ORDINARY COUNCIL MEETING

ATTACHMENTS BOOKLET

Part 4 - Item 9.3 - Attachments 27-31

Under Separate Cover

Tuesday, 6 December 2022

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GEOTECHNIQUE® PTY LTD

ABN 64 002 841 063

ACLCA

Job No: 13188/3
Our Ref: 13188/3-AA
3 August 2015

Nix Anderson Pty Ltd
17 Chuter Street
MCMAHONS POINT NSW 2060
Email: robert.mcguinness@nxa.com.au

Attention: Mr R McGuinness

Dear Sir

re: **Proposed Redevelopment**
160 Burwood Road, Concord
Additional Geotechnical Investigation

This report provides results of an additional geotechnical investigation at the above site. The investigation was commissioned by Mr R Ewing of Propertylink Holdings Pty Ltd through a subcontract agreement and was carried out in general accordance with Geotechnique Pty Ltd proposal Q6614-AC dated 12 June 2015.

Proposed Development
We understand that Nix Anderson has been retained by Propertylink to assist in carrying out feasibility review of the above site to assess the development potential on behalf of the site owners – Freshfood Australia Holdings Pty Ltd. It is also understood that the existing Robert Timms Factory (Bushell's) will be relocated prior to development and the site will be developed as an Urban Regeneration Project – an integrated Residential Community.

An additional geotechnical was required by drilling six boreholes in the north-east corner (pathway and seawall) of the site.

Background Information
Geotechnique Pty Ltd previously completed geotechnical and contamination assessments at the above site, which are detailed in our Reports 13188/1-AA dated 12 September 2014 and 13188/2-AA dated 11 September 2014. It is understood that additional boreholes are now required to be carried out in the area between the pathway and the seawall.

Regional Geology and Landscape
Reference to the Geological Map of Sydney indicates that the bedrock at the site is likely to be Hawkesbury Sandstone, comprising medium grained quartz sandstone.

Reference to the Soil Landscape Map of Sydney indicates that the landscape at the site belongs to the Gymea Group, which is characterised by undulating to rolling rises and low hills on Hawkesbury Sandstone. However, the site is likely to have been filled in the past to raise levels for development. The acid sulfate soil map indicates high probability of Acid Sulfate soils within nearby areas of the existing site.

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Scope of Work
Field work for the additional investigation was carried out between 9 and 13 July 2015 and comprised of the following:

- Review services plans obtained from "Dial Before You Dig" to assess existing services across the site.
- Conduct an OH&S and walkover survey to assess existing site conditions.
- Scan proposed borehole locations for underground services. We engaged a specialist services locator for this purpose.
- Drill six (6) boreholes (BH11 to BH16) to depths of 10m, using a truck mounted drilling rig fully equipped for geotechnical investigation. Boreholes were drilled at the locations specified by the client. All boreholes were initially drilled to V-Bit or TC-Bit refusal in bedrock and then continued using rock coring. Approximate borehole locations are shown on the attached Drawing No 13188/3-AA1. Engineering logs detailing subsurface profiles encountered in boreholes and core photographs are also attached.
- Conduct Standard Penetration Testing (SPT) at regular depth intervals in the boreholes to assess strength characteristics of overburden soils.
- Recovery of representative soil and rock samples for visual assessment and laboratory testing (point load index on rock cores, acid sulfate and contamination testing on soil samples). Results of contamination testing are provided in a separate report.
- Measure depths to groundwater/seepage level in boreholes, where encountered.

Field work was supervised by a Geotechnical Engineer, responsible for sampling and preparation of borehole logs.

Surface and Sub-surface Conditions
The following observations were made during the field work:

- The site is occupied by the multistorey Robert Timms Factory (Bushell's), administration building and guard room etc. Open areas of the site are covered with asphalt/bitumen seal, grass and scattered trees.
- The site is bound to the south by Burwood Road, to the north by a Golf Course, to the east by residential building and Exile Bay, and to the west by residential buildings and Duke Avenue.
- The topography of the site gently slopes towards the north east direction towards Exile Bay at about 3 to 5 degrees.

Sub-surface conditions encountered in the boreholes are detailed in the attached engineering logs and summarised below in Table 1.

Table 1 – Subsurface Conditions

BH	Top RL (m AHD)	Termination Depth (m)	Topsoil (m)	Fill (m)	Natural (m)	Bedrock (m)
11	3.5	10.2	NE	0.0 – 4.0*	4.0 – 4.5	4.5 –> 10.2
12	3.4	9.7	0.0 – 0.1	0.1 – 4.0	4.0 – 7.7	7.7 –> 9.7
13	3.4	10.0	0.0 – 0.1	0.1 – 2.5	2.5 – 3.5	3.5 –> 10.0
14	3.2	10.0	0.0 – 0.05	0.05 – 2.0	2.0 – 4.4	4.4 –> 10.0
15	3.2	1.3	0.0 – 0.1	0.1 –> 1.3	NE	NE
16	3.2	12.2	0.0 – 0.1	0.1 – 6.0	6.0 – 7.6	7.6 –> 12.2

** 50mm AC at ground surface*

Topsoil	Sandy Silt, low plasticity, dark brown with some roots
Fill	Sandy Gravel, coarse grained, yellow, brown Silty Sandy Clay, medium plasticity, red brown Silty Clayey Sand, fine to coarse grained, with some gravel Silty Clay, medium plasticity, grey, with some gravels
Natural	Silty Sand, fine to medium grained, brown, red, with some ironstone Silty Sandy Clay, medium plasticity, red, brown Silty Clayey Sand, fine to coarse grained, grey, brown, red
Bedrock	Sandstone, grey, brown, extremely weathered grading to slightly weathered to fresh with depth, low strength grading to high strength with depth

The six boreholes (BH11 to BH16) drilled at the location identified by the client, showed fill to depths ranging from 2m to 6m, overlying natural clays and overlying sandstone bedrock. It should be noted that the fill in BH15 and BH16 contained sandstone floaters/boulders. BH15 could not be continued beyond 1.3m due to refusal to drilling on sandstone floater or boulder.

Groundwater Measurement

Groundwater measured during auger boring was encountered at the following depths:

BH	Groundwater Depth (m)
11	4.0
12	1.8
13	2.5
14	3.0
16	3.0

The use of water for coring in the boreholes precluded measurement of groundwater level. It should be noted that fluctuations in the level of groundwater might occur due to variations in rainfall and/or other factors.

Acid Sulfate Soil Material

Laboratory tests were carried out to confirm the presence or otherwise of acid sulfate soils. Laboratory investigation consisted of testing representative soil samples to determine **pH_{KCl}**, **pH_{ox}**, **TPA** (Titratable Peroxide Acidity), **TAA** (Titratable Actual Acidity), **S_{POS}%** (Percent Peroxide Oxidisable Sulphur) and **S_{SCR}%** (Chromium Reducible Sulphur).

Laboratory tests were carried out by SGS Australia Pty Ltd (NATA accredited) in accordance with SPOCAS (Suspension Peroxide Oxidation Combined Acidity & Sulfate) / Chromium Reducible Sulphur (SCR) methods recommended by the Queensland Department of Natural Resources, Mines and Energy (Qld NRM&E) (Reference 1). The test results are attached and summary is presented below in Table 2.

Table 2 – Acid Sulfate Tests Results

BH	Depth (m)	Material Description	pH_{KCl} Unit	pH_{ox} Unit	TPA mole H^+/t	TAA mole H+/t	S_{POS} % w/w	S_{SCR} % w/w
11	3.2-3.5	Silty Sandy Clay, red-brown	5.8	4.6	35	7	0.110	0.082
12	2.2-2.5	Silty Clay, grey with gravel	4.5	4.4	57	60	0.012	<0.005
13	0.5-0.8	Silty Clay, brown-orange	6.4	4.5	<5	<5	0.017	<0.005
13	2.2-2.5	Silty Clay, brown-grey	6.4	5.2	<5	<5	0.010	<0.005
14	2.5-2.8	Silty Sand, grey-brown	6.7	6.9	<5	<5	0.005	<0.005
15	0-0.3	Silty Sand, brown	8.9	7.4	<5	<5	<0.005	<0.005
Action Criteria adopted #					18	18	0.03	0.03

Notes
pH_{KCl}: pH in a 1:40 (W/V) suspension of soil in a solution of 1M K_{Cl} extract
pH_{ox}: pH in a suspension of soil in a solution after peroxide digestion in SPOCAS method
TPA: Titratable Peroxidel Acidity (moles H^+/tonne)
TAA: Titratable Actual Acidity (moles H^+/tonne)
S_{POS}: Peroxide Oxidisable Sulphur (% w/w)
S_{SCR}: Chromium Reducible Sulphur (% w/w)
#: Action Criteria adopted (Reference 2)

Based on the consideration that the soil to be disturbed would be more than 1000 tonnes and of fine and coarse texture (sand/silty clay), the laboratory test results in the above table indicate the following:

- For soil samples, comprising silty clay, brown-orange in BH13 (0.5m-0.8m); silty clay, brown-grey in BH13 (2.2m-2.5m); silty sand, grey-brown in BH14 (2.5m-2.8m); and silty sand, brown in BH15 (0-0.15m); the TAA and TPA values were below the adopted "Action Criteria" of 18mol H+/tonne. The test results for oxidisable Sulphur SPos and S_{SCR} were also below the adopted "Action Criteria" of 0.03%. The soils at these depths are unlikely to be actual acid sulfate soil or potential acid sulfate soil. Based on the test results, no acid sulfate management plan is required for disturbance of soil at this depth.
- For soil samples, comprising silty sandy clay, red-brown in BH11 (3.2m-3.5m) the TPA value exceeded the adopted "Action Criteria" of 18 mol H+/tonne. The test results for oxidisable Sulphur (SPOs and SSCR) also exceeded the "Action Criteria" of 0.03%.
- For soil samples, comprising silty clay, grey in BH12 (2.2m-2.5m) the TPA and TAA values exceeded the adopted "Action Criteria" of 18 mol H+/tonne. However, the test results for oxidisable Sulphur (SPOs and SSCR) were below the "Action Criteria" of 0.03%. The lower peroxide oxidisable sulphur (Spos/SCR) test result indicated that the presence of pyritic sulphur (i.e. inorganic sulphur) is unlikely. The relatively higher values for TAA and TPA indicate that soils to be disturbed at this depth are acidic soil not acid sulfate soil. Based on these test results, it is considered that the soils in the samples analysed are unlikely to be acid sulfate soil (ASS) but are acidic soils (i.e. non-sulphuric and non-sulphidic) which are unlikely to produce significant amount of acid after being exposed to air due to disturbance or oxidation. The local environment is adapted to these soils in undisturbed condition. However, excavation and placement of these soils in conditions with increased rate of soil drainage could contribute for the release of acidic leachates and management of these acidic soils is required, if disturbed. The treatment of acidic soils (non-acid sulfate soils) should be carried out in accordance with processes described in NSW Acid Sulfate Soil Manual 1998 for acid sulfate management plan.

It should also be noted that during the previous geotechnical investigation in September 2015, in samples BH2 (1.5m-1.95m) which located in close proximity of BH12, the TAA and TPA values exceeded the adopted "Action Criteria" of 18 mol H+/tonne. The test results for oxidisable Sulphur (SPOs and SSCR) were below the "Action Criteria" of 0.03%. Based on the test results for BH2, it was considered that the soils in the sample BH2 (1.5m-1.95m) analysed were unlikely to be acid sulfate soil (ASS) but are acidic which are unlikely to produce significant amount of acid after being exposed to air due to disturbance or oxidation.

Point Load Strength Index

Rock cores obtained from the boreholes were photographed and tested at selected depths for determination of Point Load Strength Index (I_{s50}). The point load strength indices for the rock cores and the assessed rock strengths, in accordance with Australian Standard AS1726-1993 (Reference 3) are summarised in the following Table 3.

Table 3 – Point Load Strength Index Test Results

BH	Depth (m)	Diametral $I_{s(50)}$ (MPa)	Axial $I_{s(50)}$ (MPa)	Diametral Assessed Strength	Axial Assessed Strength
11	5.3	0.11	0.21	Low	Low
	6.1	0.45	0.34	Medium	Medium
	8.9	0.32	0.37	Medium	Medium
	9.3	1.24	1.19	High	High
13	6.5	0.18	0.26	Low	Low
	7.8	1.12	1.75	High	High
	8.8	1.33	1.71	High	High
	9.9	0.58	0.77	Medium	Medium
16	8.2	0.3	0.4	Medium	Medium
	9.8	0.71	1.46	Medium	High
	10.4	1.15	1.59	High	High
	11.5	0.97	1.67	Medium	High

The point load strength index tests results generally indicate the bedrock to be of low to very high strength. However, it should be noted that the tests could only be carried out on intact (stronger) portions of the rock cores. Therefore, strength assessments presented in Table 3 indicate the upper limits of rock strengths. Also it should be noted that some iron-hardened layers were not tested. These layers might show higher strength than the above values.

DISCUSSION AND RECOMMENDATIONS

Excavation Conditions

No information regarding cut and fill for the proposed development was available. It is our assessment that excavation of soils (including topsoil, fill and natural soils) and extremely weathered and very low strength sandstone can be achieved using conventional earthmoving equipment such as excavators and dozers. However, excavation in distinctly weathered to fresh and medium to high strength sandstone bedrock would be considerably difficult and may require larger equipment (such as a rock saw, Caterpillar D9 or equivalent). Although selection of rock cutting equipment is based on site access, desired smoothness of the excavated rock surface and acceptable ground vibration during rock excavation, we recommend the use of a rock saw for excavation into sandstone bedrock on the site boundaries, in order to minimise ground vibration.

Groundwater in BH11 to BH16 was encountered at depths ranging from 1.8m to 4m. The use of water for coring precluded further groundwater measurements in other boreholes. Depending on time of construction, groundwater might be at below or above this depth. If excavation extends below the groundwater level (most likely to be at RL 0) extensive dewatering may be required. We recommend that further groundwater monitoring be carried out if it is planned to excavate 3m depth. Installation of piezometers might be required to monitor long term groundwater conditions. Although minor groundwater inflow could be managed by a conventional sump and pump method, we do suggest that a specialist dewatering contractor be contacted if significant groundwater inflow is encountered during excavation. It should also be noted that trafficability problems could arise locally during wet weather or if water is allowed to pond at the site.

Fill Placement

We consider that the proposed development works would require only minor fill placement, if any. The following procedures are recommended for placement of controlled fill, where required.

- Strip existing topsoil and stockpile separately for possible future uses. Excess materials should be disposed off the site.
- Undertake proof rolling (using an 8 to 10 tonnes roller) of the exposed natural soils or fill to detect potentially weak spots (ground heave). Excavate areas of localised heaving to a depth of about 300mm and replace with granular fill, compacted as described below. Proof rolling will not be required if stripping of unsuitable materials exposes bedrock. Fill is generally assessed to be well compacted.
- Undertake proof rolling of soft spots backfilled with granular fill, as described above. If the backfilled area shows movement during proof rolling, this office should be contacted for further recommendations.
- Place suitable fill materials on proof rolled residual soils or bedrock. The fill should be placed in horizontal layers of 200mm to 250mm maximum loose thickness and compacted to a Minimum Dry Density Ratio (MDDR) of 98% Standard, at moisture content within 2% of Optimum Moisture Content (OMC). Controlled fill should preferably comprise non-reactive fill (e.g. crushed sandstone), with a maximum particle size not exceeding 75mm, or low plasticity clay. The natural soils and bedrock obtained from excavations within the site may be used in controlled fill after removal of unsuitable materials, if any, crushing to sizes finer than 75mm, proper mixing and moisture conditioning.
- Fill placement should be supervised to ensure that material quality, layer thickness, testing frequency and compaction criteria conform to the specifications. We recommend "Level 2" or better supervision, in accordance with AS3798-2007 – "Guidelines on Earthworks for Commercial and Residential Developments" (Reference 4). It should be noted that a Geotechnical Inspection and Testing Authority will generally provide certification on the quality of entire compacted fill only if Level 1 supervision and testing is carried out.

Batter Slopes and Retaining Structures

Cut and fill slopes during and after development works should be battered for stability or retained by engineered retaining structures. Recommend batter slopes for stability of cut and fill slopes are presented in Table 4.

Table 4 – Recommended Batter Slopes for Excavation Faces

Material	Temporary (Horizontal : Vertical)		Permanent (Horizontal : Vertical)	
	Exposed	Protected	Exposed	Protected
Controlled fill / natural soil	1.5:1.0	1.0:1.0	2.5:1.0	2.0:1.0
Extremely weathered and low strength sandstone	1.0:1.0	0.75:1.0	1.5:1.0	1.0:1.0
Distinctly weathered to fresh and medium to high strength sandstone	Sub-vertical	Sub-vertical	Sub-vertical	Sub-vertical

Surface protection of the slopes can be provided by shotcreting, which may be reinforced. It is also recommended that batter slopes are provided with adequate surface and sub-surface drainage.

Sub-vertical excavation in distinctly weathered and medium to high strength sandstone, where required, will have a very low risk of instability. However, some local rock bolting or shotcreting would be required, depending on the relative orientation of the rock discontinuities (bedding partings and joint systems) and cut faces. Therefore, the excavation faces should be inspected by a Geotechnical Engineer or an Engineering Geologist, as excavation progresses, at about every 1.5m depth interval, to assess localised rock bolting or shotcreting requirements.

Retaining structures, if required, could comprise a contiguous pier wall or secant pier walls installed prior to commencement of basement excavation. Secant pier wall will be required if excavation extends well below groundwater level. Earth pressure distribution on such retaining walls may be assumed to be triangular in shape and estimated as follows:

$$p_h = \gamma k H$$

Where,

p_h = Horizontal active pressure (kN/m^2)
γ = Total density of materials to be retained (kN/m^3)
k = Coefficient of earth pressure (k_a or k_o)
H = Retained height (m)

For design of flexible retaining structures where some lateral movement is acceptable, an active earth pressure coefficient (k_a) is recommended. If it is critical to limit the horizontal deformation of a retaining structure, use of an earth pressure coefficient at rest (k_0) is recommended. Recommended earth pressure coefficients for design of retaining structures are presented in the following Table 5.

Table 5 – Recommended Earth Pressure Parameters for Design of Retaining Structures

Retained Material	Unit Weight (kN/m^3)	Active Earth Pressure Coefficient	Passive Earth Pressure (kPa)	At Rest Earth Pressure Coefficient
Controlled fill / natural soil	18	0.40	Ignore	0.60
Extremely weathered and low strength sandstone	23	0.20	300	0.30
Distinctly weathered to fresh and medium to high strength sandstone	24	-	1000	-

The above coefficients are based on the assumption that ground level behind the retaining structure is horizontal and the retained material is effectively drained. Additional earth pressures resulting from surcharge load (buildings, infrastructures, etc) on retained materials and groundwater pressure, if any, should also be allowed for in design of retaining structures.

If the retaining structures are anchored or strutted the active earth pressure may be assumed to be rectangular and estimated as follows:

Active earth pressure $p_h = 0.8k\gamma H$

If basement excavation extends below groundwater level, then the design of retaining structures should allow for groundwater pressure.

The design of any retaining structures should also be checked for bearing capacity, overturning, sliding and overall stability of the slope.

Footings

Footings for the proposed development can consist of shallow (pad or strip) or deep footings (bored piers). The following recommended allowable bearing pressure values can be used for the design of footings.

Table 6 – Recommended Allowable Bearing Pressures

Founding Material	Allowable Bearing Pressure (kPa)	Allowable Shaft Adhesion (kPa)
Controlled fill	100	Ignore
Stiff / Medium dense natural soils	125	Ignore
Very low to low strength sandstone	750	50
Medium to high strength sandstone	5000	500

The recommended allowable shaft adhesions against uplift pressures are halves of the shaft adhesions for compressive loads presented in Table 6.

If footings are founded above and within the 1 Horizontal to 1 Vertical line projected from the base of excavations, the recommended allowable bearing pressures presented in Table 6 are not applicable and appropriate allowable bearing pressure will have to be determined by reassessment of materials exposed in the excavation face.

As depths to natural soils and bedrock with the recommended allowable bearing pressures could vary across the site, the founding depths of footings to be constructed will also vary. Therefore, an experienced Geotechnical Engineer, on the basis of assessment made during footing excavation or pier hole drilling, should confirm founding levels during construction. The engineer should ensure that the design strength of bedrock is achieved.

For footings founded in controlled fill and natural soils, the total settlements of footings under the recommended allowable bearing pressures are estimated to be in the range of 15mm to 20mm. However, for footings founded in bedrock total settlements under the recommended allowable bearing pressures are estimated to be about 1% of pier diameter or minimum footing dimension. Differential settlements are estimated to be about half the estimated total settlements.

Floor Slabs
Floor slabs could either be ground supported or suspended on footings. Floor slabs founded on controlled fill or natural soils could be designed for a modulus of subgrade reaction of 20kPa/mm.

Site Classification
Considering the presence of deep fill and existing structures, the site is classified as Class "P" (Problematic) as per AS2870-2011 "Residential slabs and footings".

Rock Anchors
It is likely that the retaining walls may require anchorage or tie-back, in order to resist lateral pressure. We suggest that all anchors are socketed in bedrock. The allowable grout to rock stress for use in rock anchorage design may be taken as 10% of the allowable bearing pressure given in Table 6. We also suggest that the anchors should have sufficient bond length outside the 1 Vertical to 1 Horizontal line drawn from the base of excavation.

Acid Sulfate Soil Assessment
Based on the soil samples analysed for acid sulfate soil during the previous geotechnical investigation in September 2014 and this assessment, it is considered that:

- Soil material at depth (0-0.8m) is unlikely to be actual acid sulfate soil or potential acid sulfate soil. Based on the test results, no acid sulfate management plan is required for disturbance of soil at these depths.
- The soil samples analysed at depth (1.5m -2.5m) are unlikely to be acid sulfate soil (ASS) but are acidic soils (i.e. non-sulfuric and non-sulfidic). However, excavation and placement of these soils in conditions with increased rate of soil drainage could contribute for the release of acidic leachates and management of these acidic soils is required, if disturbed. The treatment of acidic soils (non-acid sulfate soils) should be carried out in accordance with processes described in NSW Acid Sulfate Soil Manual 1998 for acid sulfate management plan (Reference 2). The treatment method will include neutralising soils to prevent generation of acidic leachates. However, soil comprising silty clay, brown-orange in BH13 (2.2m-2.5m) is unlikely to be acid sulfate soil and acidic soil.
- The soil samples analysed at depths (3.2m-3.5m) are considered to potential acid sulfate, and likely to produce acid if disturbed. Acid sulfate soil management plan would be required, if the soils are to be disturbed.

Assessment
Based on the investigation results the site is suitable for the proposed residential development. It is important that the recommendations made in this report are followed. If it is planned to construct deep basements, we recommend that further groundwater measurement be carried out prior to excavation.

General
Assessments and recommendations presented in this report are based on site observation and information from only limited number of boreholes and samples analysed. Although we believe that the sub-surface profile presented in this report is indicative of the general profile across the site, it is possible that the sub-surface profile across the site could differ from that encountered in the boreholes. Likewise, comments on depth to groundwater level are based on observation during field work. We recommend that this company is contacted for further advice if actual site conditions encountered during basement excavation differ from those presented in this report.

Nix Anderson Pty Ltd
ZA.sf/03.08.2015

GEOTECHNIQUE PTY LTD

13188/3-AA
160 Burwood Road, Concord

If you have any questions, please contact the undersigned.

Yours faithfully
GEOTECHNIQUE PTY LTD

ZIAUDDIN AHMED
Senior Geotechnical Engineer

Attached Drawing 13188/3-AA1
Engineering Borehole Logs, Core Photographs & Explanatory Notes
Laboratory Test Results

References

1. Queensland, Department of Natural Resources, Mines and Energy, 2004 – Acid Sulphate Soils – Laboratory Methods Guidelines.
2. New South Wales, Acid Soil Management Advisory Committee, 1988 – Acid Sulphate Soil Manual
3. Australian Standard, Geotechnical Site Investigation, AS1726-1993.
4. Australian Standard AS3798-2007 - Guidelines on Earthworks for Commercial and Residential Developments, 2007.

Nix Anderson Pty Ltd
ZA.sf/03.08.2015


BH14
BH13
BH15
BH16
BH2
BH11
BH12
BH3
BH5
BH1
BH4
BH9
BH7
BH8
BH6
BH10
DUKE AVENUE
BURWOOD ROAD
N
LEGEND
Borehole (August 2014)
Borehole (July 2015)
Imagery ©2014 NearMap.com
0 20 40 60 80 100m
Scale 1:2000
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NOTES
1. Site features are indicative and are not to scale.
2. This drawing has been produced using a base plan provided by others to which additional information e.g test pits, borehole locations or notes have been added. Some or all of the plan may not be relevant at the time of producing this drawing
Nix Management Pty Ltd
Proposed Development
Robert Timms Factory Site (Bushell's)
160 Burwood Road, Concord
Borehole Locations
Drawing No: 13188/3-AA1
Job No: 13188/3
Drawn By: MH
Date: 30 July 2015
Checked By: ZA
File No: 13188-3
Layers: 0, AA1

GEOTECHNIQUE PTY LTD

engineering log - borehole

Client : Nix Anderson Pty Ltd
Project : Proposed Development
Location : 160 Burwood Road, Concord

Job No. : 13188/3
Borehole No. : 11
Date : 09/07/2015
Logged/Checked by: MT

drill model and mounting : Utility Mounted **slope :** deg. **R.L. surface :** ≅3.5

hole diameter : 125 mm **bearing :** deg. **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
		GP				0			ASPHALT PAVEMENT				
									FILL: Sandy Gravel, course grained, brown				
		GP			N=12 9,7,5				FILL: Sandy Gravel, coarse grained, yellow				
						1			FILL: Silty Sandy Clay, medium plasticity, red brown				
		GP			N=5 3,2,3								
						2							
		GP											
					N=5 3,2,3	3							
		GP											
	▼	G				4		SM	Silty SAND, fine to medium grained, brown to red, with some ironstone	W	D		Groundwater at 4.0m
					N=40 11,20,20				SANDSTONE, grey-brown, low to medium strength, extremely weathered				Bedrock
						5			Refer to Cored Borehole				
						6							
						7							
						8							
						9							

form no. 002 version 04 - 05/11

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engineering log
cored borehole

Client :	Nix Anderson Pty Ltd	**Job No. :**	13188/3
Project :	Proposed Development	**Borehole No. :**	11
Location :	160 Burwood Road, Concord	**Date :**	09/07/2015
		Logged/Checked by :	MT
drill model and mounting :	Utility Mounted	**slope :**	deg.
core size:	NMLC	**bearing :**	deg.
		R.L. surface :	≅3.5
		datum :	AHD

barrel lift	water loss/level	depth of R.L. in meters	graphic log	CORE DESCRIPTION rock type, grain characteristics, colour, structure, minor components.	weathering	strength	point load index strength $I_S(50)$ EL VL L M H VH	DEFECT DETAILS: defect spacing (mm) 2000 1000 600 300 100 50	DEFECT DETAILS: DESCRIPTION type, inclination, thickness, planarity, roughness, coating. Specific / General
				Coring Commenced at 5.0m					
		5		SANDSTONE, fine to coarse grained, grey to red-brown	DW-SW	L-M			
		6							
		7							
				SANDSTONE, fine to coarse grained, grey-brown	DW-SW	M-H			
		8							
		9							
		10							
				Borehole No. 11 terminated at 10.2m					
		11							
		12							
		13							
		14							

form no. 003 version 03 - 09/10

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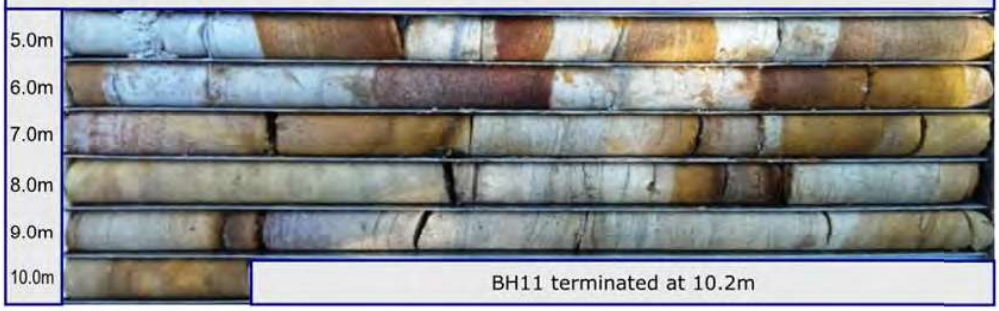
Job No 13188/3 BH11 Started Coring at 5m



Nix Anderson Pty Ltd
MT.mh/04.09.2014

GEOTECHNIQUE PTY LTD

engineering log - borehole

Client : Nix Anderson Pty Ltd
Project : Proposed Development
Location : 160 Burwood Road, Concord

Job No. : 13188/3
Borehole No. : 12
Date : 09/07/2015
Logged/Checked by: MT

drill model and mounting : Utility Mounted **slope :** **deg.** **R.L. surface :** ≅3.4
hole diameter : 125 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
		GP				0			TOPSOIL: Sandy Silt, low plasticity, dark brown, with some roots				
					N=7 3,3,4				FILL: Silty Clayey Sand, fine to coarse grained, with some gravel				
		GP							FILL: Silty Clay, medium plasticity, grey, with some gravel				
	▼	GP			N=8 4,3,5	1							Groundwater at 1.8m
		GP				2							
					N=5 1,2,3	3							
		GP											
		G				4		SC-SM	Silty Clayey SAND, fine to medium grained, black to dark brown, with some shell fragments	W			
					N=2 1,1,1			CI	Silty Sandy CLAY, medium plasticity, red to brown	M>PL	L		
						5							
					N=10 3,5,5	6							
						7							Becoming harder to drill
					N=R 12,16/ 100			SC-SM	Silty Clayey SAND, fine to coarse grained, grey-brown to red	W	MD		
						8			SANDSTONE, grey to red-brown, extremely weathered, low strength				Bedrock
						9							

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GEOTECHNIQUE PTY LTD

engineering log - borehole

Client : Nix Anderson Pty Ltd
Project : Proposed Development
Location : 160 Burwood Road, Concord

Job No. : 13188/3
Borehole No. : 12
Date : 09/07/2015
Logged/Checked by: MT

drill model and mounting : Utility Mounted **slope :** deg. **R.L. surface :** ≅3.4

hole diameter : 125 mm **bearing :** deg. **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						10			Borehole No. 12 terminated at 9.7m due to TC-Bit refusal				
						11							
						12							
						13							
						14							
						15							
						16							
						17							
						18							
						19							

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GEOTECHNIQUE PTY LTD

engineering log - borehole

Client : Nix Anderson Pty Ltd
Project : Proposed Development
Location : 160 Burwood Road, Concord

Job No. : 13188/3
Borehole No. : 13
Date : 10/07/2015
Logged/Checked by: MT

drill model and mounting : Utility Mounted **slope :** deg. **R.L. surface :** ≈3.4

hole diameter : 125 mm **bearing :** deg. **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
		GP				0			TOPSOIL: Silty Sand, fine to medium grained, dark brown, with some grass roots				
		GP			N=12 4,7,5	1			FILL: Silty Clay, medium plasticity, brown-orange, with some gravel				
		GP			N=6 3,3,3	2			FILL: Silty Clay, medium plasticity, brown-grey				
	▼	GP						SC-SM	Silty Clayey SAND, fine to medium grained, yellow, with some sandstone gravel	W	MD		Groundwater at 2.5m
					N=8 3,4,4	3							
						4		SM	Silty SAND, fine to coarse grained, grey	W	D		
					N=R 5,8,20/50	5			SANDSTONE, fine to coarse grained, grey-brown to yellow, extremely weathered, low strength				Bedrock
						6			Refer to Cored Borehole				
						7							
						8							
						9							

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GEOTECHNIQUE PTY LTD

engineering log
cored borehole

Client : Nix Anderson Pty Ltd
Project : Proposed Development
Location : 160 Burwood Road, Concord

Job No. : 13188/3
Borehole No. : 13
Date : 10/07/2015
Logged/Checked by : MT

drill model and mounting : Utility Mounted **slope :** deg. **R.L. surface :** ≅3.4
core size: NMLC **bearing :** deg. **datum :** AHD

barrel lift	water loss/level	depth of R.L. in meters	graphic log	CORE DESCRIPTION rock type, grain characteristics, colour, structure, minor components.	weathering	strength	point load index strength $I_S(50)$ EL VL L M H VH	DEFECT DETAILS: defect spacing (mm) 2000 1000 600 300 100 50	DESCRIPTION type, inclination, thickness, planarity, roughness, coating. Specific / General
				Coring Commenced at 5.8m					
		6		SANDSTONE, fine to coarse grained, brown to red-grey	DW	L-M			
				SANDSTONE, fine to coarse grained, grey to red-brown	DW	L-M	×		
		7		CORE LOSS: 7.4-7.5m					Core loss 100mm
				SANDSTONE, fine to coarse grained, grey to red-brown	DW	M			
				SANDSTONE, fine to coarse grained, brown to grey	DW-SW	M-H	×		
		8							
		9					×		
		10					×		
				Borehole No. 13 terminated at 10.0m					
		11							
		12							
		13							
		14							
		15							

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Job No 13188/3 BH13 Started Coring at 5.8m

BH13 terminated at 10.0m

Nix Anderson Pty Ltd
MT.mh/04.09.2014

GEOTECHNIQUE PTY LTD

engineering log - borehole

Client : Nix Anderson Pty Ltd
Project : Proposed Development
Location : 160 Burwood Road, Concord

Job No. : 13188/3
Borehole No. : 14
Date : 10/07/2015
Logged/Checked by: MT

drill model and mounting : Utility Mounted **slope :** deg. **R.L. surface :** ≅3.2
hole diameter : 125 mm **bearing :** deg. **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						0			TOPSOIL: Silty Sand, fine to medium grained, brown, with some grass roots				
		GP			N=6 1,2,4				FILL: Silty Clay, medium plasticity, grey-brown				
						1			FILL: Silty Sand, fine to medium grained, brown, with trace of iron shards				
		GP			N=20 11,15,5								
		GP				2			Silty SAND, fine to medium grained, grey-brown				
	▼				N=9 10,5,4	3		SM	Silty SAND, fine to coarse grained, grey-brown	W	MD		Groundwater at 3.0m
						4			Silty SAND, fine to medium grained, grey	W	MD		
					N=13 3,5,8			SC-SM	Silty Clayey SAND, fine to coarse grained, red-brown	W	MD		
						5							
					N=23 5,11,12	6		SM	Silty SAND, fine to coarse grained, red- brown, with some sandstone fragments	W	MD		
						7			SANDSTONE, red-brown to grey, extremely weathered, low strength				Bedrock
					N=R 25/50				SANDSTONE, grey to red, distinctly weathered, low to medium strength				
						8							
						9							

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GEOTECHNIQUE PTY LTD

engineering log - borehole

Client : Nix Anderson Pty Ltd
Project : Proposed Development
Location : 160 Burwood Road, Concord

Job No. : 13188/3
Borehole No. : 14
Date : 10/07/2015
Logged/Checked by: MT

drill model and mounting : Utility Mounted **slope :** deg. **R.L. surface :** ≅3.2

hole diameter : 125 mm **bearing :** deg. **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
						10			Borehole No. 14 terminated at 10.0m				
						11							
						12							
						13							
						14							
						15							
						16							
						17							
						18							
						19							

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GEOTECHNIQUE PTY LTD

engineering log - borehole

Client : Nix Anderson Pty Ltd
Project : Proposed Development
Location : 160 Burwood Road, Concord

Job No. : 13188/3
Borehole No. : 15
Date : 13/07/2015
Logged/Checked by: MT

drill model and mounting : Utility Mounted **slope :** deg. **R.L. surface :** ≅3.2

hole diameter : 125 mm **bearing :** deg. **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
		GP				0			TOPSOIL: Silty Sand, fine to medium grained, brown, with some grass				
		GP			N=R 3,5,25/50	1			FILL: Silty Sandy Clay, medium plasticity, brown				
									Borehole No. 15 terminated at 1.3m due to refusal in possible sandstone boulder				

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engineering log - borehole

Client : Nix Anderson Pty Ltd
Project : Proposed Development
Location : 160 Burwood Road, Concord

Job No. : 13188/3
Borehole No. : 16
Date : 13/07/2015
Logged/Checked by: MT

drill model and mounting : Utility Mounted **slope :** **deg.** **R.L. surface :** ≅3.2
hole diameter : 125 **mm** **bearing :** **deg.** **datum :** AHD

method	groundwater	env samples	PID reading (ppm)	geo samples	field test	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
		GP				0			TOPSOIL: Silty Sand, fine to medium grained, brown, with grass roots				
		GP			N=10 3,6,4				FILL: Silty Clay, medium plasticity, grey-brown				
						1			FILL: Silty Sand, fine to coarse grained, brown, with some gravel				
		GP			N=12 3,4,8	2							
					N=R 25/50	3			FILL: Silty Sand, fine grained, brown, with some boulders				
						4							
						5							
						6		SM	Silty SAND, fine to medium grained, dark brown, with some shell fragments	W			
						7							
									Refer to Cored Borehole				
						8							
						9							

form no. 002 version 04 - 05/11

GEOTECHNIQUE PTY LTD

engineering log
cored borehole

Client : Nix Anderson Pty Ltd
Project : Proposed Development
Location : 160 Burwood Road, Concord

Job No. : 13188/3
Borehole No. : 16
Date : 13/07/2015
Logged/Checked by : MT

drill model and mounting : Utility Mounted — **slope :** deg. — **R.L. surface :** ≅3.2
core size: NMLC — **bearing :** deg. — **datum :** AHD

barrel lift	water loss/level	depth of R.L. in meters	graphic log	CORE DESCRIPTION rock type, grain characteristics, colour, structure, minor components.	weathering	strength	point load index strength $I_S(50)$ EL VL L M H VH	DEFECT DETAILS: defect spacing (mm) 2000 1000 600 300 100 50	DESCRIPTION type, inclination, thickness, planarity, roughness, coating. Specific / General
				Coring Commenced at 7.6m					
				CORE LOSS: 7.6-7.85m					Core loss 250mm
		8		SANDSTONE, fine to coarse grained, red-brown, grey	DW-SW	M			
		9							
				SANDSTONE, fine to coarse grained, red-brown	DW-SW	M-H			
		10							
		11							
				SANDSTONE, fine to coarse grained, grey	SW-FR	H-VH			
		12							
				Borehole No. 16 terminated at 12.2m					
		13							
		14							
		15							
		16							
		17							

form no. 003 version 03 - 09/10

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Nix Anderson Pty Ltd
MT.mh/04.09.2014

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Pavement (Bitumen, Concrete Slab, etc)
	Fill
	Silty Sand
	Sandstone
	Topsoil
	Silty Clayey Sand
	Silty Sandy Clay medium plasticity
Misc. Symbols	
	Groundwater

Descriptions of various line types (solid, dotted, etc.)

____	Profile change
_ _	Gradual profile change

Notes:

1. Exploratory borings were drilled between 13/07/2015 and 13/07/2015 using a 50, 100 and 125mm diameter continuous flight power auger.
2. These logs are subject to the limitations, conclusions and recommendations in this report.
3. Results of tests conducted on samples recovered are reported on the logs.

KEY TO SYMBOLS

Symbol Description

Strata symbols


Sandstone


Core Loss

Misc. Symbols

× Point Load Strength

Descriptions of various line types (solid, dotted, etc.)

____ Profile change

__ __ Gradual profile change

Notes:

1. Exploratory borings were drilled between 13/07/2015 and 13/07/2015 using a 50, 100 and 125mm diameter continuous flight power auger.

2. These logs are subject to the limitations, conclusions and recommendations in this report.

3. Results of tests conducted on samples recovered are reported on the logs.

GEOTECHNIQUE PTY LTD

Log Symbols & Abbreviations (Non-cored Borehole Log)

Log Column	Symbol/Value		Description
Drilling Method	V-bit		Hardened steel 'V' shaped bit attached to auger
	TC-bit		Tungsten Carbide bit attached to auger
	RR		Tricone (Rock Roller) bit
	DB		Drag bit
	BB		Blade bit
Groundwater	Dry		Groundwater not encountered to the drilled or auger refusal depth
	▼		Groundwater level at depths shown on log
	▶		Groundwater seepage at depths shown on log
Environment Sample	GP		Glass bottle and plastic bag sample over depths shown on log
	G		Glass bottle sample over depths shown on log
	P		Plastic bag sample over depths shown on log
PID Reading	100		PID reading in ppm
Geotechnical Sample	DS		Disturbed Small bag sample over depths shown on log
	DB		Disturbed Bulk sample over depths shown on log
	U_{50}		Undisturbed 50mm tube sample over depths shown on log
Field Test	N=10 3,5,5		Standard Penetration Test (SPT) 'N' value. Individual numbers indicate blows per 150mm penetration.
	N=R 10,15/100		'R' represents refusal to penetration in hard/very dense soils or in cobbles or boulders. The first number represents10 blows for 150mm penetration whereas the second number represents 15 blows for 100mm penetration where SPT met refusal
	DCP/PSP	5 6 R/10	Dynamic Cone Penetration (DCP) or Perth Sand Penetrometer (PSP). Each number represents blows per 100mm penetration. 'R/10' represents refusal after 10mm penetration in hard/very dense soils or in gravels or boulders.
Classification	GP		Poorly Graded GRAVEL
	GW		Well graded GRAVEL
	GM		Silty GRAVEL
	GC		Clayey GRAVEL
	SP		Poorly graded SAND
	SW		Well graded SAND
	SM		Silty SAND
	SC		Clayey SAND
	ML		SILT / Sandy SILT / clayey SILT, low plasticity
	MI		SILT / Sandy SILT / clayey SILT, medium plasticity
	MH		SILT / Sandy SILT / clayey SILT, high plasticity
	CL		CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, low plasticity
	CI		CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, medium plasticity
	CH		CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, high plasticity
Moisture Condition Cohesive soils	M<PL		Moisture content less than Plastic Limit
	M=PL		Moisture content equal to Plastic Limit
	M>PL		Moisture content to be greater than Plastic Limit
Cohesionless soils	D		Dry - Runs freely through hand
	M		Moist - Tends to cohere
	W		Wet - Tends to cohere

Consistency Cohesive soils	Term	Undrained shear strength, C_u (kPa)	Hand Penetrometer (Qu)
VS	Very Soft	≤12	<25
S	Soft	>12 ≤25	25 – 50
F	Firm	>25 ≤50	50 – 100
St	Stiff	>50 ≤100	100 – 200
VSt	Very Stiff	>100 ≤200	200 – 400
H	Hard	>200	>400

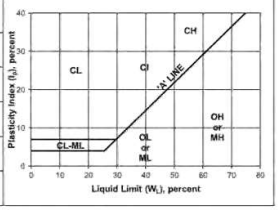
Density Index Cohesionless soils	Term	Density Index, I_D (%)	SPT 'N' (blows/300mm)
VL	Very Loose	≤15	≤5
L	Loose	>15 ≤35	>5 ≤10
M	Medium Dense	>35 ≤65	>10 ≤30
D	Dense	>65 ≤85	>30 ≤50
VD	Very Dense	>85	>50

Hand Penetrometer	100 200	Unconfined compressive strength (q_u) in kPa determined using pocket penetrometer, at depths shown on log
Remarks		Geological origin of soils
	Residual	Residual soils above bedrock
	Alluvium	River deposited Alluvial soils
	Colluvial	Gravity deposited Colluvial soils
	Aeolian	Wind deposited Aeolian soils
	Marine	Marine Soils

GEOTECHNIQUE PTY LTD

AS1726 – Unified Soil Classification System

Major Divisions		Particle size (mm)	Group Symbol	Typical Names	Field Identifications Sand and Gravels			Use the gradation of material passing 63mm for classification of fractions according to the criteria given in 'Major Divisions'	Laboratory classification				
									% (2) < 0.075mm	Plasticity of Fine Fraction	$C_u = D_{60}/D_{10}$	$C_c = (D_{30})^2/(D_{10}D_{60})$	Notes
COARSE GRAINED SOILS (more than half of material less 63mm is larger than 0.075mm)	BOULDERS	200											
	COBBLES	63											
	GRAVELS (more than half of coarse fraction is larger than 2.36mm)	Coarse 20	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength				0-5	-	>4	between 1 and 3	1. Identify lines by the method given for fine grained soils
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength				0-5	-	Fails to comply with above		
		Medium 6	GM	Silty gravels, gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength				12-50	Below 'A' line or I_p<4	-	-	2. Borderline classifications occur when the percentage of fines (fraction smaller than 0.075mm size) is greater than 5% and less than 12%. Borderline classifications require the use of dual symbols, e.g. SP-SM, GW-GC
		Fine 2.36	GC	Clayey gravels, gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength				12-50	Above 'A' line or I_p>7	-	-	
	SANDS (more than half of coarse fraction is smaller than 2.36mm)	Coarse 0.6	SW	Well-graded sands, gravelly sands, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength				0-5	-	>6	between 1 and 3	
		Medium 0.2	SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength				0-5	-	Fails to comply with above		
			SM	Silty sands, sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength				12-50	Below 'A' line or I_p<4	-	-	
		Fine 0.075	SC	Clayey sand, sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength				12-50	Above 'A' line of I_p>7	-	-	
FINE GRAINED SOILS (more than half of material less than 63mm is smaller than 0.075mm)	SILTS & CLAYS (liquid limit < 50%)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	**Dry Strength**	**Dilatancy**	**Toughness**		More than 50% passing 0.075mm	Below 'A' line			
					None to low	Quick to slow	None						
			CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Medium to high	None to very slow	Medium			Above 'A' line			
			OL	Organic silts and organic silty clays of low plasticity	Low to medium	Slow	Low			Below 'A' line			
	SILTS & CLAYS (liquid limit > 50%)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Low to medium	Slow to none	Low to medium			Below 'A' line			
			CH	Inorganic clays of medium to high plasticity, fat clays	High to very high	None	High			Above 'A' line			
			OH	Organic clays of medium to high plasticity, organic silts	Medium to high	None to very slow	Low to medium			Below 'A' line			
	HIGHLY ORGANIC SOILS		Pt	Peat and highly organic soils	identified by colour, odour, spongy feel and generally by fibrous texture				Effervesces with H_2O_2				



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Log Symbols & Abbreviations (Cored Borehole Log)

Log Column	Symbol	Description
Core Size		Nominal Core Size (mm)
	NQ	47
	NMLC	52
	HQ	63
Water Loss	◀	Complete water loss
	◁	Partial water loss
Weathering	FR	Fresh — Rock shows no sign of decomposition or staining
	SW	Slightly Weathered — Rock is slightly discoloured but shows little or no change of strength from fresh rock
	DW	Distinctly Weathered — Rock strength usually changed by weathering. The rock may be highly discoloured, usually by ironstaining. Porosity may be increased by leaching, or may be decreased by deposition of weathering products in pores
	EW	Extremely Weathered — Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrate or can be remoulded, in water
	RS	Residual Soil — Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but soil has not been significantly transported
Strength		Term — Point Load Strength Index (I_{s50}, MPa)
	EL	Extremely Low — ≤0.03
	VL	Very Low — >0.03 ≤0.1
	L	Low — >0.1 ≤0.3
	M	Medium — >0.3 ≤1
	H	High — >1 ≤3
	VH	Very High — >3 ≤10
	EH	Extremely High — >10
Defect Spacing		Description — Spacing (mm)
		Extremely closely spaced — <20
		Very closely spaced — 20 to 60
		Closely spaced — 60 to 200
		Medium spaced — 200 to 600
		Widely spaced — 600 to 2000
		Very widely spaced — 2000 to 6000
		Extremely widely spaced — >6000
Defect Description		
Type	Bp	Bedding parting
	Fp	Foliation parting
	Jo	Joint
	Sh	Sheared zone
	Cs	Crushed seam
	Ds	Decomposed seam
	is	Infilled seam
Macro-surface geometry	St	Stepped
	Cu	Curved
	Un	Undulating
	Ir	Irregular
	Pl	Planar
Micro-surface geometry	Ro	Rough
	Sm	Smooth
	Sl	Slickensided
Coating or infilling	cn	clean
	sn	stained
	vn	veneer
	cg	coating

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AS1726 – Identification of Sedimentary Rocks for Engineering Purposes

Grain Size mm		Bedded rocks (mostly sedimentary)							
More than 20	20	Grain Size Description			At least 50% of grains are of carbonate			At least 50% of grains are of fine-grained volcanic rock	
	6	RUDACEOUS		CONGLOMERATE Rounded boulders, cobbles and gravel cemented in a finer matrix	LIMESTONE and DOLOMITE (undifferentiated)	Calcirudite		Fragments of volcanic ejecta in a finer matrix	SALINE ROCKS
	2			Breccia Irregular rock fragments in a finer matrix				Rounded grains AGGLOMERATE Angular grains VOLCANIC BRECCIA	Halite Anhydrite
	0.6	ARENACEOUS	Coarse	SANDSTONE Angular or rounded grains, commonly cemented by clay, calcite or iron minerals		Calcarenite		Cemented volcanic ash	Gypsum
	0.2		Medium	Quartzite Quartz grains and siliceous cement				TUFF	
	0.06		Fine	Arkose Many feldspar grains Greywacke Many rock chips					
	0.002	ARGILLACEOUS		MUDSTONE	SILTSTONE Mostly silt	Calcareous Mudstone	Calcisiltite	CHALK	Fine-grained TUFF	
	Less than 0.002			SHALE Fissile	CLAYSTONE Mostly clay		Calcilutite		Very fine-grained TUFF	
Amorphous or crypto-crystalline				Flint: occurs as hands of nodules in the chalk Chert: occurs as nodules and beds in limestone and calcareous sandstone						COAL LIGNITE
				Granular cemented – except amorphous rocks						
				SILICEOUS		CALCAREOUS		SILICEOUS		CARBONACEOUS
				SEDIMENTARY ROCKS Granular cemented rocks vary greatly in strength, some sandstones are stronger than many igneous rocks. Bedding may not show in hand specimens and is best seen in outcrop. Only sedimentary rocks, and some metamorphic rocks derived from them, contain fossils Calcareous rocks contain calcite (calcium carbonate) which effervesces with dilute hydrochloric acid						

AS1726 – Identification of Metamorphic and Igneous Rocks for Engineering Purposes

Obviously foliated rocks (mostly metamorphic)		Rocks with massive structure and crystalline texture (mostly igneous)						Grain size (mm)
Grain size description			Grain size description	Pegmatite			Pyroxenite	More than 20
	GNEISS Well developed but often widely spaced foliation sometimes with schistose bands	MARBLE						20
COARSE		QUARTZITE		GRANITE	Diorite	GABBRO	Peridotite	6
	Migmatite Irregularly foliated: mixed schists and gneisses	Granulite	COARSE	These rocks are sometimes phorphyritic and are then described, for example, as porphyritic granite				2
		HORNFELS						
MEDIUM	SCHIST Well developed undulose foliation; generally much mica	Amphibolite		Micorgranite	Microdiorite			0.6
		Serpentine	MEDIUM	These rocks are sometimes phorphyritic and are then described as porphyries		Dolerite		0.2
								0.06
FINE	PHYLLITE Slightly undulose foliation; sometimes 'spotted'			RHYOLITE	ANDESITE			0.002
	SLATE Well developed plane cleavage (foliation)		FINE	These rocks are sometimes phorphyritic and are then described as porphyries		BASALT		Less than 0.002
	Mylonite Found in fault zones, mainly in igneous and metamorphic areas			Obsidian	Volcanic glass			Amorphous or cryptocrystalline
CRYSTALLINE				Pale<----------->Dark				
SILICEOUS		Mainly SILICEOUS		ACID Much quartz	INTERMEDIATE Some quartz	BASIC Little or no quartz	ULTRA BASIC	
METAMORPHIC ROCKS Most metamorphic rocks are distinguished by foliation which may impart fissility. Foliation in gneisses is best observed in outcrop. Non-foliated metamorphics are difficult to recognize except by association. Any rock baked by contact metamorphism is described as 'hornfels' and is generally somewhat stronger than the parent rock Most fresh metamorphic rocks are strong although perhaps fissile			IGNEOUS ROCKS Composed of closely interlocking mineral grains. Strong when fresh; not porous Mode of occurrence : 1 Batholith; 2 Laccoliths; 3 Sills; 4 Dykes; 5 Lava Flows; 6 Veins					

ANALYTICAL REPORT

NATA WORLD RECOGNISED ACCREDITATION

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Project	**13188-4 Concord**	SGS Reference	**CE116272 R0**
Order Number	**SE141506**	Report Number	0000026795
Samples	7	Date Reported	24 Jul 2015
Date Started	21 Jul 2015	Date Received	20 Jul 2015

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(3146)

SIGNATORIES

Anthony Nilsson
Operations Manager

SGS

ANALYTICAL REPORT

CE116272 R0

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	CE116272.001 Soil 09 Jul 2015 BH11 3.2-3.5	CE116272.002 Soil 09 Jul 2015 BH12 2.2-2.5	CE116272.003 Soil 09 Jul 2015 BH13 0.5-0.8	CE116272.004 Soil 09 Jul 2015 BH13 2.8-2.5
Moisture Content Method: AN002 Tested: 20/7/2015							
% Moisture	%w/w	0.5		17	19	15	14
TAA (Titratable Actual Acidity) Method: AN219 Tested: 22/7/2015							
pH KCl	pH Units	-		5.8	4.5	6.4	6.4
Titratable Actual Acidity	kg H2SO4/T	0.25		0.37	2.9	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5		7	60	<5	<5
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01		0.01	0.10	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005		0.016	0.016	0.009	0.011
Calcium (CaKCl)	%w/w	0.005		0.056	0.039	0.30	0.11
Magnesium (MgKCl)	%w/w	0.005		0.050	0.045	0.045	0.037
TPA (Titratable Peroxide Acidity) Method: AN218 Tested: 22/7/2015							
Peroxide pH (pH Ox)	pH Units	-		4.6	4.4	4.5	5.2
TPA as kg H_2SO_4/tonne	kg H2SO4/T	0.25		1.7	2.8	<0.25	<0.25
TPA as moles H+/tonne	moles H+/T	5		35	57	<5	<5
TPA as S % W/W	%w/w S	0.01		0.06	0.09	<0.01	<0.01
Titratable Sulfidic Acidity as moles H+/tonne	moles H+/T	5		27	<5	<5	<5
Titratable Sulfidic Acidity as kg H_2SO_4/tonne	kg H2SO4/T	0.25		1.3	<0.25	<0.25	<0.25
Titratable Sulfidic Acidity as S % W/W	%w/w S	0.01		0.04	<0.01	<0.01	<0.01
ANCE as % $CaCO_3$	% CaCO3	0.01		<0.01	<0.01	<0.01	<0.01
ANCE as moles H+/tonne	moles H+/T	5		<5	<5	<5	<5
ANCE as S % W/W	%w/w S	0.01		<0.01	<0.01	<0.01	<0.01
Peroxide Oxidisable Sulphur (Spos)	%w/w	0.005		0.11	0.012	0.017	0.010
Peroxide Oxidisable Sulphur as moles H+/tonne	moles H+/T	5		67	7	11	6
Sulphur (Sp)	%w/w	0.005		0.12	0.027	0.027	0.021
Calcium (Cap)	%w/w	0.005		0.10	0.038	0.32	0.12
Reacted Calcium (CaA)	%w/w	0.005		0.045	<0.005	0.016	<0.005
Reacted Calcium (CaA)	moles H+/T	5		23	<5	8	<5
Magnesium (Mgp)	%w/w	0.005		0.060	0.042	0.044	0.041
Reacted Magnesium (MgA)	%w/w	0.005		0.011	<0.005	<0.005	<0.005
Reacted Magnesium (MgA)	moles H+/T	5		9	<5	<5	<5
Net Acid Soluble Sulphur as % w/w	%w/w	0.005		-	-	-	-
Net Acid Soluble Sulphur as moles H+/tonne	moles H+/T	5		-	-	-	-

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ANALYTICAL REPORT CE116272 R0

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	CE116272.001 Soil 09 Jul 2015 BH11 3.2-3.5	CE116272.002 Soil 09 Jul 2015 BH12 2.2-2.5	CE116272.003 Soil 09 Jul 2015 BH13 0.5-0.8	CE116272.004 Soil 09 Jul 2015 BH13 2.5-2.5
SPOCAS Net Acidity Calculations Method: AN220 Tested: -							
s-Net Acidity	%w/w S	0.01	**0.05**	**0.10**	<0.01	<0.01
a-Net Acidity	moles H+/T	5	**30**	**62**	<5	<5
Liming Rate	kg CaCO3/T	0.1	**2.2**	**4.7**	<0.1	<0.1
Verification s-Net Acidity	%w/w S	-20	**0.04**	NA	NA	NA
a-Net Acidity without ANCE	moles H+/T	5	**75**	**67**	**12**	**7**
Liming Rate without ANCE	kg CaCO3/T	0.1	**5.6**	**5.0**	NA	NA
Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 21/7/2015						
Chromium Reducible Sulphur (Scr)	%	0.005	**0.082**	<0.005	<0.005	<0.005
Chromium Reducible Sulphur (Scr)	moles H+/T	5	**51**	<5	<5	<5

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ANALYTICAL REPORT

CE116272 R0

Parameter	Units	LOR	Sample Number: CE116272.005 Sample Matrix: Soil Sample Date: 08 Jul 2015 Sample Name: BH14 2.5-2.8	Sample Number: CE116272.006 Sample Matrix: Soil Sample Date: 09 Jul 2015 Sample Name: BH15.0-0.3	Sample Number: CE116272.007 Sample Matrix: Soil Sample Date: 09 Jul 2015 Sample Name: BH16 0.5-0.8
Moisture Content Method: AN002 Tested: 20/7/2015					
% Moisture	%w/w	0.5	**14**	**6.9**	**18**
TAA (Titratable Actual Acidity) Method: AN219 Tested: 22/7/2015					
pH KCl	pH Units	-	**6.7**	**8.9**	**6.3**
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	**0.011**	<0.005	<0.005
Calcium (CaKCl)	%w/w	0.005	**0.027**	**0.13**	**0.22**
Magnesium (MgKCl)	%w/w	0.005	**0.038**	**0.017**	**0.032**
TPA (Titratable Peroxide Acidity) Method: AN218 Tested: 22/7/2015					
Peroxide pH (pH Ox)	pH Units	-	**6.9**	**7.4**	**4.3**
TPA as kg H_2SO_4/tonne	kg H2SO4/T	0.25	<0.25	<0.25	<0.25
TPA as moles H+/tonne	moles H+/T	5	<5	<5	<5
TPA as S % W/W	%w/w S	0.01	<0.01	<0.01	<0.01
Titratable Sulfidic Acidity as moles H+/tonne	moles H+/T	5	<5	<5	<5
Titratable Sulfidic Acidity as kg H_2SO_4/tonne	kg H2SO4/T	0.25	<0.25	<0.25	<0.25
Titratable Sulfidic Acidity as S % W/W	%w/w S	0.01	<0.01	<0.01	<0.01
ANCE as % $CaCO_3$	% CaCO3	0.01	**0.15**	**0.25**	<0.01
ANCE as moles H+/tonne	moles H+/T	5	**30**	**50**	<5
ANCE as S % W/W	%w/w S	0.01	**0.05**	**0.08**	<0.01
Peroxide Oxidisable Sulphur (Spos)	%w/w	0.005	**0.005**	<0.005	**0.018**
Peroxide Oxidisable Sulphur as moles H+/tonne	moles H+/T	5	<5	<5	**11**
Sulphur (Sp)	%w/w	0.005	**0.017**	**0.007**	**0.019**
Calcium (Cap)	%w/w	0.005	**0.034**	**0.14**	**0.22**
Reacted Calcium (CaA)	%w/w	0.005	**0.007**	<0.005	<0.005
Reacted Calcium (CaA)	moles H+/T	5	<5	<5	<5
Magnesium (Mgp)	%w/w	0.005	**0.048**	**0.022**	**0.032**
Reacted Magnesium (MgA)	%w/w	0.005	**0.009**	<0.005	<0.005
Reacted Magnesium (MgA)	moles H+/T	5	**8**	<5	<5
Net Acid Soluble Sulphur as % w/w	%w/w	0.005	-	-	-
Net Acid Soluble Sulphur as moles H+/tonne	moles H+/T	5	-	-	-

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ANALYTICAL REPORT CE116272 R0

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name	CE116272.005 Soil 09 Jul 2015 BH14 2.5-2.8	CE116272.006 Soil 09 Jul 2015 BH15.0-0.3	CE116272.007 Soil 09 Jul 2015 BH16 0.5-0.8
SPOCAS Net Acidity Calculations Method: AN220 Tested: -						
s-Net Acidity	%w/w S	0.01		<0.01	<0.01	<0.01
a-Net Acidity	moles H+/T	5		<5	<5	<5
Liming Rate	kg CaCO3/T	0.1		<0.1	<0.1	<0.1
Verification s-Net Acidity	%w/w S	-20		NA	NA	NA
a-Net Acidity without ANCE	moles H+/T	5		<5	<5	**12**
Liming Rate without ANCE	kg CaCO3/T	0.1		<0.1	<0.1	NA
Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 21/7/2015						
Chromium Reducible Sulphur (Scr)	%	0.005		<0.005	<0.005	<0.005
Chromium Reducible Sulphur (Scr)	moles H+/T	5		<5	<5	<5

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QC SUMMARY

CE116272 R0

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Chromium Reducible Sulphur (CRS) Method: ME-(AU)-[ENV]AN217

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Chromium Reducible Sulphur (Scr)	LB028096	%	0.005	<0.005	0%	93%
Chromium Reducible Sulphur (Scr)	LB028096	moles H+/T	5	<5		

TAA (Titratable Actual Acidity) Method: ME-(AU)-[ENV]AN219

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH KCl	LB028108	pH Units	-	6.0	0%	98%
Titratable Actual Acidity	LB028108	kg H2SO4/T	0.25	<0.25	0%	NA
Titratable Actual Acidity (TAA) moles H+/tonne	LB028108	moles H+/T	5	<5	0%	92%
Titratable Actual Acidity (TAA) S%w/w	LB028108	%w/w S	0.01	<0.01	0%	92%
Sulphur (SKCl)	LB028108	%w/w	0.005	<0.005	7%	112%
Calcium (CaKCl)	LB028108	%w/w	0.005	<0.005	9%	
Magnesium (MgKCl)	LB028108	%w/w	0.005	<0.005	1%	

TPA (Titratable Peroxide Acidity) Method: ME-(AU)-[ENV]AN218

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Peroxide pH (pH Ox)	LB028109	pH Units	-	6.4	0%	100%
TPA as kg H_2SO_4/tonne	LB028109	kg H2SO4/T	0.25	<0.25	0%	107%
TPA as moles H+/tonne	LB028109	moles H+/T	5	<5	0%	107%
TPA as S % W/W	LB028109	%w/w S	0.01	<0.01	0%	107%
ANCE as % $CaCO_3$	LB028109	% CaCO3	0.01	<0.01	0%	
ANCE as moles H+/tonne	LB028109	moles H+/T	5	<5	0%	
ANCE as S % W/W	LB028109	%w/w S	0.01	<0.01	0%	
Sulphur (Sp)	LB028109	%w/w	0.005	<0.005	19%	
Calcium (Cap)	LB028109	%w/w	0.005	<0.005	17%	
Magnesium (Mgp)	LB028109	%w/w	0.005	<0.005	14%	

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METHOD SUMMARY

CE116272 R0

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN004	Soils, sediments and sludges are pulverised using an LM2 ring mill. The dry sample is pulverised to a particle size of >90% passing through a -75µm sieve.
AN217	Dried pulped sample is mixed with acid and chromium metal in a rapid distillation unit to produce hydrogen sulfide (H2S) which is collected and titrated with iodine (I2(aq)) to measure SCR.
AN218	Soil samples are subjected to extreme oxidising conditions using hydrogen peroxide. Continuous application of heat and peroxide ensure all sulfide is converted to sulfuric acid. Excess peroxide is broken down by a copper catalyst prior to titration for acidity. Calcium, magnesium, and sulfur are determined by ICP-OES. Also included is a carbonate modification step which, depending on pH after the initial oxidation, gives a measure of ANC.
AN219	Dried pulped sample is extracted for 4 hours in a 1 M KCl solution. The ratio of sample to solution is 1:40. The extract is titrated for acidity. Calcium, magnesium, and sulfur are determined by ICP-AES.
AN220	SPOCAS Suite: Scheme for the calculation of net acidities and liming rates using a Fineness Factor of 1.5.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
^	Performed by outside laboratory.	NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

KINESIS

Colliers International

BUSHELLS FACTORY REDEVELOPMENT

SUSTAINABILITY STRATEGY

04 FEBRUARY 2019

PREPARED BY KINESIS FOR COLLIERS INTERNATIONAL

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Document Version
Final

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Note: This report is provided subject to some important assumptions and qualifications:

The results presented in this report are modelled estimates using mathematical calculations. The data, information and scenarios presented in this report have not been separately confirmed or verified. Accordingly, the results should be considered to be preliminary in nature and subject to such confirmation and verification.

Energy, water and greenhouse consumption estimates are based on local climate and utility data available to the consultant at the time of the report. These consumption demands are, where necessary, quantified in terms of primary energy and water consumptions using manufacturer's data and scientific principles.

Generic precinct-level cost estimates provided in this report are indicative only based on Kinesis's project experience and available data from published economic assessments. These have not been informed by specific building design or construction plans and should not be used for design and construct cost estimates.

The Kinesis software tool and results generated by it are not intended to be used as the sole or primary basis for making investment or financial decisions (including carbon credit trading decisions). Accordingly, the results set out in this report should not be relied on as the sole or primary source of information applicable to such decisions.

CONTENTS

INTRODUCTION

Kinesis was engaged by the developer to develop a sustainability strategy for the Bushells Factory Redevelopment. This report provides an analysis of a sustainability strategy for the project.

Analysis was undertaken using the CCAP Precinct integrated sustainability, infrastructure and design tool. CCAP Precinct provides a basis from which the developer can identify and measure the potential performance outcomes and develop a suite of strategies for implementation.

We have worked with the project team through workshops and iterations to develop the recommendations in this report.

KEY INTERVENTIONS AND FINDINGS

Five key interventions were identified to enhance the sustainability outcomes of the Bushells Factory Redevelopment:

1. Efficient appliances & improved thermal design
2. Solar Photovoltaic (PV) & battery ready facilities
3. Recycled water ready infrastructure
4. Green facade treatment for cooler dwellings
5. Best practice parking measures and access to car share facilities

The modelled interventions will deliver a comprehensive precinct approach to sustainability and infrastructure delivery.

When compared to a benchmark scenario (BASIX and NCC compliance), the Bushells Factory Redevelopment has the potential to achieve:

	Impact of interventions
Greenhouse gas emissions	▼34%
Water consumption	▼38%
Peak electricity	▼50%
Solar PV contribution	20%
Recycled/rain water contribution	30%
BASIX Energy score (estimated)	53
BASIX Water score (estimated)	66
Annual household cost savings	$7,200

Table 1: Impact of interventions

The ESD strategy can be achieved through a combination of "standard" building level sustainable interventions such as installing rooftop PV systems, ensuring high thermal efficiency, installing efficient appliances and capturing and reusing rainwater along with "creative" interventions such as unbundled and decoupled parking systems, encouraging the uptake of car share, a recycled water system, a green facade and additional canopy cover and battery storage.

Based on initial cost estimates (excluding recycled water system costs), the outcomes could be achieved at an estimated capital cost of approximately $7,700 per dwelling. It should be noted, however, this cost will vary depending on the delivery model for recycled water, solar PV and other energy solutions.

This report provides the incremental cost and benefit of each intervention. The sustainability strategy developed will deliver the best financial, social and environmental outcomes for Bushells Factory Redevelopment.

PROJECT DETAILS

The development details (dwellings, floor space, site area) for the Bushells Factory Redevelopment site are provided in Table 2, based on the preliminary master plan. Results contained in the report are based on the development details provided here.

DEVELOPMENT DETAILS

Development details	Area
Total Development Area	3.98 ha
Public Open Space (including roads)	2.4 ha
Residential Dwellings	500
Terraces	36
Apartments	464
Affordable (1-bedroom)	46
1-bedroom	73
2-bedroom	275
3-bedroom	70
Building height	Average 6 storeys (ranging from 3 to 9 storeys)

Table 2: Dwelling yield and floor space for Bushells Factory Redevelopment

SCENARIO ANALYSIS

This work was undertaken using CCAP Precinct, a strategic infrastructure and sustainability design tool, used in the analysis of key performance metrics of precincts, integrating land use and development inputs with demographic, utility, transport and affordability models. Strategies were analysed and discussed with the project team on 6 March, 2017 and refined over time.

This discussion and subsequent refinements have been incorporated into the analysis provided in this report.

Analysis of energy and water demands, transport and car use and household living costs were undertaken under a scenario which incorporates a suite of energy, water and transport strategies that were explored for the development.

This modelled scenario was compared to a **Benchmark Scenario.**, which assumes the development is delivered to building compliance standards (approximate BASIX Energy 25 and BASIX Water 40 for apartments and BASIX Energy 50 and BASIX Water 40 for townhouses) and using Council DCP parking rates.

The technical details of the benchmark and modelled scenarios are summarised in Table 3 and the results are discussed below.

TECHNOLOGY ASSUMPTIONS FOR SCENARIOS

Technology	Benchmark	Modelled scenario
Hot water system	Centralised gas	Centralised gas
Thermal Design (NatHERS)	5-star average	8-star average (delivered through design & green façade)
Space heating and cooling	2-Star A/C	5-Star A/C
Lighting	Halogen, T8 & CFL	Efficient (LED)
Appliances	Dishwasher 2.5-star Energy, 2.5-star Water Dryer 1.5-star Energy Clothes washer (not installed) Fridge (not installed)	Dishwasher 4-star Energy, 5-star Water Dryer Heat Pump Clothes Dryer Clothes washer 4.5-star Energy, 5-star Water Fridge 5-star Energy
Solar PV	None	300 kW* (0.5 kW per multi unit dwelling 2 kW per townhouse)
Water Fixtures & fittings	Toilet – 4-star Showerhead – 3+ Star Kitchen Taps – 5-star Other Taps – 5-star	Toilet – 4-star Showerhead – 3+ Star Kitchen Taps – 5-star Other Taps – 5-star
Water reuse	None	Recycled water for irrigation, toilet and laundry
Car parking rates	Affordable – 1 space 1 bed – 1 space 2 bed – 1.5 space 3 bed – 2 space 1 visitor per 3 apartments	Affordable – 0 space 1 bed – 0 space 2 bed – 1 space 3 bed – 1.5 space 1 visitor per 5 apartments Unbundled parking Provision of car share spaces

Table 3: Specifications assumed for Benchmark (BASIX and NCC Compliance) and modelled scenario

*** PV system size shows cumulative total for the whole precinct but would be implemented on a building-by-building basis**

KEY FINDINGS

A summary of the incremental impact of each initiative explored in the modelled scenario is documented below in Table 4. Some further details are discussed below.

Technology	Benchmark	Modelled scenario	Upfront Marginal Capital Cost ($) per dwelling	Annual Savings per dwelling ($/year)	Simple Payback Period (years)	Net Emission Reduction	Net Water Reduction	Est. additional BASIX Energy Points	Est. additional BASIX Water Points
Hot water system	Centralised gas	Centralised gas	$0	$0					
Thermal Design (NatHERS)	5-star average	8-star average	$2,900	$80	36	4%		2	
Space heating & cooling	2-Star A/C	5-Star A/C	$500	$20	25	1%		<1	
Lighting	Halogen, T8 & CFL	Efficient (LED)	$570	$60	10	2%		2	
Appliances	Dishwasher 2.5-star Energy, 2.5-star Water	Dishwasher 4-star Energy, 5-star Water	$200	$20	10	1%		1	
	Dryer 1.5-star Energy	Dryer 5-star Energy	$500	$75	7	3%		4	
	Clothes washer (not installed)	Clothes washer 4.5-star Energy, 5-star Water	$630	$80	8	2%	17%	2	4
	Fridge (not installed)	Fridge 5-star Energy	$770	$30	25	2%		2	
Solar PV	None	300 kW (0.5 kW per multi unit dwelling 2 kW per townhouse)	$650*	$195	3	12%		7	
Water Fixtures & fittings	Toilet – 4-star Showerhead – 3+ Star Kitchen Taps – 5-star Other Taps – 5-star	Toilet – 4-star Showerhead – 3+ Star Kitchen Taps – 5-star Other Taps – 5-star	$0	$0					
Rainwater harvesting/ Recycled water	None	Recycled water for irrigation, toilet and laundry (approx.1,000 kL storage)	$1,000**	$60^	17		21%		22
Car parking rates and car share	Affordable – 1 space 1 bed – 1 space 2 bed – 1.5 space 3 bed – 2 space 1 visitor per 3 apartments	Affordable – 0 space 1 bed – 0 space 2 bed – 1 space 3 bed – 1.5 space 1 visitor per 5 apartments On-street parking controls Unbundled parking Provision of car share spaces	$0	$1,200 (fuel) [illegible]		*51% (transport emissions)* 7% (energy emissions)		5	
TOTAL			$7,720	$7,200		34%	38%	26 points	26 points

Table 4: Specifications assumed for Benchmark (BASIX and NCC Compliance) and modelled scenario

New BASIX Energy & Water Score: 53 | 66

* Capital cost of precinct scale solar PV system of 300 kW divided over 500 dwellings
** Marginal capital cost of connection to a precinct scale recycled water system including building level metering and dual pipe
^ Subject to variation based on recycled water pricing
^^ Transport fixed costs includes vehicle ownership costs such as insurance, maintenance and registration

STRATEGY CONSIDERATIONS AND NEXT STEPS

Strategy	Who Benefits	Considerations	Next steps
Car parking rates	• **Purchaser** – lower apartment cost. • **Resident/Strata** – reduced common area electricity demands and associated strata fees. • **Developer** – reduced construction costs.	• Parking can have a positive or negative impact on project feasibility (construction costs vs sale prices). • Allocating spaces for car share pods would enable residents to consider a new approach for car ownership and set up the community for a future with autonomous cars.	• Facilitate the EOI for provision of car share. • Perform further transport modelling with SCT Consulting to build a case for lower parking rates to for presentation to Council and RMS. • Determine the design implications of lower parking rates, considering the slope of land and site constraints.
Recycled water system	• **Resident/Strata** – unlimited water available to ensure lush/green common area gardens and a green facade which is not dependant on climate variability. • **Developer** – potential for lower sewer & water infrastructure costs.	• Rainwater and stormwater reuse does not provide adequate water for irrigation, toilet and laundry demand. • The scale of Bushells Factory Redevelopment is adequate for the potential for precinct scale recycled water, significantly reducing water demand and sewer loads. • Potential to enter into cost sharing arrangements with the recycled water utility provider to maintain the green facade and public gardens. In addition, the water utility may consider providing additional water to the adjacent Massey Park golf course and Edwards Park (further improving the feasibility of recycled water for the project)	• Facilitate EOI for provision of recycled water for the Bushells Factory Redevelopment. • Include the potential to share capital and operation costs for green spaces and facade in the EOI.
Solar PV & battery	• **Resident/Strata** - cost savings from reduced common area electricity demands and associated strata fees. • **Electricity** Utility – Reducing/ shifting the peak demand reduces pressure on the grid increasing the longevity of the distribution network.	• A single common area meter for each building would allow solar PV to be maximised for common area loads. • Excess electricity produced by the solar PV system during the day can be sold to the grid. Combined with a battery storage system, electricity could be sold at peak times to generate more revenue. • Potential for solar PV to be managed at a precinct level through a private energy utility.	• Facilitate EOI for alternative energy solutions for the Bushells Factory Redevelopment. • Allocate space and wiring for battery ready buildings.
8-star NatHERS	• **Resident** – improved comfort and minor cost savings through lower air conditioning use. • **Electricity Utility** (public or private) – peak demand reductions. • **Developer** - smaller air conditioner capacity could translate to lower cost and more efficient systems.	• Determine with the design team whether an 8-star rating can be achieved through both building design and green facade treatment. • Green facade capital & maintenance costs are uncertain. See link to recycled water utility provider.	• Meet with Ausgrid to discuss network benefits and potential infrastructure cost saving associated with the strategy. • Investigate design implications and maintenance requirements for green walls • Incorporate option for cost sharing arrangements with the recycled water utility provider to maintain the green facade and public gardens in EOI process.
6 star A/C	• **Supports 8-star NatHERS strategy** to improve resident comfort and network benefits (see above)	• Capital costs are low but the material benefits to households and the developer is marginal. • Main beneficiary is the utility through peak demand reductions (see next steps).	• Meet with Ausgrid to discuss network benefits and potential infrastructure cost saving associated with the strategy.
Efficient Appliances	• **Resident** - utility cost savings. • **Developer** - potential for apartment fit out cost savings as kitchens and laundries are designed and built for specific appliances.	• Potential for reduced costs and waste in apartment fit out as kitchens and laundries are designed and built for specific appliances. • Capital costs are high and include appliances the developer would usually not install (clothes washer and fridge). • Of all appliances, the clothes washer has the biggest impact on energy and water performance and household cost savings. • Additional benefits could mean less disruption when people move in to the apartment block (no moving of large appliances, scratching walls etc).	• Investigate the marketability of providing new purchases with all appliances ("move in ready" apartments). • Investigate the potential for fit out cost savings.

APPENDIX

KEY ASSUMPTIONS

Metropolitan Sydney average benchmarks

Electricity	2,132 kWh per person/year
Gas	3,688 MJ per person/year
Water	237.8 L per person/day
Transport	19.98 km per person/day

Tariffs and rates

Household cost savings outlined in this report are based on current tariffs outlined below:

Residential Water	**Rate**	**Unit**
Mains tariff	2.232	$/kL
Recycled water tariff	2.068	$/kL
Service charge per dwelling	765	$/yr
Recycled water service charge	0	$/yr

Residential Grid Electricity	**Rate**	**Unit**
Applied tariff	0.2514	$/kWh
Solar feed-in tariff	0.06	$/kWh
Service charge per dwelling	289.16	$/yr

Residential Gas	**Rate**	**Unit**
Gas (first 3,775 MJ per qtr/remaining)	0.041/0.023	$/MJ
Service charge per dwelling	207	$/yr

Residential Transport	**Rate**	**Unit**
Fuel	1.50	$/L
Annual capital costs (devaluation)	6,642	$/yr
Annual registration/insurance	2,172	$/yr

KEY DATA SOURCES

- ACADS-BSG Australian Climatic Data (Reference Meteorological Year, RMY) for hourly temperature, insulation and humidity.
- Bureau of Meteorology local rainfall and evaporation data
- Data is from the representative weather station for the local climate zone
- The RMY (Representative Meteorological Year) is synthesized from a composite of 12 typical meteorological months that best represent the historic average of the specified location using post-1986 data in addition to the earlier weather data for each of the 69 climate zones in Australia.
- Sydney Water (2009) Rouse Hill 15 minute and daily demand profiles (Kinesis request, unpublished)
- Department of Resources, Energy and Tourism, 2010, Energy in Australia – 2010, ABARE, Canberra
- Kinesis 2014, Additional water end use breakdowns derived from first principle analysis of residential and non-residential building types.
- National Water Commission, 2011, National performance report 2009-2010: urban water utilities, National Water Commission, Canberra
- NSW Department of Planning, BASIX Residential Water Consumption Data (2010)
- Sydney Water Best Practice Guidelines for water conservation in commercial office buildings and shopping centres (2007), http://www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdu0/~edisp/dd_054580.pdf
- Sydney Water Best Practice Guidelines for holistic open space turf management (2011), www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdq1/~edisp/dd_045253.pdf
- Water Corporation. (2014). Mapping water use at school. from https://www.watercorporation.com.au/home/teachers/lesson-plans-and-teaching-resources/lesson-plan-search/lesson-plan/?id=%7BD9516524-4A2C-4B98-A113-3891D59F1AAA%7D
- Department of Resources, Energy and Tourism, 2010, Energy in Australia – 2010, ABARE, Canberra
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- Department of the Environment, 2014, National Greenhouse Accounts Factors, http://www.environment.gov.au/system/files/resources/b24f8db4-e55a-4deb-a0b3-32cf763a5dab/files/national-greenhouse-accounts-factors-2014.pdf
- Energy Use in the Australian Residential Sector, 1986 – 2020, Australian Government Department of the Environment, Water, Heritage and the Arts (DEHWA), 2008.
- Energy Efficient Strategies (2009), Appliance Energy Consumption in Australia: Equations for Appliance Star Ratings
- Building Code of Australia (2007) Energy Efficiency Requirements in Commercial Buildings
- Transport Data Centre (2006) The Development of a Sydney VKT Regression Model
- ABS (2010) 'Household Expenditure Survey, Australia: Summary of Results', catalogue number 65300DO001_200910, Australian Bureau of Statistics, Canberra.

SOCIAL INFRASTRUCTURE AND COMMUNITY USES DEMAND ASSESSMENT

160 Burwood Road, Concord

August 2015

urbis

URBIS STAFF RESPONSIBLE FOR THIS REPORT WERE:

Director	Susan Rudland
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Job Code	SA5505
Report Number	FINAL

Urbis's Public Policy team has received ISO 20252 Certification for the provision of public policy research and evaluation, social planning, community consultation, market research and communications research

Template version 2015.1.0

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1 Introduction

1.1 PURPOSE OF THIS REPORT

Urbis has been engaged by Property Link Holdings Pty Ltd and NixAnderson to undertake a social infrastructure and community uses demand assessment for the City of Canada Bay Local Government Area (LGA) to inform the provision of services and facilities within and around the proposed development site, 160 Burwood Road, Concord.

The purpose of this report is to undertake an assessment of the capacity of existing services and facilities and the need for additional community services, social infrastructure or public open space for future residents of the development proposal and the general community.

1.2 THE SITE AND PROPOSAL

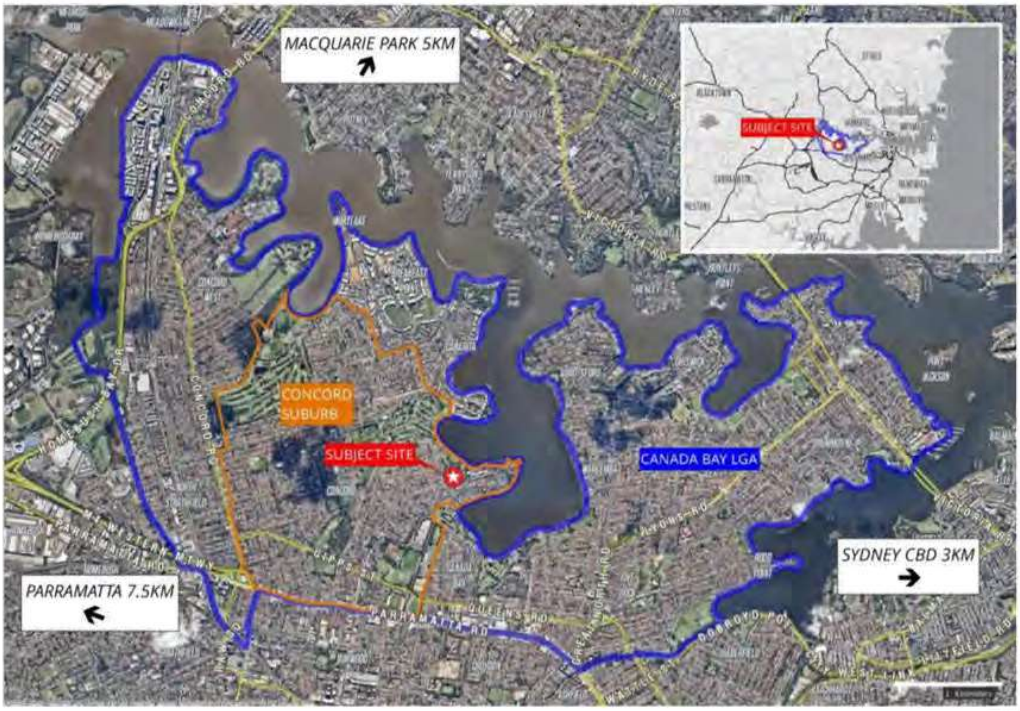
The subject site is located at 160 Burwood Road, Concord, and is a single lot legally described as Lot 5 DP129325. The site has a total area of 4ha with frontages to Burwood Road to the south and Zoeller Street to the north, 170m and 26m respectively. The Bushells Coffee factory and associated offices currently occupy the site. Existing vehicle access to the site is provided from Burwood Road and Zoeller Street.

The site is bound by Exile Bay, to the north east. One and two storey single dwellings are located immediately adjacent to the western boundary of the site, fronting Duke Avenue. A residential development known as Pelican Quays is located to the east of the site, along the eastern site boundary.

FIGURE 1 – SUBJECT SITE, 160 BURWOOD ROAD, CONCORD

Source: SixMaps 2015

FIGURE 2 – SITE LOCALITY MAP



The redevelopment of the Bushells factory on the building is proposed which includes the construction of a mixed use development comprising 670 residential units, a 500-600m^2 local supermarket, 1,500m^2 of convenience retail and 1,500m^2 restaurant or destination retail. The redevelopment is at the beginning of the planning and development process and no further details regarding the proposal have been provided at the time of writing.

1.3 METHODOLOGY

The methodology used to undertake this assessment encompassed:

- A review of relevant state and local government social and community plans and strategies to assess identified needs, priorities and current programed funding
- Demographic profiling: to establish the characteristics of the existing and potential future population, and any potential requirements for community infrastructure and open space. A review of 2011 Census data was undertaken
- Infrastructure and open space audit: A desktop audit of relevant existing and proposed community infrastructure and open space. The existing infrastructure has been assessed to establish whether appropriate capacity exists. This review considers relevant facilities such as childcare, schools, health care, open space and recreational facilities
- Interviews with service providers: Brief telephone interviews have been undertaken with ten service providers in the local area, to identify patterns of use, demand and existing capacity, potential future supply (refer to Appendix D for Survey Methodology)
- Assessment of key findings and identification of key implications for the subject site.

2 Review of policy context and strategic documents

A review of the relevant State and local policy and strategic documents was undertaken, including:

- City of Canada Bay FuturesPlan 2020 and Community Resourcing Strategy 2011
- Cultural Plan 2008-2013
- Canada Bay Local Planning Strategy 2010
- Section 94 Development Contributions Plan 2013
- A Scoping Study Developing Public Art, Deign and Cultural Programs for the Foreshores of the Parramatta River (Riverside) 2012.

A complete review of these documents is located at Appendix A. The following outlines the key findings from these documents and policies.

2.1 KEY FINDINGS

The document review revealed that:

- Most of the 124 community facilities within the LGA are single purpose, ageing, inflexible and underutilised. There is a lack of multi-purpose, adaptable community spaces across the LGA or facilities for youth activities and there is a need for spaces to provide youth related programs
- Multi-purpose facilities are deemed important to meet the future demand within the LGA. Concord library was identified as an example of best practice for community facilities
- There is a desire for community facilities to be provided near public transport, residences or other activity hubs
- Redevelopment of the Concord Community Centre as a multi-purpose facility and relocation of services to that hub was identified as a high priority for the City.
- The LGA has a reasonable amount of open space and recreation assets however there is uneven distribution across the LGA, many sports fields operate above capacity in winter and there is a high proportion of local parks within the LGA under 0.3ha which do not contribute to recreational diversity
- Accessible, flexible, desirable and easy to use public and recreational open spaces and community facilities are a key strategic direction for Council
- Due to population growth, limited land availability and rising land acquisition costs, the quality rather than quantity of open space, open space linkages/connectivity and the provision of town parks (relaxation/rest and entertainment opportunities within commercial centres) are identified as important to meet the future recreation and open space needs for residents within the LGA
- Public art enhancing the heritage of the area was also identified as desirable, particularly around the foreshores of Parramatta River.

3 Demographic profile

The following section analyses key demographic data for the suburb of Concord (as shown in Figure 2). For comparison purpose, the demographic profiles for the Canada Bay LGA and Greater Sydney Statistical Area (Sydney GCCSA) have been included in this analysis. The demographic analysis is based on 2011 Census data from the Australian Bureau of Statistics (ABS).

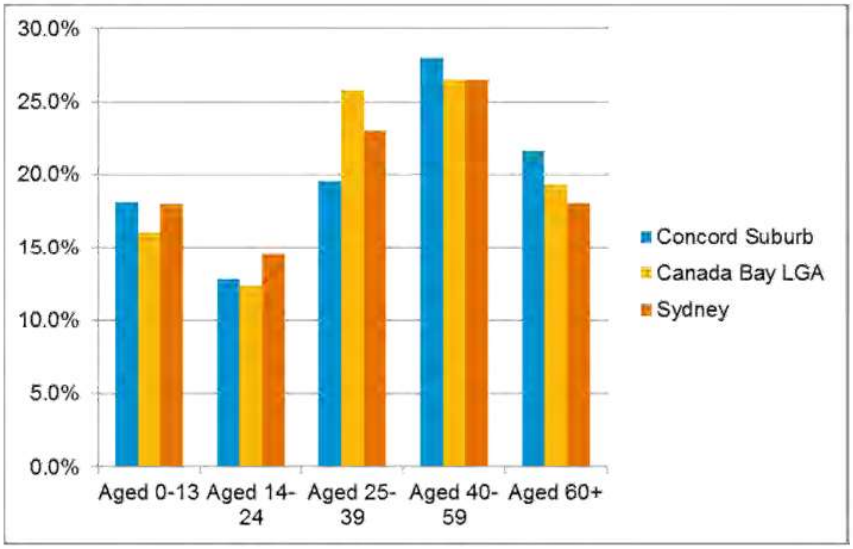
3.1 PEOPLE AND GENDER

In 2011, the suburb of Concord had a total population of 15,661 people accounting for one fifth (20.3%) of the population of the Canada Bay LGA (73,251 people). Concord and Canada Bay LGA has a similar proportion of males (48.7% and 48.6%) and females (51.3% and 51.4%) to Sydney GCCSA (49% males, 51% females). Since the 2006 Census, the total population of Canada Bay LGA has increased slightly to account for approximately 1.7% of Sydney's total population, compared to 1.5% in 2006.

3.2 AGE

Concord has a higher median age (39) than both the Canada Bay LGA (37) and Sydney GCCSA (36) as a whole, and also has a higher proportion of people aged 40-59 and over 60 years and over than either Canada Bay LGA or Sydney GCCSA (see Figure 3). Concord also has a significantly lower proportion of people aged 25 to 39 when compared to Canada Bay LGA or Sydney GCCSA.

FIGURE 3 – POPULATION AGE



Source: ABS, Census Data 2011

3.3 ANCESTRY AND CULTURAL BACKGROUND

Within the suburb of Concord, 67% of people indicated Australia as their country of birth, which is slightly higher than for Canada Bay LGA (63%) and Sydney GCCSA (63.7%). A relatively high proportion of Concord and Canada Bay LGA residents were born in Italy (6.9% and 5.6% respectively) compared to Sydney GCCSA (1%). Other than English, the language spoken by the highest proportion of people are Italian (12.5%) followed by Greek (4.2%) and Chinese (7.6%) within Concord. The portion of Italian and Greek speakers within Concord is slightly higher than for the Canada Bay LGA (9.5% and 3.0% respectively).

3.4 EMPLOYMENT, OCCUPATION AND INCOME

The Concord suburb and Canada Bay LGA have a lower unemployment rate (both 4.2%) than the Sydney GCCSA (5.7%). Concord and Canada Bay LGA are characterised by high average household incomes (see Table 1):

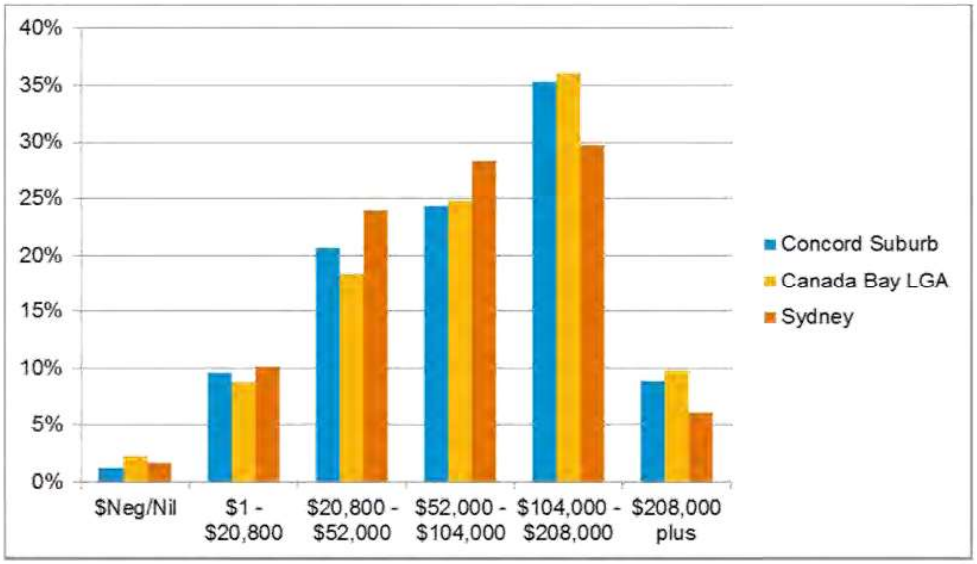
- The average household income and per capita income in Concord ($108,874 and $39,103) is slightly lower than the Canada Bay LGA ($111,919 and $45,625), but higher than the Sydney GCCSA average ($94,428 and $36,285)
- Figure 4 shows that Concord and Canada Bay LGA have a higher proportion of households earning higher incomes than in the Sydney GCCSA.

TABLE 1 – EMPLOYMENT AND INCOME

	CONCORD (SUBURB)	CANADA BAY LGA	SYDNEY GCCSA
Labour force participation	65.6%	68.5%	65.6%
Average per capita income	$39,103	$45,625	$36,285
Average household income	$108,874	$111,919	$94,428

Source: ABS, Census Data 2011

FIGURE 4 – HOUSEHOLD INCOME DISTRIBUTION



Concord and Canada Bay LGA is characterised by a high proportion of white collar professionals and managers:

- The majority of people living in the Concord (80%) and Canada Bay LGA (84%) are white collar workers, which is much higher than in the Sydney GCCSA (74%)
- Almost one third of the population in Concord (28.5%) are professionals, which is slightly lower than Canada Bay LGA (32.4%) but higher than Sydney GCCSA (26%).

3.5 HOUSEHOLD STRUCTURE AND COMPOSITION

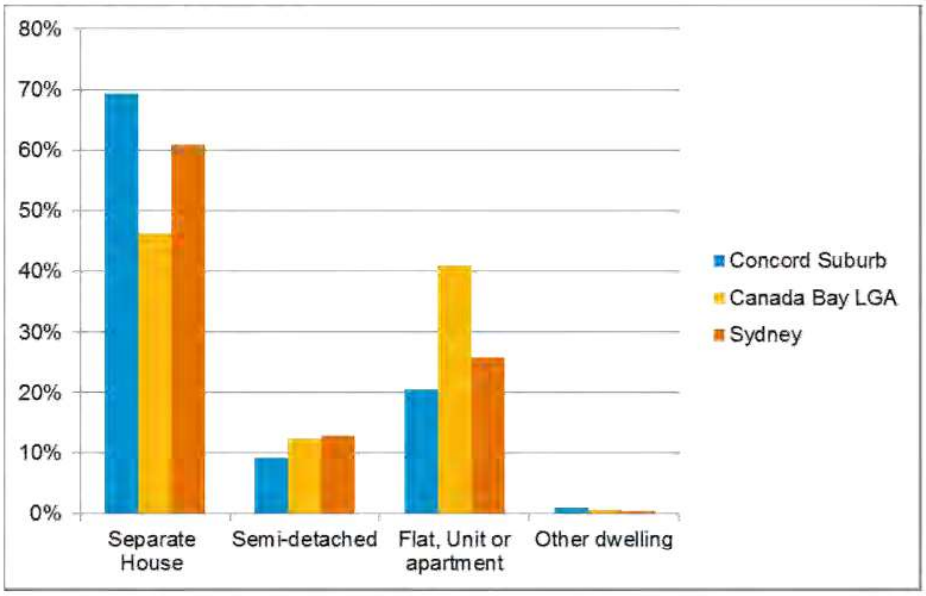
Concord is characterised by a high proportion of family households (78.7%) and low proportion of non-family households (21.3%) when compared with Canada Bay LGA (28%) and Sydney GCCSA (26.9%).

Of those that live in family households, one third (34%) are couple families with children under 15 and just under one third (31.7%) are couple families with no children. One fifth (19.7%) of couple families have children older than 15 years of age.

Population density within the Concord suburb (2,182 persons per square kilometre) and Canada Bay LGA (3,758 persons per square kilometre) is significantly higher than Sydney GCCSA (355 persons per square kilometre).

Concord has a high proportion of residents living in separate houses (69%), which is significantly higher than the Canada Bay LGA (46%) and has a low proportion of residents living in semi-detached dwellings, flats, units or apartments (refer to Figure 5).

FIGURE 5 – DWELLING STRUCTURE



The Concord area is characterised by a higher proportion of owners and a lower proportion of renters than Canada Bay LGA and Sydney GCCSA:

- Over two fifths of residents in Concord (42.4%) are owners which is significantly higher than Canada Bay LGA (34.2%) and Sydney GCCSA (31.1%)
- One quarter of residents in Concord (24.1%) are renters, which is lower than the Concord LGA (33.2%) and Sydney GCCSA (32.4%).

3.6 POPULATION PROJECTIONS

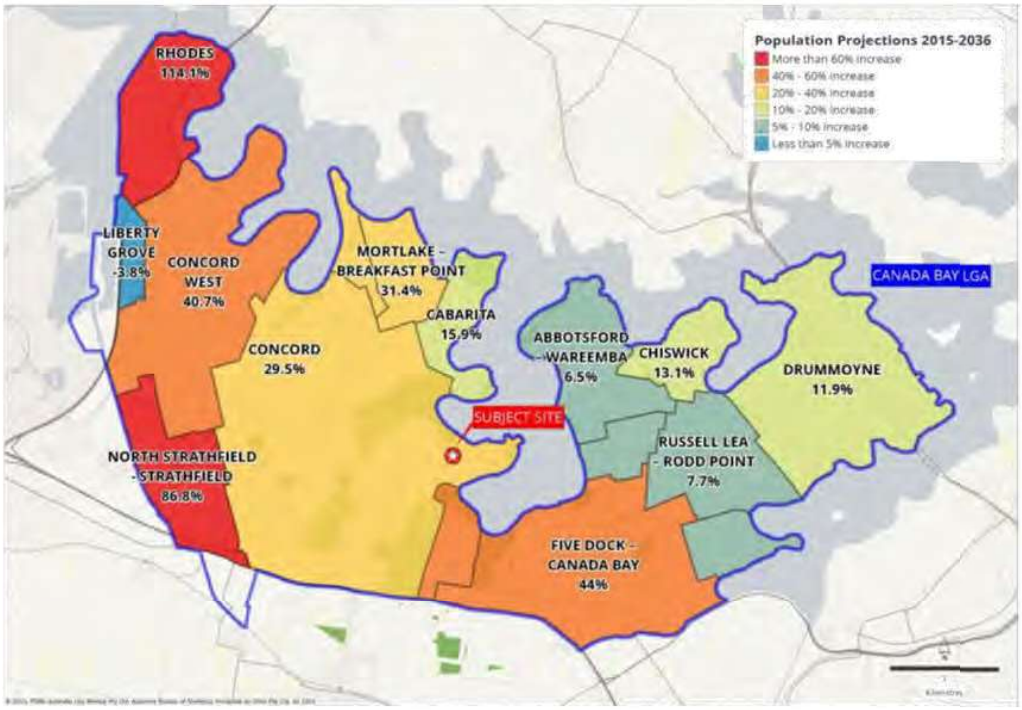
Population projects for Canada Bay LGA are also available from Forecast .id. These projections are based on projected residential development, historic migration patterns and birth and death rates. Table 3 below provides the forecast population for the LGA until 2036. This indicates that the population of Canada Bay LGA is forecast to increase by 38.4% from 87,241 in 2015 to 120,761 people by 2036.

TABLE 2 – POPULATION PROJECTIONS

SUBURB	RESIDENTIAL POPULATION		CHANGE 2011-2036 (%)
	2015	2036	
Abbotsford – Wareemba	7,164	7,632	+468 (6.5%)
Cabarita	2,113	2,450	+337 (15.9%)
Chiswick	2,662	3,011	+349 (13.1%)
Concord	15,144	19,617	+4,473 (29.5%)
Concord West	6,362	8,952	+2,590 (40.7%)
Drummoyne	12,219	13,669	+1,450 (11.9%)
Five Dock – Canada Bay	10,856	15,637	+4,781 (44.0%)
Liberty Grove	2,102	2,022	-80 (-3.8%)
Mortlake – Breakfast Point	5,595	7,353	+1,758 (31.4%)
North Strathfield - Strathfield	7,143	13,343	+6,200 (86.8%)
Rhodes	9,373	20,069	+10,696 (114.1%)
Russell Lea – Rodd Point	6,508	7,006	+498 (7.7%)
Canada Bay LGA	**87,241**	**120,761**	**+33,520 (38.4%)**

Source: Forecast .id. 2015

FIGURE 6 – POPULATION PROJECTIONS



The following table presents the projected age breakdown for residents in Concord 2011 to 2036 and the proportional change which is anticipated to occur in each age group. This indicates an anticipated minor decrease in the number of 30 to 44 year olds living in the area (-3.4%) which suggests a reduction in the

number of professional couples and established families living in the area. Despite this, it should be noted that these age groups will still constitute just over one third (37.6%) of the total population within the area. The largest increase is anticipated to be in the retired or semi-retired age groups 60 years and over (+2.6%). There will also be a slight proportional increase in the proportion of school aged residents, 0-14 years (+0.8%).

TABLE 3 – PROJECTED AGE PROFILE

AGE	2011	2026	2036	PROPORTIONAL CHANGE
0-14	18.8%	19.4%	19.6%	0.8%
15-29	18.3%	18.3%	18.3%	0.1%
30-44	20.8%	18.9%	19.1%	-1.6%
45-59	20.2%	19.1%	18.4%	-1.8%
60-74	13.7%	14.4%	14.1%	0.4%
75 over	8.1%	10.0%	10.4%	2.2%
Total	100%	100%	100%	-

Source: Forecast .id. 2015

Table 4 below outlines the proposed number of dwellings and anticipated likely incoming population projected as a result of the proposed development.

TABLE 4 – ANTICIPATED HOUSING OCCUPANCY RATES FOR PROPOSED DEVELOPMENT

DWELLING TYPE	DWELLING NUMBER	HOUSING OCCUPANCY RATE[1]	PROJECTED POPULATION
One bedroom apartments	104 (16%)	1.5	156
Two bedroom apartments	463 (69%)	2.2	1,019
Three bedroom	103 (15%)	2.7	278
Total	**670 apartments**	**-**	**1,453**

The occupancy rates used above are relatively low when compared to Greater Sydney (2.7 persons per household) and NSW State (2.6 persons per household) however are generated specifically for the current occupancy rates for one, two and three bedrooms in flats, units and apartments over four stories in the Inner West (SA2) rather than all dwelling types. Therefore this rate reflects the average household size for similar style development within the vicinity of the subject site and more appropriately reflects the anticipated household sizes for the proposed development.

Calculating the potential incoming population using the Inner West occupancy rates, it is assumed that the proposed development will result in an incoming population of approximately 1,453 people.

With the additional population projected from the proposed development, Concord will experience a +39.1% population growth by 2036 (an additional 9.6% growth than predicted by Forecast .id. for the suburb)

The potential demographic profile of the incoming population which may be attracted to live in the proposed development is unknown at this point. However the following provides an overview of the likely characteristics of the incoming population based on the demographic profile of the existing population, population projections for the area, and an understanding of the type and size of dwelling being developed. This indicates that the incoming population may be characterised by:

[1] Housing occupancy rate calculated for flat, unit or apartment block with four or more stories within Inner West Sydney (SA2)

- Young professionals between the ages of 25 - 34 years
- Potential for older residents seeking to downsize but be within reach of the City and other local amenities
- Residents in couple families without children or single person households (1 bed and 2 bed apartments)
- Some families with young children living in the larger apartments (3 bed apartments)
- Most born in Australia and speaking English as a first language
- High levels of employment and occupation in white collar roles.

It should be noted that no information has been provided relating to the potential price point for the dwellings, which would impact the potential incoming population.

3.7 KEY FINDINGS AND TRENDS

- Concord has a total population of 15,661 which accounts for one fifth (20.3%) of the population of Canada Bay LGA (73,251 people). There are slightly more females (51.3%) than males (48.7%) in Concord
- Concord has a higher than median age (39) than both the Canada Bay LGA (37) and Sydney GCCSA (36). In terms of age break down, Concord also has a higher proportion of persons aged 40 to 59 and 60 plus. Less than one fifth (19.5%) of Concord population is aged 25 to 39, compared to one quarter (25.8%) this age within Canada Bay LGA as a whole
- A majority of residents of Concord are born in Australia (67%) and Italy (6.9%), China (4%) and United Kingdom (2.5%) were most common places of birth for those not born in Australia
- Other than English, the language spoken by the highest proportion of people are Italian (12.5%) followed by Greek (4.2%) and Chinese (7.6%) within Concord. The portion of Italian and Greek speakers within Concord is slightly higher than for the Canada Bay LGA (9.5% and 3.0% respectively)
- The Concord suburb and Canada Bay LGA have a lower unemployment rate (both 4.2%) than the Sydney GCCSA (5.7%). Concord and Canada Bay LGA are characterised by high average household incomes
- A high proportion of the population of Concord are white collar works (80%), mainly classified as professionals (28.5%) and managers (16.6%)
- Concord is characterised by a high proportion of family households (78.7%) with one third (34%) couple families with children under 15, just under one third (31.7%) couple families with no children and one fifth (19.7%) of couple families have children older than 15 years of age
- Population density within the Concord suburb (2,182 persons per square kilometre) and Canada Bay LGA (3,758 persons per square kilometre) is significantly higher than Sydney GCCSA (355 persons per square kilometre)
- A majority of residents in Concord live in separate houses (69%) and has a low proportion of residents living in flats, units or apartments (21%)
- Over tow fifths of residents in Concord (42.4%) are owners which is significantly higher than Canada Bay LGA (34.2%) and Sydney GCCSA (31.1%)
- The population of Canada Bay LGA is forecast to increase by 38.4% from 87,241 in 2015 to 120,761 people by 2036. Concord is anticipated to experience 29.5% growth by 2036

- The current projected population shows that there may be a minor decrease in the number of 30 to 44 year olds living in the area (-3.4%) which suggests a reduction in the number of professional couples and established families living in the area
- With the additional population projected from the proposed development, Concord will experience a +39.1% population growth by 2036 (an additional 9.6% growth than predicted by Forecast .id. for the suburb).

4 Existing social infrastructure audit

The following provides an overview of the infrastructure currently available within 400m, one and two kilometre radius from the site, considered the most likely to be impacted by the development. It should be noted that the 400m radius is the standard walking distance for facilities within an urban setting[2].

Figure 7 (on the following page) shows the existing social and community infrastructure in the vicinity of the subject site. There is limited social and community infrastructure within the 400m walking catchment of the site. Only the eastern portion of the Massey Park Golf Course, to the north of the site, and the northern part of the Barnwell Park Golf Course, to the south of the site, are within walking distance. However, the club houses associated with both these golf courses are located outside the 400m radius, and therefore the part of these golf courses within the 400m radius is likely only be used for passive recreation.

The following sections provide a breakdown of the existing infrastructure within 1km and 2km by type.

4.1 CHILDCARE CENTRES AND KINDERGARTENS

There are a total of three childcare centres/kindergartens located within one kilometre and a total of 30 childcare centres/kindergartens within two kilometres of the site. Table 6 outlines the childcare centres within one kilometre radius and whether they have current capacity.

TABLE 5 – CHILDCARE CENTRES LOCATED WITHIN ONE KILOMETRE

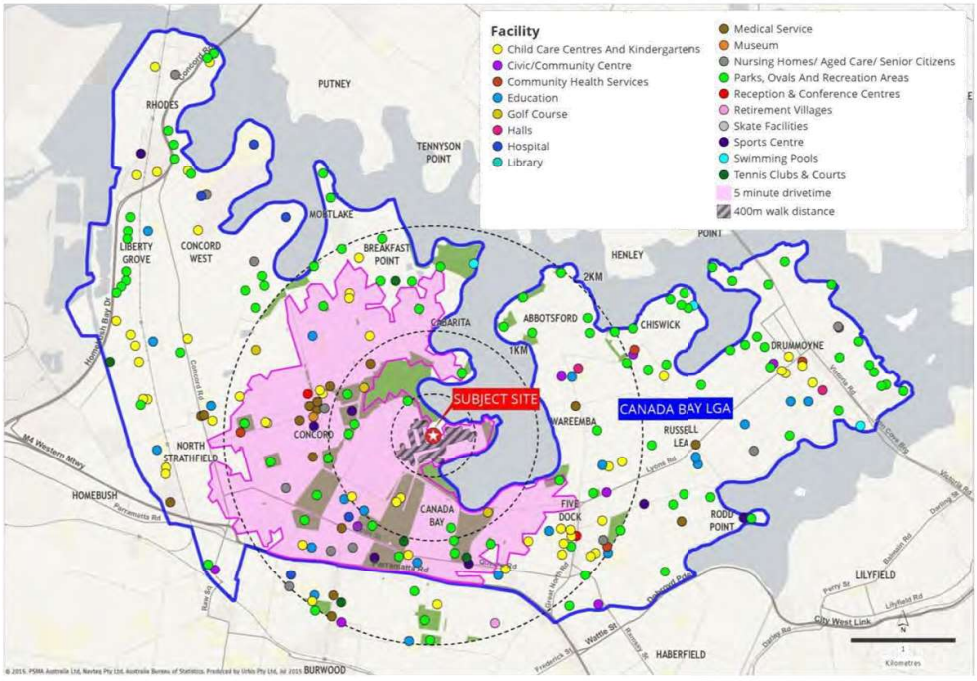
CHILDCARE CENTRE/KINDERGARTEN	VACANCY
Concord Occasional Child Care Centre	At capacity (currently 35 families on the waitlist to become members)
Concord Out of School Hours Care	Some capacity (maximum capacity is 45 children so there is room for 5-15 more children depending on the time of day)

Concord Occasional Child Care is one of only two occasional care services within the Canada Bay LGA which provides flexible care for 0-5 year olds. They take 25 children per day care between the hours of 9am to 3pm. They currently have 180 children on their client lists, about 95% of which are from the local area and Canada Bay LGA. Concord Occasional Child Care advises that there is a need for more preschools and occasional care facilities in the locality.

Concord Out of School Hours Care provides before and after school care and vacation care from 7am to 9am and 2pm to 6pm. The afternoon sessions are typically busier than the mornings with approximately 30-40 children. The before and after school care is for Concord Public School students only but vacation care clients from all over Sydney. The Concord Out of School Hours Care advise that there is some existing capacity but they expect that population growth will take up the capacity of the before and after school care. They have no plans to expand in the future.

[2] Pikora T J, Giles-Corti B and Donovan R (2001). *How far will people walk to facilities in their local neighbourhoods?* Australia: Walking the 21st Century, Perth, 1, pp. 26-31.

FIGURE 7 – SOCIAL INFRASTRUCTURE MAP



4.2 COMMUNITY CENTRES, HALLS AND LIBRARIES

Three community centres are located within the 2km radius, the Concord Community Centre, Abbotsford Community Centre and the Concord Senior Citizens Centre/Club. The Concord Community Centre and Concord Senior Citizens Centre/Club are run by Council.

The Concord Community Centre is a function facility available for hire by the public for conferences, community festivals, meetings, information sessions and parties. The Abbotsford Community Centre is a non-profit organisation which provides out of school hours and vacation care, clubs and activities for children (sewing, dancing, Lego and drama), a community garden and children's cooking lessons.

The Concord Senior Citizens Centre/Club runs regular activities including handicrafts, quilting, ballet for seniors, table tennis, chess, Pilates, art and dancing classes and computer classes from Monday to Friday. Users of this centre are mainly 55 years of age and older who reside within Concord and Concord West. Some participants are from Drummoyne. They advise that their table tennis sessions are at capacity but their other classes have capacity. There are no plans to expand the club.

The Concord Out of School Hours Care advises that there is a pressure on community halls, in particular the Concord Public School hall is hired out each week and booked out well in advance.

The Five Dock and Concord Libraries, run by the City of Canada Bay, are also located within 2km from the subject site.

4.3 HERITAGE MUSEUM

The Canada Bay Heritage Museum, run by volunteers, is also located within 2km of the subject site. It is open from Wednesday to Saturdays from 10am to 4pm, admission is free.

The Canada Bay Heritage Museum participated in an interview and stated that their capacity and demand fluctuates, "no set busy times. We can sit here all day some days, other days a busload of 50 arrives." Visitor demographics are typically older residents, especially from retirement villages and nursing homes.

They have capacity, with a meeting room which they rent out, and no plans to expand. Population growth and incoming population is unlikely to impact the museum capacity but they do struggle finding volunteers. The City of Canada Bay Heritage Society also holds a number of talks and open days at different heritage locations around the Canada Bay LGA.

4.4 HEALTH FACILITIES

The site is relatively well serviced by a range of health facilities with 14 health facilities located within a 2km radius. These facilities provide a range of services from medical centres, physiotherapists, pathologists, orthopaedics, chiropractic's and dental services. A majority of these services are provided within the commercial centre of Concord, along Majors Bay Road. There are two community health facilities located within 2km radius, the Concord Early Childhood Health Centre and the Five Dock Early Childhood Centre, both provide health services for young children and parent groups.

There are no hospitals within the 2km catchment however the Dame Edith Walker Hospital and Concord Repatriation General Hospital are located within the LGA, to the north west of the site.

A number of medical facilities within a 1-2km radius of the subject site were contacted to participate in the social infrastructure survey, including Major's Bay Medical Centre and Concord Medical Centre. These facilities were contacted on multiple occasions by phone and email and did not return communications. Concord Family Doctors and Wellbank Street Medical Practice declined to participate in an interview.

4.5 EDUCATION

There are a number of primary and secondary educational facilities within 2km of the subject site. The following Table provides a breakdown of the education facilities.

TABLE 6 – EDUCATIONAL FACILITIES LOCATED WITHIN A TWO KILOMETRE RADIUS OF SITE

LEVEL OF SCHOOLING	FACILITY
Primary schools	Concord Public School
	Lucas Gardens Public School
	Five Dock Public School
	Abbotsford Public School
	Mortlake Public School
	St Mary's Concord Catholic School
	All Hallows Catholic Primary School
Secondary school	Concord High School
	Lucas Gardens Public School
	Rosebank College
	Christian Brothers College (Lewisham)
	Burwood Girls High (Burwood)

The Concord Public School was contacted on 13 and 22 July 2015 however the School was busy with the start of a new term and did not participate in the interview. It is understood from the *Concord Public School Annual Report 2014* that the school had 261 students in 2014, up 31 students from 2008. This additional 31 students constitutes an additional 1-2 classes over the last eight years.

Concord Out of School Hours Care advise that there has been a lot of development in the area which has caused the increase in the numbers of children at the Concord Public School and they expect that there will be a flow on effect, within five years, to the capacity of before and after school care. They also advise that the Concord Public School has recently had extra classrooms added and extra teachers employed to meet this increased demand in the area.

4.6 RECREATIONAL FACILITIES AND OPEN SPACE

As previously outlined, parts of the Massey Park Golf Course and the Barnwell Park Golf Course are located within the 400m walking radius but no other recreation facilities or open space are located within 400m from the site.

Within the wider 1km and 2km radius, the site is well serviced by open space areas and local parks for both active and passive recreation opportunities. Table 7 below outlines open space and associated facilities within a one kilometre radius of the site.

TABLE 7 – PARKS AND RESERVES WITHIN A ONE KILOMETRE RADIUS OF THE SITE

PARK	FACILITIES AVAILABLE
Bayview Park	Open grass areas, playground, boat ramp, beach, foreshore walking/bike paths. The Parramatta River Our Living River Campaign, Parramatta River Catchment Group (hosted by Parramatta Council until 2016) is currently surveying the most popular beach spots within the Parramatta River. Bayview Park is currently classified as a swimming spot "under review" and is fifth on the most popular swimming spots within the campaign (155 people have voted that they want to swim in this location). Therefore, this beach/swimming spot is highly valued in the area.
Prince Edward Park	Open grass areas, playground, foreshore walking/bike paths, restaurant, beach
Greenlees Park	Open grass area, tennis courts, lawn bowling facilities, sports fields
Jessie Stewart Reserve	Open grass area, sports field, cricket pitch
Hen and Chicken Foreshore Walk	Runs along the foreshore part of the site, and connects the site to Canada Bay, Exile Bay and Hen and Chicken Bay

The suburb of Concord is well serviced by outdoor active and passive recreation facilities. A wide range of active recreation facilities are catered for, in particular rugby fields, cricket, tennis, soccer and hockey being provided at Greenless Park, Cintra Park Tennis Centre, Concord Oval, St Luke's Park, Jesse Stewart Reserve, Rothwell Park, Queens Elizabeth Park and Goddard Park located south to south west of the subject site.

There are also three golf courses within two kilometres of the subject site, Massey Park Golf Course, Barnwell Golf Course and Concord Golf Club. There are two swim centres within the LGA, Drummoyne and Cabarita Swimming Centres which both provide 50m outdoor swimming pools. The Cabarita Swimming Centre is located within two kilometres of the site.

Despite a wealth of outdoor recreation facilities, there are limited indoor recreation facilities within the two kilometre radius or within the LGA. The Five Dock Leisure Centre is located approximately 1.3km to the south east of the site, on Queens Road. The Leisure Centre is run by Council and includes a health club and gym, badminton, table tennis, basketball, futsal, indoor netball facilities.

4.6.1 WATER BASED SPORTING ACTIVITIES

UTS Haberfield Rowing Club, Drummoyne Sailing Club, Gladesville Bridge Marina, Sydney Rowing Club, d'Albora Marina Cabarita Point, Sydney Dragon Boat Association 1st Yaralla Sea Scouts and the Dobroyd Aquatic Club all operate within the Parramatta River within Canada Bay LGA.

The 1st Yaralla Sea Scouts are located in Rhodes and provide boating, canoeing, rowing, sailing and power boating activities for 6 to 26 year olds on Monday, Wednesday and Friday nights and Sundays. They advise that their peak club group is 9 to 11 year olds and most of their members come from Concord or Concord West, some from Leichhardt and Parramatta. They aren't at capacity and would like to increase their memberships. They have their own hall in Rhodes and hire this out on Saturday and Sunday nights. Yaralla Sea Scouts advise that the area is well serviced by boat ramps.

The Dobroyd Aquatic Club is a not for profit sailing club located in Rodd Point. They provide sailing classes for juniors (8 to 12 year olds) between October to April. In addition, they provide a special program for sailors with disabilities, called 'sailability', which is run on Wednesday nights. They currently have approximately 150 members however advise that in the last 10 years their membership numbers have halved, likely due to competing interests on weekends (for example school sports). Their Saturday morning classes are full and have started additional classes on Sunday to meet demand. Many of their participants are local however some travel from the Blue Mountains and the Central Coast. Whilst there is currently capacity, they have storage limitations and can only hold a maximum 30 vessels and many of their members have to bring their own boats. They would like to build another boat shed.

There is an existing public boat ramp and associated boat trailer parking within Bayview Park, approximately 350m east of the subject site.

4.7 AGED CARE

Population projections indicate that the population of Canada Bay LGA is aging, with a 2.6% increase in persons aged 60+ anticipated by 2036.There are no aged care facilities within 400m or 1km however there are four within 2km of the subject site including the Yaralla RSL Day Club, St Marys Villa, Redleaf Manor Aged Care and Parkview Nursing Home.

Yaralla RSL Day club provides social activities for older persons within the Concord area on Monday from 10am to 2.45pm with current clients aged 70 to 94 years. The service is currently operating with plenty of capacity; attendance is down from previous years. Yaralla RSL anticipates an increase in younger people moving into the area, decreasing the demand for their service.

4.8 CONCORD MEN'S SHED (HARRY'S SHED)

The Concord Men's Shed (Harry's Shed) is a joint initiative with Canada Bay Council which provides workshop space under the Concord Community Centre, located at 1a Gipps Road, Concord. The Shed operates from 9am to 12noon Monday, Wednesday, Thursday and Friday and provides power tools and a community workshop space, mainly for woodworking.

The Men's Shed participated in an interview and stated that their participants mainly come from the Canada Bay LGA and the average client is 70 years and over, mostly men. The Shed is at capacity with 58 members and are at a pinch point for space.

With projected population growth, the Shed will be unable to cope with demand and anticipate that their client demographic and scope of activities will have to broaden to cater for a growing population. They are already seeing younger people request to join, requesting additional offerings such as cooking or pottery and seeking services at different times of the week (eg. weekends).

Ideally they require a facility approximately 30m x 40m to facilitate future growth. The Shed primarily provides woodworking facilities and they would like to provide metal working machinery, with extended hours in bigger premises:

"We need our own spot somewhere. The most successful men's shed have their own land and a purpose built facility."

In addition, they are currently unable to provide a service to people with disabilities as the current premises isn't suitable. With additional facilities they anticipate that they could open Tuesdays or Saturdays.

With regards, to wider social infrastructure requirements for the LGA, the Men's Shed identified that there is inadequate child care facilities within the area, there no places available and people are being turned away.

4.9 FARMERS MARKETS

The Rotary Club of Concord run a Farmers Markets within the Cintra Park Car Park, off Crane Street, on the first and third Sunday of each month. The farmers market is open from 9am to 1pm and has approximately 30 stall holders and there is a 46 stall limit due to space restrictions. The farmers market is run by volunteers and has been in operation for three years. It is aimed at locals from within the Canada Bay area. There is no waitlist for the market but there is a level of control by the market manager over which type of seller is able to have a stall, so that there is not any double ups on types of produce.

The market manager advises that they are currently classified as a farmers market and at this stage stall holders are required to be farmers or their agents or food related, their priority is fresh and healthy food. Craft and other items are not allowed. If the Farmers Market could operate in a larger area, they advise that they could expand into craft and jewellery offerings.

4.10 SUPERMARKETS

There are two supermarkets located within the 2km radius of the site, Coles Concord located on Majors Bay Road approximately a five minute drive from the subject site, and Supabarn Five Dock located on Garfield Street approximately a ten minute drive from the subject site. No large scale supermarket is located within the 1km radius of the site.

4.11 COMMUNITY SHUTTLE SERVICES

Council runs a community shuttle service, BayRider, on Wednesday and Thursdays for those experiencing transport difficulties and takes passengers to Five Dock and Concord libraries, Concord Hospital, Five Dock and Concord shopping centres, Rhodes shopping centre, nursing homes to visit a spouse or a friend, Five Dock Leisure Centre and Burwood medical appointments. The service is free however bookings are required.

4.12 SUMMARY OF KEY FINDINGS

Whilst there is limited social infrastructure within 400m of the subject site, the site is well serviced within the 1 to 2km radius by social infrastructure. Our survey of the local facilities identifies the following:

- Child care facilities within the locality are likely close to or at capacity

- The Concord Public School is has experienced significant growth over the last 8 years and is likely to be impacted by population growth in the area
- The LGA is well serviced by community centres and senior clubs however there is declining membership for senior clubs and activities
- There are a number of medical centres located within the commercial centre of Concord which will likely support residents of the future development
- The site is well located and serviced by open space areas and local parks for both active and passive recreation opportunities, especially foreshore areas
- There are a number of water based sporting clubs and marinas within the LGA, however none within close proximity to the subject site. Whilst not at capacity with regards to membership, the Dobroyd Aquatic Club requires additional land for boat storage
- The Concord Men's Shed (Harry's Shed) is currently unable to cope with demand and anticipate that their client demographic and scope of activities will have to broaden to cater for a growing population. They are seeking new facilities to meeting their demand
- The Concord Farmers Market operates with approximately 30 stall holders and specialises in fresh food and produce only. If the Farmers Market could operate in a larger area, they advise that they could expand into craft and jewellery offerings
- Council provide a number of accessibility services, including the community shuttle service.

5 Implications, benefits and opportunities

The site is in close proximity to a number of passive recreation activities however there are limited other social infrastructure, facilities or community uses within 400m walking distance from the site.

The site is ideally located to provide additional services to residents in and around Burwood Road and Concord and Canada Bay LGA more broadly. The site provides the following benefits for the provision of social infrastructure:

- Site size: The site is one of the largest land holdings within the Concord suburb and allows for a mixed use development to be provided with dedicated retail and floor space for social and community facilities
- Industrial heritage: Existing industrial heritage of the site provides a unique sense of place and creates synergies with other heritage related uses and/or clubs within the LGA
- Waterfront location: The location provides connection to Exile Bay.

The redevelopment of the site provides the opportunity to provide existing and future residents of Burwood Road and adjoining residential areas new social and community infrastructure, services and facilities. The following outlines the potential social infrastructure opportunities for the site:

- New child care facilities: It appears that child care facilities may be at capacity within one to two kilometres for the site. The stakeholder survey of Concord Occasional Care (childcare facility) identified a need for more preschools (9.00am to 3.00pm) and more occasional care centres. In addition, there are limited school holiday child care facilities available within close proximity to the site
- Activation and engagement of the historic industrial usage on the site, in particular with regards to Bushells heritage. Canada Bay LGA has in recent times lost a lot of industrial sites to residential redevelopment. There is an opportunity to foster synergies and relationships with the Canada Bay Heritage Museum and City of Canada Bay Heritage Society, in particular the Heritage Society may wish to hold regular talks about the LGA's industrial heritage on the site
- Bayview Park is currently classified as a swimming spot "under review" and is fifth on the most popular swimming spots within the Parramatta River Our Living River Campaign (155 people have voted that they want to swim in this location). Therefore, this beach/swimming spot is highly valued and there is an opportunity to deliver further community benefit, via improved quality and access to the foreshore at this location or on the site. Any remediation requirements will need to be carefully considered given the historic industrial use of the site
- Provision of a "Town Park" (as defined by the Canada Bay Local Planning Strategy 2010) which provides rest/relaxation and entertainment opportunities for workers, shoppers and visitors within retail centres comprising:
  - A mix of hard and soft landscape rather than natural grass
  - Should aim to meet the minimum area requirement of local parks, 3,000m^2
  - Smaller areas to provide basic recreation such as seating areas and 'breakout' spaces.
- Open space linkages, access and foreshore improvement works, including passive recreation activities new walking/cycling paths through the site, gym equipment and playgrounds to enhance passive open space within and around the site
- The Concord Men's shed have identified a need for additional space to facilitate current and future demand for community infrastructure and workshop space. A new larger Men's Shed could be provided on the site

- Indoor multi-purpose recreation facilities - Within the Canada Bay Local Planning Strategy 2010, Council identify the need for an additional two multi-use sports facilities within the LGA. There is an opportunity to provide a multi-purpose indoor facility within the proposed development
- Provision of new social services and facilities within the development site, for example a stage, performance or entertainment space, spaces for delivery of youth related programs and activities - exhibition space for youth art and legal graffiti walls, and gallery space, art retail outlets and studio space for artist
- Provision of new or relocated water based sporting activities within the harbour from the site's foreshore – the Dobroyd Aquatic Club Saturday classes are currently at demand and they have storage limitations and have identified a need to another boat shed. There may be an opportunity to provide additional facilities for this club on the site and activate the foreshore in this locality
- The Concord Farmers Market is currently run within a car park off Crane Street and there is potential to improve the amenity and experience of the market by relocating it to an under cover area
- Dedicated community bus "drop-off" area to allow Council's BayRider users to access the site and associated future facilities
- Public art enhancing the heritage of the area which is identified as desirable, particularly around the foreshores of Parramatta River.

Disclaimer

This report is dated 30 June 2015 and incorporates information and events up to that date only and excludes any information arising, or event occurring, after that date which may affect the validity of Urbis Pty Ltd's (**Urbis**) opinion in this report. Urbis prepared this report on the instructions, and for the benefit only, of Urbis Pty Ltd. (**Instructing Party**) for the purpose of Report (**Purpose**) and not for any other purpose or use. To the extent permitted by applicable law, Urbis expressly disclaims all liability, whether direct or indirect, to the Instructing Party which relies or purports to rely on this report for any purpose other than the Purpose, and to any other person which relies or purports to rely on this report for any purpose whatsoever (including the Purpose).

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This report has been prepared with due care and diligence by Urbis and the statements and opinions given by Urbis in this report are given in good faith and in the reasonable belief that they are correct and not misleading, subject to the limitations above.

Appendix A State and local policy context

A.1 FUTURESPLAN20 AND COMMUNITY FACILITIES RESOURCING STRATEGY 2011

In 2008 after extensive consultation with the community, Council developed the *FuturesPlan20* which provided a vision for the LGA over the next 20 years. It noted "We will want our small village and neighbourhood centres to remain and thrive but we will have to share these spaces with more people. The importance of a diverse housing stock will become even more critical but we will also need to consider the look and feel, heritage, affordability and accessibility of our city. Similarly, increasing urbanisation means that the demand for public open spaces grows as private space diminishes and careful planning and management of active and passive recreation and leisure resources will need to be prioritised for the future of the City."

The four themes addressed in this Plan were: Active and Vibrant; Sustainable Spaces and Places; Innovative and Engaged; and Thriving and Connected.

The City of Canada Bay's 2011 *Facilities and Resourcing Strategy* which sits under the *Futures Plan20* suggested:

- Residents value access to community facilities and want them located either near public transport or within walking distance from residences or other activity hubs
- There is a demand for quality child care, including out of school hours and vacation care
- There is a need for spaces for provision of healthy ageing activities for older people
- There is a need for spaces for delivery of youth related programs and activities
- There is a need for residents from a range of cultural backgrounds to be able to access community facilities and space.

The *Strategy* found in an audit of existing facilities that of 124 community facilities in the LGA 37 are owned or controlled by Council. Many of these are single purpose, ageing and inflexible facilities and many are underutilised. This may be due to many being located in inaccessible areas or prohibitive hire costs. The audit also found a lack of spaces for young people and lack of facilities close to public transport.

Best practice in provision of community facilities was suggested as the provision of multi-purpose facilities which can adapt to changing community needs; co-location of facilities to enable pooling of resources as well as provision of one-stop-shops for the community; community hubs to support integrated use of facilities building on social networks and reducing the need for multiple trips to various facilities; location near public transport; links to pedestrian, cycle ways and public domain; links to other commercial, retail and community activities; and facilities that are viable long term through sustainable management and maintenance.

The *Strategy* noted Concord library has provided a benchmark in best practice principles by providing a vibrant, active hub where the community engages in a range of programs and activities.

It suggested provision throughout the LGA of a smaller number of strategically located and staffed multi-purpose facilities as part of community hubs. It also suggested encouragement of higher rates of community utilisation of non-Council facilities.

The review of council owned and non-council community facilities across the LGA and identified a number of Activity Hubs. The *Strategy* outlined recommendations for each of these hubs.

The relevant hub for this study is the Concord Activity hub. It identified 17 existing Council facilities within the hub and 14 non council facilities (including child care centres, clubs, respite centres, hospital and schools). Community title facilities in this hub were the community meeting room at Phillips Landing and the gym at Pelican Point.

While most facilities serviced needs well, some older facilities were average. Recommendations of potential relevance were the long term relocation of some existing services (e.g. the Concord Early

Childhood Health Centre) to a multi-purpose community hub. The Strategy also suggested the redevelopment of the Concord Community Centre to allow co-location of community services and the retention of one hall as a function centre. These were identified as long term and medium term objectives in 2011.

A.2 CULTURAL PLAN 2008-2013

Council's *Cultural Plan 2008-2013* identifies Canada Bay as part of the strong cultural identity of Sydney's inner west and suggests it is critical to form partnerships in relation to regional cultural infrastructure. This Plan outlines strategies and actions which provides Council with a robust approach in supporting the development of cultural infrastructure, support creative industries and ensures links between cultural identify and wellbeing within the LGA.

The cultural objectives of Council are to:

- Plan and develop appropriate services and facilities
- Promote and encourage a diverse and consultative community
- Invite an active partnership between Council and its community
- Provide sensible planning and economic initiatives
- Achieve desirable environmental standards.

The objective is to enable residents to enjoy a good quality life in an active and vibrant community by delivering economic, social, cultural and environmental systems for the benefit and well-being of the community.

Consultation for the development of the *Cultural Plan* identified the following facilities as important:

- A professional performing arts space with backstage and dressing rooms, rehearsal and training space for schools and local dance groups
- Multi-purpose and community facilities with spaces designed for creative activities
- Gallery space, art retail outlets and studio space
- Exhibition space for youth art and legal walls
- A staffed youth centre and youth friendly places for young people to meet
- Improvements to Drummoyne Civic Hall Stage
- A heritage museum.

In addition the *Plan* also identified the need for:

- Purpose built infrastructure in key sites e.g. Cabarita Park Conservatory
- Community activity hubs to centralise cultural interaction in Concord/Strathfield, Five Dock and Drummoyne
- Cultural Programs in existing facilities
- Strategic partnerships for cultural facilities
- Art revitalisation and adaptive reuse of vacant properties.

The Plan notes that to date there is no purpose built cultural facility in Canada Bay.

A.3 CANADA BAY LOCAL PLANNING STATEGY 2010

The purpose of the *Local Planning Strategy 2010* is to provide a framework for future land use planning within the LGA and guide the development of Local Environmental Plans and Development Control Plans. The aim of the *Strategy* is *"to provide housing and employment, consider future recreation needs, protect heritage and the natural environment and consider transport in an integrated manner."*

Part 6 – Recreation and Open Space of the *Strategy* identifies the following recreation and open assets within the LGA:

- Open space: 150 parks over 218ha.
  - 45% of open space is classified as passive open space (parks and ancillary space)
  - 37% of open space is classified as active open space. Comprising 68 sports fields, 34 netball cou (sports fields and courts)
  - 18% of open space is classified as public golf courses
  - 63% of open space is located within Concord Statistical Local Area (SLA), 3.6ha of open space per 1,000 population
  - 37% of open space is located within Drummoyne SLA, 1.95ha per 1,000 population
- 31 soccer facilities, 7.5 rugby union facilities, 2 rugby league facilities, one hockey facility, 1.5 Australian football facilities, seven baseball diamonds, 17 cricket facilities and one athletics facility

Overall, the findings presented within the *Strategy* show that the provision of open space within the LGA is "quite reasonable" however the distribution is uneven across the LGA. A high proportion of local parks within the LGA are less than 0.3ha and do not contribute to the diversity of recreational opportunities within the LGA. In addition, most sports fields and courts in the LGA are being used at or above capacity during winter but below capacity in summer.

To respond to future population growth and changing demand, the *Strategy* identifies that due to limited land availability and rising land acquisition costs, quality rather than the quantity of open space within the LGA, open space linkages and connectivity and the provision of town parks (relaxation/rest and entertainment opportunities within commercial centres) will be important to meet the future needs for the LGA.

The *Strategy* identifies the following key options for development of open space and recreation facilities within the LGA:

- More intensive use of existing space and facilities (where "spare capacity' exists)
- The embellishment or expansion of existing spaces (to increase their carrying capacity)
- Synthetic conversions of sports fields open space
- The acquisition of new open space and recreation facilities and access to currently unavailable facilities (within education facilities).

A.4 SECTION 94 DEVELOPMENT CONTRIBUTIONS PLAN

The City of Canada Bay's 2013 *S94 Development Contributions Plan* noted that projected population increases in the LGA to 2031 means that to maintain the current ratio of 2.6ha of open space per 1,000 Council would need to acquire an additional 20.8 hectares for open space and recreational facilities. As land acquisition is expensive and unlikely Council suggests development contributions are better spent on upgrading and increasing the capacity of existing infrastructure. To this purpose Council generated a table of "high priority works".

The "high priority works" include recommendations to redevelop the Concord Community Centre in the short term as a multi-purpose facility co-locating community services and retaining one function/hall space. Recommendations for areas adjoining Concord are for a new multi-purpose community hub in Five Dock over the long term and affordable facilities for the community and artists in the short term at the Cabarita Park Conservatory.

Assumptions in the *S94 Development Contributions Plan* are:

- The Community Facilities rate is based on the amount of existing community facilities (162m2 per 1,000 population) which are owned, leased or managed by Council as enumerated in the *Community Facilities Resourcing Strategy (CRED) 2011*. The new population of 7,995 would thus create 1,295m2 of additional demand at an estimated cost of $5,827,500 based on an assumed construction cost of $4,500 per sq m.
- The Civil Infrastructure rate is based on the estimated cost of "high priority works" with the new population being required to contribute 9.9% (the estimated population growth rate to 2031) of the total cost.
- The Plan Preparation and Administration rate is based on an annual estimated administration cost of $30,000 per annum and three Plan reviews over the 18 years at a cost of $100,000. The total cost of $640,000 to be fully funded by the new resident contribution.

The *S94 Development Contributions Plan* suggests Council may accept an offer to provide works in kind as full or partial payment of a contribution or the provision of a material public benefit in lieu of payment of a contribution provided the value of the works is at least equal to the value of the contribution which would otherwise be made and that the standard of works is to Council's satisfaction.

A.5 A SCOPING STUDY DEVELOPING PUBLIC ART, DESIGN AND CULTURAL PROGRAMS FOR THE FORESHORES OF THE PARRAMATTA RIVERS (RIVERSIDE) 2012

A Scoping Study Developing Public Art, Design and Cultural Programs for the Foreshores of the Parramatta River (Riverside) 2012 identifies 38kms of Parramatta River foreshore within the LGA. Its objectives include:

- Culturally enrich and beautify our foreshores
- Provide a resource for ongoing project development that may be added to and built upon as additional sites become accessible and available for cultural development and public art
- Identify opportunities to create and integrate art and design into the prioritised sites.

The study notes the rich cultural heritage of the area including the industrial heritage of Australian Gas Light Company works, Arnott's Biscuits, Phoenix Ironworks, Berger Paints. BALM (Dulux), Union Carbide, Bushells and Nestles. It notes work that "recognises the past and builds on existing cultural identity can be a tool in managing social change. The thoughtful location of art in community buildings and gathering places creates a context for affirming community life".

Appendix B Demographic profile

	CONCORD SUBURB	CANADA BAY LGA	SYDNEY
Total population	14,905	73,251	4,390,956
Average Household Size	2.8	2.5	2.7
Average per capita income	$39,103	$45,625	$36,285
Population Density (Persons per Sq.km)	2,812	3,758	355
Age Distribution (%)			
Aged 0-4	6.52%	6.87%	6.8%
Aged 5-9	6.77%	5.37%	6.25%
Aged 10-14	6.07%	4.77%	6.14%
Aged 15-19	5.86%	4.87%	6.28%
Aged 20-24	5.68%	6.51%	6.99%
Aged 25-29	5.8%	8.29%	7.75%
Aged 30-34	6.15%	8.82%	7.64%
Aged 35-39	7.58%	8.67%	7.61%
Aged 40-44	7.8%	7.57%	7.25%
Aged 45-49	7.75%	6.98%	7.0%
Aged 50-55	6.72%	6.44%	6.55%
Aged 55-59	5.74%	5.51%	5.71%
Aged 60-64	5.66%	5.22%	5.14%
Aged 65+	15.9%	14.1%	12.9%
Aged 18+	77.01%	80.13%	77.07%
Dependency Ratio	35.28%	31.12%	32.07%
Country of Birth (%)			
Australia born	66.99%	62.97%	63.65%
Overseas born	33.01%	37.03%	36.35%
Italy	6.93%	5.59%	1.01%
China	4.03%	5.58%	3.59%
United Kingdom	2.45%	3.6%	4.41%
New Zealand	1.52%	1.89%	2.05%
Language Spoken at Home (%)			
English only	61.85%	62.88%	65.73%
Italian	12.53%	9.53%	1.64%
Greek	4.16%	2.99%	1.94%
Chinese Total (Cantonese, Mandarin & other)	7.64%	9.3%	6.83%
Arabic	3.38%	1.79%	4.3%
Household Income (%)			
$Neg/Nil	1.27%	2.21%	1.73%
$1-$10,400	1.96%	1.58%	1.65%
$10,400-$15,600	2.25%	2.22%	2.77%
$15,600-$20,800	5.36%	4.95%	5.72%
$20,800-$31,200	7.54%	6.74%	8.45%
$31,200-$41,600	6.81%	5.84%	7.96%
$41,600-$52,000	6.32%	5.81%	7.59%
$52,000-$65,000	5.94%	6.63%	8.13%
$65,000-$78,000	6.49%	6.37%	7.61%

	CONCORD SUBURB	CANADA BAY LGA	SYDNEY
$78,000-$104,000	11.88%	11.78%	12.61%
$104,000-$130,000	9.43%	8.73%	9.4%
$130,000-$156,000	12.17%	14.13%	10.64%
$156,000-$182,000	8.54%	8.44%	6.35%
$182,000-$208,000	5.23%	4.78%	3.3%
$208,000 plus	8.83%	9.79%	6.09%
Average Household Income	$108,874	$111,919	$94,428
Housing Status (%)			
Owner	42.35%	34.24%	31.12%
Purchaser	33.14%	32.0%	35.71%
Renter	24.06%	33.24%	32.37%
Public Renter	3.41%	3.27%	5.4%
Private Renter	20.65%	29.97%	26.97%
Households in Mortgage Stress (% Households)	1.7%	2.87%	3.04%
Loan Mortgage Repayments (monthly $)	$2,713	$2,849	$2,424
Households in Rental Stress (% Households)	3.23%	5.19%	7.84%
Rent Payments (weekly $)	$473	$509	$397
Dwelling Structure (%)			
Separate House (%)	69.32%	46.31%	60.96%
Semi-detached (%)	9.15%	12.29%	12.78%
Flat, Unit or apartment (%)	20.57%	40.89%	25.8%
Other dwelling (%)	0.96%	0.51%	0.46%
Number of Bedrooms			
1 Bedroom	3.97%	5.5%	6.7%
2 Bedrooms	20.26%	36.95%	25.37%
3 Bedrooms	47.18%	39.08%	37.46%
4 or more Bedrooms	28.39%	18.01%	29.55%
Car Ownership (%)			
0 Cars	9.24%	10.08%	12.49%
1 Car	36.0%	43.08%	39.57%
2 Cars	38.85%	35.9%	33.92%
3 Cars	11.05%	7.88%	9.53%
4+ Cars	4.86%	3.07%	4.49%
Household Structure (%)			
Family Households	78.74%	71.95%	73.12%
Non-Family Households	21.26%	28.05%	26.88%
Group	2.76%	4.97%	4.27%
Lone Person	18.49%	23.08%	22.61%
Family Composition (%)			
Couple family with no children	31.68%	38.71%	33.46%
Couple family with children under 15	33.95%	31.44%	32.51%

	CONCORD SUBURB	CANADA BAY LGA	SYDNEY
Couple family with no children under 15	19.75%	15.41%	16.41%
One parent family with children under 15	5.05%	4.72%	7.34%
One parent family with no children under 15	8.35%	7.58%	8.39%
Other	1.22%	2.14%	1.89%
Labour Force (%)			
% Unemployed	4.22%	4.18%	5.74%
Labour Force Participation	65.64%	68.55%	65.56%
Occupation (%)			
Managers	16.62%	18.76%	13.52%
Professionals	28.5%	32.36%	26.02%
Technicians & trades workers	11.14%	9.41%	12.43%
Community & Personal Service Workers	7.85%	7.21%	9.01%
Clerical & Administrative Workers	17.33%	16.73%	16.48%
Sales Workers	9.76%	8.99%	9.2%
Machinery operators & Drivers	3.24%	2.37%	5.83%
Labourers	5.56%	4.17%	7.48%
White Collar (%)	80.06%	84.05%	74.25%
Blue Collar (%)	19.94%	15.95%	25.74%
Tertiary Education (%)			
Bachelor Degree or Higher	25.44%	32.22%	24.11%
Advanced Diploma or Associate Degree	10.07%	9.63%	8.96%
Undertaking Tertiary Education	6.05%	7.45%	6.45%
Highest Level of Schooling Achieved (%)			
Year 8 or Below	7.4%	5.52%	5.26%
Year 9 or Equivalent	4.3%	3.67%	5.25%
Year 10 or Equivalent	20.16%	16.37%	21.03%
Year 11 or Equivalent	3.79%	3.64%	4.66%
Year 12 or Equivalent	62.69%	69.54%	62.3%
Did not go to School	1.66%	1.27%	1.5%

Appendix C Stakeholder discussion guide

Discussion guide: Bushell's social infrastructure and community uses demand assessment

Good morning/afternoon, my name is ___ and I'm calling from Urbis, a social planning and research company. We're interviewing some community facilities in Canada Bay to understand current capacity and identify priorities for future provision. This will inform a report on local community facilities to inform planning for a future development and will also be provided to Council.

Would you be interested in participating in a 10 minute telephone interview? Your perspectives and suggestions on community facilities would be really valuable to this study.

During the interview I will take notes of your comments but your feedback will not directly be attributed to you. However, are you ok with us naming your organisation in our assessment?

Do you have any questions before we begin?

Questions

- Can you provide a brief overview of your organisation and the main services you provide?
- What are your opening hours and what are your busiest times? Prompt: time of day, week, month
- Who are the main users of your organisation/service? Prompt: demographic profile, age, gender etc
- Where do people come from to use the facility? What is the catchment area for the facility?
- Do you have any capacity to accommodate increased use or are you at capacity? If so, do you have a waiting list? What are the timeframes associated with being on the waiting list?
- Do you have any plans to expand your services in the future?
- Are there any current pressures on community facilities in the local area?
- How will population growth within the LGA impact on your organisation/service provided? How do expect your user profile to change? (If they feel that there may be negative impacts: Do you think these impacts could be minimised?)
- What should be the priorities for social infrastructure and community facilities within the LGA in the future to support population growth?
- Do you have anything else to add?

Thank you for your time.

Appendix D Service provider selection methodology

A total of 10 social and community infrastructure providers were interviewed in June and July 2015 to understand the broad patterns of use, demand and existing capacity and potential future supply of social infrastructure within proximity to the site and within the Canada Bay LGA.

A list of proposed services for interviews was provided to the project team. Service providers were proposed based on the following principles:

- Analysis of existing demographic within Concord and the LGA
- Future population projections
- Profile of the proposed development
- Potential demand associated with incoming population
- Potential uses to be considered on site
- Our assessment of Council's priorities and anticipated interests
- Proximity to the subject site - within 400m (walking distance), 1km (within approximately 5min drive time) and 2km radius. Some providers were chosen as they are the only service within the LGA but were located beyond the 2km radius.

The following table provides a list of the services, the type of facility, location and reasons for inclusion.

SERVICE PROVIDER	TYPE OF FACILITY	LOCATION	REASON FOR INCLUSION
Canada Bay Heritage Museum	Cultural and Heritage	1 Bent Street, Concord	Council's *Cultural Plan 2008-2013* identified the Heritage Museum as important within the LGA Heritage and cultural profile of the proposed development Heritage museum likely to be interested in the preservation of industrial heritage on the site Potential ability for Heritage Museum to provide services on the site, either permanent or temporary (eg. permanent exhibit or heritage talks/walks) To understand heritage museum demographic to determine whether incoming population would be interested in museum offering Within 1-2km of the site
Canada Bay Men's Sheds	Cultural/Social	1a Gipps Road, Concord	Population projections show an increase in proportion of 60+ residents in Concord by 2036. This age group will represent approximately one quarter of Concord's population by 2036 and therefore social facilities/activities for an ageing population are important considerations for the future of this suburb The development has the potential to provide housing for older residents seeking to downsize but be within reach of local amenities (dependent on price point of the proposed development) and therefore may generate demand for a

SERVICE PROVIDER	TYPE OF FACILITY	LOCATION	REASON FOR INCLUSION
			facility like a Men's Shed Whether the Men's shed currently has capacity and therefore whether there is potential to provide a Men's Shed within the proposed development Within 1-2km of the site
Yaralla RSL Aged Day Care, Concord RSL and Community Club	Aged Care	St Lukes Church Hall, 17 Burton Street, Concord	Ageing population projected for Concord however development is likely to cater for some older residents looking to downsize and the RSL may offer services and facilities of interest to this demand Outside 2km but the only RSL facility within the LGA
Concord Senior Citizen's Club	Activities for Senior Citizen	1 Bent Street, Concord	Social facilities/activities for an older population The development has the potential to provide housing for older residents seeking to downsize but be within reach of local amenities (dependent on price point of the proposed development) and likely to be more interested in activities and amenities in proximity of the site Understand the current demographic and demand on senior citizens services Within 1-2km of the site
Concord Occasional Child Care Centre	Child Care	Wellbank Street, Concord	High demand from existing population (13.3% of existing population within suburb of Concord aged 0 to 9 years of age) Incoming population likely to include some families with young children Changing attitude towards raising children within higher density developments and therefore there is the potential for young professionals who move into the proposed development to have children in the future, generating further demand Approximately 1km from subject site
Concord Out of School Hours Care	Child Care	17 Burton Street, Concord	High demand from existing population (18.5% of existing population within suburb of Concord aged 5 to 19 years of age) Incoming population likely to include some families with young or school aged children Changing attitude towards raising children within higher density developments and therefore there is the potential for young professionals who move into the proposed development to have children in the future, generating

SERVICE PROVIDER	TYPE OF FACILITY	LOCATION	REASON FOR INCLUSION
			further demand Approximately 1km from subject site
1st Yaralla Sea Scouts	Water based recreation	Rhodes	Potential use to be considered on the site Located within the LGA
Dobroyd Aquatic Club	Water based recreation	Rodd Point	Potential use to be considered on the site Located within the LGA
Rotary Club of Concord Farmers Market	Cultural/Social/Retail	Cintra Park Car Park, off Crane Street near Concord High School	The Farmers Market is currently located within a car park To understand the market demographic to determine demand, gaps and options to reflect a market offer in the future development

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NORTHROP

Flood Assessment Report for Planning Proposal

for

Bushells Concord

for New Concord Development Pty Ltd

NL220245 / 9 May 2022 / Revision B

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Contents

Figures

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Tables

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Acronyms and Abbreviations

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ALS	Airborne Laser Survey (LiDAR)
ARI	Average Recurrence Interval
ARR	Australian Rainfall and Runoff
BoM	Bureau of Meteorology
Council	City of Canada Bay Council
DCP	Development Control Plan
FPL	Flood Planning Level
LGA	Local Government Area
LiDAR	Light Detection and Ranging (also see ALS)
m	Measure of length / height / distance (metres)
m AHD	Meters above Australian High Datum
m/s	Measure of velocity (metres per second)
m^3/s	Measure of flow rate (cubic metres per second)
OSD	On-Site Detention
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PSD	Permissible Site Discharge
SES	NSW State Emergency Service
TUFLOW	A 1D and 2D hydraulic modelling software

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Introduction

Northrop Consulting Engineers Pty Ltd (Northrop) have been engaged to prepare a flood assessment report for a planning proposal for the proposed development of 160 Burwood Road, Concord (the subject site).

The planning proposal seeks to facilitate the urban renewal of the subject site from an industrial site into a mixed-use, riverside village offering a mix of land uses that are complementary to the existing surrounding residential area.

It provides approximately 400 new dwellings (including 10% as affordable housing), comprising a mix of shop top housing and residential flat buildings up to 6 storeys and terrace housing up to 3 storeys. A maximum of 7,000m^2 of retail/ commercial uses will be provided (including a 1,000m^2 small-format supermarket), together with a minimum 3,000 m^2 of light industry/ urban services uses that will be located in the Bushells Factory building, which is proposed for heritage listing and adaptive re-use. The 10,000 m^2 of non-residential uses will create approximately 281 new jobs. The proposed uses will be supported by 5,900m^2 of new public open space, including a new plaza and foreshore park to Exile Bay, and publicly accessible internal streets including a vehicular connection between Burwood Road and Zoeller Street.

Included herein is a:

- List of related drawings and documents.
- Description of the subject site and proposed development.
- Existing flood behaviour.
- Outline of the Ministerial Directions - Flooding, City of Canada Bay (Council) LEP and DCP requirements and development response.

Related Reports and Documents

This report is to be read in conjunction with the following reports and documents:

1. Illustrative concept plans prepared by AJC and BVN – included in Appendix A.
2. City of Canada Bay - Exile Bay Catchment Flood Study prepared by GRC Hydro, 2022.

		Date
Prepared by	DD	09/05/2022
Checked by	GB	09/05/2022
Admin	GB	09/05/2022

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Subject Site and Proposed Development

Subject Site

The subject site is located at Lot 5 DP 129325, Lot 399 DP 752023 and Lot 2 DP 230294 and is bounded by Burwood Road to the south, residential development on the east and west, Exile Bay to the northeast and Zoller Street on the northwest.

The existing site includes a coffee manufacturing plant and associated car parking. Elevations on-site ranges from approximately 3.4 to 8.4m AHD.

Characteristics of the area are presented below in Photo 1 and Photo 2.

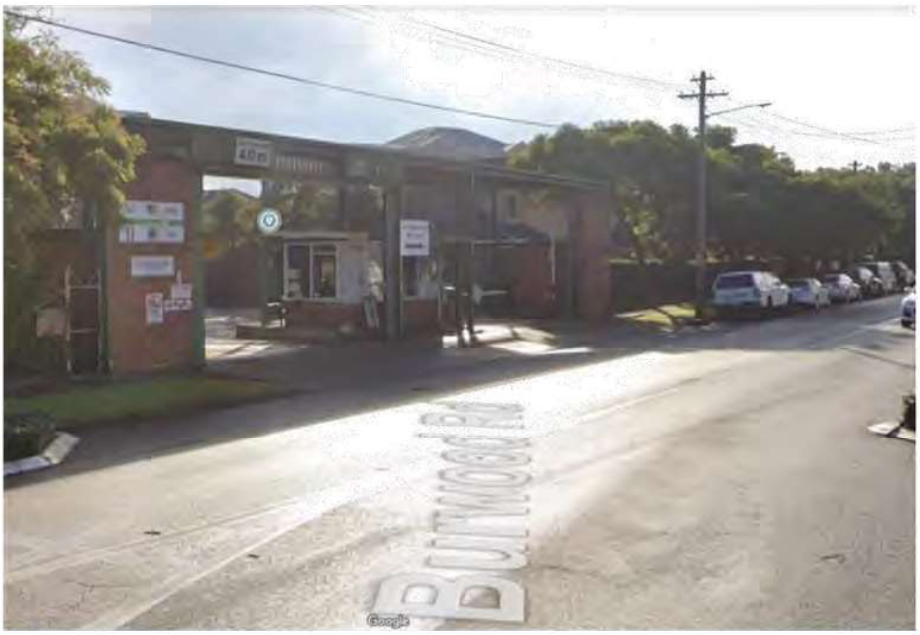

Photo 1 - Looking north along Burwood Road (©Google Maps, 2021)

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Photo 2 - Looking South-East along Zoller Street (©Google Maps, 2021)

Proposed Development

The planning proposal seeks to facilitate the urban renewal of the subject site from an industrial site into a mixed-use, riverside village offering a mix of land uses that are complimentary to the existing surrounding residential area.

It provides approximately 400 new dwellings (including 10% as affordable housing), comprising a mix of shop top housing and residential flat buildings up to 6 storeys and terrace housing up to 3 storeys. A maximum 7,000m^2 of retail/ commercial uses will be provided (including a 1,000m^2 small- format supermarket), together with a minimum 3,000 m^2 of light industry/ urban services uses that will be located in the Bushells Factory building, which is proposed for heritage listing and adaptive re-use. The 10,000 m^2 of non-residential uses will create approximately 281 new jobs. The proposed uses will be supported by 5,900m^2 of new public open space, including a new plaza and foreshore park to Exile Bay, and publicly accessible internal streets including a vehicular connection between Burwood Road and Zoeller Street.

Illustrative concept plans provided in Appendix A.

Legend

Subject Site

Figure 1

Locality

160 Burwood Road, Concord

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Data Source: Aerial (SIX Maps), Cadastre (NSW LPI)
22/4/2022 Y:\YEAR 2022 Jobs\NL220245 - Bushells Concord\0 - Drawings\Figures\Bushell_Concord.qgz

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Existing Flood Behaviour

Flooding of the subject site and vicinity is derived from local catchment overland flow. This has been quantified as part of the Exile Bay Catchment Flood Study 2020. Peak flood levels in the vicinity of the development are summarised in Table 1 below.

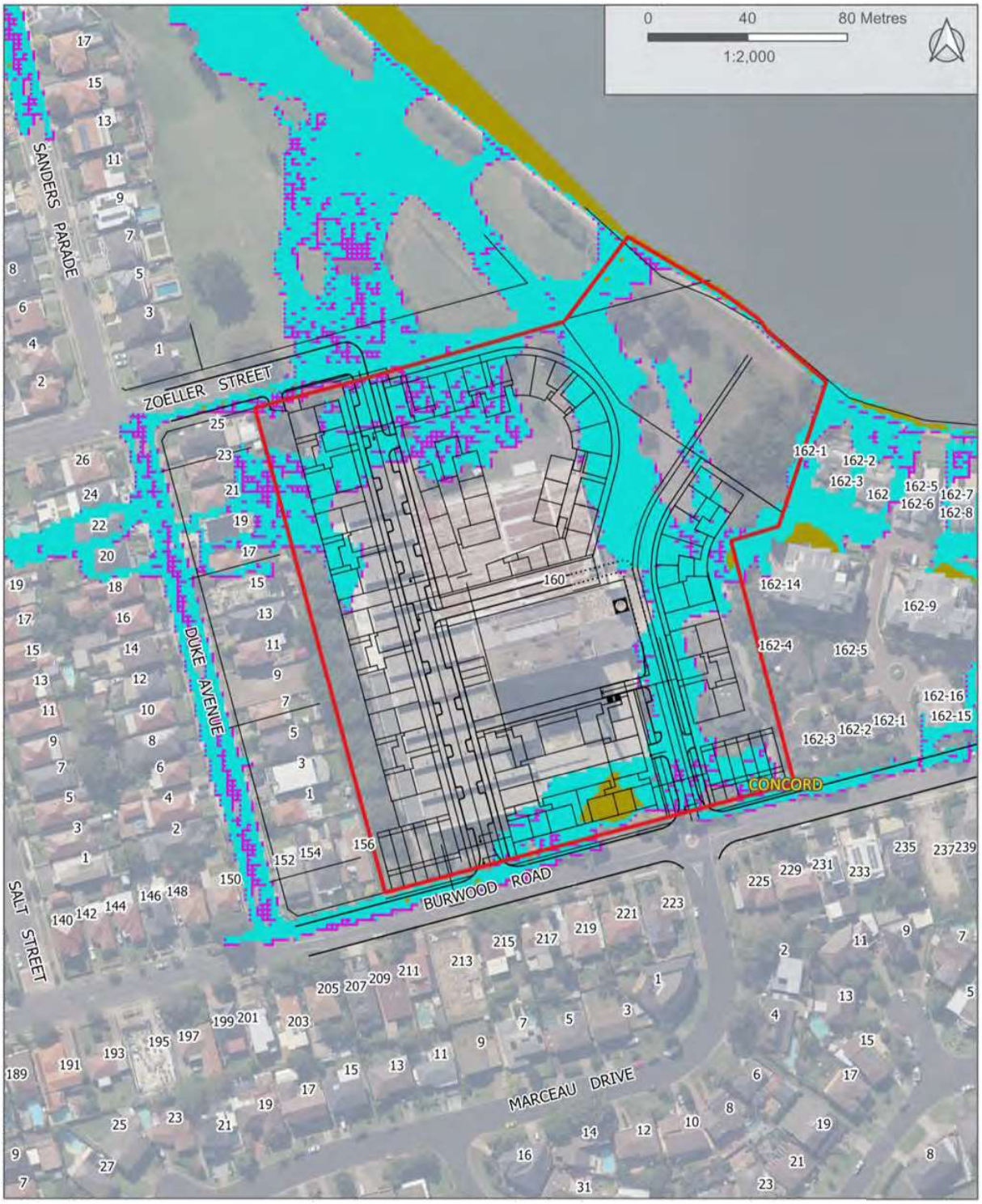
Table 1 - Existing flood levels

Flood Event	Flood Level (m AHD)
1%AEP	3.6 – 8.4
PMF	3.7 – 8.6

Flood risk precincts have been calculated based on the criteria outlined in the DCP. A figure showing the flood risk precincts is presented overleaf in Figure 2.

For the purposes of assessment against prescriptive controls, a **medium** flood risk precinct is assumed. Isolated areas of high are observed which are due to hydraulic hazard category. This is unlikely to change the overall risk of the development area.

Figures showing the existing flood behaviour are presented in Figures 3 - 7 overleaf.



Legend

- Subject Site
- Proposed Development

Flood_Risk_Precinct

- Low
- Medium
- High

Figure 2

Flood Risk Precincts

Mixed Use Development
160 Burwood Road, Concord

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Data Source: Aerial (SIX Maps), Cadastre (NSW LPI)
20/4/2022

Figure 3

1%AEP Flood Depth

Mixed Use Development
160 Burwood Road, Concord

Data Source: Aerial (SIX Maps), Cadastre (NSW LPI)
22/4/2022 Y:\YEAR 2022\Jobs\NL220245 - Bushells Concord\0 - Drawings\Figures\Bushell_Concord.qgz

Figure 4

1%AEP Hydraulic Hazard

Mixed Use Development
160 Burwood Road, Concord

NORTHROP

Data Source: Aerial (SIX Maps), Cadastre (NSW LPI)
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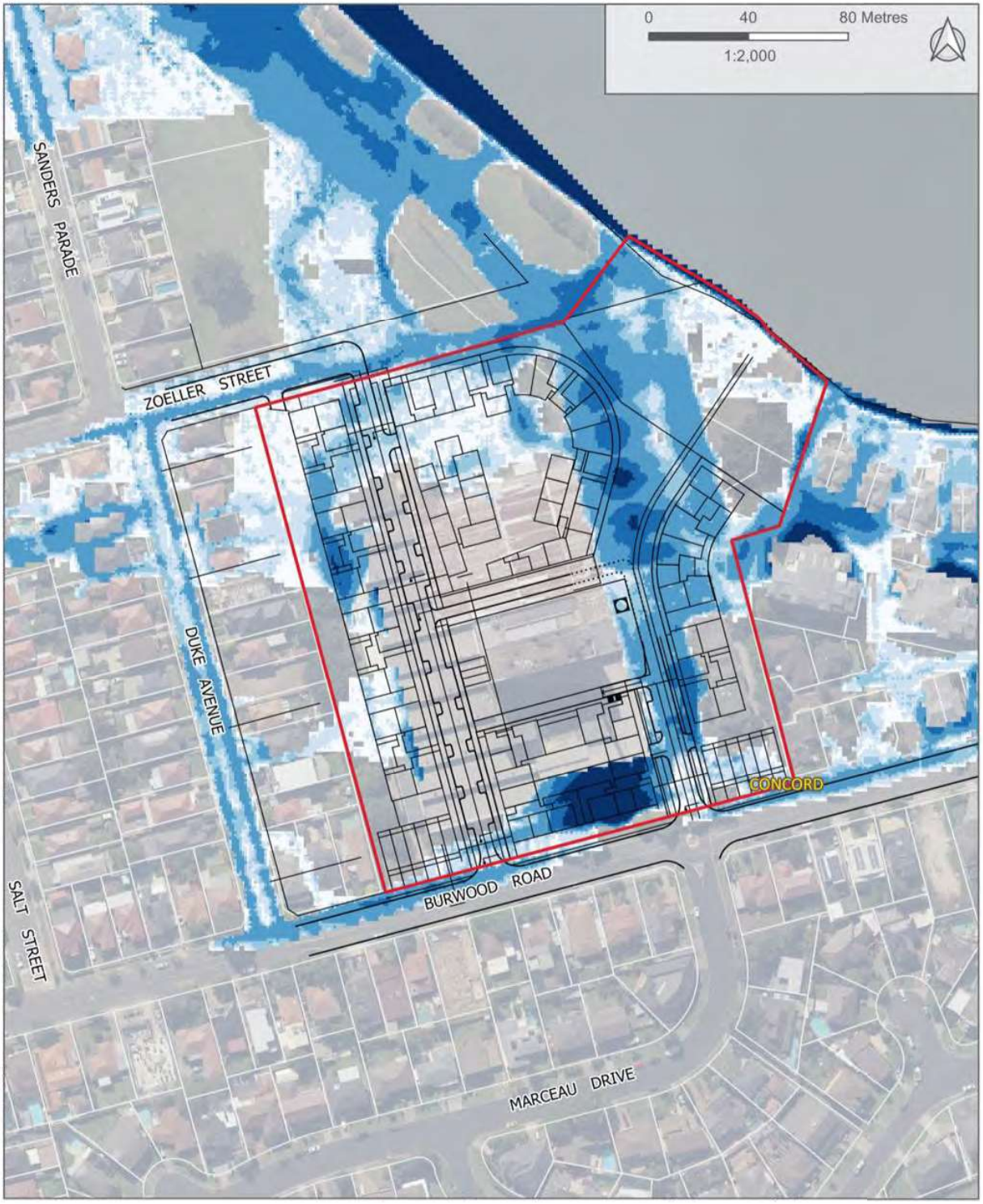

Figure 5

PMF Flood Depth

Mixed Use Development
160 Burwood Road, Concord

NORTHROP

Data Source: Aerial (SIX Maps), Cadastre (NSW LPI)
2/04/2022 Y:\YEAR 2022\Jobs\NL220245 - Bushells Concord\0 - Drawings\Figures\Bushell_Concord.qgz

Figure 6

PMF Hydraulic Hazard

Mixed Use Development
160 Burwood Road, Concord

NORTHROP

Data Source: Aerial (SIX Maps), Cadastre (NSW LPI)
22/4/2022 Y:\YEAR 2022\Jobs\NL220245 - Bushells Concord\0 - Drawings\Figures\Bushell_Concord.qgz

Legend

Subject Site

Flow Conveyance

Flood Storage

Flood Fringe

Data Source: Aerial (SIX Maps), Cadastre (NSW LPI)
26/4/2022

Figure 7

1% AEP Flood Hydraulic Classification

Mixed Use Development
160 Burwood Road, Concord

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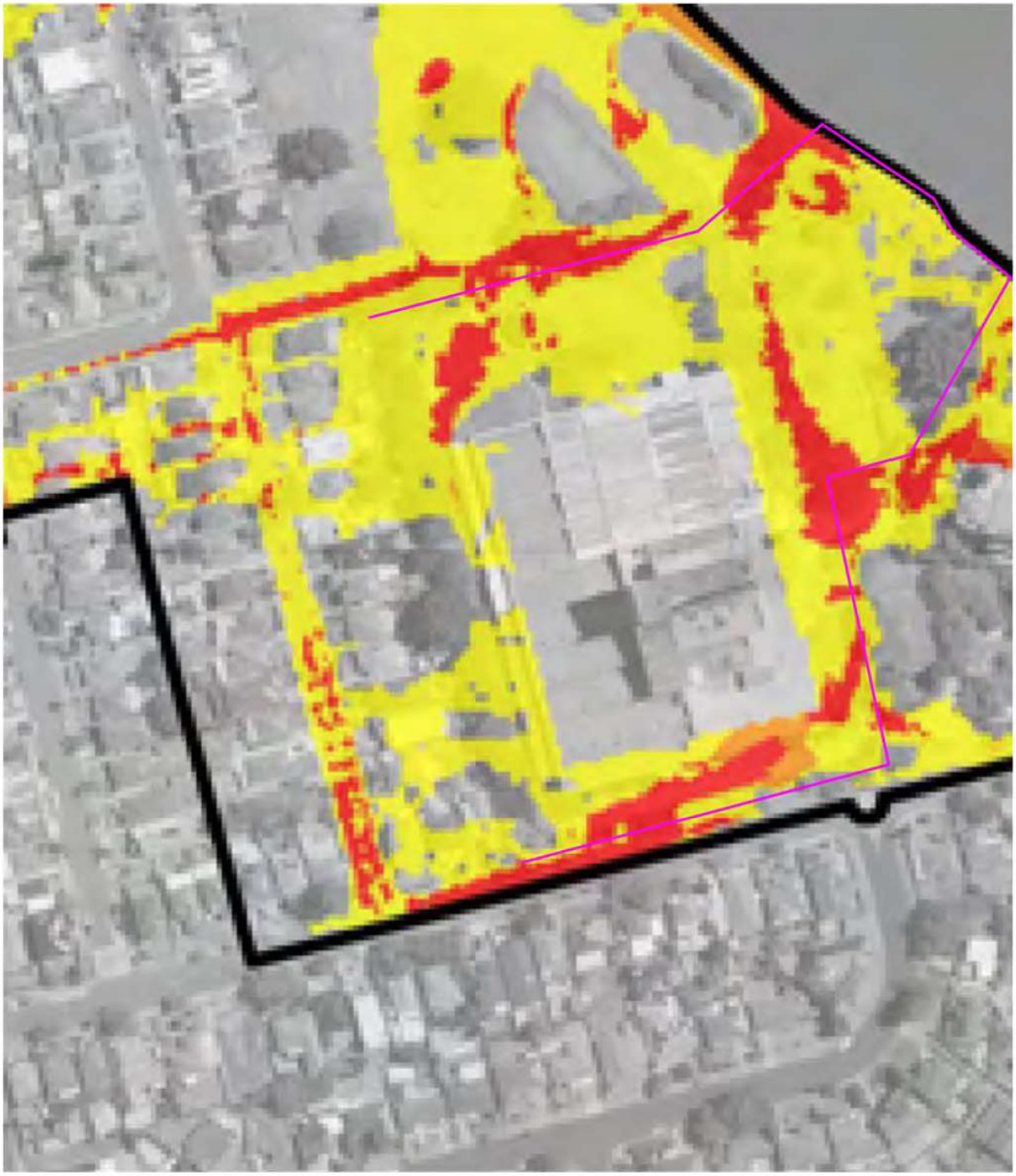

Legend

Subject Site

Flow Conveyance

Flood Storage

Flood Fringe

Data Source: Aerial (SIX Maps), Cadastre (NSW LPI)
20/4/2022

Figure 8

PMF Flood Hydraulic Classification

Mixed Use Development
160 Burwood Road, Concord

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Ministerial Directions Requirements and Response

The Local Planning Directions - Section 4.1 Flooding have been summarised and addressed in Table 2 below. The City of Canada Bay Council LEP requirements have been addressed in Table 3 overleaf. The City of Canada Bay Council DCP requirements (Table C-K) have been addressed in Table 4 overleaf.

Table 2 – Ministerial Directions Requirements

Requirement	Response
The objectives of this clause are as follows	
1. A planning proposal must include provisions that give effect to and are consistent with: a) The NSW Flood Prone Land Policy, b) The principles of the Floodplain Development Manual 2005, c) The considering folding in land use planning guideline 2021, and d) Any adopted flood study and/or floodplain risk management plan prepared in accordance with the principles of the Floodplain Development Manual 2005 and adopted by the relevant council.	The planning proposal has considered these documents and is generally consistent with their requirements.
2. A planning proposal must not rezone land within the flood planning area from Recreation, Rural, Special Purpose or Conservation Zones to a Residential, Business, Industrial or Special Purpose Zones.	The development does not propose any rezoning of Recreation, Rural, Special Purpose or Conservation Zones to a Residential, Business, Industrial or Special Purpose Zones.
3. A planning proposal must not contain provisions that apply to the flood planning area which:	
a) Permit development in floodway areas,	Hydraulic categories determined in the Exile Bay Catchment Flood Study (2020), are reproduced in Figure 7 and Figure 8. The subject site is largely flood fringe with a small section noted as "Flood Conveyance". Based on preliminary calculations, it is considered feasible for divert approach flow in the 1% AEP around future development of the site.
b) Permit development that will result in significant flood impacts to other properties,	The development is not expected to result in any impact to flood behaviour or impacts

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Requirement	Response
	neighbouring properties due to the magnitude of approach flow. It is considered feasible in future design development to incorporate elements to manage diversion of this approach flow.
c) Permit development for the purpose of residential accommodation in high hazard areas,	Hydraulic hazard is outlined in Figure 4 and Figure 6. The majority of the site is located outside high hazard areas. It is considered feasible to reduce this hazard categorisation by including stormwater diversion infrastructure as part of design development.
d) Permit a significant increase in the development and/or dwelling density of that land,	The proposed planning proposal is considered acceptable as it is considered feasible to comply with the City of Canady Bay Council's DCP for development of this type, despite the increase in dwelling density. It is considered feasible to divert runoff and provide flood protection measures so the areas earmarked for increased dwelling density are outside the flood planning area.
e) Permit development for the purpose of centre-based childcare facilities, hostels, boarding houses, group homes, hospitals, residential care facilities, respite day care centres and senior housing, in areas where the occupants of the development cannot effectively evacuate,	The development does not propose any of the aforementioned facilities.
f) permit development to be carried out without development consent except for the purposes of exempt development or agriculture. Dams, drainage canals, levees, still require development consent,	Not applicable.
g) are likely to result in a significantly increased requirement for government spending on emergency management services, flood mitigation and emergency response measures, which can include but are not limited to the provision of road infrastructure, flood mitigation infrastructure and utilities, or	The site has no reliable evacuation routes during a 1%AEP flood event because the regional road network is compromised. The flood emergency strategy for the development is to shelter in place. The planning proposal will not substantially increase the requirements for government spending on flood mitigation measures, infrastructure or services. It is likely the cost of required stormwater infrastructure will be borne by the development.

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Requirement	Response
h) permit hazardous industries or hazardous storage establishments where hazardous materials cannot be effectively contained during the occurrence of a flood event.	It is considered feasible to store hazardous materials above the 1% AEP plus 500mm free board.
4. A planning proposal must not contain provisions that apply to areas between the flood planning area and probable maximum flood to which Special Flood Considerations apply which: a) permit development in floodway areas b) permit development that will result in significant flood impacts to other properties, c) permit a significant increase in the dwelling density of that land, d) permit the development of centre-based childcare facilities, hostels, boarding houses, group homes, hospitals, residential care facilities, respite day care centres and seniors housing in areas where the occupants of the development cannot effectively evacuate, e) are likely to affect the safe occupation of and efficient evacuation of the lot, or f) are likely to result in a significantly increased requirement for government spending on emergency management services, and flood mitigation and emergency response measures, which can include but not limited to road infrastructure, flood mitigation infrastructure and utilities	Special Flood Considerations are not adopted by the City of Canada Bay Council.
5. For the purposes of preparing a planning proposal, the flood planning area must be consistent with the principles of the Floodplain Development Manual 2005 or as otherwise determined by a Floodplain Risk Management Study or Plan adopted by the relevant council.	The planning proposal is informed by the Exile Bay Flood Catchment Study 2020 which is a study prepared through the NSW floodplain management process. This is considered consistent with the principles of the Floodplain Development Manual 2005.

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Table 3 - LEP Requirements

Requirement	Response
(1) The objectives of this clause are as follows	
(a) to minimise the flood risk to life and property associated with the use of land,	The proposed development is in within a medium flood risk precinct. It is considered feasible to mitigate increases in risk to property and life through design of future development.
(b) to allow development on land that is compatible with the flood function and behaviour on the land, taking into account projected changes as a result of climate change,	Section 11 of the Exile Bay Catchment Flood Study (2020) considers the impact of climate change. Generally, this results in an increase in the order of a 100mm. This increase can be considered in the final design of the development.
(c) to avoid adverse or cumulative impacts on flood behaviour and the environment,	The proposed planning proposal is expected not to result in any impact to flood behaviour or the environment or contribute to cumulative impacts. Due to the magnitude of peak flows approaching the site we consider it feasible to manage any increases as part of design development.
(d) to enable the safe occupation and efficient evacuation of people in the event of a flood.	The planning proposal has adequate space for occupants to shelter in place in an event of a flood.
(2) Development consent must not be granted to development on land the consent authority considers to be within the flood planning area unless the consent authority is satisfied the development	
(a) is compatible with the flood function and behaviour on the land, and	The flood hazard is generally low (H2 and lower) in the 1% AEP. It is considered feasible to divert approach flows around or through the development.
(b) will not adversely affect flood behaviour in a way that results in detrimental increases in the potential flood affectation of other development or properties, and	The proposed planning proposal is unlikely to cause significant adverse impacts. Due to the magnitude of peak flows approaching the site we consider it feasible to manage any increases as part of design development.
(c) will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the event of a flood, and	The proposed development itself acts as a refuge in the PMF event.
(d) incorporates appropriate measures to manage risk to life in the event of a flood, and	Appropriate floor levels shall be adopted to minimise risk to property.

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Requirement	Response
(e) will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses.	The planning proposal shall not result in any detrimental impact on the environment, nor will it cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses. We expect stormwater quality improvement devices will be included during design development which will improve the site in comparison to current conditions.
(3) In deciding whether to grant development consent on land to which this clause applies, the consent authority must consider the following matters	
(a) the impact of the development on projected changes to flood behaviour as a result of climate change,	It is considered feasible to incorporate climate change requirements into the future design. This is not expected to alter our assessment that diversion of upstream approach flows is feasible.
(b) the intended design and scale of buildings resulting from the development,	The proposed planning proposal is a redevelopment of an existing industrial development to a mixed-use development and will not have any significant impact from a floodplain management perspective.
(c) whether the development incorporates measures to minimise the risk to life and ensure the safe evacuation of people in the event of a flood,	Refuge is available in the PMF to manage risk to life.
(d) the potential to modify, relocate or remove buildings resulting from development if the surrounding area is impacted by flooding or coastal erosion.	Given the context of the site it is unlikely to be significantly impacted by coastal erosion. The planning proposal does not provide construction approval and it would be feasible to relocated buildings during a later approval stage if required by these mechanisms.

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Table 4 – DCP requirements

Requirement	Response
Floor Level Habitable floor levels to be equal to or greater than the 1% AEP flood level plus freeboard. A restriction is to be placed on the title of the land, pursuant to S.88B of the Conveyancing Act, where the lowest habitable floor area is elevated more than 1.5m above finished ground level, confirming that the subfloor space is not to be enclosed.	It will be feasible to set finished floor levels at the 1% AEP plus freeboard to mainstream and Exile Bay flooding. The planning proposal does not seek to introduce any habitable floor areas elevated more than 1.5m above the finished ground level. It is to be noted that if a change is made to the proposed development which results in an elevated habitable floor area of 1.5m above finished ground level, then a restriction shall be placed on the title of the land, in accordance with S.88B of the conveyancing Act.
Building Components and Method All structures to have flood compatible building components below the 100-year ARI (1% AEP) flood level plus freeboard.	It is feasible to construct areas below the 1% AEP plus 500mm freeboard with flood compatible building material.
Structural Soundness An Engineer's report is required to certify that the structure can withstand the forces of floodwater, debris and buoyancy up to and including a 100 year ARI flood level (1% AEP) plus freeboard.	Given the type of construction, this is considered likely to be satisfied and will be confirmed by a suitably qualified engineer post DA approval.
Flood Affection An Engineer's report is required to demonstrate how and certify that the development will not increase flood affectation elsewhere, having regard to:	This report can be provided at DA stage and it is considered feasible to meet these requirements.
Loss of flood storage;	Based on the preliminary analysis of the site, the overland flow in the 1% AEP is generally flood fringe and will not be affected by reconfiguration of site levels. This will be confirmed at DA stage with stormwater design and flood analysis, as required.
Change in flood levels, flows and velocity caused by alterations to flood flows; and	Per the above.

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Requirement	Response
The cumulative impact of multiple potential developments in the vicinity.	Given the context of the local area, cumulative impacts is not expected to apply.
Car Parking and Driveway Access The minimum surface level of open parking space or carports shall be as high as practical, but no lower than 0.1m below the 100-year ARI (1% AEP) flood level. In the case of garages, the minimum surface level shall be as high as practical, but no lower than the 100-year ARI flood level.	The site is impacted by local overland flow. This will be investigated further at DA stage.
Garages capable of accommodating more than 3 motor vehicles on land zone for urban purposes, or enclosed car parking, must be protected from inundation by flood equal to or greater than the 100-year ARI(1% AEP) flood. Ramp level to be no lower than 0.5m above the 100-year ARI flood level.	This is considered feasible and will be further investigated at DA stage.
The level of the driveway providing access between the road and parking spaces shall be no lower than 0.2m below the 100-year ARI (1% AEP) flood level.	This is considered feasible and will be further investigated at DA stage.
Enclosed car parking and car parking areas accommodating more than 3 vehicles, with a floor below the 100-year ARI (1% AEP) flood level, shall have adequate warning system, signage, exits and evacuation routes.	This is considered feasible and will be further investigated at DA stage.
Restraints or vehicle barriers to be provided to prevent floating vehicles leaving a site during 100-year ARI (1% AEP) flood.	This is considered feasible and will be further investigated at DA stage.

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Requirement	Response
Enclosed underground car parks shall have all potential water entry points protected from the PMF. The intent of this requirement is to mitigate the creation of life-threatening circumstances and very high economic loss such as many occur with the complete inundation of an underground car park. Council may consider relaxation of this requirement if it can be shown by modelling that the catchment characteristics of the concord west precinct, an additional requirement within that precinct is for habitable floor levels to be at a minimum of RL.9.3.3, 9.3.6, and 10.2.3 of the CWFS.	This is considered feasible and will be further investigated at DA stage.
Evacuation Reliable access for pedestrians and vehicles is required from the site to an area of refuge above the PMF level, either on site (e.g., Second storey) or off site.	It is considered feasible to shelter in place for this development.
Applicant is to demonstrate the development is consistent with any relevant flood evacuation strategy or similar plan.	The recommended flood evacuation strategy stated in the Exile Bay Catchment Study (2020) is shelter in place.
Adequate flood warning is available to allow safe and orderly evacuation without increased reliance upon SES or other authorised emergency services personnel.	The Exile Bay catchment is predominantly affected by overland flash flooding. Preventive actions cannot be undertaken due to a lack of flood warning time. Shelter in place is recommended in Section 9.7 of the Exile Bay Catchment Flood Study (2020).
Management Site Emergency Response Flood plan required where the site is affected by the 100 year ARI flood level (1%AEP) (except for single dwelling-house).	A concept emergency response plan can be provided at DA stage.
Applicant is to demonstrate that area is available to store goods above the 100 year ARI flood level (1%AEP)plus freeboard.	This is considered feasible and will be further investigated at DA stage.
No storage of materials below the 100 year ARI flood level (1%AEP).	This is considered feasible and will be further investigated at DA stage.

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Discussion

Type of Inundation

The majority of the development is subject to low hazard flooding and is affected by low magnitude overland flow. In the 1% AEP event this is in the order of 1.6 m^3/s which is feasible to convey in either an above or below ground stormwater system.

Further Approvals Required

This assessment has considered the feasibility of implementing the Ministerial Directions on Flooding and Council's LEP and DCP requirements for floodplain management. Based on the supplied plans we generally believe this is feasible and will be subject to further design development and assessment as part of Development Application (DA) or State Significant Development Application (SSDA) approval processes. A Flood Imapct and Risk Assessment (FIRA) is likely to be included as part of this documentation.

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Conclusions

Northrop Consulting Engineers were engaged by New Concord Development Pty Ltd to complete the Planning proposal Application documentation for the proposed redevelopment at 160 Burwood Road Concord.

It was concluded from the assessment it is feasible to implement the requirements of the Ministerial Directions for Flooding and Council's LEP and DCP floodplain management requirements in the future design of the site.

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Limitation Statement

Northrop Consulting Engineers Pty Ltd (Northrop) has been retained to prepare this report based on specific instructions, scope of work and purpose pursuant to a contract with its client. It has been prepared in accordance with the usual care and thoroughness of the consulting profession for the use by New Concord Development Pty Ltd. The report is based on generally accepted practices and standards applicable to the scope of work at the time it was prepared. No other warranty, express or implied, is made as to the professional advice included in this report.

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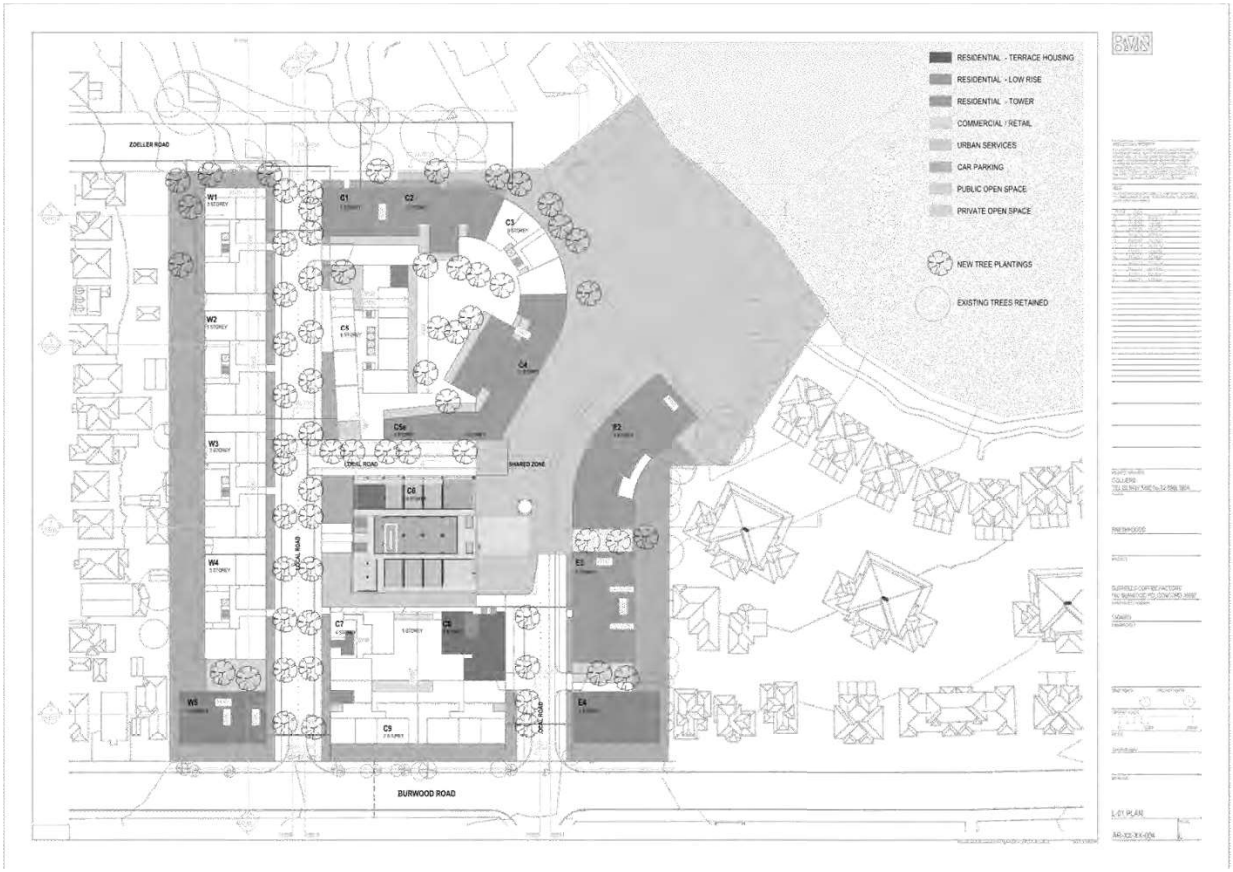
Document Register

Rev	Status	Prepared	Approved	Date
A	Client Review	DD	GB	26 April 2022
B	Approval	DD	GB	9 May 2022

Appendix A – Illustrative Concept Plans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RESIDENTIAL - LOW RISE
RESIDENTIAL - TOWER
COMMERCIAL / RETAIL
URBAN SERVICES
CAR PARKING
PUBLIC OPEN SPACE
PRIVATE OPEN SPACE
NEW TREE PLANTINGS
EXISTING TREES RETAINED
ZOELLER ROAD
BURWOOD ROAD
SHARED ZONE
W1
W2
W3
W4
W5
C1
C2
C3
C4
C5a
C6
C7
C8
C9
E1
E2
E3
E4

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DETAILED SITE INVESTIGATION (Round 1)

BUSHELLS CONCORD

LOT 2 IN DP230294, Lots 398 & 399 IN DP752023 and Lot 5 IN DP129325

160 BURWOOD ROAD, CONCORD

REPORT NO 20136/1 24 MAY 2022

(Version 1)

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ABN 64 002 841 063

Report No: 20136/1
24 May 2022
Version 1

New Concord Development Pty Ltd
C/- Hatch
Level 3, 50 Carrington Street
SYDNEY NSW 2000
Email: stephen.moore@hatch.com

Attention: Mr S Moore

Dear Sir,

re: **Bushells Concord**
Lot 2 in DP230294, Lots 398 & 399 in DP752023 and Lot 5 in DP129325
160 Burwood Road, Concord
Detailed Site Investigation (Round 1)

Please find herewith Detailed Site Investigation report (round 1) for the land known as Bushells Concord, registered as Lot 2 in DP230294, Lots 398 & 399 in DP752023 and Lot 5 in DP129325, and located at 160 Burwood Road, Concord (the site).

A brief of the outcome of the investigation is summarised in the Executive Summary.

Should you have any questions, please do not hesitate to contact the undersigned.

Yours faithfully
GEOTECHNIQUE PTY LTD

JAMES NGU
Senior Principal Environmental Engineer
BE MEngSc MIEAust CPEng NER

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