Cartridges	<i>StormFilter</i> is a proprietary device containing multiple cartridge units in a single system thereby suitable for larger catchments - One of the advantages of using <i>StormFilter</i> is that the cartridges come with various filtration media available to target site-specific pollutants - Each cartridge consists of Perlite/Zeolite media - There will be 10 standard cartridges within the OSD tank respectively as detailed in the engineering drawings.

In addition to the above measures for pollutant control, natural vegetated buffers will be maintained along the edges of roads, accesses, and areas of activity, which will further reduce pollutants to meet reduction targets. This added benefit has not been included in the modelling hence contributing to the conservative nature of the modelling and assessment.

4.3 Strategy Effectiveness

The effectiveness of the proposed water quality measures have been assessed using numerical modelling. The results were assessed against the established WSUD requirements to determine the effectiveness of the proposed strategy.

4.4 Water Quality Modelling

4.4.1 MUSIC Program

The water quality model adopted for this project is the MUSIC (Model for Urban Stormwater Improvement Conceptualisation Version 6) water quality numerical

model developed by the MUSIC Development Team of the Cooperative Research Centre for Catchment Hydrology (CRCCH). MUSIC is an event basis model, and will simulate the performance of a group of stormwater management measures, configured in series or in parallel to form a “treatment train”.

The MUSIC User Manual suggests that the time-step should not be greater than the time of concentration of the smallest sub-catchment, but consideration should also be given to the smallest detention time of treatment nodes in the system. To accurately model the performance of the treatment nodes, a 6-minute time step was chosen.

The MUSIC model was generated using the historical 6-minute rainfall and monthly evapotranspiration data for Peats Ridge, Waratah Road (BOM Station No. 61351) for a period of 10 years from 1996 to 2006.

Catchment characteristics were defined by the roof areas, communal open space and balconies with generally impervious characteristics to replicate the catchment for the development condition.

The MUSIC model layout (01328_MUSIC_FINAL.sqz) is shown in Appendix C of this report. It should be noted that due to the steep fall of the site towards the eastern boundary, providing water quality treatment for this area is difficult. As such the results on the following pages represent the treatment train effectiveness of the developed area up to the “Junction” node.

4.4.2 Event Mean Concentration

MUSIC uses different event mean concentrations (EMC) to determine the pollutant loads generated by different land uses. The standard EMCs adopted within MUSIC were based on research undertaken by Duncan (1999) through the CRCCH and the results are reproduced in Australian Runoff Quality – A Guide to Water Sensitive Urban Design (ARQ).

The EMC values used in the MUSIC models for this project were obtained from ARQ. Table 55 summarises the parameters used for the site.

Table 5 - EMC Parameters

LAND USE	MEAN BASE FLOW CONCENTRATION PARAMETERS Log ₁₀ (mg/l)			MEAN STORM FLOW CONCENTRATION PARAMETERS Log ₁₀ (mg/l)		
	TSS	TP	TN	TSS	TP	TN
Roof Areas	Not Applicable*Note 1			1.300	-0.890	0.300
Paved Area (Loading Dock & Driveway)	1.200	-0.850	0.110	2.150	-0.600	0.300
Landscaping	0.780	-1.520	-0.520	1.600	-1.100	-0.050

*Note 1 – Roof area consists of 100% impervious area so there is no base flow generated from this area

4.4.3 Configuration

Table 66 and 7 provide the treatment configurations used in the MUSIC model.

Table 6 - Catchment Areas

LAND USE	DEVELOPED CONDITIONS	
	AREA (m ²)	IMPERVIOUSNESS (%)
Roof to RWT	963	100
Roof to OSD	1023	100
Other areas to OSD	1366	50
Pervious Bypass	1426	0

Table 7 - Stormwater Quality Improvement Devices (SQID)

STORMWATER QUALITY IMPROVEMENT DEVICE (SQID)	QUANTITY OF SQID
Hydrodynamic Separator	1 x Vortech VX1000
StormFilter Cartridges	10 Standard Cartridges
Rainwater Tank	23kL

4.4.4 Results

The results of the MUSIC modelling (Version 6) are summarised in Table 88.

The total pollutant loads from the proposed development are expressed in kilograms per year. The reduction rate is expressed as a percentage and compares the resulting pollution from the post developed site with treatment to that of the proposed developed state of the site.

Table 8 - Summary of MUSIC Model Results

PARA-METER	EXISTING SITE LOADS (KG/YR)	POST DEVELOPMENT WITH TREATMENT (KG/YR)	REDUCTION %	TARGET ACHIEVED
TSS	396	59.8	85.7	Yes
TP	0.899	0.261	71.9	Yes
TN	6.75	3.71	45.7	Yes
GP	69.9	0	100	Yes

Notes:

GP = Gross Pollutants
TSS = Total Suspended Solids
TP = Total Phosphorus
TN = Total Nitrogen

In all instances, the proposed water quality control measures enabled the reduction targets to be achieved for all key stormwater pollutants.

Therefore, by implementing the proposed treatment measures within the proposed development there will be no detrimental effect on the quality of stormwater running off from the site.

5. OPERATION AND MAINTENANCE SCHEDULES

The operational and maintenance schedules for the stormwater treatment systems is outlined below:

5.1.1 Water Quantity Devices:

The onsite detention tank and rainwater tanks should be inspected on an annual basis with an estimated clean out fee of around \$1000 depending on the contractor engaged.

5.1.2 Water Quality Devices:

The maintenance frequency for the water quality devices is based on a number of different factors.

The schedule recommended by Stormwater360 for maintenance of the Vortechs system is outlined in Table 9:

Table 9 – Maintenance of Vortechs

Item	Period	Responsibility	Maintenance Procedure
Inspection – Inspect & Record Data	3-Monthly or after Major Storms	Maintenance Contractor and/or Owner	Follow procedure set out on page 9 of the Vortechs Operations Manual
Minor Maintenance; Remove Floatables	3-Monthly or after Major Storms	Maintenance Contractor	Follow procedure set out on page 9 of the Vortechs Operations Manual
Major Maintenance; Evacuation of Chamber	12 month (typ) or as required	Maintenance Contractor	Follow procedure set out on page 8 of the Vortechs Operations Manual
Emergency Maintenance	After Major Storms or Spills	Maintenance Contractor	Follow procedure set out on page 8 of the Vortechs Operations Manual

(Source - Vortechs Operations Manual)

The operations and maintenance guidelines for the Vortechs system has been attached to this report as Appendix D.

The schedule recommended by Stormwater360 for maintenance of the Stormfilter system is outlined in Table 10:

Table 10 – Maintenance of Stormfilter

Facility Component Requiring Maintenance	Maintenance Activity	When Maintenance Activity is Required	Expected Facility Performance After Maintaining
Stormfilter Cartridges and Containment Structure	Trash and Debris Removal	Floatable objects or other trash is present in the filter. Remove to avoid hindrance of filtration and estimate unsightly debris and trash.	Permanent removal from storm system.
	Cartridge Replacement and Sediment Removal	1. Media has been contaminated by high levels of pollutants, such as after a spill.	1. New media is able to effectively treat stormwater.
Drainage System Piping	Flushing with Water	Drainage system is obstructed by debris of sediment.	Outflow is not restricted.

(Source – Stormfilter Operations and Maintenance)

In addition to the above, Stormwater360 also recommends the following frequency of maintenance:

Table 11 – Frequency of Maintenance Activity

	Inspection/Minor Maintenance (Times/Year)	Major Maintenance (Times/Year)
Stormfilter	2 (and after major storms)	1 (except in case of a spill)

(Source – Stormfilter Operations and Maintenance)

The operations and maintenance guidelines for the Stormfilter system has been attached to this report as Appendix E.

6. RECOMMENDATIONS

The proposed development of the subject site could potentially lead to significant changes in water quantity as well as quality if a water sensitive urban design approach is not adopted as part of the development strategy. The traditional stormwater management and investigation that only considers impacts of flooding and flood mitigation is a thing of the past. Stormwater management practices must now also consider water quality, aquatic habitats, riparian vegetation, recreation, aesthetic and economic issues.

The key strategies to be adopted for this development include the following:

1. A pipe network system to collect minor storm runoff from surface areas which will minimise nuisance flooding;
2. On-Site Detention will be provided for the development in the form of a minimum 80m³ detention tank with orifice and weir control;
3. Vortech VX1000 Hydrodynamic Separator to provide water quality treatment by removing sediment, oils and hydrocarbons from stormwater runoff;
4. 10 standard StormFilter cartridges to polish stormwater prior to discharge to the downstream drainage network;
5. 23kL rainwater harvesting and retention systems to allow rainwater reuse while at the same time providing improvement to the quality of stormwater runoff from the site and also providing some level of stormwater detention. The harvested rainwater will be used as required by BASIX as well as for toilet flushing and irrigation.

The results from the investigations and modelling for this project that have been summarised in this report indicate that the proposed WSUD strategy and management can provide a safe and ecologically sustainable environment.

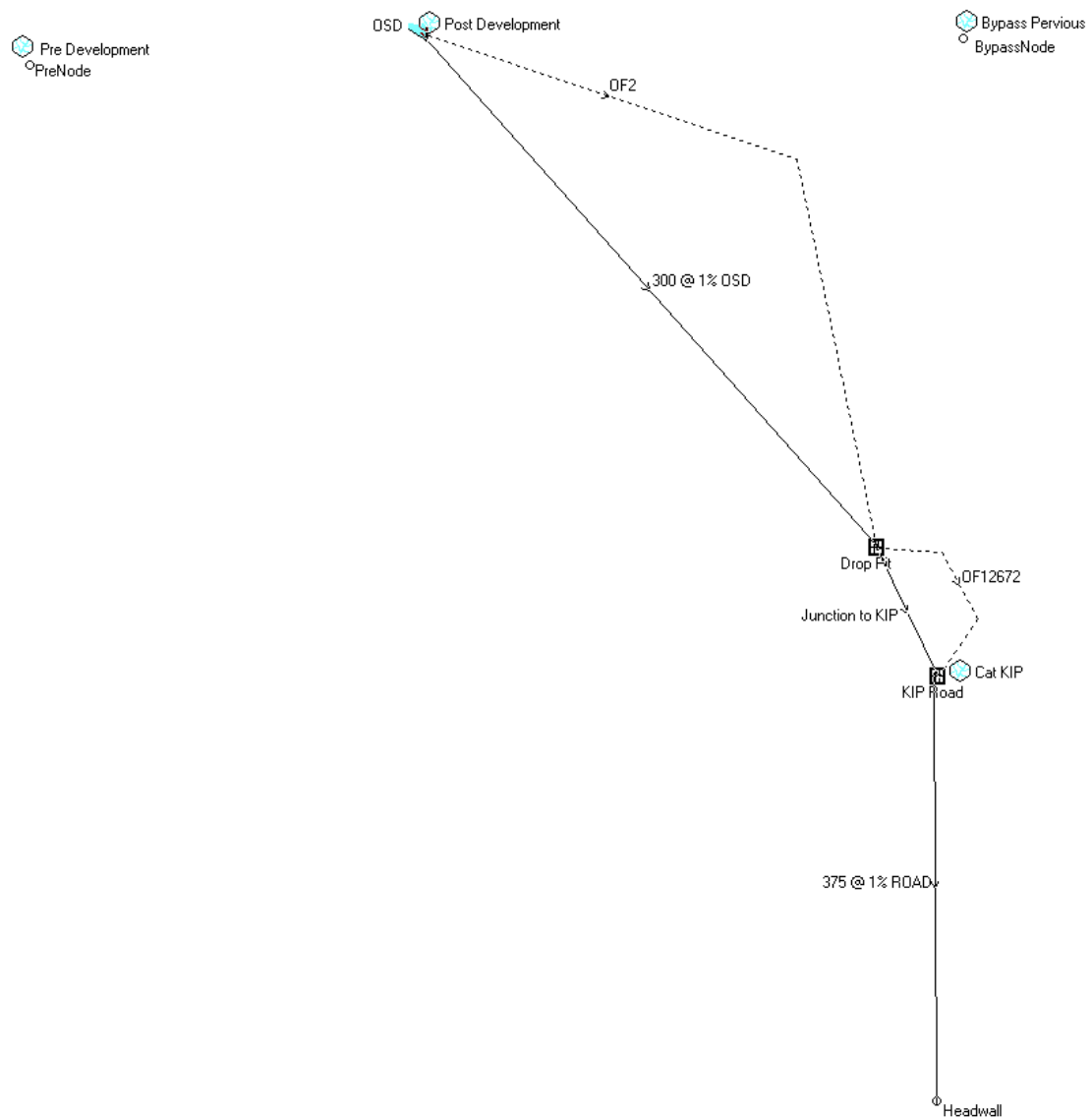
APPENDIX A

CONCEPT CIVIL ENGINEERING DRAWINGS

APPENDIX B

DRAINS MODEL LAYOUT AND SUMMARY

DRAINS – Model Setup



PIT / NODE DETAILS

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is
PreNode	Node					63		0		314.599	-328.461		2			
Drop Pit	OnGrade	Junction Pi	Junction Pit or Manhol		0.8	64.51		0	0	400.407	-377.344	Yes	80711	1 x Ku	No	New
KIP Road	OnGrade	Hornsby Cr	Hornsby 2.4 m lintel		1.5	64.33		0	0	406.576	-390.426	No	997195	1 x Ku	No	New
Headwall	Node					64		0		406.415	-433.548		29			
BypassNod	Node							0		409.089	-325.83		40332			

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Init Vol. (cu	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length	id
OSD	59.5	0.81	0	Orifice		220	59.7			354.289	-325.354	No			78
	59.7	0.81													
	59.8	48.42													
	61.3	48.42													
	61.5	48.42													

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%)	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFactor	Rainfall Multiplier
Pre Develo	PreNode	0.48	0	100	0	0	0	0	0	-1	60	-1	-1	8	-1	0.013	0.12	0	0			1
Post Develo	OSD	0.335	90	10	0	0	0	0	0	60	60	-1	20	20	-1	0.013	0.12	0	0			1
Cat KIP	KIP Road	0.031	100	0	0	0	0	0	0	26	0	0	3	0	0	0.013	0	0	0			1
Bypass Per	BypassNod	0.145	0	100	0	0	0	0	0	20	20	0	20	20	20	0.013	0.12	0	0			1

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	RI (m)	Chg (m)	RL (m)	etc (m)
300 @ 1% OSD	Drop Pit		10	59.55	59.45		1 Concrete, t	300	300	0.013	NewFixed		1 OSD		0				
Junction to Drop Pit	KIP Road		6.84	59.42	59.352	0.99	Concrete, r	375	375	0.013	New		1 Drop Pit		0				
375 @ 1% KIP Road	Headwall		13.63	59.352	59.216	1	Concrete, r	375	375	0.013	New		1 KIP Road		0				

DETAILS of SERVICES CROSSING PIPES

Pipe	Chg (m)	Bottom Elev (m)	Height of S Chg (m)	Bottom Elev (m)	Height of S Chg (m)	Bottom Elev (m)	Height of S etc (m)
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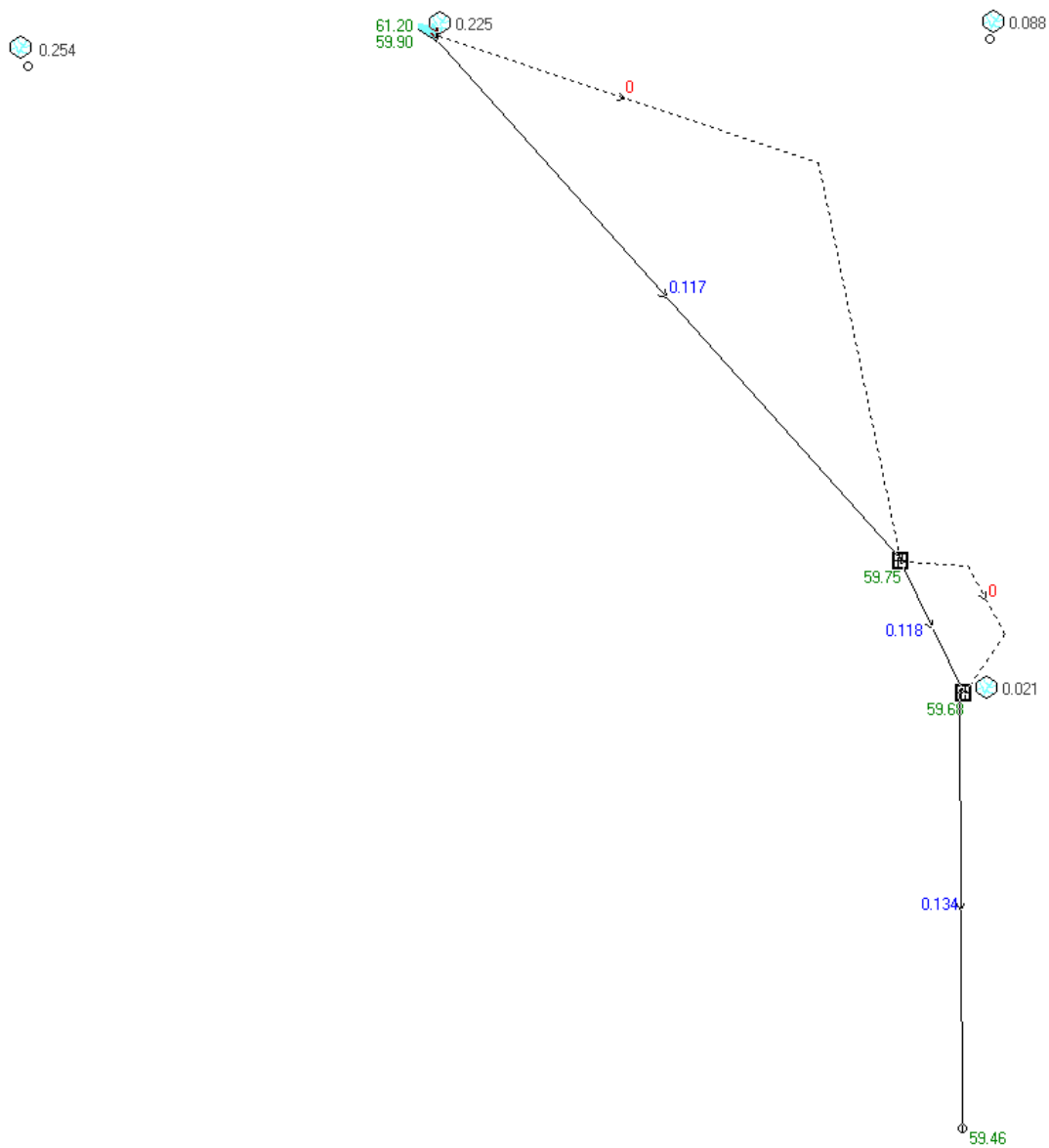
CHANNEL DETAILS

Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Width (m)	L.B. Slope (1:?)	R.B. Slope (1:?)	Manning n	Depth (m)	Roofed
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OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Stor (m)	SafeDepth Minor Stor (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id
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DRAINS – Model Results



DRAINS results prepared 23 January, 2015 from Version 2013.13

PIT / NODE DETAILS		Version 8				
Name	Max HGL	Max Pond HGL	Max Surface Flow (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s) Constraint
Drop Pit	59.75			0	4.76	0 None
KIP Road	59.68		0.021		4.65	None
Headwall	59.46		0			

SUB-CATCHMENT DETAILS						
Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min) Due to Storm
Pre Develo	0.254	0	0.254	0	6.61	0 AR&R 100 year, 20 minutes storm, average 145 mm/h, Zone 1
Post Devel	0.225	0.208	0.018	1.07	4.05	0 AR&R 100 year, 5 minutes storm, average 248 mm/h, Zone 1
Cat KIP	0.021	0.021	0	1.14	0	0 AR&R 100 year, 5 minutes storm, average 248 mm/h, Zone 1
Bypass Per	0.088	0	0.088	0.93	3.54	0 AR&R 100 year, 1.5 hours storm, average 67.0 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.33 impervious + 0.66 pervious = 0.99 total ha)

Storm	Total Rainf cu.m	Total Runoff cu.m	Impervious Runoff cu.m	Pervious Runoff cu.m	Runoff %
AR&R 100 y	204.81	144.90 (70.8%)	65.39 (31.9%)	79.51 (48.9%)	(58.4%)
AR&R 100 y	320.42	245.77 (76.7%)	104.18 (32.8%)	141.58 (43.9%)	(66.5%)
AR&R 100 y	406.31	319.21 (78.6%)	133.00 (32.7%)	186.21 (45.9%)	(69.0%)
AR&R 100 y	478.98	381.09 (79.6%)	157.38 (32.9%)	223.71 (58.7%)	(70.3%)
AR&R 100 y	589.64	472.08 (80.0%)	194.51 (33.0%)	277.57 (57.0%)	(70.8%)
AR&R 100 y	832.44	675.55 (81.1%)	275.98 (33.2%)	399.57 (58.9%)	(72.2%)
AR&R 100 y	995.95	811.81 (81.5%)	330.84 (33.3%)	480.97 (59.2%)	(72.7%)
AR&R 100 y	1334.9	1087.91 (81.6%)	444.56 (33.3%)	643.34 (58.3%)	(72.5%)
AR&R 20 y	373.28	276.43 (74.1%)	121.92 (32.7%)	154.51 (41.4%)	(62.3%)
AR&R 20 y	460.81	344.05 (74.7%)	151.29 (32.8%)	192.76 (41.9%)	(63.0%)
AR&R 20 y	644.15	488.24 (75.8%)	212.80 (32.9%)	275.44 (42.9%)	(64.4%)
AR&R 20 y	758.11	574.79 (75.8%)	251.03 (32.9%)	323.75 (56.9%)	(64.3%)

PIPE DETAILS				
Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m) Due to Storm
300 @ 1%	0.117	1.66	59.895	59.751 AR&R 100 year, 1.5 hours storm, average 67.0 mm/h, Zone 1
Junction to	0.118	1.32	59.702	59.676 AR&R 100 year, 1.5 hours storm, average 67.0 mm/h, Zone 1
375 @ 1%	0.134	2.93	59.514	59.461 AR&R 100 year, 1.5 hours storm, average 67.0 mm/h, Zone 1

CHANNEL DETAILS		
Name	Max Q (cu.m/s)	Max V (m/s) Due to Storm

OVERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF2	0	0	0.302	0	0	0	0	0
OF12672	0	0	1.339	0	0	0	0	0

DETENTION BASIN DETAILS					
Name	Max WL	Max Vol	Max Q Total	Max Q Low Level	Max Q High Level
OSD	61.2	69.6	0.117	0.117	0

CONTINUITY CHECK for AR&R 100 year, 1.5 hours storm, average 67.0 mm/h, Zone 1

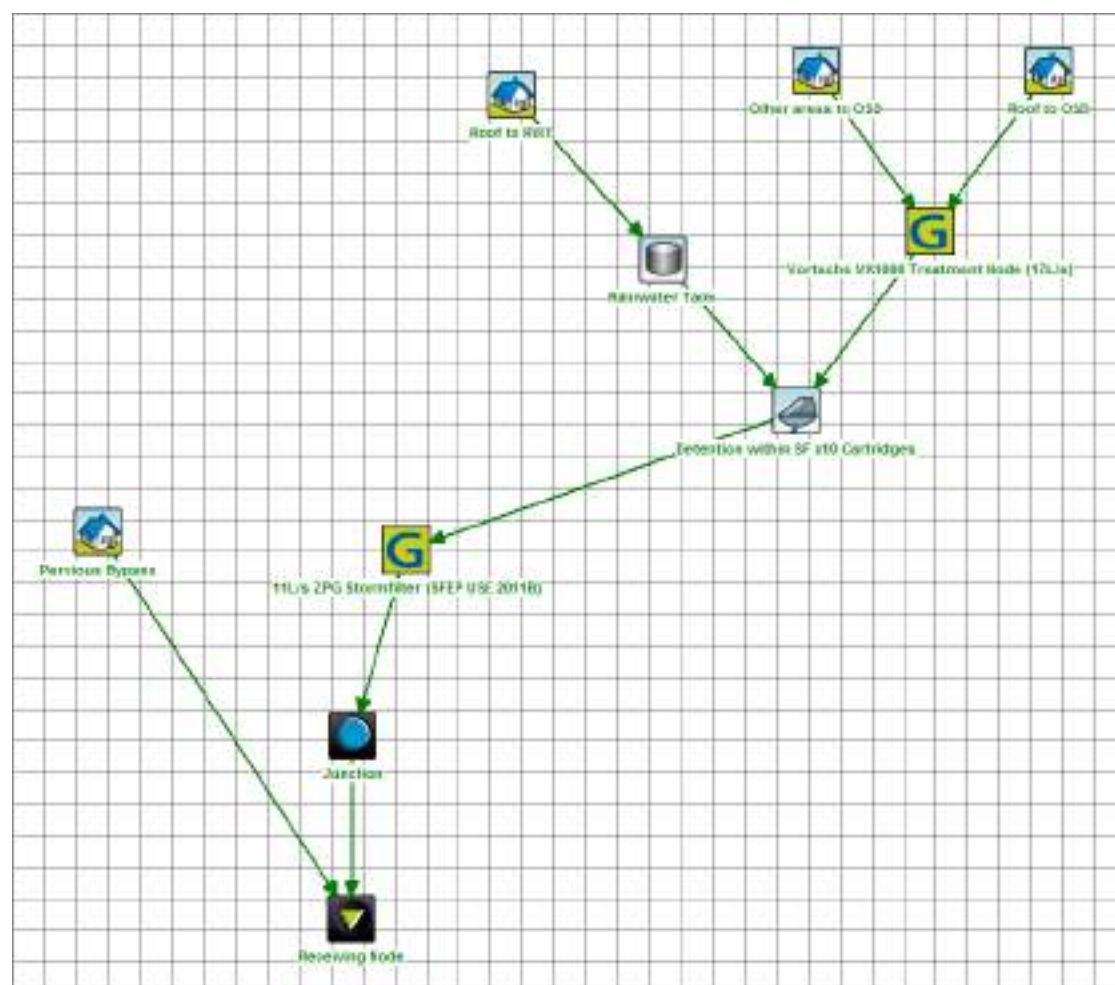
Node	Inflow (cu.m)	Outflow (cu.m)	Storage (cu.m)	Ch Difference %
PreNode	350.37	350.37	0	0
OSD	324.47	324.4	0.07	0
Drop Pit	324.4	324.32	0	0
KIP Road	355.17	355.33	0	0
Headwall	355.33	355.33	0	0
BypassNod	106.13	106.13	0	0

Run Log for 01328_DRAINS_FINAL run at 10:05:53 on 23/1/2015

No water upwelling from any pit. Freeboard was adequate at all pits.
Flows were safe in all overflow routes.

APPENDIX C

MUSIC MODEL LAYOUT



APPENDIX D

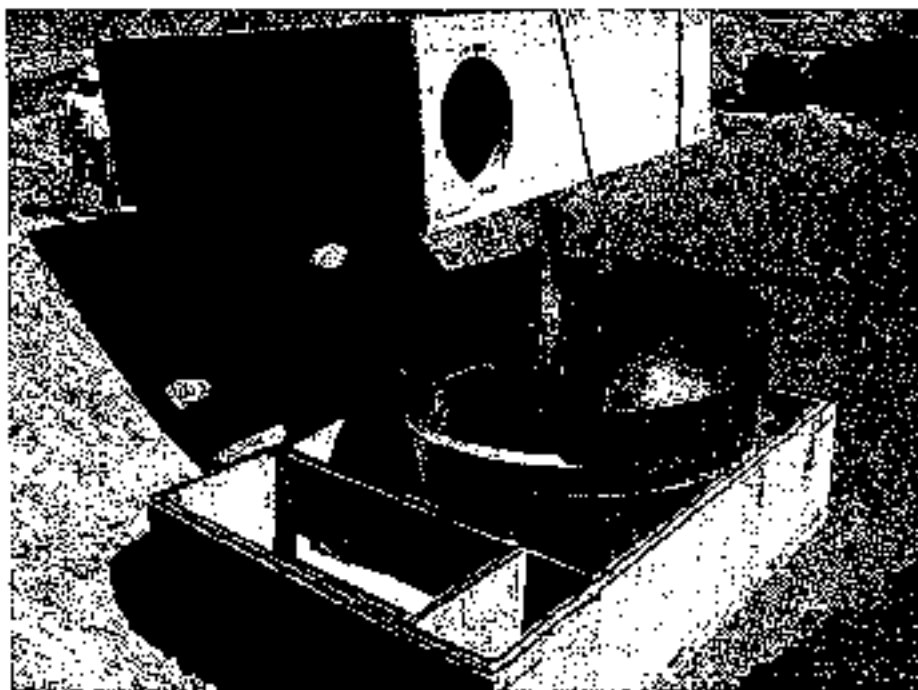
VORTECHS OPERATIONS & MAINTENANCE

Stormwater360

A U S T R A L I A

Vortechs

Operations and Maintenance Guidelines



Note: This guideline should be used as a part of the site stormwater management plan and is to be read in conjunction with the site specific Maintenance Schedule.

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APPENDICES

Appendix A – Service Receipt Example

Appendix B – Example Monitoring & Maintenance Form (LOG)

1 INTRODUCTION

The following report details the recommended methods for cleaning and maintaining the Vortechs Stormwater Treatment System. The aspects associated with cleaning included in this manual are methods for cover removal, unit inspection, and minor and major maintenance activities. This plan should be used in conjunction with the appropriate traffic management plans and site safety plans produced for each project. Other Stormwater360 (SW360) documents which SW360 staff should use in conjunction with this report include the SW360 Employee Health and Safety Manual. It is recommended that contractors develop their own health and safety plans for activities to ensure that the workers are placed in a safe work environment.



Vortechs System in service

Maintenance is an essential component of stormwater management enabling ongoing at source control of stormwater pollution. Maintenance will also prevent failures such as structural failure (e.g. prevents blocked outlets) or aesthetic failure (e.g. debris accumulation). All stormwater treatment devices require maintenance to ensure the ongoing performance of the system.

Stormwater360 is a specialised stormwater consultancy with trained and experienced staff. The company has a comprehensive database with detailed information on every Vortechs filter sold and serviced by SW360, collecting site-specific data that can be easily accessed and analysed as required.

This document consists primarily of the processes and tasks associated with the hand maintenance and inductor maintenance procedures. It does not include detail of the traffic management requirements or occupational health and safety requirements. Contractors or SW360 staff should utilise their own Employee Health and Safety Manual, which details the policies and procedures for safe work.

2 Vortechs Health and Safety

The following section details some of the considerations which may be required for a contractor to comply with relevant health and safety regulations regarding the manual handling activities, hazards associated with the waste material and issues associated with working on roads.

Cleaning of Vortechs is a specialist activity. Material collected can be harmful if not handled correctly. Sediments may contain heavy metals and carcinogenic substances as well as harmful objects such as broken glass and syringes. As all of the Vortechs units are located on roads particular care must be taken due to the potential build up of hydrocarbon based products and other vehicle based contaminants which may be carcinogenic or toxic. It is essential that Occupational Safety and Health guidelines are followed at all times, and that the following steps are carried out to ensure safe and successful maintenance operations.

In addition to the hazards associated with the cleaning & handling of material, there also hazards associated with traffic at the work site, the removal of the grate, pedestrians and other non-worker personnel, and general work place hazards associated with working outdoors.

This section is not intended to address all the safety issues associated with Vortechs maintenance, providing only information and suggestions on safety aspects associated with the maintenance procedures.

The procedures indicated in the Operations section of this manual are recommend as the safest and most efficient manner in conducting the maintenance of Vortechs Units (Section 3), however contractors and cleaning staff may vary the procedure in response to the site conditions, varying work practices or general preferences in the cleaning techniques. Please note that procedures outlined in this manual are not exhaustive, and that any changes should still comply with general safe work practices.

2.1 Personnel Health and Safety

All contractors and staff shall comply with all current Health and Safety Legislation and take all practicable steps to:

- Comply with all applicable laws, regulations and standards.
- Ensure that all employees, contractors and visitors are informed of and understand their obligations in respect of current Health and Safety Legislation.
- Ensure that employees understand and accept their responsibility to practice and promote a safe and healthy work environment.

All relevant precautions must be taken to prevent contact with sediment and litter when maintaining filters. The following personal protective equipment (PPE) safety equipment should be worn:

- Puncture resistant gloves.
- Steel capped safety boots.
- Fluorescent safety vest.
- Overalls or similar skin protection.
- Eye protection. (if necessary)*

*Higher personal safety conditions may be required when maintaining units that may contain more hazardous material, for example pits where syringes have been observed or pits/systems located in areas associated with such activities.

2.2 Confined Spaces

Confined space poses a serious safety hazard for all personnel; however during the normal maintenance procedures there should be no reason to enter a confined space. All maintenance procedures for the Vortechs system are able to be conducted from the surface.

Confined space entry procedures are not included as part of this manual, for SW360 employees confined space entry procedures are included as part of the SW360 Safety Manual. It is recommended that all contractors evaluate their own needs for confined space entry and compliance with Occupation Health and Safety regulations.

When repairs or maintenance activities cannot be conducted from the surface, the contractor/cleaner should evaluate the need to enter the confined space, considering all alternative options. Where there is a need to proceed in a confined space, only staff with current confined space training shall operate in a confined space. Appropriate measures and controls shall be put in place to meet confined space entry requirements. Safety equipment must be worn where deemed necessary and where gas or oxygen hazard occurs; staff trained in its use will only use BA gear. Non-trained staff must not go into confined spaces.

3 Operations

This section details the specific activities required to clean the Vortechs units. Please note it has been written for use by someone who has never encountered a stormwater pit or a Vortechs unit, providing a step by step process for each of the cleaning stages.

3.1 Maintenance & Monitoring of Vortechs filters

The maintenance frequency is dependant on several variables, such as catchment area, surrounding land use, vegetation type, traffic loading and rainfall patterns. Inspection is the key to effective maintenance and is easily performed. Stormwater360 recommends ongoing quarterly inspections of the accumulated sediment.

Attached in Appendix A is an example of a Vortechs Service Receipt and Maintenance & Performance Monitoring Form which is to be completed by the Cleaning Contractor when servicing any system. Relevant information is recorded and forwarded to the client and/or Council (depending upon regulations) when immediately following each maintenance/inspection clean. The frequency of each procedure is set-out below in Table 2.

Table 2: FREQUENCY OF MAINTENANCE ACTIVITY

ITEM	PERIOD	RESPONSIBILITY	MAINTENANCE PROCEDURE
Inspection - Inspect & Record Data	3-Monthly or after Major Storms	Maintenance Contractor and/or Owner	Follow procedure set out on page 9 of the Vortechs Operations Manual
Minor Maintenance; • Remove Floatables	5-Monthly or after Major Storms	Maintenance Contractor	Follow procedure set out on page 9 of the Vortechs Operations Manual
Major Maintenance; • Evacuation of Chamber	12 month (typ) or as required	Maintenance Contractor	Follow procedure set out on page 8 of the Vortechs Operations Manual
Emergency Maintenance	After Major Storms or Spills	Maintenance Contractor	Follow procedure set out on page 8 of the Vortechs Operations Manual

3.2 Stormwater Pit Cover Removal

There are several different types of stormwater pit covers used throughout Australia. These grates/lids are constructed of three main materials, cast iron, galvanised steel and concrete. Stormwater pits covers on all Vortechs units will cast iron type simply placed on a recessed frame (lockable) to prevent the grate being easily knocked open by passing traffic. A GATIC type lifter (long handle only) and socket set with 1/2in driver will be required to unlock and open the cover.

The following steps indicate a safe and efficient method to clean the Vortechs using an Inductor:

1. Ensure all PPE is worn.
2. Locate locking nut and remove with appropriate sized 1/2in driver and socket.
3. Place GATE lifter in recess and lever cover open.
4. Slide cover across frame and onto surrounding ground/pavement. Never attempt to lift the cover.
5. Repeat steps 4 & 2 when inspection/maintenance is complete.

3.3 Cleaning Methods

One of the following methods of maintenance should be used for the servicing of the Vortechs system:

- Major Maintenance (Cleaning using Inductor Truck).
- Minor Maintenance (Using grapple or net to remove floatables).
- Inspection

3.3.1 Major/Emergency Maintenance (Cleaning using Inductor Truck)

The following steps indicate a safe and efficient method to clean the Vortechs using an Inductor truck. Please complete in conjunction with the form in Appendix A & B as part of this procedure.

1. Open gully pit. (See Section 3.2)
2. Place the Inductor hose from the suction truck over the material collected in the sump and switch on the Inductor.
3. Using the inductor hose suck all of the sediment, organic leaf material, litter etc, collected in the sump
4. If material has build up around the overflows, use the inductor hose to clear the accumulated material.
5. Check the Vortechs unit. (See Section 3.4)
6. Remove the Suction hose.
7. Spray the inside of the Vortechs system with a high pressure water blaster to remove any accumulated grit. Do not use any chemicals.
8. Replace gully pit cover.



Plate 1 Cleaning a Vortechs using the inductor method

3.3.2 Minor Maintenance

The following steps indicate a safe and efficient method to clean the Vortechs manually by hand. Please complete in conjunction with the form in Appendix A & B as part of this procedure.

1. Open cover. (See Section 3.2)
2. Visually inspect the floating debris from surface and performance composition assessment of material.
3. Measure depth floating debris & record.
4. Measure depth to sediment pile & record.
5. Remove the accumulated floating debris by a net or grapple from the surface of the pit.
6. Complete paperwork.
7. Reinstate pit lids (See Section 3.2).

3.4 Unit Inspection

Pollutant deposition and transport may vary from year to year and quarterly inspections will help insure the system is cleaned out at the appropriate time. Inspections should be performed every 3 month or after major storm events. It is very useful to keep a record of each inspection. A Monitoring & Maintenance form (Attached in Appendix B) for doing so is provided.

The Vortechs should be cleaned when the sediment depth has accumulated to a depth of three feet in the treatment sump. Take two measurements with a stadia rod or similar measuring device; one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the distance measured is less than the distance given in the following table, the Vortechs should be maintained to ensure effective treatment

Vortechs Model	Design Treatment Capacity cfs (l/s)	Sediment Storage yd ³ (m ³)
1000	0 - 1.6 (0 - 45)	0.7 (0.64)
2000	1.6 - 2.8 (45-80)	1.2 (0.91)
3000	2.8 - 4.5 (80-125)	1.8 (1.38)
4000	4.5 - 6.0 (125-175)	2.4 (1.84)
5000	6.0 - 8.5 (175-240)	3.2 (2.46)
7000	8.5 - 11.0 (240-315)	4.0 (3.06)
9000	11.0 - 14.0 (315-400)	4.8 (3.67)
11000	14.0 - 17.5 (400-495)	5.6 (4.28)
16000	17.5 - 25.0 (495-710)	7.1 (5.43)

Table 1. Vortechs Maintenance Indicators

3.5 Disposal of Material

All Vortechs wastes from the site are to be taken off site and disposed of at a transfer station or similar approved disposal site/facility. No waste material shall be dewatered on-site in case of accidental spills. Dewatering must only be performed at the waste facility. Stormwater Sediments can contain Lead, Copper, Zinc, Mercury, hydrocarbons and PCBs, which are harmful to both humans and the receiving environment. Appropriate sampling and laboratory analysis may be required to classify the material as suitable for reuse, or disposal under appropriate local guidelines.

Emergency Procedures

3.6 Spill Procedures

In the event of a spill discharging into any gully pit all sediment is to be extracted and removed from site. Normal operation procedures apply to additional cleaning as a result of spills.

Appendix A

Service Receipt Example

Vortechs Service Receipt

Site:
Contractor:
Location:
Year:

Job Number:
Receipt Number:
Week Serviced:

Service Frequency:
Vortechs s on Site:

Vortechs s Cleaned:
Bags Checked:
Overflows Checked
Tonnage:

If Damaged, Action:
if Blocked, Cleaned:

Comments

This service has been performed in accordance with Vortechs Operations Management Plan (EMP) for above site. Please file this receipt with EMP and keep on site for compliance inspections.

Signature:

Position:

Appendix B
Monitoring & Maintenance Form (log) Example

3.7 Vortech's Maintenance & Performance Monitoring Log

Location: _____

Device Model: _____

Owner of Site: _____

Person Responsible for Maintenance and Contract #: _____

Date	Water Surface to Sediment Distance	Floatable Layer Thickness and Composition	Maintenance Performed ¹	Maintenance Personnel	Estimated Volume of Sediment	Estimated Volume of Floatables	Wet Mass Removed ²	Comments

- The water depth to sediment is determined by taking two measurements with a stadia and: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. When the difference between the two measurements is less than the value from the table below, maintenance should be performed.
- For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of a spill, the system should be cleaned immediately. For composition purposes estimate the percentage organics & litter e.g. 60% Litter, 40% Organics.
- Maintenance Activities Performed are:
 - Inspection
 - Minor – Deploying oil absorbents and/or removal floatables by grapple or net.
 - Major – Evacuation of entire chamber including grit and floatables
- To estimate the volume the sediment in the chamber, = 2.05m subtract (1) Water Surface to Sediment Distance multiply by 1.14 (m³).
- To estimate the volume of floatables in the chamber, = (2) Floatable Layer Thickness multiply by 1.14 (m³).
- Obtain the wet mass of the tipped pollutants by weighing the debris at the tip facility or by scales (Minor Maintenance).

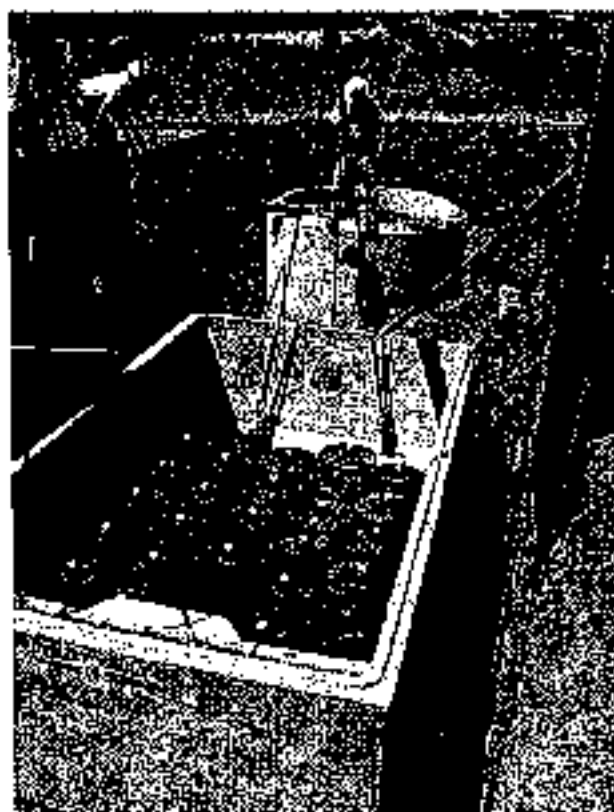
APPENDIX E

STORMFILTER OPERATIONS & MAINTENANCE

Stormwater360

A U S T R A L I A

StormFilter **Operations and Maintenance**



Note: This guideline should be used as a part of the site stormwater management plan and is to be read in conjunction with the site specific Maintenance Schedule.

SECTION 1

1.1 DESCRIPTION

StormFilter is a passive, flow-through stormwater filtration system. It consists of vaults that house rechargeable cartridges filled with a variety of filter media. The filter systems are installed in-line with storm drains. The StormFilter works by passing stormwater through media-filled cartridges, which trap particulates and adsorb materials such as dissolved metals and hydrocarbons. After being filtered through the media, the treated stormwater flows into a collection pipe or discharges into an open channel drainage way. StormFilter is offered in three different configurations: cast-in-place, precast and linear. The precast and linear models utilize pre-manufactured vaults. The cast-in-place units are customized for larger flows and may be either covered or uncovered underground units.

1.2 OPERATION

1.2.1 Purpose

The StormFilter is a passive stormwater filtration system designed to improve the quality of stormwater runoff from the urban environment before it enters receiving waterways.

Through independent third party studies, it has been demonstrated that the StormFilter is highly effective for treatment of first flush flows and flow-paced flows during the latter part of a storm. In general, StormFilter's efficiency is highest when pollutant concentrations are highest. The primary target pollutants for removal are: sediments (TSS), soluble metals, soluble phosphorus, nitrates, and oil and grease.

1.2.2 Sizing

The StormFilter® is typically sized to treat the peak flow of a water quality design storm as it passes through the filter. The peak flow is determined by calculations based on the contributing watershed hydrology and using a design storm magnitude. The design storm is usually based on the regulatory requirements set by the local stormwater management agency. The particular size of a StormFilter is determined by the number of filter cartridges (see Figure 4) required to treat the peak stormwater flow. Each cartridge is designed to treat a peak flow of 1 litre/second. For example: a peak design stormwater flow rate of 10L/s would require that 10 cartridges be used in the treatment vault.

Because of the highly porous nature of the granular filter media, the flow through a newly installed cartridge is restricted to 1L/s, using a restrictor disc, to ensure adequate pollutant-media contact time.

1.2.3 Bask Function

The StormFilter is designed to siphon stormwater runoff through a filter cartridge containing media. The variety of media available can be designed to act as a mechanical filter to remove sediments, as an ion exchanger to remove dissolved heavy metals, and as an absorber to remove oils and greases.

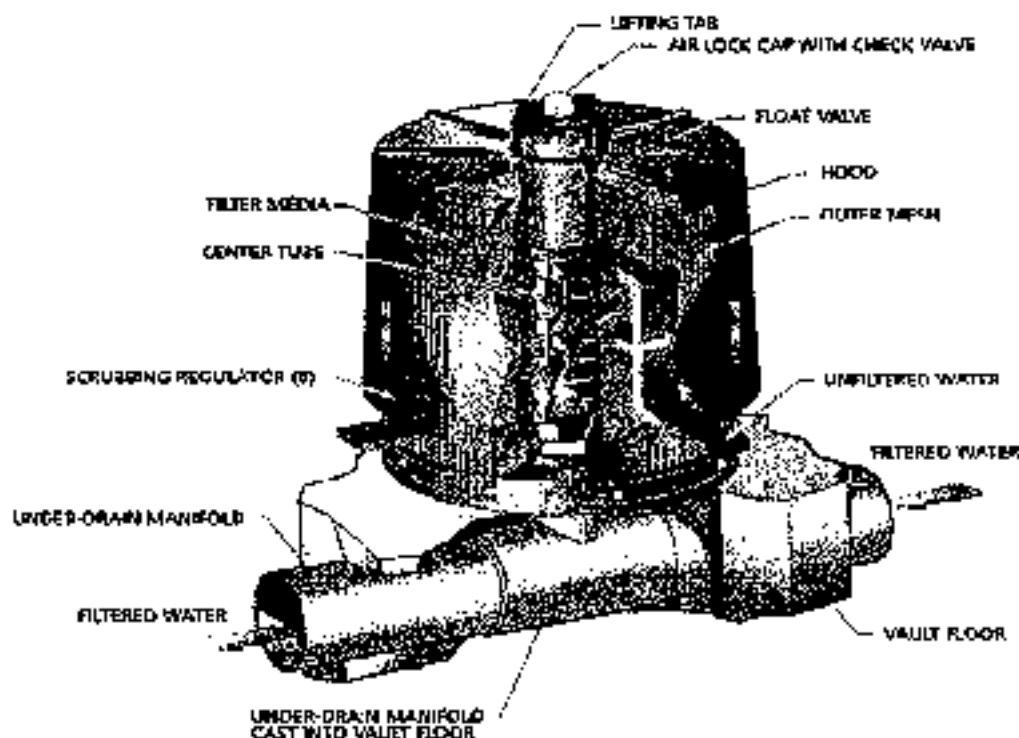


Figure 4. Filter Cartridge

1.2.4 Priming System Function

The treated stormwater collects in the centre tube of the cartridge, which is equipped with a self-priming siphon system. Figure 1 illustrates this system. The key component of the system is the plastic float. The float consists of a ball located at the base leading up to a larger portion, which provides increased buoyancy. Initially the ball rests in a seat effectively closing off the port to the drainage manifold.

As a result, the filter fills the centre drainage tube until the water level has risen high enough to purge the air from the filter cartridges and displaces the float. At a water depth of 22 inches the float pulls loose and allows the filtered water to drain out through the manifold. This effectively "primes" a siphon within the drainage tube and greatly increases the potential across the filter. The priming system increases StormFilter's ability to be loaded with sediment. A related feature is the cartridge "hood". This hood maintains the siphon effect by preventing air from being drawn into the cartridge until the external water level drops below the bottom of the hood.

Cartridges are connected to the manifold with a plastic connector. Since some media used is potentially buoyant, a threaded connector affixed to the manifold with compression bolts is necessary to ensure the cartridge isn't lifted out of place. For the heavier leaf media, a slip connector is used.

StormFilter is also equipped with flow spreaders that trap floating debris and surface films, even during overflow conditions. Depending on individual site characteristics, some systems are equipped with high and/or low flow bypasses. High flow bypasses are installed when the calculated peak storm event generates a flow that overcomes the overflow capacity of the system. This is especially important for precast systems. Low flow bypasses are sometimes installed to bypass continuous inflows caused by ground water seepage, which usually do not require treatment. All StormFilter units are designed with an overflow. The overflow operates when the inflow rate is greater than the infiltration capacity of the filter media.

1.2.5 Maintenance Overview

The primary purpose of the StormFilter is to filter out and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness. Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. To assist the owner with maintenance issues, Stormwater360 provides detailed Operation & Maintenance Guidelines with each unit.

Stormwater360 can provide maintenance services completely, or in part. Available services include tracking of installed systems, advising the system's owner of maintenance needs, and notification of the regulatory agency once the system has been maintained.

Maintenance is usually performed in the dryer periods to rejuvenate the filter media and prepare the system for the next rainy period. Maintenance activities can also be required in the event of a chemical spill or excessive sediment loading due to site erosion or extreme storms. It is good practice to inspect the system after severe storm events.

END OF SECTION 1

SECTION 2

RECOMMENDED MAINTENANCE AND EXPECTED PERFORMANCE

2.1 TYPES OF MAINTENANCE

Presently, procedures have been developed for two levels of maintenance: Inspection/minor maintenance and major maintenance. Inspection/minor maintenance activities are combined since the minor maintenance does not require special equipment and typically little or no materials are in need of disposal. Inspection/minor maintenance typically involves opening the flow restricting valves (to pre-set levels) and cleanup of vegetation and debris. Major maintenance typically includes cartridge recharging. Major maintenance may involve disposal of materials that require consideration of regulatory guidelines. Depending on the particular unit configuration and equipment used, major maintenance may require an understanding of OSHA rules. Table 1 summarizes the primary activities associated with StormFilter maintenance.

Table 1: StormFilter

Facility Component Requiring Maintenance	Maintenance Activity	When Maintenance Activity Is Required	Expected Facility Performance After Maintaining
StormFilter® Cartridges and Containment Structure	Trash and Debris Removal	Floating objects or other trash is present in the filter. Remove to avoid hindrance of filtration and eliminate unsightly debris and trash.	Debris removed from suction systems.
	Cartridge Replacement and Sediment Removal	1. Media has been contaminated by high levels of pollutants, such as after a spill.	2. New media is able to effectively filter stormwater.
Drainage System Flap	Flushing with Water	Drainage system is obstructed by debris or sediment.	Outflow is not restricted.

2.2 MAINTENANCE ACTIVITIES

2.2.1 Maintenance Activity Timing

Two scheduled inspections/maintenance activities should take place during the year. During the minor maintenance activities (routine inspection, debris removal), the type of major maintenance required is determined and, if required for disposal, samples of the sediments and media are obtained. The next scheduled date is to perform major maintenance activities (replacement of the filter cartridges and associated sediment removal). In addition to the scheduled activities, it is important to check the condition of the filter after major storms to check for damage caused by high flows and to check for high sediment accumulation, which may be caused by localized erosion in the drainage area. It may be necessary to adjust maintenance activity scheduling depending on the actual operating conditions encountered by the system.

2.2.2 Maintenance Activity Frequency

The primary factor controlling timing of maintenance for the StormFilter is sedimentation. A properly functioning system will remove solids from water by trapping these particulates within the porous structure of the media. The flow through the system will naturally decrease as more and more solids are trapped. Eventually the flow through a system will be low enough to require replacement of the cartridges. Sediment should be removed from upstream trapping devices on an as needed basis to prevent material from being re-suspended and discharged to the system.

Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction should be inspected and maintained more often than those in fully established areas. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after large storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual filter. It is recommended that the maintenance agency develop a database to properly manage StormFilter maintenance programs.

Prior to the development of the maintenance database, maintenance frequencies shown in Table 3 should be followed. Frequencies should be updated as required. The recommended initial frequency for inspection/minor maintenance is two times per year for the system. StormFilter units should be inspected after all major storms. Sediment removal on an annual basis is recommended until further knowledge is gained about a particular system.

Table 3: FREQUENCY OF MAINTENANCE ACTIVITY

	INSPECTION/MINOR MAINTENANCE (TIMES/YEAR)	MAJOR MAINTENANCE (TIMES/YEAR)
StormFilter	2 (and after major storms)	1 (except in case of a spill)

2.3 MAINTENANCE CREW REQUIREMENTS

Table 4 lists the anticipated crew requirements for maintenance operations. Removal of water and sediments during major maintenance activities can be accomplished using either a pump and water truck or a vacuum truck. All applicable safety (OH & S) and disposal regulations should be followed. A general description of the maintenance activities follows.

Table 4: ANTICIPATED CREW REQUIREMENTS

	Inspection/Minor Maintenance	Major Maintenance: Sediment Removal	Major Maintenance: Cartridge Replacement
Labourer	1		1
Skilled Worker	1	1	1
Vacuum/Water Truck Operator		1	0/1
Total	2*	2*	2/3*
Special Requirements	Knowledge of Proper StormFilter Function	Knowledge of Disposal Requirements	Knowledge of Cartridge Removal and Installation Procedures

* May require OH & S trained person if/when vault entry occurs.

2.4 MAINTENANCE METHODS

2.4.1 Minor Maintenance/Inspection (Twice A Year)

Minor maintenance typically will involve the steps below, however if it appears that a spill of some type has occurred, the local hazard control agency and Stormwater360 should be notified immediately. In the case of a spill, the worker should abort maintenance activities until the proper guidance has been obtained.

Steps for Minor Maintenance

1. Maintenance to be performed by a skilled worker familiar with StormFilter units.
2. If applicable, set up safety equipment to protect pedestrians from fall hazards presented by open doors. Also set up appropriate safety equipment for work near roadways.
3. Inspect the external condition of the unit and take notes concerning defects/problems.
4. Open the doors to the vault and allow the system to air out for 5-10 minutes.
5. Without entering the vault, inspect the inside of the unit, including components.
6. Take notes about the external and internal condition. This includes inspecting pit penetrations, walls, lids, ladders & grates etc.
7. Give particular attention to recording the level of sediment build-up on the floor of the vault in the forebay (or pre-treatment bay), and on top of the internal components. If flow is occurring, note the level of water and estimate the flow rate per drainage pipe. Record all observations.
8. Remove large loose debris and trash using a pole with a grapple or net on the end.

9. Close and fasten the door, and remove safety equipment.
10. Finally, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loadings of other materials to the system.

2.4.2 Major Maintenance Inspection (Once a Year)

The primary goal of the major maintenance inspection is to assess the condition of the cartridges relative to the level of sediment loading. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, large amounts of sediments should be present and very little flow will be discharging from the drainage pipes. It is likely that the cartridges need to be replaced. Major maintenance inspection will typically involve the steps below. However, if it appears that a spill of some type has occurred, the local hazard control agency and Stormwater360 should be notified immediately. In the case of a spill, the worker should abort maintenance activities until the proper guidance has been obtained.

Steps for Pre-Major Maintenance Inspection

1. Maintenance to be performed by a skilled worker familiar with StormFilter units.
2. If applicable, set up safety equipment to protect pedestrians from fall hazards presented by open doors. Also, set up appropriate safety equipment for work near roadways.
3. Inspect the external condition of the unit and take notes concerning defects/problems.
4. Open the doors to the vault and allow the vault to air out for 5-10 minutes.
5. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
6. Take notes about the external and internal condition.
7. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
8. Remove large loose debris and trash using a pole with a grapple or net on the end.
9. If the visit is during a storm, make the flow observations discussed above.
10. Close and fasten the door, and remove safety equipment.
11. Make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
12. Review the condition reports from the previous minor and major maintenance visits and schedule for cartridge replacement if needed.

2.4.3 Major Maintenance: Sediment Removal & Cartridge Replacement (& Emergency)

Major maintenance/filter cartridge replacement typically involves the steps below. However, if it appears that a spill of some type has occurred, the local hazard control agency and Stormwater360 should be notified immediately. In the case of a spill, the worker should abort maintenance activities until the proper guidance has been obtained. Depending on the configuration of the particular system, a worker may be required to enter the vault to perform some tasks. If vault entry is required, OH & S rules for general confined space entry must be strictly adhered to. Filter cartridge replacement should occur during dry weather and it may be necessary to plug the filter inlet pipe if base flows exist. Standing water present in the vault should be regarded as polluted and contained during this operation by temporarily capping the manifold connectors.

Steps For Cartridge Replacement Maintenance (With Vacuum Truck)

1. Depending on the particular unit, one or two utility workers and a hauling truck operator will deliver the replacement cartridges to the site. Information concerning how to obtain the replacement cartridges is available from Stormwater360.
2. If applicable, set up safety equipment to protect pedestrians from fall hazards presented by open doors. Also, set up appropriate safety equipment for work near roadways.
3. Inspect the external condition of the unit and take notes concerning defects/problems.
4. Open the doors to the vault and allow the system to air out for 5-10 minutes.
5. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
6. Make notes about the external and internal condition.
7. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
8. Remove large loose debris and trash using a pole with a grapple or net on the end.
9. Ensuring safe working procedures are met, off load the replacement cartridges (16-39kgs each) and set aside.
10. Remove the top cap (threaded), upper seal and float from the cartridge. Repeat procedure for every cartridge within StormFilter vault. Place items in a large plastic container to be lifted from the vault.
*Note: * Confined space entry may be required on StormFilter systems. In this case, please ensure that appropriate Confined Space entry training and subsequent certification has been undertaken and valid, and work procedures are strictly adhered to. If you are unsure, do not enter the vault and contact Stormwater360 immediately.*
11. Using a cordless drill and 8mm hex head, remove the three screws located around the top perimeter of the cartridge hood. Place screws in the large plastic container and, once full or completed, remove plastic container from vault.

12. Move the Vacuum truck near the StormFilter vault on the down wide side. Be sure that the Vacuum truck is not too close to the vault so as the fumes will not enter the vault. Make sure that the last 500mm of the nozzle is approx. 100-125mm in outside diameter.
13. Feed vacuum nozzle into cartridge bay and start vacuum truck. Remove cartridge hood and place nozzle directly onto filter media. Completely remove media from each cartridge and repeat process for every cartridge in vault.
14. Once completed unthread cartridges from vault floor and place hood back on cartridges.
15. Using the appropriate lifting cap, attach the cable and remove the cartridge (up to 10kgs. each) from the vault. Personnel standing under suspended cartridges is strictly prohibited. Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner unless maintenance activities are being performed by Stormwater360 and damage is not related to discharges to the system.
16. Set the used cartridge aside or load onto the hauling truck.
17. Repeat steps 14 to 15 once all cartridges have been removed.
18. Remove deposited sediment from the floor of the vault and, if large amounts are present, from the forebay. This can be accomplished by using the Vacuum truck.
15. Once the sediments are removed, it is necessary to assess the condition of the vault, particularly the manifold and the connectors. These are short sections of 2-inch schedule 50 PVC, or threaded schedule 80 PVC that should protrude above the floor of the vault. If required, apply a light coating of FDA approved silicon grease to the outside of the exposed portion of the connectors. This ensures a watertight connection between the cartridge and the drainage pipe. Replace any damaged connectors.
16. Using the boom, crane, or tripod, lower and install the new cartridges (typically 16-17kgs. for perlite cartridges). Once again, take care not to damage connections.
17. Close and fasten the door, and remove safety equipment.
18. Make notes about the local drainage area relative to ongoing construction, erosion problems, or high loadings of other materials to the system.
19. Finally, dispose of the residual materials in accordance with applicable regulations. Make arrangements to return the used cartridges to Stormwater360.

Steps For Cartridge Replacement Maintenance (Without Vacuum Truck)

1. Depending on the particular unit, one or two utility workers and a hauling truck operator will deliver the replacement cartridges to the site. Information concerning how to obtain the replacement cartridges is available from Stormwater360.
2. If applicable, set up safety equipment to protect pedestrians from fall hazards presented by open doors. Also, set up appropriate safety equipment for work near roadways.
3. Inspect the external condition of the unit and take notes concerning defects/problems.
4. Open the doors to the vault and allow the system to air out for 5-10 minutes.

5. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
6. Make notes about the external and internal condition.
7. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
8. Remove large loose debris and trash using a pole with a grapple or net on the end.
9. Ensuring safe working procedures are met, off load the replacement cartridges (16-39kgs each) and set aside.
10. Using the appropriate lifting cap, attach the cable from the boom, crane, or tripod to the cartridge being removed. Personnel standing under suspended cartridges is strictly prohibited. For more information contact Stormwater360. This activity may require that workers enter the vault* to remove the cartridges from the drainage system, and place them under the vault opening for lifting. Note that cartridges require unscrewing from their threaded connectors. Take care not to damage the manifold connectors. This connector should remain installed in the manifold and capped if necessary. (See figure 4).

*Note: * Confined space entry may be required on StormFilter systems. In this case, please ensure that appropriate Confined Space entry training and subsequent certification has been undertaken and valid, and work procedures are strictly adhered to. If you are unsure, do not enter the vault and contact Stormwater360 immediately.*

11. Remove the cartridge (up to approx. 60kgs. each for Perlite/Zeolite mix saturated & occluded cartridges) from the vault. Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner unless maintenance activities are being performed by Stormwater360 and damage is not related to discharges to the system.
12. Set the used cartridge aside or load onto the hauling truck.
13. Continue steps 10 through 12 until all cartridges have been removed.
14. Remove deposited sediment from the floor of the vault and, if large amounts are present, from the forebay. This can usually be accomplished by shoveling the sediment into containers which, once full, are lifted mechanically from the vault and placed onto the hauling truck. In some cases of extreme sediment loading, especially if the sediment is saturated, a vacuum truck may be required.
15. Once the sediments are removed, it is necessary to assess the condition of the vault, particularly the manifold and the connectors. These are short sections of 2-inch schedule 50 PVC, or threaded schedule 80 PVC that should protrude above the floor of the vault. If required, apply a light coating of FDA approved silicon grease to the outside of the exposed portion of the connectors. This ensures a watertight connection between the cartridge and the drainage pipe. Replace any damaged connectors.
16. Using the boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.

17. Close and fasten the door, and remove safety equipment.
18. Make notes about the local drainage area relative to ongoing construction, erosion problems, or high loadings of other materials to the system.
19. Finally, dispose of the residual materials in accordance with applicable regulations. Make arrangements to return the used cartridges to Stormwater360.

2.4.4 Related Maintenance Activities (Performed on an as-needed basis)

StormFilter units are often just one of many components in a more comprehensive stormwater drainage and treatment system. The entire system may include catch basins, detention vaults, sedimentation vaults and manholes, detention/retention ponds, swales, artificial wetlands, and other miscellaneous components. In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities. In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil and grease loading, and discharges of inappropriate materials.

2.5 TYPICAL EQUIPMENT REQUIRED FOR MAINTENANCE ACTIVITIES

Typical equipment required for conducting maintenance is shown in Table 5. Some of the materials listed are suggestions rather than requirements. It should be noted that there is more than one way to accomplish some tasks. Owners with available labour and equipment resources may desire to use alternative methods. However, it is advisable that guidance from Stormwater360 be obtained prior to using alternative techniques.

Table 5: MAINTENANCE EQUIPMENT REQUIREMENTS

Maintenance Equipment Required		
Minor Maintenance	Pre-Major Maintenance Inspection	Major Maintenance Cartridge Replacement
Safety Equipment*: First aid, cones, barricades, flagging, flares, tape, vests, hard hats.	Safety Equipment*: First aid, cones, barricades, flagging, flares, tape, vests, hard hats.	Safety Equipment*: First aid, cones, barricades, flagging, flares, tape, vests, hard hats.
Work Clothes: Rubber boots, overalls, and gloves.	Work Clothes: Rubber boots, overalls, and gloves.	Work Clothes: Rubber boots, overalls, and gloves.
Door Bolt, Wrench, proprietary lifters (e.g. Gatic) and Miscellaneous Tools.	Door Bolt, Wrench, proprietary lifters (e.g. Gatic) and Miscellaneous Tools.	Door Bolt, Wrench, Pentasocket and Miscellaneous Tools.
Tape Measure	Tape Measure	Tape Measure
Flashlight	Flashlight	Flashlight
Grapple or Net Pole	Grapple or Net Pole	Grapple or Net Pole
Record Keeping Forms	Record Keeping Forms	Record Keeping Forms
Trash/Debris Container	Trash/Debris Container	Vacuum Truck
		Replacement Cartridges
		Cartridge Hauling Truck
		Crane, Tripod and Hoist, or Other Lifting Device (150kg minimum capacity)
		Shovels
		Extra 50mm PVC cartridge connectors
		Spare Flow Restrictor disks
		Trash/Debris Container
		Vault Inlet Pipe Plug
		Dolly
		PVC Pipe Cutter
		Ladder
		Cartridge Installation and Removal Sling

* Confined space equipment may be required for vault entry. This equipment must be used by personnel with the appropriate OHS training. This equipment typically includes: Atmospheric testing devices, atmospheric purging and ventilating devices, and entry, exit, and rescue assisting devices.

2.6 MATERIAL DISPOSAL

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in a manner that will not allow the material to affect surface or ground water. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads. Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. It is not appropriate to discharge these materials back to the stormwater drainage system. Part of arranging for maintenance to occur should include coordination of disposal of solids (landfill coordination) and liquids (municipal vacuum truck decant facility, local wastewater treatment plant, on-site treatment and discharge). Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals. Disposal methods or reuse of the media contained in the cartridges will be determined by Stormwater360. If the material has been contaminated with any unusual substance, the cost of special handling and disposal will be the responsibility of the owner.

Sample StormFilter Minor Maintenance Inspection Data Sheet

Date: _____ Location: _____

System Size: _____ TYPE: Cast-In-Place Precast Linear

Personnel: _____

System Observations

Media Months In Service: _____

Oil and Grease In Forebay: _____

Sediment Depth in Forebay: _____

Sediment Depth on Vault Floor: _____

Structural Damage: _____

Estimated Flow from Drainage Pipes (if available): _____

Cartridges Submerged? (Yes _____ No _____) How Deep? _____

StormFilter Minor Maintenance Activities (check off if done and give description)

Remove Trash and Debris: _____

Minor Structural Repairs: _____

Drainage Area Report

Excessive Oil and Grease Loading (Yes _____ No _____) Source: _____

Sediment Accumulation on Pavement (Yes _____ No _____) Source: _____

Erosion of Landscaped Areas (Yes _____ No _____) Source: _____

Items Needing Further Work: _____

Comments: _____

Sample StormFilter Major Maintenance Inspection Data Sheet

It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, large amounts of sediments should be present, very little flow will be discharging from the drainage pipes, and it is likely that the cartridges need to be replaced during major maintenance.

Date: _____ Location: _____

System Size: _____ TYPE: Cast-In-Place Precast Linear

Personnel: _____

System Observations

Media Months in Service: _____

Oil and Grease in Forebay: _____

Sediment Depth in Forebay: _____

Sediment Depth on Vault Floor: _____

Structural Damage: _____

Estimated Flow from Drainage Pipes (if available): _____

Cartridges Submerged? (Yes _____ No _____) How Deep? _____

Drainage Area Report

Excessive Oil and Grease Loading (Yes _____ No _____) Source: _____

Sediment Accumulation on Pavement (Yes _____ No _____) Source: _____

Erosion of Landscaped Areas (Yes _____ No _____) Source: _____

Comments: _____

Review the condition reports from the previous minor and major maintenance visits.

Sample StormFilter Major Maintenance/Cartridge Replacement Data Sheet

Date: _____ Location: _____

System Size: _____ TYPE: Cast-In-Place Precast Linear

Personnel: _____

List Safety Procedures and Equipment Used: _____

System Observations

Media Months in Service: _____

Oil and Grease in Forebay: _____

Sediment Depth in Forebay: _____

Sediment Depth on Vault Floor: _____

Structural Damage: _____

Drainage Area Report

Excessive Oil and Grease Loading (Yes _____ No _____) Source: _____

Sediment Accumulation on Pavement (Yes _____ No _____) Source: _____

Erosion of Landscaped Areas (Yes _____ No _____) Source: _____

StormFilter Cartridge Replacement Maintenance Activities (check off if done and give description)

Remove Trash and Debris (Yes _____ No _____) Details: _____

Replace Cartridges (Yes _____ No _____) Details: _____

Sediment Removed (Yes _____ No _____) Details: _____

Quantity of Sediment Removed (estimate?): _____

Minor Structural Repairs (Yes _____ No _____) Details: _____

Residuals (debris, sediment) Disposal Methods: _____

Notes/Problems: _____



dem

Waste Management Plan

Prepared by:

DEM (Aust) Pty Ltd

on behalf of:

Taskin Satici

Project:

Lot 100, 70 John Whiteway Drive, Gosford

Residential Development

This Waste Management Plan has been prepared on behalf of the Client and does not constitute a representation in any way by DEM (Aust) Pty Limited.

Lot 100, 70 Whiteway Drive, Gosford

Waste Management Plan



dem

Site Address:

Lot 100

Address 70 John Whiteway Drive Gosford.

Building and other structures existing on site:

Vacant Land

Description of Proposal:

Residential development consisting of 75 apartments over 5 levels with 2 basement car parking levels, associated landscaping and civil works.

Signed by

Taskin Satici

A handwritten signature in black ink, appearing to read 'Taskin Satici'.

Date: January 2015

Applicant's Name:

Taskin Satici

Address:

PO Box 20, Erskineville NSW 2043

Tel No. 0414878860 email: taskin@integralfinancial.com.au

The details provided within this plan are indicative only and intended as a guide to managing waste related to this project.

Final waste management procedures will be subject to selected building/civil works contractor input and confirmation and final body corporate/community association requirements.

Prepared by DEM (Aust) Pty Ltd

on behalf of Taskin Satici

Phillip Waterman

Date: January 2015

Waste Management Plan

dem

Demolition Stage (Site preparation)

Materials On-site		Destination		
		Re-use and Recycling		Disposal
Type of Material	Estimated Volume (m ³)	On-site estimate volume (m3) Proposed Re-use of On-site Recycling Methods	Off-site estimate volume (m3) Contractor and recycling outlet	Contractor and landfill site
Excavation Material	17,000m ³ approximately TBC by builder	Selected stone excavated from the site to be used in retaining walls (210m3) and rip-rap stone rubble (250 m3) indicated in the landscape drawings. Topsoil and selected crushed material (2000m3) to be reused in proposed deep soil planted area along eastern side of site. Excess excavated material to be removed from site. Volume TBC by builder	Expressions of interest will be sought from contractors for acceptance of certified fill as recyclable material. Contractor and recycling outlet to be confirmed	Excess excavated material not recycled elsewhere will be transported by a certified contractor to an approved landfill site to be confirmed
Green Waste	150 m ³ approximately TBC by builder	All trees noted on the landscape drawing to be removed will be mulched and removed from the site.	Expressions of interest will be sought from contractors, landscape suppliers for acceptance of mulch as recyclable material. Contractor and recycling outlet TBC	NA
Bricks	N/A	N/A – Vacant land	N/A	N/A
Concrete	N/A	N/A – Vacant land	N/A	N/A
Timber	N/A	N/A – Vacant land	N/A	N/A
Plasterboard	N/A	N/A – Vacant land	N/A	N/A
Metals	N/A	N/A – Vacant land	N/A	N/A
Other	N/A	N/A – Vacant land	N/A	N/A
Hazardous material asbestos	N/A	N/A – Vacant land	N/A	N/A

Waste Management Plan**Construction Stage**

dem

Materials On-site		Destination		
		Re-use and Recycling		Disposal
Type of Material	Estimated Volume (m ³)	On-site estimate volume (m3) Proposed Re-use of On-site Recycling Methods	Off-site estimate volume (m3) Contractor and recycling outlet	Contractor and landfill site
Excavation Material	140m ³ approx	Detailed excavated material to be re-used on site as fill under RC slabs and driveway/landscape areas. Remainder to be trucked off site.	Expressions of interest will be sought from contractors for acceptance of certified fill as recyclable material. Accredited contractor and recycling outlet to be confirmed	Excess excavated material will be transported by a certified contractor to an approved landfill to be confirmed by the Contractor on commencement of the works
Green Waste	Nil	Site cleared during site preparation	N/A...	N/A
Masonry	TBC	Broken blocks to be used in the temporary construction driveway areas to maintain all weather access. Arrangements for full blocks to be returned to supplier.	Upon completion, any material used in the temporary construction phase to be transported to a suitable crushing plant. Contractor and recycling plant to be confirmed	
Concrete	TBC	Excess concrete to be used to maintain all weather access point onto site or returned to plant	Upon completion, any material used in the temporary construction phase is to be transported to a suitable crushing plant. Contractor and recycling plant to be confirmed	N/A
Timber treated softwoods	TBC	Minimal use of timber in building Excess timber offcuts to be used for blocking.	Any long lengths to be re-used on next job by building contractor.	N/A
Glass			Recycle by reprocessing	N/A

Waste Management Plan

Construction Stage



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Materials On-site		Destination		
		Re-use and Recycling		Disposal
Plasterboard	TBC	Minimal waste due to standard sheet sizes utilized.	Any waste to be stockpiled on site and collected by Boral Plasterboard for recycling at Thackeray Street, Camellia.	N/A
Metals Steel lead copper	TBC	N/A	Minimal waste due to proposed prefabricated components Metals off-cuts to be transported to suitable recycling yard for reprocessing. Contractor and recycling plant to be confirmed	
Paper and Cardboard	TBC		Recycled by reprocessing	Arrangements to be made by builder to transfer material to accredited recycling site
Carpet			Reprocessed into carpet or packaging	Arrangements to be made by builder to transfer material to accredited recycling site
Other Plastics, Pallets, Packaging	TBC	Pallets/packaging to be collected by relevant suppliers for recycling, where possible.	Recycled back to relevant suppliers where possible or accredited recycling contractor.	
Residual Waste	TBC	To be confirmed by builder		Excess excavated material will be transported by a certified contractor to an approved landfill to be confirmed by the Contractor on commencement of the works
Hazardous /special waste	TBC	Special waste removal requirements to be verified by builder prior to site establishment		Transported by a certified contractor to an approved site in accordance with EPA requirements

Lot 100, 70 Whiteway Drive, Gosford

Waste Management Plan

Construction Stage

Construction design

The following measures have been incorporated into the design to minimise construction waste.

Design and order only what you need

- Walls and openings setout to block dimensions to avoid cutting and reduce construction time
- Walls to be face block to minimise ongoing maintenance and to compliment adjacent buildings
- Standardise external door and window sizes (minimise the number of window and door types)
- Steel framed roof framing fabricated offsite with pre-cut profiled prefinished metal roofing
- Steel framing/plasterboard lining proposed for internal wall partitions to units

Negotiate with suppliers to take back unused materials, packaging or offcuts

Provide separate waste containers for recycling if space permits on site.

Lifecycle

Materials to be used in the project are ecological sustainable and exhibit good to excellent environmental qualities

The chart below highlights the ecological sustainability of the materials chosen

Ecological sustainability of building materials							
materials	Environmental factors						
	Raw material availability	Minimal environmental impact	Embodied energy efficiency	Product lifespan	Freedom from maintenance	Potential for product reuse	Material recyclability
aluminium	Very good	poor	fair	excellent	Very good	Very good	excellent
Concrete and concrete products	Good	good	Very good	Excellent	Excellent	poor	Very good
Plasterboard	Very good	fair	Very good	Good	fair	poor	good
steel	Very good	Fair	fair	Very good	fair	fair	Very good
glass	Good	Good	Good	Excellent	Very good	Good	Very good
Timber	Very good	Very good	Very good	Very good	fair	fair	fair

Waste Management Plan



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Design of Facilities

Type of Waste to be Generated	Proposed on-site Storage and Waste Management Strategy	Waste generated and bin storage capacity calculations
Recyclable generation rates for multi- unit dwellings are 120 litres per unit per week (Appendix B, Gosford Council's Waste Management DCP) One recyclable bin can be used for the following recyclables – bottles, paper, tins, plastics and cardboards	Each apartment will be equiped with an waste and recycling storage system sufficient for a minimum of one day's garbage and recycling generation. The system proposed would consist of an under bench unit similar to the Franke sorter series 300-45 duo which has 2 x 22 litre capacity bins Communal waste storage rooms will be provided in the basement for each of the 3 unit blocks. Each storage room will be conveniently located in close proximity to the lift to provide ready and easy access to the users. Signage will clearly define the recyclable areas within the storage facility The areas will accommodate councils required number of recycling containers and will be constructed in accordance with BCA and Council requirements. Bin washing facilities will also be provided within the storage rooms and hold area The bins in garbage rooms 1 and 2 will be transferred to the holding area within garbage room 3 adjacent to Georgiana Terrace by a contractor using appropriate equipment through prior arrangement with the body corporate on the designated collection nights.	Recyclables generation rates 17 litres per unit per day 120 litres per unit per week Block 1 = 15 units Waste generated per week 120L x 15 = 1800L (based on 2 collections per week this equates to 1 x 1100 litre bin) Block 2 = 24 units Waste generated per week 120L x 24 = 2880L (based on 2 collections this equates to 2 x 1100 litre bins /1x 1500 litre bin) Block 3 = 36 units Waste generated per week 120L x 36 = 4320L (based on 2 collections per week this equates to 2 x 1100 litre bins) Note The above calculations are based on two(2) collections per week

Waste Management Plan



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Design of Facilities

Type of Waste to be Generated	Proposed on-site Storage and Waste Management Strategy	Waste generated and bin storage capacity calculations
Waste generation rates for multi- unit dwellings are 120 litres per unit per week (Appendix B, Gosford Council's Waste Management DCP) Waste –includes food scraps and other non-recyclable material	Each apartment will be equipped with a waste and recycling storage system sufficient for a minimum of one day's garbage and recycling generation. The system proposed would consist of an under bench unit similar to the Franke sorter series 300-45 duo which has 2 x 22 litre capacity bins Waste storage will be provided within the communal storage rooms located in the basement for each of the three unit blocks. Each storage room will be conveniently located adjacent to the lift to provide ready and easy access to the users. Signage will clearly define the waste areas within the storage facility The room will accommodate councils required number of waste and recycling containers will be constructed in accordance with BCA and Council requirements. Bin washing facilities will also be provided within the storage rooms and hold area The bins in garbage rooms 1 and 2 will be transferred to the holding area within garbage room 3 adjacent to Georgiana Terrace by a contractor using appropriate equipment through prior arrangement with the body corporate prior to council pickup	Waste generation rates 17 litres per unit per day 120 litres per unit per week Block 1 = 15 units Waste generated per week 120L x 15 = 1800L (based on 2 collections per week this equates to 1 x 1100 litre bin) Block 2 = 24 units Waste generated per week 120L x 24 = 2880L (based on 2 collections this equates to 2 x 1100 litre bins /1x 1500 litre bin) Block 3 = 36 units Waste generated per week 120L x 36 = 4320L (based on 2 collections per week this equates to 2 x 1100 litre bins) Refer DA Plans for communal storage locations and collection area Note The above calculations are based on two(2) collections per week
Garden organics	To be separated at each unit, and placed in 240 litre bins, located in each of the 3 garbage rooms.	Bins to be placed out for kerbside collection on designated collection day

Waste Management Plan

On-going Management



On-going Management of Waste On-site

It is anticipated that each new resident will be instructed by way of a Waste Management Information Pack provided by the Body Corporate/Community Association, outlining how to recycle and use bins that are to be stored in each of the garbage rooms located in the basement for each of the three unit blocks.

Based on two (2) collection days per week the garbage rooms in each block will be supplied with the following bins.

Apartment Building 1 - 1 x 1100L garbage bins and 1 x 1100L recycle bins plus one green waste bin

Apartment Building 2 - 2x 1100L garbage bins and 2x 1100L recycle bins plus one green waste bin

Apartment Building 3 - 2 x 1100L garbage bins and 2 x 1100L recycle bins plus two green waste bins

A waste/recycling cupboard with a minimum of one day's garbage and recycling generation will be provided for each unit.

Residents will be responsible for disposing of their daily garbage and recycling by placing it in the appropriate bins provided within the garbage rooms located in the basement of each of the three unit blocks. The garbage rooms have been located in close proximity to the lifts in each block to provide ready and easy access for the residents. Signage will clearly define the waste areas and recyclable areas within the storage facility and clear instructions on how to use the facilities.

The bins in garbage rooms 1 and 2 will be transferred to the holding area within **garbage room 3, adjacent to Georgiana Terrace** by a contractor using appropriate equipment through prior arrangement with the body corporate prior to council pickup on the designated collection days. The contractor will also be responsible for returning the bins to the designated garbage rooms on the same day immediately after collection.

Council's will be responsible for removing, emptying and replacing the garbage and recycling bins from garbage room 3 adjacent to Georgina terrace

Waste Management Plan



Appendices

Appendix 1 – Communal Waste Storage Areas

Construction & requirements

Floor

Concrete- towelled to a smooth and even surface with fall to waste connected to sewer.
Waste to be fitted with an approved in-floor dry basket arrestor

Walls

Block walls- rendered to a smooth even surface and painted with light coloured washable paint.
Provide coved interface between wall and floor.

Ceiling

Concrete painted with a light coloured washable paint

Doors

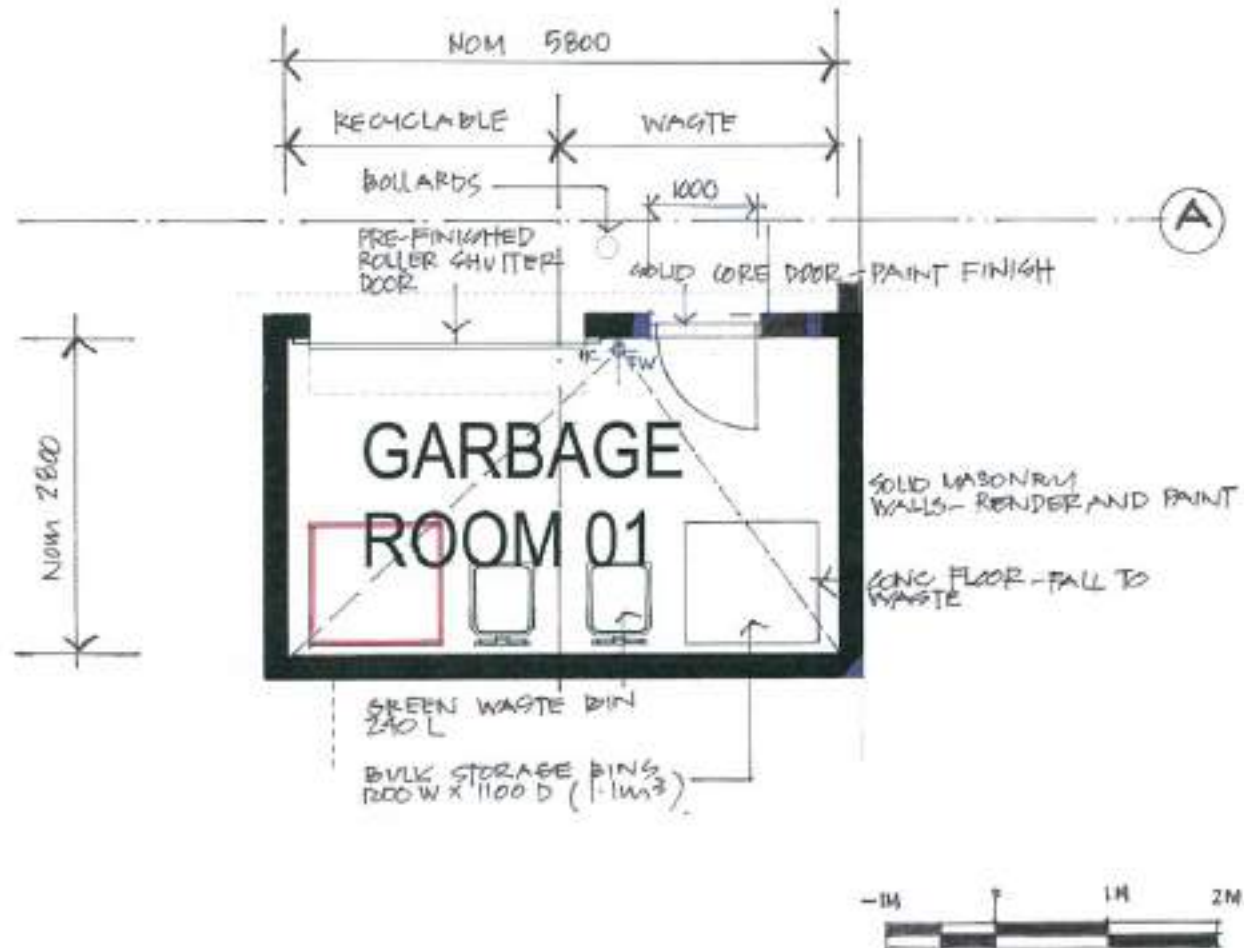
Smooth faced impervious materials for easy cleaning. Doors to be close fitting and self -closing openable fitted with a lever action handle in accordance with BCA requirements.

Rooms are to be provided with a,

- Tap and hose connection
- Permanent natural ventilation direct to the outside or a system of mechanical exhaust ventilation in accordance with relevant standards.
- Artificial lighting controlled by switches outside and inside or sensor switches.
- Clear signage describing how to use the waste facilities correctly

Waste Management Plan

Appendices Garbage Room 1



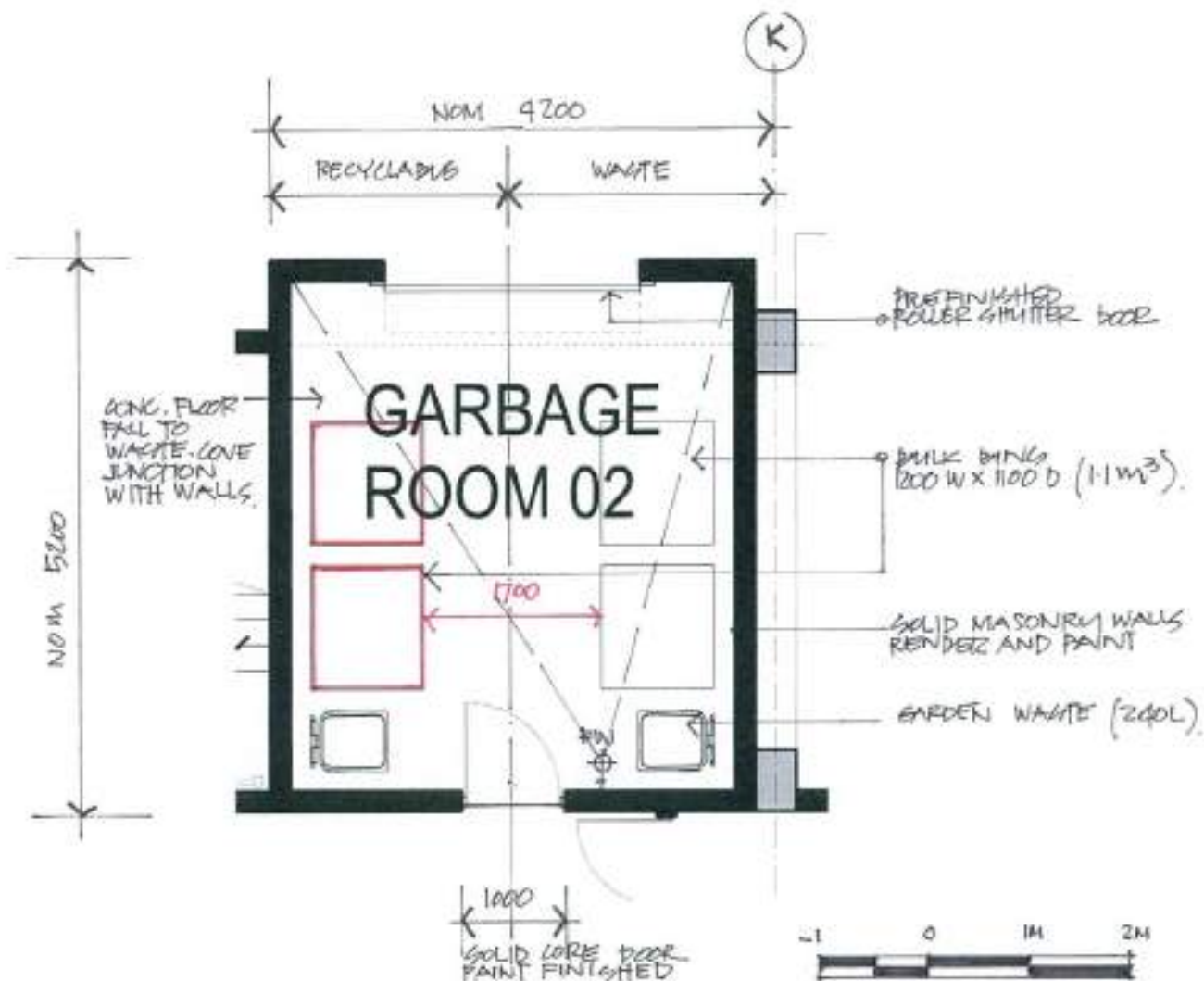
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Appendices

Garbage Room 2



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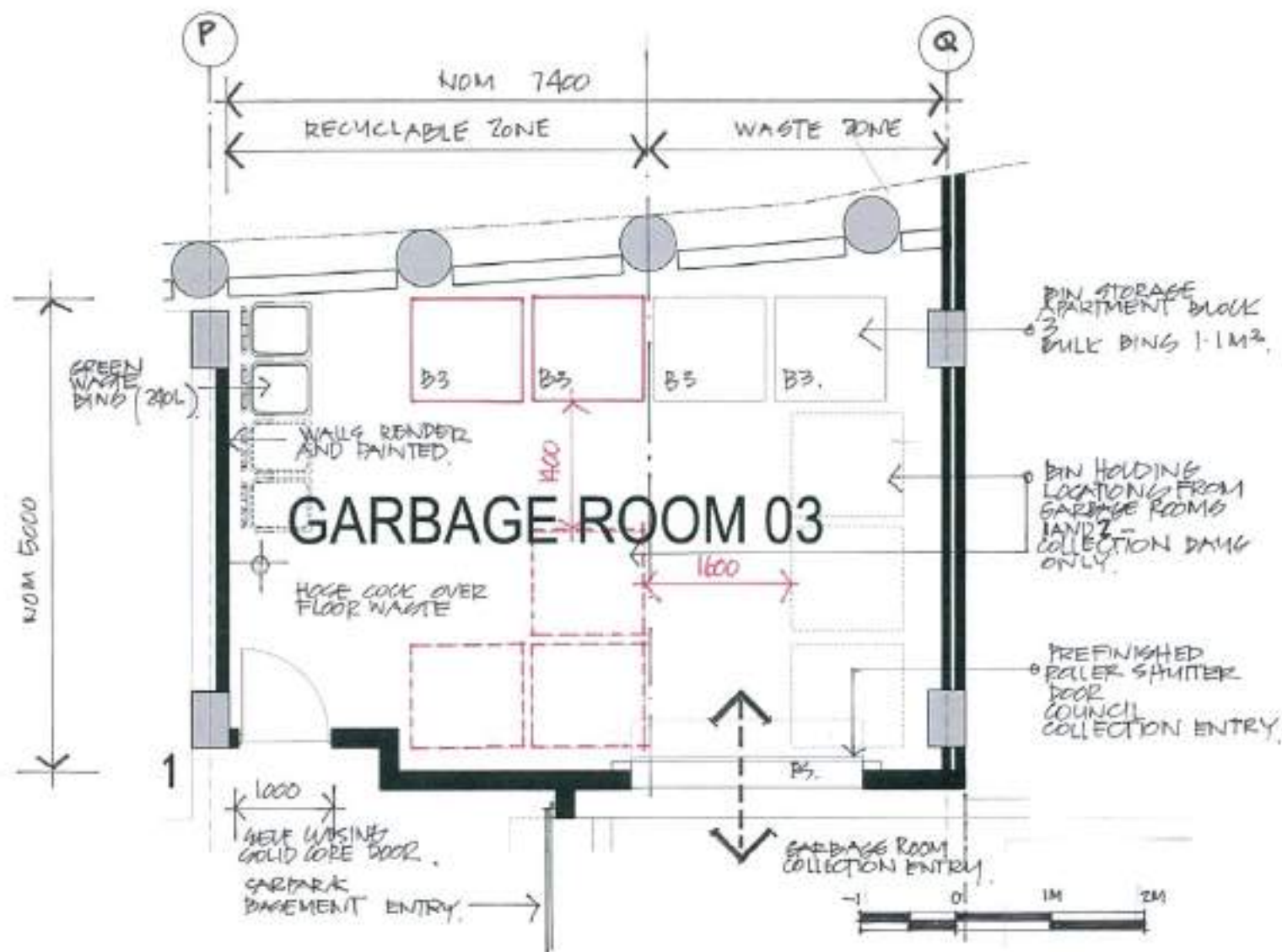


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Appendices Garbage Room 3



Waste Management Plan



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Appendices

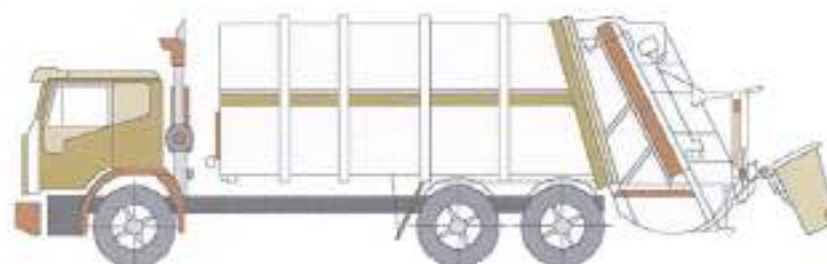
Appendix 2 – Collection Vehicle Type & Truck Turning Area

Collection vehicles

Waste collection vehicles may be side loading, rear-end loading, front-end loading or crane trucks. The size of vehicle varies according to the collection service. Thus it is impossible to specify what constitutes the definitive garbage vehicle. Developers should consult the local council and/or relevant contractors regarding the type of vehicle used in that area.

The following characteristics represent the typical collection vehicle, however, these are only for guidance:

It may be possible to engage a collection service provider to use smaller collection vehicles to service developments with narrow roadways and laneways, or for on-site collections. However, as the availability of smaller vehicles to make services varies between councils and private contractors, wherever possible the development should be designed to accommodate vehicles of a similar size to that reported below.



Rear loading collection vehicle

Rear loading collection vehicle	
Length overall	10.34m
Width overall	2.5m
Operational height	3.5m
Travel height	3.5m
Weight (vehicle only)	12.4 tonnes
Weight (payload)	9.5 tonnes
Turning circle	18.0m

This is commonly used for domestic garbage and recycling collections from MUDs. It can be used to collect waste stored in MGBs or bulk bins, particularly where bins are not presented on the kerbside.

Waste Management Plan



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Appendices

Appendix 2 – Collection Vehicle Type & Truck Turning Area



Waste Management Plan



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Appendices

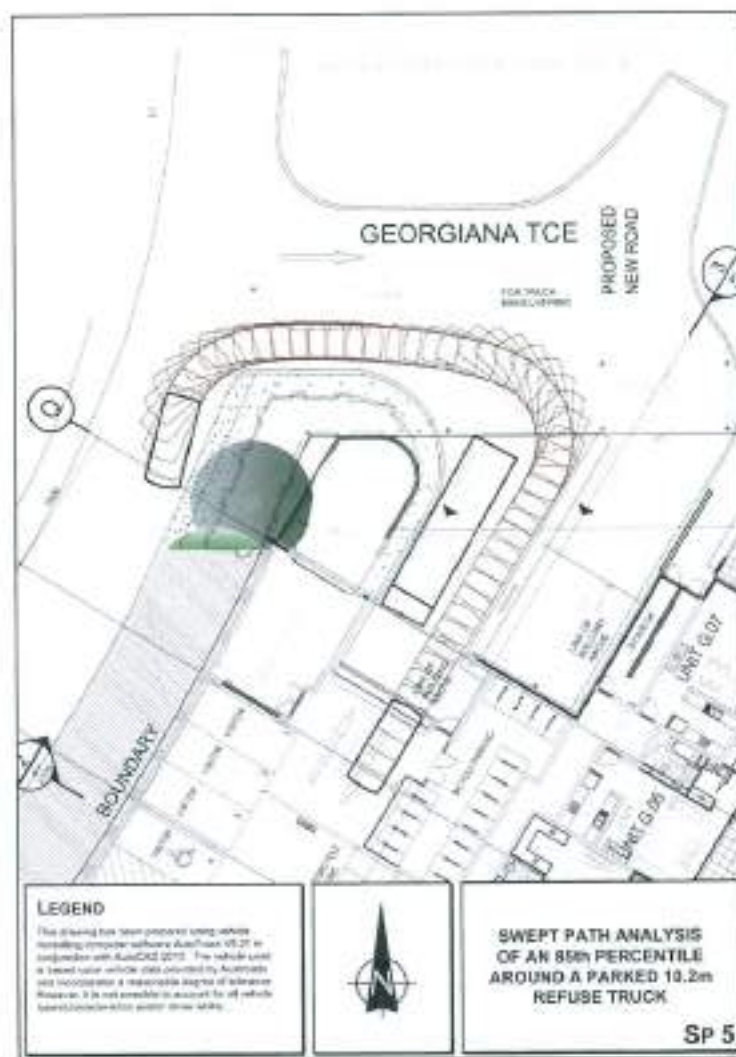
Appendix 2 – Collection Vehicle Type & Truck Turning Area



Waste Management Plan

Appendices

Appendix 2 – Collection Vehicle Type & Truck Turning Area





70 John Whiteway Drive Gosford

Flora and Fauna Assessment

Prepared for
DEM

16 December 2014



DOCUMENT TRACKING

Item	Detail
Project Name	70 John Whiteway Drive Gosford – Flora and Fauna Assessment
Project Number	14GOS - 708
Project Manager	Daniel Copeland (02) 4302 1224 Suite 5 Baker One, 1-5 Baker Street Gosford NSW 2250
Prepared by	Dr Enhua Lee
Reviewed by	Bruce Mullins
Approved by	Daniel Copeland
Status	DRAFT
Version Number	1
Last saved on	17 December 2014
Cover photo	70 John Whiteway Drive Gosford. Photo taken on 4/12/2014 by Enhua Lee

This report should be cited as 'Eco Logical Australia 2014. *70 John Whiteway Drive Gosford: Flora and Fauna Assessment*. Prepared for DEM.'

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Disclaimer

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Template 08/05/2014

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Abbreviations

Abbreviation	Description
BOM	Bureau of Meteorology
CA	Controlled Action
DA	Development Application
DECC	Department of Environment and Climate Change (State, now OEH)
DCP	Development Control Plan
DoE	Department of the Environment (Commonwealth)
EEC	Endangered Ecological Community
ELA	Eco Logical Australia
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (State)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
GEMS	Gosford Council's Electronic Mapping System
GPS	Global Positioning System
LEP	Local Environment Plan
LGA	Local Government Area
NCA	Non-controlled action
NCA-SM	Non-controlled action – specified manner
NES	National Environmental Significance
OEH	Office of Environment and Heritage (State)
REMS	Regional Environmental Management Strategy
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
TSC Act	<i>Threatened Species Conservation Act 1995</i> (State)
WONS	Weeds of National Significance

Certification

The results presented in this report are a true and accurate account of the species recorded, or considered likely to occur, within the study area.

The survey work has been undertaken in accordance with the *Flora and Fauna Survey Guidelines: Lower Hunter Central Coast Region 2002* (Murray et al. 2002), and where it has departed from the Guidelines, details are discussed and justified.

All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995*, *National Parks and Wildlife Act 1974* and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

1 Introduction

1.1 Background

Eco Logical Australia Pty Ltd (ELA) was commissioned by DEM to undertake a flora and fauna assessment to accompany a Development Application (DA) for a residential development at 70 John Whiteway Drive, Gosford (the subject site). The subject site is located within the Gosford Local Government Area (LGA), and lies near the centre of Gosford between the suburbs of West Gosford, North Gosford, and East Gosford (**Figure 1**).

This report:

- Describes the method to determine the presence of vegetation communities or threatened species;
- Assesses the likelihood of occurrence for threatened species occurring in the subject site;
- Describes the extent of remnant native vegetation on the subject site;
- Describes the habitat features on the subject site, such as the occurrence of tree hollows;
- Assesses the potential impacts of the proposal on threatened flora and fauna species with the potential to occur in the subject site;
- Makes recommendations to minimise impacts to ecological matters in the study area; and
- Includes Assessments of Significance (7-part Tests) and Significance Assessments for relevant threatened species, populations or communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), respectively.

Key Terms:

Subject Site: the area directly affected by the proposal (70 John Whiteway Drive, Gosford).

Study Area: according to the *Threatened species survey and assessment; guidelines for developments and activities* (Department of Environment and Conservation [DEC] 2004), and the *Flora and Fauna Survey Guidelines: Lower Hunter Central Coast Region 2002*; Murray et al. 2002), the study area includes the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. It is difficult to estimate the additional areas of indirect impacts from this proposal. However, given the current and future access to, and the presence of apartment blocks directly downslope of, 70 John Whiteway Drive, it is likely that indirect impacts will be contained within 70 John Whiteway Drive. Therefore, for the purposes of this report, the study area is the same as the subject site.

1.2 Subject site

The subject site is approximately 0.47 ha in size. It is bound in the west by John Whiteway Drive, in the south and east by residential development, and in the north and east by Rumbalara Reserve. The subject site has been the subject of a previous DA, lodged in 2002, and modifications to this DA have been lodged (information from Gosford Council website). It has also been subject to previous ground disturbance.

Vegetation in the study area and locality are comprised of forest and rainforest communities, with some woodland, shrubland/heathland, and wetland communities also present (Bell 2004). Hawkesbury Sandstone forms the underlying geology of the study area and locality. The subject site has been

mapped as occurring on disturbed terrain (southern parts of the site) and on the Erina Soil Landscape group (northern parts of the site). The Erina Soil Landscape group supports a variety of soil types including brownish-back fine sandy loam, yellowish-brown sandy clay loam, yellowish-brown sandy clay, reddish-brown clay, and yellow-orange clay. Nearby areas have been mapped as occurring on the Watagan Soil Landscape group.

There are no watercourses or wetlands within the subject site. The nearest watercourses are Erina Creek and Narara Creek, which are located approximately 1.3 km to the south east and 1.7 km to the west, respectively. The nearest reserve, Rumbalara Reserve, lies directly adjacent to the subject site, to the north east (**Figure 1**). Contiguous vegetation connects Rumbalara Reserve to Katandra Reserve, which is located approximately 2 km north east of Rumbalara Reserve. Brisbane Water National Park lies approximately 2 km away from the subject site, to the south west.

1.3 The Project

The Project proposes to clear vegetation and flora and fauna habitat on 70 John Whiteway Drive for the construction of a 75 unit apartment block. The disturbance footprint is approximately 0.33 ha. The indicative layout of the units is shown in **Figure 2**. The proposal includes sub-terraneum disturbance.

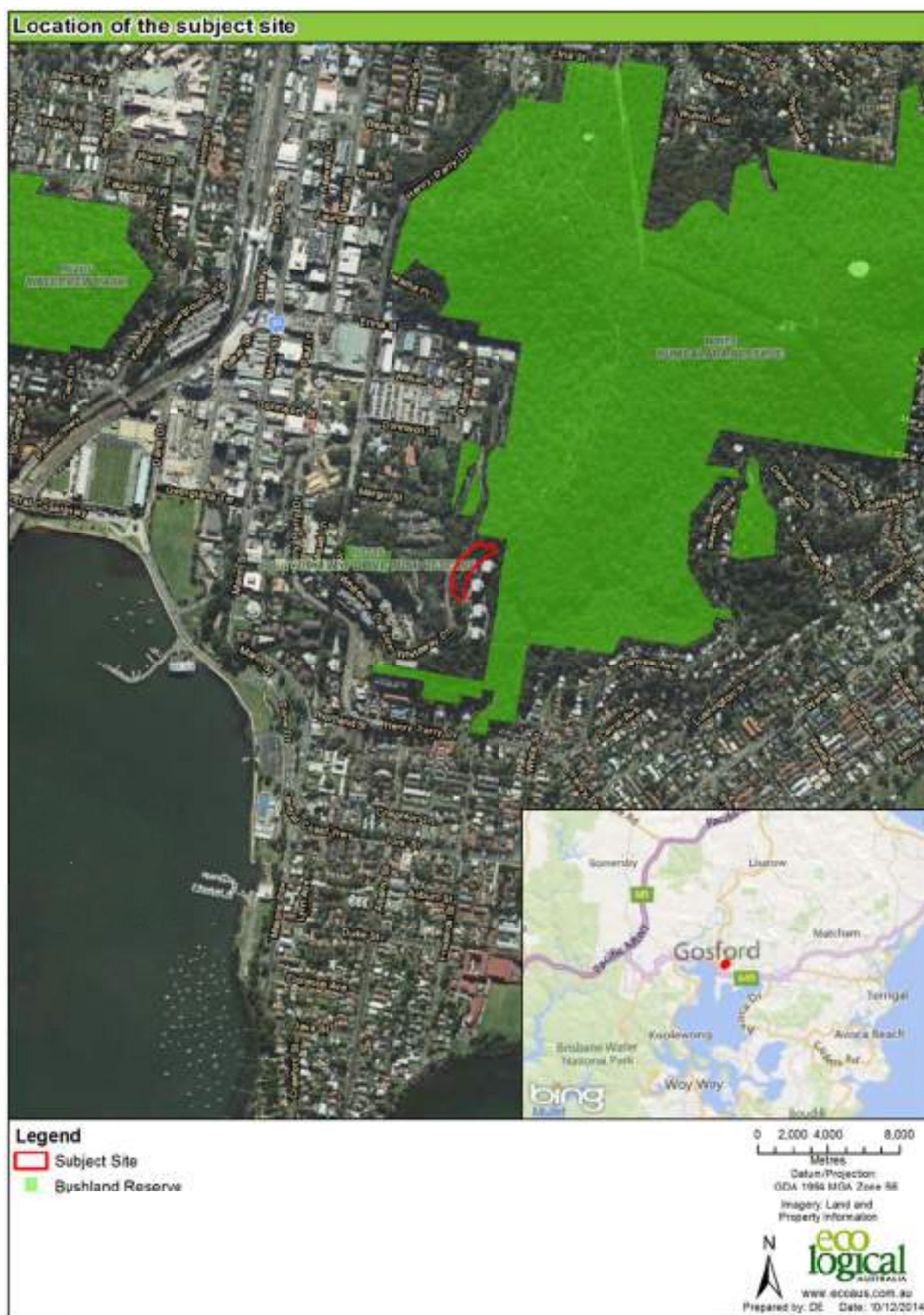


Figure 1: Location of the subject site and nearby bushland reserves



2 Legislative requirements

Commonwealth and State legislation and policies, as well as local policies apply to the assessment, planning and management of ecological issues within the subject site. A brief outline of the relevant Commonwealth and State Acts and policies, and local policies, is provided below.

2.1 Commonwealth legislation

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes a process for assessing the environmental impact of activities and developments where 'matters of national environmental significance' (NES) may be affected. The matters of NES relevant to this study include threatened species, ecological communities and migratory species (JAMBA/CAMBA/ROKAMBA) that are listed under the Act.

Under the Act, any action which 'has, will have, or is likely to have a significant impact on a matter of national environmental significance' is defined as a 'controlled action', and requires approval from the Commonwealth Department of the Environment (DoE) which is responsible for administering the EPBC Act.

Actions that may have a significant impact on one or more matters of NES need to be referred to the Department under the EPBC Act. The EPBC Act referrals process can produce one of three outcomes:

1. Non-controlled action (NCA): Assessment and approval under the EPBC Act is not required. The project may proceed without further approval under the EPBC Act.
2. Non-controlled action – particular manner (NCA-PM): Assessment and approval under the EPBC Act is **not required** provided the action is undertaken in a specific way (similar to conditions).
3. Controlled Action (CA): The project will, or is likely, to have a significant impact on one or more matters of national environmental significance. The project **will require** full assessment and approval before it can proceed.

This report highlights any EPBC NES matters potentially impacted, presents the results of Significance Assessments for these, and advises if a referral to the federal DoE is required.

2.2 State legislation and policies

2.2.1 Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. Various legislation and instruments, such as the NSW *Threatened Species Conservation Act 1995* (TSC Act), are integrated with EP&A Act.

In determining a development application, the consent authority is required to take into consideration matters listed under Section 79C of the EP&A Act that are relevant to the application. Key considerations include:

- Any environmental planning instrument, including drafts;

- The likely impacts of the development (including on biodiversity and threatened species, populations or ecological communities listed under the TSC Act);
- The suitability of the site for the development;
- Any submissions made in accordance with the EP&A Act or its regulations; and
- The public interest.

2.2.2 Threatened Species Conservation Act 1995

The TSC Act, as amended, aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The interactions between the TSC Act and the EP&A Act requires consideration of whether a development (Part 4 of the EP&A Act), or an activity (Part 5 of the EP&A Act), is likely to significantly affect threatened species, populations, ecological communities or their habitats.

This report highlights threatened species, communities and populations and their habitats that are present or have the potential to be present on the site. It provides results of EP&A Act assessments (Assessments of Significance, also known as 7-part tests) for matters protected under the TSC Act that may be impacted.

2.2.3 State Environmental Planning Policy No. 19 – Bushland in Urban Areas

State Environmental Planning Policy (SEPP) No. 19 aims to protect and preserve bushland within the urban areas for its value to the community as part of the natural heritage, its aesthetic value, and its value as a recreational, educational and scientific resource. SEPP 19 applies to the Gosford LGA area. Given the subject site lies adjacent to Rumbalara Reserve, Gosford Council must consider the effect of The Project on the erosion of soils, the siltation of streams and waterways and the spread of weeds and exotic plants within Rumbalara Reserve.

2.2.4 State Environmental Planning Policy No. 44 – Koala Habitat Protection

SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline. SEPP 44 applies to the Gosford LGA area. However, it does not apply to the subject site given the subject site is not greater than 1 ha. Even so, an assessment of Koala habitat has been made in accordance with Part 2 of the SEPP (see Section 3.2).

2.3 Local Government Plans

The Gosford Local Environmental Plan (LEP) 2014 is the principal planning instrument for the Gosford LGA. The LEP sets out planning decisions and establishes the requirements for the protection, use and development of land in Gosford. In the hierarchy of Gosford Council's environmental planning documents it stands at the top, providing broad direction. Further detail is provided in Gosford Council's Development Control Plan (DCP) 2013, which outlines specific, more comprehensive guidelines for certain types of development in the Gosford area. Detail is also provided in Gosford Council's planning maps.

According to Gosford Council's DCP (Part 6 - Environmental Controls, specifically Part 6.6 - Preservation of Trees or Vegetation), flora and fauna impact assessments (survey and reporting) are to be undertaken in accordance with *Flora and Fauna Survey Guidelines: Lower Hunter Central Coast Region 2002* (Murray et al. 2002), and with guidelines prepared by the NSW State Government for assessment of matters under the TSC Act. This report meets these requirements, with justifications provided where requirements have not been met.

The land constraint maps provided in Gosford Council's planning maps show that the subject site is unaffected by constraints including flooding, acid sulphate soils, and significant and endangered vegetation. However, the subject site lies on bushfire prone land (Category 1).

3 Methods

3.1 Data audit

Database records and relevant literature and mapping pertaining to the ecology of the site and surrounding area were reviewed to determine the biodiversity values, in particular the presence of threatened species, populations and ecological communities, and to guide the field survey component and gain site context. The material reviewed included:

- Gosford LGA vegetation mapping (as mapped in Gosford Council's Electronic Mapping System; GEMS) (Gosford Council 2014);
- Gosford vegetation community profiles (Bell 2004);
- Regional Environmental Management Strategy (REMS) vegetation mapping;
- BioNet Atlas of NSW Wildlife (OEH 2014a). Search of data undertaken on 20/11/2014, 5 km search radius around -33.43 151.35;
- DoE Protected Matters Search Tool (DoE 2014). Point search of coordinates -33.43 151.35 with 10 km buffer undertaken on 20/11/2014);
- Threatened species profiles (OEH 2014b); and
- Scientific Committee threatened species determinations (OEH 2014c).

High resolution aerial photographs of the site and surrounding area were also used to investigate the extent of vegetation cover, landscape features and land use in the area prior to field survey. In addition, relevant GIS datasets (soil, drainage) were reviewed.

Species from both the Atlas of NSW Wildlife searches and searches for matters of NES, other than marine species (e.g. turtles and seabirds), were combined to produce a list of threatened species that may possibly occur within the site ('subject species'). Likelihood of occurrences for threatened species, endangered populations and communities in the site were then made based on location of database records, the likely presence or absence of suitable habitat on the site, and knowledge of the species' ecology, to limit the list of threatened species to potentially 'affected species' (those that were defined as "yes", "likely" or having "potential" to occur on the site – see below).

Five terms for the likelihood of occurrence of species are used in this report, as defined below:

- "yes" = the species was or has been observed on the site;
- "likely" = a medium to high probability that a species uses the site;
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur;
- "unlikely" = a very low to low probability that a species uses the site; and
- "no" = habitat on the site and in its vicinity is unsuitable for the species.

Note that assessments for the likelihood of occurrence were made both prior to and following field survey. The pre-survey assessments were performed to determine which species were potentially 'affected species', and hence determine which sorts of habitat to look for during field survey. The post-survey assessments to determine final 'affected species' were made after observing the available habitat on the site first hand.

3.2 Site inspection

The subject site was surveyed for approximately two person hours on 4 December 2014 by Senior Ecologist, Dr Enhua Lee, to determine biodiversity values on the subject site and the presence of threatened species, populations and ecological communities. Qualifications are provided in **Appendix A**, along with relevant licence details. The survey included vegetation mapping validation, photographs, noting of habitat features such as hollow-bearing trees, and recordings of signs of fauna usage.

During the survey, temperatures were mild to warm and the sky was overcast. The maximum temperature for the day, recorded at Gosford, reached 29.1°C (Bureau of Meteorology [BOM] 2014). There was some light rain during survey, but most fell following survey (6.2 mm for the day; BOM 2014). Further detail of the methodology used for the flora and fauna assessment has been provided below.

The subject site is 0.47 ha, while the area of ground disturbance is 0.33 ha. The subject site is just beyond the “small site” (0.1 ha) described in the guidelines (Murray et al. 2002), thereby requiring a more detailed site inspection. The recommended minimum guidelines were considered for this assessment, but based on the size of the site, level of disturbance, position in the landscape and absence of corridors, a more streamlined assessment cognisant of the site’s small size, was devised. Our methods are described in more detail in the following sections.

3.2.1 Validation of vegetation communities and threatened flora and fauna species searches

Vegetation validation was undertaken by ground-truthing the vegetation communities mapped for the subject site and adjacent areas (see **Figure 3**). Ground-truthing of vegetation communities and searches for threatened flora and fauna species were undertaken through random meander traverses. The traverses were undertaken on all accessible parts of the subject site and looking down at vegetation from the road where terrain was steep and vegetation was dense (i.e. southern end of the subject site); however, traverses focussed on areas where native vegetation, microhabitats, or other types of potential fauna habitat were present.

During traverses of the subject site, all visible vascular flora and fauna species encountered were recorded, and dominant flora species in the canopy, mid-storey and under-storey were noted. Flora species were identified to the lowest taxonomic level possible. Where threatened flora or fauna species were encountered, their locations were marked using a Global Positioning System (GPS).

No measurements of cover abundance for flora species, within vegetation survey plots or otherwise, were undertaken. Further, no targeted fauna survey was undertaken. The subject site did not contain the sensitive matters listed in the guideline checklist for surveying small sites: rainforest, coastal dunes/headlands, wetlands and swamps, dams/ponds/watercourses/riparian areas, vegetation communities listed in Sections 5.7 or 5.8 of the guidelines, vegetation communities listed in Appendix 5.13 of the guidelines. However, the subject site contained Koala feed trees. The feed tree species in the subject site, *Eucalyptus pilularis*, is not a preferred feed tree species listed under Schedule 2 of SEPP 44. Rather, it is a supplementary feed tree species listed in the guidelines. The *Flora and Fauna Survey Guidelines: Lower Hunter Central Coast Region 2002* (Murray et al. 2002) only requires further assessment for Koala (vegetation mapping and Koala habitat identification and activity levels) if sites contain greater than 15% Schedule 2 tree species.

3.2.2 Flora and fauna habitat

The presence of potentially important habitat features for flora and fauna, such as hollow-bearing trees, potential nesting or roosting sites, rocky outcrops, water bodies, Koala preferred feed tree species (as listed in Schedule 2 of SEPP 44), and winter-flowering eucalypts were recorded during traverses