Planning Proposal

Rockdale Local Environmental Plan 2011

Rezoning of land at 119 Barton Street, Monterey to R3, Medium Residential Density

Bayside Council

August 2017

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Introduction

This Planning Proposal explains the intended effect of, and justification, for the proposed amendment to *Rockdale Local Environmental Plan 2011 (Rockdale LEP 2011)*. It has been prepared in accordance with Section 55 of the *Environmental Planning and Assessment Act 1979* and the relevant Department of Planning and Environment guides, including 'A Guide to Preparing Local Environment Plans' and 'A Guide to Preparing Planning Proposals'.

Background

Comprising the former Francis Drake Bowling Club, the site is a large battle axe lot at 119 Barton Street, Monterey. With a northern frontage of approximately 35 metres to Barton Street, the site has a total area of 7,218 sqm.

The site is proximate to commercial centres at Brighton-Le-Sands, 1.6km to the north, Ramsgate commercial centre 1.2km to the south and Kogarah commercial centre 1.5km to the north west. It is also 1.5km from the St George Hospital precinct which has been designated for major education/health development with employment of up to 10,000.

A site-specific zoning of RE2 Private Recreation applies to the subject land. However, the land lies within an R3 Medium Density Residential zone that surrounds it on all four sides.

This Planning Proposal seeks to amend the current zoning under RLEP 2011 from Private Recreation (RE2) to Medium Density Residential (R3) to make permissible the redevelopment of the subject land at 119 Barton Street.

Planning Proposal will be achieved by:

- Amending the Rockdale LEP 2011 Land Use Map for the former Sir Francis Drake Lawn Bowls Club at 119 Barton Street in accordance with Part 4 of this report.
- Establishing a Building Height that is consistent with the existing land uses of the subject area, i.e. 8.5m.
- Establishing an FSR that is the same as the surrounding area, currently 0.6:1 in the Rockdale LEP 2011.

An analytical study conducted by Rothelowman has produced a model for potential development yield and building typology. By way of example, this concept illustrates the capacity of the subject site to accommodate 28 two and three-bedroom townhouses under a fully compliant proposal with Council current guidelines for R3.

Rezoning of the site will not deprive the community of open space. The site was a private open space with its use limited to club members. Additionally, there is considerable open space 400m to the west at Scarborough Park, and 150m to the east, at Cook Park on the bay front.

The objective of the current scheme is to increase the number and diversity of dwellings in the subject area which is within proximity to an identified strategic centre. The relevant objectives of the Planning Proposal are as follows:

- *To provide increased housing consistent with the surrounding residential zoning of the locality*
- *To provide quality housing choices that are consistent with the existing zoning of the neighbourhood.*
- *Provide a feasible and sustainable economic use of the subject site.*

The proposal is compliant with all relevant SEPPs and the Minister's s117 Directions under the EPA Act.

Part 1 - Objectives and Intended Outcomes

Currently, the subject site is underutilised and does not meet its full development potential. Located on the site is a redundant lawn bowls facility with a low capacity for improvement. Changes to the land use zoning and development standards identified below, will allow the site to potentially accommodate a residential development of high quality design. It is intended that the Planning Proposal form a site-specific amendment to the RLEP 2011.

The intended outcomes of the Planning Proposal are to amend *Rockdale LEP 2011* as follows:

- **Rezone the subject land to R3 Medium Density Residential (as is the land surrounding the site to all sides);**

- **Establish a site-specific maximum building height of 8.5 m (as is the land surrounding the site to all sides); and**

- **Establish a site-specific maximum floor space ratio (FSR) of 0.6:1 (as is the land surrounding the site to all sides).**

A site-specific zoning of RE2 Private Recreation applies to the subject land. However, the land lies within a R3 Medium Density Residential zone that surrounds it on all four sides.

Census statistics shows that houses in Monterey are dwellings primarily occupied by older people who are likely to be empty nesters remaining in family homes which are now larger than their needs in terms of bedroom numbers.

Regarding accessibility to modes of public transport for residents, the subject land lies within easy walking distance of bus services along Chuter Ave (270m west) and the Grand Parade (130m east). The Grand Parade is serviced by bus routes travelling north, Route 303 (Sans Souci to Circular Quay), and south, Route 478 (Ramsgate to Rockdale). An express service, Route X03, operates between Sans Souci and Circular Quay during peak periods Monday to Friday providing access to the city (Central Station) within 30 mins. Chuter Ave is serviced by Route 947 (operated by Transdev NSW), which runs between Hurstville to Kogarah.

The draft District Plans support the increase of housing across the Bayside LGA by monitoring the delivery of the five-year housing target of 10,150 dwellings while recognising significant growth in infill areas. Housing diversity and affordability are also major considerations in the strategic direction of LGAs located in the Central District. An increase in the proportion of people that are ageing and/or disabled has highlighted a need for the delivery of diverse housing which includes smaller homes, group homes, adaptable homes and aged care facilities.

A Plan for Growing Sydney (the Plan) anticipates that 664,000 new homes will be needed by 2031. The Plan highlights the importance of facilitating the movement of Sydney residents between their homes, their jobs, commercial centres and open spaces.

The proposal is consistent with the Plan as it will accelerate the delivery of housing to contribute to the State Government target of 664,000 homes by 2031 (direction 2.1). These homes will be provided within established centres supported by public transport, utilities, social infrastructure and employment opportunities within the Kogarah strategic centre, which lies approximately 1.6km from the subject site. The Kogarah priority health and education precinct is planned to provide at least 10,000 jobs (direction 2.2). The proposal will permit infill medium density development to meet the needs of growing number of small households within a locality otherwise dominated by detached dwelling houses (direction 2.3).

The proposal will provide an opportunity to revitalise an existing suburb through the redevelopment of a disused facility to create an improved streetscape (direction 3.1). Redevelopment of the site has the potential to encourage a healthy community through the provision of communal open space, sustainable design and end of journey facilities that encourage cycling in this relatively flat area (direction 3.3).

Section 117 Directions

Direction 3.1 Residential Zones

The first relevant s117 Direction is 3.1 – Residential Zones whose objectives are:

> *(a) to encourage a variety and choice of housing types to provide for existing and future housing needs,*
> *(b) to make efficient use of existing infrastructure and services and ensure that new housing has appropriate access to infrastructure and services, and*
> *(c) to minimise the impact of residential development on the environment and resource lands*.

The development of townhouses on the subject site will be consistent with the planning for the area which seeks medium density housing, will increase the choice of housing which is currently and predominantly single dwellings, and will make good use of existing open space and public transport infrastructure. Services such as water, sewerage and electricity are available in the street. No adverse impact on the environment at large will result from the infilling of residential development on the subject site.

Direction 3.4 Integrating land use and transport

The objective of Direction 3.4 is to:

ensure that urban structures, building forms, land use locations, development designs, subdivision and street layouts achieve the following planning objectives:

> *(a) improving access to housing, jobs and services by walking, cycling and public transport, and*
> *(b) increasing the choice of available transport and reducing dependence on cars, and*
> *(c) reducing travel demand including the number of trips generated by development and the distances travelled, especially by car, and*
> *(d) supporting the efficient and viable operation of public transport services, and*
> *(e) providing for the efficient movement of freight. Where this direction applies*

A planning proposal must include provisions that are consistent with the principles of *Improving Transport Choice – Guidelines for planning and development (DUAP 2001)*, and *The Right Place for Business and Services – Planning Policy*[1].

As mentioned above, the subject site is serviced by a number of bus services, along Chute Avenue and the Grand Parade. The proposal satisfies the objectives of Direction 3.4.

Though the planning proposal does change the existing RE2 – Private Recreation zoning to R3 - Residential, it will provide an increased and diverse supply of housing within approximately 2km of the Kogarah Strategic Health Centre. The proposal makes use of existing transport infrastructure and, therefore, it is consistent with the policy.

Direction 7.1 Implementation of A Plan for Growing Sydney

Direction 7.1 applies to land within the former local government area of Rockdale. Its objective is to:

> *give legal effect to the planning principles; directions; and priorities for subregions, strategic centres and transport gateways contained in A Plan for Growing Sydney.*

Refer to discussion regarding consistency with strategic direction under Part 3-B below.

[1] Department of Planning and Environment. Policy Directions for Plan Making. (Page 17)

Part 2 - Explanation of Provisions

A – Provisions that are shown on control maps

2.1 – land use zoning

The subject site is zoned RE2 Private Recreation under the Rockdale Local Environmental Plan 2011, the objectives of the RE2 Zone are as follows:

- *To enable land to be used for private open space or recreational purposes.*
- *To provide a range of recreational settings and activities and compatible land uses.*
- *To protect and enhance the natural environment for recreational purposes.*

Permissible and prohibited uses within the zone are summarised in Table 2 below. The former Francis Drake Bowling Club constituted development for the purpose of a registered club (outdoor). Residential development is prohibited within the RE2 zone.

TABLE 1: DEVELOPMENT STANDARDS UNDER ROCKDALE ENVIRONMENTAL PLAN 2011 - Part 2 Permitted or Prohibited Development	
CONTROL	**PROPOSAL**
Clause 2 Permitted without consent	Roads
Clause 3 Permitted with consent	Boat launching ramps; Building identification signs; Business identification signs; **Community facilities**; Environmental facilities; Environmental protection works; Jetties; Kiosks; Recreation areas; Recreation facilities (indoor); Recreation facilities (major); Recreation facilities (outdoor); Registered clubs; Water supply systems
Clause 4 Prohibited	Any development not specified in item 2 or 3

As mentioned above, the subject site is currently zoned RE2 – Private Recreation with the surrounding area being R3 – Medium Density Residential. Residential development under the current zoning is prohibited. Notwithstanding, this Planning Proposal is for the change in land use zoning from RE2 to R3, which is justified as it is consistent with the surrounding zoning and will accommodate a townhouse-style development such as the neighbouring site at 125 Barton Street.

2.2 – Height of Building

Building height for the subject site is not currently prescribed under clause 4.3 in the RLEP 2011. Though the site is excluded from the Height of Buildings Map, the immediate area has a maximum height of 8.5m. The objectives of this clause are as follows:

(*a*) *to establish the maximum limit within which buildings can be designed and floor space can be achieved,*
(*b*) *to permit building heights that encourage high quality urban form,*
(*c*) *to provide building heights that maintain satisfactory sky exposure and daylight to buildings, key areas and the public domain,*
(*d*) *to nominate heights that will provide an appropriate transition in built form and land use intensity*

The Planning Proposal will establish a maximum building height of 8.5m, which is consistent with the prevailing height limit for the subject area. Amending the map referred to in clause 4.3 to include the subject site meets the above objectives.

2.3 – Floor Space Ratio (FSR)

FSR for the subject site is not currently prescribed under clause 4.4 in the RLEP 2011. Though the site is excluded from the FSR Map, the immediate area has a maximum FSR of 0.6:1. The objectives of this clause are as follows:

(a) to establish the maximum development density and intensity of land use, accounting for the availability of infrastructure and generation of vehicular and pedestrian traffic, in order to achieve the desired future character of Rockdale,
(b) to minimise adverse environmental effects on the use or enjoyment of adjoining properties,
(c) to maintain an appropriate visual relationship between new development and the existing character of areas or locations that are not undergoing or likely to undergo a substantial transformation.

Currently, the subject site is exempt from the RLEP 2011 Floor Space Ratio map (see figure 6). Amending the FSR of the site to a density that is consistent with the surrounding area will have no unreasonable adverse impact on the amenity, extent of overshadowing or privacy of the adjoining properties.

B – All provisions

Development standards applicable to the subject land are summarised in Table 3 below.

TABLE 2: DEVELOPMENT STANDARDS UNDER ROCKDALE LOCAL ENVIRONMENTAL PLAN 2011	
CONTROL	**PROPOSAL**
Clause 4.1 Minimum subdivision lot size	**Not relevant.** No amendment of Clause 4.1 is proposed.
Clause 4.3 Building Height	**Not applicable.** The subject land is not identified on the Floor Space Ratio Map (Sheet HOB_005). A site-specific maximum building height of 8.5m, consistent with that permissible within the surrounding R3 medium density zone, is proposed to be applied to the subject land. Refer section **4 Mapping** below.
Clause 4.4 FSR	**Not applicable.** The subject land is not identified on the Floor Space Ratio Map (Sheet FSR_005). A site-specific maximum floor space ratio of 0.6:1, consistent with that permissible within the surrounding R3 medium density zone, is proposed to be applied to the subject land. Refer section **4 Mapping** below.
Clause 5.9 Preservation of trees or vegetation	**Not relevant.** No amendment of Clause 5.9 is proposed.

TABLE 2: DEVELOPMENT STANDARDS UNDER ROCKDALE LOCAL ENVIRONMENTAL PLAN 2011	
CONTROL	**PROPOSAL**
Clause 5.10 Heritage conservation	No amendment of Clause 5.10 is proposed. Subject land is not identified as a heritage item under this instrument nor does it lie within a conservation area identified on the RLEP 2011 Heritage Map (Sheet HER_005). The subject land does, however, lie within 150 metres of Cook Park along the Grand Parade to the east, which is identified as an item of local heritage significance (I168) under schedule 5 of RLEP 2011.
Part 6 Additional Local Provisions	**Not relevant.** No amendment of Part 6 is proposed.

Control Maps

Tile 005 of *Rockdale LEP 2011* control maps shows land use zoning, FSR and Height of Building for the subject site. Proposed changes and the amended development control maps are provided under Part 4 ‘Mapping’ below.

Part 3 - Justification

A Need for the planning proposal

A1 Is the planning proposal a result of any strategic study or report?

As noted below, the proposal meets many strategic objectives but the site is too small to have been featured in any strategic plans for the area.

Cook Park Plan of Management and Masterplan 2010

Cook Park is a large public recreation area that spans approximately 8 kilometers along the Botany Bay foreshore from the Cooks River to the mouth of the Georges River. Due to its size and local significance, Cook Park is the focal point for a number of suburbs on the western shore of Botany Bay. The Cook Park Plan of Management and Masterplan sets out the strategic direction for the park and minimising impacts from surrounding areas.

Part 5 of the Plan outlines the strategy for conserving the park's environment, heritage and character. This is relevant to the proposal as views of Botany Bay, through the park, are available along Barton Street. The proposed change of use will be consistent with the values of this section which outline the conservation of heritage, social and natural value, visual quality, and recreational space.

As a part of this proposal, the site will have a maximum building height of 8.5m with an FSR of 0.6:1. Strategies identified in the Plan, such as establishing green links and maintaining view corridors, have been recognised and are encompassed in the objectives, **Section 4.1**, below.

Figure 1: Extract – *Cook Park – Plan of Management and Masterplan*

Open Space & Recreation Strategy 2010

In 2010, Rockdale City Council released a strategy to enhance the quality of open space and recreational areas. The Open Space & Recreation Strategy set goals that are consistent with the key strategic direction of The Rockdale City Plan 2009-2018. These goals are:

- A City with a Sense of Pride
- A Liveable City with Lifestyle Qualities
- A Connected and Accessible City
- A City with Viable Business and Employment Opportunities

A2 Is the planning proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

Due to the very restrictive nature of the current zoning, RE2 Private Recreation, there is no other way to achieve economic and orderly use of the site other than by a rezoning.

B Relationship to strategic planning framework

B1 Is the planning proposal consistent with the objectives and actions contained within the applicable regional, sub-regional or district plan or strategy (including any exhibited draft plans or strategies)?

There are no detail strategies of sufficient detail to state that the proposal has been brought into existence following the adoption of such strategies. However, all of the more generalised strategies, such as the exhibited draft district plans, support a conversion of the subject site into a minor residential development (potentially 28 dwellings). It is completely consistent with surrounding zoning.

Draft District Plans

The draft District Plans were put on exhibition by the Greater Sydney Commission (GSC) in November 2016 and follow the direction set by *A Plan for Growing Sydney*. Goals set out by the GSC have included the strategy of providing integrated and effective land use, transport and infrastructure over the next 20 years. The draft plans will also act as an intermediary plan between state and local policies. More specifically, the draft plans aim to manage the growth of the region by enhancing the local liveability and productivity of the six districts. Provisions for Bayside Council are outlined in the draft Central District Plan, which includes targets for housing and employment.

For the Central District, opportunities for job growth should be supported by facilitating the needs of innovative and creative industries. Consideration should be given to the full spectrum of economic activity including small start-ups which should incorporate efficient working arrangements that are in close proximity to home[2].

Though Monterey is located within the Central District, it is situated approximately 1.5 km east of Kogarah which lies within the South District. The Kogarah strategic centre has been identified in the South District Plan as a health and education super precinct (Action P1 – South District)[3]. Development in Kogarah,

[2] Greater Sydney Commission. Draft Central District Plan (p. 42-55, Rep.)
[3] Greater Sydney Commission. Draft South District Plan (p. 47-49, Rep.)

according to the draft plan, is apparently more important for Monterey than development further north around Sydney Airport. Objectives for managing the growth of the health and education precinct are as follows:

- *promote synergies between the St George Hospital and other health and education related activities*

- ***encourage land use that will support the growth of the Kogarah health and education super precinct and will cater for specialised housing demands from staff, students and health visitors*** (our emphasis)

The draft District Plans support the increase of housing across the Bayside LGA by monitoring the delivery of the five-year housing target of 10,150 dwellings while recognising significant growth in infill areas. Housing diversity and affordability are also major considerations in the strategic direction of LGAs located in the Central District. An increase in the proportion of people that are ageing and/or disabled has highlighted a need for the delivery of diverse housing which includes smaller homes, group homes, adaptable homes and aged care facilities.

A Plan for Growing Sydney

A Plan for Growing Sydney (the Plan) anticipates that 664,000 new homes will be needed by 2031. The Plan highlights the importance of facilitating the movement of Sydney residents between their homes, their jobs, commercial centres and open spaces. Goals established by the Plan include the following (emphasis added):

- *A competitive economy with world-class services and transport;*

- ***A city of housing choice with homes that meet our needs and lifestyles;***

- ***A great place to live with communities that are strong, healthy and well connected; and***

- *A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources.*

The proposal is consistent with the Plan as it will accelerate the delivery of housing to contribute to the State Government target of 664,000 homes by 2031 (direction 2.1). These homes will be provided within established centres supported by public transport, utilities, social infrastructure and employment opportunities within the Kogarah strategic centre, which lies approximately 1.6km from the subject site. The Kogarah priority health and education precinct is planned to provide at least 10,000 jobs (direction 2.2). The proposal will permit infill medium density development to meet the needs of growing number of small households within a locality otherwise dominated by detached dwelling houses (direction 2.3).

The proposal will provide an opportunity to revitalise an existing suburb through the redevelopment of a disused facility to create an improved streetscape (direction 3.1). Redevelopment of the site has the potential to encourage a healthy community through the provision of communal open space, sustainable design and end of journey facilities that encourage cycling in this relatively flat area (direction 3.3).

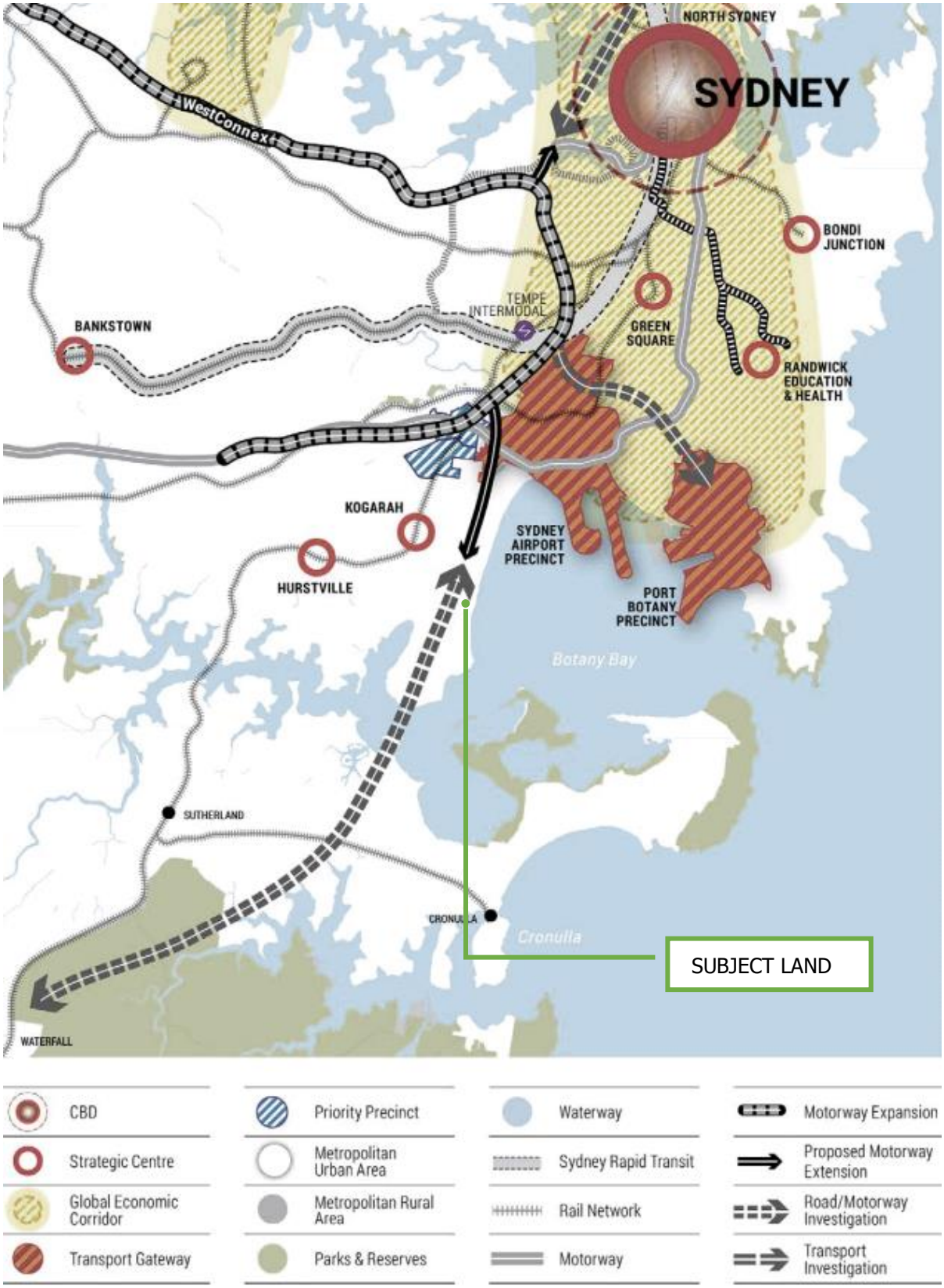

Figure 2: Extract from NSW Department of Planning's *Sydney Metropolitan Strategy: A Plan for Growing Sydney 2015* (p. 58).

B2 Is the planning proposal consistent with the local council's Community Strategic Plan or other local strategic plan?

To the extent possible for such a minor proposal, it is consistent with the former Rockdale's local strategy under which all of the surrounding land has been zoned Residential, R3, as is proposed in this case. There is no reason to believe that the strategy has changed following amalgamation of the Rockdale and Botany Bay City Councils into the Bayside Council.

Community Strategic Plan 2013-2025

The Community Strategic Plan's aim is to guide growth in the Rockdale LGA over a 12-year span. It will provide a strategic planning framework for a number of community outcomes that have been identified as council aspirations. The plan also provides a vision for how Rockdale City will encourage diverse development with effective housing choice and enhance opportunities for business growth.

Outcome 2 - Quality natural and built environment

TABLE 3 – Rockdale Community Strategic Plan 2013-2025

STRATEGY	PROPOSAL	COMPLIANCE
2.1.1 Protect, preserve and promote the City's natural resources	The proposal and related development will be consistent with the existing features of the subject area and complement significant City resources such as the foreshore and Cook Park.	**Complies**
2.1.2 Demonstrate leadership in responding to climate change through action and adaptation	Rezoning of the site has the potential to accommodate 28 townhouse units which will include an efficient design, compliant with building sustainability requirements.	**Complies**
2.2.1 Ensure planning enables the provision of quality affordable housing	Does not apply to the subject development. Not proposed	**N/A**
2.2.2 Promote high quality, well designed and sustainable development and places that enhance the City	Proposed design of the dwellings will respond to contemporary SEPP 65 principles even though the project does not fall under SEPP 65. Design of the dwellings will be provided at a later DA stage.	**Complies**
2.3.1 Ensure waste minimisation to reduce the impact on the environment	Waste management plan will be provided at DA stage.	**Can comply**
2.4.1 Ensure that Rockdale's natural and built heritage and history is respected, protected and well maintained reflecting the rich and diverse past of both Aboriginal and European settlement	The subject site has not been identified as a heritage item and is not situated in a conservation area. The closest heritage item is Cook Park (I168), which is located approximately 200m to the west.	**N/A**
2.5.1 Ensure that the City's transport networks and infrastructure are well planned, integrated and maintained	As mentioned in section 2.3, the subject area is serviced by a number of bus routes along Chuter Ave toward the CBD and is situated approximately 2 km from Kogarah train station. Public transport is currently underutilized in the Monterey locality as 62.5% of residents use private vehicle as a mode of transportation.	**Can comply**

TABLE 3 – Rockdale Community Strategic Plan 2013-2025		
STRATEGY	**PROPOSAL**	**COMPLIANCE**
2.5.2 Ensure sustainable current and future transport needs of the community providing access to services and facilities and enabling active living.	As above.	**N/A**

B3 Is the planning proposal consistent with applicable State Environmental Planning Policies (SEPPs)?

No SEPPs are contradicted by the planning proposal for the rezoning of the subject land that is totally encompassed by the existing low density residential development designated for conversion to medium density development. There is no inconsistency with the SEPPs.

Consistency with the State Environmental Planning Policies is provided in Table 4, below.

Table 4 - Consistency with State Environmental Planning Policies

No.	Title	Consistency with Planning Proposal
1	Development Standards	(Repealed by *RLEP 2011)*
14	Coastal Wetlands	Not Applicable
15	Rural Landsharing Communities	Not Applicable
19	Bushland in Urban Areas	Not Applicable
21	Caravan Parks	Not Applicable
22	Shops and Commercial Premises	Not Applicable
26	Littoral Rainforests	Not Applicable
29	Western Sydney Recreation Area	Not Applicable
30	Intensive Aquaculture	Not Applicable
32	Urban Consolidation (Redevelopment of Urban Land)	(Repealed*)*
33	Hazardous and Offensive Development	Not Applicable
36	Manufactured Home Estates	Not Applicable
39	Spit Island Bird Habitat	Not Applicable
44	Koala Habitat Protection	Not Applicable
47	Moore Park Showground	Not Applicable
50	Canal Estate Development	Not Applicable
52	Farm Dams and Other Works in Land and Water Management Plan Areas	Not Applicable
55	Remediation of Land	The proposal will be assessed at the DA stage as there is no indication that site requires remediation.
59	Central Western Sydney Regional Open Space and Residential	Not Applicable
60	Exempt and Complying Development	(Repealed by *RLEP 2011*)
62	Sustainable Aquaculture	Not Applicable
64	Advertising and Signage	Not Applicable
65	Design Quality of Residential Flat Development	Not Applicable
70	Affordable Housing (Revised Schemes)	Not Applicable
71	Coastal Protection	Not Applicable
	(Affordable Rental Housing) 2009	Not Applicable
	(Building Sustainability Index: BASIX) 2004	The proposal will comply with the relevant

		requirements at the DA stage.
	(Exempt and Complying Development Codes) 2008	Not Applicable
	(Housing for Seniors or People with a Disability) 2004	Not Applicable
	(Infrastructure) 2007	Not Applicable
	(Kosciuszko National park Alpine Resorts) 2007	Not Applicable
	(Kurnell Peninsula) 1989	Not Applicable
	(Major Development) 2005	Not Applicable
	(Mining, Petroleum Production and Extractive Industries) 2007	Not Applicable
	(Miscellaneous Consent Provisions) 2007	Not Applicable
	(Penrith Lakes Scheme) 1989	Not Applicable
	(Rural Lands) 2008	Not Applicable
	(SEPP 53 Transitional Provisions) 2011	Not Applicable
	(State and Regional Development) 2011	Not Applicable
	(Sydney Drinking Water Catchment) 2011	Not Applicable
	(Sydney Region Growth Centres) 2006	Not Applicable
	(Three Ports) 2013	Not Applicable
	(Urban Renewal) 2010	Not Applicable
	(Western Sydney Employment Area) 2009	Not Applicable
	(Western Sydney Parklands) 2009	Not Applicable

See Table 5 below which reviews the consistency with the formerly named State Regional Environmental Plans, now identified as deemed SEPPs.

Table 5 - Consistency with deemed State Environmental Planning Policies

No.	Title	Consistency with Planning Proposal
8	(Central Coast Plateau Areas)	Not Applicable
9	Extractive Industry (No.2 – 1995)	Not Applicable
16	Walsh Bay	Not Applicable
18	Public Transport Corridors	Not Applicable
19	Rouse Hill Development Area	Not Applicable
20	Hawkesbury-Nepean River (No.2 – 1997)	Not Applicable
24	Homebush Bay Area	Not Applicable
26	City West	Not Applicable
30	St Marys	Not Applicable
33	Cooks Cove	Not Applicable
	(Sydney Harbour Catchment) 2005	Not Applicable

B4 Is the planning proposal consistent with applicable Ministerial Directions (s.117 directions)?

The first relevant s117 Direction is 3.1 – Residential Zones whose objectives are:

(a) to encourage a variety and choice of housing types to provide for existing and future housing needs,
(b) to make efficient use of existing infrastructure and services and ensure that new housing has appropriate access to infrastructure and services, and
(c) to minimise the impact of residential development on the environment and resource lands.

As noted above, the rezoning of the subject site to R3:

- will be consistent with the planning for area which seeks medium density housing,
- will increase the choice of housing which is currently and predominantly single dwellings, and
- will make good use of existing open space and public transport infrastructure.

Services such as water, sewerage and electricity are available in the street. No adverse impact on the environment at large will result from the infilling of residential development on the subject site.

The objectives of Direction 3.4, Integrating Land Use and Transport, are to:

> *ensure that urban structures, building forms, land use locations, development designs, subdivision and street layouts achieve the following planning objectives:*
>
> *(a) improving access to housing, jobs and services by walking, cycling and public transport, and*
> *(b) increasing the choice of available transport and reducing dependence on cars, and*
> *(c) reducing travel demand including the number of trips generated by development and the distances travelled, especially by car, and*
> *(d) supporting the efficient and viable operation of public transport services, and*
> *(e) providing for the efficient movement of freight. Where this direction applies*

Through changing the existing RE2 – Private Recreation zoning to R3 - Residential, the proposal will provide an increased and diverse supply of housing within approximately 2km of the Kogarah Strategic Health Centre. As mentioned above, the subject site is well serviced by a number of bus routes, close to the site, along Chute Avenue and the Grand Parade. The proposal satisfies the objectives of Direction 3.4

Direction 7.1 - Implementation of A Plan for Growing Sydney, applies to land within the former local government area of Rockdale. Its objective is to:

> *give legal effect to the planning principles; directions; and priorities for subregions, strategic centres and transport gateways contained in A Plan for Growing Sydney.*

As noted elsewhere in this report, the proposal is entirely consistent with the strategic direction sought for its locality.

See Table 6 below which reviews the consistency with the Ministerial Directions for LEPs under section 117 of the *Environmental Planning and Assessment Act 1979*.

Table 6 - Consistency with applicable Ministerial Directions

1. Employment and Resources

No.	Title	Consistency with Planning Proposal
1.1	Business and Industrial Zones	Not Applicable
1.2	Rural Zones	Not Applicable
1.3	Mining, Petroleum Production & Extractive Industries	Not Applicable
1.4	Oyster Aquaculture	Not Applicable
1.5	Rural Lands	Not Applicable

2. Environment and Heritage

No.	Title	Consistency with Planning Proposal
2.1	Environmental Protection Zones	Not Applicable
2.2	Coastal Protection	Not Applicable
2.3	Heritage Conservation	Not Applicable
2.4	Recreation Vehicle Areas	Not Applicable

3. Housing, Infrastructure and Urban Development

No.	Title	Consistency with Planning Proposal
3.1	Residential Zones	It is consistent, see above.
3.2	Caravan Parks and Manufactured Home Estates	Not Applicable
3.3	Home Occupations	Not Applicable
3.4	Integrating land use and Transport	It is consistent, see above.
3.5	Development near Licensed Aerodromes	Not Applicable
3.6	Shooting ranges	Not Applicable

4. Hazard and Risk

No.	Title	Consistency with Planning Proposal
4.1	Acid Sulfate Soils	Not Applicable
4.2	Mine Subsidence and Unstable Land	Not Applicable
4.3	Flood Prone Land	Not Applicable
4.4	Planning for Bushfire Protection	Not Applicable

5. Regional Planning

No.	Title	Consistency with Planning Proposal
5.1	Implementation of Regional Strategies	Not Applicable
5.2	Sydney Drinking Water Catchments	Not Applicable
5.3	Farmland of State and Regional Significance on the NSW Far North Coast	Not Applicable
5.4	Commercial and Retail Development along the Pacific Highway, North Coast	Not Applicable
5.5	Development on the vicinity of Ellalong…	Not Applicable
5.6	Sydney to Canberra Corridor	Not Applicable
5.7	Central Coast	Not Applicable
5.8	Second Sydney Airport: Badgerys Creek	Not Applicable

6. Local Plan Making

No.	Title	Consistency with Planning Proposal
6.1	Approval and Referral Requirements	Not Applicable
6.2	Reserving land for Public Purposes	Not Applicable
6.3	Site Specific Provisions	It is consistent, see above.

7. Metropolitan Planning

No.	Title	Consistency with Planning Proposal
7.1	Implementation of A Plan for Growing Sydney	It is consistent, see above.

C Environmental, social and economic impact

C1 Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

The site is fully developed and does not accommodate any critical habitat, threatened species, etc.

C2 Are there any other likely environmental effects as a result of the planning proposal and how are they proposed to be managed?

No other environmental effects, other than those reported above, have been identified.

C3 How has the planning proposal adequately addressed any social and economic effects?

No other social or economic effects, other than those reported above, have been identified.

D State and Commonwealth interests

D1 Is there adequate public infrastructure for the planning proposal?

As noted above, the locality is rich in public infrastructure, especially public transport and open space.

D2 What are the views of State and Commonwealth public authorities consulted in accordance with the Gateway determination?

State and Commonwealth public authorities have not yet been consulted.

E Conclusions

E1 Economic and orderly use of the site

The objectives of the EPA Act include, at S5(a)(ii),

> *the promotion and co-ordination of the orderly and economic use and development of land …*

Formerly used as a bowling club which included a registered club encompassing the service of alcohol and a small number of gambling machines, the site use never-the-less fell into financial difficulties due to changing community preferences. This situation has been repeated in many locations throughout both Sydney and the nation as old pastimes give way to new and different choices. If the site could not make an economic return, even with its associated registered club, it is clear that no other similar use (tennis courts, croquet, etc) will be more successful.

If the economic and orderly use of the site is to be achieved, a rezoning to some other use than private recreation is required. The most obvious use is one that is the same as the area surrounding the site, Residential R3 with the same Building Height and FSR.

As noted above, there is strategic planning support for the provision of housing in the general area of the now Bayside City (formerly Rockdale City) and this site meets the necessary strategic imperatives of proximity to transport and the designated growth centres.

E2 Impact of the proposal

As may be seen from the proposal's architectural drawings, the very acceptable and not unreasonable impact of the proposal will fall upon those surrounding houses which have enjoyed the twin benefits of adjoining private open space and lack (thus far) of medium density redevelopment for which the locality has been designated. Development of the site as currently proposed may create minor privacy impacts, from the upper bedroom storeys of the proposed townhouses (subject to detailed design). Such an impact is within the range of that expected in any transition to medium density development. It will be no worse than if new development occurred next door rather than behind the existing houses.

Distances between windows of the proposed new and the existing will exceed the old AMCORD standard of 9m and the equivalent under the Apartment Design Guide of SEPP 65 (which itself is not applicable to the development). Adopting the development standards of the surrounding area will make all medium density housing in the area equal in impact and within the bounds framed by the zoning controls.

Based on the potential concept design, overshadowing will not be a general issue due to the favourable orientation of the site, the separation distances between new and proposed buildings and the limited building height of 8.5m.

E3 Summary conclusions

- The proposal aligns exactly with the zoning surrounding the subject site on all four sides in terms of land use, density expressed in FSR, building height.
- Rezoning of the site will not deprive the community of open space. The site was a private open space with its use limited to club members. Additionally, there is considerable open space 400m to west at Scarborough Park, and 150m to the east, at Cook Park on the bay front.
- Demonstrably, as shown in the proposed architectural plans appended, development of the site is possible in accordance with all planning controls contained in the Rockdale LEP and DCP. This means that the impact of the proposal is within the acceptable bounds prescribed in the LEP and DCP.
- Development of the site will not give rise to unacceptable or unreasonable impacts on surrounding housing which is slated for redevelopment as medium density residential.
- Located between Chuter Avenue and The Grand Parade, the site is well served by bus routes. It is also proximate to the St George Hospital precinct which has been designated as a major health/education precinct under A Plan for Growing Sydney.
- The proposal is compliant with all relevant SEPPs and the Minister's s117 Directions under the EPA Act.

Part 4 – Mapping

To assist the community in understanding the proposed amendment(s), the following maps are provided as part of this application:

- Site context map – this should identify the site(s) subject to the Planning Proposal;

Figure 3: Site and its surrounds. Extract from 'Urban Design Analysis' report prepared by Rothe Lowman, January 2016.

Figures 4 to 9 below illustrate the current control maps as well as proposed controls. The control maps that need to be amended subject to this planning proposal are land use zoning, height of building and floor space ratio.

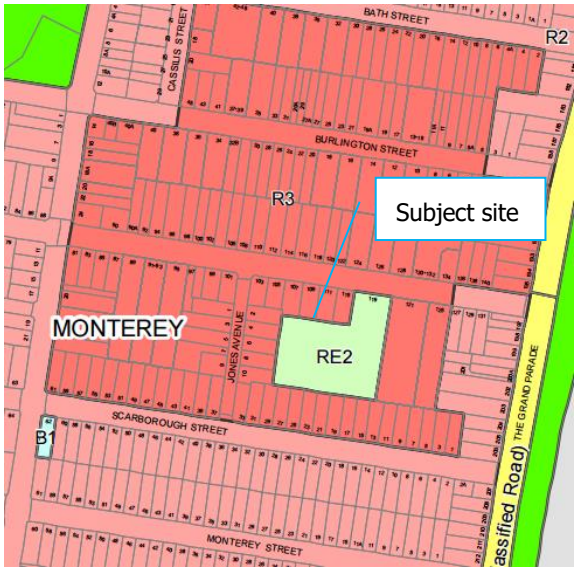

Figure 4: The land use zoning map as per RLEP 2011

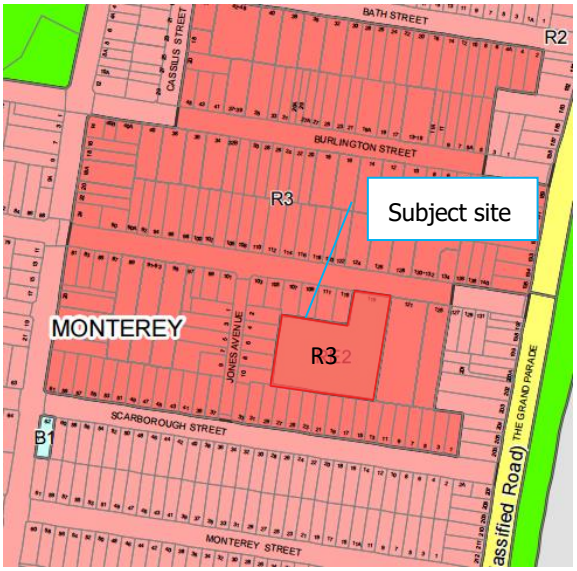

Figure 5: The proposed land use zoning map as amended

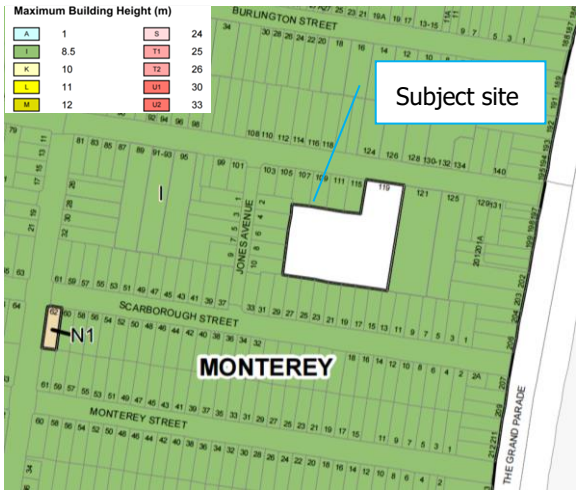

Figure 6: The height of building map as per RLEP 2011

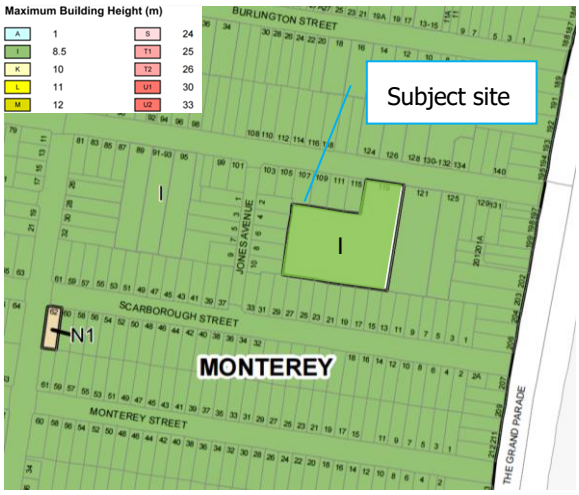

Figure 7: The proposed height of building map as amended

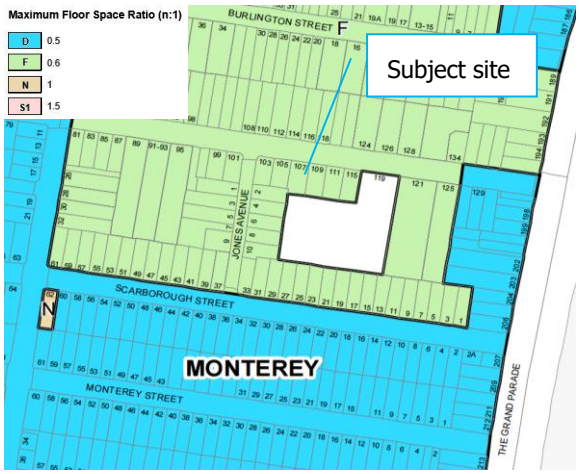

Figure 8: The floor space ratio as per RLEP 2011

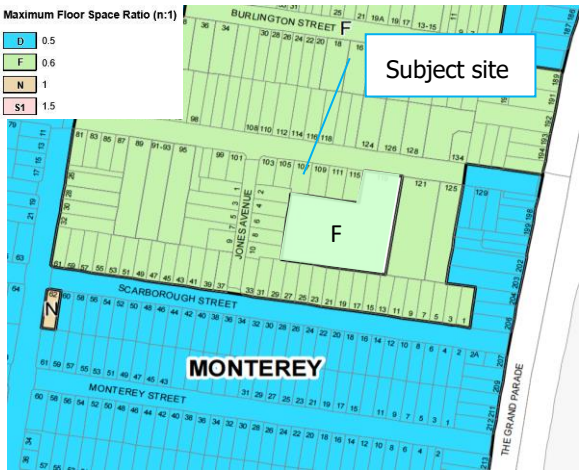

Figure 9: The proposed floor space ratio map as amended

Part 5 - Community Consultation

Community consultation process will be defined post submission in consultation with Council's 'Place Outcomes' team.

Part 6 – Project Timeline

The project timeline will be completed in consultation with Council's 'Place Outcomes' team after submission of the Planning Proposal.

The table below provides a proposed timeframe for the project.

Table 7– Approximate Project Timeline

Task	**Timing**
Date of Gateway determination	Will be discussed post submission
Anticipated timeframe for the completion of required technical information	Will be discussed post submission
Timeframe for government agency consultation (pre and post exhibition as required by Gateway determination)	Will be discussed post submission
Commencement and completion dates for public exhibition period	Will be discussed post submission
Dates for public hearing (if required)	Will be discussed post submission
Timeframe for consideration of submissions	Will be discussed post submission
Timeframe for the consideration of a PP following exhibition	Will be discussed post submission
Consideration of PP by Council (Council Meeting)	Will be discussed post submission
Date of submission to the department to finalise the LEP	Will be discussed post submission
Anticipated date RPA will make the plan (if delegated) or Anticipated date RPA will forward to the department for notification	Will be discussed post submission
Anticipated publication date	Will be discussed post submission

Appendix 1 - Supporting environmental assessment, design and engineering studies

The Planning Proposal is supported by the urban design study and the following schematic master plan drawings prepared by Rothelowman:

Drawing No.	Issue/Rev	Description	Date
SK00.02	P2	Ground floor / level 1 masterplan	21/01/2016
SK00.03	P2	Level 2 masterplan	21/01/2016
SK00.04	P1	Solar analysis – Mar, Sep, Dec	21/01/2016
SK00.05	P1	Solar analysis – June	21/01/2016
SK01.01	P2	Townhouse Type A – Floor plans	21/01/2016
SK01.02	P2	Townhouse Type B – Floor plans	21/01/2016

The following relevant documents are appended to this Proposal:

- Survey plan prepared by Project Surveyors dated 26 August, 2015;
- Geotechnical assessment report prepared by Douglas Partners dated 4 March, 2016;
- Stormwater management overview report and drawings prepared by ADG dated 9 March 2016;
- Traffic impact assessment prepared by Colston Budd Rogers & Kafes Pty Ltd dated February 2016

119 BARTON ST, MONTEREY, NSW

URBAN DESIGN ANALYSIS

JANUARY 2016

119 BARTON ST, MONTEREY, NSW

CONTENTS

PRESENTED BY:

SYDNEY

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DARLINGHURST NSW 2010

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1.0 EXECUTIVE SUMMARY

This Urban Design Analysis Report has been prepared in support of a Planning Proposal for a development at 119 Barton Street, Monterey, NSW.

The purpose of the report is to analyse the site and its urban context, so as to inform the design principles for the development. These design principles are tested in concept scenarios, demonstrating the ability of the site to support:

- A variation to rezone the subject land to R3 Medium Density Residential.

This report will show that the proposed development meets the objectives of the Rockdale Development Control Plan in the following ways:

- Sustainably accommodate population growth, in an appropriate medium density location, within close proximity to public transport

- Deliver high quality articulation of built form on a masterplanned site and well designed dwelling spaces.

DEVELOPMENT SUMMARY AREA SCHEDULE				
	HEIGHT	**SITE AREA**	**DEVELOPMENT GFA**	**DEVELOPMENT FSR**
119 BARTON STREET	2 STOREYS	7218sqm	4330sqm	0.6:1

2.0 URBAN CONTEXT SITE ANALYSIS

The following pages describe the current and physical attributes of the Rockdale Precinct in order to best contextualise and define location specific initiatives for the project site.

This section considers:

- Overall Context Analysis
- Site Context & Vehicular Network
- Public Transport & Pedestrian Movement
- Topography
- Built Form Height Context
- Streetscape Context
- Site Constraints Analysis
- Site Opportunities Analysis
- Views of Existing Site

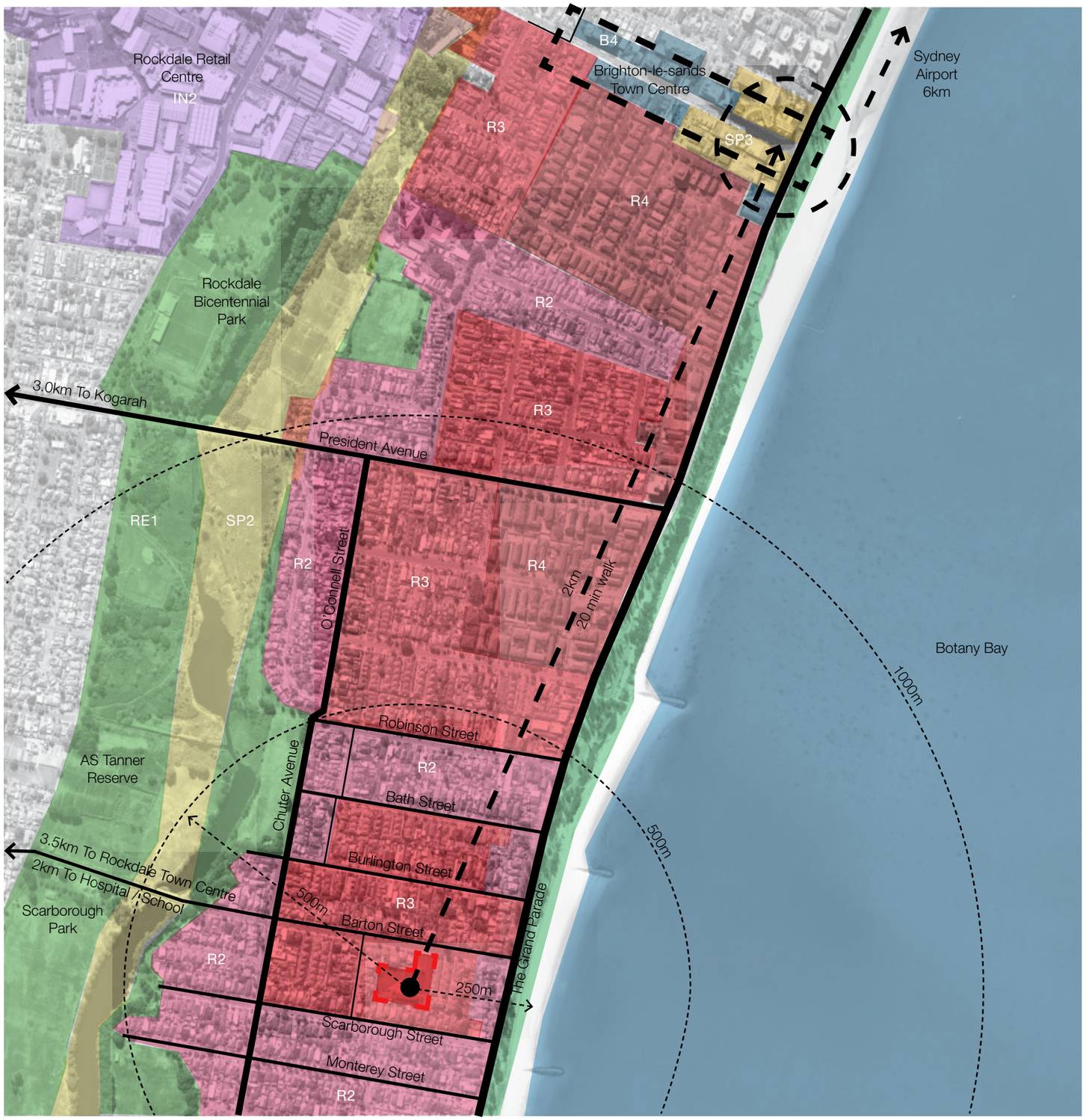
119 BARTON ST, MONTEREY, NSW

2.0 URBAN CONTEXT & SITE ANALYSIS

2.1 OVERALL CONTEXT ANALYSIS

119 Barton Street, Monterey is located 15km's south of Sydney Central Business District, 5km's from Sydney Airport and 2km's from Brighton-le-sands. The site is well positioned to provide a high level of local amenity with nearby mixed-use environments supporting current and future community needs.

The site has good access to Sydney's bus network with connections to the train network at nearby Rockdale.



Legend

- Subject Site
- B4 - Mixed-Use
- IN2 - Light Industrial
- R2 - Low Density Residential
- R3 - Medium Density Residential
- R4 - High Density Residential
- RE1 - Public Recreation
- SP2 - Infrastructure
- SP3 - Tourist

119 BARTON ST, MONTEREY, NSW

2.0 URBAN CONTEXT & SITE ANALYSIS

2.2 SITE CONTEXT & VEHICULAR NETWORK

The Grand Parade is the dominant vehicular connection between Brighton-le-sands to the North and the Taren Point Bridge crossing to the South.

The East-West streets service mainly the local community.

Legend

- Subject Site
- Major Road
- Primary Road
- Local road
- Traffic Controlled Pedestrian Crossing
- Public Carpark

NORTH

119 BARTON ST, MONTEREY, NSW

2.0 URBAN CONTEXT & SITE ANALYSIS

2.3 PUBLIC TRANSPORT & PEDESTRIAN MOVEMENT

The site has access to buses providing direct access to Circular Quay via Westfield Eastgardens, Surry Hills and Martin Place, Sydney. Nearby buses also connect the subject site with Miranda and Rockdale.

Buses operate along both The Grand Parade and Chuter Avenue.

Legend

- Subject Site
- Bus Stop
- Off-Road Cycle Routes
- On-Road Cycle Routes
- Traffic Controlled Pedestrian Crossing
- Pedestrian Movement
- Bus Route 3
- Bus Route 303
- Bus 479
- Bus 947

NORTH

119 BARTON ST, MONTEREY, NSW

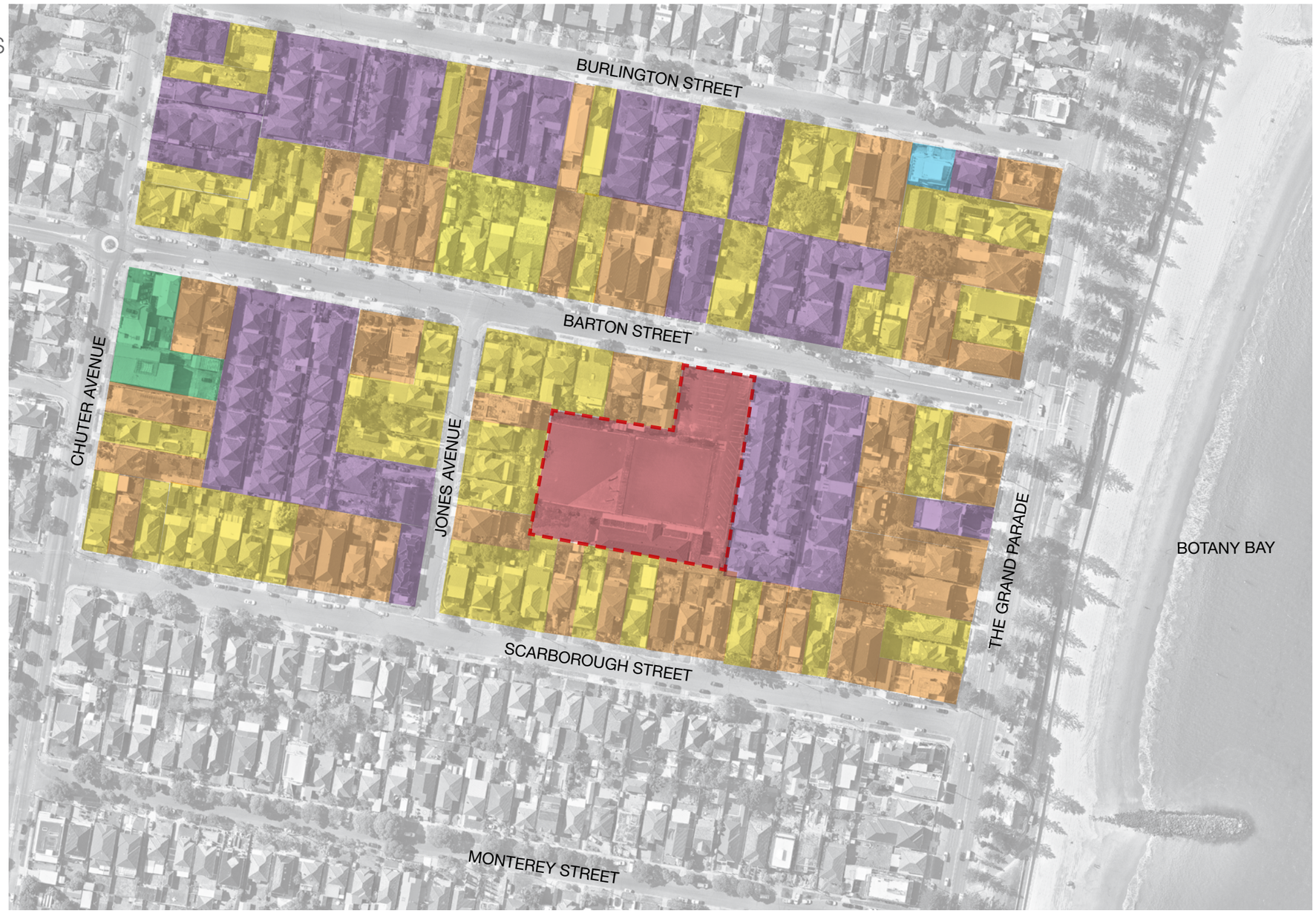
2.0 URBAN CONTEXT & SITE ANALYSIS

2.4 SITE SURVEY

2.0 URBAN CONTEXT & SITE ANALYSIS
STREETSCAPE ANALYSIS

2.5 BUILT FORM CONTEXT

The subject site sits within a well-established local residential neighbourhood comprising of a mixture of single and double storey houses and some early strata title development. The surrounding land zoning is R3 and R2.



Legend

- Subject Site
- 1 Storey Dwelling
- 2 Storey Dwelling
- 3 Storey Dwelling
- Multi-Unit / Strata Title 1 / 2 Storey Dwelling
- Industrial / Commercial

NORTH

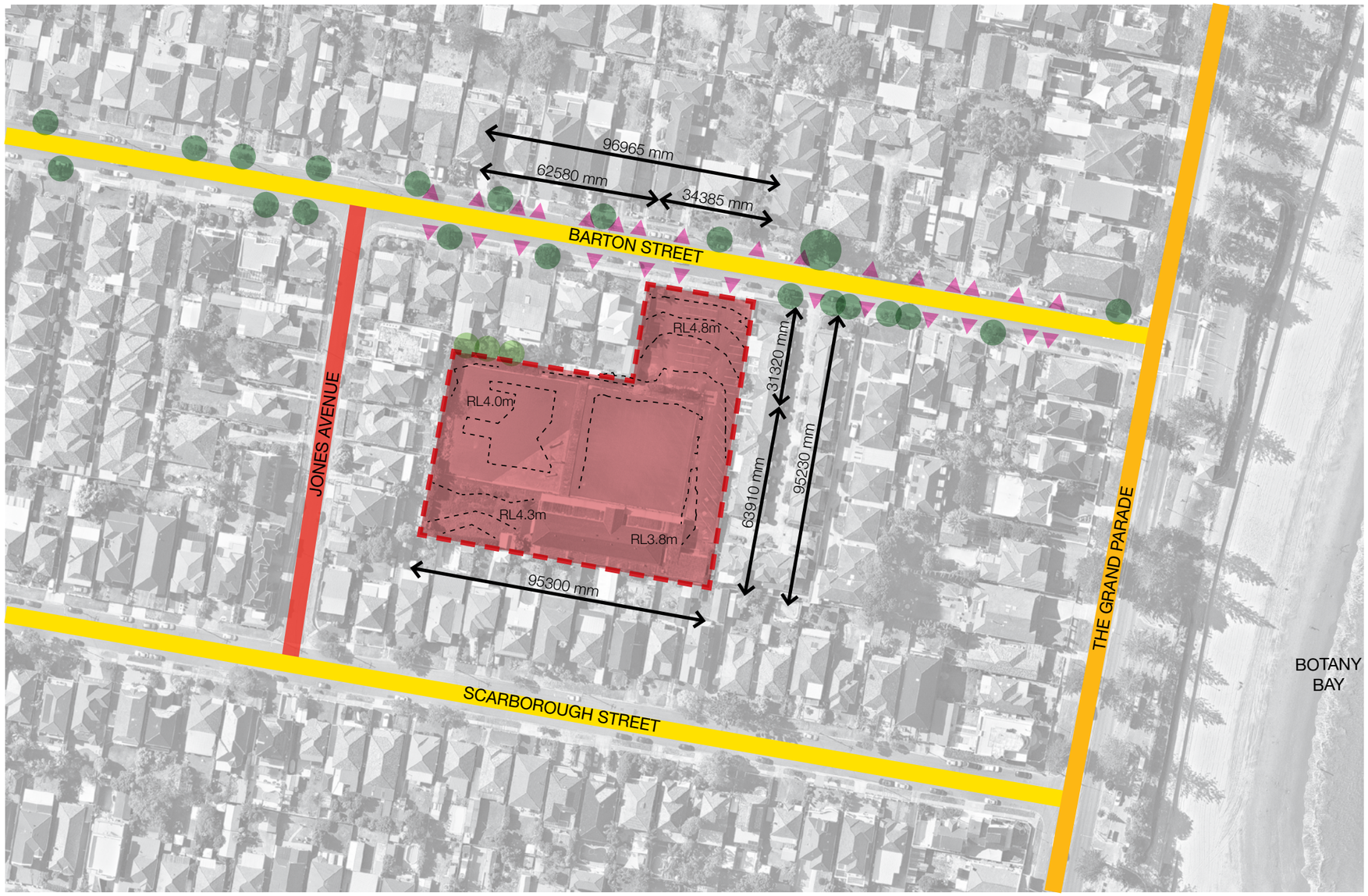
2.0 URBAN CONTEXT & SITE ANALYSIS
STREETSCAPE ANALYSIS

2.6 STREETSCAPE CONTEXT

The existing streetscape is still very much a low rise, low density residential typology.

The street is punctuated with driveways accessing individual properties and there are few sporadically place street trees. There is no consistency of planting.

The street is serviced with foot paths on both sides.



Legend

- Subject Site
- Major Road
- Primary Road
- Local Road
- Contour Lines (Indicative) RL shown in metres AHD
- Existing Driveway Crossover Locations
- Existing Street Tree Locations
- Trees on Adjacent Site

2.0 URBAN CONTEXT & SITE ANALYSIS

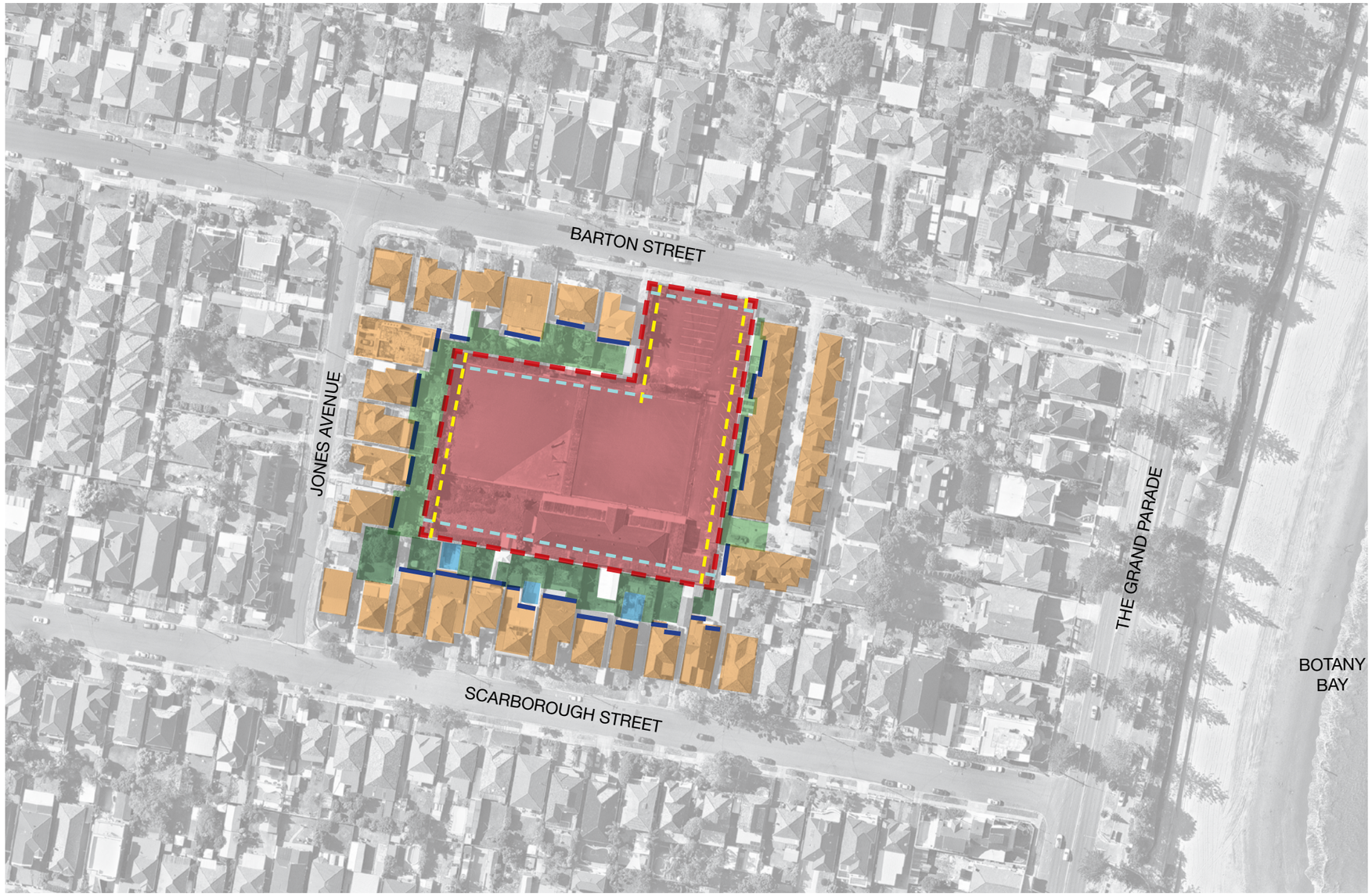
2.7 SITE CONSTRAINTS ANALYSIS

The main site specific constraints to future development on the subject site will be around the visual impact, overshadowing impact and privacy impact to all adjoining sites. Particular overlooking issues are to the sites along the southern boundary where there are significant parcels of private open space comprising a mixture of lawns and paved areas along with a number of in-ground pools.

It should be assumed there are habitable windows along all properties looking on to the subject site.

There is a gradual fall across the site from Barton Street to the south-east corner of the site. The remainder of the site is relatively flat and should be considered so.

The site sits in a well-established residential neighbourhood with limited examples of multi-unit subdivision, the existing “residential” streetscape and setbacks to Barton Street will need to be carefully addressed.



Legend

- Subject Site
- Potential Windows on Neighbouring Property
- Min. 4.5m Side Setback from Boundary
- Min. 3.0m Rear Setback from Boundary (Ground Floor)
- 6.0m Rear Setback from Boundary (First Floor)
- Adjacent Low Scale Residential Buildings
- Private Open Sapce in Neighbouring Property
- In-ground Swimming Pool in Neighbouring Property

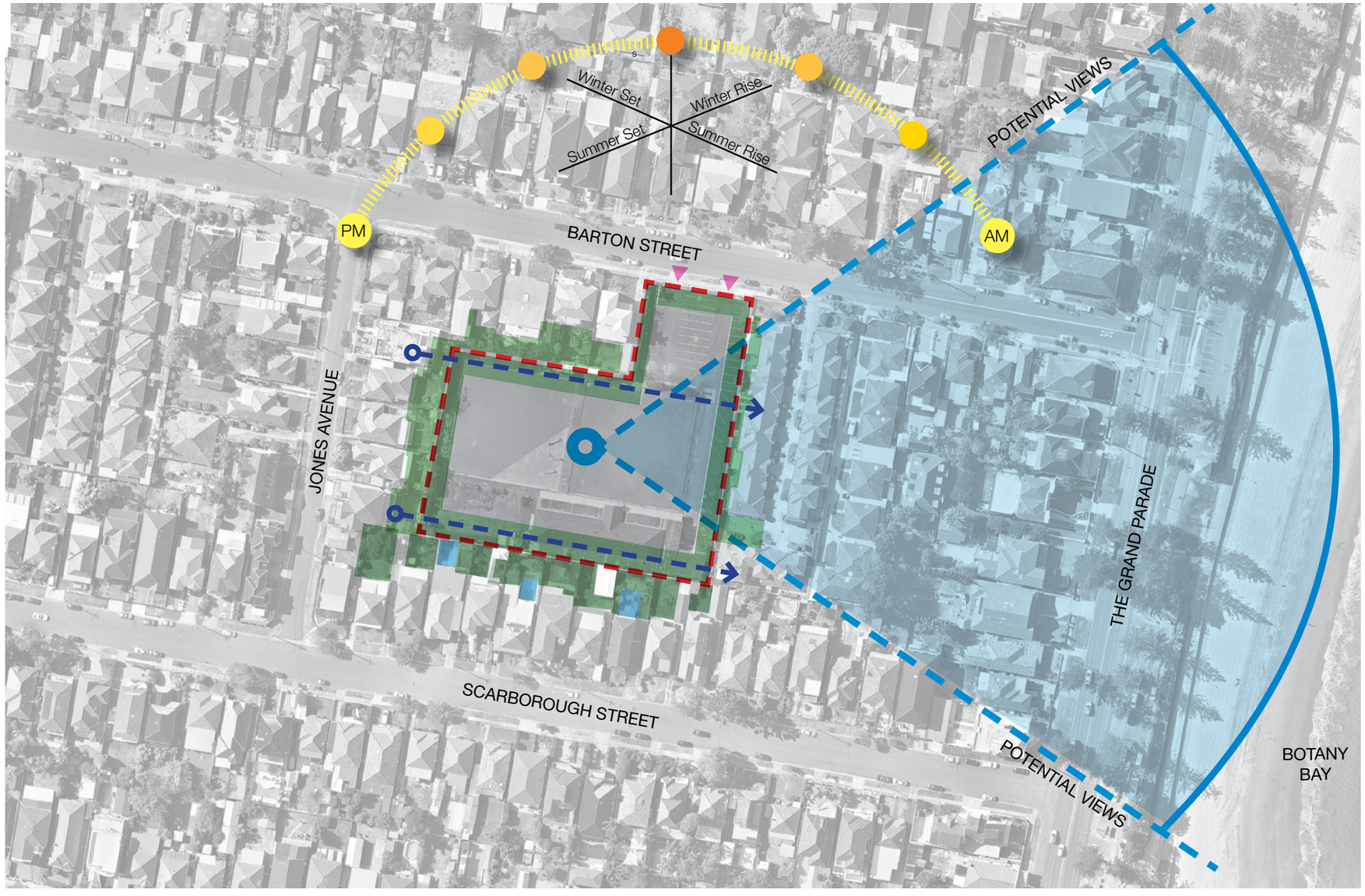
NORTH

2.0 URBAN CONTEXT & SITE ANALYSIS

2.8 SITE OPPORTUNITIES ANALYSIS

The main opportunities on the site surround landscaping and complimenting the surrounding existing private open spaces with new open space.

While views toward Botany Bay are plausible, the 8.5m height limit will reduce this possibility across all lots.



Subject Site

Existing Driveway Crossover Locations

Private Open Space in Neighbouring Property

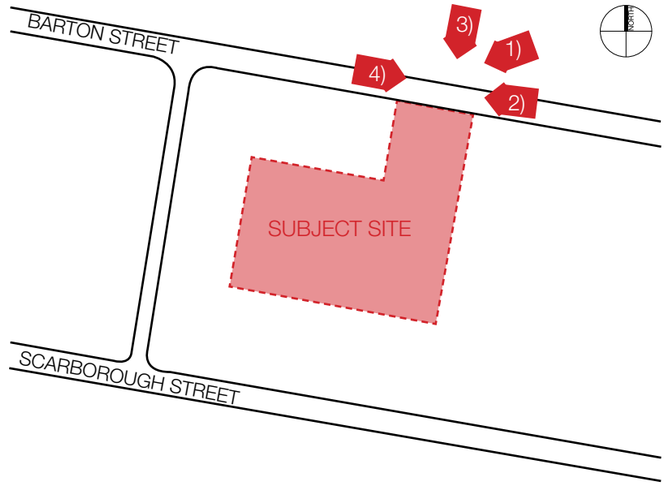
Potenital Private Open Space in Subject Site

Existing Views Maintained

119 BARTON ST, MONTEREY, NSW

2.0 URBAN CONTEXT & SITE ANALYSIS

2.9 VIEWS OF EXISTING SITE



1) VIEW TO SOUTH WEST

2) VIEW TO WEST

3) VIEW OF ENTRANCE OF SITE

4) VIEW TO EAST

3.0 PROPOSED SCHEMATIC MASTERPLAN

PRELIMINARY

TOWNHOUSE DEVELOPMENT

LEVEL 2 MASTERPLAN

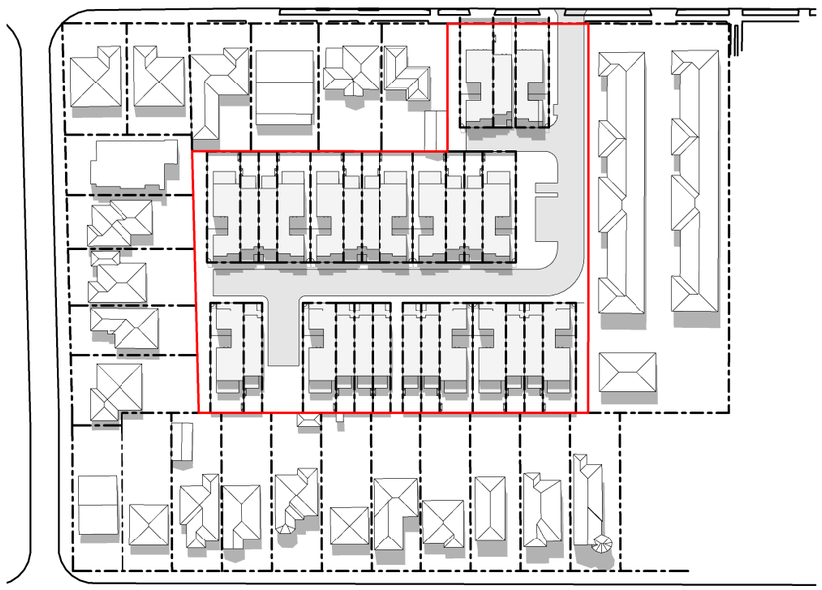
215416

21/01/16

JF

1 : 1000

SK00.03 P2



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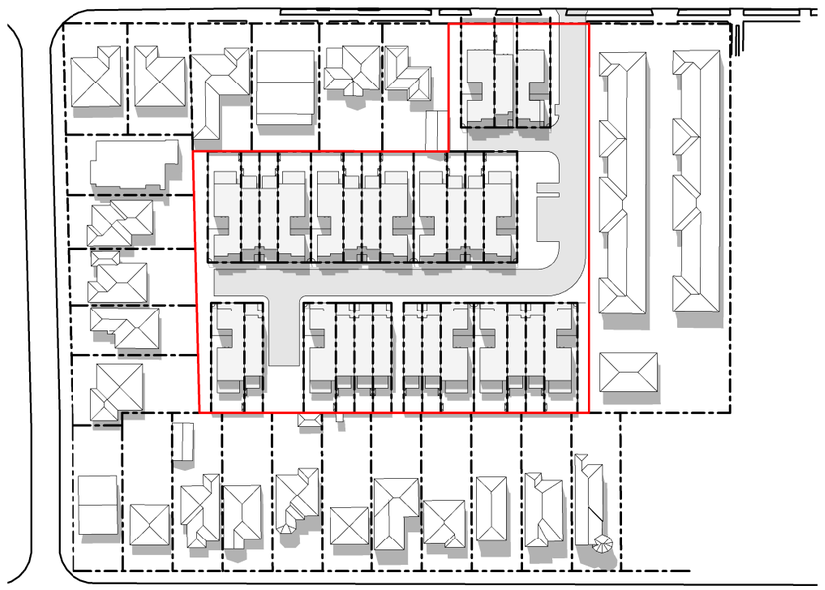

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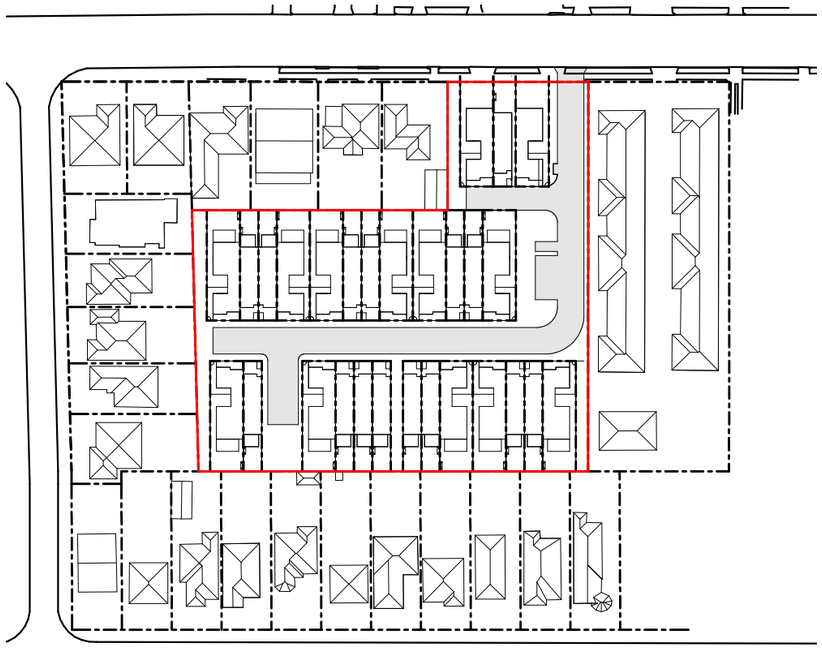

21 DEC 12pm - SOLAR ANALYSIS

PRELIMINARY

Revisions				Project	Drawing	Project No	Date	Author	Scale: @ A3	Drawing No.
P1	21/01/16	PRELIMINARY - FOR INFORMATION	JF	**TOWNHOUSE DEVELOPMENT** 119 Barton Street, Monterey, NSW	**SOLAR ANALYSIS - MAR, SEP, DEC**	**215416**	**21/01/16**	**JF**	**1 : 1500**	**SK00.04 P1**

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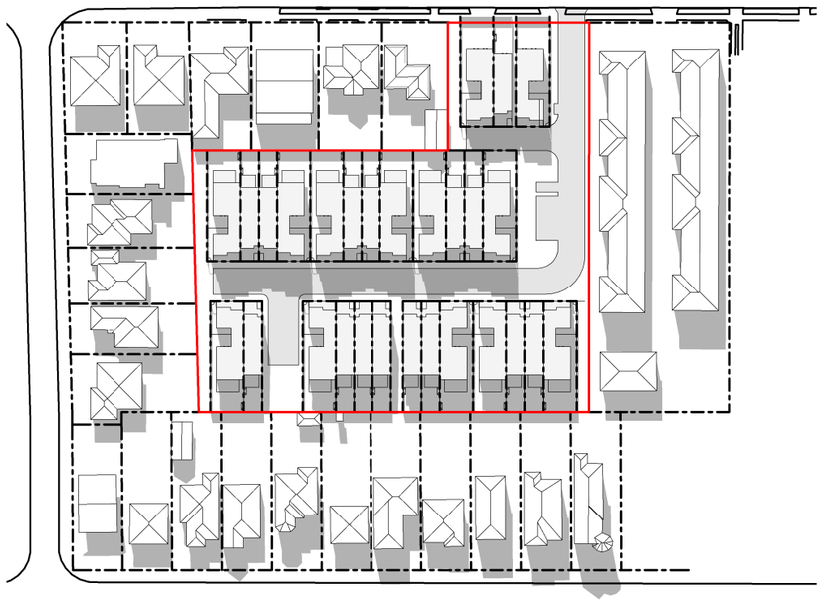
21 JUNE 9am - SOLAR ANALYSIS



21 JUNE 12pm - SOLAR ANALYSIS

21 JUNE 3pm - SOLAR ANALYSIS

PRELIMINARY

Revisions				Project	Drawing	Project No	Date	Author	Scale: @ A3	Drawing No.
P1	21/01/16	PRELIMINARY - FOR INFORMATION	JF	**TOWNHOUSE DEVELOPMENT** 119 Barton Street, Monterey, NSW	**SOLAR ANALYSIS - JUNE**	**215416**	**21/01/16**	**JF**	**1 : 1500**	**SK00.05 P1**

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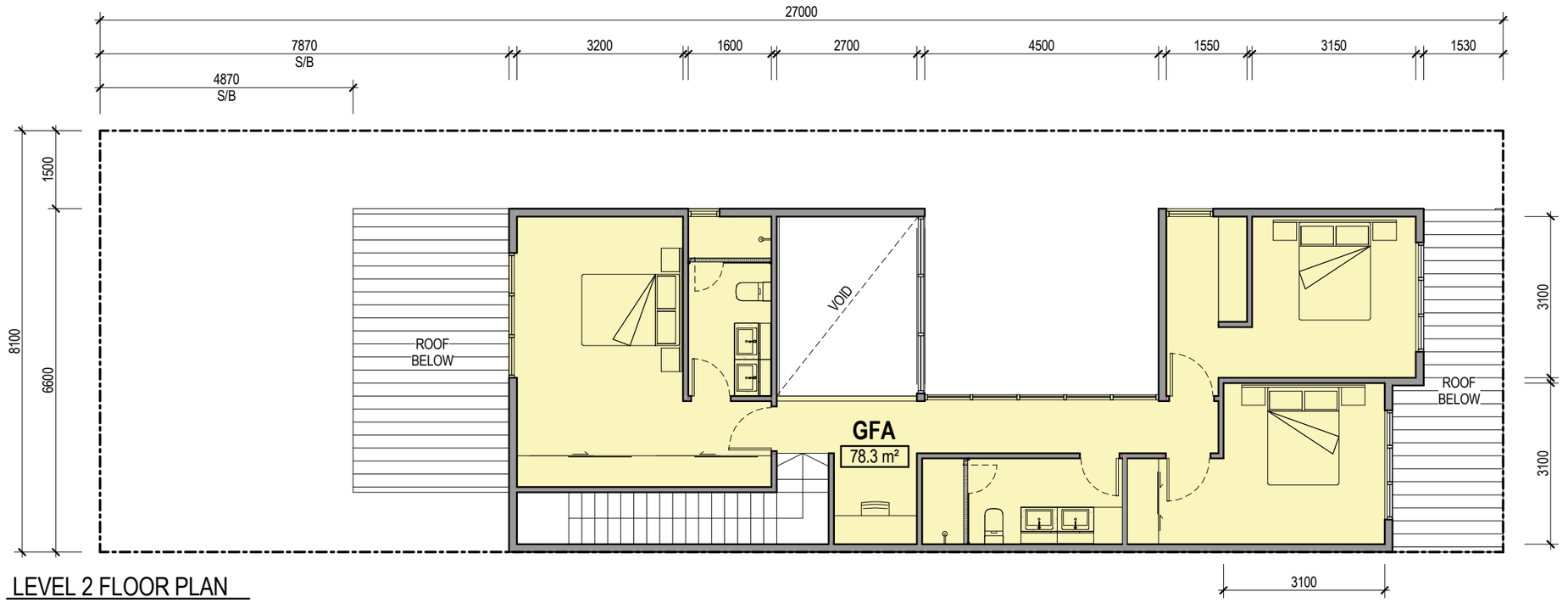
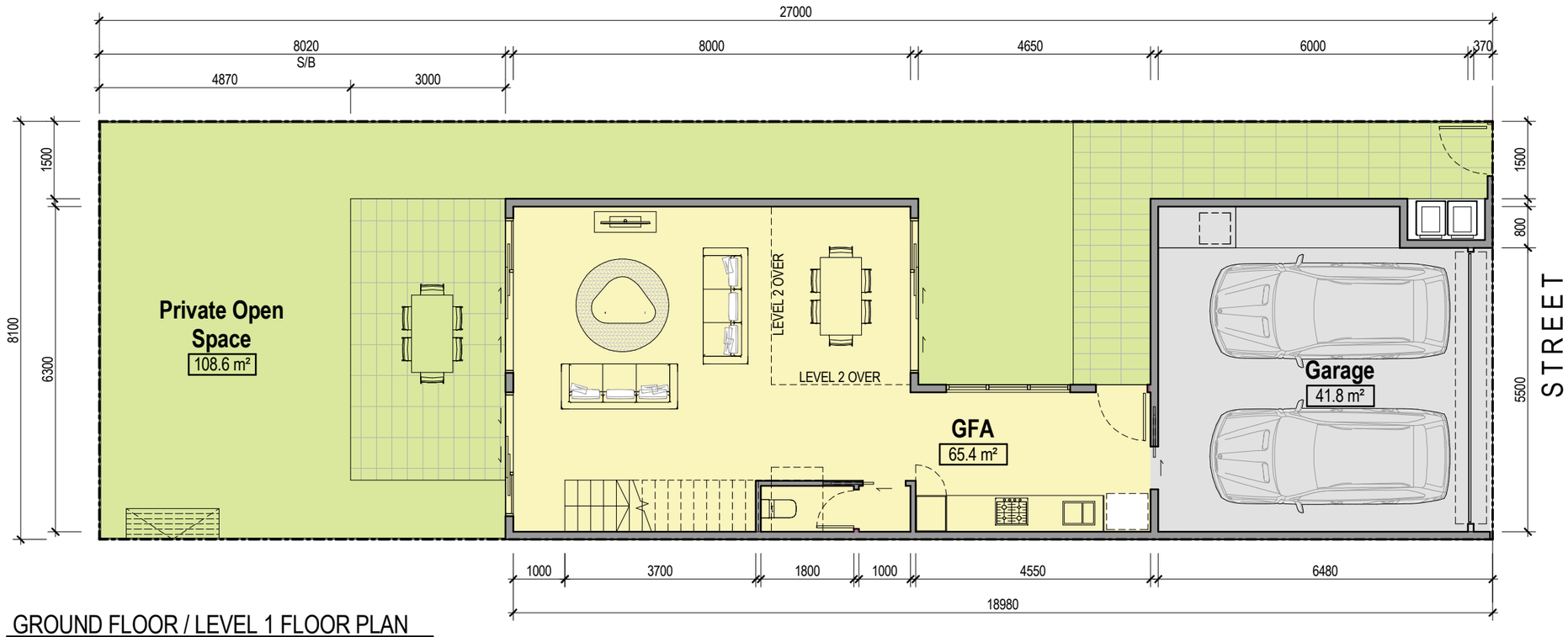


LEVEL 2 FLOOR PLAN



GROUND FLOOR / LEVEL 1 FLOOR PLAN

Area Schedule

Level	Name	Area
GROUND/L1	GFA	65.4 m²
LEVEL 2	GFA	78.3 m²
Grand total		143.7 m²

PRELIMINARY

Revisions			
P1	17/12/15	PRELIMINARY ISSUE	JF
P2	21/01/16	PRELIMINARY - FOR INFORMATION	JF

Project: **TOWNHOUSE DEVELOPMENT**
119 BARTON STREET, MONTEREY NSW

Drawing: **TOWNHOUSE TYPE A - FLOOR PLANS**

Project No: **215416**

Date: **21/01/16**

Author: **JF**

Scale: @ A3 **1 : 100**

Drawing No.: **SK01.01 P2**

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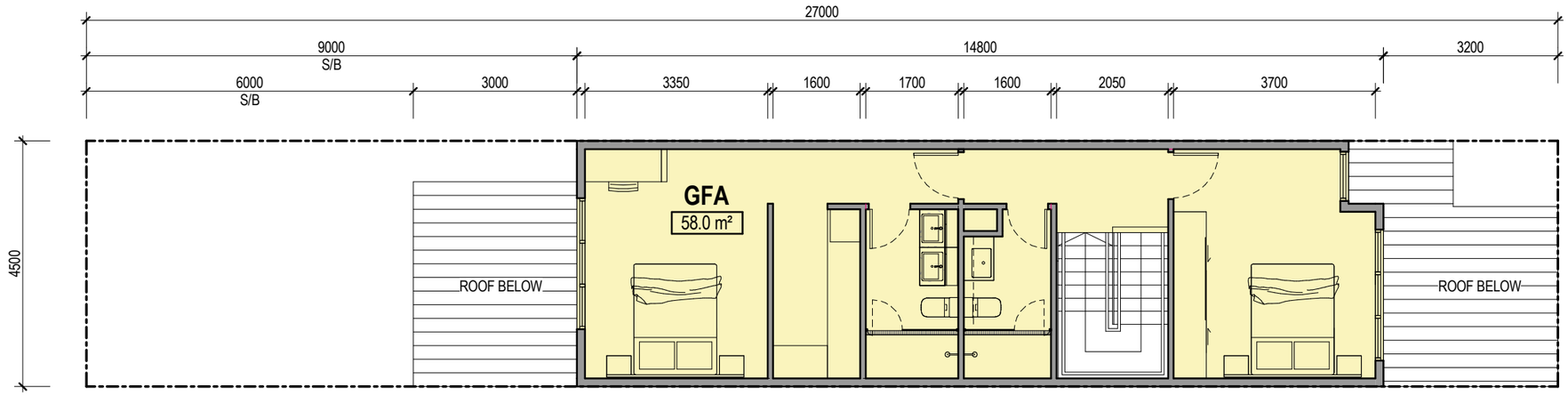
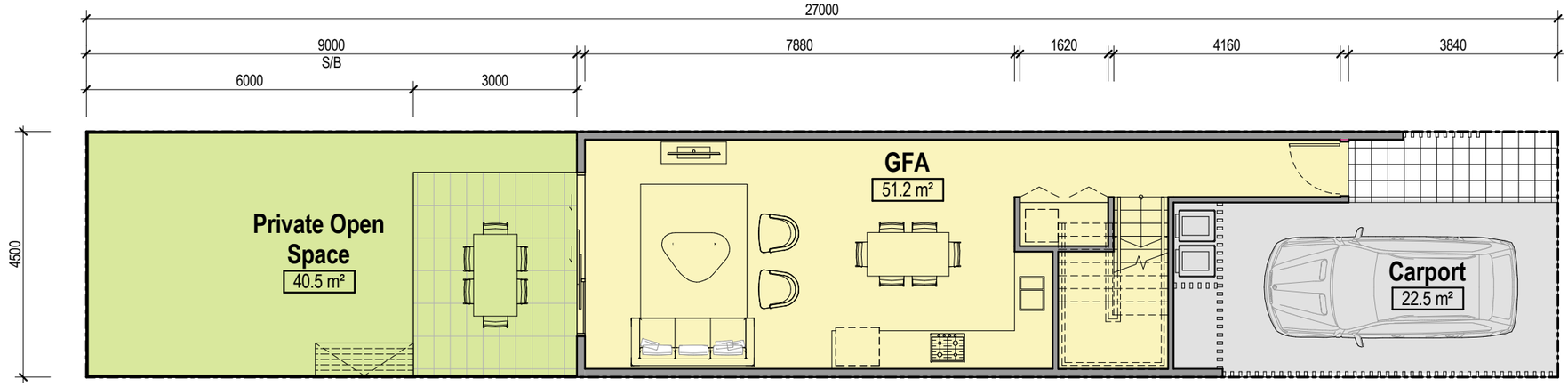


LEVEL 2 FLOOR PLAN



GROUND FLOOR / LEVEL 1 FLOOR PLAN

Area Schedule

Level	Name	Area
GROUND/L1	GFA	51.2 m²
LEVEL 2	GFA	58.0 m²
Grand total		109.2 m²

PRELIMINARY

Revisions

P1	17/12/15	PRELIMINARY ISSUE	JF
P2	21/01/16	PRELIMINARY - FOR INFORMATION	JF

Project: **TOWNHOUSE DEVELOPMENT**
119 BARTON STREET, MONTEREY

Drawing: **TOWNHOUSE TYPE B - FLOOR PLANS**

Project No: **215416**

Date: **21/01/16**

Author: **JF**

Scale: @ A3: **1 : 100**

Drawing No.: **SK01.02 P2**

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* THE SUBJECT TITLE NOTES
1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)

A1

NOTES :

* BOUNDARIES HAVE NOT BEEN DEFINED BY SURVEY AND ARE DIAGRAMMATIC ONLY.
* LAND DIMENSIONS AND AREAS HAVE BEEN COMPILED FROM PLANS OBTAINED FROM LPMA.
* BEARINGS RELATE TO ISG NORTH ORIGINATING FROM DP857520
* LEVEL DATUM IS AHD ORIGINATING FROM SSM171745 RL 4.284 LOCATED AT BARTON STREET.
* VISIBLE, ACCESSIBLE SERVICES ONLY HAVE BEEN LOCATED. THIS PLAN DOES NOT PURPORT TO SHOW UNDERGROUND SERVICES.
* THE EXISTENCE OF UNDERGROUND SERVICES HAS NOT BEEN ESTABLISHED.
* EXISTENCE OF SERVICES MUST BE VERIFIED BY CONTACTING DIAL BEFORE YOU DIG (DBYD) 1100.COM.AU CRITICAL SERVICES MUST BE EXPOSED AND LOCATED
* NEIGHBOURING HOUSES , WINDOWS AND ROOF POSITIONS ARE APPROXIMATE ONLY.
* FLOOR LEVELS GENERALLY SURVEYED AT DOOR THRESHOLDS. INTERNAL ROOMS NOT SURVEYED.
* CONTOURS SHOWN ARE INDICATIVE OF LAND FORM. SPOT LEVELS SHOULD TAKE PRECEDENCE.
* REFER TO FACE OF PLAN FOR SUBJECT TITLE NOTATIONS.
* THIS TITLEBLOCK IS AN INTEGRAL PART OF THIS DRAWING AND SHOULD NOT BE REMOVED.

LEGEND

ELP - ELECTRIC LIGHT POLE
HYD - HYDRANT
TW - TOP WALL
TK - TOP KERB
TG - TOP GUTTER
PP - POWER POLE
SMH - SEWER MANHOLE
SP - SIGN POST
SV - STOP VALVE
TEL - TELSTRA PIT
VC - VEHICLE CROSSING
WM - WATER METER

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REV		DATE
A	CONTOURS & SERVICES ADDED	11.09.15
REV	AMENDMENTS	DATE

CLIENT: HEYMAN COHEN

PLAN OF: 119 BARTON STREET MONTEREY

BEING: LOT 2 IN DP 857520

SHOWING: GENERAL DETAIL AND SITE LEVELS

PURPOSE: ARCHITECTURAL DESIGN COUNCIL SUBMISSION

SHEET 1 0F 4

SCALE 1:400

0 10 20 30 40

SURVEYOR :	KURT F
DATUM :	AUSTRALIAN HEIGHT DATUM
ORIGIN :	SSM131745 RL 4.284
JOB REF. :	B1968
DRAWING No.	B1968–1
CHECKED :	AB
DATE OF SURVEY:	26 AUGUST 2015
REDUCTION RATIO :	1:400

MACQUARIE PARK

PO Box 4004
MACQUARIE CENTRE NSW 2113

SUITE 404, LEVEL 4
No13–15 LYON PARK ROAD,
MACQUARIE PARK NSW 2113

PHONE : 9888 3848
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Monterey Equity Pty Limited
c/- Heymann-Cohen Pty Ltd
Level 1/14 Martin Place
SYDNEY NSW 2000

Project 85348.00
4 March 2016
R.001.Rev0
PAV:dh

Attention: Mr Richard Pajor

Email: richard.pajor@dcwc.com.au

Dear Sirs

Geotechnical Assessment of Nominal Absorption Rate
Proposed Residential Development
119 Barton Street, Monterey

1. Introduction

This letter report describes the results of a geotechnical assessment undertaken by Douglas Partners Pty Ltd (DP) at 119 Barton Street, Monterey. The investigation was commissioned by Monterey Equity Pty Limited.

It is understood that the proposed development will include the construction of townhouses, which will include a stormwater management system.

The assessment included eight boreholes and constant-head permeability tests to assess the subsurface profile and soil permeability at potential locations of the absorption pits. The permeability testing was carried out in accordance with the requirements of Section 5.2 of Rockdale City Council's Technical Specification: Stormwater Management, dated 2011. Details of the field work are provided together with comments on stormwater management.

2. Site Description and Geology

The site is currently occupied by Francis Drake Bowling Club, which includes a single-storey building (club house), two synthetic grass bowling greens, grassed areas, garden beds and an on-grade asphaltic concrete car park. One and two-storey buildings surround the site, except where the car park adjoins Barton Street.

The ground surface slopes gently down from the site boundaries towards the central area of the site, with reduced levels ranging from approximately RL 4.9 m to RL 3.7 m relative to Australian Height Datum (AHD).

Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the site is located in an area underlain by wind-blown sand (Aeolian), with some silt and shells also present.

3. Field Work

3.1 Field Work Methods

The field work for the investigation comprised:

- Eight boreholes drilled to 3 m depth or prior refusal or hole collapse using a 100 mm diameter hand-auger. The boreholes were located at the possible locations for absorption pits, as nominated by Heymann-Cohen Pty Ltd;
- Logging and collection of soil samples and observation of the soil moisture condition;
- Eight constant-head permeability tests at depths of 0.5 m or 0.55 m within each borehole and carried out in accordance with Australian Standard *AS 1547 On site domestic waste water management - 2012 - Appendix G*. For the constant-head test, the borehole was initially filled with water to saturate the soil prior to testing. A water-filled standpipe (permeameter) was then inserted into the water-filled borehole to maintain a constant head of 0.3 – 0.35 m above the base of the borehole. The water level in the standpipe was measured and recorded at regular time intervals until total water loss from the permeameter had occurred.

Surface levels at the test locations were interpolated from Survey Drawing No. B1968-1, dated 11 September 2015, by Project Surveyors Pty Ltd. The locations of the tests are shown on the attached Drawing No. 1.

3.2 Field Work Results

The detailed borehole logs and permeability test results are attached, together with notes defining classification methods and descriptive terms.

3.2.1 Boreholes

The ground conditions encountered in the boreholes can be summarised as follows:

- **Artificial Grass** – 0.01 m thick in BH1 and BH2;
- **Filling (Topsoil)** – 0.1 m thick root-affected silty sand topsoil layer in BH5 to BH8;
- **Filling** – predominantly sand and silty sand filling extending to depths of between 0.6 m and 1.2 m in all boreholes. Gravel and cobble sized inclusions of sandstone, charcoal and slag were encountered in the filling. Borehole BH4 was discontinued at 1.2 m depth due to practical refusal of the hand auger on buried concrete;

- **Sand/Sandy Gravel** – medium to coarse grained sand with traces of shells extending to the final depths (i.e. 2.7 m to 3 m) of boreholes BH1, BH3 and BH5 to BH8. Borehole BH2 had sand to 2.4 m depth underlain by sandy gravel, with auger refusal at 2.5 m depth.

Above the groundwater table, the moisture condition of the filling and natural soil was variably humid to wet, with the degree of saturation generally increasing with depth. Free groundwater was observed in BH1, BH3 and BH5 to BH8 at depths of between 2.5 m and 2.8 m.

3.2.2 Permeability Tests

The saturated hydraulic conductivity (K_{sat}) results of the eight constant-head permeability tests are summarised in Table 1.

Table 1: Results of Constant Head Permeability Tests

Permeability Test Location	Hydraulic Conductivity (K_{sat}) (m/s)
BH1	4.2×10^{-4}
BH2	1.1×10^{-3}
BH3	8.7×10^{-5}
BH4	3.5×10^{-4}
BH5	4.2×10^{-4}
BH6	7.0×10^{-4}
BH7	2.3×10^{-4}
BH8	7.0×10^{-4}

4. Comments

4.1 Proposed Development

It is understood that the proposed development will include the construction of townhouses, which will include a stormwater management system. The feasibility and potential locations of absorption pits for the stormwater system is being assessed for the development.

4.2 Soil Category and Nominal Absorption Rate

Based on the results of the constant-head tests, the 'soil category' has been correlated in accordance with Table 5.1 of AS 1547 – 2012. For all eight tests, the soil texture correlates to 'Gravels and Sands' and the (soil horizon) structure correlates to 'Structureless (Massive)'.

In accordance with Section 5.2 of Rockdale City Council's Technical Specification: Stormwater Management, dated 2011, the hydraulic conductivity for each permeability test has been calculated in terms of a nominal absorption rate (litres/square metre/second), as shown in Table 2. The nominal absorption rate has been calculated by assuming a hydraulic gradient of 1 for sandy soil. The calculated results have been rounded to the nearest 0.1 of a decimal place.

Table 2: Nominal Absorption Rate

Permeability Test Location	Nominal Absorption Rate (L/s/m^2)
BH1	0.4
BH2	1.1
BH3	0.1
BH4	0.4
BH5	0.4
BH6	0.7
BH7	0.2
BH8	0.7

5. Conclusion

Council's Specification indicates that absorption may not be practical where the nominal absorption rate is less than 0.05 L/s/m^2 or where physical limitations such as a high water table, bedrock close to ground surface or contaminated soils exist.

It should be noted that the hydraulic conductivity is dependent on the density and the degree of saturation of the soil, and therefore, it is likely to decrease with depth and vary according to weather conditions. The nominal absorption rate is also dependent upon the hydraulic gradient, that is, the rate will change with changes of the depth to the underlying water table.

Based on the permeability test results, the nominal absorption rates are greater than Council's nominal absorption rate of 0.05 L/s/m^2 and as such the use of on-site absorption pits is considered to be feasible from a hydrogeoligical point of view. It is noted that an impermeable layer such as bedrock was not encountered within the depths of the boreholes (up to 3 m deep). A relatively shallow groundwater table, however, was encountered 2.5 m to 2.8 m below the current ground surface levels. DP has not carried out a contamination assessment of soils for this site.

6. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at 119 Barton Street, Monterey in accordance with DP's proposal (SYD160043.P.001.Rev1 dated 1 February 2016 and acceptance received from Monterey Equity Pty Limited dated 9 February 2016. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Monterey Equity Pty Limited and their agents for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of

potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Please contact the undersigned if you have any questions on this matter.

Yours faithfully
Douglas Partners Pty Ltd

Peter Valenti
Geotechnical Engineer

Reviewed by

Bruce McPherson
Principal

Attachments: About this Report
Borehole Logs
Constant Head Test Results
Drawing No. 1 – Location of Tests

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

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

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

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

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

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

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

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

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

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

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Sampling

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

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Symbols & Abbreviations

Douglas Partners

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete


Filling

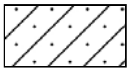
Soils


Topsoil

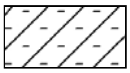

Peat


Clay

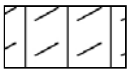

Silty clay

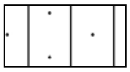

Sandy clay

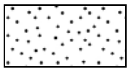

Gravelly clay

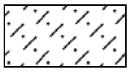

Shaly clay

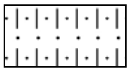

Silt


Clayey silt


Sandy silt

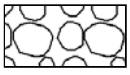

Sand

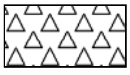

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

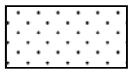

Talus

Sedimentary Rocks

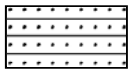

Boulder conglomerate

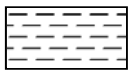

Conglomerate


Conglomeratic sandstone

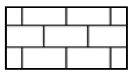

Sandstone


Siltstone


Laminite

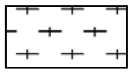

Mudstone, claystone, shale

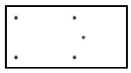

Coal


Limestone

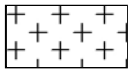
Metamorphic Rocks

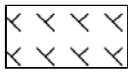

Slate, phyllite, schist

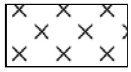

Gneiss

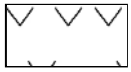

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 3.7 AHD
EASTING: 329004
NORTHING: 6239143
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 85348.00
DATE: 15/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.01	ARTIFICIAL GRASS		A	0.05				
		FILLING - brown, fine, gravelly, medium to coarse sand filling, humid			0.1				
		0.07m: becoming light yellow-brown		A	0.3				
		0.22m: becoming grey			0.4				
	0.45			A	0.45				
		FILLING - dark brown, medium to coarse silty sand filling with some fine to medium gravel, damp			0.5				
		0.8m: with some medium to coarse slag gravel							
	1.0	SAND - brown, medium to coarse sand with some silt, damp		A	1.1				
					1.2				
				A	1.9				
					2.0				
	2.3	SAND - light grey-brown and orange, medium to coarse sand, wet becoming saturated		A	2.4			▼	
					2.5				
	2.75	Bore discontinued at 2.75m - hole collapsed							

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 2.75m

WATER OBSERVATIONS: Free groundwater observed at 2.55m

REMARKS: Permeability test carried out at 0.55m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 3.7 AHD
EASTING: 328999
NORTHING: 6239113
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 85348.00
DATE: 15/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.01	ARTIFICIAL GRASS		A	0.05				
		FILLING - brown, fine, gravelly, medium to coarse sand filling, humid			0.1				
		0.07m: becoming light yellow-brown							
		0.22m: becoming grey		A	0.4				
					0.5				
	0.6	SAND - brown, medium to coarse sand with some fine gravel and silt, damp		A	0.6				
					0.7				
		1.4m: becoming light grey-brown		A	1.5				
					1.6				
	1.8	SAND - light brown, medium to coarse sand, damp							
				A	2.1				
					2.2				
	2.4	SANDY GRAVEL - dark grey and brown, medium to coarse, sandy, fine to medium gravel with some shells		A	2.4				
	2.5	Bore discontinued at 2.5m - practical refusal on medium to coarse gravel			2.5				

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 2.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Permeability test carried out at 0.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 4.1 AHD
EASTING: 328935
NORTHING: 6239114
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 85348.00
DATE: 15/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
4		FILLING - dark brown-grey, medium to coarse silty sand filling with some rootlets, humid		A	0.1				
					0.2				
		0.3m: with some fine to medium sandstone and charcoal gravel							
		0.4m: becoming moist		A	0.5				
					0.6				
3	1 1.0	SAND - brown, medium to coarse sand with some shells, moist		A	1.0				1
					1.1				
				A	1.4				
					1.5				
2	2			A	1.9				2
					2.0				
				A					
	2.6	SAND - light brown, medium to coarse sand, wet becoming saturated						▼	
1	3 3.0	Bore discontinued at 3.0m - target depth reached			3.0				3
0	4								4

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 3.0m

WATER OBSERVATIONS: Free groundwater observed at 2.7m

REMARKS: Permeability test carried out at 0.55m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 4.3 AHD
EASTING: 328935
NORTHING: 6239105
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 85348.00
DATE: 15/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - dark brown-grey, medium to coarse silty sand filling with some rootlets, humid			0.1				
				A	0.2				
					0.4				
				A	0.5				
		0.8m: with some charcoal gravel							
	1	0.9m: becoming light brown			0.9				1
				A	1.0				
					1.1				
	1.2			A	1.2				
		Bore discontinued at 1.2m - refusal on buried concrete							
	2								2
	3								3
	4								4

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased
TYPE OF BORING: Hand augered to 1.2m
WATER OBSERVATIONS: No free groundwater observed
REMARKS: Permeability test carried out at 0.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 4.2 AHD
EASTING: 328922
NORTHING: 6239137
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 85348.00
DATE: 16/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - dark brown, silty, fine to medium sand filling with trace of rootlets, humid (topsoil to 0.1m)		A	0.1 0.2				
		0.5m: becoming grey-brown		A	0.5 0.6				
	1.0	SAND - pale brown, medium to coarse sand with trace of shells, moist		A	1.1 1.2				
	2.5	SAND - dark brown mottled red-brown, medium to coarse sand with trace of shells, saturated		A	2.5 2.6			▼	
	2.7	Bore discontinued at 2.7m - hole collapsed							

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 2.7m

WATER OBSERVATIONS: Free groundwater observed at 2.5m

REMARKS: Permeability test carried out at 0.55m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 4.0 AHD
EASTING: 328927
NORTHING: 6239160
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 85348.00
DATE: 16/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
4		FILLING - dark brown, silty, fine to medium sand filling with trace of rootlets, humid (topsoil to 0.1m)			0.1				
				A	0.2				
		0.5m: becoming grey-brown							
	0.8	SAND - pale brown, medium to coarse sand with traces of shells, moist			0.8				
3	1			A	0.9				1
		1.4m: becoming grey			1.4				
				A	1.5				
2	2	2.4m: becoming pale brown mottled red							2
	2.8	SAND - pale brown mottled red, medium to coarse sand with trace of shells, saturated						▼	
1	3	3.0 Bore discontinued at 3.0m - target depth reached							3
0	4								4

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 3.0m

WATER OBSERVATIONS: Free groundwater observed at at 2.8m

REMARKS: Permeability test carried out at 0.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 4.0 AHD
EASTING: 328951
NORTHING: 6239158
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 85348.00
DATE: 16/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
4		FILLING - dark brown, silty, fine to medium sand filling with trace of rootlets, humid (topsoil to 0.1m)		A	0.1 0.2				
		0.25m: with some fine to medium slag and sandstone gravel							
		0.4m: becoming grey-brown							
	0.6	SAND - light grey, medium to coarse sand, moist		A	0.7 0.8				
3	1								1
		1.2m: becoming brown							
		1.7m: becoming yellow-brown							
2	2								2
		2.5m: becoming light brown-grey		A	2.4 2.5				
	2.7	SAND - light brown-grey, medium to coarse sand, saturated						▼	
1	3	3.0 Bore discontinued at 3.0m - target depth reached							3
0	4								4

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 3.0m

WATER OBSERVATIONS: Free groundwater observed at 2.7m

REMARKS: Permeability test carried out at 0.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 3.9 AHD
EASTING: 328977
NORTHING: 6239157
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 85348.00
DATE: 16/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - dark brown, silty, fine to medium sand filling with trace of rootlets, humid (topsoil to 0.1m)		A	0.1 0.2				
		0.2m: with some fine to medium sandstone gravel and brick fragments							
		0.4m: becoming grey-brown							
	0.8	SAND - brown, medium to coarse sand, moist		A	0.8 0.9				
		1.3m: becoming light brown grey							
				A	2.5 2.6				
	2.8	SAND - light brown-grey, medium to coarse sand, saturated						▼	
	3.0	Bore discontinued at 3.0m - target depth reached							

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 3.0m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS: Permeability test carried out at 0.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	15/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

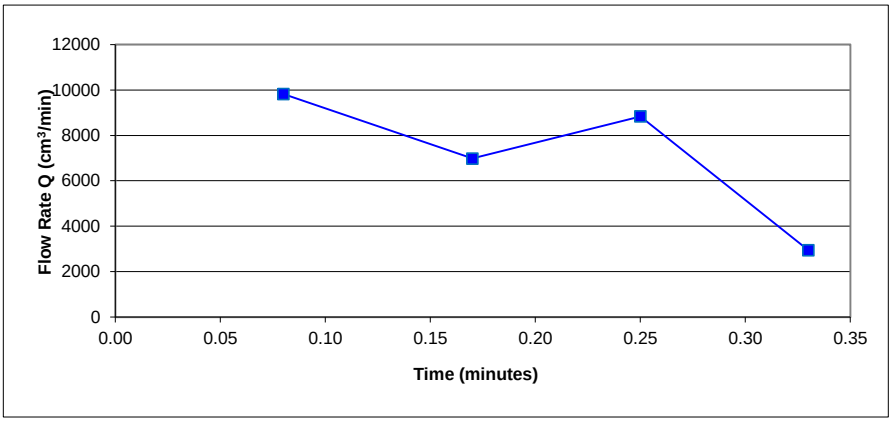
Description:	Bowling Green	**Test No.**	BH1	
Material type:	Sand Filling	Easting:	329004	m
Condition of ground surface before test: Artificial Grass		Northing	6239143	m
Weather during test: 29º, Cloudy		Surface Level:	3.7	m AHD

Details of Bore Installation

Depth of augered hole	550	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	350	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	200	785	9817
0.17	120	628	6981
0.25	30	707	8836
0.33	0	236	2945
Average		589	7145



Saturated Hydraulic Conductivity - Over total duration of test

k =	**2.54E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**4.23E-04**	m/sec	ref. AS1547-2012 App G
=	**36.56**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	15/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

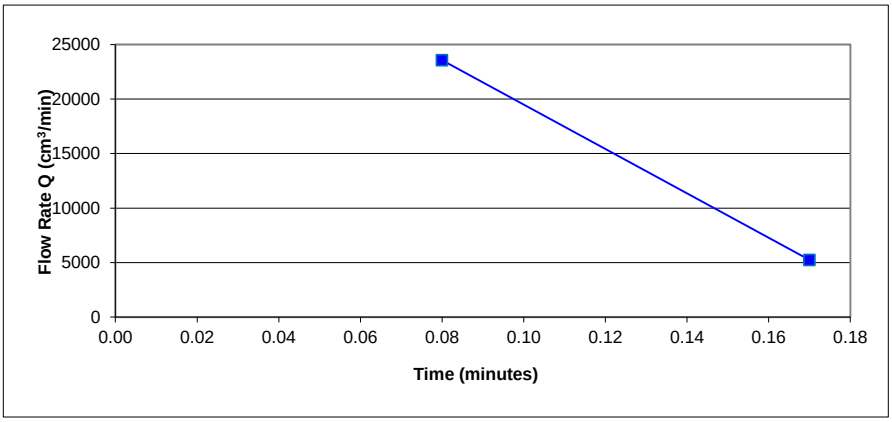
Description:	Bowling Green	**Test No.**	BH2	
Material type:	Sand Filling	Easting:	328999	m
Condition of ground surface before test: Artificial Grass		Northing	6239113	m
Weather during test: 29°, Cloudy		Surface Level:	3.7	m AHD

Details of Bore Installation

Depth of augered hole	500	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	300	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	60	1885	23562
0.17	0	471	5236
Average		1178	14399



Saturated Hydraulic Conductivity - Over total duration of test

k =	**6.39E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**1.07E-03**	m/sec	ref. AS1547-2012 App G
=	**92.02**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	15/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

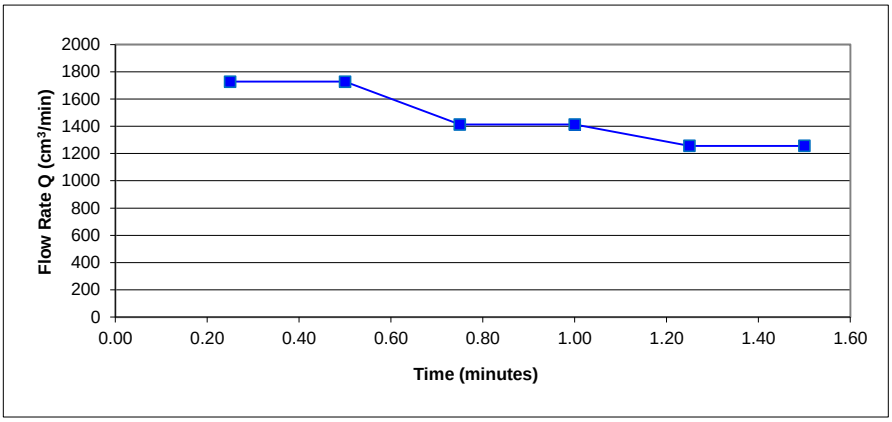
Description:	Lawn	**Test No.**	BH3	
Material type:	Silty Sand Filling	Easting:	328935	m
Condition of ground surface before test: Topsoil		Northing	6239114	m
Weather during test: 29°, Cloudy		Surface Level:	4.1	m AHD

Details of Bore Installation

Depth of augered hole	550	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	350	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.25	245	432	1728
0.50	190	432	1728
0.75	145	353	1414
1.00	100	353	1414
1.25	60	314	1257
1.50	20	314	1257
Average		367	1466



Saturated Hydraulic Conductivity - Over total duration of test

k =	**5.21E-01**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**8.68E-05**	m/sec	ref. AS1547-2012 App G
=	**7.50**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	15/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

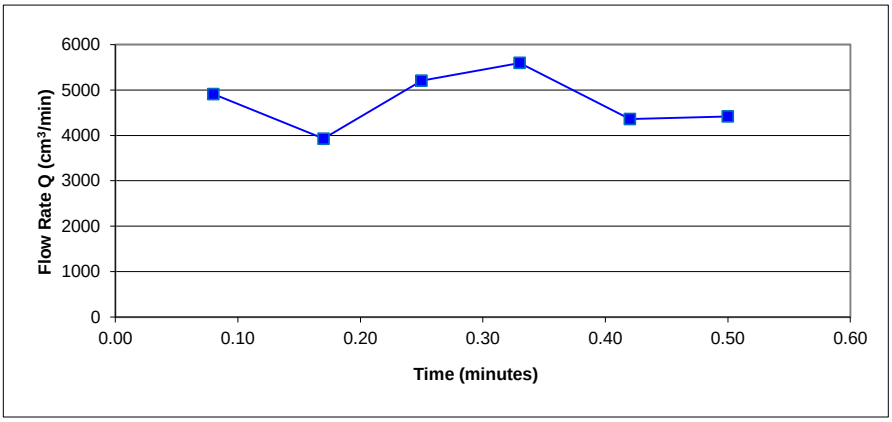
Description:	Lawn	**Test No.**	BH4	
Material type:	Silty Sandy Filling	Easting:	328935	m
Condition of ground surface before test: Topsoil		Northing	6239105	m
Weather during test: 29°, Cloudy		Surface Level:	4.3	m AHD

Details of Bore Installation

Depth of augered hole	500	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	300	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	250	393	4909
0.17	205	353	3927
0.25	152	416	5203
0.33	95	448	5596
0.42	45	393	4363
0.50	0	353	4418
Average		393	4736



Saturated Hydraulic Conductivity - Over total duration of test

k =	**2.10E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**3.50E-04**	m/sec	ref. AS1547-2012 App G
=	**30.27**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	16/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

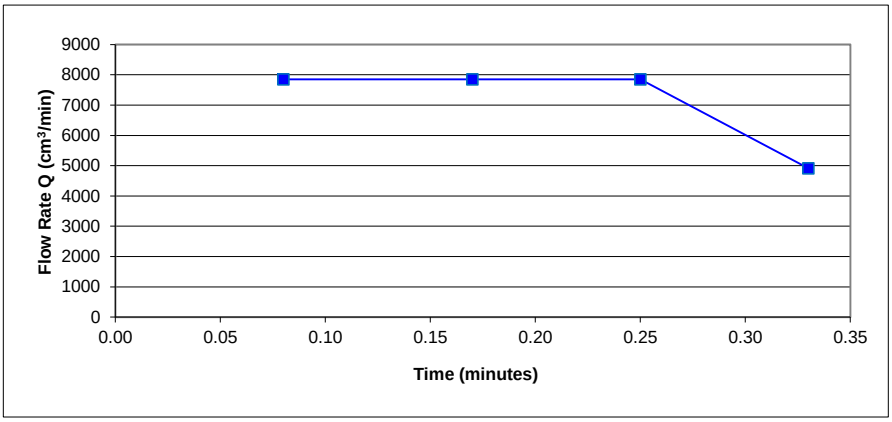
Description:	Lawn	**Test No.**	BH5	
Material type:	Silty Sandy Filling	Easting:	328922	m
Condition of ground surface before test:	Topsoil	Northing	6239137	m
Weather during test:	28°, Sunny	Surface Level:	4.2	m AHD

Details of Bore Installation

Depth of augered hole	550	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	350	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	220	628	7854
0.17	130	707	7854
0.25	50	628	7854
0.33	0	393	4909
Average		589	7118



Saturated Hydraulic Conductivity - Over total duration of test

k =	**2.53E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**4.22E-04**	m/sec	ref. AS1547-2012 App G
=	**36.42**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	16/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

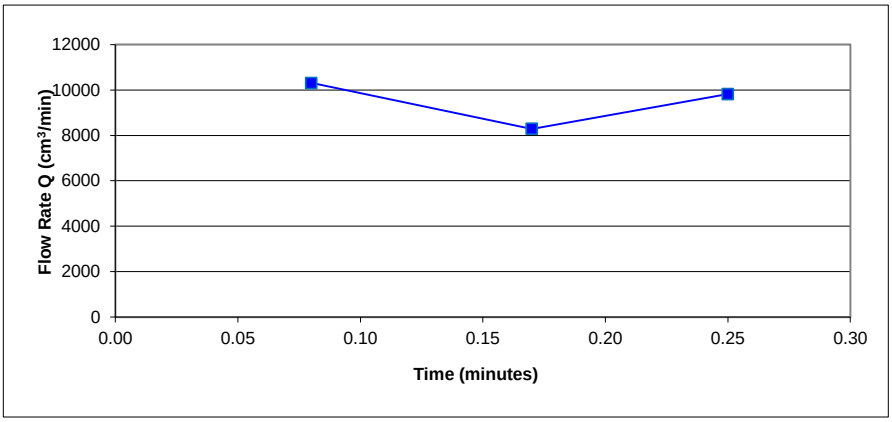
Description:	Lawn	**Test No.**	BH6	
Material type:	Silty Sandy Filling	Easting:	328927	m
Condition of ground surface before test:	Topsoil	Northing	6239160	m
Weather during test:	28°, Sunny	Surface Level:	4	m AHD

Details of Bore Installation

Depth of augered hole	500	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	300	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	195	825	10308
0.17	100	746	8290
0.25	0	785	9817
Average		785	9472



Saturated Hydraulic Conductivity - Over total duration of test

k =	**4.20E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**7.01E-04**	m/sec	ref. AS1547-2012 App G
=	**60.53**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	16/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

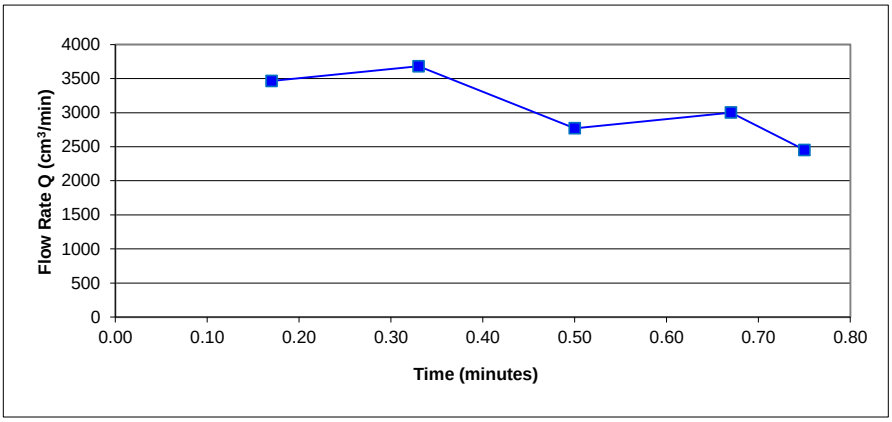
Description:	Lawn	**Test No.**	BH7	
Material type:	Silty Sandy Filling	Easting:	328951	m
Condition of ground surface before test:	Topsoil	Northing	6239158	m
Weather during test:	28°, Sunny	Surface Level:	4	m AHD

Details of Bore Installation

Depth of augered hole	500	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	300	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.17	225	589	3465
0.33	150	589	3682
0.50	90	471	2772
0.67	25	511	3003
0.75	0	196	2454
Average		471	3075



Saturated Hydraulic Conductivity - Over total duration of test

k =	**1.36E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**2.27E-04**	m/sec	ref. AS1547-2012 App G
=	**19.65**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	16/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

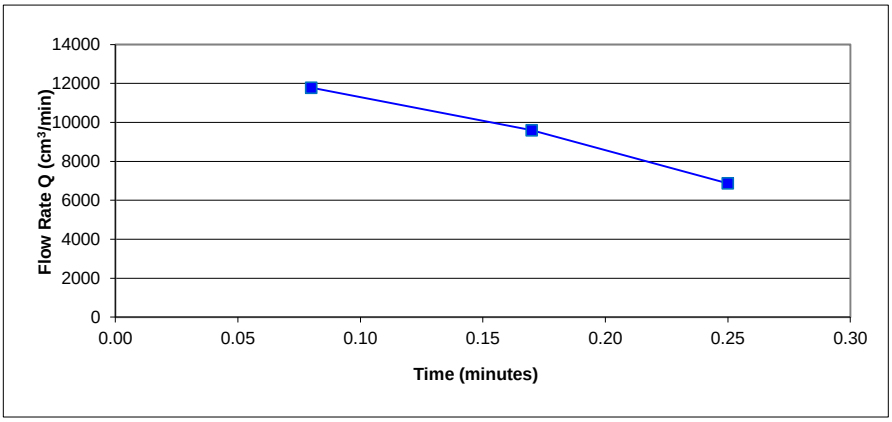
Description:	Flower Bed	**Test No.**	BH8	
Material type:	Silty Sandy Filling	Easting:	328977	m
Condition of ground surface before test:	Topsoil	Northing	6239157	m
Weather during test:	28°, Sunny	Surface Level:	3.9	m AHD

Details of Bore Installation

Depth of augered hole	500	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	300	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	180	942	11781
0.17	70	864	9599
0.25	0	550	6872
Average		785	9418



Saturated Hydraulic Conductivity - Over total duration of test

k =	**4.18E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**6.97E-04**	m/sec	ref. AS1547-2012 App G
=	**60.18**	m/day	

Locality Plan

NOTE:

1: Base drawing from Project Surveyors (Dwg B1968-1, dated 11.9.2015)
2: Test locations are approximate only and are shown with reference to existing features.

LEGEND

Borehole and Soil Permeabilty Test Location

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Monterey Equity Pty Limited	TITLE: **Location of Tests** **Proposed Residential Development** **119 Barton Street, Monterey**	PROJECT No: 85348.00
	OFFICE: Sydney / DRAWN BY: PSCH		DRAWING No: 1
	SCALE: 1:800 @ A3 / DATE: 22.2.2016		REVISION: 0

Sydney Office
Suite 802, Level 8, 181 Miller Street
North Sydney NSW 2060, Australia

1300 657 402

www.adgce.com

Planning Assessment

Rockdale City Council
PO Box 21
Rockdale NSW 2216

Our Ref: 18623 C L003
9 March 2016
AM / hd
Sydney Office

Re: 119 BARTON STREET, MONTEREY
LOTS 7 & 8 ON SEC4 DP401 AND LOT 10 ON DP21626
STORMWATER MANAGEMENT OVERVIEW

ADG Engineers (Aust) Pty Ltd have been engaged by Heymann-Cohen Pty Ltd to prepare a stormwater management overview for submission to Rockdale City Council (Council) as additional information in support of a Development Application for a planning proposal to modify the approved use for the property (rezone land to R3 Medium Density Residential) located at 119 Barton Street, Monterey.

An indicative development proposal concept is described in the Rothe Lowman architectural drawings (dated December 2015).

Refer to the architectural drawings in **Appendix A** for further information.

All relevant standards and guidelines are addressed in the report including the requirements of criteria from the Councils DCP and Technical Specification.

Existing Drainage

As identified form a site visit undertaken by ADG Engineers, there is no existing stormwater drainage within connectable proximity to the subject site.

As identified from the detailed survey by Project Surveyors (**Appendix B**), the ground surface within the site falls from the site boundaries towards the centre of the site. Although multiple inlet pits were identified within the existing carpark, no formalised drainage system that conveys runoff off site has been identified. Stormwater runoff generated within the subject site is contained wholly within the boundaries of the site and is discharged gradually via infiltration to the sandy soils beneath.

External Catchments

No external catchments have been identified to impact the subject site.

Flooding Considerations

Council has advised that the subject site has not been identified as flood affected.

Stormwater Quantity Assessment

The stormwater quantity objective was to demonstrate that there is no increase in peak discharges from the subject site. The purpose of this objective is to ensure that the existing infrastructure and/or downstream properties are not adversely affected.

Councils 'Technical Specification: Stormwater Management' has identified that on-site retention and/or detention will be required for all developments to mitigate any increase in stormwater quantity. ADG Engineers recommend that an on-site retention system in the form of an absorption system be installed to mitigate stormwater quantity.

Appendix F of Council's Technical Specification: Stormwater Management provides the methodology for calculating the required absorption volume for developments within the city of Rockdale. The key variable in determining a suitable absorption volume is the Nominal Absorption Rate (AR_n) at the location of the absorption system. A geotechnical investigation has been undertaken by Douglas Partners Pty Ltd and the corresponding report has been provided in **Appendix D.** The geotechnical investigation has assessed multiple locations across the site and has identified a Nominal Absorption Rate (AR_n) of between 0.1 to 1.1L/s/m^2. In the proposed location of the absorption tank, two geotechnical tests were undertaken which will hereby by referred to as BH1 & BH2. The tests at these locations returned an AR_n of 0.4L/s/m^2 and 1.1L/s/m^2 for BH1 and BH2 respectively. As a conservative approach, ADG propose to use the lesser figure of 0.4L/s/m^2 for the absorption pit calculations.

The size of the absorption pit has been calculated in accordance with Section 5.4 of Councils Technical Specification: Stormwater Management. A design spreadsheet has been provided by Council and can be found in **Appendix C.**

Table 1 below displays a summary of the calculation sheet provided in Councils Technical Specification.

Table 1: Absorption Pit Calculation Summary

Contributing Impervious Area (m^2)	Nominal Absorption Rate (L/s/m^2)	Required Tank Storage (m^3)
4845	0.4	173.4

To achieve the required storage volume, ADG recommends to install an infiltration tank with dimensions 25.5m (L) x 8.5m (W) x 0.8m (D) at the location identified in ADG's conceptual stormwater management sketch in **Appendix E**. With the incorporation of the absorption system to control the release of peak flow discharge to permissible limits, ADG Engineers expects that the stormwater quantity control solution shall be supported by Council.

Refer to **Appendix C** for the City of Rockdale Absorption Pit Design Calculation Sheet.

Stormwater Quality Assessment

Currently no stormwater quality management measures are in place for the subject site. Stormwater quality requirements will be achieved through the infiltration of stormwater runoff to the soil via the absorption tank. As per Section 7.2.1 of Councils Stormwater Management Technical Specification (2011), a BASIX certificate will be supplied at a later date which may provide the provision of a minimum rainwater tank volume to further reduce potable water demand and increase stormwater quality.

As a pre-treatment solution, ADG propose that litter baskets be installed in all field inlet pits upstream of the infiltration tank. The litter baskets will aid in preventing solid pollutants from entering the infiltration tank.

Stormwater Management Strategy

Assuming a future BASIX certificate provides a minimum rainwater reuse volume, ADG anticipate that stormwater runoff collected within the roof area of the proposed development will initially be directed towards the rainwater re-use tank/s for retention. Overflow from the re-use tanks will be conveyed to the proposed 173.4m^3 infiltration system where stormwater runoff will be allowed to infiltrate into the ground. Should the future BASIX report not include a provision for rainwater reuse tanks, runoff from the roof area of the proposed development will be conveyed directly to the infiltration system. In accordance with Section 7.5.4 of Councils Technical Specification: Stormwater Management, should the proposed layout result in over 10 parking spaces, the incorporation of an oil and grit separator prior to the infiltration tank will be required.

A preliminary sketch of the proposed stormwater management strategy has been prepared by ADG and is attached within **Appendix E** of this overview.

Should you wish to discuss further, please feel free to contact myself on 1300 657 402.

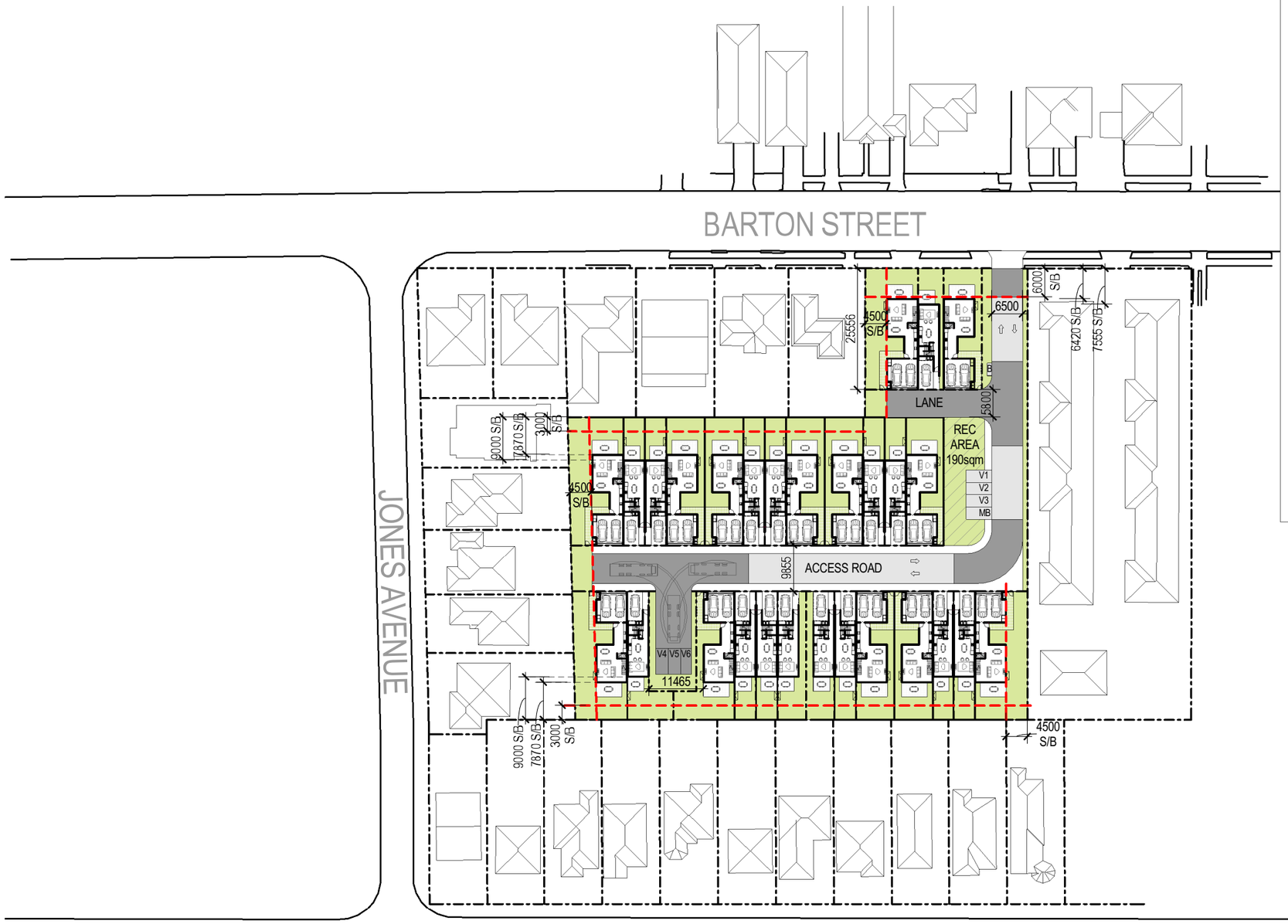
Regards,

ADG ENGINEERS (AUST) PTY LTD

ADAM MOLINA

Senior Civil Engineer

Appendix A
Rothe Lowman Site Plan



TOWN PLANNING REQUIREMENTS

	COMPLIES
4.3.1 (8) OPEN SPACE & LANDSCAPE DESIGN 25%	YES
TYPE A 8.1m x 27m LOT = 219sqm x 0.25 = 56 sqm REQ. (ACTUAL OPEN SPACE PROVIDED = 108 sqm)	YES
TYPE B 4.5m x 27m LOT = 121.5 sqm x 0.25 = 30 sqm (ACTUAL OPEN SPACE PROVIDED = 40.5 sqm)	YES
(9) AT LEAST 20% OF THE FRONT SETBACK AREA TO BE LANDSCAPED AREA	YES
4.3.2 PRIVATE OPEN SPACE	
2 BEDROOM: 40 sqm	YES
3 BEDROOM: 50 sqm	YES
4.3.3 COMMUNAL OPEN SPACE	
5sqm PER DWELLING	YES
MIN. AREA OF 40% SUNLIGHT AT 1PM 21 JUNE	YES

PARKING

3 BED: 2 CAR SPACES PER TOWNHOUSE REQUIRED	YES
2 BED: 1 CAR SPACE PER TOWNHOUSE REQUIRED	YES
VISITOR CAR PARKS: 1 PER 5 DWELLINGS REQ.	YES
BICYCLE: 1 SPACE / 10 DWELLINGS	YES
MOTORCYCLE: 1 SPACE / 15 DWELLINGS	YES

DEVELOPMENT SUMMARY

TOTAL SITE AREA:	7218 m2
TOTAL TOWNHOUSES:	28
	13 TYPE A (46%) 3 BED 15 TYPE B (54%) 2 BED
HEIGHT:	2 STOREYS
FSR: 0.6:1	= 7218 m2 x 0.6 = 4330 m2 MAX. GFA /28 = 154 m2 AVE. GFA PER TOWNHOUSE

18/12/2015 11:30:47 AM

REVISIONS

No	Date	Description	By
P1	17/12/15	PRELIMINARY ISSUE	JF

N

PROJECT TITLE
TOWNHOUSE DEVELOPMENT
119 Barton Street, Monterey, NSW

DRAWING TITLE
GROUND FLOOR/LEVEL 1 MASTERPLAN

SCALE: @ A3 1 : 1000
PROJECT No: 215416
DATE: 17/12/15
DRAWN BY: JF
DWG No: SK00.02
REV P1

PRELIMINARY

SYDNEY
LEVEL 2/171 WILLIAM STREET
DARLINGHURST NSW 2010
AUSTRALIA
T 02 8645 2600
www.rothelowman.com.au ACN 005 783 997

ROTHELOWMAN

Appendix B
Detail Survey

* THE SUBJECT TITLE NOTES
1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)

A1

NOTES :

* BOUNDARIES HAVE NOT BEEN DEFINED BY SURVEY AND ARE DIAGRAMMATIC ONLY.
* LAND DIMENSIONS AND AREAS HAVE BEEN COMPILED FROM PLANS OBTAINED FROM LPMA.
* BEARINGS RELATE TO ISG NORTH ORIGINATING FROM DP857520
* LEVEL DATUM IS AHD ORIGINATING FROM SSM171745 RL 4.284 LOCATED AT BARTON STREET.
* VISIBLE, ACCESSIBLE SERVICES ONLY HAVE BEEN LOCATED. THIS PLAN DOES NOT PURPORT TO SHOW UNDERGROUND SERVICES.
* THE EXISTENCE OF UNDERGROUND SERVICES HAS NOT BEEN ESTABLISHED.
* EXISTENCE OF SERVICES MUST BE VERIFIED BY CONTACTING DIAL BEFORE YOU DIG (DBYD) 1100.COM.AU CRITICAL SERVICES MUST BE EXPOSED AND LOCATED
* NEIGHBOURING HOUSES , WINDOWS AND ROOF POSITIONS ARE APPROXIMATE ONLY.
* FLOOR LEVELS GENERALLY SURVEYED AT DOOR THRESHOLDS. INTERNAL ROOMS NOT SURVEYED.
* CONTOURS SHOWN ARE INDICATIVE OF LAND FORM. SPOT LEVELS SHOULD TAKE PRECEDENCE.
* REFER TO FACE OF PLAN FOR SUBJECT TITLE NOTATIONS.
* THIS TITLEBLOCK IS AN INTEGRAL PART OF THIS DRAWING AND SHOULD NOT BE REMOVED.

LEGEND

ELP - ELECTRIC LIGHT POLE
HYD - HYDRANT
TW - TOP WALL
TK - TOP KERB
TG - TOP GUTTER
PP - POWER POLE
SMH - SEWER MANHOLE
SP - SIGN POST
SV - STOP VALVE
TEL - TELSTRA PIT
VC - VEHICLE CROSSING
WM - WATER METER

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REV		DATE
A	CONTOURS & SERVICES ADDED	11.09.15
REV	AMENDMENTS	DATE

CLIENT: HEYMAN COHEN

PLAN OF: 119 BARTON STREET MONTEREY

BEING: LOT 2 IN DP 857520

SHOWING: GENERAL DETAIL AND SITE LEVELS

PURPOSE: ARCHITECTURAL DESIGN COUNCIL SUBMISSION

SHEET 1 0F 4

SCALE 1:400

0 10 20 30 40

SURVEYOR :	KURT F
DATUM :	AUSTRALIAN HEIGHT DATUM
ORIGIN :	SSM131745 RL 4.284
JOB REF. :	B1968
DRAWING No.	B1968–1
CHECKED :	AB
DATE OF SURVEY:	26 AUGUST 2015
REDUCTION RATIO :	1:400

MACQUARIE PARK

PO Box 4004
MACQUARIE CENTRE NSW 2113

SUITE 404, LEVEL 4
No13–15 LYON PARK ROAD,
MACQUARIE PARK NSW 2113

PHONE : 9888 3848
FAX : 9888 3875
email: office@projectsurveyors.com.au
www.projectsurveyors.com.au
ABN 20 068 433 974

PROJECT SURVEYORS
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Appendix C
Absorption Tank Calculation Spreadsheet

ABSORPTION PIT DESIGN
ROCKDALE CITY COUNCIL

TANK STYLE ABSORPTION

Fill in only those boxes that appear as:

Width (m)	Length (m)	= Base Area		
8.5	25.5	216.75	Base Thickness (m) =	0.1
Height	0.8		Tank Storage=	173.4

Available Storage (m^3) = 177.735

Calculating Inflows, Outflows and Storages

Contributing Impervious Area (m^2)= 4845 F_R= 0.75

Nominal Absorption Rate (l/s/m^2) = 0.4

Design Absorption Rate (l/s/m^2) = 0.3 Outflow (l/s) = 65.025

Time (min)	Intensity (mm/hr)	Inflow (l/s)	Inflow Vol (m^3)	Ouflow Vol (m^3)	Required Vol (m^3)	Avail-Requd (m^3)
5	238	320.31	96.09	19.51	76.59	101.15
6	223	300.12	108.04	23.41	84.63	93.10
7	211	283.97	119.27	27.31	91.96	85.78
8	202	271.86	130.49	31.21	99.28	78.46
9	194	261.09	140.99	35.11	105.88	71.86
10	186	250.33	150.20	39.02	111.18	66.56
11	180	242.25	159.89	42.92	116.97	60.77
12	174	234.18	168.61	46.82	121.79	55.95
13	169	227.45	177.41	50.72	126.69	51.05
14	164	220.72	185.40	54.62	130.78	46.95
15	160	215.33	193.80	58.52	135.28	42.46
20	142	191.11	229.33	78.03	151.30	26.44
25	129	173.61	260.42	97.54	162.88	14.85
30	118	158.81	285.86	117.05	168.81	8.93
40	102	137.28	329.46	156.06	173.40	4.34
45	96	129.20	348.84	175.57	173.27	4.46
50	90.6	121.93	365.80	195.08	170.72	7.01
55	85.8	115.47	381.06	214.58	166.48	11.26
60	81.7	109.95	395.84	234.09	161.75	15.99
65	77.9	104.84	408.88	253.60	155.28	22.45
70	74.6	100.40	421.68	273.11	148.57	29.16
75	71.5	96.23	433.02	292.61	140.41	37.33
80	68.7	92.46	443.80	312.12	131.68	46.05
85	66.2	89.09	454.38	331.63	122.75	54.98
90	63.9	86.00	464.39	351.14	113.26	64.48
100	59.8	80.48	482.89	390.15	92.74	85.00
120	44.7	60.16	433.14	468.18	-35.04	212.77
						4.34

Rainwater Tank

Vol of Tank (m^3)	Offset Applies	Offset Allowance	
0	**N**	**0**	4.3350

NOTE THAT COLUMN 'Avail-Requd' MUST BE POSITIVE FOR ALL VALUES.

THE DESIGN IS: SATISFACTORY

Appendix D
Douglas Partners Geotechnical Report

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SYDNEY NSW 2000

Project 85348.00
4 March 2016
R.001.Rev0
PAV:dh

Attention: Mr Richard Pajor

Email: richard.pajor@dcwc.com.au

Dear Sirs

Geotechnical Assessment of Nominal Absorption Rate
Proposed Residential Development
119 Barton Street, Monterey

1. Introduction

This letter report describes the results of a geotechnical assessment undertaken by Douglas Partners Pty Ltd (DP) at 119 Barton Street, Monterey. The investigation was commissioned by Monterey Equity Pty Limited.

It is understood that the proposed development will include the construction of townhouses, which will include a stormwater management system.

The assessment included eight boreholes and constant-head permeability tests to assess the subsurface profile and soil permeability at potential locations of the absorption pits. The permeability testing was carried out in accordance with the requirements of Section 5.2 of Rockdale City Council's Technical Specification: Stormwater Management, dated 2011. Details of the field work are provided together with comments on stormwater management.

2. Site Description and Geology

The site is currently occupied by Francis Drake Bowling Club, which includes a single-storey building (club house), two synthetic grass bowling greens, grassed areas, garden beds and an on-grade asphaltic concrete car park. One and two-storey buildings surround the site, except where the car park adjoins Barton Street.

The ground surface slopes gently down from the site boundaries towards the central area of the site, with reduced levels ranging from approximately RL 4.9 m to RL 3.7 m relative to Australian Height Datum (AHD).

Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the site is located in an area underlain by wind-blown sand (Aeolian), with some silt and shells also present.

3. Field Work

3.1 Field Work Methods

The field work for the investigation comprised:

- Eight boreholes drilled to 3 m depth or prior refusal or hole collapse using a 100 mm diameter hand-auger. The boreholes were located at the possible locations for absorption pits, as nominated by Heymann-Cohen Pty Ltd;
- Logging and collection of soil samples and observation of the soil moisture condition;
- Eight constant-head permeability tests at depths of 0.5 m or 0.55 m within each borehole and carried out in accordance with Australian Standard *AS 1547 On site domestic waste water management - 2012 - Appendix G*. For the constant-head test, the borehole was initially filled with water to saturate the soil prior to testing. A water-filled standpipe (permeameter) was then inserted into the water-filled borehole to maintain a constant head of 0.3 – 0.35 m above the base of the borehole. The water level in the standpipe was measured and recorded at regular time intervals until total water loss from the permeameter had occurred.

Surface levels at the test locations were interpolated from Survey Drawing No. B1968-1, dated 11 September 2015, by Project Surveyors Pty Ltd. The locations of the tests are shown on the attached Drawing No. 1.

3.2 Field Work Results

The detailed borehole logs and permeability test results are attached, together with notes defining classification methods and descriptive terms.

3.2.1 Boreholes

The ground conditions encountered in the boreholes can be summarised as follows:

- **Artificial Grass** – 0.01 m thick in BH1 and BH2;
- **Filling (Topsoil)** – 0.1 m thick root-affected silty sand topsoil layer in BH5 to BH8;
- **Filling** – predominantly sand and silty sand filling extending to depths of between 0.6 m and 1.2 m in all boreholes. Gravel and cobble sized inclusions of sandstone, charcoal and slag were encountered in the filling. Borehole BH4 was discontinued at 1.2 m depth due to practical refusal of the hand auger on buried concrete;

- **Sand/Sandy Gravel** – medium to coarse grained sand with traces of shells extending to the final depths (i.e. 2.7 m to 3 m) of boreholes BH1, BH3 and BH5 to BH8. Borehole BH2 had sand to 2.4 m depth underlain by sandy gravel, with auger refusal at 2.5 m depth.

Above the groundwater table, the moisture condition of the filling and natural soil was variably humid to wet, with the degree of saturation generally increasing with depth. Free groundwater was observed in BH1, BH3 and BH5 to BH8 at depths of between 2.5 m and 2.8 m.

3.2.2 Permeability Tests

The saturated hydraulic conductivity (K_{sat}) results of the eight constant-head permeability tests are summarised in Table 1.

Table 1: Results of Constant Head Permeability Tests

Permeability Test Location	Hydraulic Conductivity (K_{sat}) (m/s)
BH1	4.2×10^{-4}
BH2	1.1×10^{-3}
BH3	8.7×10^{-5}
BH4	3.5×10^{-4}
BH5	4.2×10^{-4}
BH6	7.0×10^{-4}
BH7	2.3×10^{-4}
BH8	7.0×10^{-4}

4. Comments

4.1 Proposed Development

It is understood that the proposed development will include the construction of townhouses, which will include a stormwater management system. The feasibility and potential locations of absorption pits for the stormwater system is being assessed for the development.

4.2 Soil Category and Nominal Absorption Rate

Based on the results of the constant-head tests, the 'soil category' has been correlated in accordance with Table 5.1 of AS 1547 – 2012. For all eight tests, the soil texture correlates to 'Gravels and Sands' and the (soil horizon) structure correlates to 'Structureless (Massive)'.

In accordance with Section 5.2 of Rockdale City Council's Technical Specification: Stormwater Management, dated 2011, the hydraulic conductivity for each permeability test has been calculated in terms of a nominal absorption rate (litres/square metre/second), as shown in Table 2. The nominal absorption rate has been calculated by assuming a hydraulic gradient of 1 for sandy soil. The calculated results have been rounded to the nearest 0.1 of a decimal place.

Table 2: Nominal Absorption Rate

Permeability Test Location	Nominal Absorption Rate (L/s/m^2)
BH1	0.4
BH2	1.1
BH3	0.1
BH4	0.4
BH5	0.4
BH6	0.7
BH7	0.2
BH8	0.7

5. Conclusion

Council's Specification indicates that absorption may not be practical where the nominal absorption rate is less than 0.05 L/s/m^2 or where physical limitations such as a high water table, bedrock close to ground surface or contaminated soils exist.

It should be noted that the hydraulic conductivity is dependent on the density and the degree of saturation of the soil, and therefore, it is likely to decrease with depth and vary according to weather conditions. The nominal absorption rate is also dependent upon the hydraulic gradient, that is, the rate will change with changes of the depth to the underlying water table.

Based on the permeability test results, the nominal absorption rates are greater than Council's nominal absorption rate of 0.05 L/s/m^2 and as such the use of on-site absorption pits is considered to be feasible from a hydrogeoligical point of view. It is noted that an impermeable layer such as bedrock was not encountered within the depths of the boreholes (up to 3 m deep). A relatively shallow groundwater table, however, was encountered 2.5 m to 2.8 m below the current ground surface levels. DP has not carried out a contamination assessment of soils for this site.

6. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at 119 Barton Street, Monterey in accordance with DP's proposal (SYD160043.P.001.Rev1 dated 1 February 2016 and acceptance received from Monterey Equity Pty Limited dated 9 February 2016. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Monterey Equity Pty Limited and their agents for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of

potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Please contact the undersigned if you have any questions on this matter.

Yours faithfully
Douglas Partners Pty Ltd

Peter Valenti
Geotechnical Engineer

Reviewed by

Bruce McPherson
Principal

Attachments: About this Report
Borehole Logs
Constant Head Test Results
Drawing No. 1 – Location of Tests

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

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

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

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

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

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

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

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

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

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

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Sampling

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

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Symbols & Abbreviations

Douglas Partners

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete


Filling

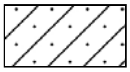
Soils


Topsoil

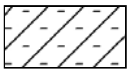

Peat


Clay

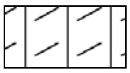

Silty clay

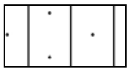

Sandy clay

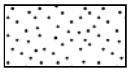

Gravelly clay

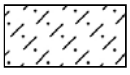

Shaly clay

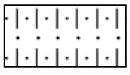

Silt


Clayey silt


Sandy silt

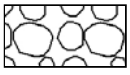

Sand

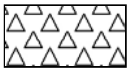

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

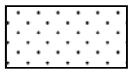

Talus

Sedimentary Rocks

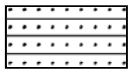

Boulder conglomerate

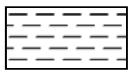

Conglomerate


Conglomeratic sandstone

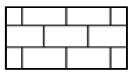

Sandstone


Siltstone


Laminite

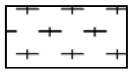

Mudstone, claystone, shale

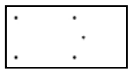

Coal


Limestone

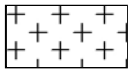
Metamorphic Rocks

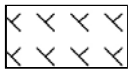

Slate, phyllite, schist

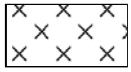

Gneiss

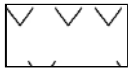

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 3.7 AHD
EASTING: 329004
NORTHING: 6239143
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 85348.00
DATE: 15/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.01	ARTIFICIAL GRASS		A	0.05				
		FILLING - brown, fine, gravelly, medium to coarse sand filling, humid			0.1				
		0.07m: becoming light yellow-brown		A	0.3				
		0.22m: becoming grey			0.4				
	0.45			A	0.45				
		FILLING - dark brown, medium to coarse silty sand filling with some fine to medium gravel, damp			0.5				
		0.8m: with some medium to coarse slag gravel							
	1.0	SAND - brown, medium to coarse sand with some silt, damp		A	1.1				
					1.2				
				A	1.9				
					2.0				
	2.3	SAND - light grey-brown and orange, medium to coarse sand, wet becoming saturated		A	2.4			▼	
					2.5				
	2.75	Bore discontinued at 2.75m - hole collapsed							

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 2.75m

WATER OBSERVATIONS: Free groundwater observed at 2.55m

REMARKS: Permeability test carried out at 0.55m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 3.7 AHD
EASTING: 328999
NORTHING: 6239113
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 85348.00
DATE: 15/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.01	ARTIFICIAL GRASS		A	0.05				
		FILLING - brown, fine, gravelly, medium to coarse sand filling, humid			0.1				
		0.07m: becoming light yellow-brown							
		0.22m: becoming grey		A	0.4				
					0.5				
	0.6	SAND - brown, medium to coarse sand with some fine gravel and silt, damp		A	0.6				
					0.7				
		1.4m: becoming light grey-brown		A	1.5				
					1.6				
	1.8	SAND - light brown, medium to coarse sand, damp							
				A	2.1				
					2.2				
	2.4	SANDY GRAVEL - dark grey and brown, medium to coarse, sandy, fine to medium gravel with some shells		A	2.4				
	2.5	Bore discontinued at 2.5m - practical refusal on medium to coarse gravel			2.5				

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 2.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Permeability test carried out at 0.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 4.1 AHD
EASTING: 328935
NORTHING: 6239114
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 85348.00
DATE: 15/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
4		FILLING - dark brown-grey, medium to coarse silty sand filling with some rootlets, humid		A	0.1				
					0.2				
		0.3m: with some fine to medium sandstone and charcoal gravel							
		0.4m: becoming moist		A	0.5				
					0.6				
3	1 1.0	SAND - brown, medium to coarse sand with some shells, moist		A	1.0				1
					1.1				
				A	1.4				
					1.5				
2	2			A	1.9				2
					2.0				
				A					
	2.6	SAND - light brown, medium to coarse sand, wet becoming saturated						▼	
1	3 3.0	Bore discontinued at 3.0m - target depth reached			3.0				3
0	4								4

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 3.0m

WATER OBSERVATIONS: Free groundwater observed at 2.7m

REMARKS: Permeability test carried out at 0.55m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 4.3 AHD
EASTING: 328935
NORTHING: 6239105
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 85348.00
DATE: 15/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - dark brown-grey, medium to coarse silty sand filling with some rootlets, humid			0.1				
				A	0.2				
					0.4				
				A	0.5				
		0.8m: with some charcoal gravel							
	1	0.9m: becoming light brown			0.9				1
				A	1.0				
					1.1				
	1.2			A	1.2				
		Bore discontinued at 1.2m - refusal on buried concrete							
	2								2
	3								3
	4								4

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased
TYPE OF BORING: Hand augered to 1.2m
WATER OBSERVATIONS: No free groundwater observed
REMARKS: Permeability test carried out at 0.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 4.2 AHD
EASTING: 328922
NORTHING: 6239137
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 85348.00
DATE: 16/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - dark brown, silty, fine to medium sand filling with trace of rootlets, humid (topsoil to 0.1m)		A	0.1 0.2				
		0.5m: becoming grey-brown		A	0.5 0.6				
	1.0	SAND - pale brown, medium to coarse sand with trace of shells, moist		A	1.1 1.2				
	2.5	SAND - dark brown mottled red-brown, medium to coarse sand with trace of shells, saturated		A	2.5 2.6			▼	
	2.7	Bore discontinued at 2.7m - hole collapsed							

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 2.7m

WATER OBSERVATIONS: Free groundwater observed at 2.5m

REMARKS: Permeability test carried out at 0.55m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 4.0 AHD
EASTING: 328927
NORTHING: 6239160
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 85348.00
DATE: 16/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
4		FILLING - dark brown, silty, fine to medium sand filling with trace of rootlets, humid (topsoil to 0.1m)			0.1				
				A	0.2				
		0.5m: becoming grey-brown							
	0.8	SAND - pale brown, medium to coarse sand with traces of shells, moist			0.8				
3	1			A	0.9				1
		1.4m: becoming grey			1.4				
				A	1.5				
2	2	2.4m: becoming pale brown mottled red							2
	2.8	SAND - pale brown mottled red, medium to coarse sand with trace of shells, saturated						▼	
1	3	3.0 Bore discontinued at 3.0m - target depth reached							3
0	4								4

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 3.0m

WATER OBSERVATIONS: Free groundwater observed at at 2.8m

REMARKS: Permeability test carried out at 0.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 4.0 AHD
EASTING: 328951
NORTHING: 6239158
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 85348.00
DATE: 16/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
4		FILLING - dark brown, silty, fine to medium sand filling with trace of rootlets, humid (topsoil to 0.1m)		A	0.1 0.2				
		0.25m: with some fine to medium slag and sandstone gravel							
		0.4m: becoming grey-brown							
	0.6	SAND - light grey, medium to coarse sand, moist		A	0.7 0.8				
3	1								1
		1.2m: becoming brown							
		1.7m: becoming yellow-brown							
2	2								2
		2.5m: becoming light brown-grey		A	2.4 2.5				
	2.7	SAND - light brown-grey, medium to coarse sand, saturated						▼	
1	3	3.0 Bore discontinued at 3.0m - target depth reached							3
0	4								4

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 3.0m

WATER OBSERVATIONS: Free groundwater observed at 2.7m

REMARKS: Permeability test carried out at 0.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Monterey Equity Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: 119 Barton Street, Monterey

SURFACE LEVEL: 3.9 AHD
EASTING: 328977
NORTHING: 6239157
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 85348.00
DATE: 16/2/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - dark brown, silty, fine to medium sand filling with trace of rootlets, humid (topsoil to 0.1m)		A	0.1 0.2				
		0.2m: with some fine to medium sandstone gravel and brick fragments							
		0.4m: becoming grey-brown							
	0.8	SAND - brown, medium to coarse sand, moist		A	0.8 0.9				
		1.3m: becoming light brown grey							
				A	2.5 2.6				
	2.8	SAND - light brown-grey, medium to coarse sand, saturated						▼	
	3.0	Bore discontinued at 3.0m - target depth reached							

RIG: Hand tools **DRILLER:** MB/JS **LOGGED:** MB/JS **CASING:** Uncased

TYPE OF BORING: Hand augered to 3.0m

WATER OBSERVATIONS: Free groundwater observed at 2.8m

REMARKS: Permeability test carried out at 0.5m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	15/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

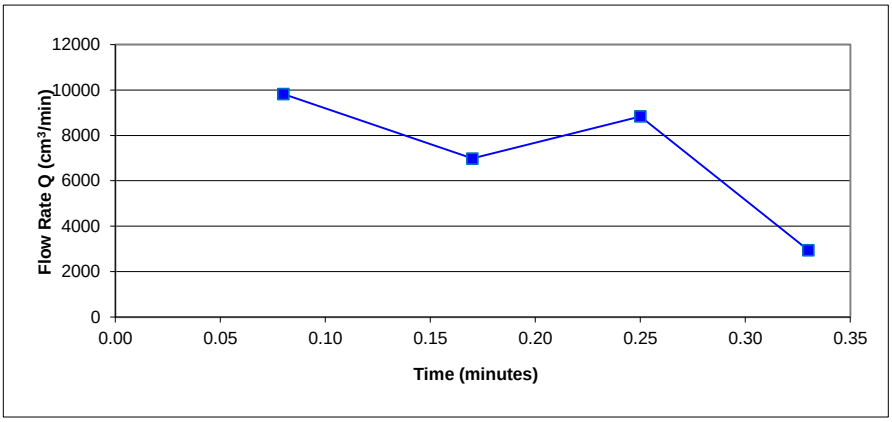
Description:	Bowling Green	**Test No.**	BH1	
Material type:	Sand Filling	Easting:	329004	m
Condition of ground surface before test: Artificial Grass		Northing	6239143	m
Weather during test: 29º, Cloudy		Surface Level:	3.7	m AHD

Details of Bore Installation

Depth of augered hole	550	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	350	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	200	785	9817
0.17	120	628	6981
0.25	30	707	8836
0.33	0	236	2945
Average		589	7145



Saturated Hydraulic Conductivity - Over total duration of test

k =	**2.54E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**4.23E-04**	m/sec	ref. AS1547-2012 App G
=	**36.56**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	15/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

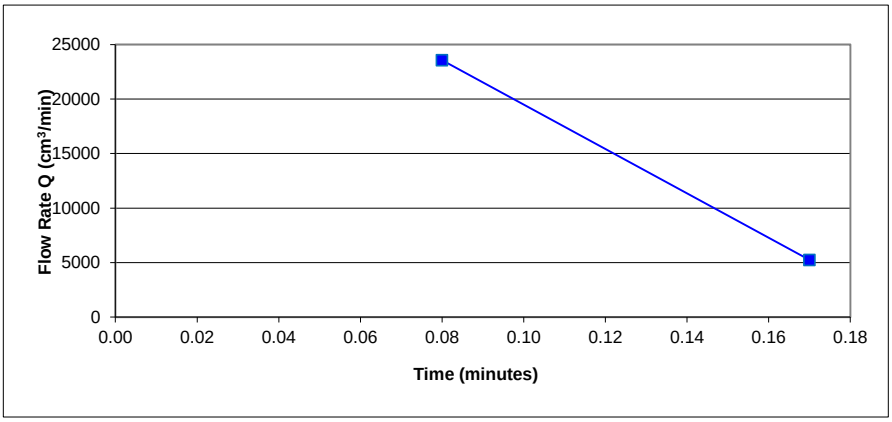
Description:	Bowling Green	**Test No.**	BH2	
Material type:	Sand Filling	Easting:	328999	m
Condition of ground surface before test: Artificial Grass		Northing	6239113	m
Weather during test: 29°, Cloudy		Surface Level:	3.7	m AHD

Details of Bore Installation

Depth of augered hole	500	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	300	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	60	1885	23562
0.17	0	471	5236
Average		1178	14399



Saturated Hydraulic Conductivity - Over total duration of test

k =	**6.39E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**1.07E-03**	m/sec	ref. AS1547-2012 App G
=	**92.02**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	15/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

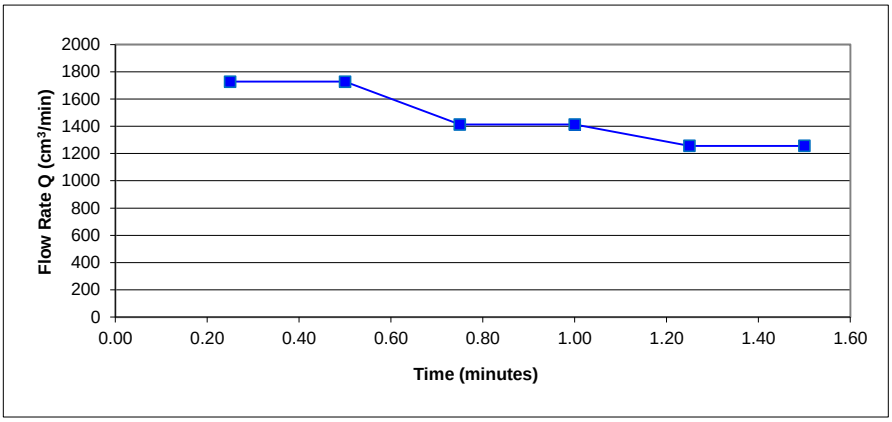
Description:	Lawn	**Test No.**	BH3	
Material type:	Silty Sand Filling	Easting:	328935	m
Condition of ground surface before test: Topsoil		Northing	6239114	m
Weather during test: 29°, Cloudy		Surface Level:	4.1	m AHD

Details of Bore Installation

Depth of augered hole	550	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	350	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.25	245	432	1728
0.50	190	432	1728
0.75	145	353	1414
1.00	100	353	1414
1.25	60	314	1257
1.50	20	314	1257
Average		367	1466



Saturated Hydraulic Conductivity - Over total duration of test

k =	**5.21E-01**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**8.68E-05**	m/sec	ref. AS1547-2012 App G
=	**7.50**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	15/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

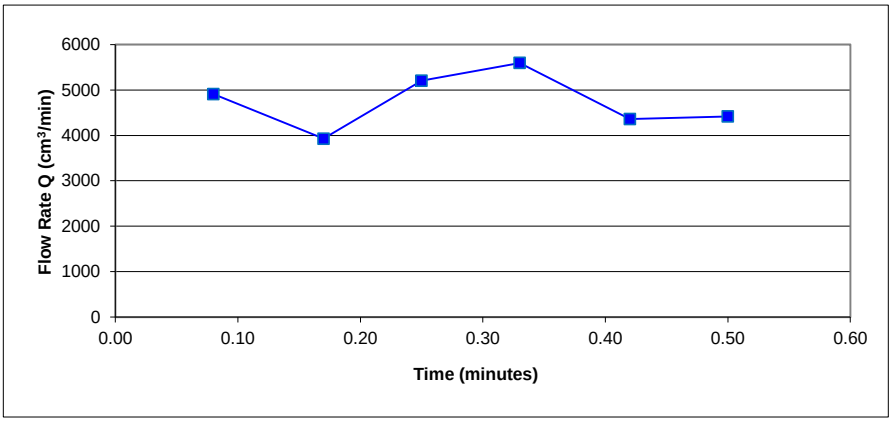
Description:	Lawn	**Test No.**	BH4	
Material type:	Silty Sandy Filling	Easting:	328935	m
Condition of ground surface before test: Topsoil		Northing	6239105	m
Weather during test: 29°, Cloudy		Surface Level:	4.3	m AHD

Details of Bore Installation

Depth of augered hole	500	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	300	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	250	393	4909
0.17	205	353	3927
0.25	152	416	5203
0.33	95	448	5596
0.42	45	393	4363
0.50	0	353	4418
Average		393	4736



Saturated Hydraulic Conductivity - Over total duration of test

k =	**2.10E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**3.50E-04**	m/sec	ref. AS1547-2012 App G
=	**30.27**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	16/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

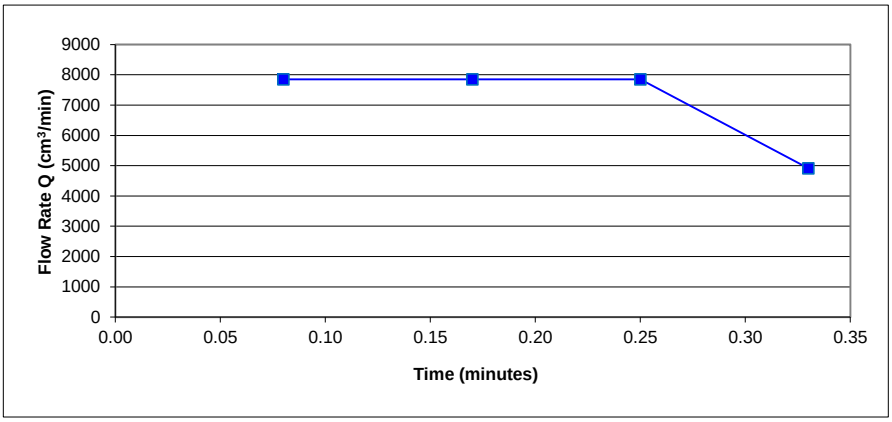
Description:	Lawn	**Test No.**	BH5	
Material type:	Silty Sandy Filling	Easting:	328922	m
Condition of ground surface before test:	Topsoil	Northing	6239137	m
Weather during test:	28°, Sunny	Surface Level:	4.2	m AHD

Details of Bore Installation

Depth of augered hole	550	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	350	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	220	628	7854
0.17	130	707	7854
0.25	50	628	7854
0.33	0	393	4909
Average		589	7118



Saturated Hydraulic Conductivity - Over total duration of test

k =	**2.53E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**4.22E-04**	m/sec	ref. AS1547-2012 App G
=	**36.42**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	16/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

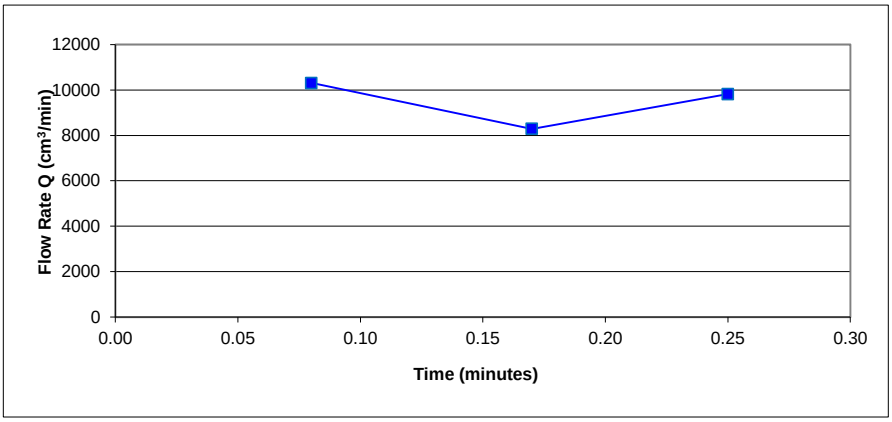
Description:	Lawn	**Test No.**	BH6	
Material type:	Silty Sandy Filling	Easting:	328927	m
Condition of ground surface before test:	Topsoil	Northing	6239160	m
Weather during test:	28°, Sunny	Surface Level:	4	m AHD

Details of Bore Installation

Depth of augered hole	500	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	300	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	195	825	10308
0.17	100	746	8290
0.25	0	785	9817
Average		785	9472



Saturated Hydraulic Conductivity - Over total duration of test

k =	**4.20E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**7.01E-04**	m/sec	ref. AS1547-2012 App G
=	**60.53**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	16/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

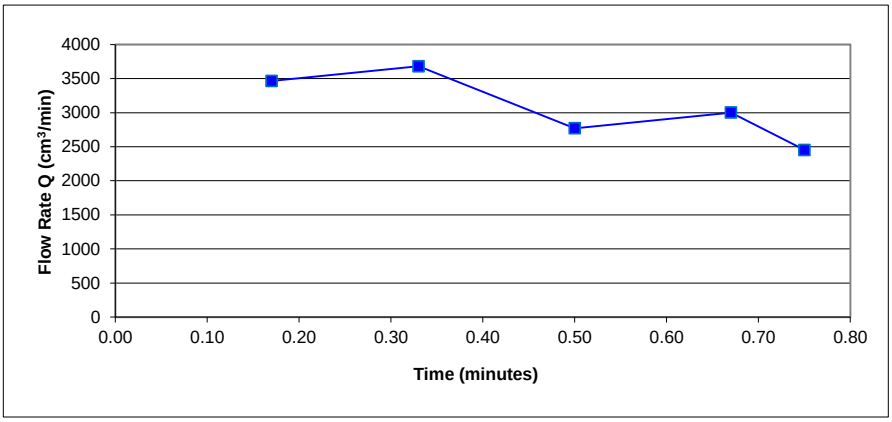
Description:	Lawn	**Test No.**	BH7	
Material type:	Silty Sandy Filling	Easting:	328951	m
Condition of ground surface before test:	Topsoil	Northing	6239158	m
Weather during test:	28°, Sunny	Surface Level:	4	m AHD

Details of Bore Installation

Depth of augered hole	500	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	300	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.17	225	589	3465
0.33	150	589	3682
0.50	90	471	2772
0.67	25	511	3003
0.75	0	196	2454
Average		471	3075



Saturated Hydraulic Conductivity - Over total duration of test

k =	**1.36E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**2.27E-04**	m/sec	ref. AS1547-2012 App G
=	**19.65**	m/day	

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Constant Head Permeameter Test Report [AS1547:2012 App G]

Client:	Monterey Equity Pty Ltd	Project No:	85348
Project:	Proposed Residential Development	Date:	16/2/16
Location:	119 Barton Street, Monterey	Tested by:	MB

Test Location

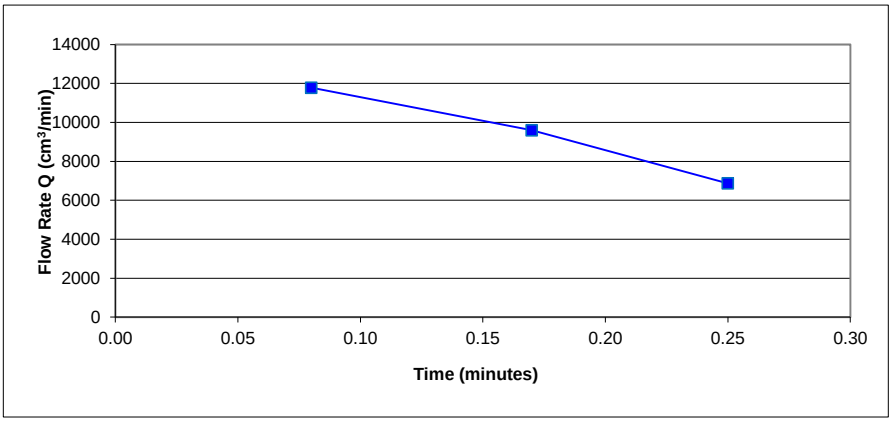
Description:	Flower Bed	**Test No.**	BH8	
Material type:	Silty Sandy Filling	Easting:	328977	m
Condition of ground surface before test:	Topsoil	Northing	6239157	m
Weather during test:	28°, Sunny	Surface Level:	3.9	m AHD

Details of Bore Installation

Depth of augered hole	500	mm	Depth to impermeable layer	>3	m
Depth of constant water below permeameter	300	mm	Time from filling to start	0	minutes
Diameter of hole	100	mm			

Test Results

Time (minutes)	Level below top (mm)	Flow Volume (cm^3)	Rate of Loss [Q] (cm^3/min)
0.00	300		
0.08	180	942	11781
0.17	70	864	9599
0.25	0	550	6872
Average		785	9418



Saturated Hydraulic Conductivity - Over total duration of test

k =	**4.18E+00**	cm/min	where $K = 4.4Q[0.5 \sinh^{-1}(H/2r)-\sqrt{[(r/H^2)+0.25]}+r/H]/2\pi H^2$
=	**6.97E-04**	m/sec	ref. AS1547-2012 App G
=	**60.18**	m/day	

Locality Plan

NOTE:

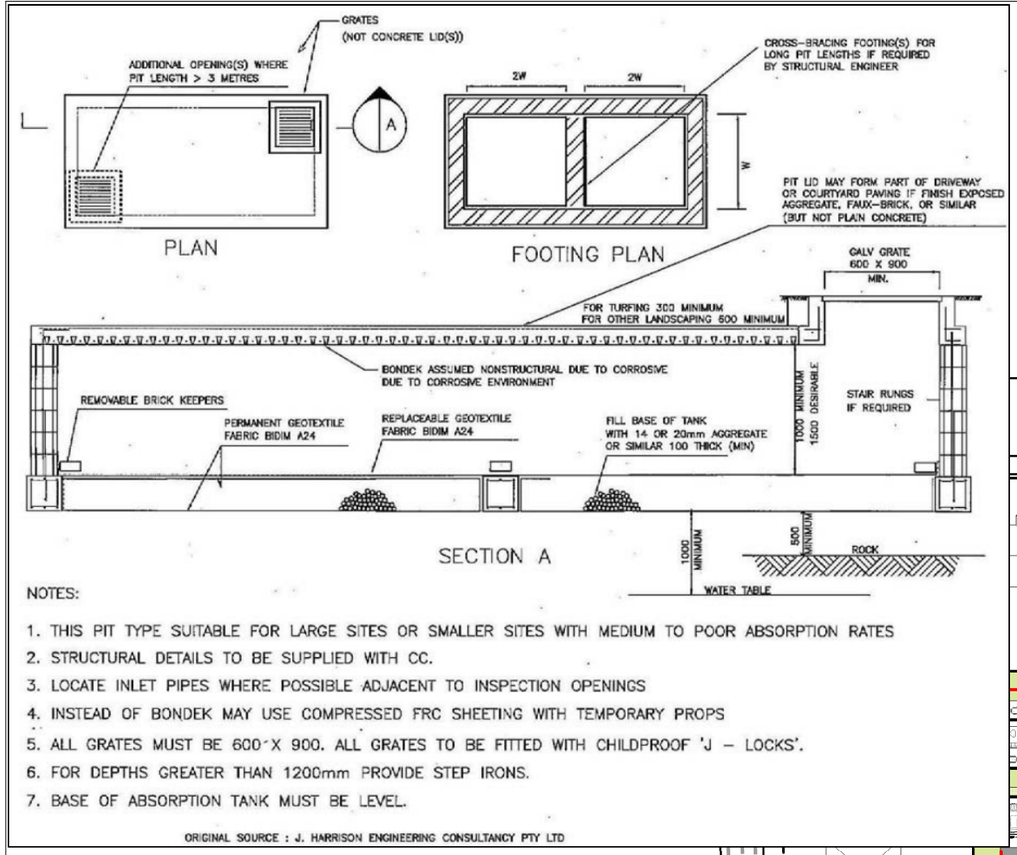
1: Base drawing from Project Surveyors (Dwg B1968-1, dated 11.9.2015)
2: Test locations are approximate only and are shown with reference to existing features.

LEGEND

Borehole and Soil Permeabilty Test Location

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Monterey Equity Pty Limited	TITLE: **Location of Tests** **Proposed Residential Development** **119 Barton Street, Monterey**	PROJECT No: 85348.00
	OFFICE: Sydney / DRAWN BY: PSCH		DRAWING No: 1
	SCALE: 1:800 @ A3 / DATE: 22.2.2016		REVISION: 0

Appendix E
ADG Conceptual Stormwater Management Layout Plan



NOTES:

1. THIS PIT TYPE SUITABLE FOR LARGE SITES OR SMALLER SITES WITH MEDIUM TO POOR ABSORPTION RATES
2. STRUCTURAL DETAILS TO BE SUPPLIED WITH CC.
3. LOCATE INLET PIPES WHERE POSSIBLE ADJACENT TO INSPECTION OPENINGS
4. INSTEAD OF BONDEK MAY USE COMPRESSED FRC SHEETING WITH TEMPORARY PROPS
5. ALL GRATES MUST BE 600 X 900. ALL GRATES TO BE FITTED WITH CHILDPROOF 'J – LOCKS'.
6. FOR DEPTHS GREATER THAN 1200mm PROVIDE STEP IRONS.
7. BASE OF ABSORPTION TANK MUST BE LEVEL.

ORIGINAL SOURCE : J. HARRISON ENGINEERING CONSULTANCY PTY LTD

COVERED TANK ABSORPTION PIT

SITE PARAMETERS –
CONTRIBUTING IMPERVIOUS AREA = 4845m2
NOMINAL ABSORPTION RATE = 0.4L/s/m2

TOWN PLANNING REQUIREMENTS

	COMPLIES
4.3.1 (8) OPEN SPACE & LANDSCAPE DESIGN 25%	YES
TYPE A 8.1m x 27m LOT = 219sqm x 0.25 = 56 sqm REQ. (ACTUAL OPEN SPACE PROVIDED = 108 sqm)	YES
TYPE B 4.5m x 27m LOT = 121.5 sqm x 0.25 = 30 sqm (ACTUAL OPEN SPACE PROVIDED = 40.5 sqm)	YES
(9) AT LEAST 20% OF THE FRONT SETBACK AREA TO BE LANDSCAPED AREA	YES
4.3.2 PRIVATE OPEN SPACE	
2 BEDROOM: 40 sqm	YES
3 BEDROOM: 50 sqm	YES
4.3.3 COMMUNAL OPEN SPACE	
5sqm PER DWELLING	YES
MIN. AREA OF 40% SUNLIGHT AT 1PM 21 JUNE	YES
PARKING	
3 BED: 2 CAR SPACES PER TOWNHOUSE REQUIRED	YES
2 BED: 1 CAR SPACE PER TOWNHOUSE REQUIRED	YES
VISITOR CAR PARKS: 1 PER 5 DWELLINGS REQ.	YES
BICYCLE: 1 SPACE / 10 DWELLINGS	YES
MOTORCYCLE: 1 SPACE / 15 DWELLINGS	YES

DEVELOPMENT SUMMARY

TOTAL SITE AREA:	7218 m2
TOTAL TOWNHOUSES:	28
	13 TYPE A (46%) 3 BED 15 TYPE B (54%) 2 BED
HEIGHT:	2 STOREYS
FSR: 0.6:1	= 7218 m2 x 0.6 = 4330 m2 MAX. GFA /28 = 154 m2 AVE. GFA PER TOWNHOUSE

Rev	Date	Description
01	09.03.2016	ISSUED FOR DA APPROVAL

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E info@adgce.com W www.adgce.com
AUSTRALASIA / ASIA / EUROPE / MIDDLE EAST

Client	HEYMANN-COHEN PTY LTD
Project Name	119 BARTON STREET, MONTEREY
Discipline	CIVIL
Status	PRELIM
Designed By	HD
Checked By	AM
Approved By	
Project No.	18623
Drawn By	HD
Scale	1:1000 (at A3)

Title	CONCEPTUAL STORMWATER MANAGEMENT SKETCH
Drawing No.	SK01
Revision	01

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HEYMANN COHEN

REPORT ON THE TRAFFIC ASPECTS OF PLANNING PROPOSAL FOR 119 BARTON STREET, MONTEREY

FEBRUARY 2016

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REF: 10021/1

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Colston Budd Rogers and Kafes Pty Ltd has been commissioned by Heymann Cohen to prepare a report examining the traffic implications of a planning proposal to allow residential development on the bowling club site (currently used by the Coptic Church) at 119 Barton Street, Monterey. The site location is shown in Figure 1.

1.2 The proposed rezoning would allow for 28 townhouses (15 x two bedroom units and 13 x three bedroom units) with internal road, on-site parking and access from Barton Street. 47 parking spaces (41 residential and 6 visitor) are proposed.

1.3 This report assesses the traffic implications of the planning proposal through the following chapters:

- Chapter 2 - describing the existing conditions; and
- Chapter 3 - assessing the traffic implications of the planning proposal.

2. EXISTING CONDITIONS

Site Location and Road Network

2.1 The subject bowling club site is currently occupied by a Coptic Church. The site is located within the block bounded by The Grand Parade, Barton Street, Scarborough Street and Jones Avenue. It has frontage and access to/from Barton Street and is surrounded by residential dwellings.

2.2 The road network in the vicinity of the site includes The Grand Parade, Barton Street, Scarborough Street and Jones Avenue. The Grand Parade travels in a north-south direction located east of the site. It is a divided road providing two lanes in each direction with right turn bays provided. In the vicinity of the site The Grand Parade is subject to a 60km/h speed limit with no stopping restrictions applying on both sides. The Grand Parade and Barton Street form a signalised intersection east of the site.

2.3 Barton Street is located north of the site (forming the northern site frontage). Barton Street travels in an east-west direction between The Grand Parade to the east and Rocky Pont Road to the west. Barton Street provides one traffic lane and one parking lane in both directions and is subject to a 50km/h speed limit. Barton Street provided access to the subject bowling club site.

2.4 Scarborough Street is located south of the site and travels in an east-west direction between The Grand Parade to the east and its termination at a cul-de-sac near Scarborough Park to the west. Scarborough Street provides one traffic lane and one parking lane in both directions and is subject to a 50km/h speed limit.

2.5 Jones Avenue is located west of the site, travelling in a north-south direction between Barton Street and Scarborough Street. It provides for two way traffic flow with kerb side parking on both sides. Jones Avenue is subject to a 50/km/h speed zoning and forms 'T'-junctions with Barton Street to the north and Scarborough Street to the south.

Traffic Flows

2.1 Traffic generated by the proposed development will have its greatest effects during the weekday morning and afternoon peak period. In order to gauge traffic conditions, counts were undertaken at the following intersections:

- The Grand Parade/Barton Street; and
- Barton Street/Jones Avenue.

2.2 The results are summarised in Table 2.1 and Figures 2 and 3.

Table 2.1: Existing Two-Way (Sum of Both Directions) Peak Hour Traffic Flows

Road	**Weekday Morning**	**Weekday Afternoon**
The Grand Parade		
– north of Barton Street	2,910	4,300
– south of Barton Street	2,780	3,995
Barton Street		
– west of The Grand Parade	210	340
– west of Jones Avenue	230	345
Jones Avenue		
– south of Barton Street	30	15

2.3 Examination of Table 2.1 reveals that:

- The Grand Parade carried some 2,780 to 4,300 vehicles per hour (two way) during the weekday morning and afternoon peak periods;

- Barton Street carried some 210 to 345 vehicles per hour (two way) during the weekday morning and afternoon peak periods; and

- Jones Avenue carried some 15 to 30 vehicles per hour (two way) during the weekday afternoon and weekend midday peak periods.

Intersection Operations

2.4 The capacity of the road network is largely determined by the capacity of its intersections to cater for peak period traffic flows. The intersections of Barton Street with The Grand Parade and Jones Avenue have been analysed using the SIDRA computer program. SIDRA analyses intersections controlled by traffic signals, roundabouts and signs.

2.5 SIDRA provides a number of performance measures. The most useful measure provided is average delay per vehicle expressed in seconds per vehicle. Based on average delay per vehicle, SIDRA estimates the following levels of service (LOS):

- For traffic signals, the average delay per vehicle in seconds is calculated as delay/(all vehicles), for roundabouts the average delay per vehicle in seconds is selected for the movement with the highest average delay per vehicle, equivalent to the following LOS:

0 to 14	=	"A"	Good
15 to 28	=	"B"	Good with minimal delays and spare capacity

29 to 42	=	"C"	Satisfactory with spare capacity
43 to 56	=	"D"	Satisfactory but operating near capacity
57 to 70	=	"E"	At capacity and incidents will cause excessive delays. Roundabouts require other control mode.
>70	=	"F"	Unsatisfactory and requires additional capacity

- For give way and stop signs, the average delay per vehicle in seconds is selected from the movement with the highest average delay per vehicle, equivalent to following LOS:

0 to 14	=	"A"	Good
15 to 28	=	"B"	Acceptable delays and spare capacity
29 to 42	=	"C"	Satisfactory but accident study required
43 to 56	=	"D"	Near capacity and accident study required
57 to 70	=	"E"	At capacity and requires other control mode
>70	=	"F"	Unsatisfactory and requires other control mode

2.6 It should be noted that for roundabouts, give way and stop signs, in some circumstances, simply examining the highest individual average delay can be misleading. The size of the movement with the highest average delay per vehicle should also be taken into account. Thus, for example, an intersection where all movements are operating at a level of service A, except one which is at level of service E, may not necessarily define the intersection level of service as E if that movement is very small. That is, longer delays to a small number of vehicles may not justify upgrading an intersection unless a safety issue was also involved.

2.7 The SIDRA analysis found that the signal controlled intersection of The Grand Parade/Barton Street operates with average delays for the highest delayed

movement of some 27 seconds per vehicle during the weekday afternoon peak hour. This represents a level of service B, a good level of service.

2.8 The priority controlled 't'-intersection of Barton Street/Jones Avenue operates with average delays for the highest delayed movement of some 15 seconds per vehicle during the weekday afternoon peak hour. This represents a level of service A/B, a good level of service.

Public Transport

2.9 Public transport is provided by Sydney Buses and Transdev NSW. Sydney Busses operate routes 303 (City to Sans Souci), X03 (City to Sans Souci (express)) and 478 (Rockdale Station to Miranda) along The Grand Parade. Transdev NSW operates route 947 (Hurstville to Kogarah via Ramsgate and Bells Point) along Chuter Avenue.

2.10 Bus stops are located within the vicinity of the site on either side of The Grand Parade at the intersection with Barton Street (east of the site) and on Chuter Avenue near the intersection with Barton Street (west of the site). Footpaths are provided along Barton Street, The Grand Parade and Chuter Avenue.

2.11 Overall, the site has good access to regular public transport services with bus stops located within 300 metres walking distance of the subject site.

3. IMPLICATIONS OF PLANNING PROPOSAL

3.1 The proposed rezoning would allow for 28 townhouses (15 x two bedroom units and 13 x three bedroom units) with internal road, on-site parking and access from Barton Street. 47 parking spaces (41 residential and 6 visitor) are proposed. This chapter assesses the implications of the planning proposal through the following sections:

- public transport;
- parking provision;
- access and internal layout;
- traffic effects; and
- summary.

Public Transport

3.2 As previously discussed, the site is located close (within 300 metres walking distance) of regular bus services that operate along The Grand Parade and Chuter Avenue. These bus services provide links to City, Hurstville, Kogarah, Rockdale, Miranda and surrounding areas. The site is therefore accessible by public transport. The planning proposal will increase residential densities close to existing public transport services.

Parking Provision

3.3 Parking requirements for the planning proposal have been estimated using Rockdale City Council DCP 2011. The DCP requires 1 space per two bedroom

unit and 2 spaces per three bedroom unit and 1 space per 5 dwellings for visitor parking.

3.4 The development proposes to provide 28 townhouses comprising 15 x two bedroom units and 13 x three bedroom units. Adopting the rates provided by the Rockdale City Council DCP 2011, the planning proposal would require the provision of 47 parking spaces (41 residential and 6 visitor spaces). It is proposed to provide 47 parking spaces.

3.5 Thus the proposed parking provision satisfies the requirements Rockdale City Council DCP 2011.

Access and Internal Layout

3.6 Vehicular access is proposed from Barton Street via a 6.5 metre wide entry/exit driveway located on the eastern side of the site frontage to Barton Street. The proposed driveway will comply with the requirements of AS2890.1-2004 (with respect to width, grades and provision of pedestrian sight lines). An internal road is proposed, providing access to the residential townhouses.

3.7 Residential parking spaces will be provided within separate garages attached to each individual townhouse. Visitor parking spaces will be provided at ground and will be a minimum of 2.5 metres wide by 5.4 metres long. Accessible car parking spaces will be a minimum of 2.4 metres wide by 5.4 metres long to be accompanied with an adjacent shared area with the same dimensions. Spaces located next to walls will be a further 300mm wider. The minimum aisle width will be 5.8 metres and a further 300mm wider where a wall is located immediately adjacent the parking aisle. Dead end aisles will have a one metre extension for

appropriate accessibility to end spaces. Height clearance will be a minimum of 2.2 metres generally, with 2.5 metres over disabled spaces. These dimensions are considered appropriate, being in accordance with AS2890.1-2004 and AS2890.6-2009.

3.8 With regard to servicing, larger vehicles (such as garbage collection vehicles) are proposed to undertake servicing on site within a designated loading area via the proposed internal road, a turning area will be provided to enable the service vehicles to enter and exit the site in a forward direction. Servicing by other vehicles (such as tradesman vehicles or similar van sized vehicles) will be undertaken by either parking on site (if parking is available) or in Barton Street using the available on-street parking.

3.9 Overall the proposed access arrangements, parking layout, internal circulation and service arrangements are considered appropriate.

Traffic Effects

3.10 The RMS Guideline provides traffic generation rates for medium density residential developments of between 0.4 to 0.5 vehicle trips per hour for smaller units (up to two bedrooms) and 0.5 to 0.65 vehicle trips per hour for larger units (up to three bedrooms). With a mix of two and three bedroom townhouses being proposed, a rate of 0.5 has been adopted and is considered appropriate for this development. Using this rate the planning proposal would generate some 15 vehicles per hour two-way during the morning and afternoon peak hours.

3.11 This additional traffic has been assigned to the adjoining road network and would result in traffic flow increases on Barton Street of some 5 to 10 vehicles per hour

(two-way). This is a low increase, equivalent to an average of only one vehicle every six to twelve minutes at peak times. Such a low traffic generation would not have noticeable effects on the operation of the surrounding road network.

Summary

3.12 In summary, the main points relating to the transport implications of the proposed development are:

i) The subject site is accessible by regular bus services with bus stops located within 300 metres walking distance of the site;

ii) the proposed parking provision satisfies the requirements of Rockdale City Council DCP 2011;

iii) access and internal layout will be provided in accordance with AS 2890.1-2004 and AS2890.6-2009;

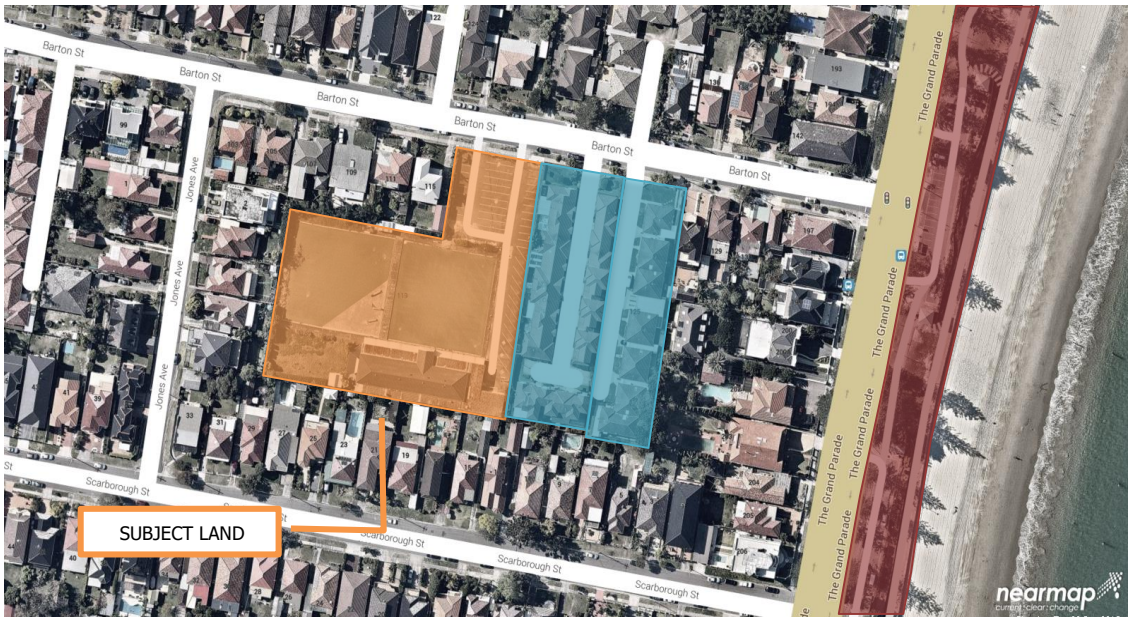
iv) the proposed development would result in a minor increase in traffic during the morning and afternoon peak periods on the surrounding road network; and

v) the surrounding road network can accommodate traffic from the proposed development with no noticeable effects on the surrounding road network.

Appendix 2 – Subject site, locality and regional context

2.1 Site description

The subject land, comprising the former Francis Drake Bowling Club, is a large battle axe lot known as 119 Barton Street, Monterey. It has the legal description of Lot 2 DP 857520. With a northern frontage of approximately 35 metres to Barton Street, the site has an eastern (side) boundary shared with the part one- part two-storey 'Oak Flats' townhouse development at 121 Barton Street. The irregular western (side) boundary measures approximately 155 metres and adjoins the rear yards of residential development at Nos. 107-115 Barton Street and Nos. 2-10 Jones Avenue. The southern (rear) boundary, approximately 95 metres in length, abuts the rear yards of residential development at 13-29 Scarborough Street. The total area of the site is approximately 7,218 sqm. The location and context of the site are shown in the aerial photograph below.



Legend
Subject land, 119 Barton Street
Cook Park, The Grand Parade (I168)
Adjoining medium-density residential development

The Francis Drake Bowling Club ceased operations on March 23, 2015. Remaining on the site is a single-storey building comprising club/event space. Also on the site are two bowling greens and an at-grade parking area accommodating 53 parking spaces as well as a loading zone. Soft landscaping within the site is limited, confined for the most part to the south west corner of the site. There are no significant trees existing on the site. The property is currently occupied by St Pope Kyrillos VI & St Habib Girgis Coptic Orthodox Church.

The land is zoned **RE2 Private Recreation** under the *Rockdale Local Environmental Plan 2011 (RLEP 2011)*. It is not identified as a heritage item under this instrument nor does it lie within a conservation area identified on the RLEP 2011 Heritage Map (Sheet HER_005). The subject land does, however, lie within proximity of Cook Park along the Grand Parade 150 metres to the east, which is identified as an item of local heritage significance (I168) under schedule 5 of RLEP 2011.

2.2 Surrounding development and land uses

A site-specific zoning of RE2 Private Recreation applies to the subject land. However, the land lies within a R3 Medium Density Residential zone that surrounds it on all four sides. Surrounding the R3 zone is an area zoned R2 Low Density Residential. In spite of the R3 zoning, residential development in the immediate context of the subject land is dominated by single and two-storey detached dwellings with the exception of medium density developments at 123 Barton Street and 125 Barton Street, east of the subject site, comprising the Oaks Flats townhouse development and a seven-villa development, respectively. There are some newer houses on Grand Parade but those in the streets away from the bay front are generally older and less changed.

150m to the east of the subject land is Cook Park, which provides accessible public green space adjoining Lady Robinsons Beach and the foreshore of Botany Bay. Public open space is also located 400m to the west at Scarborough Park and the AS Tanner Reserve. The latter parks surround Scarborough Ponds and the Toomevara Lane Chinese Market Gardens.

Nearby commercial centres include the Brighton-Le-Sands commercial centre 1.6km to the north, Ramsgate commercial centre 1.2km to the south and Kogarah commercial centre 1.5km to the north west. Isolated commercial uses such as cafes and other eateries are scattered along Chuter Avenue and the Grand Parade.

Legend

Subject land

R3 Medium Density Residential zone

Cook Park, The Grand Parade (I168)

Public Open Space

Early education facilities, Bambino's Kindergarten and the Montessori By-the-Bay

2.2.1 Development typical of the locality

Two-storey dweling at 115 Barton St, Image: Googlemaps

Single-storey dweling at 126 Barton St, Image: Googlemaps

Townhouse development at 121 Barton St, Image: Googlemaps

2.3 Regional context and transport

2.3.1 Population and census statistics

Monterey is a small suburb in southern Sydney, 15 km south of the Sydney CBD in the local government area of Bayside City and is part of the St George area. Monterey extends to President Avenue in the north and Emmaline Street to the south. The mostly residential suburb is bounded by the shores of Botany Bay to the east and Scarborough Park to the west. Commercial uses are scattered along Chuter Avenue and the Grand Parade. At the time of the 2011 census, Monterey had a population of 4,344 persons with a median age of 40 years compared to a median age of 35 years in the metropolitan region[4].

At 2011, Monterey contained a total of 1,943 dwellings with an average household size of 2.43 persons compared to 2.7 persons across Metropolitan Sydney (as per ABS, Sydney – Significant Urban Area). There is a greater proportion of single person households in Monterey relative to New South Wales, 28.2% and 22.3% respectively (refer TABLE 1 below). Notwithstanding, Monterey has less than half the number of single-bedroom dwellings compared with Greater Sydney.

TABLE 8: COMPARISON OF HOUSEHOLD COMPOSITION (MONTEREY/ METRO SYDNEY)		
HOUSEHOLD COMPOSITION	**MONTEREY %**	**METRO SYDNEY %**
Family households	68.8	73.2
Single person households	28.2	22.3
Group households	2.9	4.5

TABLE 9: COMPARISON OF DWELLING COMPOSITION (MONTEREY/ METRO SYDNEY)		
DWELLING COMPOSITION	**MONTEREY %**	**METRO SYDNEY %**
0 bedroom (includes bedsitters)	0.9	1.0
1 bedroom	2.6	7.0
2 bedroom	41.1	25.9
3 bedroom	34.4	36.2
4 bedroom	19.1	28.0
Not stated	1.9	1.8

The conclusion we draw from the statistics and the characteristics of the houses in Monterey is that dwellings tend to be occupied by older people who are likely to be empty nesters remaining in family homes which are now larger than their needs in terms of bedroom numbers.

2.3.2 Transport

The subject land lies 2.4 km from Kogarah Railway Station to the north west, well outside of the 800m (ten minute) pedestrian catchment relevant for considerations of modal split[5].

However, the subject land lies within easy walking distance of bus services along Chuter Ave (270m west) and the Grand Parade (130m east). The Grand Parade is serviced by bus routes travelling north, Route 303 (Sans Souci to Circular Quay), and south, Route 478 (Ramsgate to Rockdale). An

[4] *Australian Bureau of Statistics*, 2011 Census QuickStats: Monterey (NSW), accessed 07 Oct, 2015, at http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/SSC11578?opendocument&navpos=220
[5] NSW Department of Planning, 2004, *Planning Guidelines for Walking and Cycling*, accessed http://www.planning.nsw.gov.au/plansforaction/pdf/guide_pages.pdf

express service, Route X03, operates between Sans Souci and the Circular Quay during peak periods Monday to Friday providing access to the city (Central Station) within 30 mins. Chuter Ave is serviced by Route 947 (operated by Transdev NSW), which runs between Hurstville to Kogarah.

At the 2011 Census, the most common method of travel to work for employed residents of Monterey was by car, 62.5% as driver and 5.2% as passenger. The location of bus and train services, as discussed above, is not reflected in greater usage by Monterey residents of bus services in combination with train services compared with Metropolitan Sydney as a whole (refer figure 3 below). 15.5% of employed people in Monterey travelled to work on public transport compared with 21.4% across the Sydney region.

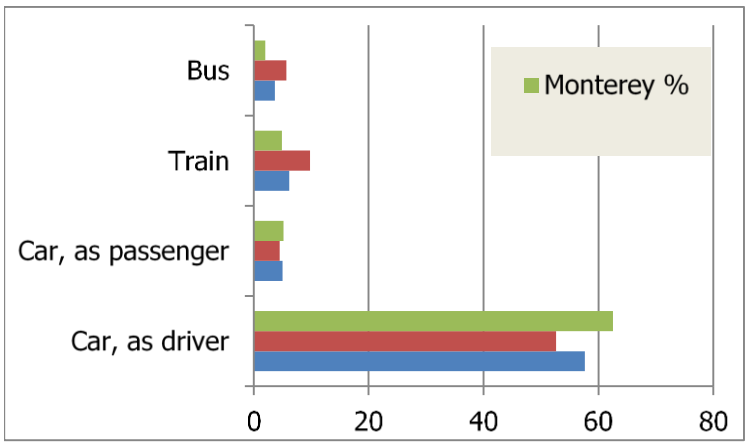


Figure 3: Comparison of journey to work modal split – Monterey, Metro Sydney and NSW

Appendix 3 – 3D study model

An analytical study conducted by Rothelowman has produced a model for development yield and building typology. This concept illustrates the capacity of the subject site to accommodate 28 two and three-bedroom townhouses, as shown in Figures 10 and 11 below.

Figure 10 – 3D study model, looking south – north

Figure 11 – 3D study model, looking north – south

Appendix 4 – Rockdale Development Control Plan 2011

TABLE 10 – Rockdale Development Control Plan 2011		
CONTROL	**PROPOSAL**	**COMPLIANCE**
4.3.1 (8) Landscape Area Landscaped areas, as defined in Rockdale LEP, must be provided at the following rates: Low and medium density residential – 25% of site area Required: 3 Bedroom dwellings – 219 sqm x 0.25 = 56 sqm 2 Bedroom dwellings – 121.5 sqm x 0.25 = 30.4 sqm	Proposed landscaped areas have been provided in accordance with the relevant requirements for two and three bedroom dwellings under the Rockdale DCP. 2 bedroom dwellings will have a minimum of 40.5 sqm per unit, while 3 bedroom dwellings will provide a generous minimum of 108 sqm per unit.	**Complies**
4.3.2 Private Open Space Each dwelling must be provided with a minimum private open space area as specified in the following table: Multi Dwelling Housing 2 bedroom – 40m^2 3 bedroom – 50m^2	Private open space, in accordance with the requirements of this section, is considered for the proposed new dwellings on the subject site. See drawing SK00.02 of proposed schematic masterplan by Rothelowman architects.	**Complies**
4.3.3 Communal Open Space The development must provide a communal area for the benefits of its residents at the rate of 5m² for each dwelling within the development. 28 dwellings x 5m^2/dwelling = 140m^2	A recreation area, located adjacent to the visitor car parking, is proposed to provide approximately 175m^2 of communal open space.	**Complies**
4.6 Car parking, access and movement Parking Rates Development is to provide on-site parking in accordance with the following rates: • 1 space/studio, 1 and 2 bedrooms apartments – 15 x 1 = 15 spaces • 2 spaces/3 bedrooms apartments or more - 13 x 2 = 26 spaces • Visitor parking: 1 space/5 Dwellings – 41/5 = 8.2 spaces Total spaces required: 49.2	Provision of car parking per dwelling is compliant with DCP requirements. Visitor car parking is non-compliant by 2 spaces. 6 visitor spaces provided 8 visitor spaces required	**Complies** **Does not comply**