Acid Sulfate Soil Management Plan

Saint John Paul Collage Redevelopment

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1. Introduction

1.1 Introduction

GeoLINK has been engaged by DRA Architects on behalf of the Trustees of the Roman Catholic Church Lismore Dioceses to prepare an Acid Sulfate Soils Management Plan (ASSMP) for the Saint John Paul College (SJPC) alterations and additions and associated works on land described as Lot 12 DP 709701, 421 Hogbin Drive, Coffs Harbour.

The site is located within the Coffs Harbour City Council (CHCC) Local Government Area (LGA). The locality of the site is shown in **Illustrations 1.1** and the site plan detailing the proposed works are shown in Illustration **1.2**.

1.2 Background

The objective of this assessment is to confirm the presence of acid sulfate soils (ASS) in the relocation work areas and to provide a management plan for excavation, storage and treatment of acid sulfate soil material.

This report provides an assessment of the proposal's compliance with:

- Acid Sulfate Soil Management Advisory Committee (ASSMAC) Acid Sulfate Soil Manual (1998); and
- New South Wales (NSW) Environmental Protection Authority (EPA) Sampling Design Guidelines (1995).

ASS is a naturally occurring soil type which contains significant concentrations of iron sulfides, principally pyrite. Un-oxidised pyritic soils are referred to as potential ASS (PASS). When the soils are exposed, oxidation of sulfides results in generations of sulphuric acid and acid leachate with soil pH dropping below 4.0. The soils are then referred to as actual ASS (AASS).

ASS materials in subsurface sediments, not exposed of oxygen, do not pose a problem if left undisturbed. However, when exposed to oxygen by either lowering of the water table or by excavation, the ASS materials oxidise and with the presence of water will form sulphuric acid (refer to **Appendix A**). This can occur through natural processes such as dry periods without rainfall resulting in a lowering of the water table and formation of acid pools, which are later released during flooding events.

Exposure of ASS can cause significant damage to the environment, agricultural productivity and infrastructure including:

- inducing soil toxicities such as aluminium, iron and manganese;
- inducing soil deficiencies in phosphorous, potassium and calcium;
- degradation of water quality through severe acidification, de-oxygenation and contamination;
- loss or change in habitat in waterways and on land;
- fish disease, fish kills and decline;
- corrosion of infrastructure such as roads, bridges, pipes, and foundations; and
- diminished agricultural productivity and food production.

1.3 Description of Proposal

The proposed alterations and additions comprise of the following:

- new sealed open carpark to accommodate 28 parking spaces to the south of the entrance to the school;
- two new single storey Personal Development, Health and Physical Education (PDHPE) buildings linked by a covered concrete concourse (between Blocks O and P);
- new two-storey library building (in vicinity of Block M);
- renovation of existing buildings (Blocks A to O); and
- demolition of two buildings (agricultural block and gymnasium).

The proposed PDHPE and library buildings will be constructed at the existing ground level. Standard excavations for the construction of footings and importation of material for the construction of slabs will occur.

The location of the proposed alterations and additions within Blocks A-O and the proposed new library and PDHPE buildings are shown in **Illustration 1.2**.

Information shown is for illustrative purposes only

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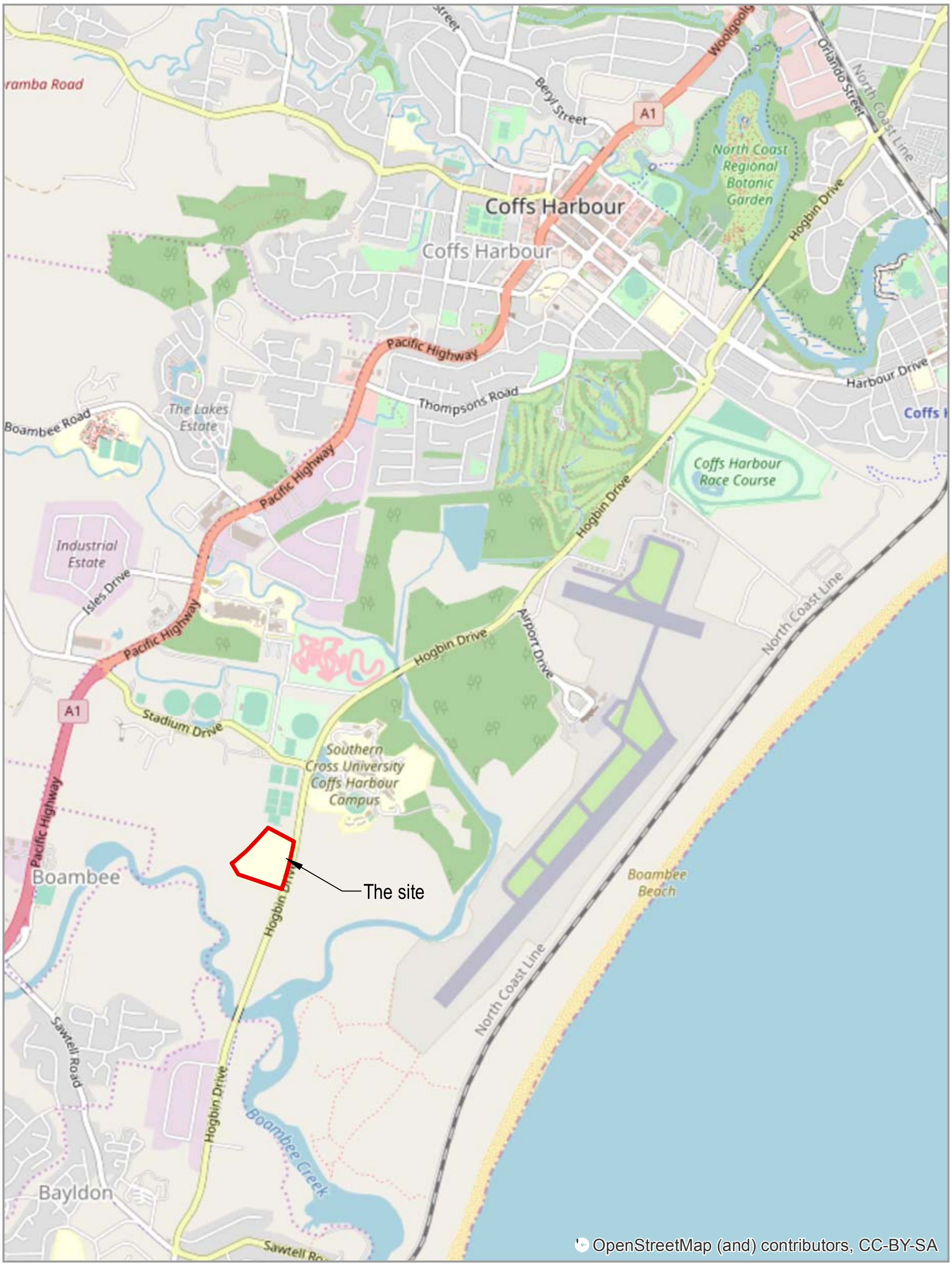
Source of base data: DFS&I



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Locality Plan

Acid Sulfate Soil Management Plan
St John Paul College Alteration and Additions
3089-1020

Illustration 1.1

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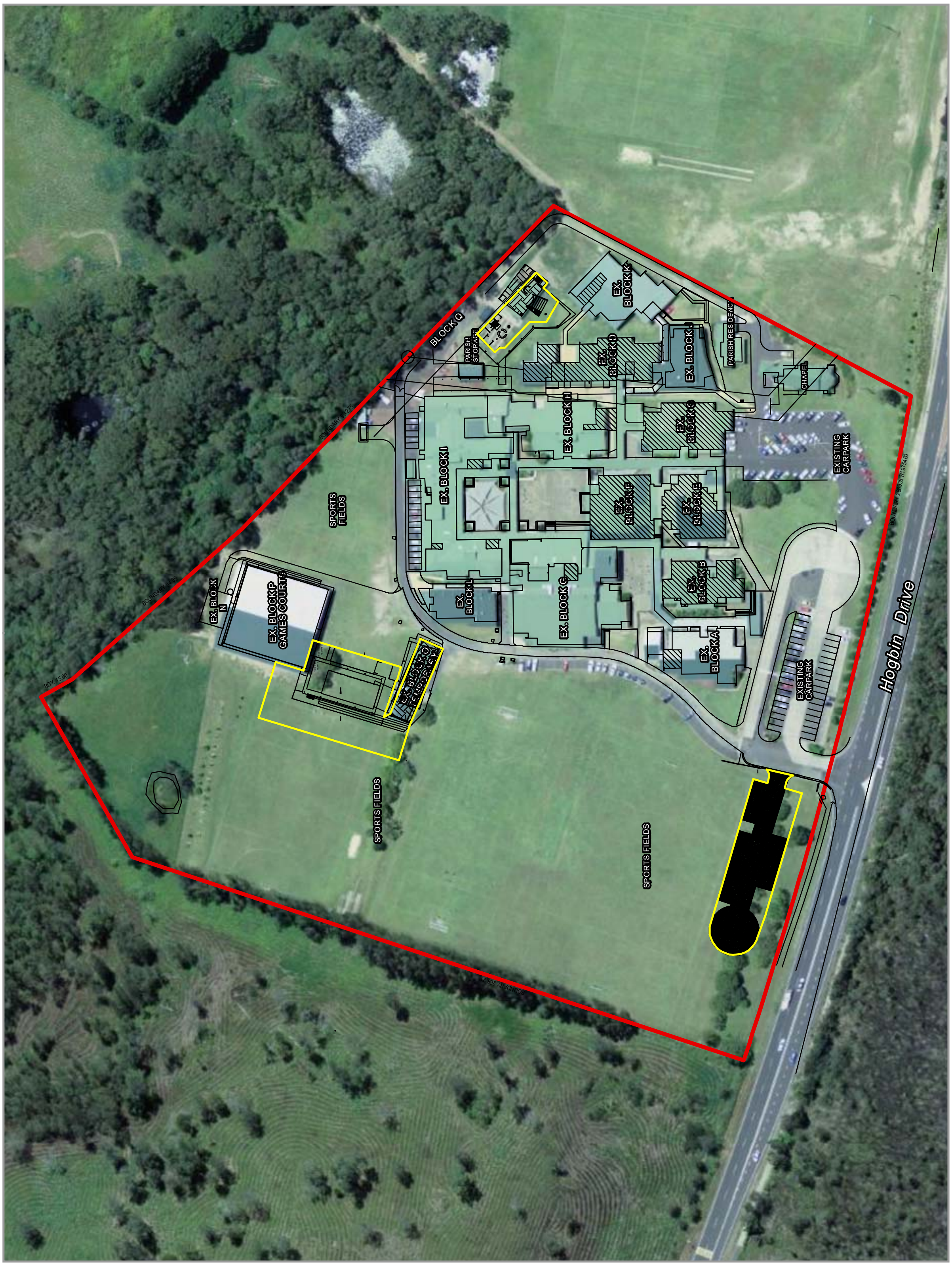


LEGEND

Saint John Paul College boundary

Proposed new structure

0 50

The Site

Illustration 1.2

GeoLINK environmental management and design

Acid Sulfate Soil Management Plan
St John Paul College Alteration and Additions
3089-1021

2. Site Description

2.1 Subject Site

The site is described as Lot 12 DP 709701 and is located on the western side of Hogbin Drive, approximately 5.5 km from the centre of Coffs Harbour on the Mid North Coast of NSW. The site is on the northern side of Boambee Creek. Other land uses in proximity to the site include the Coffs Coast Sport and Leisure Park and the Southern Cross University Coffs Harbour Campus.

The site has a total area of approximately 7.65 ha. It currently contains the full range of buildings, structures, car parks etc associated with a large high-school. This includes 15 classroom blocks, two major car parking areas and two smaller ones, a school bus drop off and pick up bay, maintenance sheds, storage sheds, sports fields, covered courtyards and gardens. The school has one access point off Hogbin Drive.

Within the school grounds there is a small amount of vegetation, consisting of planted shrubs and trees of varying size.

The site slopes from west (the rear of the site) to the east, from approximately four metres AHD (Australian Height Datum) down to two metres AHD. In the north-eastern corner of the site, there are some higher points around six metres AHD. The site is affected by flooding, however the areas where new buildings are proposed to be located are above the modelled 100-year flood level.

Plate 2.1 Photo taken looking north, location of proposed parking lot extension, looking north along Hogbin Drive

Plate 2.2 Photo taken looking to the north-west, location of proposed PDHPE building 1

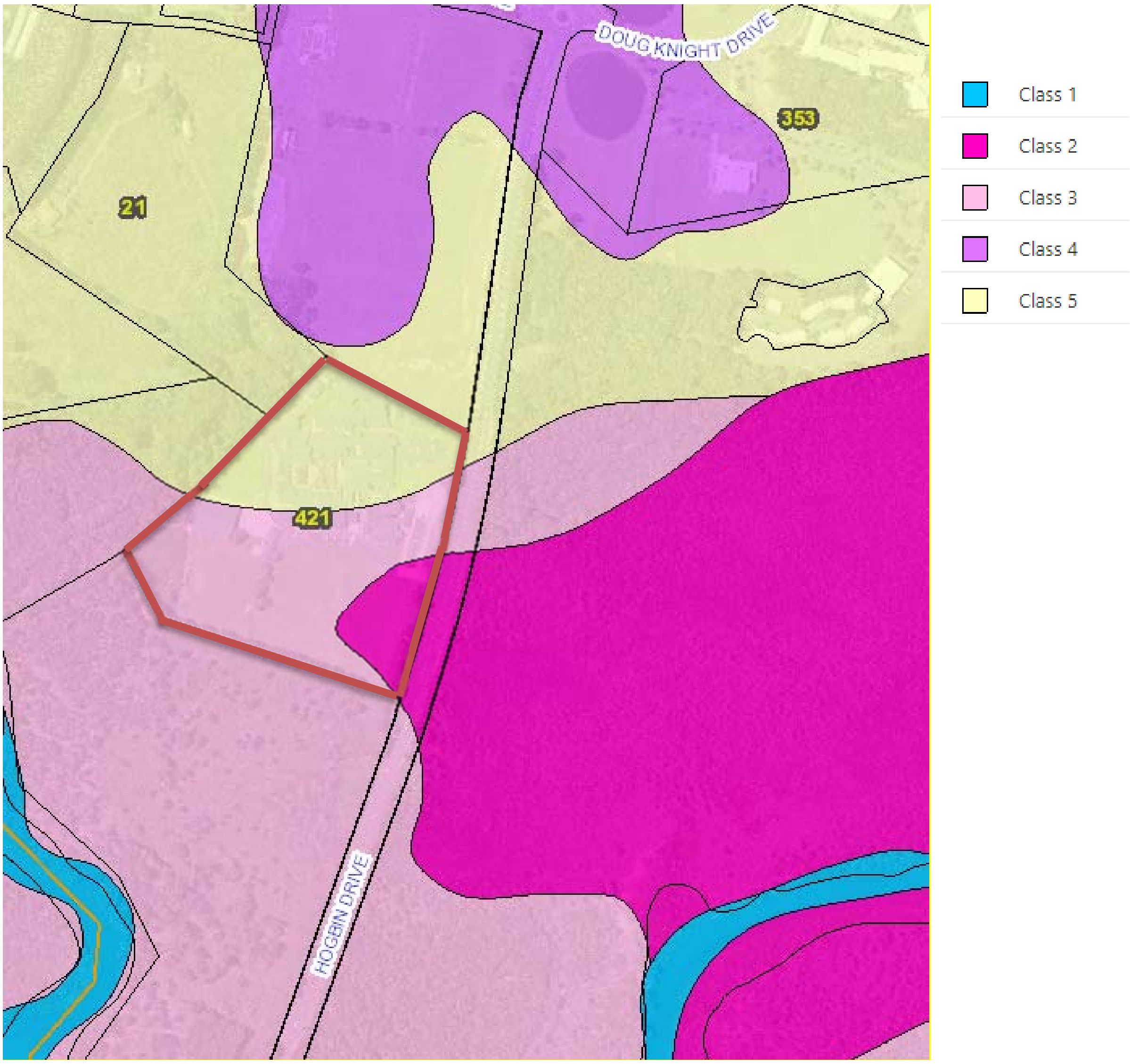
Plate 2.3 Photo taken looking to the west, location of the existing Block O (colorbond shed) where the proposed PDHPE building 2 will be located

2.2 Soils

The NSW Soil and Land Information System indicates that in this area of South Coffs Harbour, the site's physiography is hillslope under unknown on siltstone/ mudstone lithology. Soil type is Acidic Red Dermosol and Krasnozem. It is well drained; erosion hazard is moderate and there is no salting evident.

2.3 Coffs Harbour City Council Acid Sulfate Soils Mapping

According to Coffs Harbour City Council mapping, the development area is located within land mapped as having Acid Sulfate Soils (see **Figure 2.1**).



Source: CHCC LEP 2013 - Acid Sulfate Soils Mapping

Figure 2.1 Acid Sulfate Soils Map

The area where the library is proposed to be built is mapped as having Class 5 ASS. In accordance with Clause 7.1 (2) of the Coffs Harbour Local Environmental Plan (LEP) 2013, the proposed works will not require the need for preliminary assessment or preparation of an ASSMP as excavation works will not result in the lowering of the water table by one metre AHD on adjacent Class 1, 2, 3 or 4 land. Therefore, for the purpose of this ASSMP, the library has been excluded from further assessment.

The area where the PDHPE buildings is proposed to be built is mapped as having Class 3 ASS and the proposed car park is mapped as being within Class 2 ASS. Clause 7.1 (2) of the Coffs Harbour LEP 2013 requires ASS investigations for any works more than one metre below the natural grown surface (Class 3) and any works below the natural ground surface (Class 2).

In consultation with the DRA Architects, it was determined that the maximum depth of excavation for both PDHPE buildings is approximately 400 mm reduced level (RL) for footings and piers.

3. Soil Analysis

3.1 Soil Sampling

In accordance with Table 4.1 of the ASSMAC guidelines, the extent of the works footprint required a total of four boreholes across the proposed development site (locations of each borehole are shown in **Illustration 3.1**). The collection of soil samples for each bore was obtained at 0.5 m intervals to a maximum depth of 1.5 m (for PDHPE building 1). This is in accordance with ASSMAC assessment guidelines which state that the sampling depth of investigations should usually be at least one metre beyond the depth of the proposed excavation.

The depth of sampling generally extended to 0.5-1.0 m beyond the maximum depth of excavation. It is noted that within the footprint of both PDHP buildings, overlaying fill was observed extending outwards and to the east of the existing games court and carpark. It is assumed that this fill was 300-400 mm above the adjacent levelled playing fields. To confirm, a borehole sample was taken in this area and fill was encountered within the first soil horizon.

To obtain a representative sample, two bore holes (refer to **Illustration 3.1** for BH3 and BH4) were taken adjacent to both building envelopes on the natural ground level of the sporting field. However, further underlining fill was encountered at depths of approximately 600mm and extended beyond one metre (refer to **Plate 3.3**).

Analysis of samples were screened by undertaking field pH (pHF) and field peroxide pH (pH_{fox}) tests to provide initial indication of PASS/ AASS, the results of which are displayed **Table 3.1**. pHF and pH_{fox} tests were in accordance with ASSMAC test method codes 21Af and 21Bf respectively (refer to **Plate 3.1**). Furthermore, pH_{fox} testing was carried out using 30 per cent hydrogen peroxide adjusted to pH 5.5.

Plate 3.1 Field pH test being undertaken

3.2 Soil Sample Collection

Soil samples were obtained using a hand auger (refer to **Plate 3.2**). The hand auger was thoroughly washed and decontaminated between each sample location.

Soil samples were placed in sealed plastic bags and kept in a chilled state in an esky to reduce the oxidation of sulfidic compounds.

The samples were couriered to a National Association of Testing Authorities registered laboratory: Environmental Analysis Laboratory (EAL) at Southern Cross University, Lismore.

The Chain of Custody forms for the samples is included in **Appendix C**.

Plate 3.2 Soil samples were obtained using a hand auger, photo taken looking south from PDHP building 1

Plate 3.3 Example of soil profile consisting of granular to light clay fill, photo taken from BH4 (PDHP building 2).

3.3 Field Results

A summary of the field-testing results is displayed in **Table 3.1** below. A total of nine samples (two from each borehole plus an additional one to a depth of approximal 1.5 m (at BH3) were sent for laboratory analysis. The field peroxide test is only an indicative test that is used to guide the selection of laboratory test samples.

Table 3.1 Field Sampling Results

Sample Number	*Sample Depth (m)*	*pHw*	*pH_{fox}*	*PASS/ ASS Indication**
BH1	0.5	4.21	3.71	PASS/ AASS
BH1	1.0	4.81	3.89	PASS/ AASS
BH2	0.5	4.72	3.79	PASS/ AASS
BH2	1.0	4.43	3.41	PASS/ AASS
BH3	0.5	5.40	4.11	Inconclusive
BH3	1.0	5.13	4.09	Inconclusive
BH3	1.5	5.09	4.16	Inconclusive
BH4	0.5	5.35	4.21	Inconclusive
BH4	1.0	5.52	4.26	Inconclusive

*Indications are based on the ASSMAC guidelines and are determined as follows:

- pH readings of pH less than or equal to four (≤4) indicate that ASS are present with the sulphides having been oxidised in the past, resulting in acid soil (and soil pore water conditions);
- pH values greater than four (>4) and less than five decimal five (<5.5) are acid and may be the result of some previous or limited oxidation of sulphides, but are not definite confirmations of AASS;
- to test for the presence of unoxidised sulphides and therefore PASS, the oxidation of the soil with 30% (100 volume) hydrogen peroxide can be performed in the field; and
- potentially positive reactions for PASS usually result in a final pH of <3.5 and lowering of soil pH by at last one pH unit.

3.4 Laboratory Analysis

Samples were submitted to the EAL for analysis of the percentage of Reduced Inorganic Sulfur (% $_{Scr}$), Titratable Actual Acidity (TAA), net acidity and liming rate. The laboratory results are based on the following:

- Non-Actual Acid Sulfate Soils (Non-AASS) - Laboratory testing indicates these soils have a TAA and reduced $\%_{Scr}$ below the ASSMAC action criteria and are not considered to present an environmental hazard;
- Non-Potential Acid Sulfate Soils (Non-PASS) – Laboratory testing indicates these soils have a reduced $\%_{Scr}$ below the ASSMAC action criteria and are not considered to present an environmental hazard;
- Potential Acid Sulfate Soils (PASS) – Laboratory testing indicates these soils have reduced $\%_{Scr}$ above the ASSMAC action criteria. They may generate sulfuric acid and may present an environmental hazard. Management of these soils will be required;
- Actual Acid Sulfate Soils (AASS) – Laboratory testing indicates that these soils have a TAA and reduced $\%_{Scr}$ above the ASSMAC action criteria. These soils may leach acid and will require management; and

- Acidic Soils – Laboratory testing indicates that these soils have a net acidity (based on $\%_{Scr}$) above the ASSMAC action criteria, but they have reduced inorganic sulfur content below the ASSMAC action criteria. These soils may present an environmental hazard and may require management.

Samples were therefore analysed for TAA and Reduced Inorganic Sulfur (S_{CR}) to determine if the soil is AASS or PASS.

3.5 Laboratory Results

Refer to **Appendix C** for laboratory testing which shows parameters analysed for each sample, including TAA, S_{CR} and net acidity against the Water Quality Australia National Acid Sulfate Soils Guidance National acid sulfate soils sampling and identification methods manual June 2018 criteria.

The laboratory test results presented in **Table 3.2** indicate:

- Soils in the area of the proposed carpark are naturally acidic with acidity levels (TAA) exceeding the action criteria for all of the samples tested down to 1m (BH1 and BH2); and
- Soil tested within the proposed PDHPE buildings were negative for ASS/PASS (BH3 and BH4) therefore, confirming the presence of fill.

The analysis of results indicates that the proposed works will not encounter ASS/ PASS. The exception to this is the location of the proposed carpark. Ground disturbance is not anticipated to extend beyond one metre depth. Therefore, in accordance with the Acid Sulfate Soils Manual, an ASS Management Plan has been formulated (refer to **Section 4**) by establishing a range of mitigation measures that will be undertaken during the excavation of naturally occurring soils onsite, should ASS/ PASS be encountered.

Table 3.2 Summary of ASS Laboratory Test Results

Sample Number	*Sample Depth (m)*	*Texture*	*Actual Acidity – TAA (mol H+ / t)*	*Potential Sulfidic Acidity – CRS (mol H+ / t)*	*Net Acidity (mol H+ / t)*	*Lime Calculation kg CaCO3 / tonne DW)*
BH1	0.5	Medium	58	9	66	5
BH1	1.0	Fine	43	16	59	4
BH2	0.5	Medium	59	8	67	5
BH2	1.0	Fine	78	3	81	6
BH3	0.5	Medium	29	3	32	2
BH3	1.0	Medium	28	0	28	2
BH3	1.5	Medium	30	0	30	2
BH4	0.5	Medium	26	0	26	2
BH4	1.0	Medium	32	0	32	2

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Source of base data: DFS&I

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LEGEND

- Saint John Paul College boundary
- Proposed PDHPE building
- Proposed new carpark
- Sample location

0 30

Sampling Locations

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Acid Sulfate Soil Management Plan
St John Paul College Alteration and Additions
3089-1019

Illustration 3.1

4. Acid Sulfate Soil Management Plan

As discussed in **Section 2.3**, the construction methodology does not require any significant excavation works to be undertaken. Laboratory analysis on soil samples taken within the proposed carpark footprint confirmed the presence of ASS material to a depth of one metre. No ASS/ PASS is anticipated to be encountered within the PDHPE buildings works footprint. Therefore, the following measures are applicable to earthworks within the carpark footprint.

4.1 Responsibility

The Site Manager is responsible for implementing the management procedures described in this Acid Sulfate Soil Management Plan.

The personnel undertaking any monitoring are to be suitably qualified and competent with use of the monitoring equipment and interpretation of the results. In addition to the following management measures, the treatment and handling of ASS must be carried out in accordance with standard Work Health and Safety (WHS) guidelines. Personnel will be appropriately trained in handling of chemicals and test equipment.

4.2 Management Principles

The following principles of Acid Sulfate Soil Management are in accordance with the ASSMAC Management Guidelines (1998) and are the fundamental strategies that underpin the management of ASS:

- *avoidance* is the most-sound strategy and the proposed works should always attempt to modify work practices in order to avoid unnecessarily exposing or disturbing ASS;
- *minimisation* of the disturbance of ASS materials. Appropriate handling techniques and treatment of excavated soil are to be used to minimise and/or prevent the disturbance of PASS. Furthermore, earthworks activities should be managed to minimise or mitigate the potential of ASS to impact on the surrounding environment. If applicable, backfill of excavated material should be taken within 48 hours of excavation and ensure separated topsoil is used for the upper layer of backfill; and
- *neutralisation* of excavated soils using lime in order to neutralise acid that is generated over time due to the gradual oxidation of ASS. Neutralising agent should also be applied to acidified water run-off and any remaining water 'in-situ' (within the pore spaces of the material being excavated) that has become acidified.

4.3 Management and Processing of ASS

The laboratory results confirm the presence of ASS, therefore disturbance of ASS material is unavoidable as part of the works. Excavations for trenches and pits should aim to backfill within 24 hours which will minimise oxidation of ASS material and avoid the need for neutralisation (reburial of ASS material is generally acceptable within 48 hours of disturbance for fine grained (i.e. clayey) soils).

Excavated soil that cannot be re-buried within 24-48 hours will need to be stockpiled and neutralised using lime (refer below).

4.3.1 Treatment Area – Temporary Stockpiling of ASS Material

ASS shall be placed in a prepared treatment area, preferably the treatment area should be located close to the area where the materials will be excavated.

The treatment area shall be fully enclosed by a bund wall to prevent runoff to other areas of the site. The following measures will need to be applied:

- The size of the treatment area should be sufficient to treat the excavated materials at the proposed excavation rate and to store material for the period required to undertake verification testing.
- The treatment area should be lined with several layers of heavy-duty plastic (HDPE). Lime the base layer of the stockpile areas with a five millimetre thick layer of fine grade-1 agricultural lime.
- Spread spoil onto the treatment area in layers 100 – 300mm thick.
- Lime shall be incorporated into the material at a rate of six kilograms lime/ cubic metre of soil to neutralize the acid (this liming rate is based on the rates in **Table 3.2**). The lime shall be thoroughly mixed with the spoil.
- The effectiveness of the adopted dosing rate should be confirmed by the regular sample screening of the treated material using pH and peroxide pH field tests, with additional lime added as required.
- pH of the neutralised soils is to be monitored daily until reburial/ backfilling or until a pH in the range of 6.5 to 8.5 is achieved. This is to ensure there is adequate lime application. If pH is below 6.5 additional small amounts of lime should be added to bring the soil to the range of 6.5 to 8.5.
- As a precautionary measure, treatment works involving lime shall not be conducted during excessively windy conditions, unless the material can be appropriately conditioned to prevent dust generation.
- Stockpile areas shall be inspected at least daily to ensure they are functioning, and materials/ leachate are not causing contamination outside the treatment site.
- Sufficient amounts of lime and other materials shall be procured for neutralization and emergency situations.
- Stockpile areas and treated material will be kept moist or otherwise stabilised to prevent wind-blown dust and to inhibit oxidation

If the material is to be removed from the site for treatment, approval should be sorted from regulatory authorities (council and EPA) prior to it being removed (refer to **Section 4.5**).

4.3.2 Leachate and Run-off Control

Water exposed to ASS and having a pH <6.0, including water generated from ASS treatment, will require collection and management. Any leachate generated during the treatment operations exposed to ASS and having a pH <6.0 will be directed to impermeable collection tanks/ ponds and treated as follows:

- leachate and run-off from areas containing stockpiles, excavations and pit spoil handling areas will be captured and contained or directed to leachate treatment tanks/ ponds prior to discharge;
- treatment and neutralisation will be accomplished with dissolved lime slurry, hydrated lime, quicklime or other suitable reagents, with the liming rate determined following assessment of actual pH levels. Discharge of leachate/ run-off may occur when the pH of the leachate/ run-off has been consistent for 24 hours at a pH between 6.5 and 8.5 and other discharge requirements such as those outlined in the Erosion and Sediment Control Plan have been met;

- pH of leachate/ run-off treated 'in-situ' in excavations/ pits will be measured daily or whenever the flow rate changes. pH results will determine the application rate for neutralization lime and the amount of treatment prior to discharge;
- treated leachate will be discharged at an appropriate point and will be monitored during discharge; and
- if leachate contains contaminants, including heavy metals, it will be disposed offsite at an appropriate treatment facility.

4.4 Monitoring

Regular (at least daily) visual monitoring of work areas will be undertaken to identify signs of ASS or oxidation of ASS. This monitoring will include checking for the following:

- unexplained scalding, degradation or death of vegetation;
- unexplained death or disease in aquatic organisms in adjacent water bodies;
- formation of the mineral jarosite and other acidic salts in exposed or excavated soils;
- areas of green-blue water or unnaturally clear water indicating high concentrations of aluminium and/or low pH;
- rust coloured deposits on plants and on the banks of water bodies and watercourses indicating iron precipitates;
- black to very discoloured waters indicating de-oxygenation; and
- any sulfurous smells.

All personnel are responsible for reporting all incidents to their supervisor and project environment team. Immediate, short-term and long-term controls or remediation will be implemented to control impacts.

4.5 Offsite Disposal

Where off-site disposal of material, or reuse of material at an alternative site is proposed it should be assessed in accordance with the requirements of the *Department of Environment and Climate Change NSW Waste Classification Guidelines Part 1 Classifying Waste* (July 2009) and/or the EPA Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014. As this material is identified as ASS, the materials cannot be classified as virgin excavated natural material (VENM) or excavated natural material (ENM). This could have implication on the proposed development from a material disposal perspective. A site-specific exemption for the material could be requested from the EPA to enable the material to be used elsewhere, otherwise the material may require disposal to landfill.

References

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The dimensions, number, size and shape of lots shown on drawings are subject to detailed engineering design, final survey and Council conditions of consent.

Topographic information presented on the drawings is suitable only for the purpose of the document as stated above. No reliance should be placed upon topographic information contained in this report for any purpose other than that stated above.

Appendix A

Identifying Acid Sulfate Soils

Potential Acid Sulfate Soil (PASS)

Soil Characteristics

- Waterlogged soils – unripe muds (soft, sticky and can be squeezed between fingers, blue-grey or dark greenish-grey mud with a high water content), silty sands or sands (mid to dark grey) or bottom sediments (dark grey to black e.g. iron monosulfides 'black oozes') possibly exposed at sides and bottom of drains or cuttings, or in boreholes;
- peat or peaty soils;
- coffee rock horizons; or
- a sulfurous smell e.g. hydrogen sulfide or 'rotten egg' gas.

Potential ASS Soil Profile

Water Characteristics

- Waterlogged soils;
- water pH usually neutral but may be acidic; and
- oily looking iron bacterial surface scum (the similar appearances of iron bacterial scum and a hydrocarbon slick can be differentiated by disturbing the surface with a stick: bacterial scum will separate if agitated whereas a hydrocarbon slick will adhere to the stick upon removal).

NB: Caution should be taken when inspecting highly altered landscapes in the field (e.g. where inert fill has been placed over ASS material, dredge spoil, etc.). Soil, water and landscape indicators may be masked by past landscape and drainage modifications and this should be taken into consideration when determining borehole locations.

Vegetation Characteristics

- Dominant vegetation is tolerant of salt, acid and/or waterlogging conditions e.g. mangroves, salt couch, *Phragmites* (a tall acid tolerant grass species), swamp-tolerant reeds, rushes, paperbarks (*Melaleuca spp.*) and swamp oak (*Casuarina spp.*).

Field Indicators for Potential Acid Sulfate Soil Conditions

- Typically waterlogged, unripe muds (soft, buttery texture, blue-grey or dark greenish-grey) or estuarine silty sands or sands (mid to dark grey) or bottom sediments of estuaries and tidal lakes (dark grey to black); and
- offensive odour, predominantly due to ‘rotten egg gas’ (hydrogen sulfide H2S).

Actual Acid Sulfate Soil (AASS)

Soil Characteristics

- Presence of corroded shell;
- sulfurous smell e.g. hydrogen sulfide or ‘rotten egg’ gas; and any jarositic horizons or substantial iron oxide mottling in surface encrustations or in any material dredged or excavated and left exposed.

AASS Soil Profile

Water Characteristics

- Water of pH <5.5 (and particularly below 4.5) in surface water bodies, drains or groundwater (this is not a definitive indicator as organic acids may contribute to low pH in some environments such as *Melaleuca* swamps);
- unusually clear or milky blue-green water flowing from or within the area (aluminium released by ASS acts as a flocculating agent);

- extensive iron stains on any drain or pond surfaces, or iron-stained water and ochre deposits; and
- oily looking bacterial surface scum (differentiated from a hydrocarbon slick of similar appearance as described for PASS).

Vegetation Characteristics

- Dead, dying, stunted vegetation*;
- scalded or bare low-lying areas*; and
- poor vegetation regrowth in previously disturbed areas.

Infrastructure

- Corrosion of concrete and/ or steel structures* (including foundations, fences, masonry/ brick walls, pipes).

NB: May also be due to excessive salinity or to salinity in combination with AASS.

Field Indicators for Actual Acid Sulfate Soil Materials and Conditions

- Unusually clear or milky blue-green drainage water within or flowing from the area, (aluminium released by the ASS acts as a flocculating agent);
- extensive iron stains on any drain or pond surfaces, or iron-stained water and ochre deposits;
- Jarosite containing horizons or iron oxide mottling in auger holes or recently dug surfaces. The straw-coloured material in this black clay is the mineral Jarosite. Jarosite is evidence that there are oxidised ASS. It is found in places where the ASS has been disturbed (excavated or drained) so that the previously inundated ASS layers have been exposed to air. This shows the typical Jarosite formation in drained soil: first appearing along the root channels. Jarosite present in surface encrustations or in any material dredged or excavated and left exposed;
- corrosion of concrete and/or steel structures;
- dominance of mangroves, reeds, rushes and other swamp-tolerant vegetation; and
- sulfurous (H2S) smell after rain following a dry spell, or when the soils are oxidised or disturbed.

Sulfidic material in Acid Sulfate Soil - Type 1 – formed in the River Murray under permanently waterlogged or saturated conditions under 75 to 100 cm of water.

White and yellow **salt efflorescence** on soil surface and with bright yellow mottles in cracks.

Sulphuric material black to dark grey with brownish mottles. Light clay. Become acidic (pH <4) after drainage. Bright yellow and white salts in mottles and on sides of cracks.

Monosulfidic black ooze (MBO) material in Acid Sulfate Soil - Type 3 – exposed in shallow back swamp/ wetlands. MBO in water is able to remove most of the oxygen from the water.

Appendix B

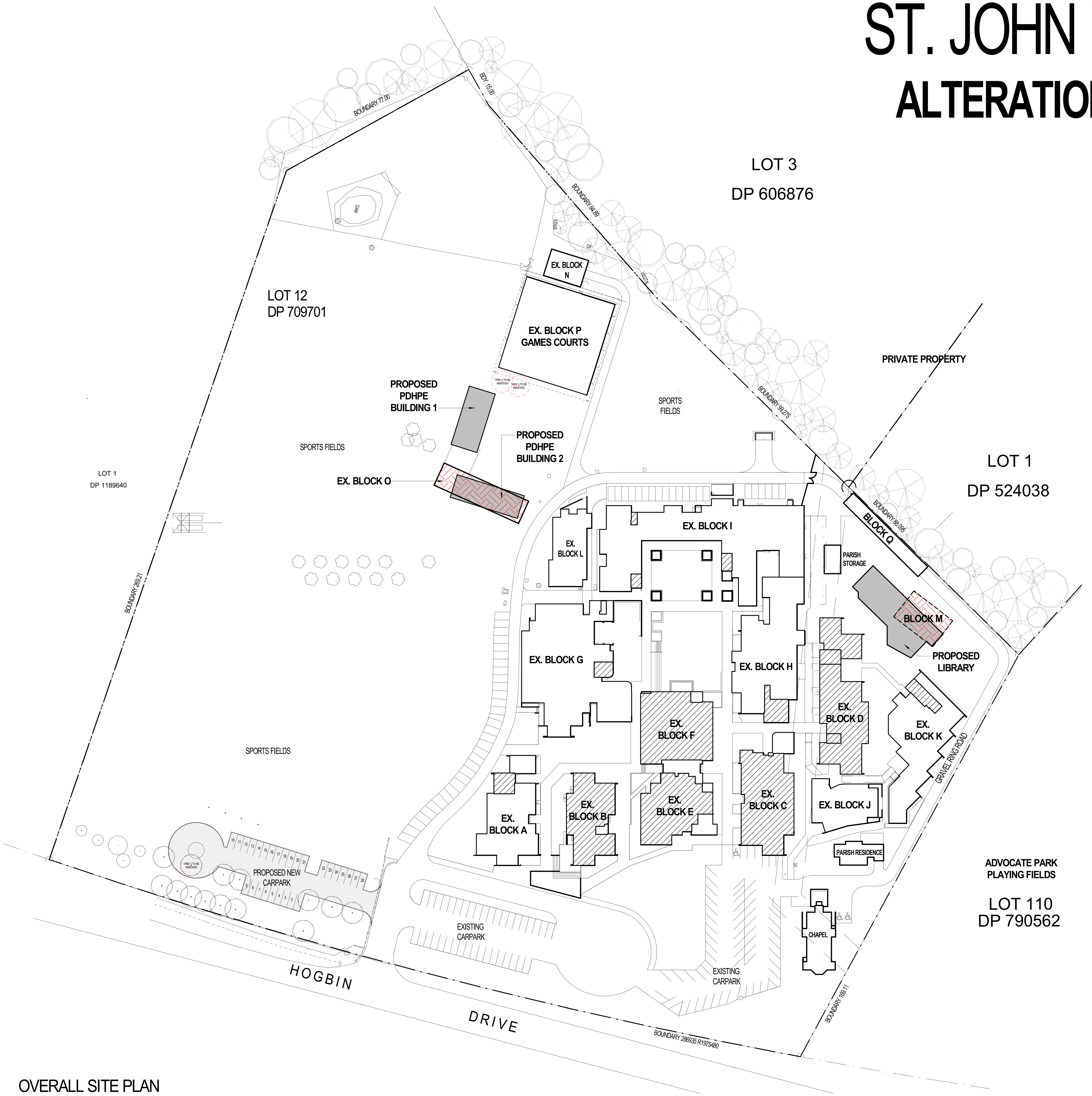
Detailed Design Plans

LEGEND

EX	EXISTING
PDHPE	PERSONAL DEVELOPMENT, HEALTH AND PHYSICAL EDUCATION

ST. JOHN PAUL COLLEGE

ALTERATIONS AND ADDITIONS



OVERALL SITE PLAN

SCALE: 1 : 750

KEY

- NEW BUILDINGS
- EXISTING BUILDING ALTERATIONS
- EXISTING BUILDING TO BE DEMOLISHED
- NEW CARPARKING
- EXISTING BUILDING - NO PROPOSED WORKS
- EXISTING TREE TO BE DEMOLISHED

rev	date	details	initials	checked
1	15/03/19	ISSUED FOR DEVELOPMENT APPLICATION	LM/BR	AB

DEVELOPMENT APPLICATION

CONTROLLED DOCUMENT - CHANGES WILL BE NOTIFIED

DRAARCHITECTS PTY LTD

Adrian Borsato NSW 4172 Warren Steele NSW 6526

(02) 6651 4905 ABN 12 096 929 387

dracoffs@draarchitects.com.au

client

ST JOHN PAUL COLLEGE, COFFS HARBOUR

project

ALTERATIONS AND ADDITIONS

421 HOGBIN DRIVE
COFFS HARBOUR NSW 2450
LOT 223 DP 1136502

scale	1 : 750		@A1
drawn	LM/BR		
checked	Checker	15/03/19	
verified	Approver	15/03/19	
approved	Approver	15/03/19	
total number of sheets		31	

plotted 15/03/2019 4:19:14 PM

true north

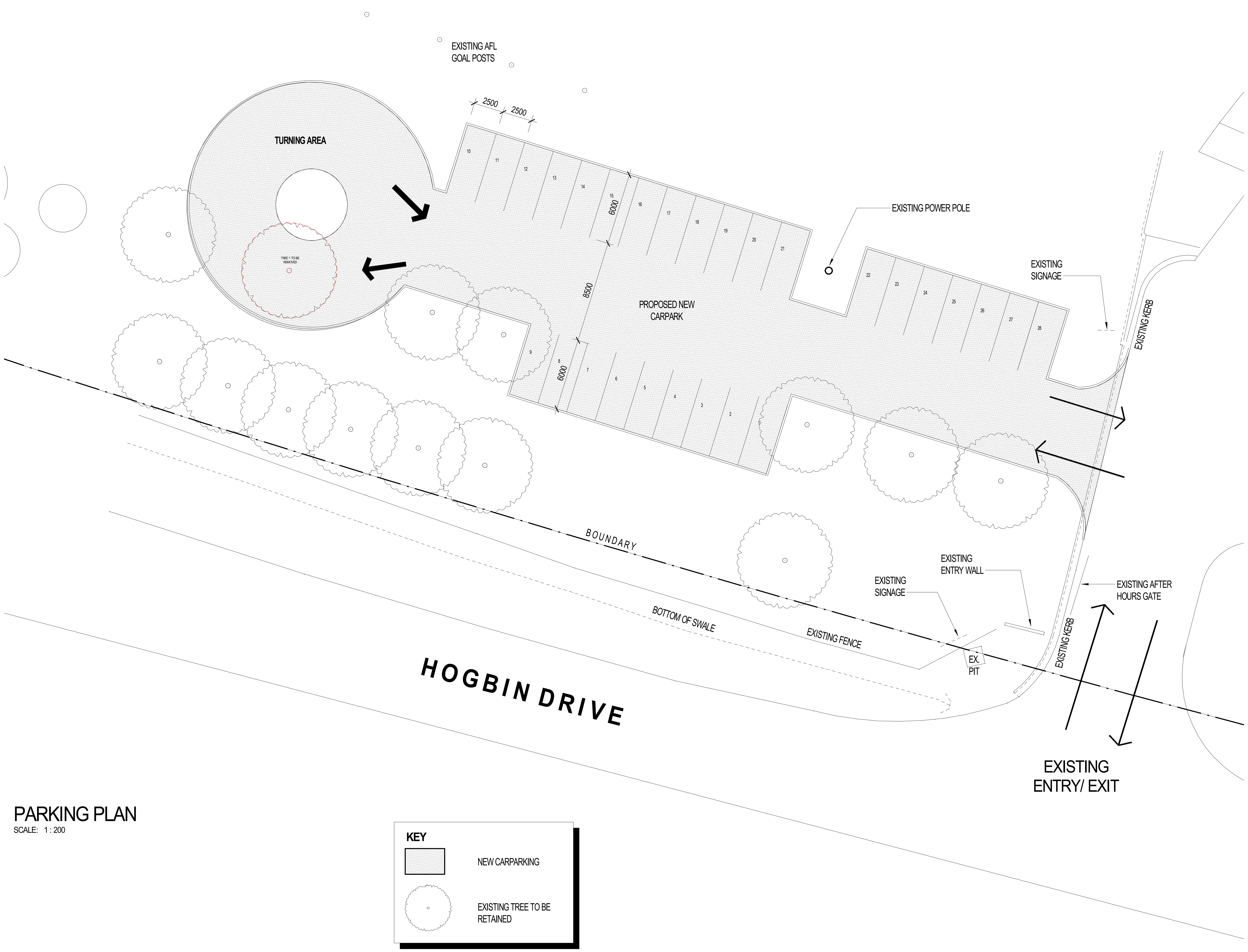
drawing

OVERALL SITE PLAN

project number	drawing number	revision
18001	DA01	1

LEGEND

EX	EXISTING
PDHPE	PERSONAL DEVELOPMENT, HEALTH AND PHYSICAL EDUCATION



PARKING PLAN
SCALE: 1 : 200

KEY

	NEW CARPARKING
	EXISTING TREE TO BE RETAINED

rev	date	details	initials	checked
1	15/03/19	ISSUED FOR DEVELOPMENT APPLICATION	LM/BR	AB

DEVELOPMENT APPLICATION

CONTROLLED DOCUMENT -
CHANGES WILL BE NOTIFIED

DRAARCHITECTS PTY LTD
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dracoffs@draarchitects.com.au

client
ST JOHN PAUL COLLEGE, COFFS HARBOUR

project
ALTERATIONS AND ADDITIONS
421 HOGBIN DRIVE
COFFS HARBOUR NSW 2450
LOT 223 DP 1136502

scale	1 : 200	@A1	plotted 15/03/2019 4:19:21 PM
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checked	Checker	15/03/19	
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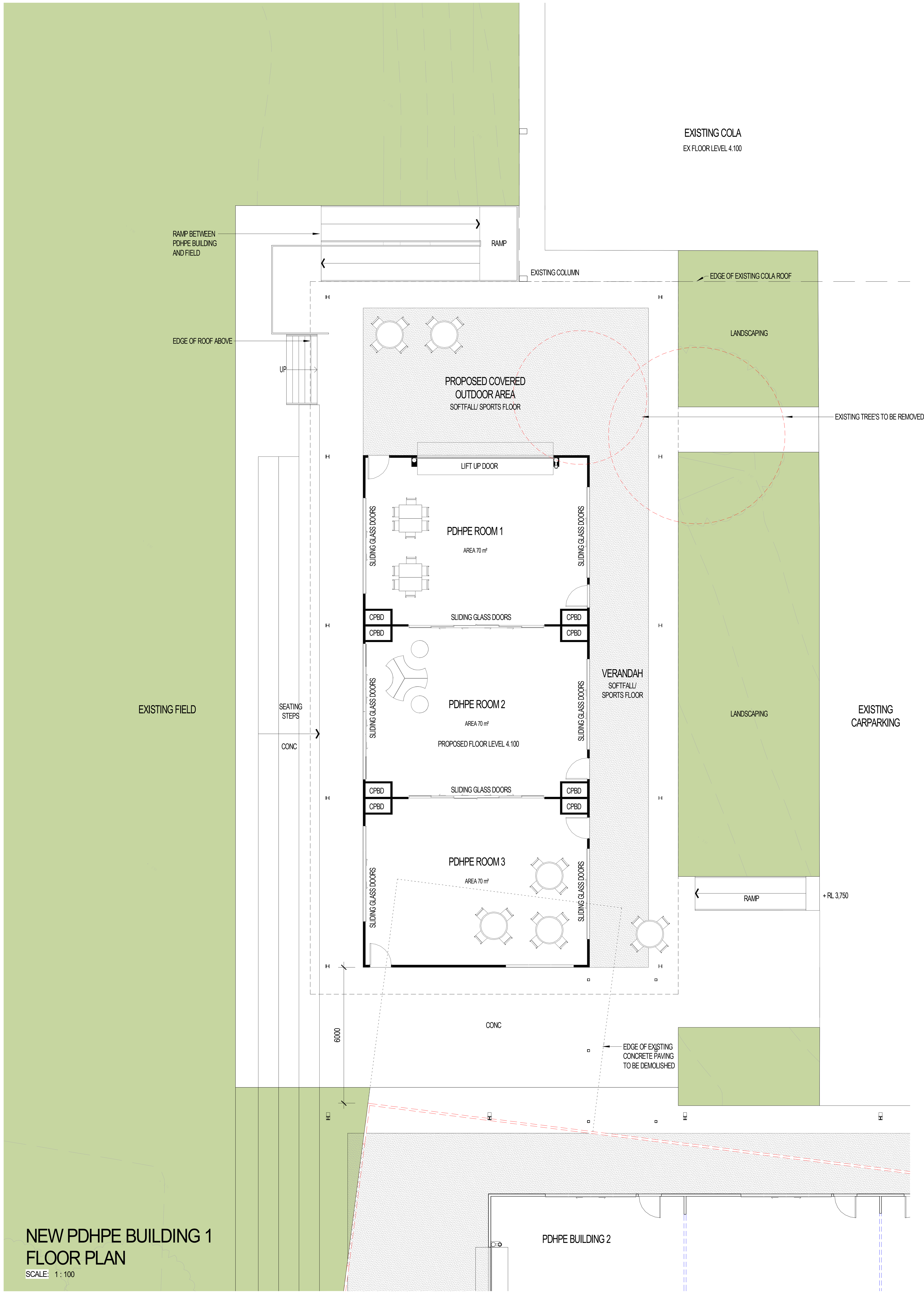
approved	Approver	15/03/19	
total number of sheets		31	true north

drawing
PARKING PLAN

project number	drawing number	revision
18001	DA02	1

LEGEND	
EX	EXISTING
PDHPE	PERSONAL DEVELOPMENT, HEALTH AND PHYSICAL EDUCATION
GPLA	GENERAL PURPOSE LEARNING AREA
AV	AUDIO VISUAL
AP	ASSISTANT PRINCIPAL



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SCALE: 1 : 100

rev	date	details	initials	checked
1	15/03/19	ISSUED FOR DEVELOPMENT APPLICATION	LM/AB	AB

DEVELOPMENT APPLICATION

CONTROLLED DOCUMENT - CHANGES WILL BE NOTIFIED

DRAARCHITECTS PTY LTD

Adrian Borsato NSW 4172 Warren Steele NSW 6526

(02) 6651 4905 ABN 12 096 929 387

dracoffs@draarchitects.com.au

client

ST JOHN PAUL COLLEGE, COFFS HARBOUR

project

ALTERATIONS AND ADDITIONS

HOGBIN DRIVE
COFFS HARBOUR NSW 2450
LOT 223 DP 1136502

scale	1 : 100 @A1	plotted	15/03/2019 3:07:59 PM
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checked	AB	15/03/19	
verified	AB	15/03/19	
approved	AB	15/03/19	
total number of sheets	31		

true north

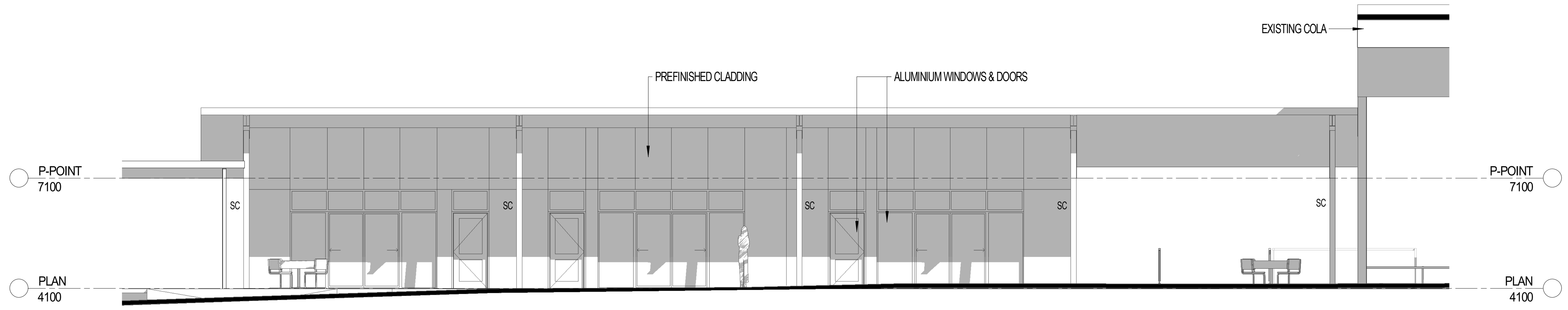
drawing

NEW PDHPE BUILDING 1 PLAN

project number	drawing number	revision
18001	DA20	1

LEGEND

EX	EXISTING
PDHPE	PERSONAL DEVELOPMENT, HEALTH AND PHYSICAL EDUCATION
GPLA	GENERAL PURPOSE LEARNING AREA
AV	AUDIO VISUAL
AP	ASSISTANT PRINCIPAL



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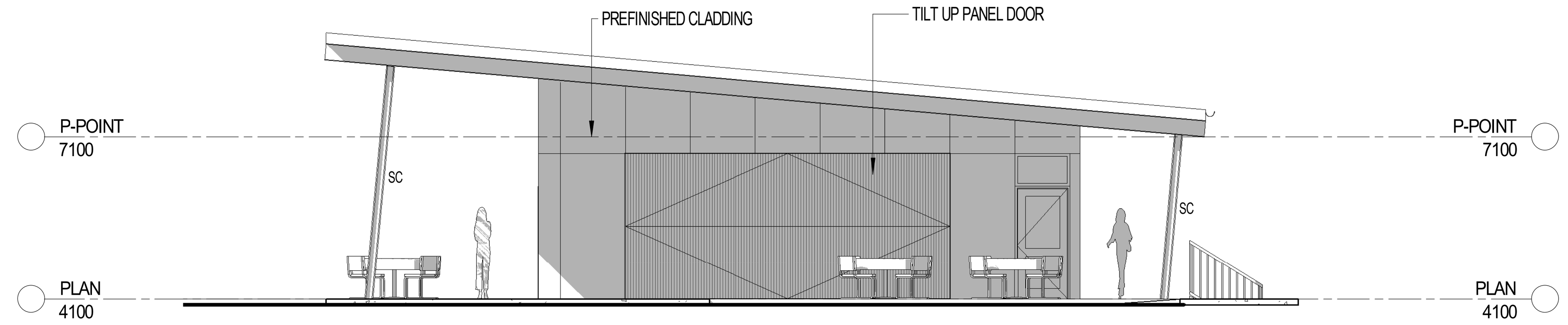
NORTH ELEVATION
SCALE: 1 : 100



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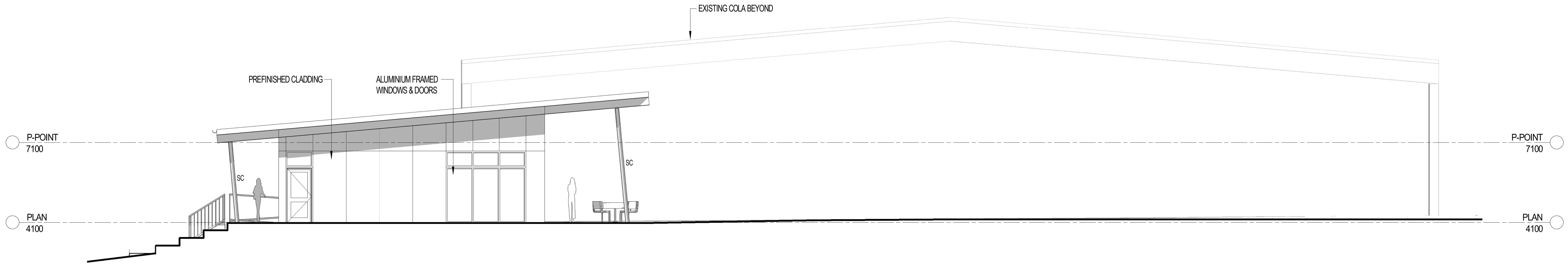
WEST ELEVATION
SCALE: 1 : 100



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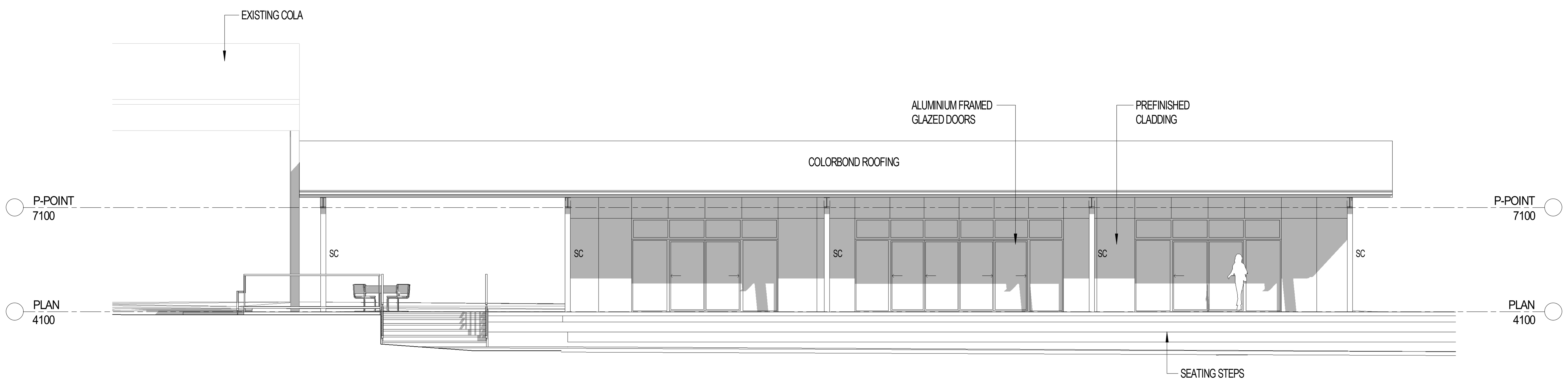
EAST ELEVATION
SCALE: 1 : 100



NEW PDHPE BUILDING 1
SOUTHELEVATION
SCALE: 1 : 100

rev	date	details	initials	checked
1	15/03/19	ISSUED FOR DEVELOPMENT APPLICATION	LM/AB	AB

DEVELOPMENT APPLICATION

CONTROLLED DOCUMENT - CHANGES WILL BE NOTIFIED

DRAARCHITECTS PTY LTD
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client
ST JOHN PAUL COLLEGE, COFFS HARBOUR

project
ALTERATIONS AND ADDITIONS
HOGBIN DRIVE
COFFS HARBOUR NSW 2450
LOT 223 DP 1136502

scale	1 : 100 @A1	plotted	15/03/2019 3:08:02 PM
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verified	Approver 15/03/19		
approved	Approver 15/03/19		
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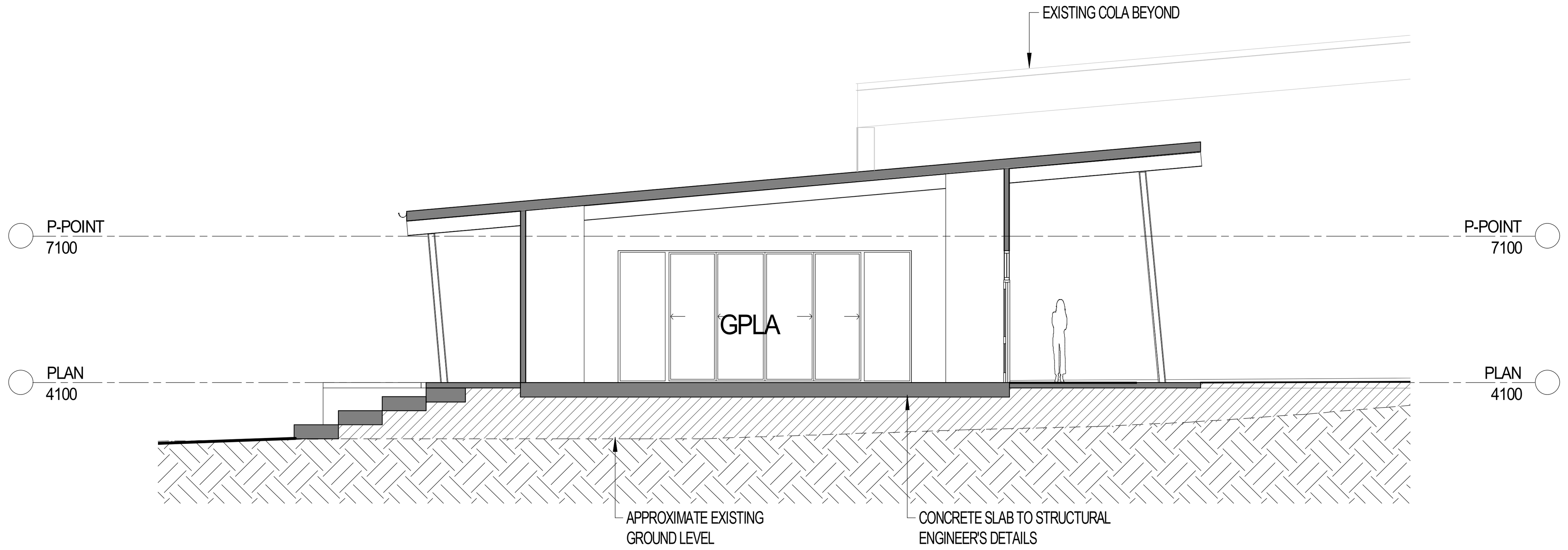
drawing
NEW PDHPE BUILDING 1 ELEVATIONS

project number	drawing number	revision
18001	DA21	1

LEGEND

EX	EXISTING
PDHPE	PERSONAL DEVELOPMENT, HEALTH AND PHYSICAL EDUCATION
GPLA	GENERAL PURPOSE LEARNING AREA
AV	AUDIO VISUAL
AP	ASSISTANT PRINCIPAL



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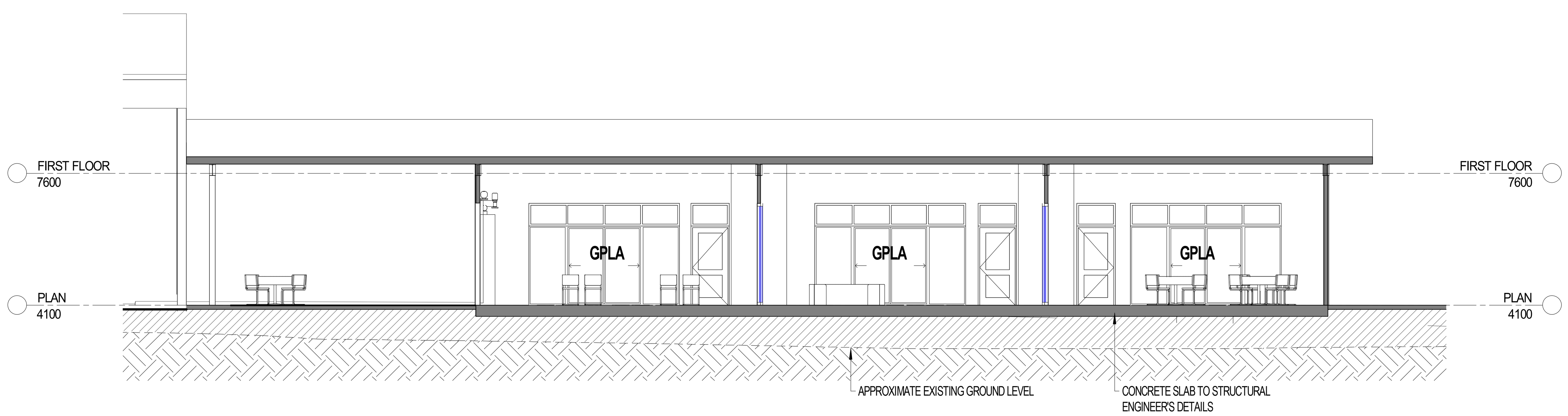
SECTION AA

SCALE: 1 : 100



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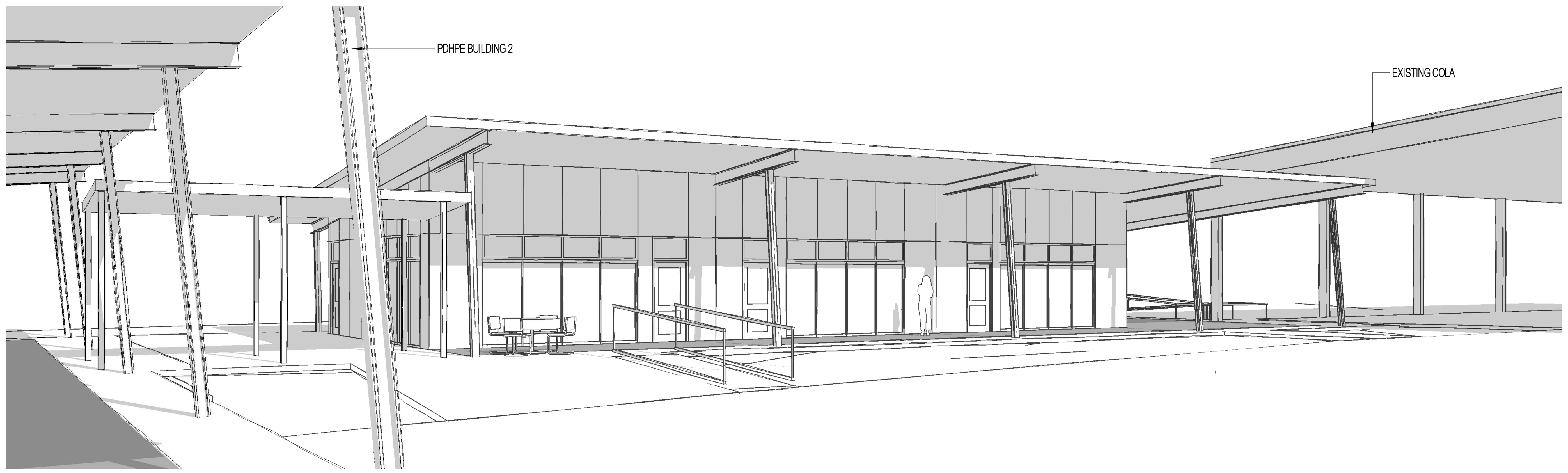
SECTION BB

SCALE: 1 : 100



NEW PDHPE BUILDING 1
INDICATIVE 3D VIEW

SCALE:

rev	date	details	initials	checked
1	15/03/19	ISSUED FOR DEVELOPMENT APPLICATION	LM/AB	AB

DEVELOPMENT APPLICATION

CONTROLLED DOCUMENT -
CHANGES WILL BE NOTIFIED

DRAARCHITECTS PTY LTD
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client
ST JOHN PAUL COLLEGE, COFFS HARBOUR

project
ALTERATIONS AND ADDITIONS
HOGBIN DRIVE
COFFS HARBOUR NSW 2450
LOT 223 DP 1136502

scale	1 : 100	@A1	plotted 15/03/2019 3:08:06 PM
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checked	Checker	15/03/19	
verified	Approver	15/03/19	
approved	Approver	15/03/19	
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drawing
NEW PDHPE BUILDING 1 SECTIONS & PERSPECTIVES

project number	drawing number	revision
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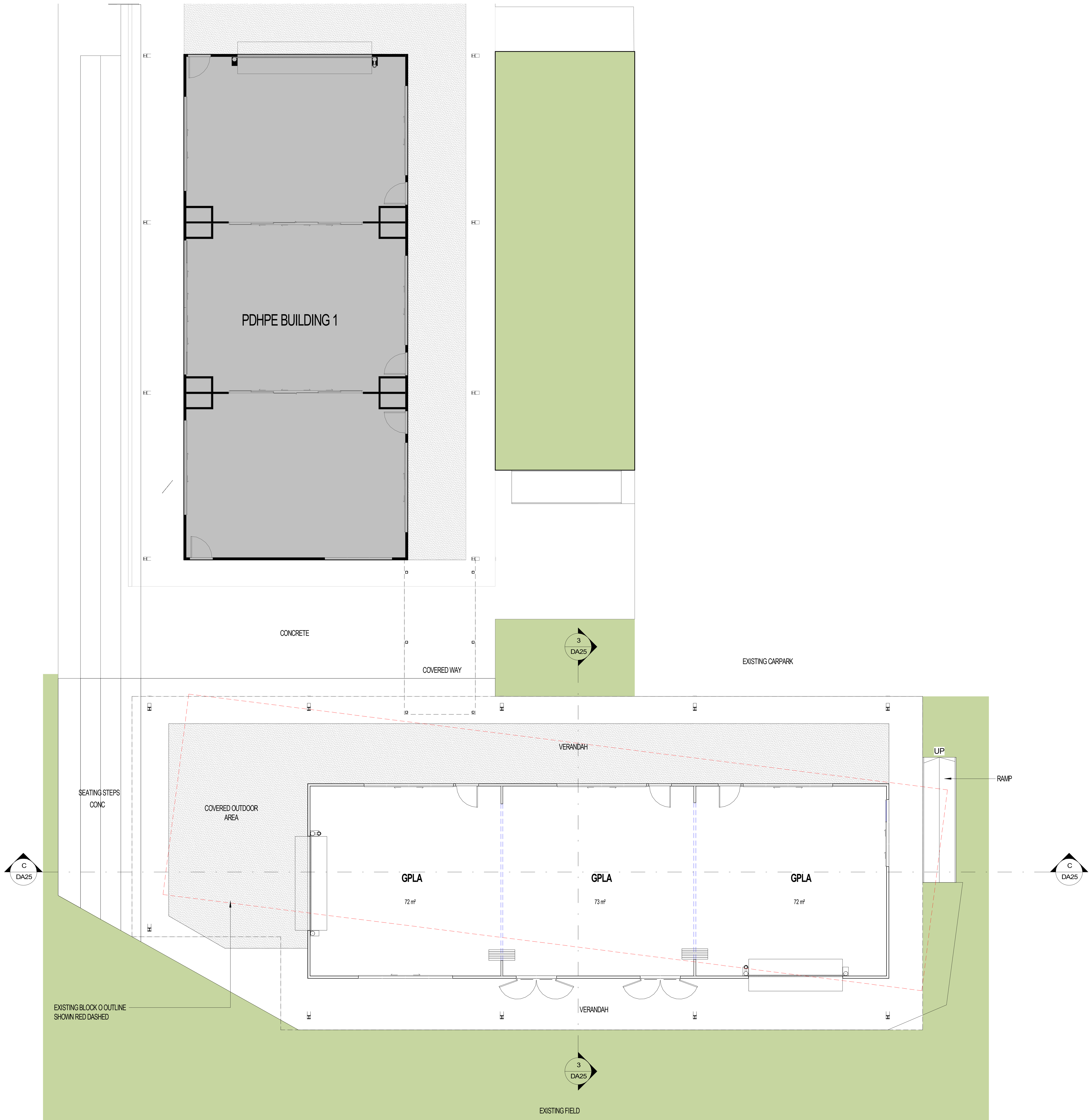

LEGEND

EX	EXISTING
PDHPE	PERSONAL DEVELOPMENT, HEALTH AND PHYSICAL EDUCATION
GPLA	GENERAL PURPOSE LEARNING AREA
AV	AUDIO VISUAL
AP	ASSISTANT PRINCIPAL

rev	date	details	initials	checked
1	15/03/19	ISSUED FOR DEVELOPMENT APPLICATION	LM/AB	AB

DEVELOPMENT APPLICATION

CONTROLLED DOCUMENT - CHANGES WILL BE NOTIFIED

DRAARCHITECTS PTY LTD

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(02) 6651 4905
dracoffs@draarchitects.com.au
ABN 12 096 929 387

client
ST JOHN PAUL COLLEGE, COFFS HARBOUR

project
ALTERATIONS AND ADDITIONS
HOGBIN DRIVE
COFFS HARBOUR NSW 2450
LOT 223 DP 1136502

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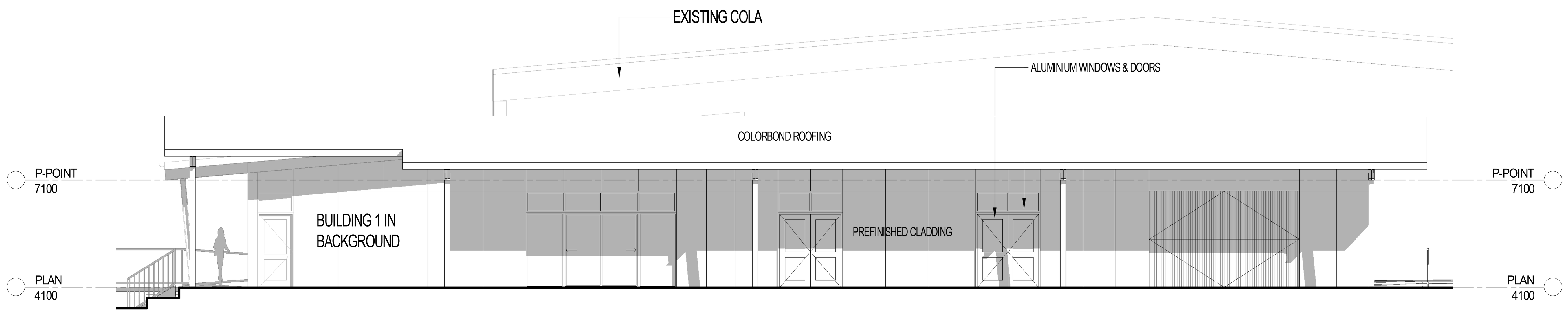
approved	Approver	15/03/19	
total number of sheets	31		true north

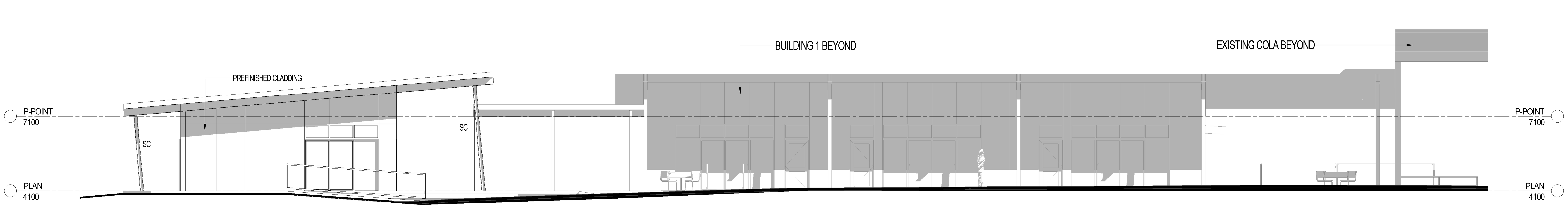
drawing
NEW PDHPE BUILDING 2 PLAN

project number	drawing number	revision
18001	DA23	1

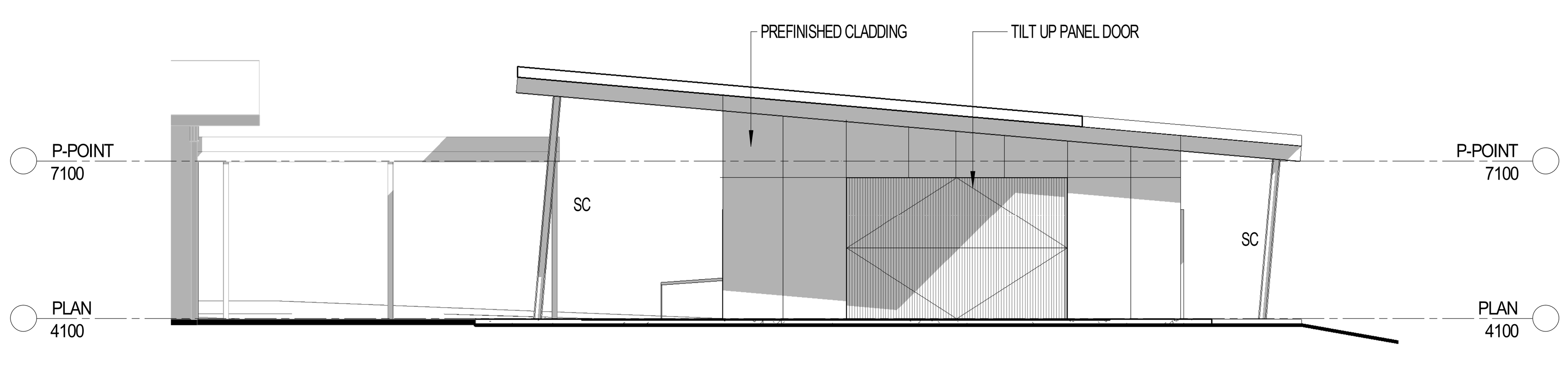
LEGEND	
EX	EXISTING
PDHPE	PERSONAL DEVELOPMENT, HEALTH AND PHYSICAL EDUCATION
GPLA	GENERAL PURPOSE LEARNING AREA
AV	AUDIO VISUAL
AP	ASSISTANT PRINCIPAL



NEW PDHPE BUILDING 2
EAST ELEVATION
SCALE: 1 : 100



NEW PDHPE BUILDING 2
NORTH ELEVATION
SCALE: 1 : 100



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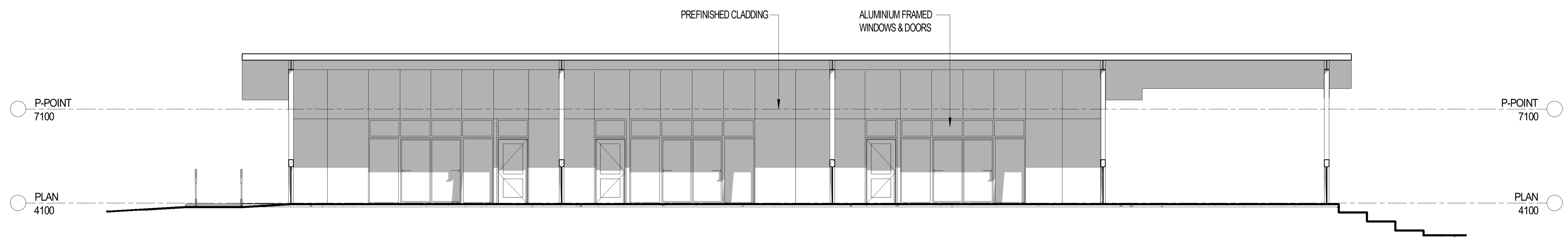
SOUTH ELEVATION
SCALE: 1 : 100



NEW PDHPE BUILDING 2
WEST ELEVATION
SCALE: 1 : 100

rev	date	details	initials	checked
1	15/03/19	ISSUED FOR DEVELOPMENT APPLICATION	LM/AB	AB

DEVELOPMENT APPLICATION

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ABN 12 096 929 387

client
ST JOHN PAUL COLLEGE, COFFS HARBOUR

project
ALTERATIONS AND ADDITIONS
HOGBIN DRIVE
COFFS HARBOUR NSW 2450
LOT 223 DP 1136502

scale	1 : 100 @A1	plotted	15/03/2019 3:08:15 PM
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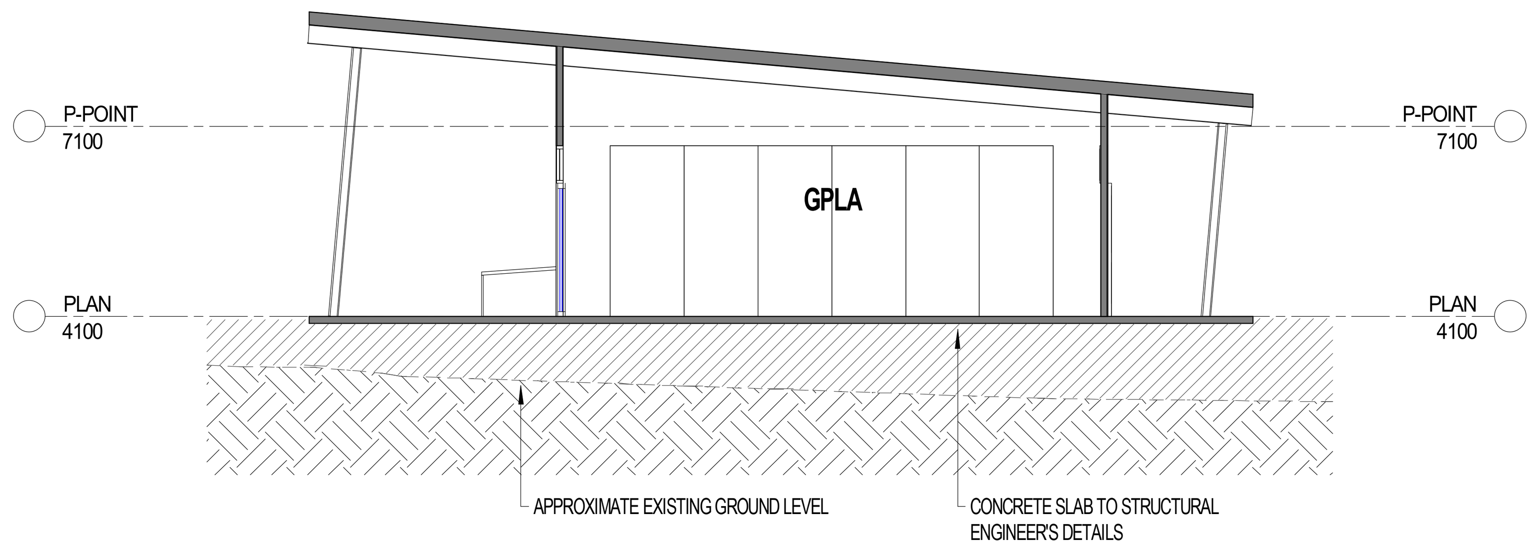
checked	Checker	15/03/19	
verified	Approver	15/03/19	
approved	Approver	15/03/19	
total number of sheets	31	true north	

drawing
NEW PDHPE BUILDING 2 ELEVATIONS

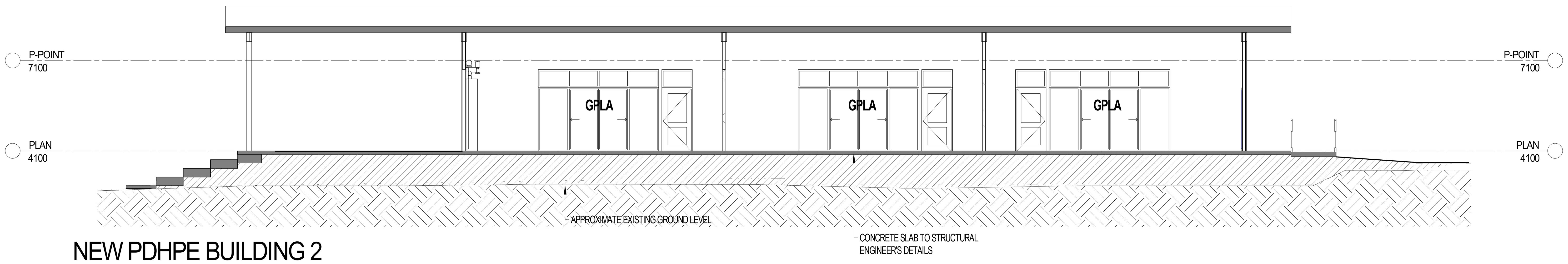
project number	drawing number	revision
18001	DA24	1

LEGEND

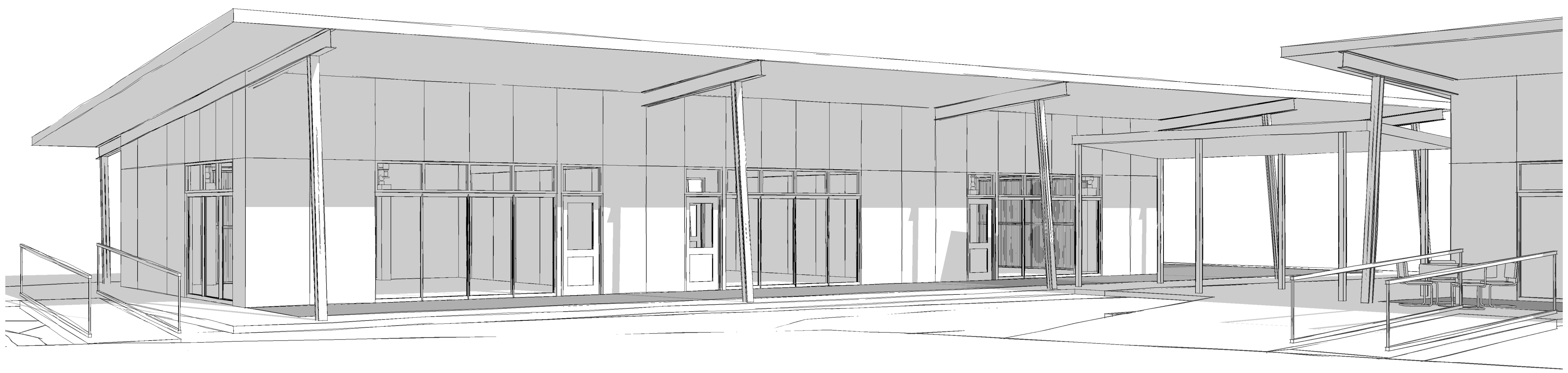
EX	EXISTING
PDHPE	PERSONAL DEVELOPMENT, HEALTH AND PHYSICAL EDUCATION
GPLA	GENERAL PURPOSE LEARNING AREA
AV	AUDIO VISUAL
AP	ASSISTANT PRINCIPAL



NEW PDHPE BUILDING 2
SECTION DD
SCALE: 1 : 100



NEW PDHPE BUILDING 2
SECTION CC
SCALE: 1 : 100



NEW PDHPE BUILDING 2
INDICATIVE 3D VIEW
SCALE:

rev	date	details	initials	checked
1	15/03/19	ISSUED FOR DEVELOPMENT APPLICATION	LM/AB	AB

DEVELOPMENT APPLICATION

CONTROLLED DOCUMENT - CHANGES WILL BE NOTIFIED

DRAARCHITECTS PTY LTD
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dracoffs@draarchitects.com.au

client
ST JOHN PAUL COLLEGE, COFFS HARBOUR

project
ALTERATIONS AND ADDITIONS
HOGBIN DRIVE
COFFS HARBOUR NSW 2450
LOT 223 DP 1136502

scale	1 : 100	@A1	plotted 15/03/2019 3:08:18 PM
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checked	Checker	15/03/19	
verified	Approver	15/03/19	
approved	Approver	15/03/19	
total number of sheets		31	true north

drawing
NEW PDHPE BUILDING 2 SECTIONS & PERSPECTIVES

project number	drawing number	revision
18001	DA25	1

Appendix C

Laboratory Analysis Results and Chain of Custody

EAL Environmental Analysis Laboratory

PO Box 157 (Military Road)
LISMORE NSW 2480
T: 02 6620 3678 E: eal@scu.edu.au W: www.scu.edu.au

Submitting Client Details

Quote Id: N/A
Job Ref: 3089 - SJPC Prelim ASS Investi
Company: GeoLINK
Contact: Kale Hardie-Porter
Phone: 0266517666
Mobile:
Email: khardieporter@geolink.net.au
Postal address: 1130A Orlando Street Coffs Harbour

Billing Client Details

□ Tick if same as submitting details
ABN: 79 896 839 729
Company: GeoLINK
Contact: Kim Fuller
Phone: 02 6651 7666
Mobile:
Email: kfuller@geolink.net.au
Postal address: →

Payment Method:

- □ Purchase Order
- □ Cheque
- □ Credit/Debit Card (EAL staff will phone for details)
- □ Invoice (prior approval)

Relinquished: Kale Hardie-Porter Date: 27/5/2019
Received: [signature] Date: 28/5/19

Preservation: none - freezer bricks - ice - acidified - filtered - other
Condition on receipt: ambient - cool - frozen - other

In submitting samples, the Client agrees to the EAL Laboratory Services Terms and Conditions. These Terms and Conditions are available on the EAL website: scu.edu.au/eal, or on request.

Comments:

Likelihood and nature of Hazardous material:

Total number of samples: 9

Sample Analysis Request — Price list code (e.g. SW-PACK-06)

Lab ID	Sample ID	Sample Depth	Sampling Date	Sampler	Your Client	Crop ID	Sample Type (e.g. water, leaf, soil)	ASS-PACK-008					
	BH1-.05m	.05m	21/5/19	Kale	DRA		Soil	✓					
	BH1-1.0m	1.0m	" "	" "	" "		" "	✓					
	BH2-.05m	.05m	" "	" "	" "		" "	✓					
	BH2-1.0m	1.0m	" "	" "	" "		" "	✓					

Comments :							**Total number of samples**	**Sample Analysis Request**					
								Price list code (e.g. SW-PACK-06)					
							9	ASS-PACK-008					
Likelihood and nature of Hazardous material:													
Lab ID	Sample ID	Sample Depth	Sampling Date	Sampler	Your Client	Crop ID	Sample Type (e.g. water, leaf, soil)						
	BH3-.05m	.05m	21/5/19	Kale	DRA		Soil	✓					
	BH3-1.0m	1.0m	" "	" "	" "			✓					
	BH3-1.5m	1.5m	" "	" "	" "			✓					
	BH4-.05m	.05m	" "	" "	" "			✓					
	BH4-1.0m	1.0m	" "	" "	" "			✓					

RESULTS OF ACID SULFATE SOIL ANALYSIS

9 samples supplied by Geolink - Coffs Harbour on 28th May, 2019. Lab Job No.i2189
Analysis requested by Kale Hardie Porter. Your Job: 3089-SJPC Prelim ASS Invest.

PO Box 1446 COFFS HARBOUR NSW 2450

Sample Identification	EAL Lab Code	Texture	Moisture Content		Potential Sulfidic Acidity (Chromium Reducible Sulfur - CRS)		pH_{KCl}	Actual Acidity (Titratable Actual Acidity - TAA)	Retained Acidity		Non-treated soil: Acid Neutralising Capacity (ANC_{BT})		Non-treated soil: Net Acidity	Non-treated soil: Lime Calculation
			(% moisture of total wet weight)	(g moisture / g of oven dry soil)	(% S_{cr})	(mol H^+/t)		(mol H^+/t)	(% S_{NAS})	(mol H^+/t)	(% $CaCO_3$)	(mol H^+/t)	(mol H^+/t)	(kg $CaCO_3$/t DW)
Method Info.		**	**		*(In-house method S20)*		*(In-house method 16b)*		**		*(In-house method S14)*		**	**
BH1 - 0.5	*i2189/1*	Medium	17.5	0.21	0.014	9	4.47	58	< 0.001	0	..	..	66	5
BH1 - 1.0	*i2189/2*	Fine	17.9	0.22	0.026	16	4.56	43	..	..	..	..	59	4
BH2 - 0.5	*i2189/3*	Medium	17.1	0.21	0.013	8	4.52	59	..	..	..	..	67	5
BH2 - 1.0	*i2189/4*	Fine	19.5	0.24	0.005	3	4.11	78	< 0.001	0	..	..	81	6
BH3 - 0.5	*i2189/5*	Medium	14.6	0.17	0.005	3	4.58	29	..	..	..	..	32	2
BH3 - 1.0	*i2189/6*	Medium	16.0	0.19	< 0.005	0	4.63	28	..	..	..	..	28	2
BH3 - 1.5	*i2189/7*	Medium	17.8	0.22	< 0.005	0	4.59	30	..	..	..	..	30	2
BH4 - 0.5	*i2189/8*	Medium	14.6	0.17	< 0.005	0	4.59	26	..	..	..	..	26	2
BH4 - 1.0	*i2189/9*	Medium	15.4	0.18	< 0.005	0	4.52	32	..	..	..	..	32	2

NOTES:

1. All analysis is reported on a dry weight (DW) basis, unless wet weight (WW) is specified.
2. Samples are dried and ground immediately upon arrival (unless supplied dried and ground).
3. Analytical procedures are sourced from Sullivan L, Ward N, Toppler N and Lancaster G. 2018. National acid sulfate soils guidance: national acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0.
4. The Acid Base Accounting Equation, where Acid Neutralising Capacity has not been corroborated by other data, is **Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity** (Eq. 3.2; Sullivan et al. 2018 - full reference above).
5. The Acid Base Accounting Equation for post-limed soil materials is **Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - (post treatment Acid Neutralising Capacity - initial Acid Neutralising Capacity)** (Eq. 3.3; Sullivan et al. 2018 - full reference above).
   While the Acid Neutralising Capacity of a soil material may not be included in the Net Acidity calculation (Note 4), it must be measured to give an Initial Acid Neutralising Capacity if verification testing is planned post-liming.
   The Inital Acid Neutralising Capacity must be provided by the client to enable EAL to produce Net Acidity and Liming calculations for post-limed soil materials.
6. The Acid Base Accounting Equation, where Acid Neutralising Capacity has been corroborated by other data, is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - Acid Neutralising Capacity (Eq. 3.1; Sullivan et al. 2018 - full reference above).
7. The lime calculation includes a Safety Factor of 1.5 as a safety margin for acid neutralisation (Sullivan et al. 2018). This is only applied to positive values. An increased Safety Factor may be required in some cases.
8. Retained Acidity is required when the pH_{KCl} < 4.5 or where jarosite has been visually observed.
9. A negative Net Acidity result indicates an excess acid neutralising capacity.
10. If insufficient mixing occurs during intial sampling, or during post-liming, or both: the Potential Sulfidic Acidity may be greater in the post-limed sample than in the intial sample; the post-liming Acid Neutralising Capacity may be lower in the post-limed sample than in the intial sample.
11. **An acid sulfate soil management plan is triggered by Net Acidity results greater than the texture dependent criterion: coarse texture ≥ 0.03% S or 18 mol H^+/t; medium texture ≥ 0.06% S or 36 mol H^+/t; fine texture ≥ 0.1% S or 62 mol H^+/t)** (Table 1.1; Sullivan et al. 2018 - full reference above)
12. For projects that disturb > 1000 t of soil material, the coarse trigger of ≥ 0.03% S or ≥ 18 mol H^+/t must be applied in accordance with Sullivan et al. (2018) (full reference above).
13. Acid sulfate soil texture triggers can be related to NCST (2009) textures: coarse and peats = sands to loamy sands; medium = clayey sand to light clays; fine = light medium to heavy clays (Sullivan et al. 2018 - full reference above).
14. Bulk density is required to convert liming rates to soil volume based results. Field bulk density rings can be submitted to EAL for bulk density determination.
15. A negative Net Acidity result indicates an excess acid neutralising capacity.
16. '..' is reported where a test is either not requested or not required. Where pH_{KCl} is < 4.5 or > 6.5, zero is reported for S_{NAS} and ANC in Net Acidity calculations, respectively.
17. Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
18. ** NATA accreditation does not cover the performance of this service.
19. Analysis conducted between sample arrival date and reporting date.
20. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).
21. This report was issued on 31/05/2019.

NATA
WORLD RECOGNISED ACCREDITATION
Accreditation No. 14960
Accredited for compliance with ISO/IEC 17025 - Testing

checked: ....
Graham Lancaster
Laboratory Manager