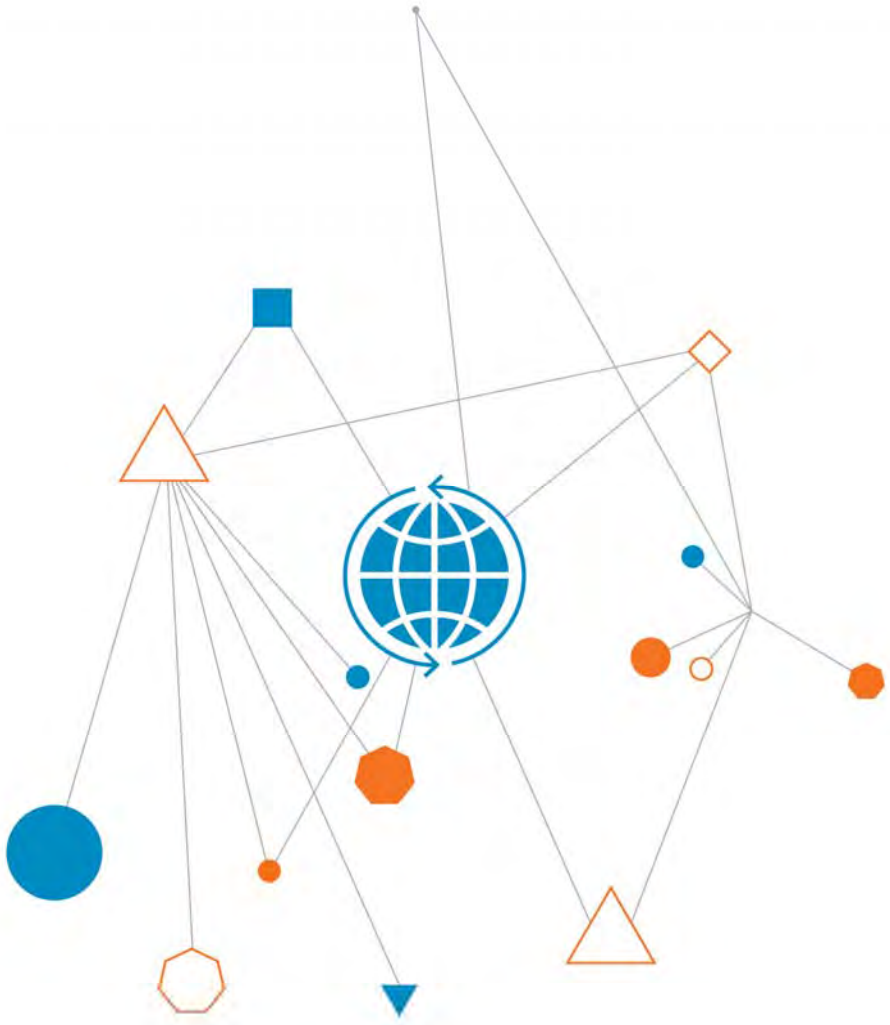
Bouygues Construction Australia

Remedial Action Plan

Dooley's Catholic Club & Hotel Development,
Olympic Drive, Lidcombe NSW

29 June 2016



When you
think with a
global mind
problems
get smaller

This page has been left intentionally blank

Remedial Action Plan

Prepared for
Bouygues Construction Australia

Prepared by
Coffey Geotechnics Pty Ltd
Level 19, Tower B, 799 Pacific Highway
Chatswood NSW 2067 Australia
t: +61 2 9406 1193 f: +61 2 9406 1002
ABN: 65 140 765 902

29 June 2016

GEOTLCOV25554AA-AJ

Quality information

Revision history

Revision	Description	Date	Originator	Reviewer
Draft V1	Initial draft	30 April 2016	M. Locke	C. Quayle
V2	Final. Report considers amended development.	29 June 2016	M. Locke	C. Quayle

Distribution

Report Status	No. of copies	Format	Distributed to	Date
Draft	1	PDF	Bouygues Construction Australia	30 April 2016
Final	1	PDF	JLL / Dooley's Catholic Club	29 June 2016

Table of contents

Figures

Appendices

Abbreviations

ACM	Asbestos Containing Materials
AF	Asbestos Fines
AHD	Australian Height Datum
AMP	Asbestos Management Plan
ARCP	Asbestos Removal Control Plan
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure revised 2013
BCA	Bouygues Construction Australia
BH	Borehole
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
C6-C36	Hydrocarbon chainlength fraction
COPC	Chemicals of Potential Concern
DA	Development Application
DP	Deposited Plan
ENM	Excavated Natural Material
NSW EPA	Environmental Protection Authority of NSW
FA	Friable Asbestos
HA	Hand auger
Ha	Hectare
LOR	Limit of Reporting
mbgs	Metres below ground surface
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NSW OEH	Office of Environment & Heritage of NSW
PAH	Polycyclic Aromatic Hydrocarbon
POEO	Protection of the Environment Order
QA	Quality Assurance
QC	Quality Control
RAP	Remedial Action Plan
RPD	Relative Percent Difference
SAQP	Sampling Analysis Quality Plan
SMF	Synthetic Mineral Fibre
SWMS	Safe Work Method Statement
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
UFP	Unexpected Finds Protocol
VENM	Virgin Excavated Natural Material
VOC	Volatile Organic Compounds
w/w	Weight per weight
WA DOH	Dept. of Health of Western Australia

1. Introduction

1.1. Overview

Coffey Geotechnics Pty. Ltd. (Coffey) was commissioned by the Bouygues Construction Australia (BCA) to prepare a Remedial Action Plan (RAP) to support a Development Application (DA) to expand the facilities within the existing Dooley's Catholic Club site (herein referred to as the 'site'). The location of the site is shown on Figure 1.

The RAP is required to manage and remove asbestos contaminated soils identified within parts of the site. Asbestos contamination is further discussed in Section 3.

The work was commissioned by Mr. George Pontifix on behalf of BCA. The works were undertaken in accordance with our fee proposal submitted by Coffey dated 2nd March 2016 (ref: GEOTLCOV25554AA-AF).

1.2. Proposed Development

The proposed development will comprise the construction of new club facilities within the existing Dooley's Catholic Club site. A selection of drawings provided to Coffey which describes the proposed development is provided in Appendix A. With reference to these drawings, the proposed development comprises:

- A two-storey basement for:
  - Staff and club/hotel patron car parking,
  - Plant equipment /system rooms,
  - Storage rooms including food, beverages, linen, garbage bins and compactors,
  - Offices for administration and security staff),
  - Staff rooms (e.g. toilets/change rooms, kitchen and dining)
  - Delivery docks
- A two-storey club podium over the basement. The club will contain restaurants, gaming areas, conference facility, bars and hotel reception.
- A 260 room, seven storey hotel above the southern part of the club podium.
- Realignment of Board Street along the eastern boundary of the site over the basement, providing access to Church Street to the south.
- Construction of an access road linking the basement car park with Ann Street to the north, over existing residential property located at No. 17 Ann Street.
- Minimal landscaping provided along the northern and eastern boundaries of the club development, above the basement.

- Construction of a five-storey above ground car park. The location of the proposed above ground car park shall be situated over existing residential properties at No.s 4 – 12 Board Street and No.s 3 – 11 Ann Street.

Figure 2 provides an overview of the above components of the proposed development.

1.3. Objectives

The overall objective of the remediation is to render the site suitable for the proposed development. The purpose of this document is to outline a strategy to mitigate the potential risks associated with asbestos containing materials (ACM), which has been identified within shallow fill within a number of existing residential properties. This document also presents a procedure to manage unexpected finds encountered during the implementation of the proposed construction earthworks.

1.4. Scope of Works

To achieve the objective of the RAP, the following activities were completed:

- Review of available investigation reports for the site;
- Selection of the preferred remediation and/or management methods from appropriate remediation options;
- Outline procedures for the preferred remediation and/or management method;
- Outline procedures for validation, site control and occupational health and safety, as required for the remediation and/or management works;
- Review of the environmental measures to be undertaken during the remedial works to protect the health and safety of site workers, the general public surrounding the site, and the surrounding environment;
- Development of validation criteria and scope of the unexpected finds management plan.

1.5. Available Assessments

Information from the following reports was used to prepare this RAP:

- SGA Environmental (2011); *Detailed Environmental Site Investigation: 5/5a Church Street, Lidcombe* (Ref: 92121; dated February 2011).
- Coffey (Jan 2016); *Detailed Site Investigation – Dooley's Catholic Club and Hotel Development, Olympic Drive, Lidcombe NSW* (Ref: GEOTLCOV25554AA-AB)
- Coffey (Mar 2016a); *Supplementary Contamination Investigation - Multilevel Aboveground Car Park, Board Street, Lidcombe* (Ref: GEOTLCOV25554AA-AH)
- Coffey (Mar 2016b); *Limited Health Risk Screening Assessment: Groundwater Seepage at Proposed Development, Olympic Drive, Lidcombe, Sydney, NSW* (Ref: GEOTLCOV25554AA-AI)
- Coffey (Apr 2016); *Dooley's Lidcombe Catholic Club Redevelopment: Groundwater Assessment* (Ref: GEOTLCOV25554AA-AK)

2. Site Description & Setting

2.1. Site Identification

The site is located within the suburb of Lidcombe, which is situated within the Auburn Local Government Area. The location of the site is shown in Figure 1.

The proposed club and hotel development will be situated to the west of the existing Dooley's Catholic Club, and includes:

- At-grade club car park located at the corner of Church Street and Olympic Drive.
- Western part of Board Street.
- Existing residential dwellings located at No. 14 to 28 Board Street, and No. 17 Ann Street.

The proposed four storey above ground car park will be situated to the north of the existing Dooley's Catholic Club, and includes:

- Existing residential dwellings located at No. 4 to 12 Board Street
- Existing residential dwellings located at No. 3 to 11 Ann Street

Figure 2 shows the boundary of the site and an overview of the proposed layout of the development. A summary of the individual Lot references that fall within the site are summarised within Appendix B.

The existing club car park is zoned 'B4 Mixed Use' and the residential dwellings are zoned as 'R4 High Density Residential' under the Auburn Local Environment Plan 2010.

2.2. Site Description

A detailed description of site conditions is presented within the Detailed Site Investigation and Supplementary Contamination Investigation reports (Coffey, Jan 2016; Mar 2016a). A summary of this information is presented below:

- The southern portion of the site comprises a secure car park for the adjoining Dooley's Catholic Club, and covers an area of approximately 0.6 ha. The car park pavement comprises asphalt with small areas of landscaping established along the boundary of the car park and verges within the car park.
- The northern portion of the site comprises 19 residential dwellings situated between Board Street and Ann Street. In general, these structures comprise single storey brick and/or cladded buildings with tile or corrugated roofs. Outhouse/sheds are present within the majority of the Lots within the site.
- Building materials suspected to contain asbestos were observed to be present some of the dwellings and sheds/outhouses. Several large fragments of cement sheeting suspected to contain asbestos (i.e. Bonded ACM) were present on surface soils in the rear yard of No.8 and 26 Board Street. The fragments of Bonded ACM varied in size and were observed to be in a good condition showing no significant sign of excessive weathering (i.e. the fragments were relatively angular and did not crumble readily with hand pressure).
- Paint condition of the dwellings and outhouses was observed to vary from poor to good condition.

- Coffey note that access was not available to all residential properties. Where this was the case, observations were made from the property boundary, and supplemented using web-based aerial photographs.

2.3. Surrounding Land Uses

The site is situated in an area characterised by various residential and commercial retail land uses which are summarised in Table 2.1.

Table 2.1: Surrounding Land Uses

Direction	Land Uses
North	• Residential properties along Ann Street.
East	• Residential dwelling at 2 Board Street, beyond which lies ground floor retail premises and residential dwelling within the upper floors. • Dooley's Catholic Club beyond which John Street and associated commercial properties.
South	• Church Street, beyond which lies Lidcombe train station and the rail corridor.
West	• Olympic Drive, beyond which lies Auburn Swim Centre and associated public open space.

2.4. Topography and Hydrology

Available topographic survey data indicates that site levels range from 17.8m Australian Height Datum (AHD) in the northeast of the site (4 Board Street) to 13mAHD in the southeastern corner of the existing club car park. These levels are consistent with observations made during the walkover which indicated a gentle gradient down towards the west, towards Olympic Drive.

2.5. Geology and Soil

Published geological records indicate the site is underlain by Triassic aged Ashfield Shale, consisting of black to dark grey shale and laminite (NSW Geological Survey, Sheet No. 9130; dated 1983; Scale 1:100,000). The generalised subsurface conditions encountered across the site during previous investigations comprised fill material underlain by residual clayey soils. Residual soils were underlain by interbedded siltstone and sandstone, and laminate at depth across the site. Table 2.2 summarises subsurface conditions encountered within the site.

Table 2.2: Summary of Typical Subsurface Conditions

Unit	Depth to Top of Unit (mbgs)	Approx. Unit Thickness	Material Description
Fill	0m	0.15m to 1.0m	**ASPHALT** hardstanding (car park only) **FILL** with the consistency of Sand, gravelly Sand, clayey Gravel, sandy Clay. Sands and gravels were generally fine to coarse grained, brown-dark brown, sub-rounded to sub angular. The clay was low plasticity. Anthropogenic materials including brick, tiles, glass, concrete and trace amounts of asphalt were noted. Fibre cement fragments were also noted locally (refer Section 3).
Residual Soil	0.15m to 1.0m	0.4m to 2.3m	**CLAY:** medium to high plasticity, stiff to very stiff Clay, brown-red-grey mottled with some silt and trace ironstone gravel.
Bedrock	1.1m to 3.0m. Generally deepest at northeastern corner of site	Not proven	**INTERBEDDED SILTSTONE & SANDSTONE:** brown-dark grey, fine grained interbedded siltstone and sandstone ranging highly weathered, low strength to fresh rock.

With reference to the Acid Sulfate Soil Risk Map available in the Australian Soil Resource Information System (Prospect – Parramatta Map No 9130N3), the site is identified as having low risk of acid sulfate soil materials being present.

2.6. Hydrogeology and Hydrology

Groundwater inflow was not encountered during the drilling of any of the boreholes on site. Standing water levels recorded in three monitoring wells installed within the club car park ranged from 9.0mAHD (BH03) to 9.9mAHD (BH05) on 1 December 2015, approximately one week after borehole drilling was complete (and piezometers had been developed by purging).

Supplementary monitoring of standing groundwater levels was undertaken between 16 March 2016 and 20 April 2016 using an automatic logger. Table 2.3 provides a summary of the groundwater levels observed.

Table 2.3: Summary of Manually Observed Groundwater Levels

Piezometer	Ground Surface Elevation [a] (m AHD)	Depth to Groundwater Below Existing Ground Level (m)			Estimated Groundwater Elevation (m AHD)[a]		
		1 Dec 2015	16 Mar 2016	20 Apr 2016	1 Dec 2015	16 Mar 2016	20 Apr 2016
BH01	14.66	4.31	4.67	4.73	10.35	9.99	9.93
BH03	13.20	4.81	4.36	4.43	8.39	8.84	8.77
BH05	15.60	5.95	6.21	5.91	9.65	9.39	9.69

Notes: [a]Inferred from survey plan provided.

Groundwater levels within the bedrock did not show significant response to rainfall recorded at the nearest gauging station during the monitoring record (Coffey, Apr 2016).

The standing water levels reported indicate a westerly groundwater flow direction towards Haslam's Creek, which flows within a concrete lined channel, approximately 150m northwest of the site.

2.7. Site History

A detailed appraisal of the historical site uses is presented within the Detailed Site Investigation and Supplementary Contamination Investigation reports (Coffey, Jan 2016; Mar 2016a). A summary of this information is presented below:

- Historic records obtained indicate the rail and local road infrastructure near to and adjoining the site were established by 1885, and individual Lots within the site were gradually acquired and developed for residential land uses during by the mid-20th century. The majority of the site appears to have remained in use for residential accommodation, albeit several Lots within the site were modified since this time. The construction of additional structures (i.e. sheds, garages etc.) was noted.
- The Dooley's Catholic Club was established on land to the east of the site prior to 1970 and had been extended to encompass a number of existing residential dwellings.
- Land within the site was subsequently acquired by Dooley's, with existing residential and commercial structures within the southern portion of the site being demolished to enable the construction of the current club car park on site in 2014. Land to the north, beyond Board Street has continued to be used for residential purposes.
- A previous study indicated that the property located at 5/5a Church Street (Lot 100 DP 829270) was acquired in 1954 by Redex and subsequently appears to have conducted commercial operations at the premises until 1972 (SGA Environmental, 2011). During this period development applications were lodged to install a 1,500 gallon tank and workshop. This property was subsequently acquired by the Ukrainian Youth Association of Australia and later the Society of St Vincent de Paul, until structures within this lot were demolished to construct the current car park.

3. Previous Investigations

3.1. Summary of Available Reports

The site has been subject to a number of previous investigations and contamination assessments. A summary of these documents are presented in Table 3.1. Figure 3 illustrates the position of the investigation locations.

Table 3.1: Summary of Contamination Investigations and Assessments

Report	Scope of Works and Report Findings and Recommendations
Detailed Environmental Site Investigation: 5/5a Church Street, Lidcombe (SGA Env.; 2011)	• The report presents a contamination assessment for the property formerly located at 5/5a Church Street Lidcombe (Lot 100 of DP 829270) situated within the southeastern part of the club car park. • This Lot was held in private ownership until c.1954 where the site was acquired by Redex who operated a workshop until c.1972. Council records indicated that Redex stored fuel and oil within a 1500gal tank in the workshop during this time. Redex divested the Lot and occupied by various charitable organisations. The Lot was subsequently acquired by Dooley's where structures on site were demolished to construct the car park. • SGA conducted intrusive investigations within this Lot to assess the significance of potential contamination from past uses. Seven boreholes (BH01 to BH07) were drilled to depths between 0.8m and 3.45mbgs, using push tube and solid flight auger techniques (refer Figure 3). • Ground conditions encountered comprised a surface layer of concrete surfacing overlying variable fill comprising Sand, gravelly Sand, gravelly Clay and Clay deposits. The thickness of fill ranged between 0.2m (BH02) and 3.45m (BH05), with the deeper fill in BH05 suspected to derive from the backfill of a former tank pit or subsurface void. Natural residual soils comprised mottled clay and silty clay overlying weathered shale and siltstone. Shale bedrock was recorded at depths between 1.6m and 3.45mbgs. Groundwater was not encountered during the investigation. • Samples collected by SGA did not report concentrations of COPC above health/ecological criteria for commercial/industrial uses, and concluded that this Lot was suitable for use as a car park.
Detailed Site Investigation (Coffey, Jan 2016)	• The report presents a contamination assessment of the club car park and residential properties located at No.s 14 to 28 Board Street, and consider the proposed club and hotel development described in Section 1.2 (in this RAP), with the inclusion of a 5-storey waterproofed basement. • A review of available records indicates the land to the north of Board Street had been used for residential purposes since the mid 20th century. The club car park had been also been used for residential uses, with the exception of 5/5a Church Street noted above. Available aerial photographs indicate that some structures had been modified. • Coffey conducted intrusive investigations across the car park and residential dwellings to assess the significance of potential contamination from past uses. The sampling locations are shown on Figure 3. • Analysis of soil and groundwater samples collected from the investigation reported

Report	Scope of Works and Report Findings and Recommendations
	concentrations of COPC below the adopted assessment criteria, with the exception of: - Lead in shallow soil surrounding building facades, which was assessed to derive from lead-based paint residues. The reported concentrations of lead exceeded health assessment criteria for a low density residential setting (current use), yet was below the criteria for a commercial setting (proposed use). - Bonded ACM observed in 26 Board Street. - Trace concentrations of TRH F1 (C6-C10 – BTEX) and xylene in groundwater samples collected from monitoring standpipes installed at BH01 and BH05. • The assessment concluded that the proposed basement excavation would remove fill materials containing lead based paint residues and bonded ACM, thereby effectively mitigating potential health risks to future users of the site. The trace hydrocarbon concentrations in groundwater were also assessed to pose a low health risk given the waterproofing proposed for the basement structure. • Coffey concluded that the site can be made suitable for the proposed development, subject to the implementation of a RAP to mitigate the health risks associated with ACM in soil, classify surplus soil to facilitate offsite disposal, and outline a strategy to manage unexpected finds of contamination.
Supplementary Contamination Investigation (Coffey, Mar 2016a)	• The report presents a contamination assessment in support of the four-storey above ground car park, situated over residential properties located at No. 4 to 12 Board Street and No. 3 to 11 Ann Street. The assessment also considers land at No. 17 Ann Street where the proposed road will be constructed to access the basement car park beneath the club. • Investigations recorded a thin layer of variable fill over residual soil comprising medium to high plasticity clay. Various anthropogenic materials including fragments of brick, tiles, glass, concrete and asphalt were observed in fill in some sampling locations. Fragments of fibre cement sheeting were also noted in no. 8 Board Street, although subsequent laboratory analysis of these fragments confirmed this material comprised Synthetic Mineral Fibre (SMF) board that did not contain asbestos. • Analysis of soil samples identified asbestos fines in samples of fill collected from HA3 and HA5 in the vicinity of existing residential structures. These materials were expected to derive from weathering of building materials within residential dwellings. Elevated concentrations of lead and zinc were also detected at concentrations exceeding ecological criteria, indicating existing topsoil/fill would be unsuitable to retain as a planting medium on site. • Coffey concluded that the site can be made suitable for the proposed development, subject to the implementation of a RAP to mitigate the health risks associated with asbestos fines in soil.

Report	Scope of Works and Report Findings and Recommendations
Limited Health Risk Screening Assessment: Groundwater Seepage at Proposed Development (Coffey, Mar 2016b)	• Reassessment of the significance of potential health risks from hydrocarbons in groundwater was recommended in response to modifications to the 5-storey, waterproofed basement structure considered within the Detailed Site Investigation (Coffey Jan 2016) to a 2-storey, drained basement. • The limited site specific health risk screening assessment was undertaken to assess the potential health risks to site users of the proposed future development where hydrocarbon impacted groundwater infiltrates into a basement or construction excavation. The assessment considered a range of receptors including construction workers, club workers and persons undertaken future maintenance works along drainage sumps. • In summary, the assessment concluded that the concentrations of hydrocarbons detected in groundwater at the site are considered to present a low and acceptable health risk for the proposed 2-storey, drained basement scenario. As such, no remedial action was considered necessary. • A copy of the Limited Health Risk Screening Assessment is provided in Appendix C.

This RAP should be read in conjunction with the above reports.

3.2. Review of Investigation Sampling, Analysis & Quality Control

3.2.1. Sampling Pattern and Density

A detailed appraisal of the site's historical uses has identified a number of potential sources of contamination within the site, which includes heterogeneous fill which appears to present as a thin layer covering large parts of the site, and localised potential sources of contamination, including the former Redex workshop located at 5/5a Church Street, and hazardous buildings materials in shallow soils adjacent to existing residential dwellings.

A review of the reports prepared by SGA Environmental and Coffey indicate that the soil sampling pattern has adopted a combination of judgemental and systematic sampling patterns, which is considered consistent with the recommendations made within the Sampling Design Guidelines (NSW EPA, 1995). With regards to the former Redex workshop, SGA Environmental established 7 sampling locations on a systematic sampling grid over an area of 0.1ha, which is consistent with the minimum recommended sampling density set out within Table A of the Sampling Design Guidelines (NSW EPA, 1995) for a potential source this size. A lower sampling density was achieved across the remainder of the existing club car park.

A total of 23 sampling locations were established within the residential properties that fall within the site between Ann Street and Board Street, which cover an area of 0.8ha. The sampling density attained within this part of the site exceeds the 19 sampling positions recommended in the Sampling Design Guidelines (NSW EPA, 1995) for an area of this size, although many of these sampling locations were positioned in accessible areas of these properties that generally target areas where building materials (e.g. ACM, lead, zinc etc.) may concentrate. It is noted that restrictions have prevented access to a number of residential properties, with the distance between sampling locations increasing to 30m in this part of the site. In consideration of the age of the dwellings present on site and the suspected presence of building material in these structures containing ACM and certain

heavy metals, it is considered possible that ACM and heavy metals may be present within topsoil/shallow fill adjacent to the façade of these dwellings.

Investigations were completed predominantly using augered boreholes. This investigation method was selected to characterise the soil and bedrock profile to inform basement design, minimise disturbance to operational car park and occupied residential dwellings, and allow installation of groundwater monitoring wells that intersect the water table. Coffey recognise that augered boreholes have limitations when characterising fill materials, as they are less conducive to allowing anthropogenic inclusions (including potential asbestos containing materials) than other investigation methods such as test pitting.

Three groundwater monitoring wells were installed across the site, with BH01 and BH03 positioned within and down hydraulic gradient of the former Redex workshop, respectively. No groundwater monitoring wells were installed within the northern part of the site, however given that this part of the site has remained is use as residential dwellings that are less likely to result in groundwater contamination, it is assessed that this does not represent a significant data gap.

Coffey considers that uncertainty associated with the presence of potentially unidentified contamination between investigation positions and limitations of the investigation methods can be addressed as part of contingency planning to manage unexpected finds of contamination during the proposed development works.

3.2.2. Reliability Assessment of Existing Data

Previous investigation programmes have adopted a range of quality control measures to assess the reliability of field and laboratory procedures, in accordance with recommendations provided within Schedule B2 of the National Environment Protection (Assessment of Site Contamination) Measure 1999 (the 'ASC NEPM') (NEPC, 2013). In summary, the reports prepared by SGA Environmental and Coffey concluded that the field and laboratory data met the Data Quality Objectives. Coffey's review of this information indicates that that the data appears generally accurate, representative and usable for the purposes of developing a RAP.

4. Conceptual Site Model

4.1. Asbestos Source Zone Characteristics

The primary sources of contamination impact at the site are considered to be:

- Fragments of bonded ACM present within surface soils observed within No. 26 Board Street.
- Asbestos fines (AF) present within surface soils collected from No.s 4 and 8 Board Street, which are likely to have derived from weathering of bonded ACM present in cladding and eves of these buildings.

In consideration of the age of the dwellings present on site, restrictions to access all areas within the site, and the suspected presence of building material in these structures containing ACM, it is considered likely that ACM and AF may be present in other properties on site, particularly in soils adjacent to the building façade, or where outbuildings have been previously demolished.

4.2. Contaminant Exposure Pathways

The primary exposure mechanisms applicable to the migration of contamination identified at the site include is the incidental inhalation of asbestos fibres.

The following transportation mechanisms are considered relevant to asbestos in fill:

- Wind-blown soils/dust containing asbestos fibres.
- Mechanical abrasion and chemical weathering of bonded ACM which may spread these materials and/or allowing asbestos fibres to become airborne.
- Vertical migration of asbestos caused by machinery pushing surface asbestos deeper into the soil profile.
- Surface water runoff may inadvertently expose fill material containing asbestos, and/or spread these materials along drainage routes.

4.3. Identification of Potential Receptors

The following potentially sensitive areas and possible receptors for the proposed site use have been considered:

- Current users of the site. These receptors are assessed to be both adult and child residents, and visitors.
- Future maintenance and construction workers involved in subsurface excavations during site redevelopment.
- Future users of the site, including both adult and child patrons of the club and hotel, and adult workers.
- Occupants of adjoining land. This includes the established residential dwellings adjoining the site, and publically accessible areas surrounding the site.

4.4. Source – Pathway – Receptor Relationships

The following paragraphs discuss the plausible pollutant linkages between the contamination sources and receptors identified in relation to the site.

4.4.1. Bonded ACM

The fragments of Bonded ACM identified by Coffey were observed to be in relatively good condition showing limited signs of excessive weathering. Bonded ACM in good condition are considered to represent a low health risk to human health.

Bonded ACM has the potential to weather (i.e. deteriorate) by way of chemical weathering and mechanical abrasion, which may result in an increased likelihood of fibres being released. Chemical weathering of cement used to bond asbestos fibres within a solid matrix can occur in acidic soils or where other chemical oxidants are present. The pH of soil within the site has not been recorded; although it is assessed soil pH is unlikely to be highly acidic given there has been no evidence of vegetation die-back or extensive bare exposed soils reported in previous assessments. Further, based on the review of historical uses of the site, the presence of other chemical oxidants is not anticipated. This suggests that soil conditions at the site are unlikely to result in significant chemical weathering and/or rapid deterioration of cement that bonds the asbestos fibres within a solid matrix.

Mechanical abrasion is associated with the breaking down of cement bonding asbestos fibres by physical forces, and could include the movement of vehicles and plant, excavation etc. These activities have the potential to degrade/deteriorate the bonding cement and increase the potential for asbestos fibres to be released. Mechanical abrasion of bonded ACM through vehicle movements for grounds maintenance, or during site redevelopment works, has the potential to pose an increased health risk to current site users, users of adjoining land and ground workers. Furthermore, such works have the potential to spread bonded ACM over a wider area (i.e. for example, inadvertent transport of fragments via excavator tracks moving across the site).

Bonded ACM in good condition is less susceptible to being spread through surface water runoff.

The substantial basement excavation proposed for the club/hotel development will effectively remove the shallow fill containing Bonded ACM, mitigating the potential risks to future site users and workers undertaking subsurface maintenance works. Bonded ACM that remains on site following the development of the above ground car park has the potential to pose potential risks to workers undertaking subsurface maintenance works in this part of the site. The hard surfacing is assessed to effectively mitigate risks to future users of the car park.

4.4.2. Asbestos Fines (AF)

AF has been identified in two samples collected from HA3 and HA5 from surface soils. AF is a friable form of asbestos, where free fibres and loose fibre bundles can become airborne, posing potential health risks to current site users, occupants in adjoining land, construction and maintenance workers involved in subsurface excavations via the inhalation pathway. AF may be present within other areas of the site. The basement excavation will effectively remove shallow fill which may contain AF. Hard pavements present across the site will effectively separate future users of the above ground car park

site, with fill containing AF. Construction earthworks and vehicle movements on site during site redevelopment has the potential to spread AF-impacted soil and increase the release of AF.

5. Remedial Strategy

5.1. Remediation Goals

The goals for the proposed remediation works are:

a) that the potential risks associated with the identified areas of unacceptable contamination have been mitigated to an acceptable level, and

b) the site is suitable for the proposed development.

5.2. Remediation Options Assessment

The following remediation options were considered for management of soil materials within the remediation area shown in Figure 4.

5.2.1. 'Do Nothing' Approach

Given that the overall remedial goal is to make the site suitable the proposed use, a 'do nothing' option is not considered to be acceptable as potentially unacceptable health risks have been identified in relation to asbestos in fill.

5.2.2. Hazard Removal and Validation

This option would comprise the removal of fill materials containing asbestos and disposal at a licensed landfill facility.

The advantages of this option include the removal of the contaminant, negating the need for on-going management of the land, as well as restrictions on future land use following remediation and validation. A substantial portion of the site will be excavated to form a basement, effectively remediating this part of the site. The disadvantages of utilising this option include increased costs and environmental impacts associated with waste transport and disposal, and importation of appropriate materials to backfill the void created by removal of contaminated fill to construction formation level (if required).

5.2.3. Isolation of Asbestos and On-site Management

The potential health risks associated with the asbestos in soils is via the inhalation pathway. Isolation of asbestos impacted soils may be achieved by a Cover Layer that separates future site users on the surface of the redeveloped site from asbestos impacted fill material below the Cover Layer. The Cover Layer may comprise landscaping, road or pavement construction materials of a specified form and thickness. On-site management could also comprise other physical barriers and associated institutional controls to restrict access to certain areas of the site.

This remedial option does not remove the hazard from the site and relies upon a Cover Layer to separate users from asbestos impacted fill. The option would require long term management of the Cover Layer to maintain its effectiveness. The benefits of this remedial option reduced environmental impacts and costs associated with waste transport and disposal, and importation of clean fill.

5.3. Preferred Remediation Option

The preferred remediation option to mitigate potential risks from asbestos-impacted fill is hazard removal and validate.

The primary factors considered during the appraisal of the options outlined above are as follows:

- Hazard removal provides improved confidence in remediation performance, programme and cost.
- Hazard removal removes the need for longer term management measures.
- The development proposal requires the removal of asbestos contaminated fill over the western portion of the site to form a two storey basement.
- The option would allow the site to be made suitable for the proposed use without the need of implementation of an environmental management plan.

5.4. Extent of Remediation Works

Based on the findings of previous investigations and site history, it is assessed that the anticipated extent of soils impacted with asbestos comprise fill materials present within residential dwellings on site situated between Board and Ann Streets. Figure 4 illustrates the anticipated extent of the remediation works.

The source of ACM in soil has been assessed to comprise the weathering or localised damage to ACM within existing building fabric, which typically results in ACM concentrating within shallow topsoil/fill. Investigation records also suggest asbestos fines are present within the initial 0.1m of soil, although it is noted that localised disturbance (e.g. gardening, maintenance activities etc.) may have mixed topsoil/ with deeper fill materials locally. On this basis, the vertical extent of remediation is provisionally proposed as 0.3m below ground surface (mbgs) to improve confidence in the removal of AF. The vertical extent of the excavation works shall be limited by the depth of fill.

Coffey consider the existing car park and Board Street represents a lower risk of encountering asbestos-impacted fill. This assessment is based on the following lines of evidence:

- Historic aerial photographs show this area of the site to have been developed with residential housing, which was removed in c. 2014. It is assessed that the formation of the car park would have resulted in the removal of shallow fill potentially containing asbestos derived from building products to construct the pavement and associated below ground services. This appears consistent with observations from bores established within the car park.
- Observations and laboratory records presented within the previous contamination investigation reports prepared by SGA Environmental and Coffey.

In consideration of the limitations of investigation techniques adopted within previous contamination assessments, it is proposed that if ACM is encountered within the existing car park and Board Street, these materials are managed as an unexpected find of contaminated and managed in accordance with the protocol presented within Section 8.

5.5. Proposed Sequence of Works

5.5.1. Preliminaries

Prior to any works commencing on the site, notifications to third parties and obtaining any licences, approvals and permits will need to be undertaken. Further information regarding notifications, licenses, approvals and permits is presented in Section 10.

A licensed asbestos assessor shall be engaged to undertake a pre-demolition survey to identify hazardous materials within the residential properties within the site that will be removed as part of the proposed development.

Asbestos presents a health risk and must be appropriately managed with specific controls based on SafeWork Codes of Practice and relevant health and safety legislation. It is recommended that a site specific Asbestos Management Plan (AMP) is developed to appropriately manage the health and safety risk of workers undertaking demolition and remediation works. In addition, an Asbestos Removal Control Plan will be required for removal of friable asbestos (as found in the soils). This is prepared by the Class A licensed asbestos removal contractor.

Prior to the implementation of the proposed remediation works, an unexpected finds protocol (UFP) will be prepared by the parties implementing the demolition and remediation works. The UFP should be implemented during the remediation and construction / development works and should include a protocol for managing other finds of asbestos and other contamination. It is noted that the UFP should be reviewed following the completion of the remediation works to ensure that it remains relevant to the construction/site redevelopment works proposed. Some considerations in relation to an UFP are presented in Section 8.

5.5.2. Site Establishment

It is anticipated that remedial works would commence following the demolition/removal of existing structures, as part of other site redevelopment works.

Site establishment will include:

- Work area fencing, warning signage and temporary site facilities.
- Occupational health and safety controls (as required by the AMP).
- Environmental monitoring and controls.
- Preparing stockpiling areas.
- Vehicular haul roads and transit routes onto and off the site.
- Location, isolation, relocation, protection and/or termination of services potentially affected by the remediation works, if any.
- Establishing contingency planning and controls to address unexpected finds.

5.5.3. Demolition of Existing Residential Dwellings

A licensed asbestos removalist will be engaged to manage the removal of ACM identified within the pre-demolition survey prior to demolition. Demolition should only occur once formal clearance has been issued by the licensed asbestos removalist so as to minimise the potential for ACM to be spread across the site.

5.5.4. Excavation of Asbestos Impacted Fill

Fill materials present within the remediation area shall be excavated to a depth of 0.3mbgs and stockpiled separately from the underlying soils. The excavation shall be monitored by a Licensed Asbestos Assessor to closely observe the presence of visible ACM, and guide the segregation of shallow fill materials. The remediation excavation shall be limited by the depth of fill.

The depth of the excavation shall be terminated at the interface of fill and natural soils, if encountered within the initial 0.3mbgs.

5.6. Roles and Responsibilities

The key responsibilities for personnel in relation to remediation and validation activities are summarised in Table 5.1.

Table 5.1: Roles and Responsibilities in relation to this RAP

Personnel	Responsibilities
Principal Contractor	• Facilitate the implementation of this RAP. • Provision of safe working environment in relation to contamination. • Provide an appropriate induction for all persons working on this site, and check that personnel have undertaken appropriate occupational health and safety training relevant to their role on this project. • Ensure that all persons working in the asbestos management areas have been provided appropriate occupational health and safety training in relation to asbestos, asbestos awareness training and training in the identification of ACM. • Keep the training and induction records relevant to this RAP for persons involved in this project. • Ensure that a site specific site safety plan is prepared for the site, which should cover contamination at the site. • Ensure that any subcontractors provide adequate Safe Work Method Statement (SWMS), which should cover contamination at the site. • Monitor the compliance with this RAP, and other relevant regulations, standards and codes related to contamination. • Control access into area where contamination is identified. • Be responsible for the contamination issues within the project at all times until work completed. • Maintain the Unexpected Finds register for this project. • Manage accident and emergency procedures related to contamination. • Manage workplace injury management and rehabilitation, in relation to contamination. • Inform the environmental consultant/asbestos assessor of all unexpected finds. • Maintain material tracking records relating to the excavation, stockpiling and disposal of waste material, as well as importation of materials to site and make this available to environmental consultant/asbestos assessor following completion of the project. • Compliance with all other applicable statutory responsibilities related to management of asbestos in the workplace.
Subcontractor(s) or their Supervisor(s)	• Comply with this RAP. • Understand the requirements of this RAP.

Personnel	Responsibilities
	• Prepare SWMS, as required by the Principal Contractor, for specific activities undertaken within the project where contamination may be encountered. • Take reasonable care for their own safety and the safety of others, with respect to contamination. • Attend site induction contamination awareness training and identification of contamination, follow all site rules and work instructions. • Take immediate action to rectify contamination hazards that should arise during the course of the work. • Immediately report unexpected finds of contamination to site supervisor or Principal Contractor. • Compliance with all other applicable statutory responsibilities related to management of contamination in the workplace.
Environmental Consultant	• Provision of safe working environment with respect to contamination. • Issue this RAP and coordinate works to review/update the RAP, as necessary. • Provide onsite supervision of all potential contamination works. • Engage suitably qualified and competent staff and/or contractors to manage works in areas impacted with contamination. • Provide advice on handling, management and treatment of potentially contaminated material. • Provide validation of excavation, waste classification and other advice in relation to contamination. • Other activities related to contamination that may be required by the Principal Contractor from time to time.
Licensed Asbestos Assessor	• Understand the requirements of and comply with this RAP. • Preparation of an AMP; • Undertake role in accordance with all requirements of Safe Work NSW. • Undertake asbestos air monitoring in accordance with regulatory requirements. • Undertake all activities in accordance with the Safe Work NSW regulatory requirements. • Other activities related to asbestos remediation that may be required by the Principal Contractor.
Licensed Asbestos Removalist	• Understand the requirements of and comply with this RAP. • Undertake role in accordance with all requirements of Safe Work NSW. • Preparation of an Asbestos Removal Control Plan (ARCP) (based on AMP requirements); • Undertake all activities in accordance with the Safe Work NSW regulatory requirements. • Other activities related to asbestos remediation that may be required by the Principal Contractor.

6. Validation Plan

6.1. Validation Objective

The intent of the soil validation works is to collect suitable and adequate data to assess whether the remediation objectives have been achieved.

6.2. Validation Strategy

The source of asbestos derives from building products from residential dwellings and outhouses/sheds currently on site, or structures that were historically demolished on site. Available records for the site indicate the predominant form of asbestos in fill comprises bonded ACM in surface/shallow soils. Asbestos Fines (AF) has been encountered in two of 23 sampling locations positioned in areas surrounding the dwellings/outhouses present on site.

Schedule B2 of the ASC NEPM (NEPC, 2013) states that '*for sites contaminated with bonded ACM only (i.e. no insulation materials or other non-bonded asbestos products), assessment for free fibres is only warranted where greater than 10% of the total bonded ACM is significantly damaged i.e. present as small pieces less than 7 mm x 7 mm or can be crushed/crumbled with hand pressure.*'. On this basis, it is proposed that visual validation of the remediation area will be used as the primary line of evidence to demonstrate ACM has been removed from the remediation area.

The visual validation process should record the following information, referenced to a site inspection plan and/or site grid reference:

- The presence/absence of bonded ACM.
- Where encountered, the nature and condition of bonded ACM fragments (e.g. signs of weathering, angularity etc.)
- The size of fragments observed. Where several fragments are encountered in a particular area, the range of fragment dimensions should be recorded.
- Description of affected fill unit.
- Location, depth and sample reference of samples taken.
- Location/direction of photographs.
- Details of equipment/machinery used (e.g. sieve sizes, rake teeth length, tilling rotor blade size, excavator etc.)

Where identified, hand picking shall be employed to remove bonded ACM. The hand picking events shall be undertaken by a Licensed Asbestos Assessor or competent environmental consultant. Hand picking shall comprise at least two events (or passes), enhanced with raking or mechanical tilling. If after two events, no visible bonded ACM fragments are found, then that area can be considered effectively free of asbestos fragments

Validation sampling of the remedial excavation will used as a secondary line of evidence, depending on the following:

- The excavation extent and depth;

- If the excavation is terminated within fill material;
- If the excavation is terminated within natural soils.

Upon completion of excavation works, if excavation walls and base are within natural soils, a visual inspection of the walls and base should be undertaken by a licensed asbestos assessor. If ACM is identified, further localised excavation and validation sampling may be required.

If the excavation walls and base are terminated within fill material, soil validation samples will be collected from the excavations. The frequency of validation sampling will be carried out in general accordance with the 'Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia' (WA DOH, 2009) and be determined in consideration of:

- Observations made during the walkover survey, particularly where bonded ACM is encountered at the base/wall of the remediation excavation that shows significant signs of weathering or damage.
- The depth of disturbance caused by the demolition activities, particularly where demolition plant has reworked topsoil/shallow fill potentially containing AF with deeper fill materials.
- Previous investigation records where FA was identified.

6.3. Remediation Criteria

6.3.1. Remediation Criteria for Bonded ACM (Fragments)

The proposed remediation criterion for bonded ACM is 'no visible asbestos for surface soil' as set out within Schedule B1 of the ASC NEPM (NEPC, 2013).

6.3.2. Asbestos Remediation Criteria for Friable Asbestos

The screening level of 0.001%w/w set out within Schedule B1 of the ASC NEPM (NEPC, 2013) is adopted as the remediation criteria for friable forms of asbestos (i.e. AF and FA).

Assessment may utilise trenching or test pits to expose the soils at validation sampling locations. At each sampling location, a 0.5L sample of fill from the base or wall of the excavation will be collected for analysis of asbestos fines by the method described in AS 4964-2004. This procedure is consistent with that described in Section 11.3.2 in Schedule B2 of the ASC NEPM (NEPC, 2013).

6.4. Imported Fill Criteria

The proposed development is unlikely to require significant quantities of fill material, if any. Where imported fill material is required to supplement site derived materials, materials imported to site must be either:

- Virgin Excavated Natural Material (VENM),
- Excavated Natural Material (ENM) and subject to the specific requirements stipulated within the Excavated Natural Material Exemption (NSW OEH, 2012), or
- Similar material certified in accordance with an exemption issued by the NSW EPA.

Prior to importing material to site, the following fill sampling plan will be implemented:

- A visual inspection of the source site and the proposed fill material (must be exposed); and

- Collection and laboratory analysis of the minimum number of samples of the fill material per source, as required by the Schedule B2 of the ASC NEPM (NEPC, 2013) or Excavated Natural Material Exemption (NSW OEH, 2012), whichever is greater.

Subject to receipt of adequate VENM certification documentation from the appointed contractor, the validation consultant will advise the BCA or their appointed contractor of the suitability of the material (from a contamination perspective) for importation to the site.

Where ENM is imported to site as fill the Generator must provide a written statement of compliance that this material complies with relevant conditions of the ENM general exemption, and shall provide a copy of the relevant sampling plan and test results for the imported ENM.

The source site, volume, associated chemical test certificates and placement locations of the imported fill material will be tracked by the appointed contractor. These records will be presented within the Validation Report.

It is noted that other non-contamination related criteria may also need to be met (e.g. engineering or geotechnical requirements) although such issues are considered beyond the scope of this document.

6.5. Re-use of Site Won Fill Material On-site

Fill materials excavated from the remediation area shall not be reused as fill elsewhere on site.

If excavated natural material is considered for re-use on any part of the site, then these materials will be assessed to demonstrate that they are suitable for use within the site. This assessment should consider the presence of chemical and aesthetic characteristics of the materials taking account of the historic land uses and available data presented within previous investigation reports (Coffey, Jan 2016; Mar 2016a).

7. Quality Assurance / Quality Control

7.1. Data Quality Objectives

Validation of remediation will be undertaken in accordance with a Sampling, Analytical and Quality Plan (SAQP). The approach to developing the SAQP is presented below, which have been developed generally in accordance with the Data Quality Objectives outlined in Schedule B2 of the ASC NEPM (2013).

Table 7.1: Summary of Data Quality Objectives

Data Quality Objective	Outcome
State the Problem	The overall objective is to assess if the remediation areas has been made suitable for the proposed uses in relation to asbestos. The main problems are: • What areas require remediation? • How should site soils be validated? • What validation sampling density should be used? • What contaminants should be analysed for, in relation to imported fill?
Identify the Decision	Is the data suitable for assessing whether the asbestos impacts have been remediated? Are the remediation areas suitable for the proposed land uses in relation to asbestos?
Identify Inputs to the Decision	The inputs to the decisions are: • Current understanding of site's current and historical uses. • Results and findings of previous investigations and assessments. • The remediation acceptance criteria. • Data collected during remediation and validation works, including field measurements, observations, laboratory results and survey records. • Outcome of quality assessment of relevant data. • Applicable regulatory guidelines.
Define the Study Boundaries	The lateral boundary of the remediation area is shown on Figure 4. Records indicate that the majority of asbestos impact recorded to date is within surface soils, however given the uncertainty associated with the distribution of asbestos in soil, the suggested vertical study boundary is 0.3mbgs or the base of fill materials within the site, whichever occurs first.

Data Quality Objective	Outcome
Develop a Decision Rule	The decision rules for the project will be as follows: If after two events, no visible bonded ACM fragments are found at the base of the excavation, then that area can be considered effectively free of asbestos fragments. If evidence of significant AF or FA is encountered during the remediation works, sampling and analysis for AF or FA will be undertaken to demonstrate FA and AF are below the adopted validation criteria of 0.001%.
Specify Limits on Decision Errors	The confidence in reliability of visual validation methods (e.g. field observations made during hand picking/tilling events or excavation) will be based on appropriate levels of qualification and experience in the personnel undertaking the relevant validation task. Sampling procedures and laboratory analytical methods shall be selected to enable analysis with a practical quantification limit equal to 0.001% (w/w), where this is possible. Coffey note however that the selected analytical laboratory may not achieve a practical quantification limit equal to or less than 0.001%. However, results will be reported in accordance with Australian Standard AS4964 (2004). WA DoH 'Recommended Procedures for Laboratory Analysis of Asbestos in Soil' (June 2011) provide additional guidance on laboratory analysis which 'in some circumstances, the WA DoH considers it will be possible to measure asbestos contamination at or lower than 0.001% w/w … however, it is not practical to give a general quantitative estimate of the level of improvement as this will be variable and may not be feasible at all.'
Optimise the Design for Obtaining Data	Validation will be undertaken in accordance with the validation plan outlined within Section 6, over the remediation area shown in Figure 4.

7.2. Fieldwork QA/QC

In accordance with Schedule B2 of the ASC NEPM (NEPC, 2013), the following DQIs will be assessed for both field and laboratory procedures:

- Completeness
- Comparability
- Representativeness
- Precision
- Accuracy (bias)

It is noted that the validation plan presented in Section 6 is based predominantly on visual observations in the field with minimal laboratory analysis required. Hence many of the laboratory considerations outlined in Guidelines for the NSW Site Auditor Scheme (NSW DEC; 2006) are

unlikely to be, or will have limited relevance to the validation of asbestos remediation proposed within the site.

In relation to the field considerations, an important element of the proposed field QA/QC is the works being undertaken under the presence of an experienced Licensed Asbestos Assessor or competent environmental consultant who will also conduct the walk over and visual observations for asbestos fragments.

The following procedures will be used as a guide in undertaking sampling to validate aspects of the proposed remediation works. These procedures are based on the recommendations presented within AS 4482 (2005): *Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soils* (Australian Standard; Parts 1 and 2).

7.2.1. Preparation

Sampling equipment required for fieldwork will include the following (where appropriate):

- notebook/indelible marker pens;
- sampling trowel or shovel;
- 7mm sieve and plastic sheeting in a colour contrasting with soils within the site.
- deionised or distilled water and Decon 90 detergent to decontaminate non-disposable sampling equipment.
- decontamination buckets
- laboratory prepared sample containers appropriate to the analysis requested.
- insulated containers and ice;
- disposable latex gloves;
- personal protective equipment (PPE); and
- camera, GPS and field tape.

7.2.2. Soil Sampling, Preservation and Storage Procedure

Samples will be collected using a decontaminated trowel, shovel or scooped directly into the laboratory prepared container using a new pair of nitrile gloves. Samples proposed for asbestos analysis will be placed into a separate zip lock bags, or laboratory supplied bulk bags and sealed using an elastic band or tape.

Where soil sample are collected for chemical analysis (e.g. waste classification, validation of imported fill etc.), representative samples shall be lightly packed into glass container with headspace minimised to avoid the loss of volatiles. The glass sample container will be sealed using a Teflon-lined lid.

The sample containers will be labelled with a project number, sample location, sample depth (where applicable) and date the sample was collected.

Sample storage and preservation will be undertaken in accordance with Table 7.2.

Table 7.2: Soil Sample Preservation and Storage

Analyte	Sample Volume and Container Type	Sample Container Preservative	Storage / Transport
Forms of Asbestos	Double zip lock bag (Grab Samples for fragments of bonded ACM) 1 x 500mL plastic bulk bag (Sample for asbestos fines analysis)	None	Air tight and labelled for asbestos analysis No special requirements
Chemical Parameters	1 x 250ml glass & Teflon lined lid	None	Minimal headspace Attempt to cool to 4˚C

7.2.3. Decontamination Procedures

Non-disposable sampling equipment coming into in contact with soils will be decontaminated before and between sampling events to minimise the possibility of cross contamination between samples and minimise the risk of impacting sample integrity. The decontamination process will include the following procedure:

- removal of soil residue from the equipment with a clean plastic brush in potable water;
- washing the equipment in a solution of Decon 90 (or similar) detergent and potable water; and
- rinsing the equipment in potable water.

7.2.4. Storage and Transport Procedures

The sample containers will be transported to the NATA accredited analytical laboratory with the Chain of Custody form recording the following information:

- project reference;
- date of sampling;
- sample identifications;
- matrix and container details;
- preservation methods (if any);
- name of sampler;
- required analysis;
- turnaround times required; and
- signatures of sender and receiving laboratory.

A copy of the Chain of Custody record will be kept in the project file. Samples will be transported to the laboratory with sufficient time to perform analysis within the applicable recommended holding period.

7.2.5. Quality Control Samples

Due to the random distribution of asbestos in soils, it is not proposed to collect and analyse blind duplicate samples for analysis.

The following QA/QC samples shall be collected for sampling events where chemical analysis is required[1]:

- Intra-laboratory and Inter-laboratory duplicates samples should be collected at a rate of one sample per twenty primary samples collected for chemical analysis (5%). The analytical results of the two spilt samples will be compared to assess the precision of the sampling protocol and to provide an indication of variation in the sample source and accuracy of the primary laboratory.
- Rinsate samples will be on a 'spot check' frequency to check the efficiency of field procedures used to decontaminate non-disposable sampling equipment.

Based on previous investigation results, volatile petroleum hydrocarbon are not a contaminant of concern and therefore trip spike and trip blank samples will not be carried into the field.

Data Quality Indicators that will be adopted for quality control samples are presented in Table 7.3

Table 7.3: Data Quality Indicators for Quality Control Samples

Type of Quality Control Sample	Control Limit – Chemical Analysis
Duplicate Samples	RPD within 30% and 50%for inorganic and organic analytes respectively. Where the reported soil concentration is less than 10 times LOR, no limit applies.
Rinsate Samples	Analytes not detected.

7.3. Laboratory QA/QC

7.3.1. Laboratory Selection

The primary and secondary laboratories selected for this project will hold NATA-accredited methods for the analyses to be undertaken. Laboratory Quality Control would include the following:

- the laboratory analysis of samples will be undertaken by a laboratory holding NATA accredited analytical methods.
- the NATA accredited environmental testing laboratory will implement a quality control plan conforming to Schedule B3 Guideline for Analysis of Potentially Contaminated Soils of the ASC NEPM (NEPC, 2013);

[1] Duplicate, triplicates and rinsate blanks are not required for asbestos assessment and these will only apply where fill is imported to site, or surplus soil is subject to wastes classification for off site disposal.

- where appropriate, the laboratory will include reagent blanks, spike samples, duplicate spikes, matrix spikes, and surrogates spikes and duplicates to assess the laboratory quality control.

7.3.2. Data Assessment

The laboratory quality control data shall be assessed as appropriate:

- checking that the reporting limits and procedures are satisfactory;

For samples subject to chemical analysis:

- checking that the samples are analysed within holding times;
- checking that laboratory blanks / reagent blanks are less than the laboratory reporting limits;
- checking the reproducibility of samples by calculating the Relative Percentage Differences (RPDs) between primary and duplicate laboratory samples submitted for chemical analysis; and
- checking that spikes, surrogate spikes, matrix spikes and duplicate matrix spike recoveries are within acceptable control limits.

8. Data Gaps, Uncertainties & Contingency Planning

8.1. Data Gaps & Uncertainties

The site has been subject to several phases of investigations and assessments to characterise historic site uses, and the contamination status of the site. Following the review of the available site history information and investigation data, the following potential data gaps and uncertainties have been identified:

- The presence of potentially unidentified contamination between investigation positions, or in areas where limited investigation data is currently available, or constraints have prevented access for appropriate assessment.
- Limitations associated with the investigation methods employed during previous investigations.
- Potential for additional asbestos impacted soils in subsurface soils.

The above data gaps and uncertainties have been used to develop the Unexpected Finds Protocol presented in the following Sections.

8.2. Unexpected Finds Contingency Plan

An unexpected finds protocol must be prepared for the site by a competent environmental consultant prior to the commencement of the site redevelopment works. The following presents a discussion regarding the management of unexpected finds.

8.2.1. Management of Unexpected Finds

Should unexpected contamination or aesthetically unacceptable material be encountered onsite as assessed by the licensed asbestos assessor or environmental consultant monitoring the remediation activities, works will stop in the affected part of the site. This area will be isolated to minimise potential for disturbance. BCA and their sub-contractors on site will be notified of the unexpected find.

Due to the potential variability in both the nature and extent of an unexpected find, it is not considered reasonable to define specific remedial strategies for contamination associated with the unexpected find. However, it is considered reasonable to follow the preferred method for remediation option assessment, similar to that discussed in Section 5.2.

If wastes are likely to be generated as a result of managing unexpected finds, a methodology for waste classification is presented in Section 11.

8.2.2. Training and Induction of Personnel

Personnel involved in earthworks on site are to be inducted on the identification of potential unexpected finds and asbestos awareness. The induction can be undertaken at the time of general site induction and refreshed periodically at toolbox meetings.

Induction to provide awareness of all types of possible unexpected finds is not practicable. In general, a precautionary approach will be employed and the unexpected finds procedure outlined in the following section will be implemented.

Additionally, it is noted that some forms of potential contamination may not be associated with any visual or olfactory indications in the field. The unexpected finds procedure will not provide protection against such impacts.

8.2.3. Unexpected Finds Procedure

Should an unexpected actual or suspected contamination be encountered during the remediation or site redevelopment works, the following procedure applies:

1. Stop work in the potentially hazardous area as soon as it is safe to do so and move to the upwind side of the area, or away from the area.
2. Assess the potential immediate risk to human health posed by the unexpected find and assess if evacuation or emergency services need to be contacted.
3. Delineate an exclusion zone around the affected area using fencing and/or appropriate barriers and signage. Additional control measures may be required for odours and/or volatile compounds.
4. Contact the appointed licensed asbestos assessor/environmental consultant for advice and request a site visit to undertake an assessment of the unexpected find.
5. The licensed asbestos assessor/environmental consultant will assess the unexpected find and provide advice regarding:
    a) Preliminary assessment of the contamination and need for immediate management controls;
    b) What further assessment and/or remediation works are required and how such works are to be undertaken in accordance with contaminated site regulations and guidelines;
    c) Preparation of an addendum to the remediation action plan (if necessary) or provide clean up advice;
    d) Remediation works required (where applicable);
    e) Validation works required following remediation works (if applicable).
6. Works are not to recommence in the affected area until appropriate advice has been obtained from the environmental consultant.
7. If it is deemed safe to do so by the Principal Contractor or appointed Subcontractor, works may resume in the affected area.

8.2.4. Potential Unexpected Finds

Based on findings of previous investigations and site history, potential unexpected finds which could reasonably be expected within the site are summarised in Table 8.1.

Table 8.1: Summary of Non-specific Unexpected Finds

Potential Unexpected Find	Observed Characteristic	Key Contaminant of Concern
Buried dry waste materials	May include a variety of waste materials including wood, plastic, metal fragments, building rubble (e.g. concrete, brick, asphalt, cement fibre sheeting containing asbestos etc.).	Heavy metals, TPH, PAH, forms of asbestos
Ash deposits	Ash may be present in areas surrounding the existing residential houses. Ash deposits are typically light weight, grade in colour from grey-white to black, and varying in size from say 1mm to 10mm particles (e.g. consistent with coarse sand to fine grained gravels).	PAH, heavy metals
Structures or conduits containing deleterious materials	Could be identified as follows: • A buried tank or former process pipelines; particular in the southern area of the site (i.e. 5/5a Church Street) where a former vehicle workshop operated; • Deeper sand fill sometimes with stained or odorous characteristics; • Presence of small concrete footings surrounding by odorous or visually impacted soils and/or groundwater.	TPH, BTEX, PAH, lead, VOC
Hydrocarbon Compounds	May be identified by a hydrocarbon odour which may vary in strength from weak (just detectable) to very strong (easily detectable at a distance from the source). The odour may or may not be accompanied by specific areas of dark staining (black-grey) or larger scale discolouration of strata from a previously identified 'natural colour' (e.g. brown-dark brown fill, or brown red mottled residual clay) May also be visible as a distinct coloured sheen on water within an excavation.	TPH, BTEX, PAH, lead, VOC

9. Site Management for Remediation Works

9.1. Access Control

Coffey understands that access to the site will be restricted to authorised contractors who have been inducted and appropriately trained for the works being undertaken. A fence or hoarding will be installed and maintained around the perimeter of the site.

Signage will be erected near the access gate to the site that details for BCA and their appointed sub-contractor undertaking the demolition and earthworks.

Excavation and other equipment will be transported to the area in accordance with standard regulatory requirements. The need for traffic controls will be assessed based on the number of truck movements, proximity of excavation to public roads and in consultation with the relevant authorities.

9.2. Fill/Soil Management

Remediation excavation works will take place after the demolition of the existing dwellings/outhouses, and in advance of the preparation works required to develop the site. Asbestos removal and associated validation works shall be undertaken in a staged manner to minimise the potential for cross contaminating areas that have been previously been validated.

Measures will be in place to reduce opportunities for soil to leave remediation areas as a result of vehicle, plant and equipment movements. To limit the potential for tracking of soil beyond the extent of the remediation area:

- vehicles, plant and equipment on the site will be kept to a practical minimum;
- vehicles, plant and equipment entry to and exit from the remediation areas will be kept to a practical minimum; and
- vehicles, plant and equipment will be washed down before it leaves the remediation area.

Stockpiles generated as part of the remediation works shall be handled to ensure that fill materials excavated from the site are properly tracked and classified appropriately and minimise the potential for different classes of waste to be mixed. Stockpiles will contain asbestos and require appropriate management in accordance with AMP.

Soils that are stockpiled for assessment will be placed on a reasonably robust barrier to minimise cross-contaminating soils below the stockpile. Stockpiles potentially containing forms of asbestos shall be covered and stockpiled separate to other materials.

Stockpiles will not be placed near the site boundary, footpaths, roadways, gutters or storm water pits.

Stockpiles will be positioned and formed to minimise potential for stockpile erosion where possible.

The height of stockpiles shall not significantly exceed the height of site boundary hoarding to minimise dust generation from the site.

9.3. Noise Controls

Noise producing machinery and equipment will only be operated during working hours as approved by local Council and/or NSW OEH. Australian Standard *AS2436-1981 Guide to noise control on*

construction, maintenance and demolition sites outlines guidelines for the minimisation of noise on construction and demolition sites and these will be followed at all times.

No 'offensive noise' as defined under the *Protection of the Environment Operations Act 1997* should be created during remediation works/activities.

Mechanical plant, equipment and the like used during remediation works/activities will use practical and reasonable noise attenuating devices and measures to minimise noise being transmitted from the site. All equipment and machinery must be properly maintained and operated in an efficient manner to minimise the emission of noise.

9.4. Dust Control

Specific control and monitoring measures for managing dust on an asbestos impacted site are outlined in an AMP and are in addition to the generic measures listed below. These measures include but not limited to, air monitoring undertaken by an occupational hygienist and dust suppression by licenced asbestos removalist.

In general, site activities will be managed to minimise the generation of dust and the movement of dust off the site. The following strategies will be implemented to minimise dust generation and dust movement:

- wetting down of dry soils during raking, tilling, excavation and loading;
- covering loads during transportation;
- application of shade cloth or similar to perimeter fencing;
- limiting excavation and loading activities during high winds;
- wetting down stockpiles and/or covering with plastic sheeting/geofabric; and
- maintaining stockpile heights below the heights of perimeter fencing.

9.5. Water Management

Water management is not anticipated to form a significant part of the proposed remediation or construction earthworks. Notwithstanding this, the contractor should implement controls to divert surface water away from stockpiles, cleared areas and open excavations formed as part of the remediation and subsequent site redevelopment works.

9.6. Hours of Operation

The actual hours of operations will be determined by development consent conditions. Typically, works will be allowed during the following hours:

- Monday – Friday 0700hrs – 1800hrs
- Saturday 0800hrs – 1300hrs
- Sunday & Public Holidays No work undertaken

9.7. Communication & Complaints

The communication procedures developed as part proposed redevelopment of the site shall include appropriate provision inform stakeholders on the type and extent of contamination identified within the site. Guidance provided within Schedule B8 of the ASC NEPM (NEPC, 2013) may be used to refine existing procedures to appropriately engage with members of the community, including users of the club and residents adjoining the site.

Communication and complaints received for the site will be reported to appointed contractor and/or BCA representative. All communications and complaints will be assessed and an appropriate response, corrective and/or preventative action implemented (as necessary).

A communication and complaints register will be operated on site to ensure that concerns of local residences and businesses are recorded and addressed.

9.8. Emergency Preparedness and Response

BCA or their contractor appointed to undertake the remediation works shall prepare plans to respond to incidents and emergencies (e.g. fires, spills or other uncontrolled releases) in advance of commencing the works. This should include procedures to inform workers within the site and site visitors users during site inductions.

10. Regulatory, Notification, Licence and Approval Requirements

10.1. Regulatory

The remediation works will be undertaken in accordance with, but not limited to, all relevant sections of:

- Work Health and Safety Act 2011;
- Work Health and Safety Regulations 2011;
- Protection of the Environment Operations Act 1997 and associated Regulations;
- Contaminated Land Management Act 1997;
- State Environmental Planning Policy No 55 Remediation of Land and associated planning guidelines entitled Managing Land Contamination (DUAP/EPA, 1998).

Relevant guidelines made or approved by the NSW EPA under Section 105 of the Contaminated Land Management Act 1997 including:

- NEPC (2013) National Environment Protection (Assessment of Site Contamination) Amendment Measure (ASC NEPM) (No. 1) 1999, as registered 2013, and associated Schedule B guidelines.
- NSW EPA (2014) 'Waste Classification Guidelines'
- NSW DEC (2006); 'Guidelines for the NSW Site Auditor Scheme' (2nd edition)
- NSW OEH (2011); 'Guidelines for Consultants Reporting on Contaminated Sites'
- NSW WorkCover (2014); 'Managing Asbestos in or on Soil'
- NSW EPA (2015); 'Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997

This RAP has been prepared having regard to the above regulations and guidance documentation.

10.2. Planning Consent

Coffey understands that site redevelopment works and the associated remediation works will be implemented in accordance with the development consent for the scheme. Details of the consent were not available for consideration as this documented was being prepared.

10.3. Licences, Approvals and Permits

All parties involved in the remedial works will ensure that they hold all relevant licences, approvals and permits for demolition activities, excavation activities and transport of wastes. This may include, but not be limited to:

- NSW Department of Fair Trading Contractor Licence

- Asbestos removal contractor licence. Coffey notes that only Class A asbestos removal licence holders may conduct works with friable forms of asbestos. Notification to Safe Work NSW (formerly WorkCover NSW) five days before asbestos removal work is commenced.

11. Waste Classification

11.1. Waste Classification Criteria

The waste material generated as part of the remediation and site redevelopment works will be assessed in accordance with Waste Classification Guidelines (NSW EPA, 2014).

11.2. Waste Classification Procedure

The preference for soil sampling for waste classification purposes will be via sampling of a stockpile. The material will be assessed by a suitably qualified environmental consultant prior to removal and disposal offsite. This assessment will include:

- inspection of the stockpiled material, or review of a relevant photographic record; and
- collection and laboratory analysis of spatially representative samples of the soil material.

It is recommended that samples are collected at a rate of 1 sample per 25m^3 as per the guidance provided in Schedule B2 of the ASC NEPM (NEPC 2013). It is noted that this sampling frequency is for general waste classification of smaller stockpiles (i.e. <250m^3). The sampling frequency and analytical schedule may need to be adjusted on a 'case by case' basis by the environmental consultant, depending on factors such as:

- the volume of the material;
- the homogeneity of the material;
- investigation and laboratory analytical records relating to the material; and
- the visual assessment of the material.

Samples collected of waste soil will be analysed for a broad range of COPC consistent with the site history and informed by data presented within previous contamination assessment reports (refer Section 1.5).

Samples will be collected using hand tools and/or mechanical excavation where a significant volume of soil is present within the stockpile being assessed.

Where sampling of stockpiled soil material is not practical or feasible, sampling of in-situ material would be used. The sampling plan would be designed in consideration of the recommendations made within the Sampling Design Guidelines (NSW EPA, 1995) so to gather sufficient evidence and collect samples for chemical characterisation that is representative of the waste materials being classified. Where in-situ classification is used, excavation of the material will be observed to confirm that the materials are reasonably consistent with those assessed for the in-situ waste classification.

11.3. Waste Classification Reporting

The environmental consultant will prepare a letter, advising the classification of the waste. These reports will be provided within the Validation Report.

11.4. Waste Tracking

The source location, volume, classification and destination of waste material removed from site will be tracked by the appointed contractor. The contractor shall maintain a materials tracking register along with consignment dockets confirming receipt of the material at the disposal facility. These records shall be presented within the Validation report.

Additionally, for any asbestos or asbestos containing material the Protection of the Environment Operations (POEO) (Waste) Regulation 2014 requires tracking of all loads of asbestos greater than 100 kilograms, or 10 square metres within NSW. The POEO (Waste) Regulation 2014 requires the transport of asbestos in NSW to be recorded from the place of generation to its final destination using the NSW EPA's new online "WasteLocate" system.

12. Validation Reporting

12.1. Validation Report

The validation report aims to provide an independent verification that remedial goals associated with site works have been met and the site is suitable for its ongoing or future uses. The validation report should be prepared by a suitably qualified and experienced environmental consultant.

At the completion of remediation and validation works, a validation report will be prepared in general accordance with the relevant sections of NSW EPA Guidelines for Consultants Reporting on Contaminated Sites (NSW OEH, 2011) and other relevant guidance documentation.

The validation report will include:

- Executive Summary
- Scope of Work
- Site Identification
- Summary of Site History
- Summary of Site Condition and Surrounding Environment
- Summary of Geology and Hydrogeology
- Remediation Activities Undertaken (including extent and observations of excavation/s, waste documentation and imported fill documentation)
- Validation Sampling and Analysis Plan (including Methodology)
- Field QA / QC
- Laboratory QA / QC, where applicable
- QA / QC Data Evaluation
- Basis for Validation Criteria
- Validation Sampling Results (including sample descriptions)
- Site Characterisation
- Ongoing Site Management Requirements, if any
- Conclusions and Recommendations

Validation reporting may be undertaken in a phased manner to align with the remediation and site redevelopment activities to support the phased occupation of the site.

13. Summary and Conclusions

The site is located within the suburb of Lidcombe, and includes an existing club car park located at the corner of Church Street and Olympic Drive, the western part of Board Street, and existing residential dwellings located at No. 4 to 28 Board Street, and No. 3 to 11 and 17 Ann Street.

Bouygues, on behalf of Dooley's Catholic Club, intends to lodge a Development Application to redevelop the site for a multi-level club and hotel development with two-storey basement, and an above ground multi-storey car park. Section 1.2 and drawings provided in Appendix A provide further detail of the proposed development.

The site has been subject to several phases of investigation and assessment to characterise historical uses of the site and surrounding land, and the contamination status of the site. These investigations concluded that asbestos identified in topsoil/shallow fill surrounding the existing residential dwellings on site requires remediation to make the site suitable for the proposed development in accordance with SEPP55. Coffey considers that investigations carried out to date are adequate for preparation of this RAP.

This RAP outlines a strategy to mitigate health risks associated with asbestos in soil and thereby mitigate potentially unacceptable risks. This RAP also presents a strategy to manage unexpected finds of contamination that may be encountered during construction. Recommendations are made for the development of Asbestos Management Plan and Asbestos Removal Control Plan prior to implementation of the development

If the remediation is carried out in accordance with this RAP using the preferred remedial option, then Coffey concludes the site should be made suitable for the proposed development.

The reader should refer to the 'Important Information about Your Coffey Environmental Report' which follows References.

References

- Australian Standard AS 4482 (2005): *Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soils* (Parts 1 and 2).
- Australian Standard AS 4964 (2004); *Method for the qualitative identification of asbestos in bulk samples*
- Coffey (Jan 2016); *Detailed Site Investigation – Dooley's Catholic Club and Hotel Development, Olympic Drive, Lidcombe NSW* (Ref: GEOTLCOV25554AA-AB)
- Coffey (Mar 2016a); *Supplementary Contamination Investigation - Multilevel Aboveground Car Park, Board Street, Lidcombe* (Ref: GEOTLCOV25554AA-AH)
- Coffey (Mar 2016b); *Limited Health Risk Screening Assessment: Groundwater Seepage at Proposed Development, Olympic Drive, Lidcombe, Sydney, NSW* (Ref: GEOTLCOV25554AA-AI)
- Coffey (Apr 2016); *Dooley's Lidcombe Catholic Club Redevelopment: Groundwater Assessment* (Ref: GEOTLCOV25554AA-AK)
- Geological Survey of New South Wales (1983); *Geological Series Sheet 9130 - Sydney* (1st Edition; Scale 1:100 000)
- NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure* (No. 1) 1999, as registered 2013, and associated Schedule B guidelines.
- NSW DEC (2006); *Guidelines for the NSW Site Auditor Scheme* (2nd edition)
- NSW EPA (1995); *Sample Design Guidelines*
- NSW EPA (2014) *Waste Classification Guidelines*
- NSW EPA (2015); *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*
- NSW OEH (2012); *Excavated Natural Material Exemption*
- NSW OEH (2011); *Guidelines for Consultants Reporting on Contaminated Sites*
- NSW WorkCover (2014); 'Managing Asbestos in or on Soil'
- SGA Environmental (2011); *Detailed Environmental Site Investigation: 5/5a Church Street, Lidcombe* (Ref: 92121; dated February 2011).
- *State Environmental Planning Policy No 55 - Remediation of Land* and its associated planning guidelines *Managing Land Contamination* (DUAP/EPA, 1998)
- WA Dept. of Health (June 2011); *Recommended Procedures for Laboratory Analysis of Asbestos in Soil*.

Important information about your **Coffey** Environmental Report

Introduction

This report has been prepared by Coffey for you, as Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice,

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but

steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Coffey prepared the report and has familiarity with the site, Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Coffey disowns any responsibility for such misinterpretation.

Data should not be separated from the report

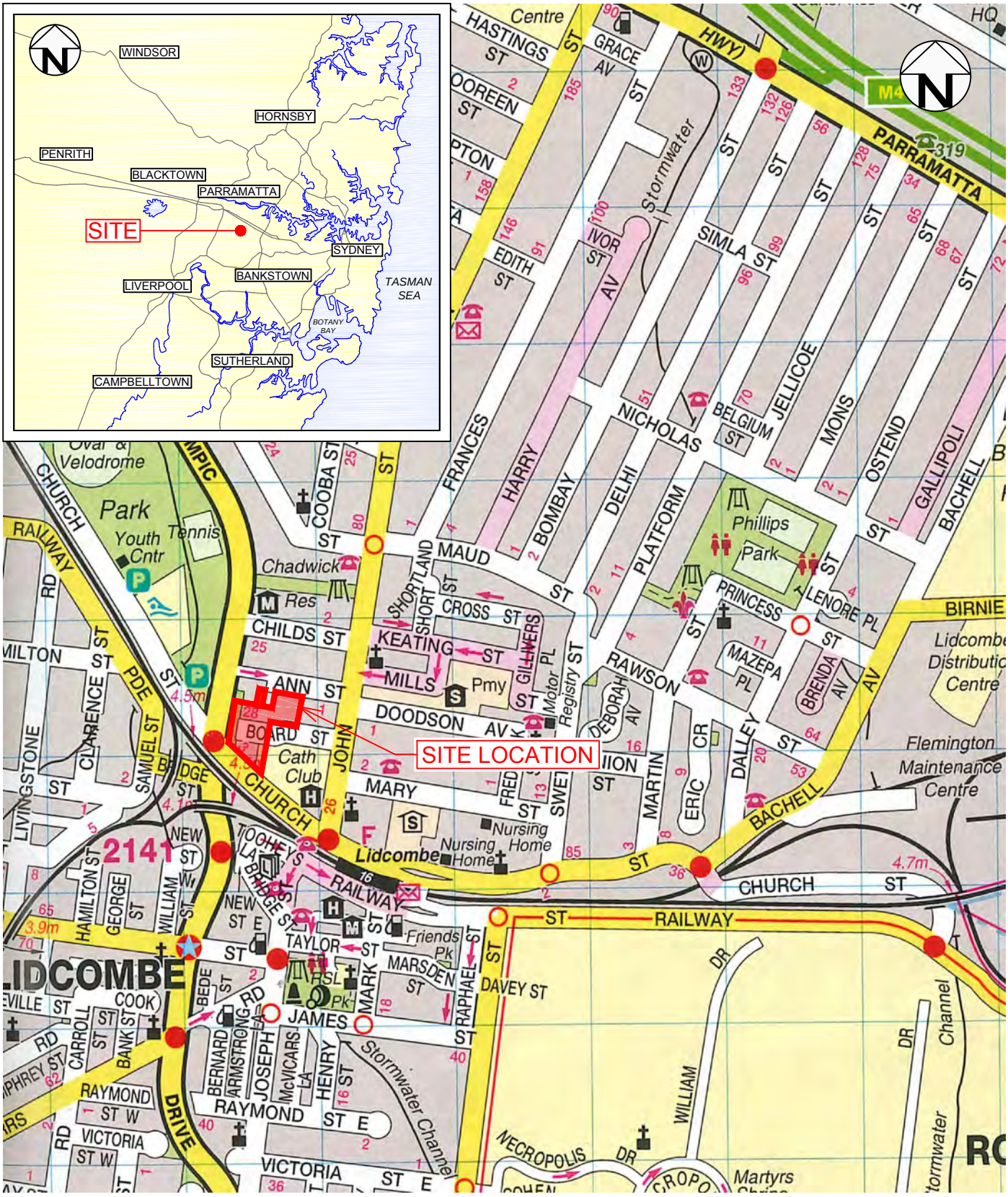
The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

Figures



drawn	ML / AW
approved	-
date	20 / 04 / 16
scale	AS SHOWN
original size	A4

coffey
A TETRA TECH COMPANY

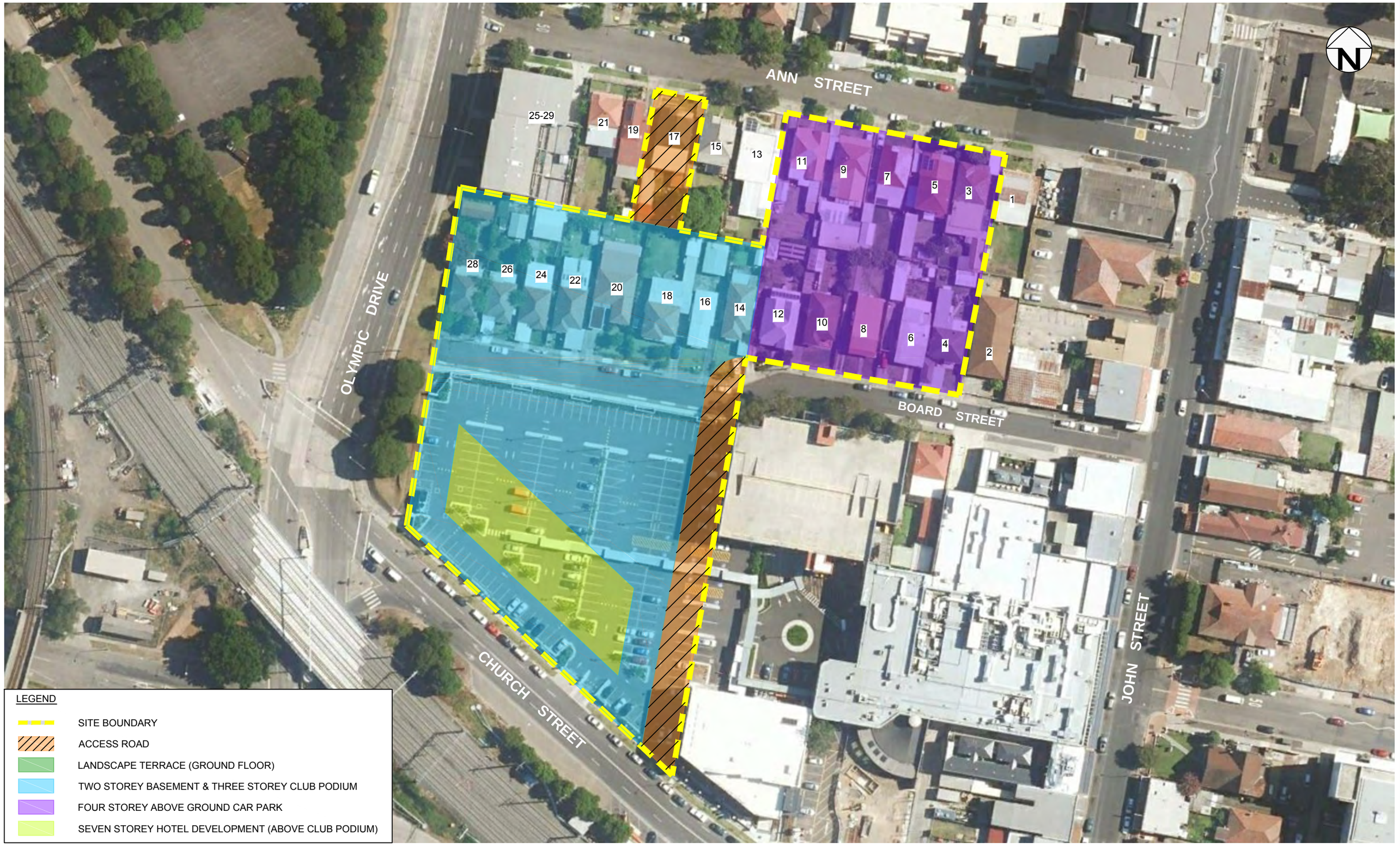
client: BOUYGUES CONSTRUCTION AUSTRALIA

project: REMEDIAL ACTION PLAN
DOOLEY'S LIDCOMBE CLUB & HOTEL DEVELOPMENT
LIDCOMBE, SYDNEY, NSW

title: SITE LOCATION PLAN

project no: GEOTLCOV25554AA-AJ | figure no: FIGURE 1 | rev: A

PLOT DATE: 20/04/2016 11:21:52 AM DWG FILE: F:\GEOTECHNICS\1.PROJECTS\GEOTLCOV25\GEOTLCOV25554AA DOOLEY'S LIDCOMBE CLUB & HOTEL DEVELOPMENT\CAD\GEOTLCOV25554AA-AJ.DWG



LEGEND

- SITE BOUNDARY
- ACCESS ROAD
- LANDSCAPE TERRACE (GROUND FLOOR)
- TWO STOREY BASEMENT & THREE STOREY CLUB PODIUM
- FOUR STOREY ABOVE GROUND CAR PARK
- SEVEN STOREY HOTEL DEVELOPMENT (ABOVE CLUB PODIUM)

revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE			

10 0 10 30 50

Scale (metres) 1:1000

AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 7.1.2
AERIAL IMAGE ©: 2015 AEROMETREX

drawn	ML / AW
approved	-
date	20 / 04 / 16
scale	AS SHOWN
original size	A3

coffey
A TETRA TECH COMPANY

client: BOUYGUES CONSTRUCTION AUSTRALIA

project: REMEDIAL ACTION PLAN
DOOLEY'S LIDCOMBE CLUB & HOTEL DEVELOPMENT
LIDCOMBE, SYDNEY, NSW

title: PROPOSED DEVELOPMENT - LAYOUT

project no: GEOTLCOV25554AA-AJ | figure no: FIGURE 2 | rev: A

PLOT DATE: 20/04/2016 11:21:12 AM DWG FILE: F:\GEOTECHNICS\1.PROJECTS\GEOTLCOV25\GEOTLCOV25554AA DOOLEYS LIDCOMBE CLUB & HOTEL DEVELOPMENT\CAD\GEOTLCOV25554AA-AJ.DWG

revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE			

10 0 10 30 50

Scale (metres) 1:1000

AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 7.1.2
AERIAL IMAGE ©: 2015 AEROMETREX

drawn	ML / AW
approved	-
date	20 / 04 / 16
scale	AS SHOWN
original size	A3

coffey
A TETRA TECH COMPANY

client: BOUYGUES CONSTRUCTION AUSTRALIA

project: REMEDIAL ACTION PLAN
DOOLEY'S LIDCOMBE CLUB & HOTEL DEVELOPMENT
LIDCOMBE, SYDNEY, NSW

title: BOREHOLE LOCATION PLAN

project no: GEOTLCOV25554AA-AJ | figure no: FIGURE 3 | rev: A

PLOT DATE: 22/04/2016 12:39:02 PM DWG FILE: F:\GEOTECHNICS\1 PROJECTS\GEOTLCOV25\GEOTLCOV25554AA DOOLEYS LIDCOMBE CLUB & HOTEL DEVELOPMENT\CAD\GEOTLCOV25554AA-AJ.DWG

revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE			

10 0 10 30 50

Scale (metres) 1:1000

AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 7.1.2
AERIAL IMAGE ©: 2015 AEROMETREX

drawn	ML / AW
approved	-
date	29 / 04 / 16
scale	AS SHOWN
original size	A3

coffey
A TETRA TECH COMPANY

client: BOUYGUES CONSTRUCTION AUSTRALIA

project: REMEDIAL ACTION PLAN
DOOLEY'S LIDCOMBE CLUB & HOTEL DEVELOPMENT
LIDCOMBE, SYDNEY, NSW

title: REMEDIATION EXTENT

project no: GEOTLCOV25554AA-AJ | figure no: FIGURE 4 | rev: A

PLOT DATE: 29/04/2016 8:34:22 AM DWG FILE: F:\GEOTECH\NICS\1-PROJECTS\GEOTLCOV25\GEOTLCOV25554AA DOOLEYS LIDCOMBE CLUB & HOTEL DEVELOPMENT\CAD\GEOTLCOV25554AA-AJ.DWG

Appendix A - Proposed Development Information

LEGEND

PLANT/ SERVICES	378m²
CARPARK	5569m²
BACK OF HOUSE	1307m²
LOADING DOCK & WASTE	1880m²
COMPACTORS	
TURNING BAY	
HOTEL STORE	
CLUB STORE	
LOADING DOCK	

C:\Revit_Local\214019_DOOLEYS_Master_Central_stejp.rvt

Project: DOOLEYS LIDCOMBE CATHOLIC CLUB JOHN STREET, LIDCOMBE, NSW 2141	Client: DOOLEYS CATHOLIC CLUB	23/6/16	Job No: 2014.019	Dwg No: DA-1008	CLUB/HOTEL - BASEMENT PLAN B2	Rev 2	1:200	@ A1	0 1 2 5 10 20m	20/06/2016 4:38:02 PM

NSW Nominated Architects
S Parsons Architect No.6098
D Jones Architect No.4778
A Rossi Architect No.5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
PTW Axil architects
T +612 9232 5877
F +612 9221 4139

LEGEND

	CARPARK	4215m²
	HOTEL BOH	934m²
	COMBINED BOH	604m²
	CLUB BOH	419m²
	PLANT/ SERVICES	916m²

CHURCH STREET

BACK OF HOUSE

CARPARK

FHR

STRUCTURE ZONE

PLENUM ZONE

STRUCTURE ZONE

EXISTING BUILDING

EXISTING BUILDING

C:\Revit_Local\214019_DOOLEYS_Master_Central_stieg.rvt

Project: DOOLEYS LIDCOMBE CATHOLIC CLUB JOHN STREET, LIDCOMBE, NSW 2141	Client: DOOLEYS CATHOLIC CLUB	23/6/16	Job No: 2014.019	Dwg No: DA-1009	CLUB/HOTEL - BASEMENT PLAN B1	Rev 2	1:200	@ A1	0 1 2 5 10 20m	20/06/2016 4:38:02 PM

NSW Nominated Architects
S Parsons Architect No.6096
D Jones Architect No.4778
A Rossi Architect No.5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139

PTW Axil architects

LEGEND

GAMING	1988m²
FOOD & BEVERAGE	1852m²
FUNCTION	421m²
ENTRY	951m²
HOTEL	526m²
PLANT	54m²

C:\Revit_Local\21401\9_DOOLEYS_Master_Central_stejy.rvt

Project: DOOLEYS LIDCOMBE CATHOLIC CLUB | Client: DOOLEYS CATHOLIC CLUB | 23/6/16 | Job No: 2014.019 | Dwg No: DA-0110 | CLUB/HOTEL - GROUND FLOOR | Rev 2 | 1:200 @ A1

JOHN STREET, LIDCOMBE, NSW 2141

0 1 2 5 10 20m

20/06/2016 4:38:02 PM

NSW Nominated Architects
S Persons Architect No 6096
D Jones Architect No 4778
A Ross Architect No 3057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139

PTW Axil architects

LEGEND

FOOD & BEVERAGE	1725m²
CIRCULATION	1192m²
CONFERENCE	1579m²

C:\Revit_Local\214019_DOOLEYS_Master_Central_stkp.rvt

Project: DOOLEYS LIDCOMBE CATHOLIC CLUB | Client: DOOLEYS CATHOLIC CLUB | 23/6/16 | Job No: 2014.019 | Dwg No: DA-1011 | CLUB/HOTEL - L01 | Rev 2 | 1:200 @ A1 | 0 1 2 5 10 20m

JOHN STREET, LIDCOMBE, NSW 2141

20/06/2016 4:38:02 PM

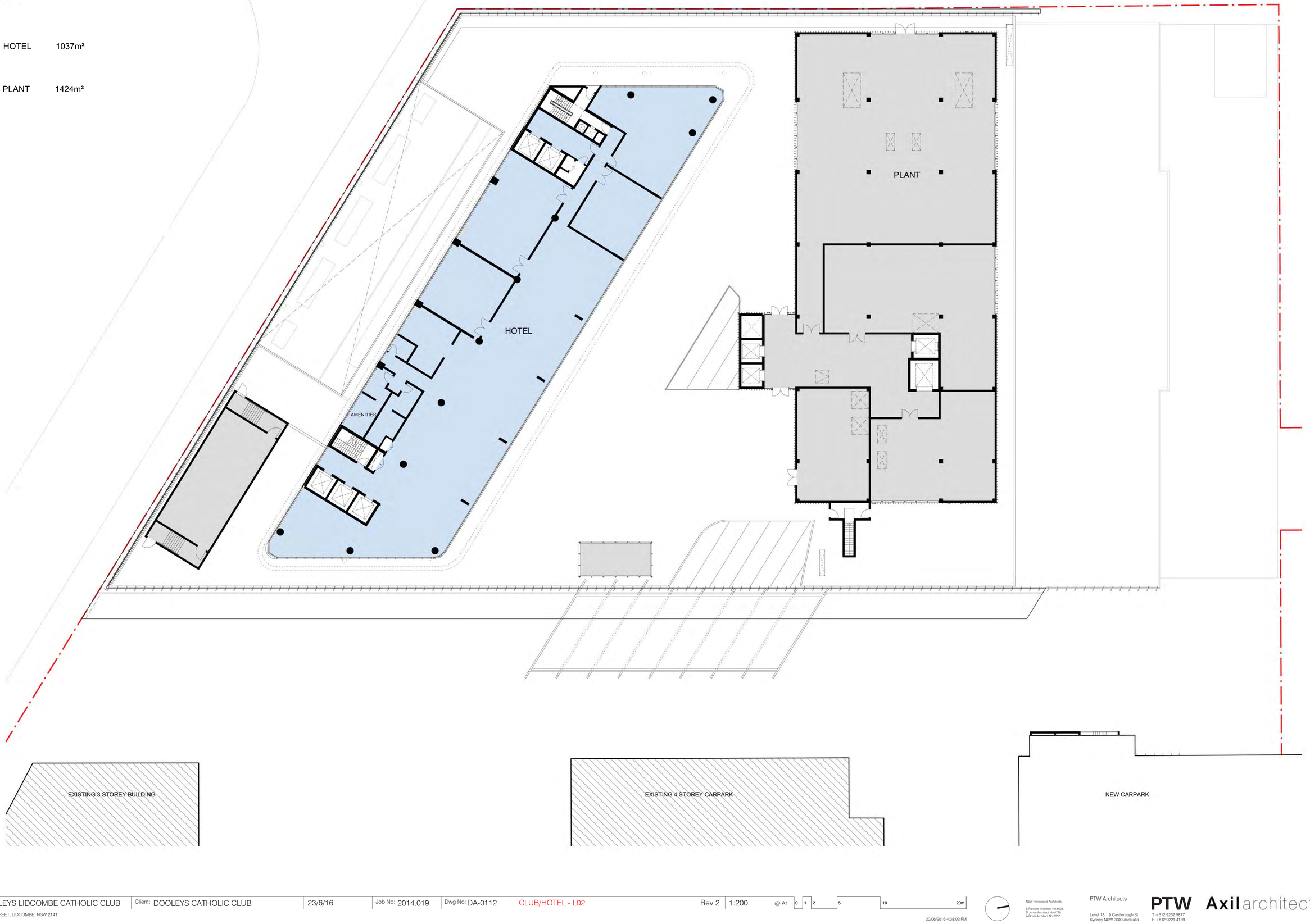
NSW Nominated Architects
S Parsons Architect No.6098
D Jones Architect No.4778
A Ross Architect No.5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139

PTW Axil architects

LEGEND

	HOTEL	1037m²
	PLANT	1424m²



C:\Revit_Local\214019_DOOLEYS_Master_Central_sblg.rvt

Project: DOOLEYS LIDCOMBE CATHOLIC CLUB | Client: DOOLEYS CATHOLIC CLUB | 23/6/16 | Job No: 2014.019 | Dwg No: DA-0112 | CLUB/HOTEL - L02 | Rev 2 | 1:200 @ A1

JOHN STREET, LIDCOMBE, NSW 2141

0 1 2 5 10 20m

20/06/2016 4:38:02 PM

NSW Nominated Architects

S Parsons Architect No.6098
D Jones Architect No.4778
A Road Architect No.5057

PTW Architects

Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia

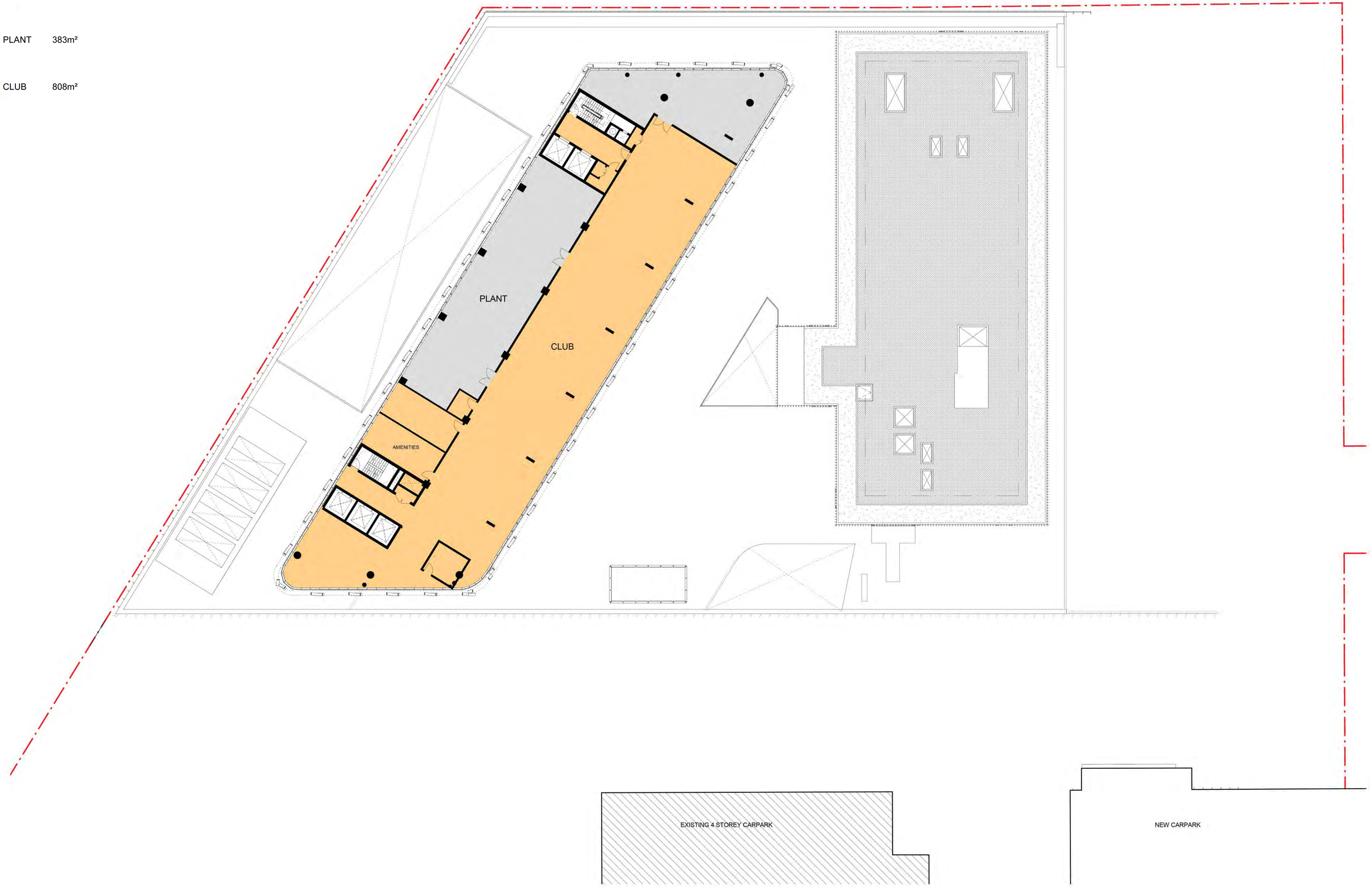
PTW T +612 9232 5877 F +612 9221 4139

Axil architects

LEGEND

PLANT 383m²

CLUB 808m²



C:\Revit_Local\214019_DOOLEYS_Master_Central_stieg.rvt

Project: DOOLEYS LIDCOMBE CATHOLIC CLUB
JOHN STREET, LIDCOMBE, NSW 2141

Client: DOOLEYS CATHOLIC CLUB

23/6/16

Job No: 2014.019

Dwg No: DA-0113

CLUB/HOTEL - L03

Rev 2

1:200 @ A1

0 1 2 5 10 20m

20/06/2016 4:38:02 PM

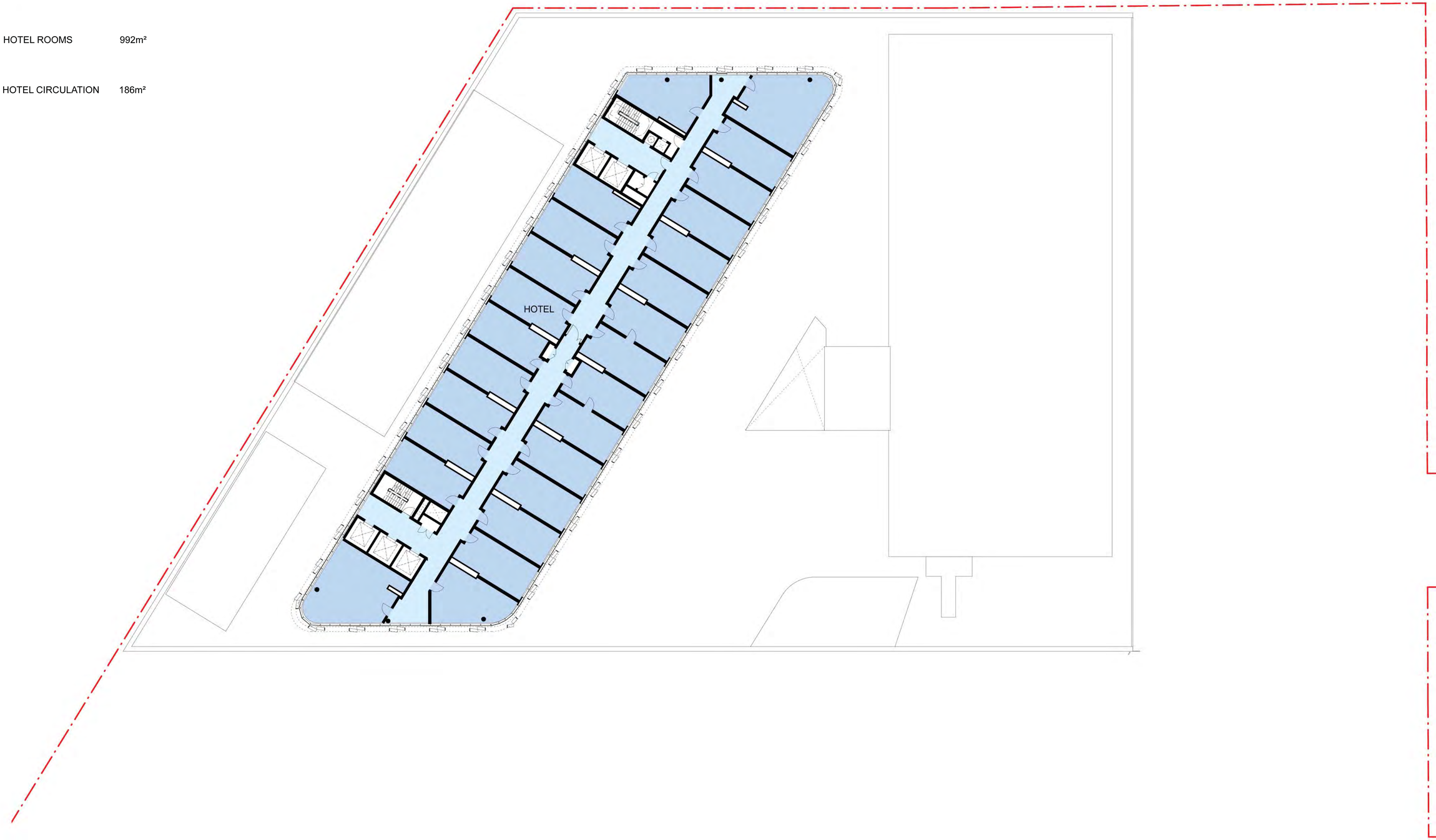
NSW Nominated Architects
S Parsons Architect No.6098
D Jones Architect No.4778
A Rossi Architect No.5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139

PTW Axil architects

LEGEND

	HOTEL ROOMS	992m²
	HOTEL CIRCULATION	186m²



C:\Revit_Local\21401\9_DOOLEYS_Master_Central_stbg.rvt

Project: DOOLEYS LIDCOMBE CATHOLIC CLUB
JOHN STREET, LIDCOMBE, NSW 2141

Client: DOOLEYS CATHOLIC CLUB

23/6/16

Job No: 2014.019

Dwg No: DA-0114

HOTEL - TYPICAL LEVEL 4 - 14

Rev 2

1:200 @ A1

0 1 2 5 10 20m

20/06/2016 4:38:02 PM

NSW Nominated Architects

S Persons Architect No 6098
D Jones Architect No 4778
A Rossi Architect No 3057

PTW Architects

Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia

PTW
T +612 9232 5877
F +612 9221 4139

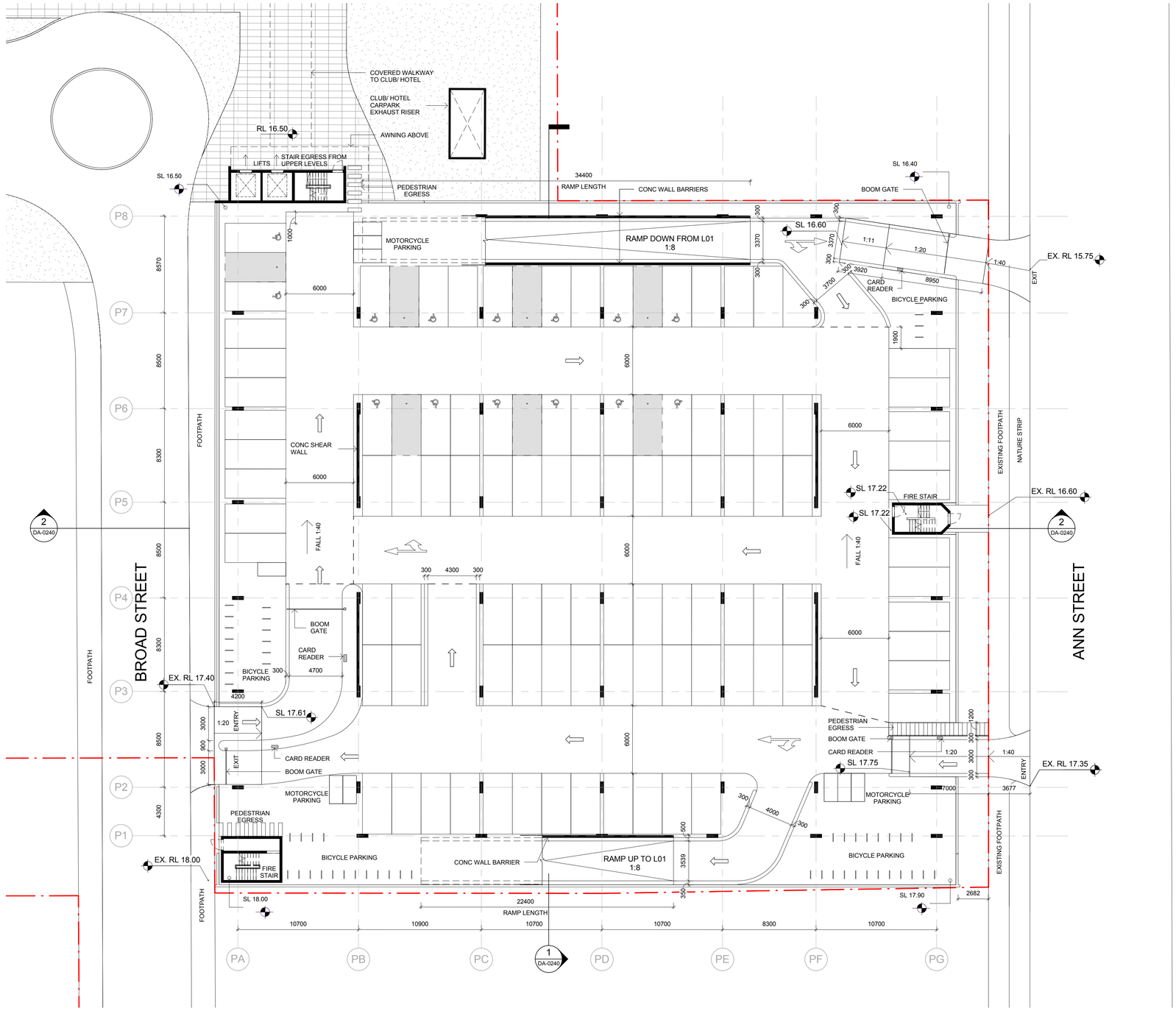
Axil architects

PARKING SCHEDULE

Disabled Carpark Bay
14
Standard Carpark Bay
596
Grand total: 610

BICYCLES AND MOTORBIKES

Bicycle Parking
54
Motorcycle Bay
9
Grand total: 63



1 GROUND FLOOR PLAN
1 : 200

C:\Revit_Local\214019_DOOLEYS_Carpark_Central_A140.rvt

Project:	Client:		Job No:	Dwg No:			
DOOLEYS LIDCOMBE CATHOLIC CLUB John Street, Lidcombe, NSW 2141	DOOLEY'S CATHOLIC CLUB	23/06/2016	214019	DA-0210	CARPARK - PLAN L00	1 : 200 @ A1	

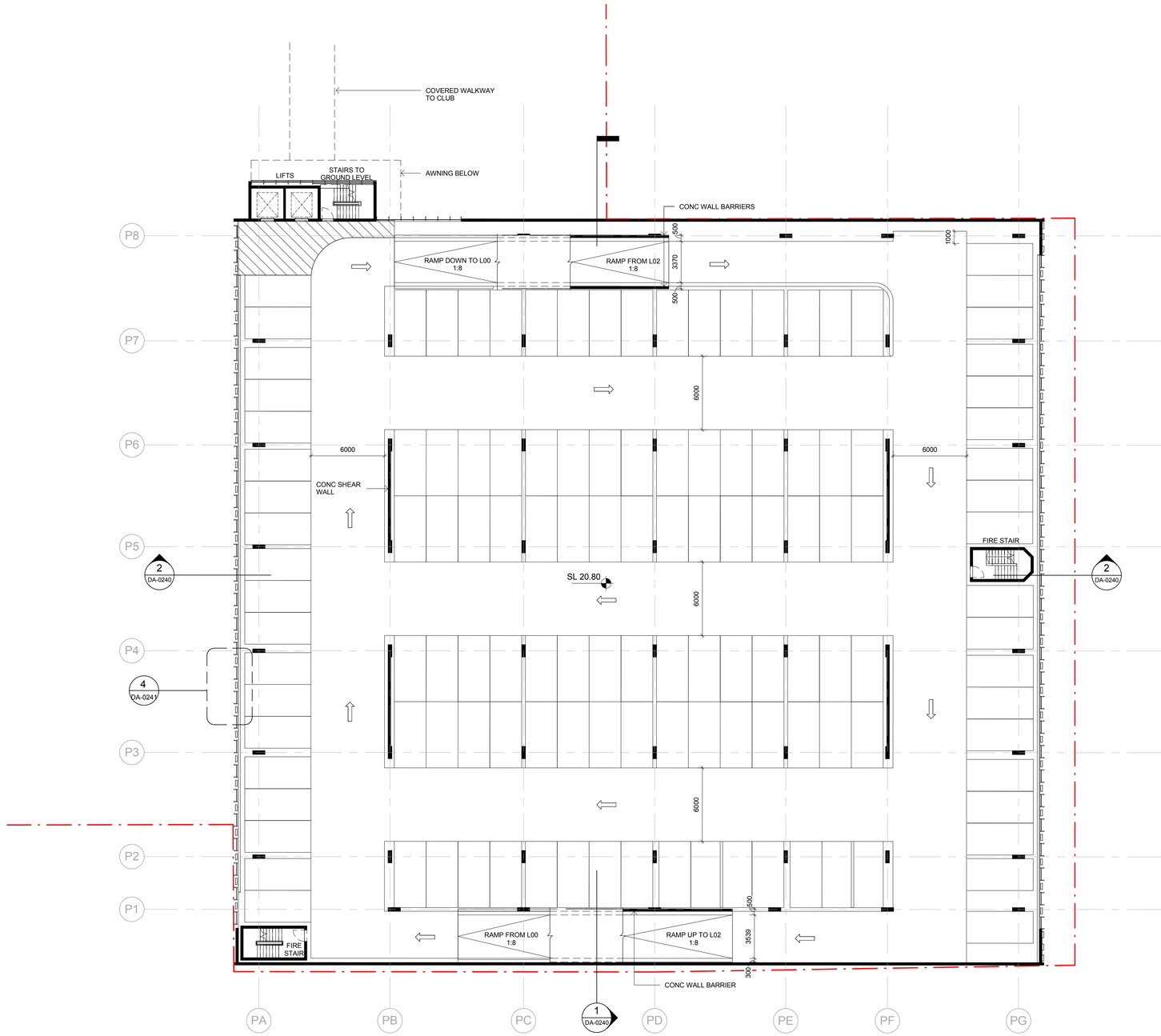
23/06/2016 11:42:56 AM

NSW Nominated Architects
S Parsons Architect No.6098
D.Jones Architect No.4778
A Rossi Architect No.5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139

PARKING SCHEDULE

Disabled Carpark Bay
14
Standard Carpark Bay
596
Grand total: 610



1 LEVEL 1 PLAN
1 : 200

C:\Revit_Local\214019_DOOLEYS_Carpark_Central_A140.rvt

Project:	Client:		Job No:	Dwg No:			
DOOLEYS LIDCOMBE CATHOLIC CLUB John Street, Lidcombe, NSW 2141	DOOLEY'S CATHOLIC CLUB	23/06/2016	214019	DA-0211	CARPARK - PLAN L01	1 : 200	@ A1

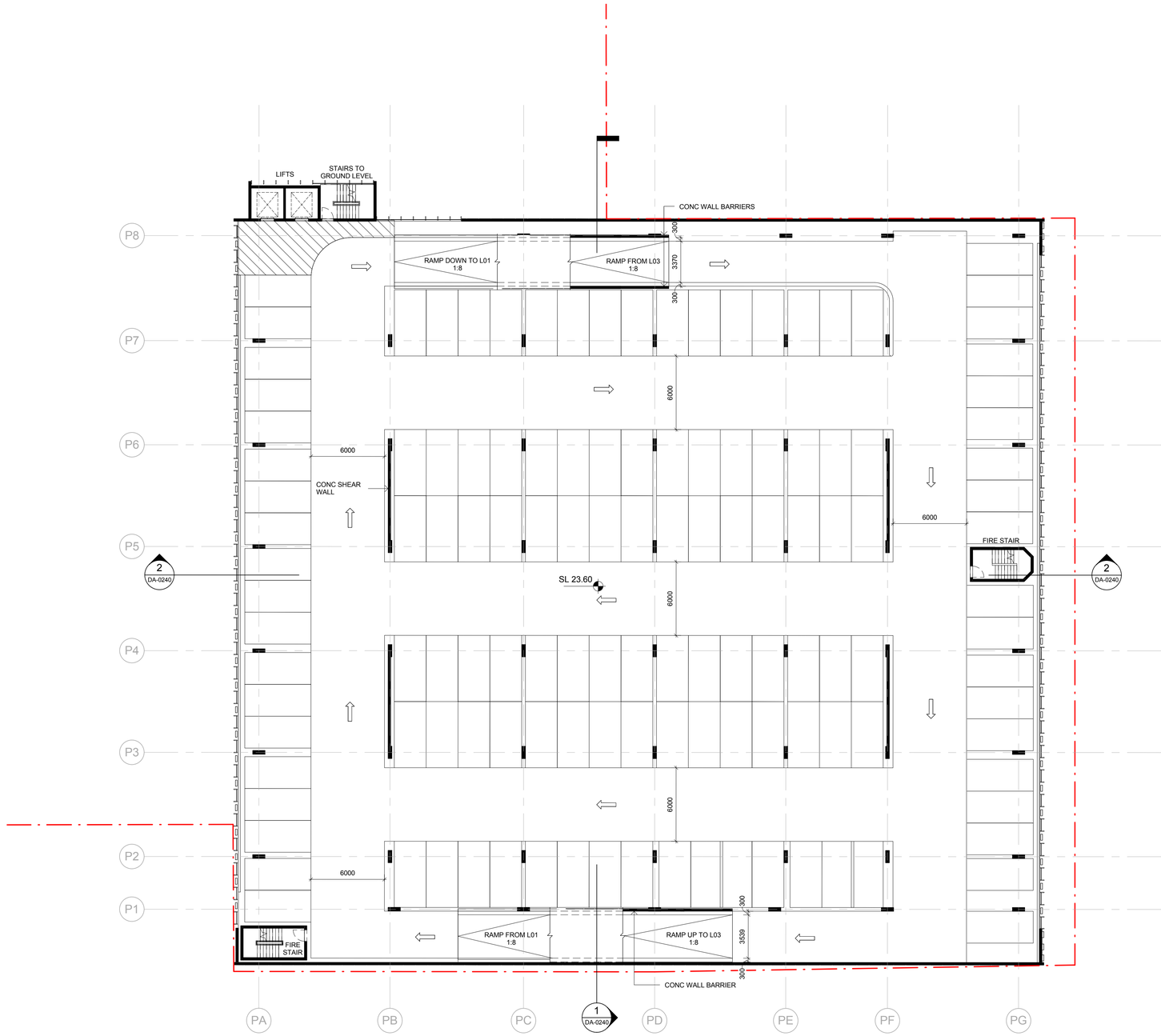
23/06/2016 11:42:58 AM

NSW Nominated Architects
S Parsons Architect No.6098
D Jones Architect No.4778
A Rosa Architect No.5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139

PARKING SCHEDULE

Disabled Carpark Bay
14
Standard Carpark Bay
596
Grand total: 610



1 LEVEL 2 PLAN
1 : 200

C:\Revit_Local\214019_DOOLEYS_Carpark_Central_A140.rvt

Project:	Client:		Job No:	Dwg No:			
DOOLEYS LIDCOMBE CATHOLIC CLUB John Street, Lidcombe, NSW 2141	DOOLEY'S CATHOLIC CLUB	23/06/2016	214019	DA-0212	CARPARK - PLAN L02	1 : 200 @ A1	

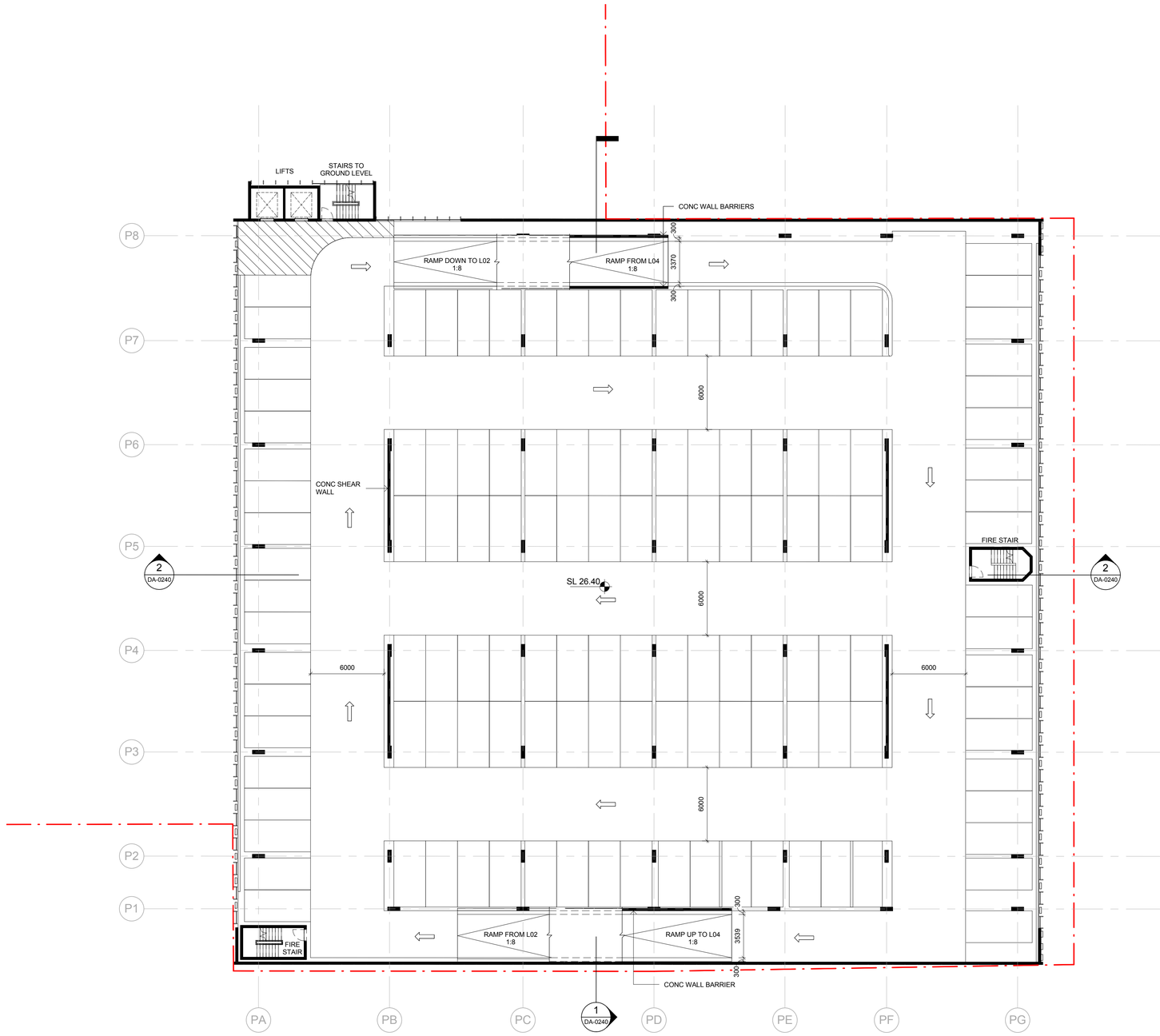
23/06/2016 11:43:00 AM

NSW Nominated Architects
S Parsons Architect No.6098
D Jones Architect No.4778
A Rosa Architect No.5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139

PARKING SCHEDULE

Disabled Carpark Bay	
14	
Standard Carpark Bay	
596	
Grand total: 610	



1 LEVEL 3 PLAN
1 : 200

C:\Revit_Local\214019_DOOLEYS_Carpark_Central_A140.rvt

Project:	Client:		Job No:	Dwg No:			
DOOLEYS LIDCOMBE CATHOLIC CLUB John Street, Lidcombe, NSW 2141	DOOLEY'S CATHOLIC CLUB	23/06/2016	214019	DA-0213	CARPARK - PLAN L03	1 : 200	@ A1

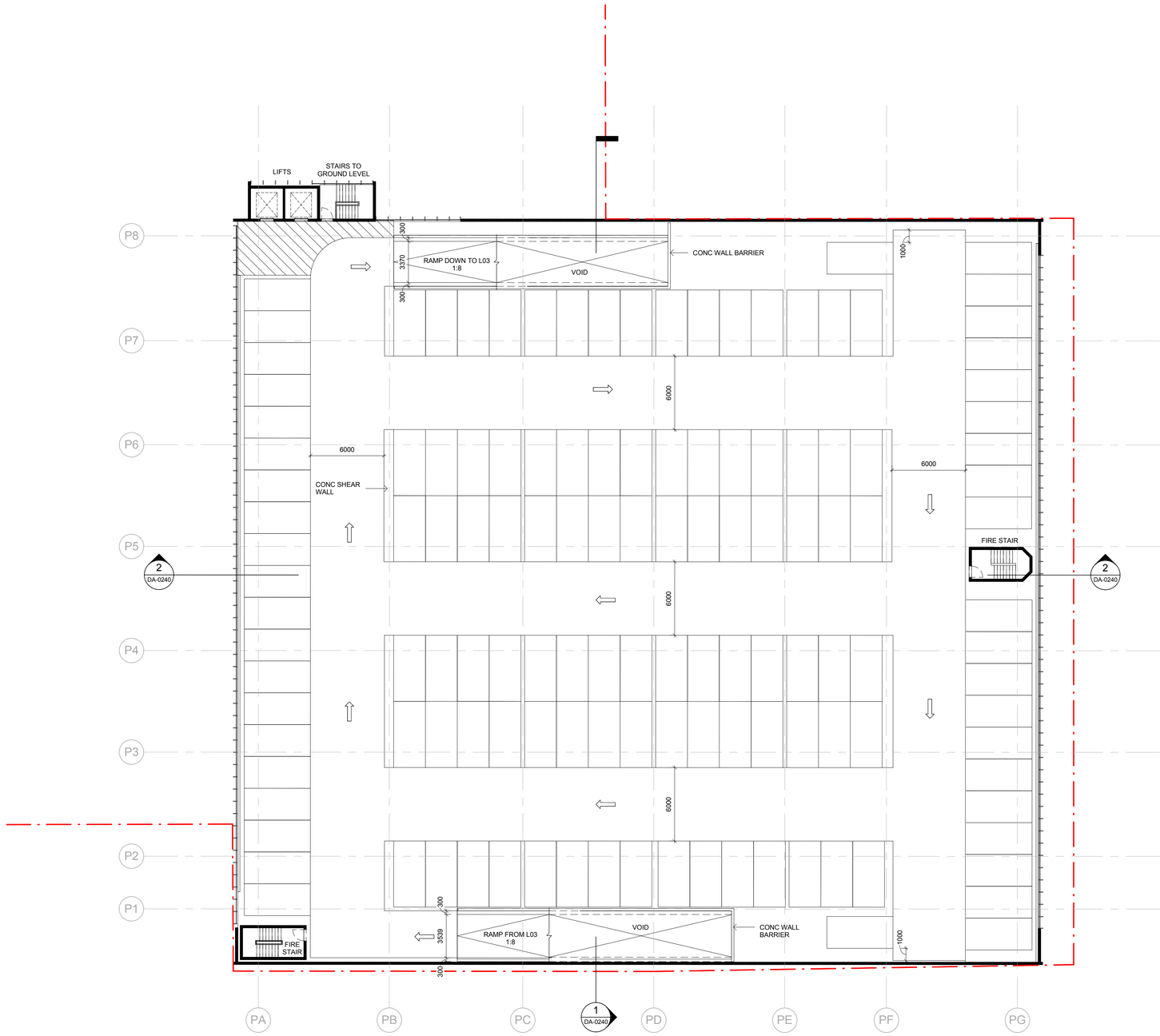
23/06/2016 11:43:02 AM

NSW Nominated Architects
S Parsons Architect No.6098
D Jones Architect No.4778
A Rosa Architect No.5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139
PTW

PARKING SCHEDULE

Disabled Carpark Bay	
14	
Standard Carpark Bay	
596	
Grand total: 610	

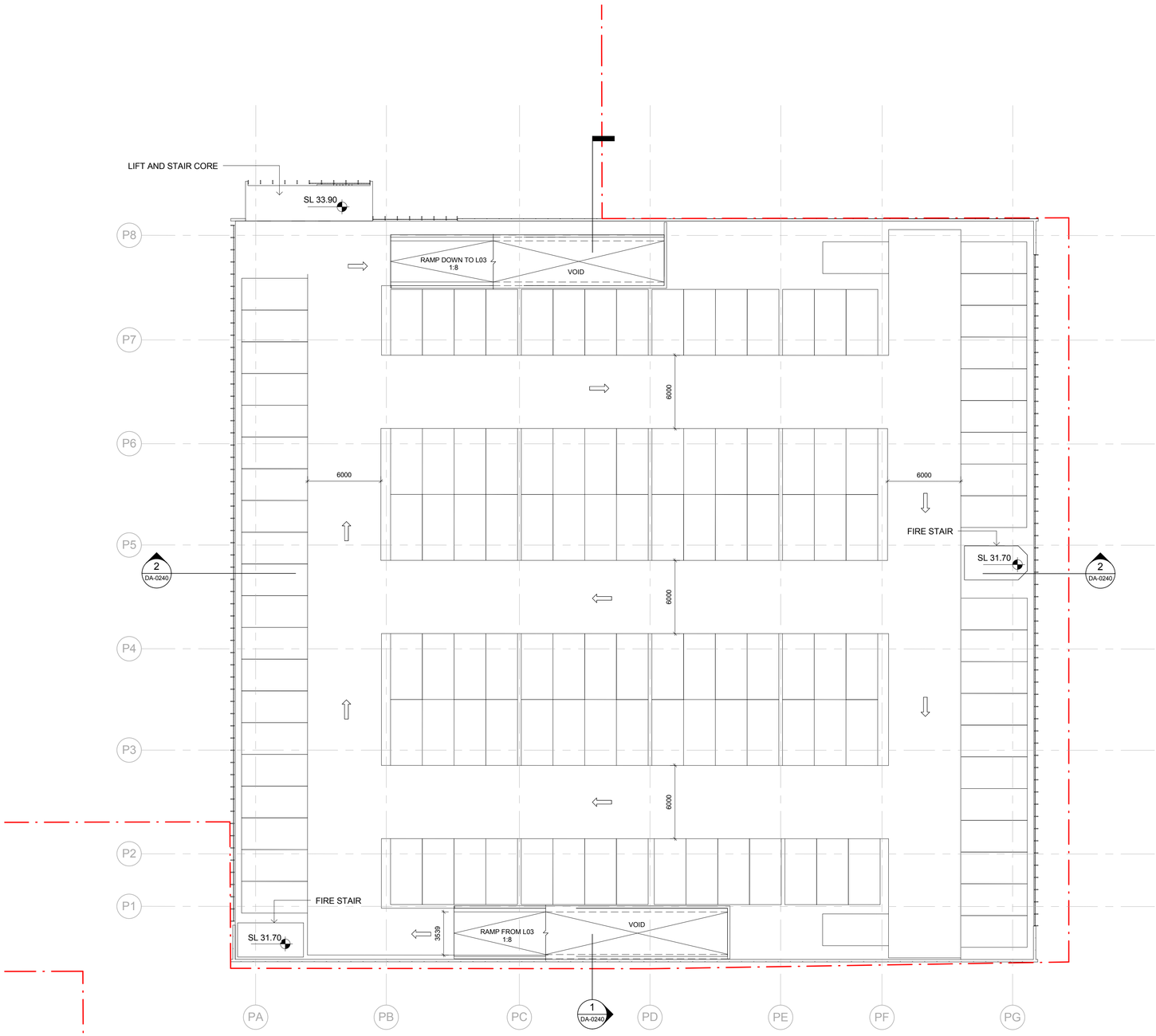


1 LEVEL 4 PLAN
1 : 200

C:\Revit_Local\214019_DOOLEYS_Carpark_Central_A14D.rvt

NSW Nominated Architects
S Parsons Architect No.6098
D Jones Architect No.4778
A Rossi Architect No.5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139



1 ROOF PLAN
1 : 200

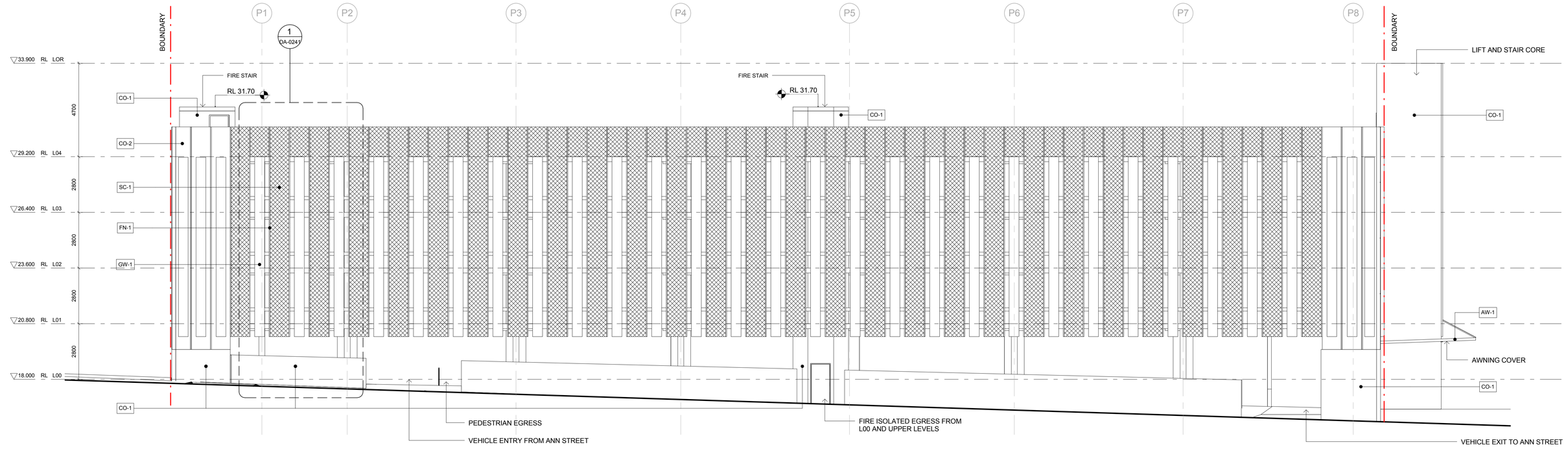
C:\Revit_Local\214019_DOOLEYS_Carpark_Central_A14D.rvt

Project:	Client:		Job No:	Dwg No:			
DOOLEYS LIDCOMBE CATHOLIC CLUB John Street, Lidcombe, NSW 2141	DOOLEY'S CATHOLIC CLUB	23/06/2016	214019	DA-0215	CARPARK - ROOF PLAN	1 : 200 @ A1	

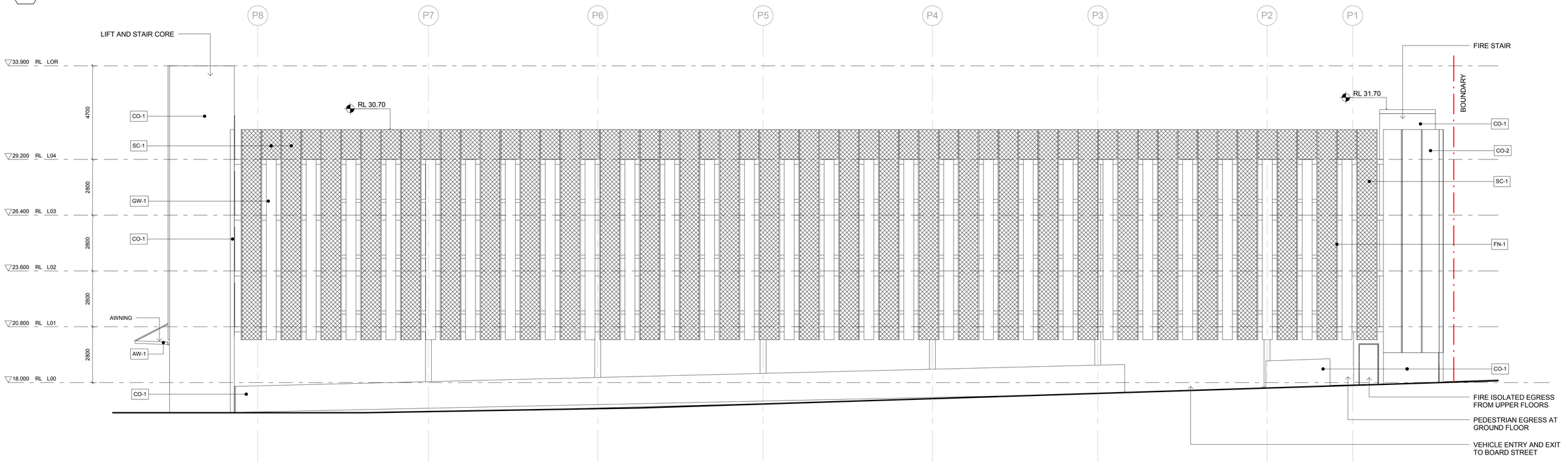
23/06/2016 11:43:06 AM

NSW Nominated Architects
S Parsons Architect No:6098
D Jones Architect No:4778
A Rossi Architect No:5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139



1 NORTH ELEVATION
1 : 100



2 SOUTH ELEVATION
1 : 100

MATERIALS LEGEND

CO-1	IN- SITU CONCRETE CLASS 2
C0-2	CONCRETE PRECAST PANELS, VERTICAL GROOVES @ 1000mm CENTRES
SC-1	EXPANDED ALUMINIUM MESH SCREEN
FN-1	ANODIZED ALUMINUIM FINS, 300 X 50mm
GW-1	GREENWALL SYSTEM PANEL, 500 WIDE X 150 DEEP
AW-1	STEEL FRAME, METAL DECK AWNING, FC SHEET LINING

C:\Revit_Local\214019_DOOLEYS_Carpark_Central_A140.rvt

Project: DOOLEYS LIDCOMBE CATHOLIC CLUB
John Street, Lidcombe, NSW 2141

Client: DOOLEY'S CATHOLIC CLUB

23/06/2016

Job No: 214019

Dwg No: DA-0230

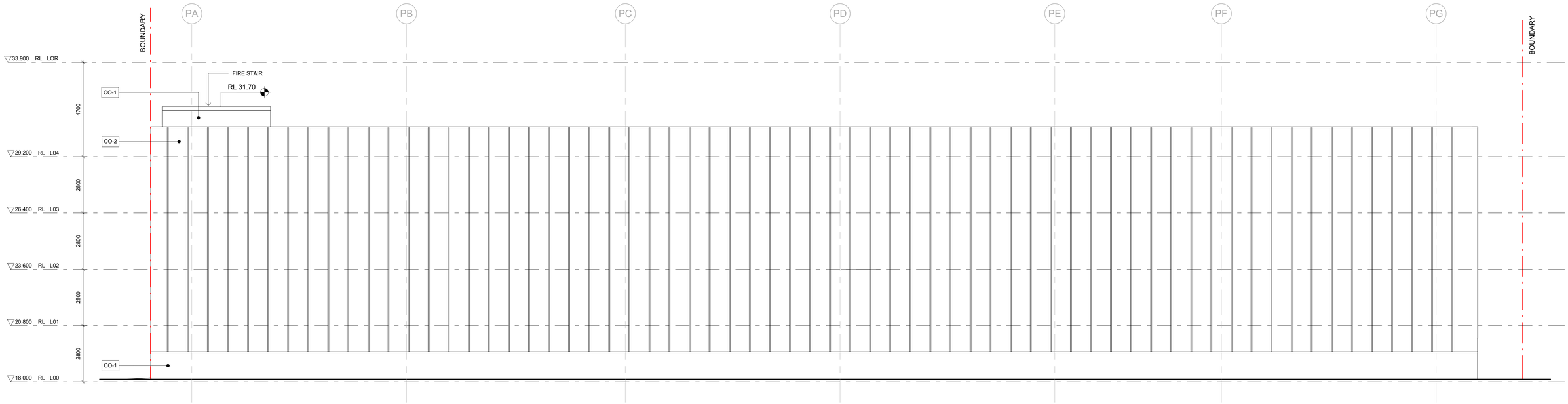
CARPARK ELEVATIONS

As indicated @ A1

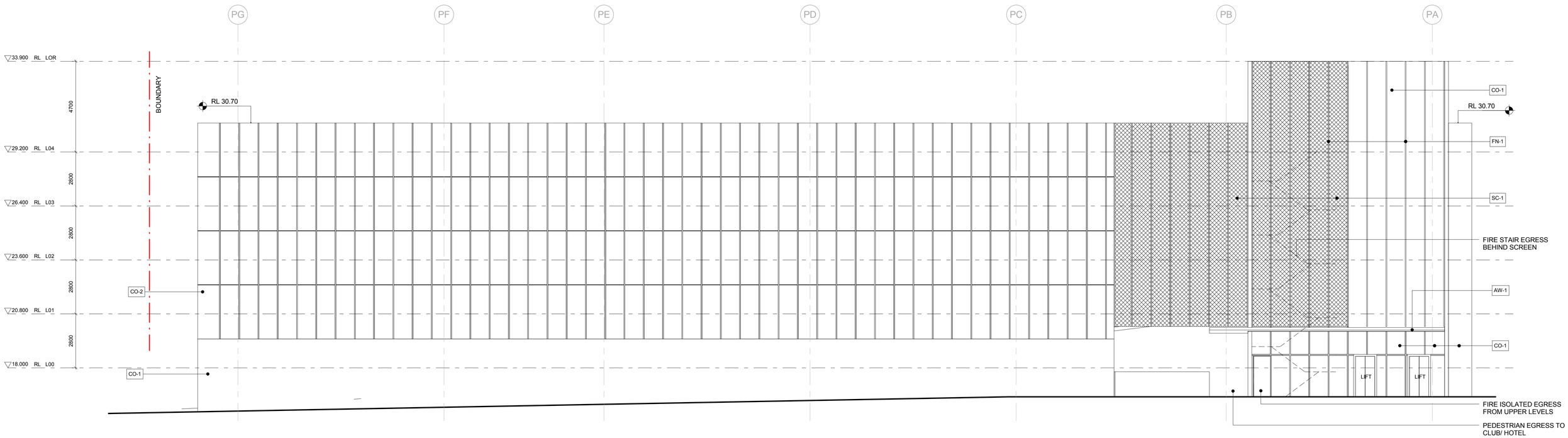
23/06/2016 11:43:12 AM

NSW Nominated Architects
S Parsons Architect No.6596
D Jones Architect No.4778
A Rossi Architect No.5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139



1 EAST ELEVATION
1 : 100



2 WEST ELEVATION
1 : 100

MATERIALS LEGEND

CO-1	IN- SITU CONCRETE CLASS 2
C0-2	CONCRETE PRECAST PANELS, VERTICAL GROOVES @ 1000mm CENTRES
SC-1	EXPANDED ALUMINIUM MESH SCREEN
FN-1	ANODIZED ALUMINUIM FINS, 300 X 50mm
GW-1	GREENWALL SYSTEM PANEL, 500 WIDE X 150 DEEP
AW-1	STEEL FRAME, METAL DECK AWNING, FC SHEET LINING

C:\Revit_Local\214019_DOOLEYS_Carpark_Central_A1401.rvt

Project: DOOLEYS LIDCOMBE CATHOLIC CLUB
John Street, Lidcombe, NSW 2141

Client: DOOLEY'S CATHOLIC CLUB

23/06/2016

Job No: 214019

Dwg No: DA-0231

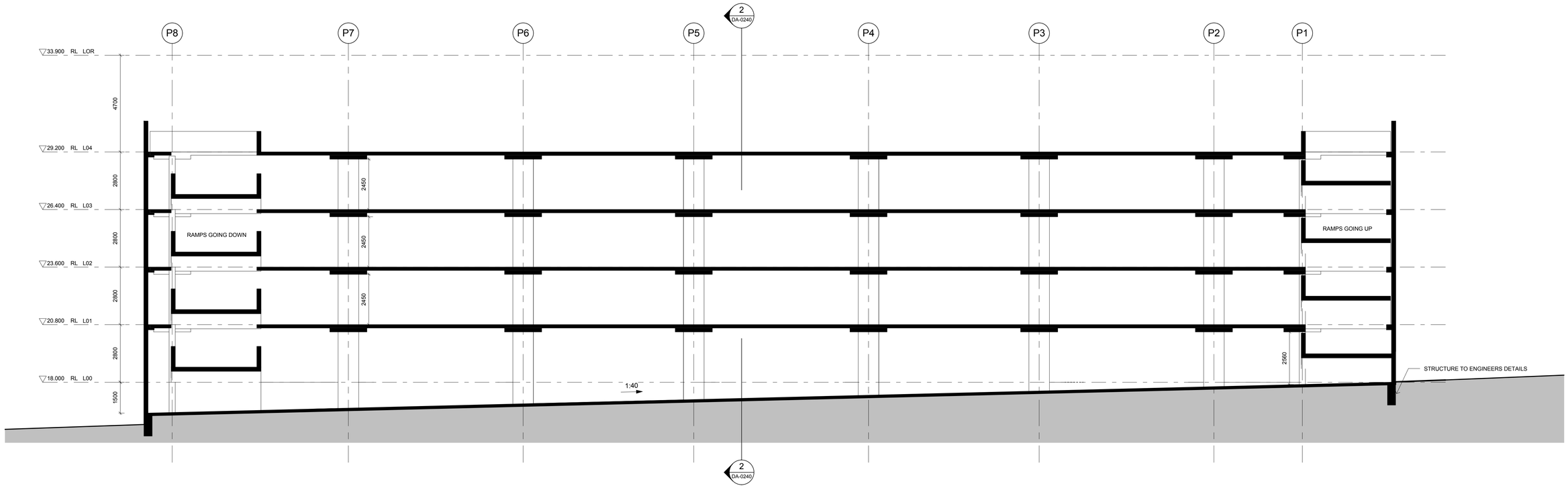
CARPARK ELEVATIONS

As indicated @ A1

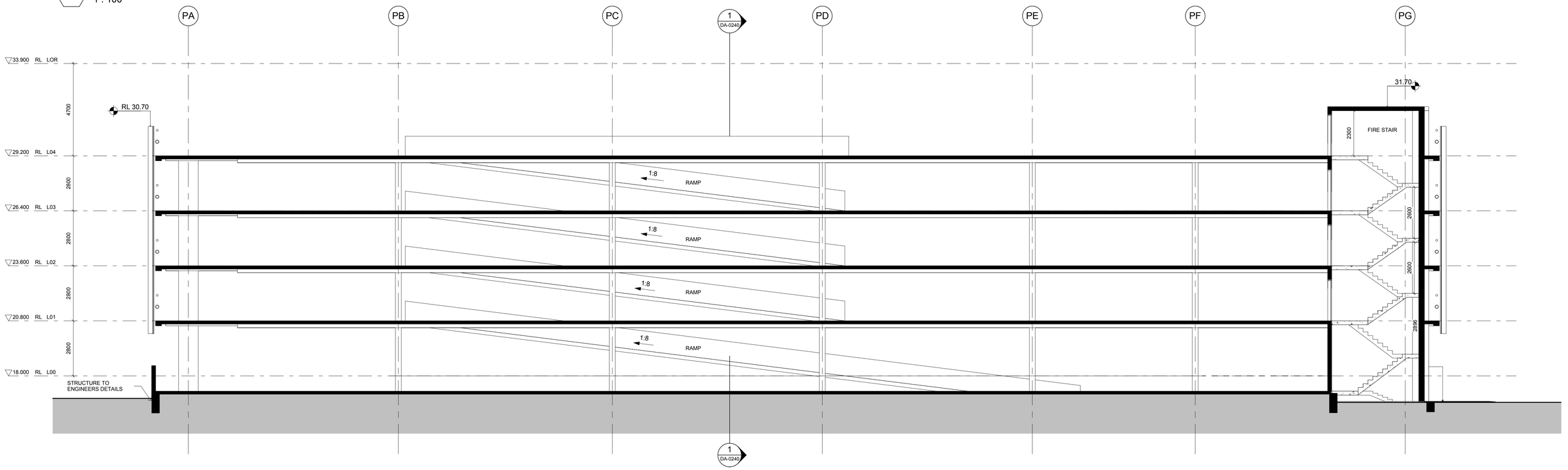
23/06/2016 11:43:14 AM

NSW Nominated Architects
S Parsons Architect No.6098
D Jones Architect No.4778
A Rossi Architect No.5057

PTW Architects
PTW
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139



1 CARPARK SECTION - NORTH / SOUTH
1 : 100



2 CARPARK SECTION - EAST / WEST
1 : 100

C:\Revit_Local\214019_DOOLEYS_Carpark_Central_A140.rvt

Project:	Client:		Job No:	Dwg No:			
DOOLEYS LIDCOMBE CATHOLIC CLUB John Street, Lidcombe, NSW 2141	DOOLEY'S CATHOLIC CLUB	23/06/2016	214019	DA-0240	CARPARK SECTIONS	1 : 100	@ A1

23/06/2016 11:43:16 AM

NSW Nominated Architects
S Parsons Architect No:6098
D Jones Architect No:4778
A Rossi Architect No:5057

PTW Architects
Level 13, 9 Castlereagh St
Sydney NSW 2000 Australia
T +612 9232 5877
F +612 9221 4139

Appendix B - Summary of Lot & Deposited Plan References for Site

The site includes the following individual Lots:

Development Component	Street Address	Lot References
Club & Hotel Development	Existing at-grade club car park	• Lots 1 and 2 in Deposited Plan (DP) DP229616 • Lot 100 in DP829270 • Lot 6 in DP976322 • Lot 7 in DP737977 • Lot 8 in DP976322 • Lots 1 to 8 in DP15910
	14 Board Street	• Lot B in DP 190260
	16 Board Street	• Lot A in DP 190260
	18 Board Street	• Lot B in DP 395349
	20 Board Street	• Lot 1 and Lot 11 in DP 741584
	22 Board Street	• Lot 12 in DP 64696
	24 Board Street	• Lot 13 in DP 64696
	26 Board Street	• Lot 14 in DP 64696
	28 Board Street	• Lot 15 in DP 64696
Club Access Road	17 Ann Street	• Lot 1 in DP 79131
Four Storey Above Ground Car Park	4 Board Street	• Lot Y in DP 391142
	6 Board Street	• Lot X in DP 391142
	8 Board Street	• Lot 12 in DP 741212
	10 Board Street	• Lot 14 in DP 1083698
	12 Board Street	• Lot 1 in DP 779654
	3 Ann Street	• Lot 9 in DP 979289
	5 Ann Street	• Lot 11 in DP 78789
	7 Ann Street	• Lot 13 in DP 78789
	9 Ann Street	• Lot 15 in DP 78789
	11 Ann Street	• Lot 14 in DP 1083657

Appendix C – Limited Health Risk Screening Assessment

Level 1, 436 Johnston Street
Abbotsford
VIC 3067 Australia

t: +61 3 9290 7098
f: +61 3 9290 7499

coffey.com

30 March 2016

Our ref: GEOTLCOV25554AA-AI

Bouygues Construction Australia
Olympic Drive, Lidcombe, Sydney, NSW

Attention: George Pontifix

Dear George

Limited Health Risk Screening Assessment - Groundwater Seepage at Proposed Development at Olympic Drive, Lidcombe, Sydney, NSW

1. Background

A limited risk assessment was conducted to address potential impacts to human health associated with groundwater seepage into a basement structure based on the proposed redevelopment at Olympic Drive, Lidcombe, NSW, referred to further as the 'site'.

The proposed development includes a two level basement structure that will extend approximately 6 m below ground surface (mbgs). The development will include a club area (gaming, dining, bar, reception), business/conference area and a hotel. The current (December 2015) water level has been recorded to range between 4.3mbgs and 6.0mbgs at monitoring well BH05 and the lower basement level is likely to intersect the water table. Based on the development plans provided, it is understood the lower basement level will be used for a range of purposes:

- Car parking
- Plant equipment /system rooms
- Storage (including food & beverages, linen, garbage bins and compactors)
- Offices (administration and security)
- Staff rooms (toilets/change rooms, kitchen and dining)
- Delivery docks

Groundwater infiltrating into the proposed basement is understood to be collected via a floor drainage system and pumped to stormwater drains for discharge.

Hydrocarbon impact in groundwater was detected in the December 2015 monitoring event with maximum hydrocarbon concentrations of TPH (F1 fraction) 40 μg/L (at monitoring wells BH01 and

BH05) and xylenes 5 μg/L (BH01). All other hydrocarbon analytes were reported at concentrations below the limit of reporting.

2. Purpose

The purpose of this basement screening evaluation was to determine the likely health risks to future site users associated with the identified hydrocarbon impacted groundwater.

The screening assessment was conducted in accordance with the Schedule B4 of the NEPM (2013) "Site-Specific Health Risk Assessment Methodology".

3. Exposure assessment

Based on the proposed usage of the lower basement level, the selected receptors include car park users, club and hotel employees (commercial workers), workers involved in the maintenance and repair of the drainage and sump/pump systems, and construction workers within a basement excavation during site development.

The identified hydrocarbon contaminants in groundwater are considered to be volatile; therefore, lower basement users may be exposed via the inhalation of hydrocarbon vapours associated with impacted groundwater seeping into the basement structure. Similarly, maintenance and construction workers may be exposed via the inhalation of hydrocarbon vapours, in addition to incidental ingestion or dermal contact with impacted water whilst conducting drainage/sump works or construction of the proposed basement.

It is assumed the floor drains will be inaccessible to general car park users or commercial workers, thereby preventing direct contact exposures. The identified exposure pathways are summarised in Table 3-1.

Table 3-1: Exposure Pathway Evaluation

On-site Receptor	Source	Point of Exposure	Complete exposure pathway/Scenario		
			Inhalation	Dermal Contact	Incidental ingestion
Lower basement car park /store room user / commercial worker	Groundwater seepage & volatilisation	Basement car park	✓	×	×
Maintenance worker		Basement drainage/sump area	✓	✓	✓
Construction Worker		Basement excavation	✓	✓	✓

✓ *Pathway potentially complete*
× *Pathway incomplete*

4. Screening Assessment

The selection of appropriate screening criteria for groundwater associated with seepage into a basement is based on the identified potentially complete exposure scenarios in Table 3-1.

Screening criteria deemed protective of future construction and maintenance workers and users of a basement structure (particularly intersecting the watertable) have not been established in the amended NEPM for the identified potentially complete exposure pathways.

Australian and international sources of screening criteria for TPH fractions are limited given they are based on mixtures rather than individual compounds. Two guideline sources were selected based on the following:

Drinking water guidelines - World Health Organisation (WHO)

Petroleum Products in Drinking-Water. Background document for development of WHO Guidelines for Drinking water Quality (WHO, 2008).

- Drinking water guidelines were derived by the WHO that are protective of health associated with the ingestion of petroleum hydrocarbon impacted water. The guidelines are not considered to address aesthetic impacts; however, given the groundwater is not intended for drinking water purposes, the consideration of aesthetics is not considered relevant for the groundwater seepage scenarios identified.

- The drinking water guideline assumes 2.0 L is consumed per day for 365 days/year which is conservative given incidental ingestion is likely to be less than 0.1 L/day for 40 days/year for workers in the identified scenarios.

- The guideline includes a conservative assumption that 90% of exposure to the contaminant is associated with other background sources such as in air, food and direct contact. Given the low concentrations reported in groundwater at the site, the guideline is considered to be protective of exposures via other pathways such as dermal contact.

Regional Screening Levels (RSLs) for Tapwater – United States Environmental Protection Agency, (USEPA, 2015) (http://www.epa.gov/risk/regional-screening-levels-rsls -generic-tables-november-2015)

- Tapwater RSLs are generally derived to be protective of the inhalation (volatilisation of compounds during bathing/showering), ingestion and dermal contact pathways, where appropriate (i.e. if sufficiently volatile at room temperature), and where toxicity criteria is available.

- The RSLs for tapwater are intended to be protective of children.

- Exposure parameters adopted to derive criteria are based on daily domestic use of the water which is significantly higher than exposure parameters expected in the scenarios identified in this assessment. For example, residential exposures, assumed to occur 365 days/year for 30 years and are based on the physical parameters for children, are considered to overestimate exposures relating to an adult worker exposed for 10 days/year over a 30 year period (maintenance),40 days/year over a 1 year period (construction) or 240 days/year over a 30 year period (commercial).

- It is noted the published RSLs for the low aliphatic TPH fraction is only based on the inhalation pathway, and the medium aliphatic TPH fraction is based on the inhalation and ingestion pathways. The low and medium aromatic fractions however have included the inhalation, dermal and ingestion pathways in the RSL derivation.

The maximum reported hydrocarbon concentrations and selected screening criteria are presented in Table 4-1.

Table 4-1: Screening Criteria Selection

TPH fraction	WHO drinking water criteria ug/L	USEPA Tapwater criteria ug/L	Maximum Groundwater Concentration µg/L
TPH Aliphatic EC >5 – EC 8	300 (1)	13,000 (2)	40
TPH Aliphatic EC >9 – EC 16	300 (1)	100 (1),(2)	
Xylenes	500 (1)	190 (1) (2) (3)	5

(1) *Protective of ingestion pathway*
(2) *Protective of inhalation pathway*
(3) *Protective of dermal contact pathway.*

The comparison of the maximum reported concentrations with the selected screening criteria indicates scenarios involving inhalation and/or ingestion exposures are considered to be acceptable. On this basis, car park users where only inhalation is expected to be the complete exposure pathway, no exceedances of the screening criteria were noted.

Whilst the dermal contact exposure pathway was not specifically evaluated in the development of the USEPA tapwater RSLs for the TPH aliphatic fractions associated with the F1 fraction, the selected criteria are considered appropriate based on the following:

- Conservative background exposures incorporated into the derivation of the WHO screening criteria are considered to be sufficiently protective of acute or subchronic dermal exposures by commercial, maintenance and construction workers.
- The exposure periods generally associated with commercial, maintenance and construction workers are considerably less than those assumed in deriving tapwater RSLs for domestic usage, and adopted physical parameters for children are also considered conservative.
- Preliminary studies conducted by Coffey and other consultants (Hanson, 2015) have evaluated the use of drinking water guidelines, developed based on 90% background exposures (i.e. WHO and the Australian Drinking Water Guidelines (ADWG)), to screen for other exposure pathways based on recreational or maintenance scenarios. The preliminary outcomes indicate the WHO and ADWG guidelines were protective of recreational or maintenance trench scenarios (which include inhalation, ingestion and dermal contact pathways).

5. Conclusions

The limited site specific health risk screening evaluation was undertaken to assess the potential health risks to site users of the proposed future development where hydrocarbon impacted groundwater infiltrates into a basement or construction excavation.

Based on the information provided, receptors of concern included car park users, commercial workers, maintenance workers and construction workers. Although limited screening criteria have been specifically established for the TPH F1 fraction and identified exposure scenarios by international agencies, protective screening criteria were selected based on the pathways included in their derivation and the conservative assumptions adopted. The health risks associated with the exposure scenarios evaluated are summarised in Table 5-1.

Table 5-1: Exposure Pathway – Risk Evaluation

On-site Receptor	Source	Point of Exposure	Exposure Scenario – Risk Evaluation		
			Inhalation	Dermal Contact	Incidental ingestion
Lower basement car park / store room user, commercial worker	Infiltration of groundwater	Basement car park	Low & Acceptable	NA	NA
Maintenance worker		Basement drainage systems	Low & Acceptable		
Construction Worker		Basement excavation	Low & Acceptable		

NA – Not applicable as pathway not considered complete based on managed limited access.

Based on the current concentrations of hydrocarbons detected in groundwater at the site, the seepage of groundwater into a lower basement structure or construction excavation is considered to present a low and acceptable health risk to future basement car park users, commercial workers, drainage/sump maintenance workers and construction workers within a basement excavation.

For and on behalf of Coffey

Karen Teague
Principal

Attachment: Statement of Limitations

References

Hanson, K. (2015). RISK-BASED SCREENING CRITERIA. *CleanUp 2015* (pp. 258-259). Melbourne: CRC Care.

NEPC. (2013). *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1).* Canberra: National Environment Protection Council.

NHMRC & NRMMC. (2015). *Australian Drinking Water Guidelines 6 Version 3.1.* Canberra: National Health and Medical Research Council and Natural Resource Management Ministerial Council.

USEPA. (2015). *Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites. Summary Table (TR=1E-6, HQ=0.1), June 2015.* U.S. Environmental Protection Agency.

WHO. (2008). *Petroleum Products in Drinking-water. Background document for development of WHO Guidelines for Drinking-water Quality.* Geneva: World Health Organisation.

Important information about your **Coffey** Environmental Report

Introduction

This report has been prepared by Coffey for you, as Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice,

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but

steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Coffey prepared the report and has familiarity with the site, Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Coffey disowns any responsibility for such misinterpretation.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

This page has been left intentionally blank