University of Tasmania Sandy Bay Masterplan

Introduction – Planning Scheme Amendment incl. Sandy Bay Masterplan

After more than a decade of increasing and enhancing our city-based presence, in 2019 the University made a choice between two options regarding the future of our southern campus: consolidate in central Hobart or maintain the current distributed model split across Sandy Bay and the city.

Following extensive consultation with our community, the University decided to consolidate in the city. We did so in order to secure the future of higher education in Tasmania, and to provide better access, better facilities, a better student and staff experience and a more sustainable institution. Consultation and planning continued around how the city campus would take shape.

In 2021, the University began the process of consulting and engaging with the community about what the future of the Sandy Bay campus would be. We sought what the community valued and what principles they thought should guide it. Then, after a great deal of input from staff, students, the local community and a range of stakeholders, through multiple engagement processes, we developed a masterplan setting out the long-term vision for the site. We shared the key elements of the vision with the community. It was a proposal that protected bushland and featured a mix of housing, education, aged care, sporting facilities, retail and commercial space and more.

For any such new future to be realised on the site, we would need to apply for a planning scheme amendment to remove the educational overlay from the site. Such an application is made to the relevant council, in this case the City of Hobart, which then initiates the process enabling a period of public consultation and feedback before it is ultimately considered by the Tasmanian Planning Commission.

In December of 2021, the University lodged our application for a planning scheme amendment, which incorporates the full Sandy Bay masterplan and all supporting reports, but later withdrew it to enable further engagement through council processes. This means the proposal never got to the stage where the application and all the material it contains was available for the public to see. Given the community interest in the move to the city and the possible futures for Sandy Bay, we are releasing the application in full.

This document is split over six downloadable files. This is file 5 of 6 - Go to Building our Hobart University presence since 2007 for more.

REPORTING TO INFORM THE MASTERPLAN DESIGN

Conservation Management Plan (Volume 2)

Paul Davies Architect

UTAS Sandy Bay Campus
Building Data Sheets
Volume 2

September 2021

for University of Tasmania

by Paul Davies Pty Ltd

Revision	Date	Issued By
Draft 1	9th September 2021	Paul Davies

Report reviewed by:	Paul Davies Director B Arch MB Env ARIA Reg. No. 6653

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Volume 1 : Conservation Management Plan

Volume 2 : Building Data Sheets

Table of Contents

Building 1
301 Sandy Bay Road

Building No:	Building Name:	Previous Name:
1	301 Sandy Bay Road	Apartments
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1955	S.W.T Blythe Architect & Roderick W. Cooper Architects in Association	-
Date of Major Extension	**Architect for Extension**	**Description**
1964?	S.W.T Blythe	Conversion from Temporary Admin Building
1972	Department of Public Works-Tasmania. Chief Architect S.T Tomlinson in association with MG Vincent	Internal Alterations
Post 2000		Major rework of building

Description of Current Building

Exterior Form	301 Sandy Bay Road is a three-storey rectilinear office building orientated towards the north-east and parallel with Sandy Bay Road. The building features red face brick with some rendered and painted spandrel panels above and below some of the windows on the north-eastern facade. The building features a glazed central entrance lobby and staircase with an eastern and western wing on either side. The building is accessed from Sandy Bay Road via a central concrete path and small set of wide concrete stairs to the central entrance lobby that divides the building into two sections. The exterior of the building has been modified with the addition of metal awnings/hoods over the windows to the wings for solar protection on both the front and rear of the building. The windows and roof top have also been modified to accommodate air-conditioning services. Former garages located at the base of the building under the eastern wing have been infilled to create offices.
Interior Form	Interior not accessible during site inspection
Significance	The building has moderate significance as one of the early campus buildings designed by a then prominent collaboration of architects.
Key Elements	-

Condition	The building appears to be in reasonable condition, however a detailed inspection was not conducted.

Current Photos

Building 1 – 301 Sandy Bay Road

North-eastern elevation (Sandy Bay Road elevation)

Source: Paul Davies Pty Ltd

Building 1 – 301 Sandy Bay Road

South-western elevation

Source: Paul Davies Pty Ltd

Building 1 – 301 Sandy Bay Road

South-eastern elevation

Source: Paul Davies Pty Ltd

Building 1 – 301 Sandy Bay Road

Detail of central stair circulation (Sandy Bay Road elevation)

Source: Paul Davies Pty Ltd

Building 1 – 301 Sandy Bay Road

Detail of central stair circulation (South-western elevation)

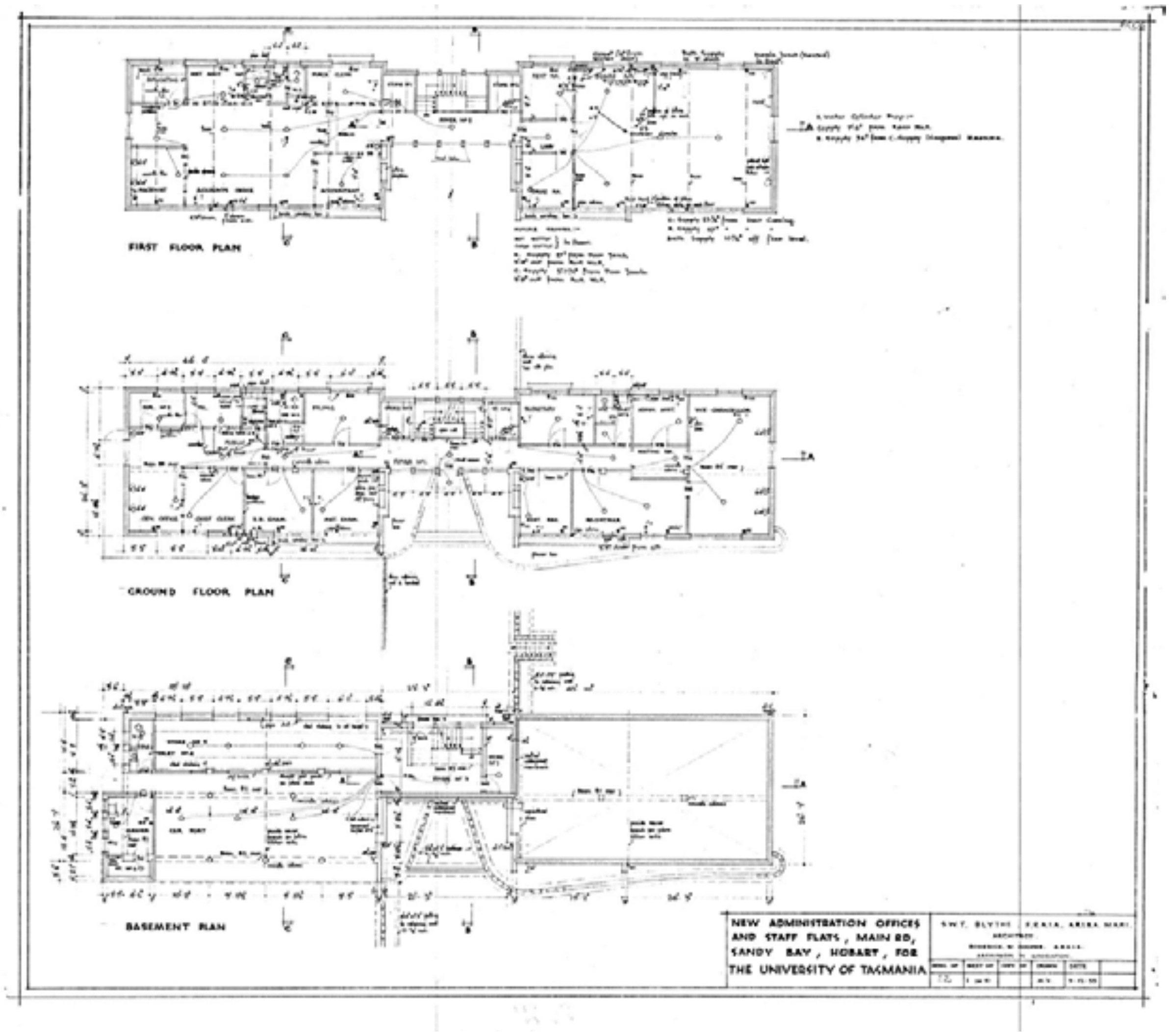
Source: Paul Davies Pty Ltd

Building 1 – 301 Sandy Bay Road

Detail of the eastern wing facing Sandy Bay Road

Source: Paul Davies Pty Ltd

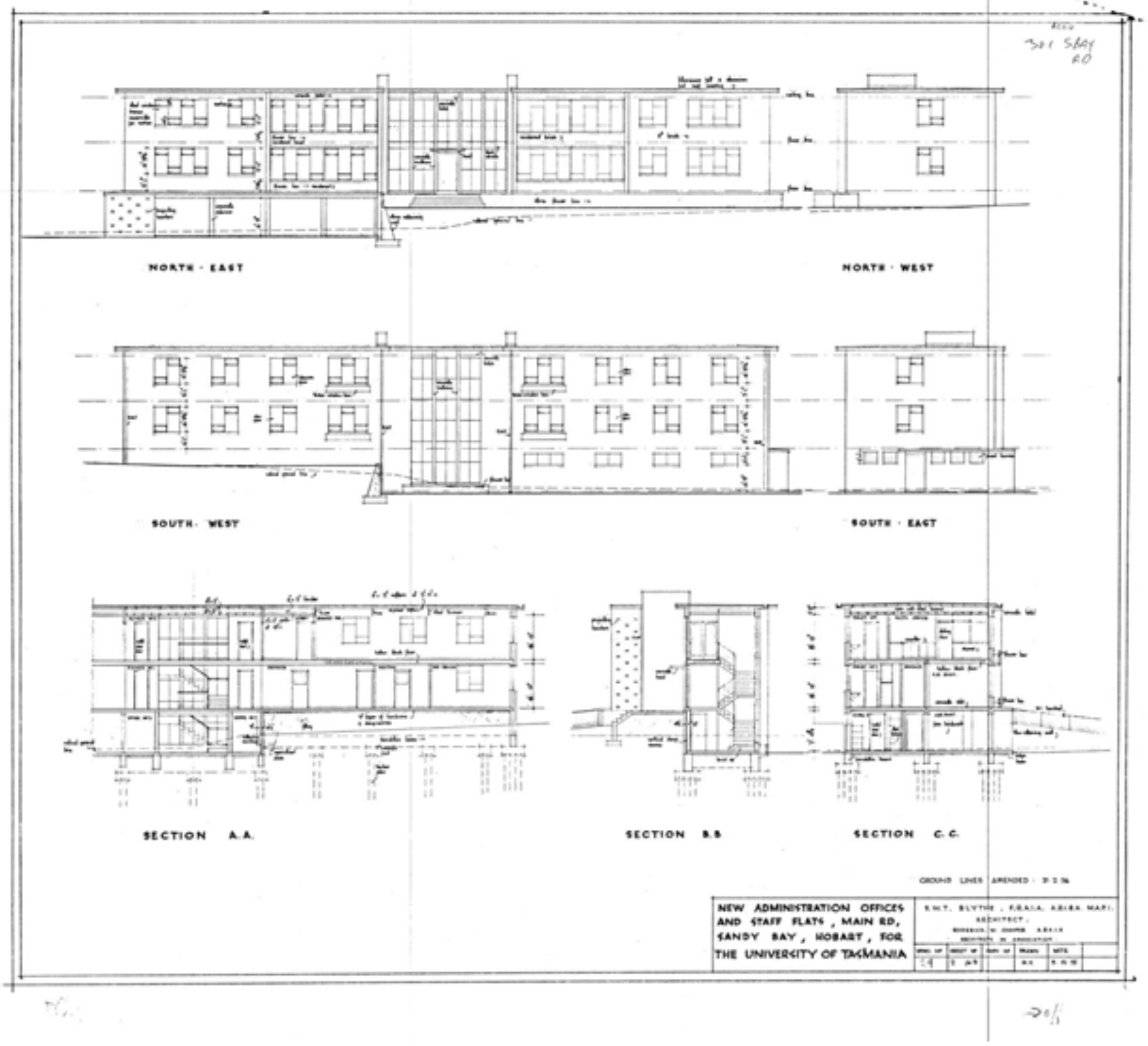
Key Plans



Building 1 – 301 Sandy Bay Road

Floor Plans - New Administration Offices and Staff Flats, Main Rd, Sandy Bay, Hobart, for The University of Tasmania. Prepared by S.W.T Blythe, 1955.

Source: Box 13-041.tif



Building 1 – 301 Sandy Bay Road

Elevations and Sections - New Administration Offices and Staff Flats, Main Rd, Sandy Bay, Hobart, for The University of Tasmania. Prepared by S.W.T Blythe, 1955.

Source: Box 13-042.tif

Building 2
6 Grace Street

Building No:	Building Name:	Previous Name:
2	6 Grace Street	Staff Apartments
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1955	S.W.T Blythe Architect with Roderick W. Cooper Architects in association	-
Date of Major Extension	**Architect for Extension**	**Description**
-	-	-

Description of Current Building	
Exterior Form	6 Grace Street is a two-storey rectilinear red face brick apartment building which has been converted into offices. The building is orientated south-west, to face Grace Street. An open projecting bay containing the common staircase is located in the middle of the two wings, but off-centre to the north-western side of the building. The common stair is accessed from Grace Street via a curved concrete path leading to an open and uncovered staircase parallel with the front of the building. The flat roof has a projecting eaves lines that sits proud of the red face brick walls below.
Interior Form	Interior not accessible during site inspection
Significance	The building has moderate significance as one of the early campus buildings designed by a then prominent collaboration of architects.
Key Elements	-
Condition	The building appears to be in reasonable condition, however a detailed inspection was not conducted.

Current Photos

Building 2 – 6 Grace Street

South-western elevation (Grace Street Elevation)

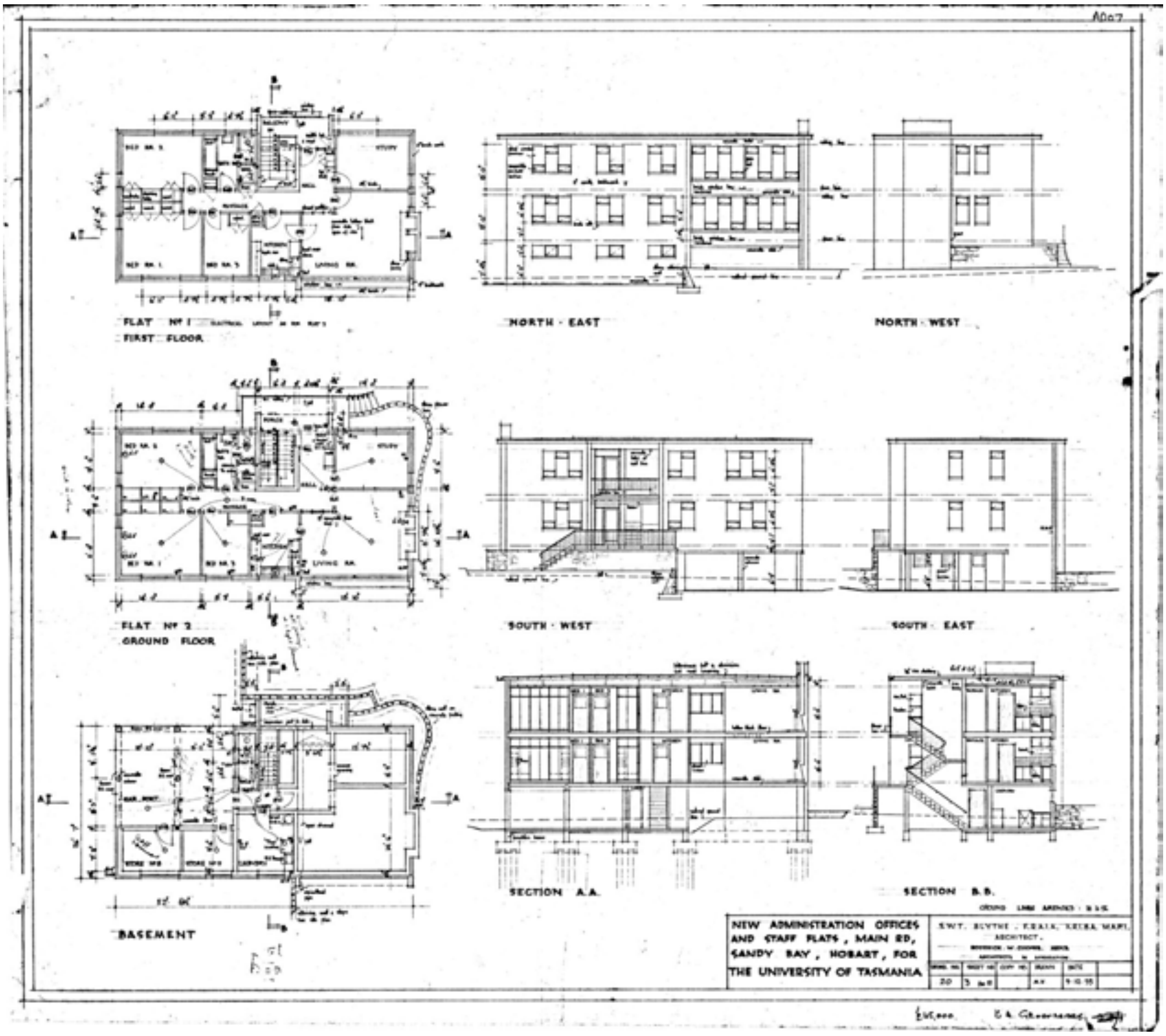
Source: Paul Davies Pty Ltd

Building 2 – 6 Grace Street

North-eastern elevation

Source: Paul Davies Pty Ltd

Key Plans



Building 2 – 6 Grace Street

Floor Plans, Elevations and Sections - New Administration Offices and Staff Flats, Main Rd, Sandy Bay, Hobart, for The University of Tasmania. Prepared by S.W.T Blythe, 1955.

Source: Box 13-025.tif

Building 3
Childcare (Lady Gowrie)

Building No:	Building Name:	Previous Name:
3	Childcare (Lady Gowrie)	Community Child Care Centre
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1974	Blythe and Blythe Architects	-
Date of Major Extension	**Architect for Extension**	**Description**
1994	Sue Small Landscape Architect	Landscape Works
1995	Blythe Yeung Menzies	Alterations and Additions (including first floor addition)

Description of Current Building

Exterior Form	Building not accessible during the site inspection. The visible portion of the building is a two-storey box form with a flat roof. The walls are bagged and painted blockwork. A two-storey verandah is contained within the box form on the north-eastern corner of the building. The bulk of the building located behind this two-storey form to the north-west appears to be single storey. The original 1974 building appears to have been a modest single storey face brick building with a flat roof as shown on the original drawings by Blythe and Blythe. Alterations and additions were carried out in 1995 by Blythe Yeung Menzies which included adding a first floor to the north eastern corner of the building.
Interior Form	Interior not accessible during site inspection
Significance	The building has no heritage significance in its current form.
Key Elements	-
Condition	The building appears to be in reasonable condition, however a detailed inspection was not conducted.

Current Photos

Building 3 – Childcare (Lady Gowrie)

North-eastern corner

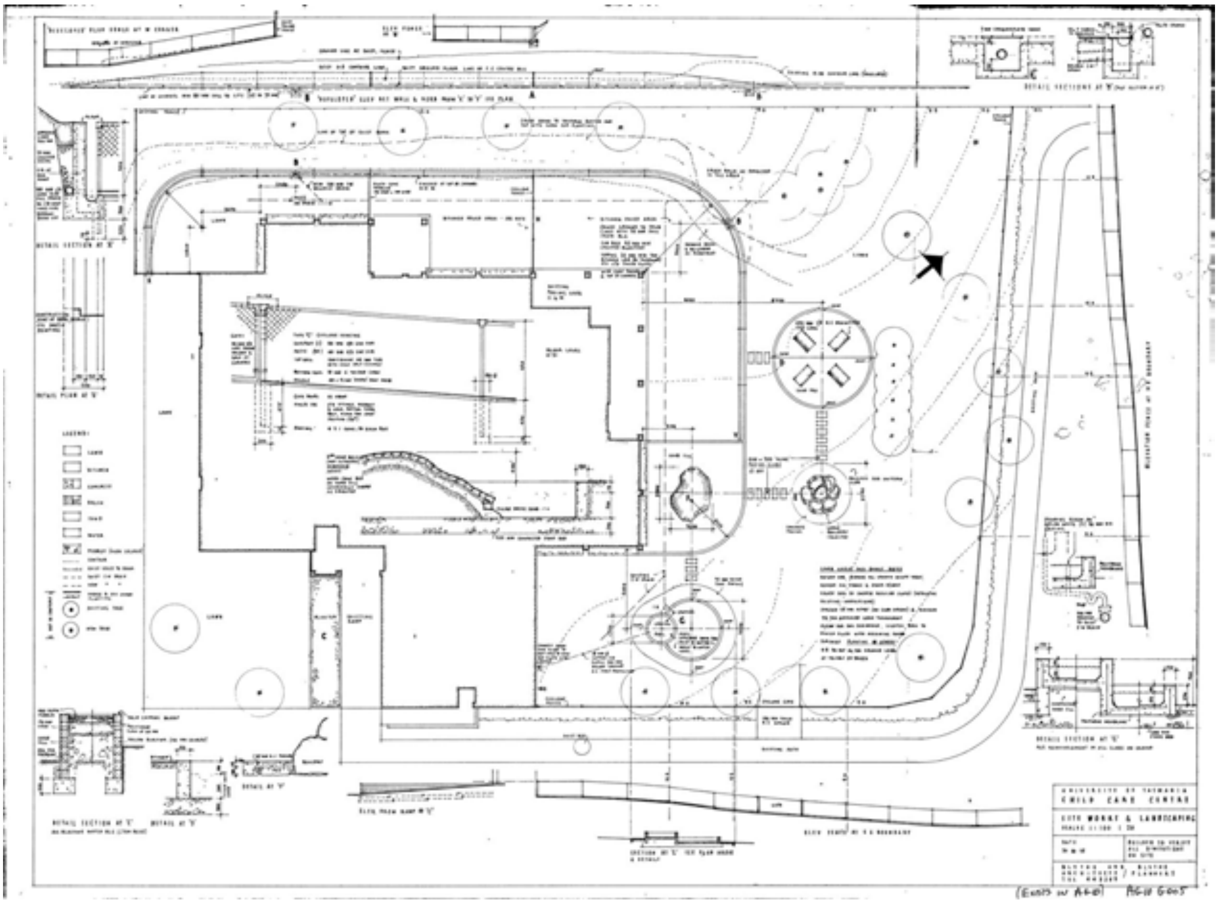
Source: Paul Davies Pty Ltd

Building 3 – Childcare (Lady Gowrie)

South-eastern corner

Source: Paul Davies Pty Ltd

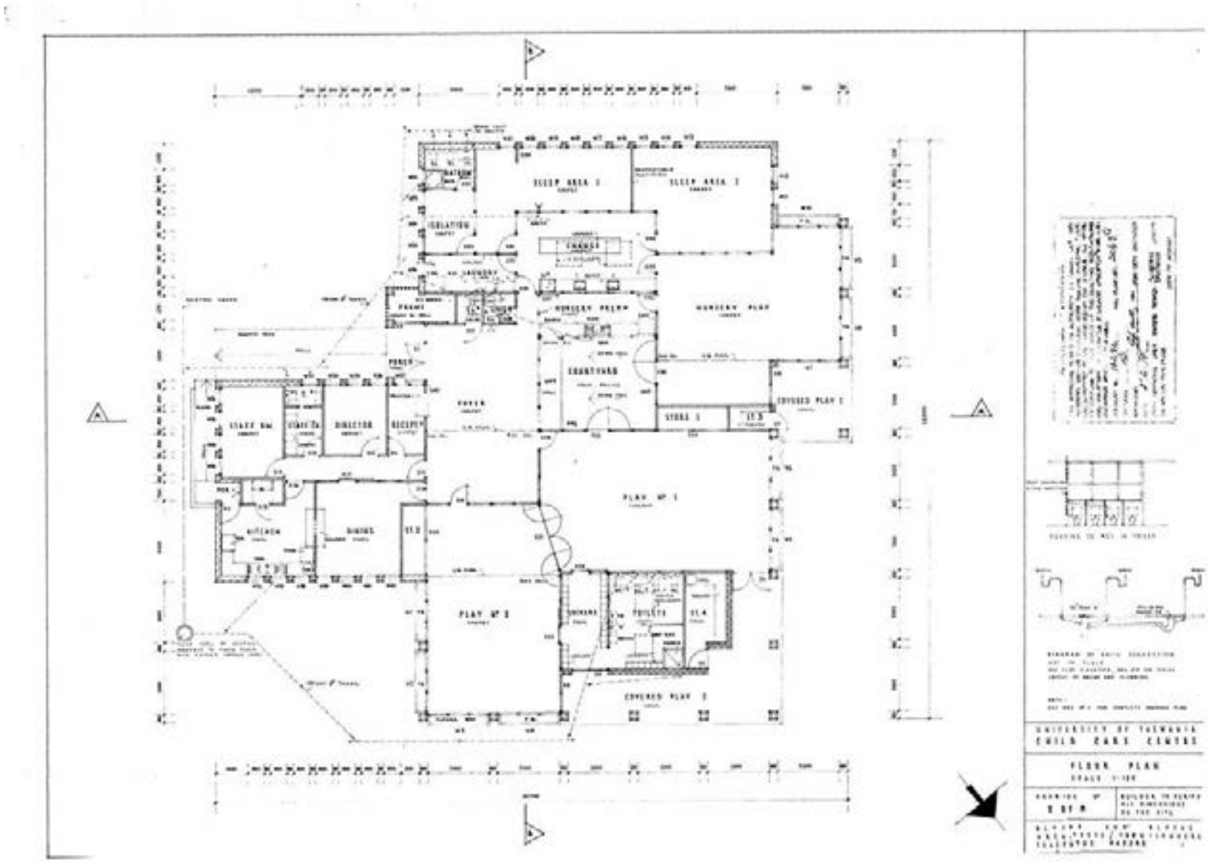
Key Plans



Building 3 – Childcare (Lady Gowrie)

Site Plan – University of Tasmania Childcare Centre. Prepared by Blythe and Blythe c1974.

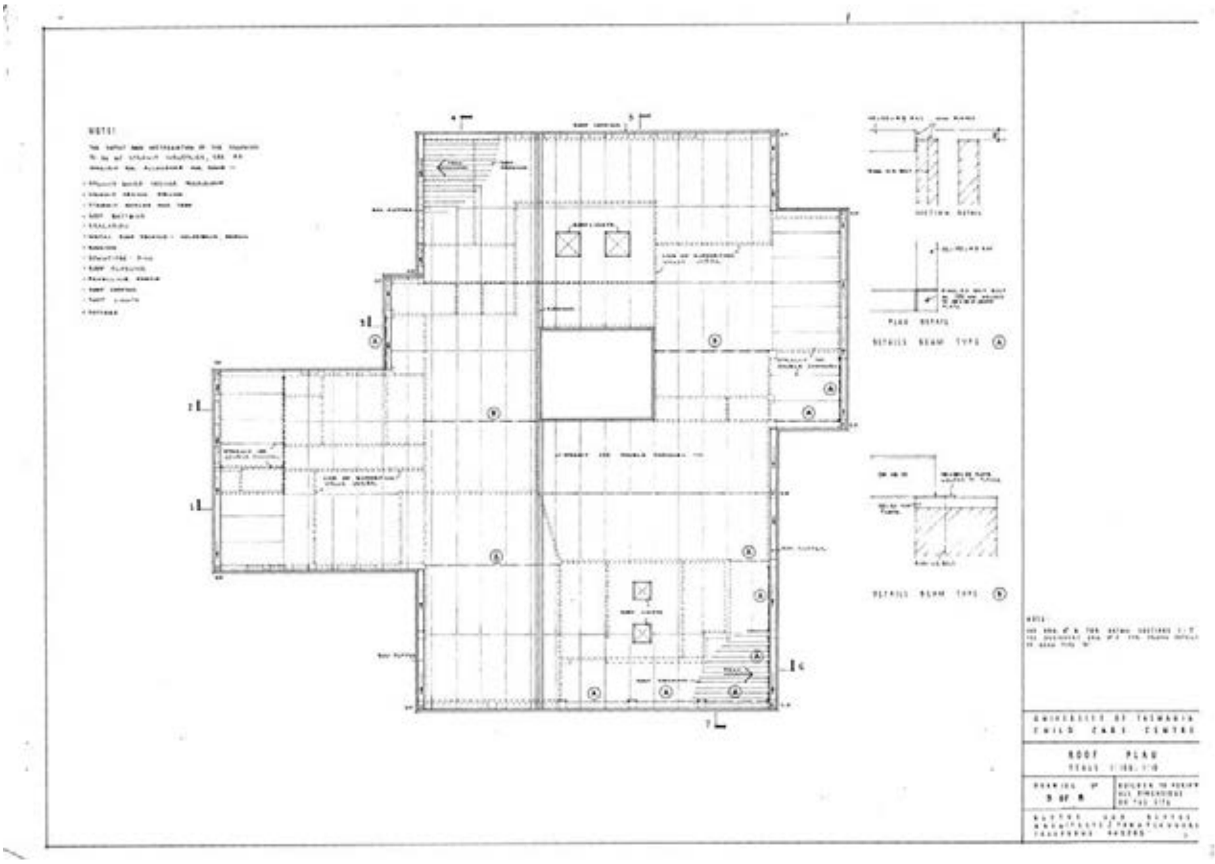
Source: Hanger 94-021.tif



Building 3 – Childcare (Lady Gowrie)

Floor Plan – University of Tasmania Childcare Centre. Prepared by Blythe and Blythe c1974.

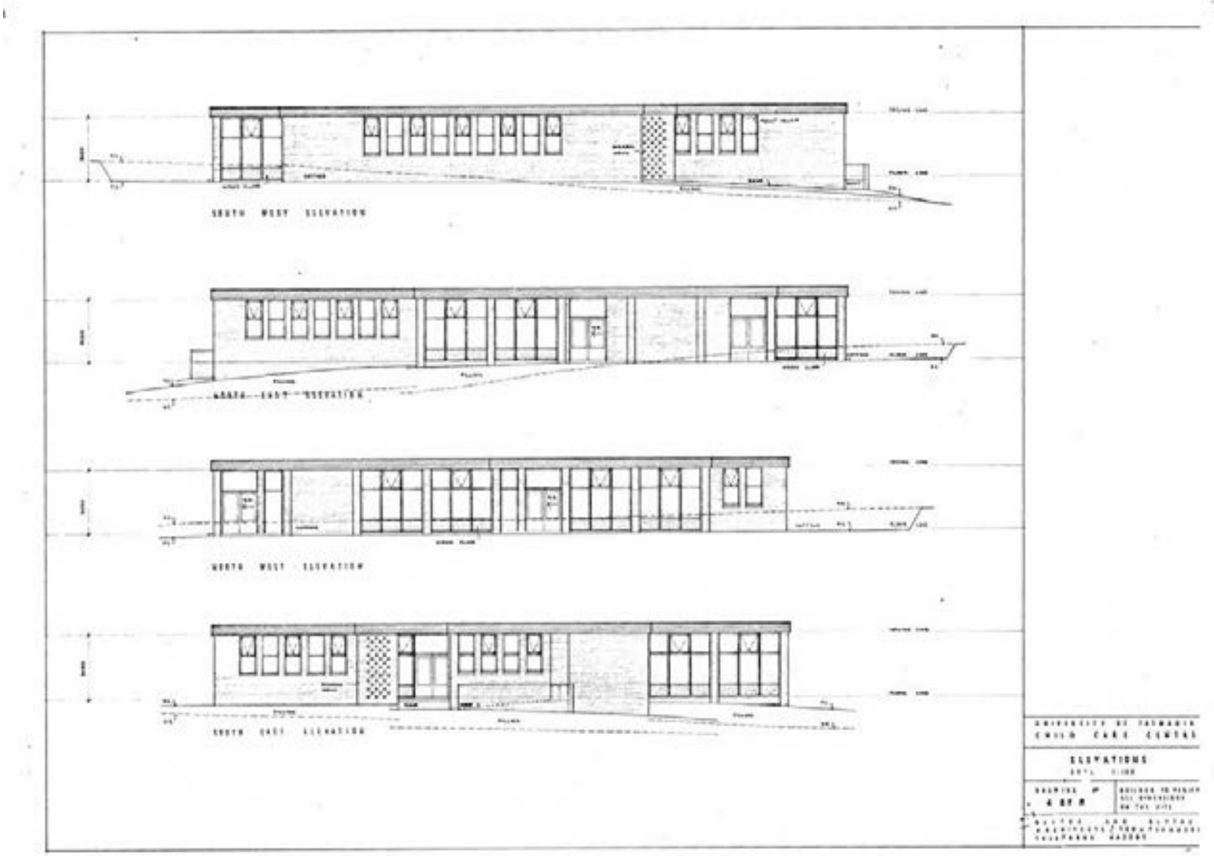
Source: Hanger 22-013.tif



Building 3 – Childcare (Lady Gowrie)

Roof Plan – University of Tasmania Childcare Centre. Prepared by Blythe and Blythe c1974.

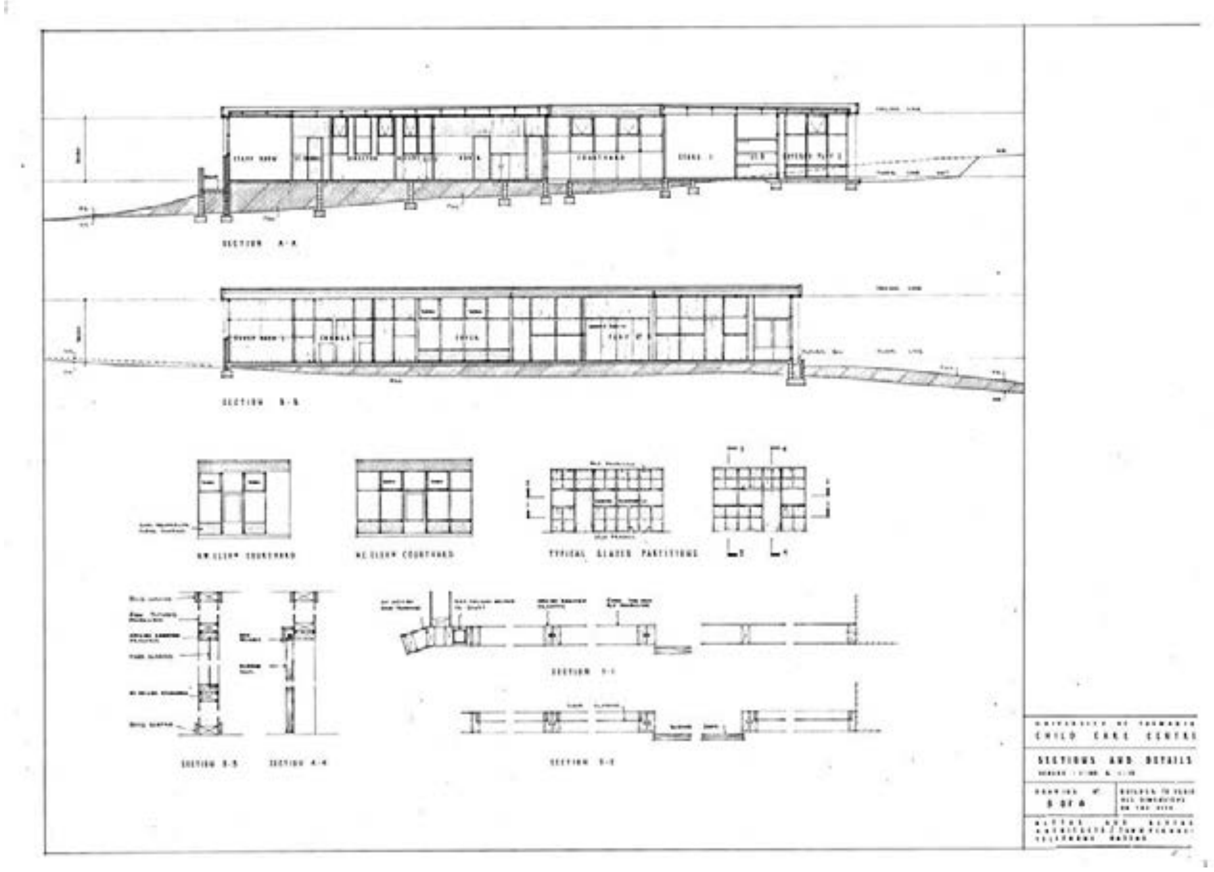
Source: Hanger 22-014.tif



Building 3 – Childcare (Lady Gowrie)

Elevations – University of Tasmania Childcare Centre. Prepared by Blythe and Blythe c1974.

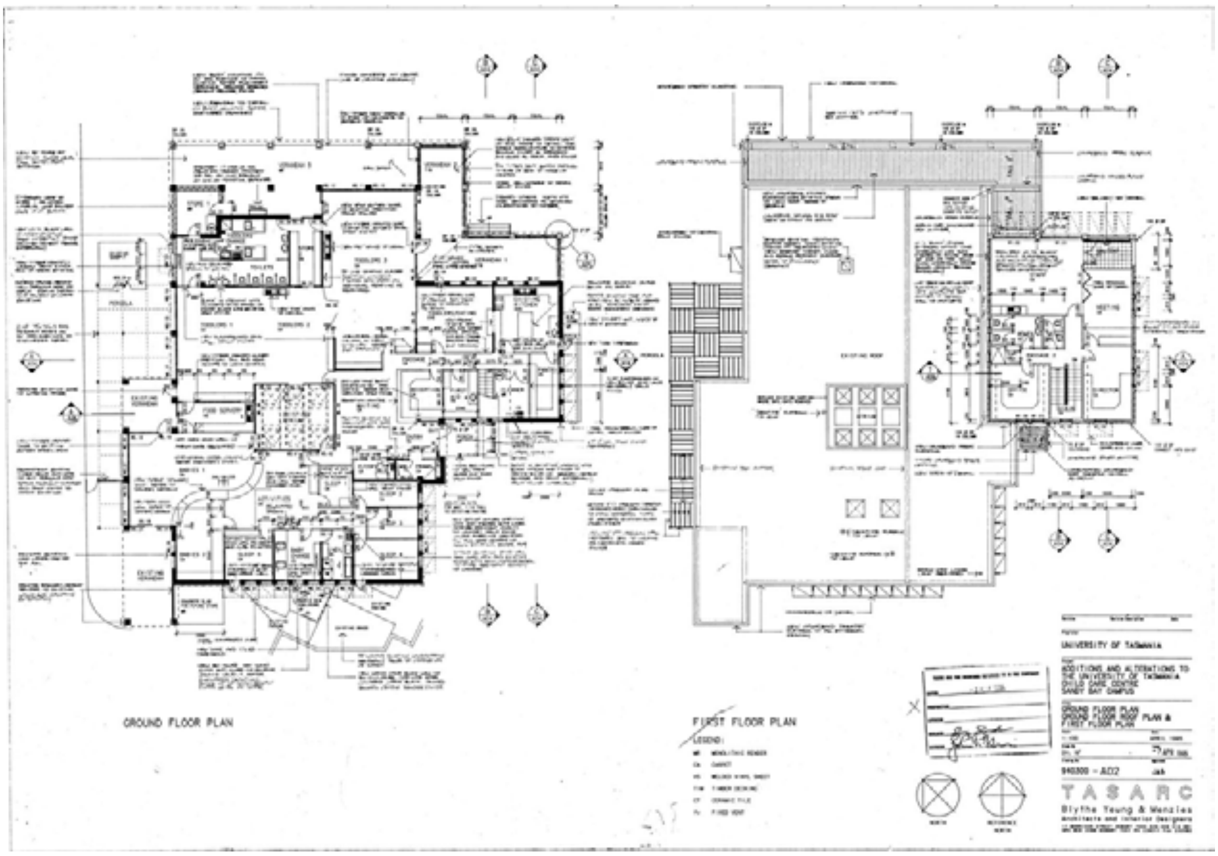
Source: Hanger 22-015.tif



Building 3 – Childcare (Lady Gowrie)

Sections – University of Tasmania Childcare Centre. Prepared by Blythe and Blythe c1974.

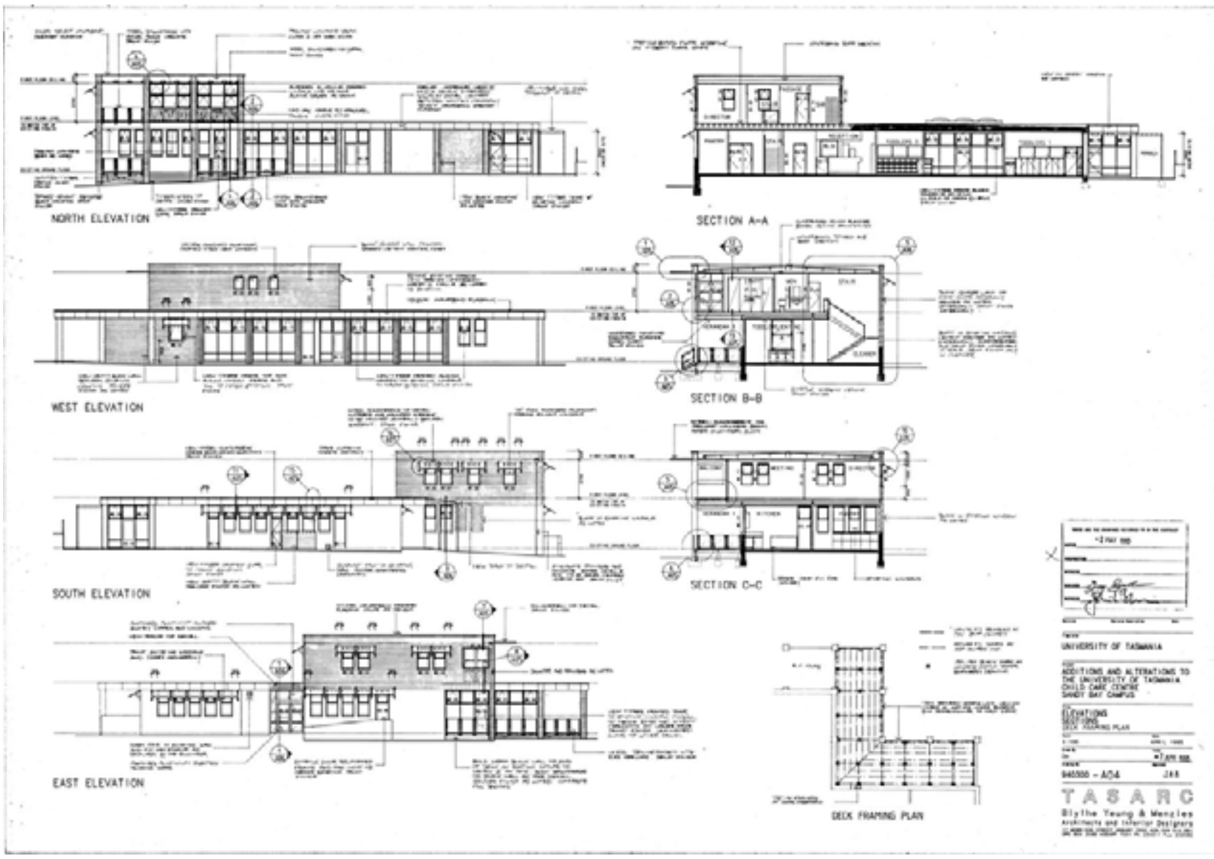
Source: Hanger 22-016.tif



Building 3 – Childcare (Lady Gowrie)

Plans – Additions and Alterations to the University of Tasmania Childcare Centre Sandy Bay Campus. Prepared by Blythe Yeung and Menzies 1995. The works included alterations to the general arrangement of the ground floor and the addition of a first floor.

Source: Hanger 22-025.tif



Building 3 – Childcare (Lady Gowrie)

Plans – Additions and Alterations to the University of Tasmania Childcare Centre Sandy Bay Campus. Prepared by Blythe Yeung and Menzies 1995. The works included alterations to the general arrangement of the ground floor and the addition of a first floor.

Source: Hanger 22-027.tif

Building 4
Uni Gym

Building No:	Building Name:	Previous Name:
4	Uni Gym	Gymnasium Sport and Recreation Department

Date of Construction or Date of Original Drawings	Original Architect	Date Opened
1973	Department of Public Works Tasmania – S.T. Tomlinson Chief Architect Consulting architects: Blythe and Blythe	-

Date of Major Extension	Architect for Extension	Description
Date not shown on drawing. Pre 1982	Blythe Yeung Associates Architects	Squash Courts
1982	Blythe Hudson Yeung Architects	Additional Squash Courts
1988	Jacob Allom Wade	Stage 1 - Aerobics
1990	Jacob Allom Wade	Stage 2 - Multipurpose
1995	Philp Lighton Pty Ltd Architects	Alterations, weights room addition

Description of Current Building	
Exterior Form	The original gymnasium is a steel portal frame structure with blond face brick walls. The main façade of the gym is broken into three bays with the metal clad steel columns expressed proud of the in-fill brick walls. Strips of hi-light windows are located above the brickwork and the metal-clad columns sail past these windows and return on top of the roof form. The roof has a minimal pitch with a central ridge. The gym has had numerous alterations and additions over the years and externally only the main gymnasium form remains visible and intact.
Interior Form	Interior not accessible during site inspection
Significance	The building has no heritage significance.
Key Elements	-
Condition	The building appears to be in reasonable condition, however a detailed inspection was not conducted.

Current Photos

Building 4 – Uni Gym

South-eastern elevation, original gymnasium form (image left)

Source: Paul Davies Pty Ltd

Building 4 – Uni Gym

South-eastern facade

Source: Paul Davies Pty Ltd

Building 4 – Uni Gym

Detail of entrance

Source: Paul Davies Pty Ltd

Building 4 – Uni Gym

Detail of entrance

Source: Paul Davies Pty Ltd

Building 4 – Uni Gym

Detail of entrance

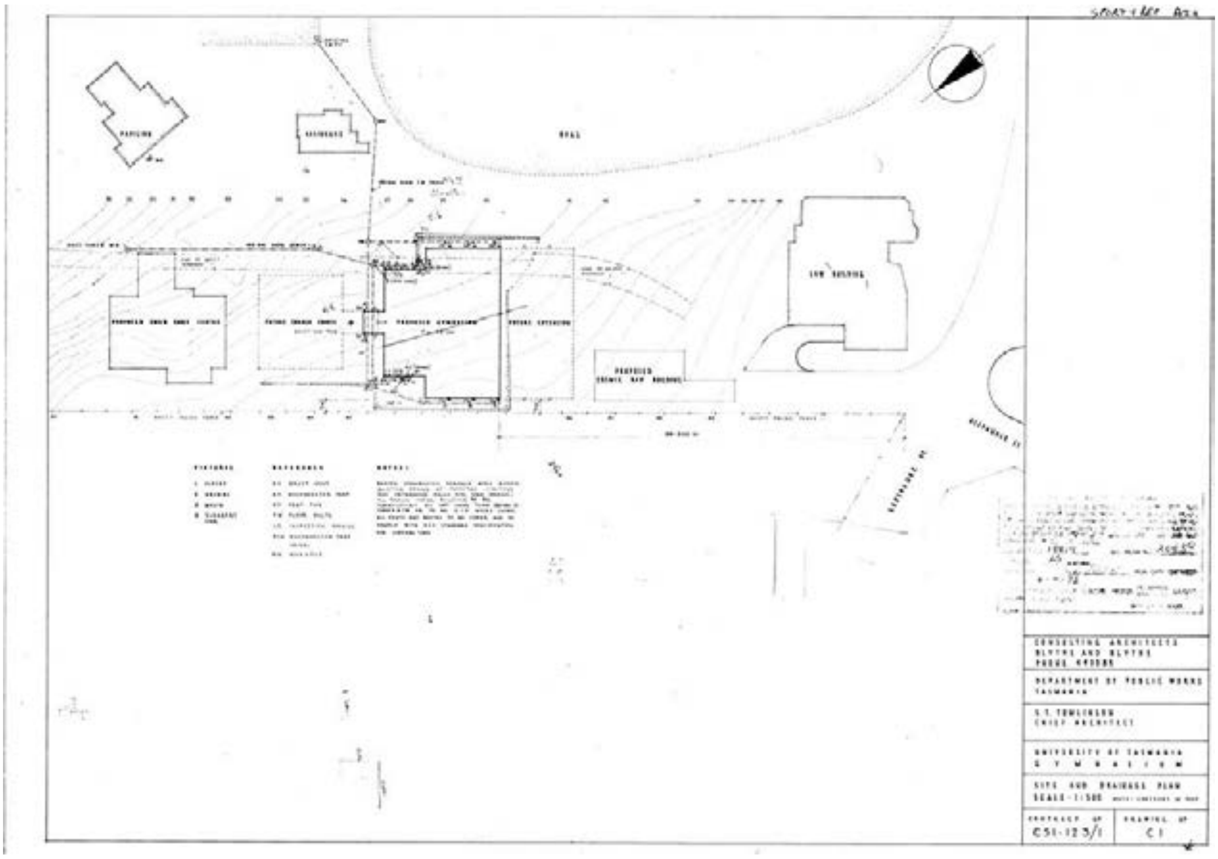
Source: Paul Davies Pty Ltd

Building 4 – Uni Gym

North-eastern corner

Source: Paul Davies Pty Ltd

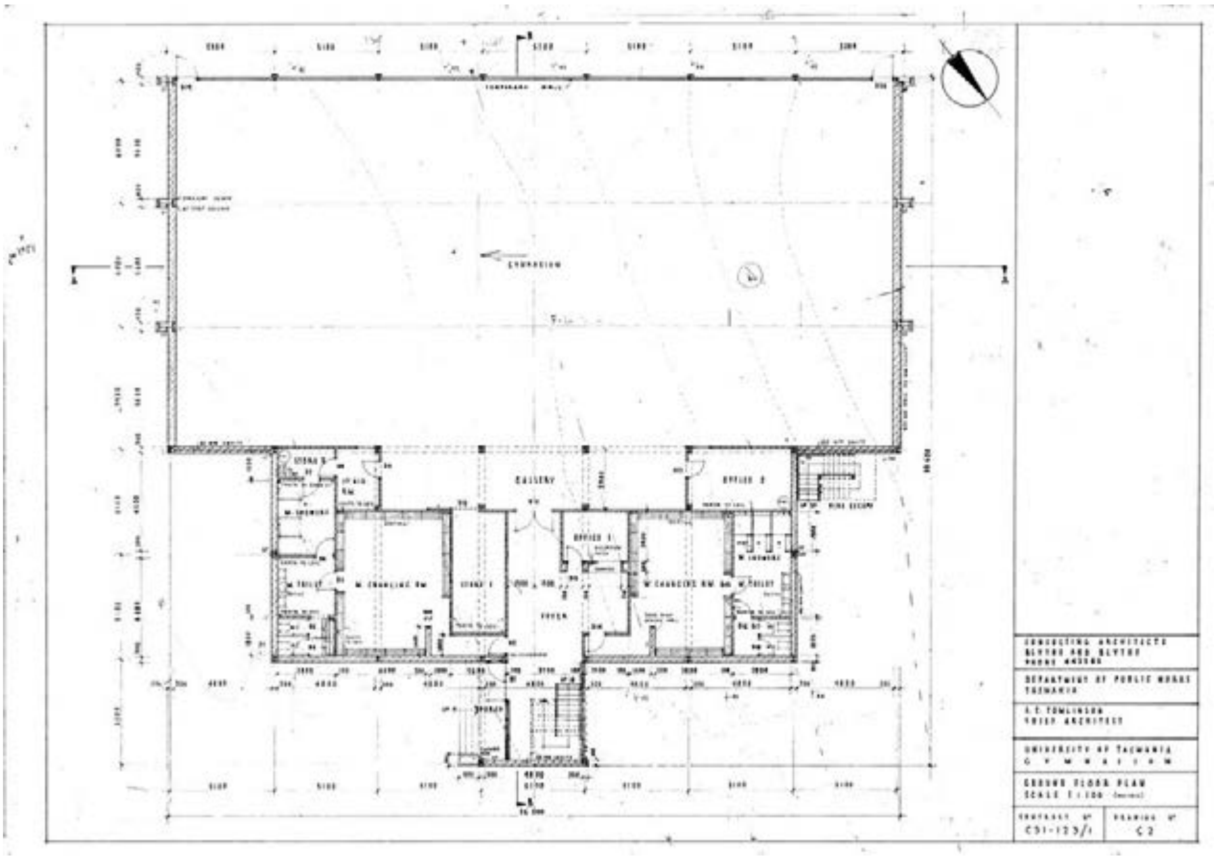
Key Plans



Building 4 – Uni Gym

Site Plan – University of Tasmania Gymnasium. Prepared by Department of Public Works Tasmania – S.T. Tomlinson Chief Architect In association with Blythe and Blythe, 1973.

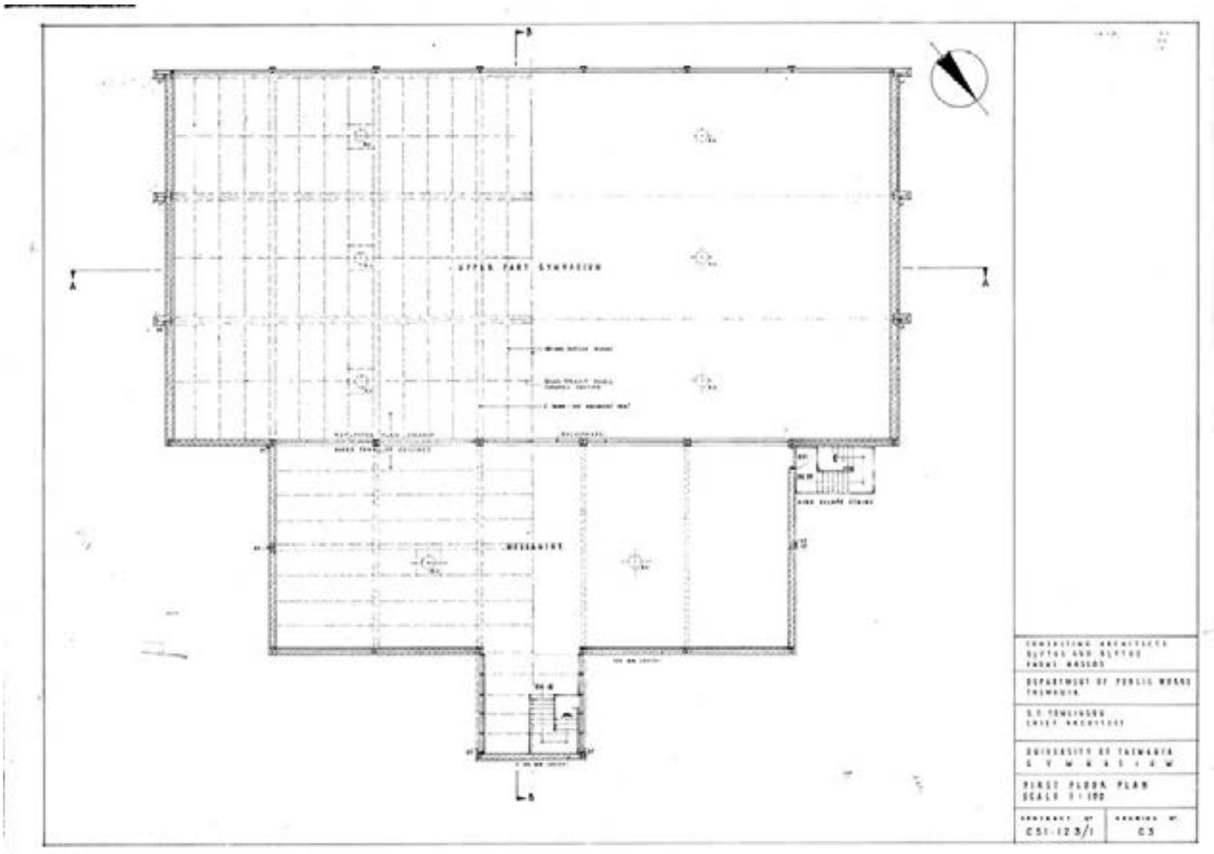
Source: Hanger 20-013.tif



Building 4 – Uni Gym

Ground Floor Plan – University of Tasmania Gymnasium. Prepared by Department of Public Works Tasmania – S.T. Tomlinson Chief Architect Consulting architects: Blythe and Blythe, 1973.

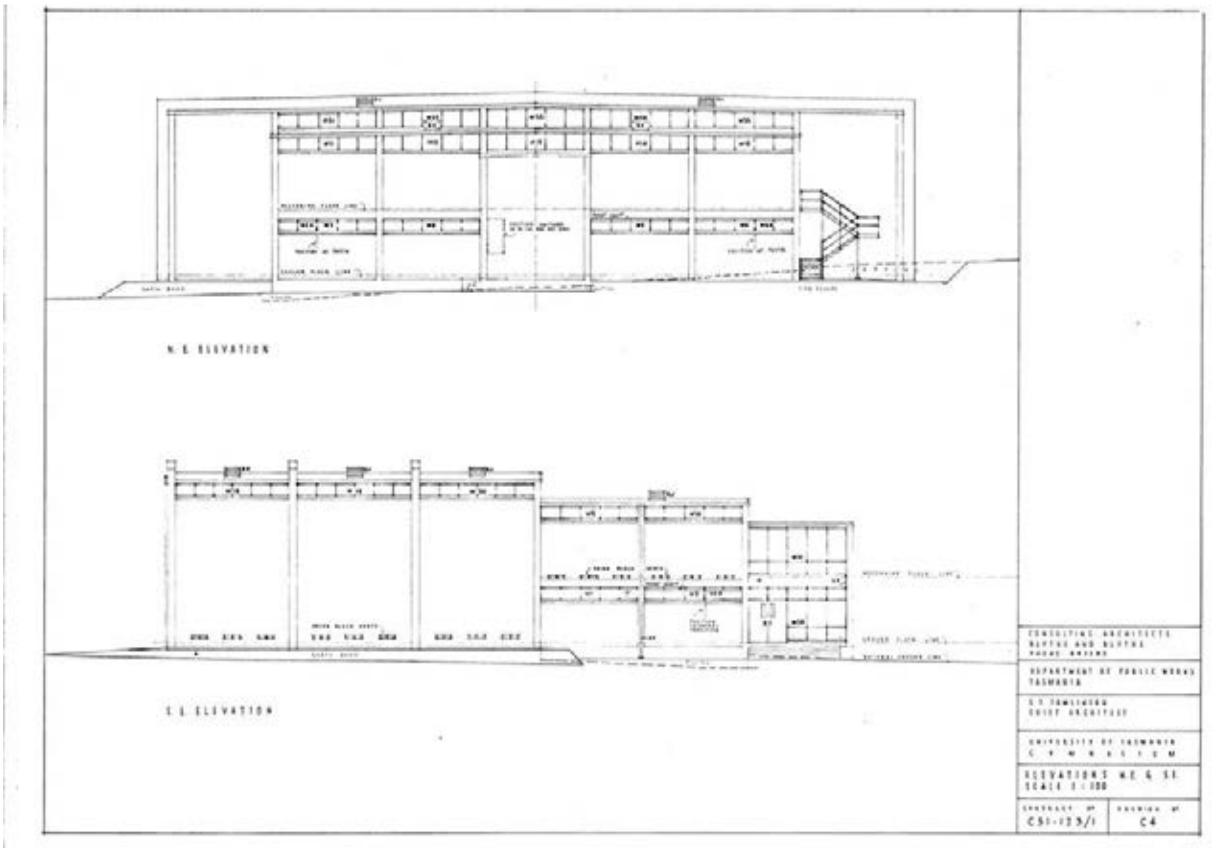
Source: Hanger 20-014.tif



Building 4 – Uni Gym

First Floor Plan – University of Tasmania Gymnasium. Prepared by Department of Public Works Tasmania – S.T. Tomlinson Chief Architect Consulting architects: Blythe and Blythe, 1973.

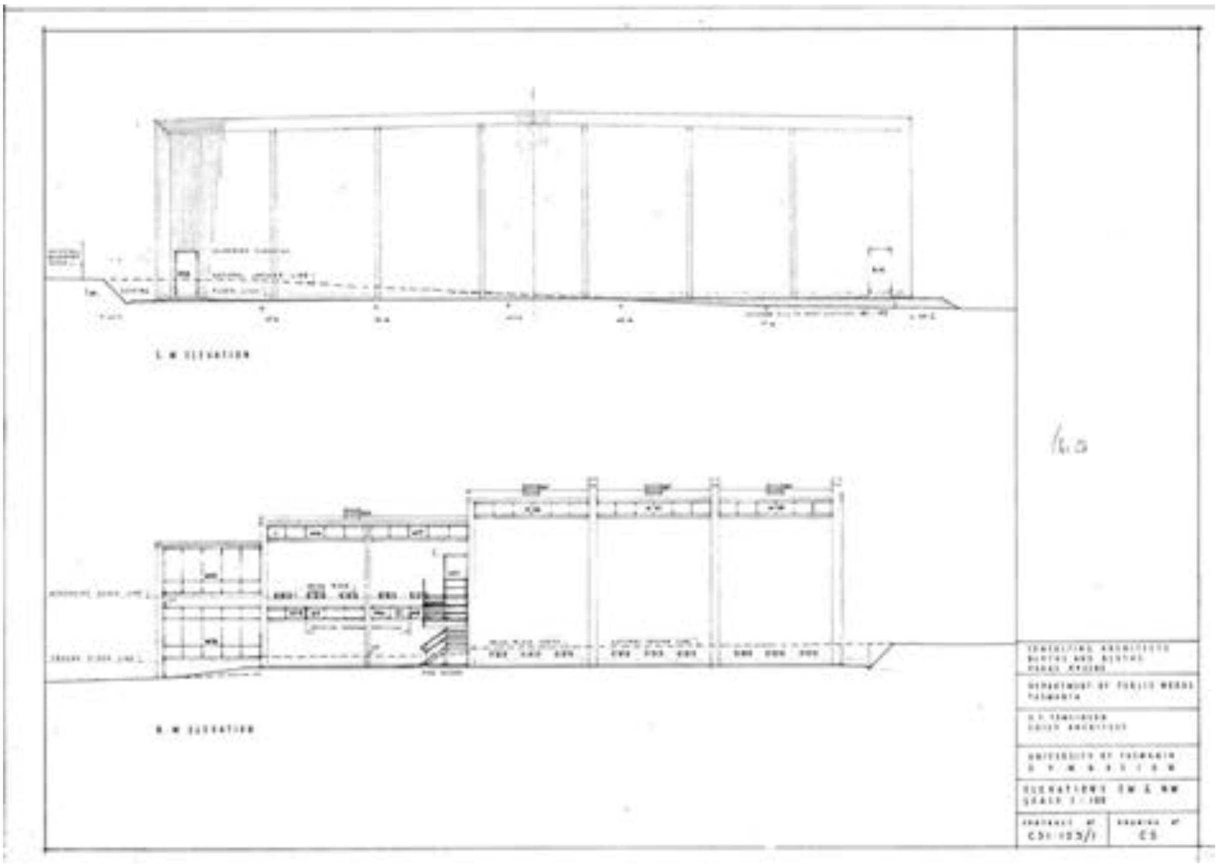
Source: Hanger 20-015.tif



Building 4 – Uni Gym

N.E and S.E Elevations – University of Tasmania Gymnasium. Prepared by Department of Public Works Tasmania – S.T. Tomlinson Chief Architect Consulting architects: Blythe and Blythe, 1973.

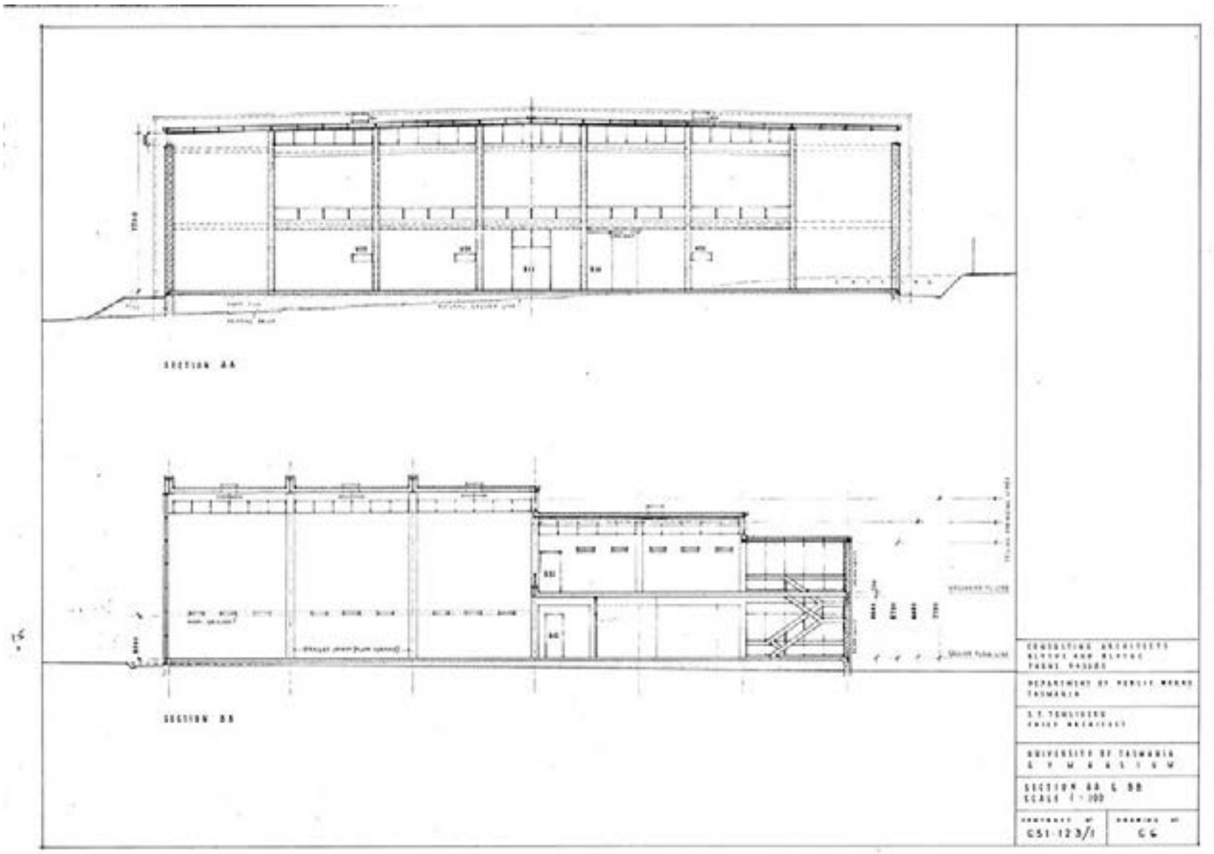
Source: Hanger 20-016.tif



Building 4 – Uni Gym

S.W and N.W Elevations – University of Tasmania Gymnasium. Prepared by Department of Public Works Tasmania – S.T. Tomlinson Chief Architect Consulting architects: Blythe and Blythe, 1973.

Source: Hanger 20-017.tif



Building 4 – Uni Gym

Sections – University of Tasmania Gymnasium. Prepared by Department of Public Works Tasmania – S.T. Tomlinson Chief Architect Consulting architects: Blythe and Blythe, 1973.

Source: Hanger 20-018.tif

Building 5
Cricket Pavilion

Building No:	Building Name:	Previous Name:
5	Cricket Pavilion	University Sports Pavilion
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1986	Forward Consultants	1988?
Date of Major Extension	**Architect for Extension**	**Description**
-	-	-

Description of Current Building

Exterior Form	The Cricket Pavilion features three connected gable end bays, with the gable end forms facing the cricket oval. The bay on the southern end is two-storey in scale with the two northern bays being single storey. The gable roofs are formed from timber trusses clad in colorbond metal roofing. The exterior walls are blond face blockwork with a smaller format dark concrete block base to the wall. The eastern façade of the southern bay features extensive glazing, and the gable end is also fully glazed providing a view of the exposed timber roof trusses through the windows. The centre bay is recessed between the northern and southern bays with a small single storey verandah facing the cricket oval. A small clock is located near the top of the central gable. The northern bay features some glazing to the gable form and a small window to the eastern facade. The northern façade features service windows and doors, including a roller door. A lightweight scoreboard with a large clock, also with a gable end form, is located separately to the north and painted bright yellow. The building uses a post modern design approach.
Interior Form	Interior not accessible during site inspection
Significance	The building was awarded an Institute of Architects Award. It does not have heritage significance.
Key Elements	-
Condition	The building appears to be in fair condition, however a detailed inspection was not conducted.

Current Photos

Building 5 – Cricket Pavilion

South-eastern elevation (facing oval)

Source: Paul Davies Pty Ltd

Building 5 – Cricket Pavilion

North-eastern corner (facing oval)

Source: Paul Davies Pty Ltd

Building 5 – Cricket Pavilion

South-eastern elevation (facing oval)

Source: Paul Davies Pty Ltd

Building 5 – Cricket Pavilion

South-western elevation

Source: Paul Davies Pty Ltd

Building 5 – Cricket Pavilion

Detail of Cricket Score Board

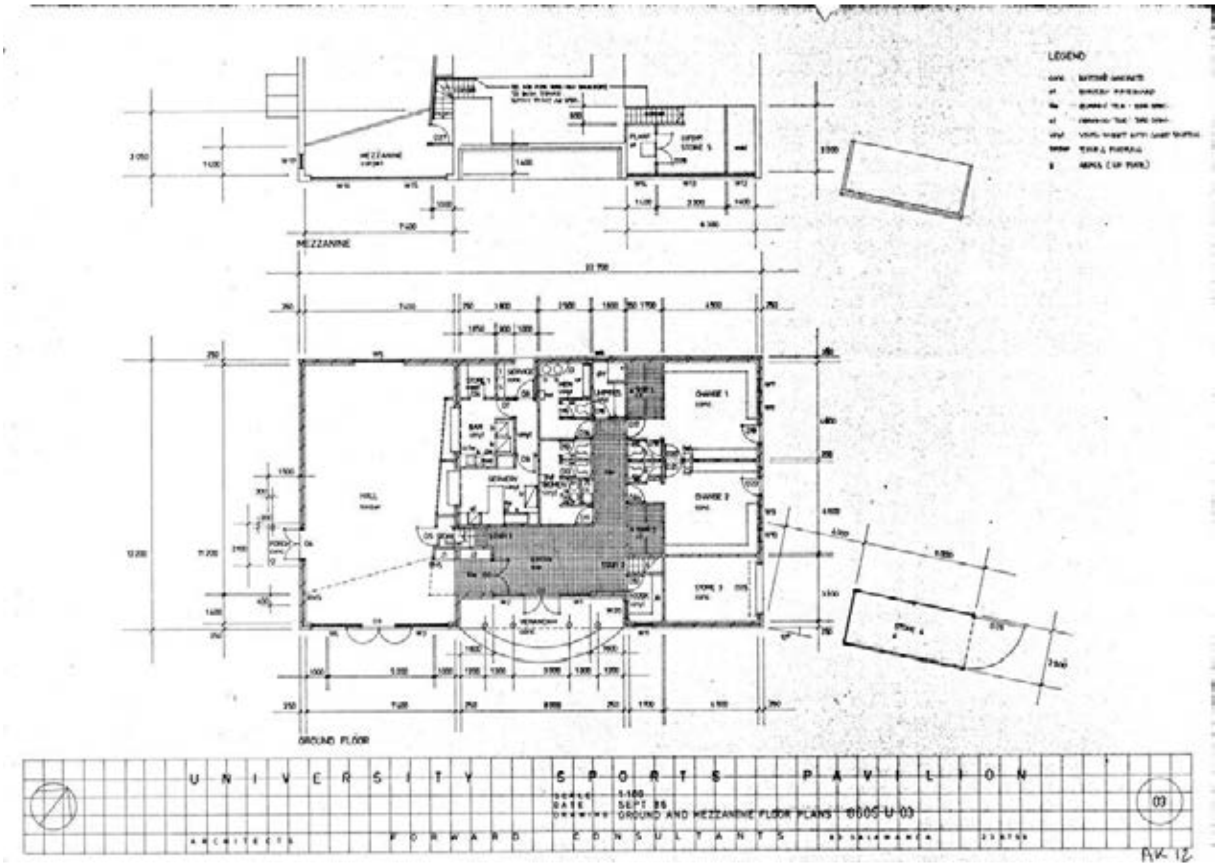
Source: Paul Davies Pty Ltd

Building 5 – Cricket Pavilion

Detail of Cricket Score Board

Source: Paul Davies Pty Ltd

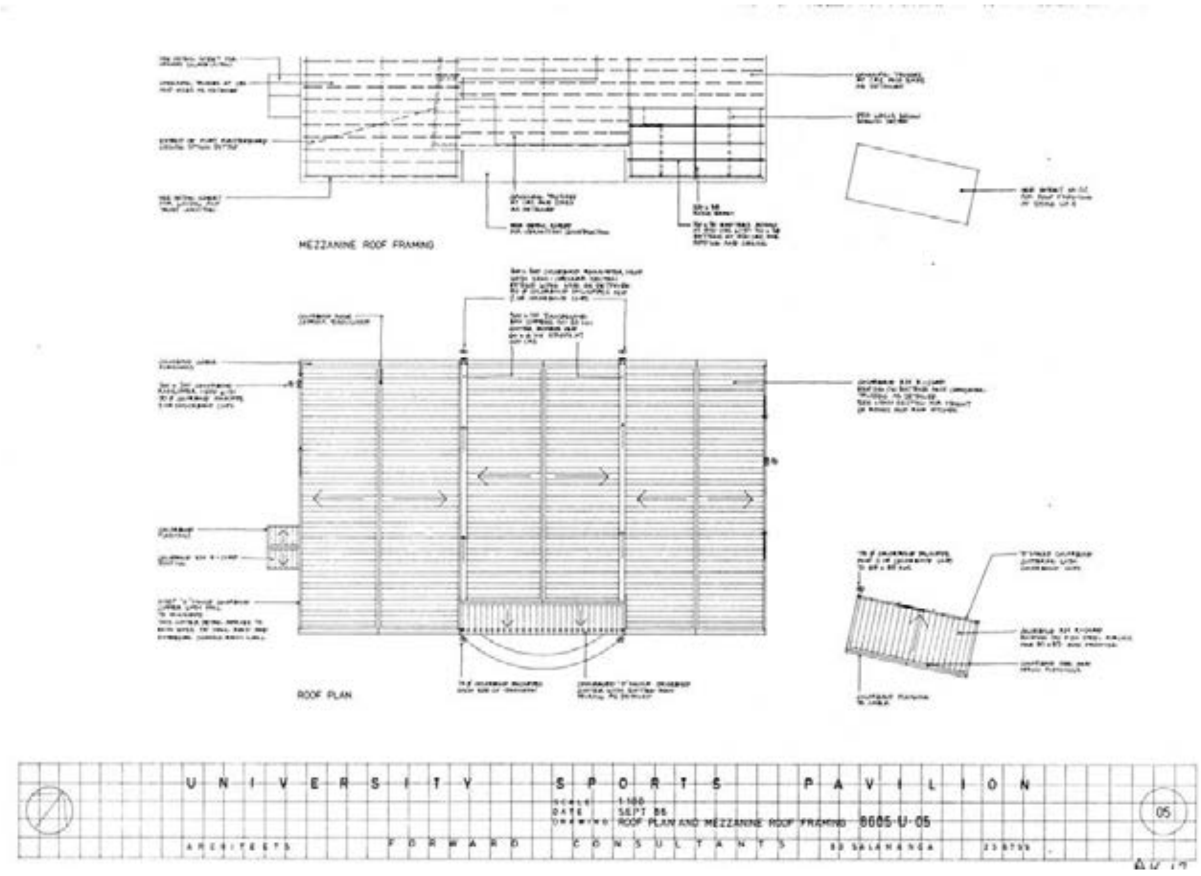
Key Plans



Building 5 – Cricket Pavilion

Ground and Mezzanine Floor Plan – University Sports Pavilion. Prepared by Forward Consultants 1986.

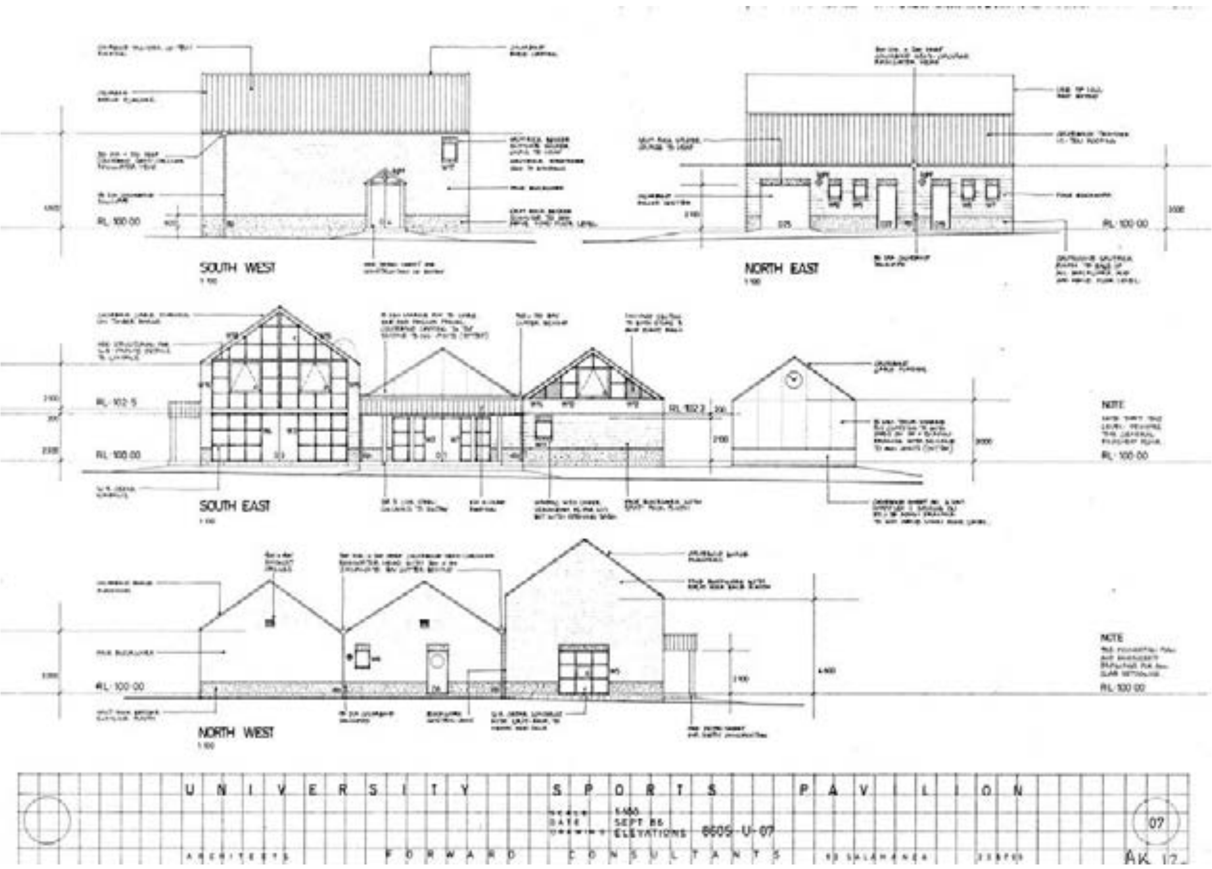
Source: Hanger 20-002.tif



Building 5 – Cricket Pavilion

Roof Plan – University Sports Pavilion. Prepared by Forward Consultants 1986.

Source: Hanger 20-005.tif



Building 5 – Cricket Pavilion

Elevations – University Sports Pavilion. Prepared by Forward Consultants 1986.

Source: Hanger 20-007.tif

Building 6
Law Building

Building No:	Building Name:	Previous Name:
6	Law Building	Law
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1971	Department of Public Works – Tasmania. Chief Architect: S.T. Tomlinson in association with Bush Park Shugg and Moon.	-
Date of Major Extension	**Architect for Extension**	**Description**
1988	Forward Consultants	Stage 1: South-eastern Extension and Alterations
1989	Forward Consultants	Stage 2: Library Extension
1990	Forward Consultants	Stage 3: South-eastern Extension and Alterations
1993	Eastman Heffernan Walch and Button	South-Western Extension

Description of Current Building

Exterior Form

The original two-storey 1971 building featured a central main entrance accessed from the south-western side of the building facing Grosvenor Crescent. The library wing is located on the ground floor to the west of the main entry with seminar and lecturer offices located to the east. The first floor lecture theatre is located above the southern part of the library, and again offices are located along the eastern façade on the first floor. The library roof is expressed as three saw-tooth roofs with high level south-facing glazing. Externally the lecture theatre form remains evident with its bold and simple angled blond face brick walls and asymmetrical ridge adjacent to the main entrance. The original north-eastern wing features semi-circular window headers to the windows on the ground floor. The brickwork under these arched windows is slightly recessed, which reinforces the rhythm of the windows in the façade.

The south-eastern 1988 extension by Forward Consultants presents regular square aluminium framed windows and regular decorative blond face brickwork. A band of brick solider coursing is located along the full face of the elevation above and below the windows on both the ground and first floor. The first floor overhangs the ground floor to the east and is supported by a regular row of painted concrete round columns. Several new and enlarged openings to the original facades were part of these works.

The northern 1989 library extension by Forward Consultants added a square box addition to the north of the existing library. The eastern façade features full height aluminium framed curtain wall glazing whilst the northern and western facades present restrained but decorative blond face brick walls with a slight decorative curve to the brickwork in plan to the north-east and south-west corners of the extension. These two facades contain a regular grid of very small square windows to each elevation. The brickwork to the north-western corner of the extension mimics the original brick work detailing with an overlapping hatch form to the brick work. This addition is a well considered new element.

The south-eastern wing was further extended in 1990 by Forward Consultants in an identical architectural language and materials as the 1988 extension. A central rainwater head and downpipe to the eastern façade of the extension marks the joint between the 1988 extension and the 1990 extension. The new concrete entry ramp from Grosvenor Crescent was also built as part of these extension and upgrade works.

The curved three-storey post-modern blockwork extension to the south-west of the original building was designed by Eastman Heffernan Walch and Button in 1993. The extension contains computer labs, a new lecture theatre, seminar rooms, offices and amenities. The curved blonde blockwork wall to the north-west contains two ribbons of horizontal aluminium windows with continuous metal mesh awnings for sun shading above each row of windows. The curved blockwork wall to the lecture theatre (facing south-west) is a solid blockwork wall (except for one low height horizonal window) constructed from regular square concrete blocks in a grey-green colour and features a regular grid of slightly protruding blocks as fenestration.

Over time the building has shifted to having a post modern appearance although that is manifested in quite different stylistic approaches that results in a now quite confused overall building form.

Interior Form	Interior not accessible during site inspection
Significance	The building is not of heritage significance.
Key Elements	-
Condition	The building appears to be in reasonable condition, however an extensive inspection was not conducted.

Current Photos

Building 6 – Law Building

South-western elevation (main entrance)

Source: Paul Davies Pty Ltd

Building 6 – Law Building

South-western elevation (main entrance). The concrete entrance ramp was added in 1990.

Source: Paul Davies Pty Ltd

Building 6 – Law Building

South-eastern corner, showing the 1988 and 1990 extension.

Source: Paul Davies Pty Ltd

Building 6 – Law Building

South-eastern façade. This is the original façade from 1971 however several of the openings were enlarged as part of the 1988 alterations.

Source: Paul Davies Pty Ltd

Building 6 – Law Building

North-eastern corner of the 1989 library extension

Source: Paul Davies Pty Ltd

Building 6 – Law Building

Northern elevation of the 1989 library extension

Source: Paul Davies Pty Ltd

Building 6 – Law Building

1989 library extension (image left), 1993 postmodern extension (image right).

Source: Paul Davies Pty Ltd

Building 6 – Law Building

1989 library extension (image left), 1993 postmodern extension (image right). Note the decorative hatched brickwork corner to the library extension.

Source: Paul Davies Pty Ltd

Building 6 – Law Building

North-western façade of the 1993 extension

Source: Paul Davies Pty Ltd

Building 6 – Law Building

South-western façade of the 1993 extension

Source: Paul Davies Pty Ltd

Building 6 – Law Building

South-western corner and junction between the original 1971 lecture theatre (image right) and the later 1993 extension

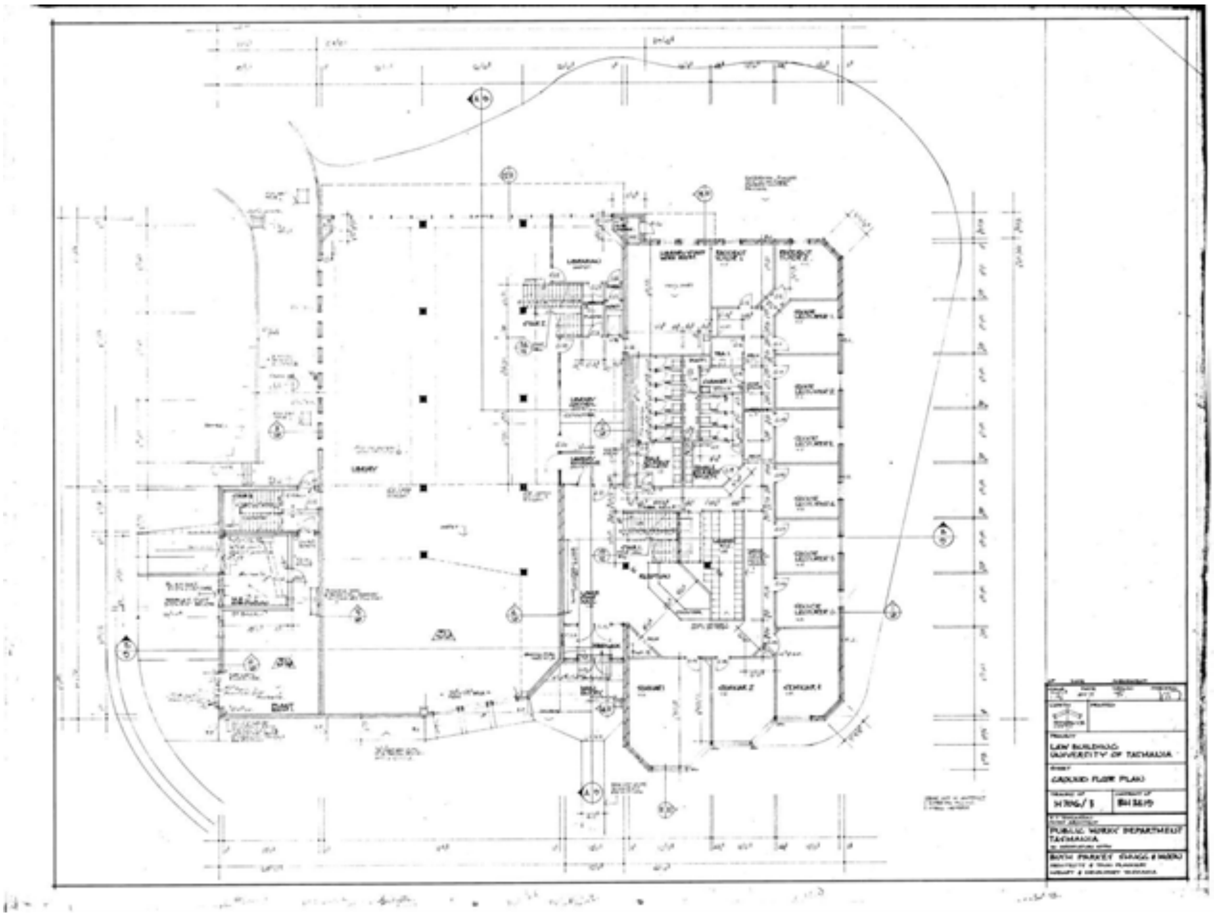
Source: Paul Davies Pty Ltd

Building 6 – Law Building

South-western façade, showing the original 1971 lecture theatre (the two window openings at the top are not original).

Source: Paul Davies Pty Ltd

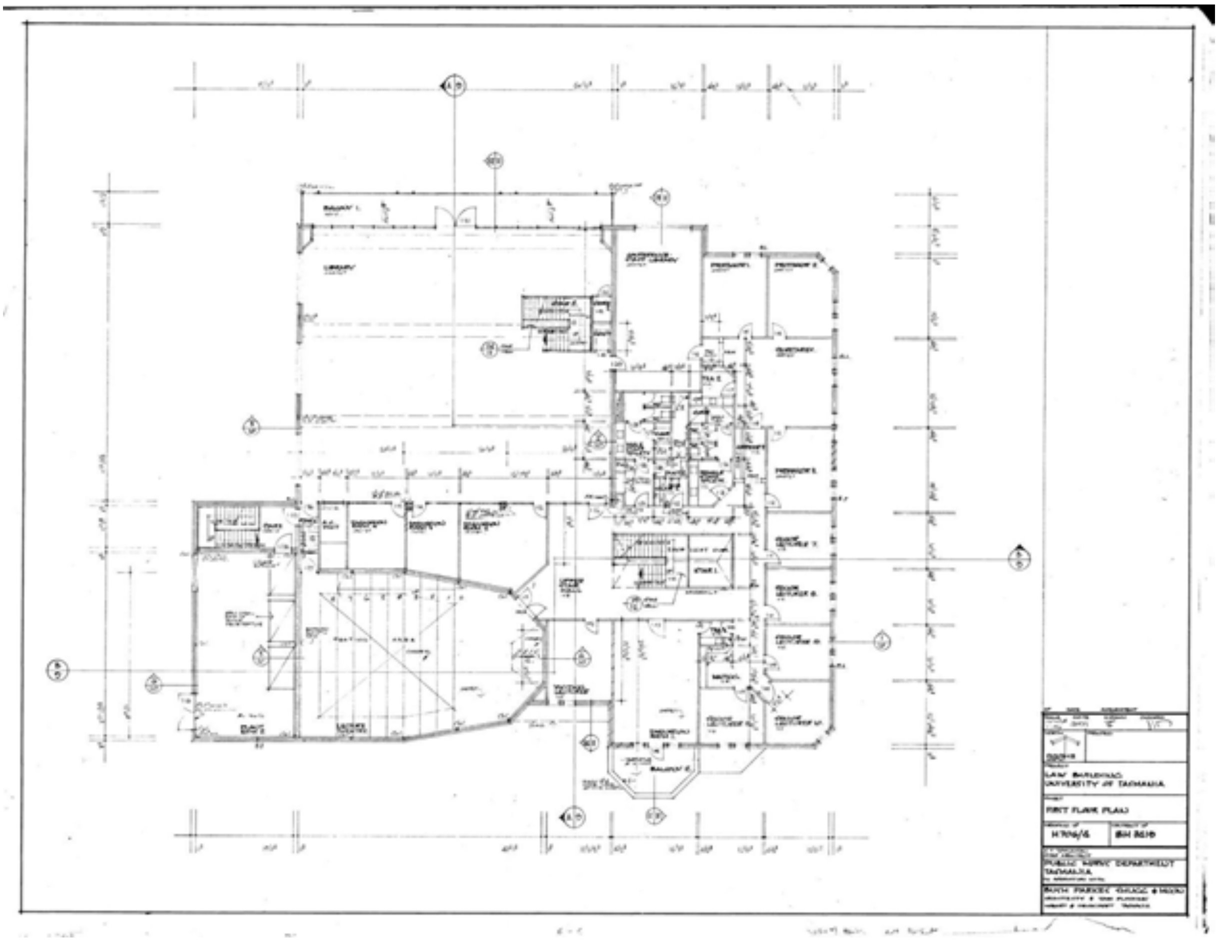
Key Plans



Building 6 – Law Building

Ground Floor Plan – Prepared by Public Works Department- Tasmania. Chief architect S.T. Tomlinson in association with Bush Parkes Shugg and Moon Architects, 1971

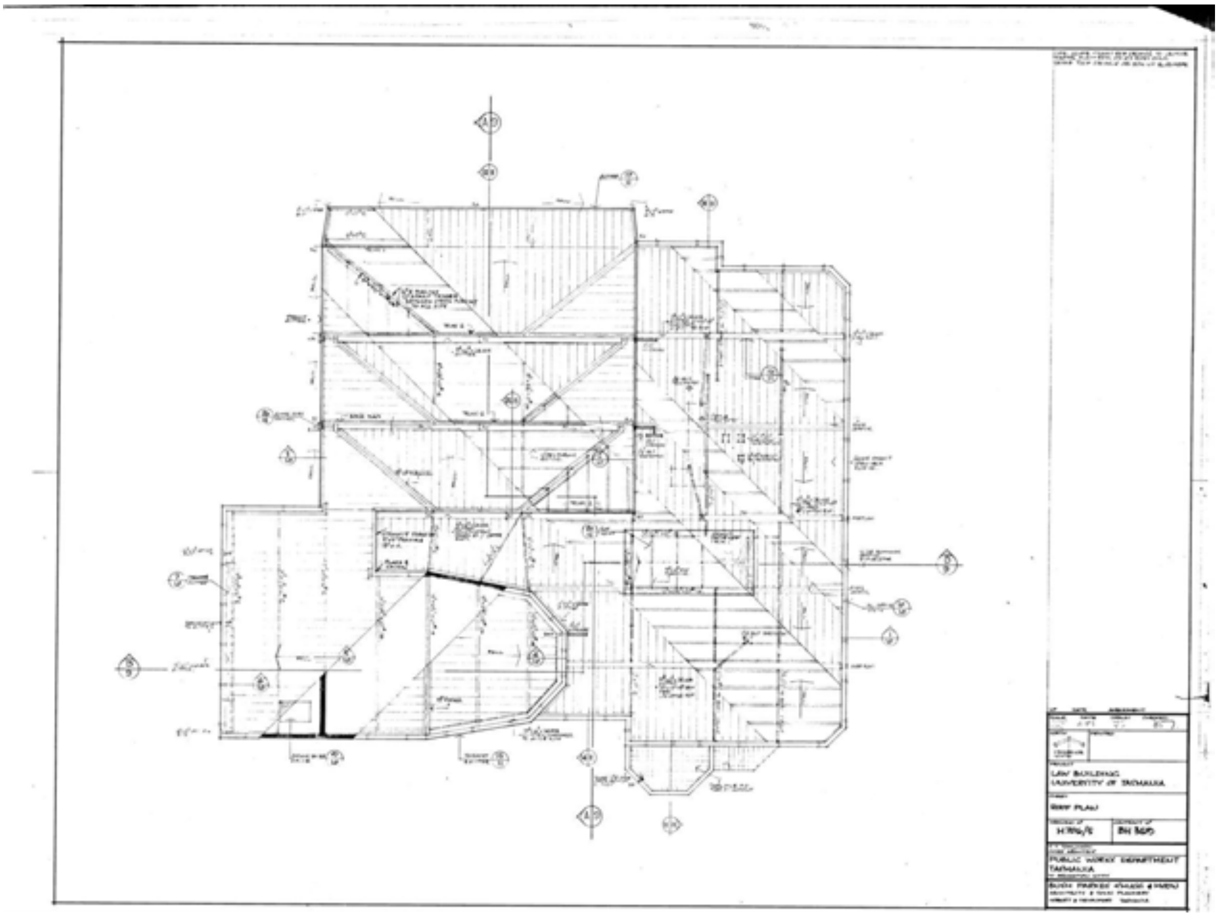
Source: Hanger 19-032.tif



Building 6 – Law Building

First Floor Plan – Prepared by Public Works Department - Tasmania. Chief architect S.T. Tomlinson in association with Bush Parkes Shugg and Moon Architects, 1971

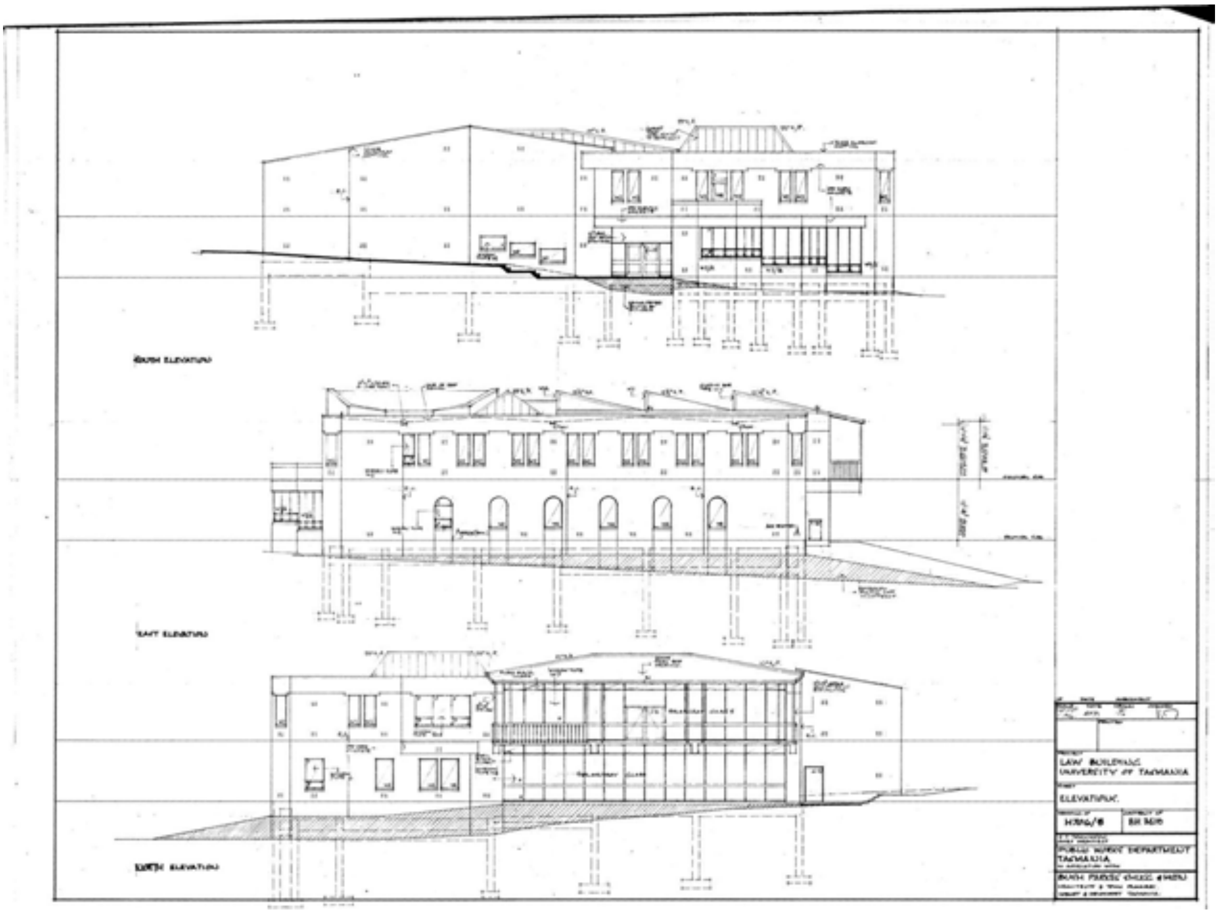
Source: Hanger 19-033.tif



Building 6 – Law Building

Roof Plan – Prepared by Public Works Department- Tasmania. Chief architect S.T. Tomlinson in association with Bush Parkes Shugg and Moon Architects, 1971

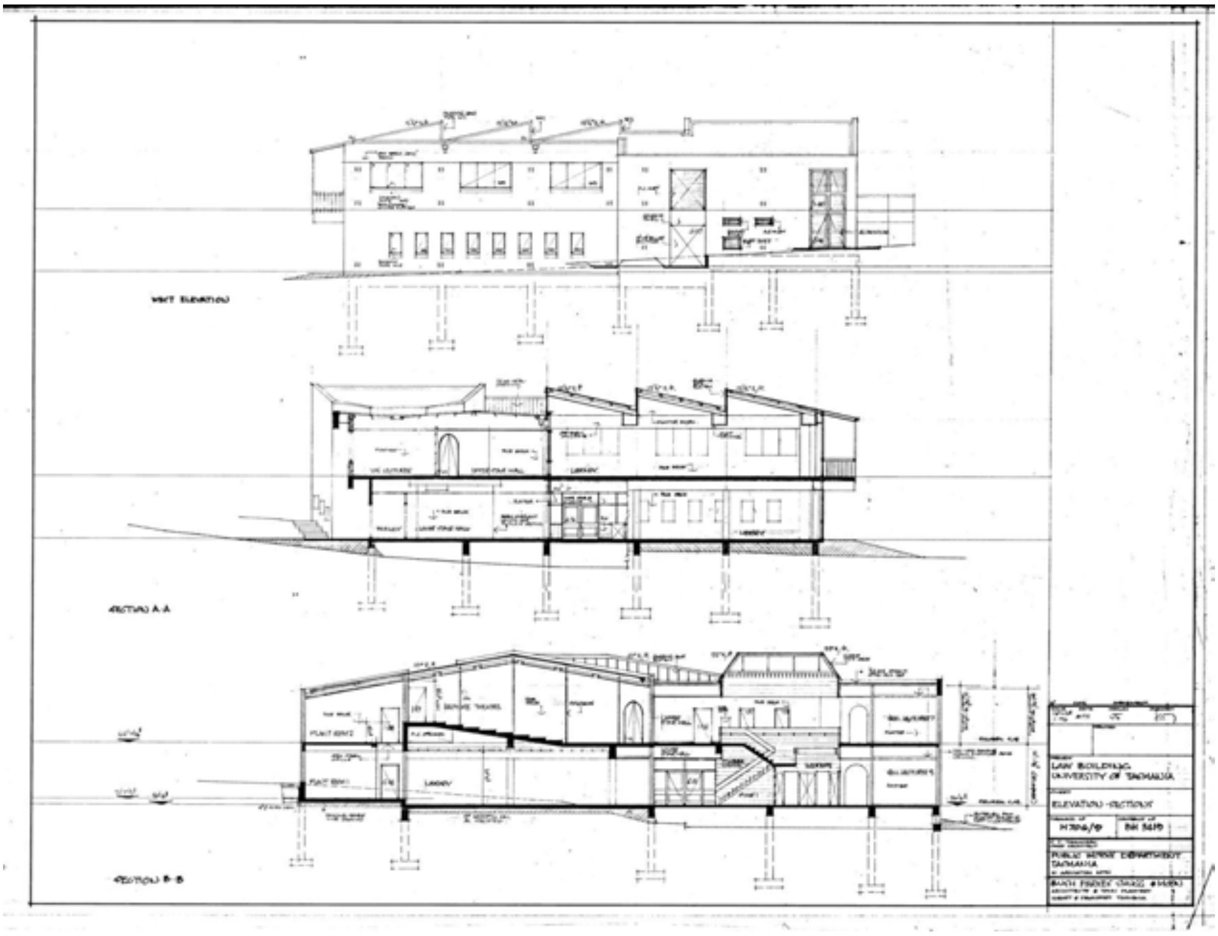
Source: Hanger 19-034.tif



Building 6 – Law Building

Elevations – Prepared by Public Works Department - Tasmania. Chief architect S.T. Tomlinson in association with Bush Parkes Shugg and Moon Architects, 1971

Source: Hanger 19-037.tif



Building 6 – Law Building

Elevations and Sections – Prepared by Public Works Department - Tasmania. Chief architect S.T. Tomlinson in association with Bush Parkes Shugg and Moon Architects, 1971

Source: Hanger 19-038.tif

Building 8
Engineering Building

Building No:	Building Name:	Previous Name:
8	Engineering Building	Engineering

Date of Construction or Date of Original Drawings	Original Architect	Date Opened
1957	Department of Public Works - Tasmania. Chief Architect C.D Rose	1959

Date of Major Extension	Architect for Extension	Description
1984	University of Tasmania: Buildings Branch	Alterations Levels 1 and 2

Description of Current Building

Exterior Form

The Engineering Building is a three-storey L-shaped linear building orientated to face north-east, with a two-storey rectangular lecture theatre, with main drawing office above, projecting forward of the main building bulk at the north-western end (adjacent to the main entrance). A south-eastern wing containing the machine laboratories is located at the opposite end of the building.

The north-western frontage to Dobson Road presents a two-storey form with a centrally located narrow vertical window with warm yellow face brick to the south-side of the window and a painted panelled wall to the north side of the window. Six small square windows are located on the ground floor in a grid of three across by two high to the face brick wall with building identification signage above with the text "Engineering". The main entrance is located at the north-western end of the main linear building form and is accessed via wide external steps to a glazed foyer with a cantilevered concrete canopy. Curtain wall glazing with some green coloured glass panels are installed to the first floor above the entrance awning.

The two-storey lecture theatre volume features windowless warm yellow face brick to the northern façade and a windowless painted panelled façade facing entrance to the west. There is small single storey projection box featured popping out on the northern face brick façade to the lecture theatre which features a repeating geometric patten of coloured yellow, brown and white glazed square tiles.

The primary north-eastern façade features warm yellow face brick to the basement floor, which is dug into the ground, and identical ribbons of steel glazed windows with green vertical enamel panelling underneath running the full length of the façade to the ground and first floors. A row of staff rooms fit within the structural steel grid along the north-eastern façade with a central corridor and then larger labs, lecture rooms, and the library located on the south-western side of the building.

The eastern elevation originally featured the university logo at high level on the predominately face brick façade facing the middle of the campus, however the Centenary Building was constructed in 1989 and a two storey solid rendered block work link was built between the two buildings. This façade of the building is no longer able to be viewed as originally intended from the centre of the campus.

The southern façade and western façade of the southern wing maintain the same architectural language and materiality with warm yellow face brick to the basement level and a defined painted and rendered rectangle unifying the steel glazed windows to the ground and first floors which are contained within a projecting rendered rectangular concrete border. The original steel framed bridge link from the first floor of the Engineering Building connects through to the Engineering Workshop Building adjacent to the south. A minor entrance and stairwell is located at the eastern end of the southern elevation accessed via a small set of concrete steps. This stairwell features a vertical fully glazed steel framed panel above the entrance doors and cantilevered concrete canopy.

The most notable feature of the south elevation of the south-eastern wing is the external cantilevered pre-cast concrete fire escape stair which has a simple but elegant design.

The external elevations are largely still intact with minor alterations and additions, such as the Surveying Building extension to the north, the two storey bridge link to the Centenary Building to the east and some alterations to the openings on the basement level of the southern façade.

Interior Form

Interior not accessible during site inspection.

Significance

The building is one of the early campus buildings to the design of the Public Works Department and retains a high level of overall integrity. It is clearly modernist building using new construction forms and materials in a modest and competent way.

The building has moderate significance for its design quality (it is not an outstanding example of the period even though it does demonstrate the modernist approach to design on the campus) and it makes a contribution to the overall site layout form and consistency.

Key Elements

- Overall external form of the building in relation to the campus masterplan
- External form demonstrating an early and basic form of utilitarian modernism including use of materials and fenestration
- Unusual cantilevered external stair on south facade

Condition

The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 8 – Engineering Building

North-western façade (facing Dobson Road)

Source: Paul Davies Pty Ltd

Building 8 – Engineering Building

Northern façade (Main Entrance)

Source: Paul Davies Pty Ltd

Building 8 – Engineering Building

Tile detail on the northern-façade

Source: Paul Davies Pty Ltd

Building 8 – Engineering Building

Northern façade (eastern end)

Source: Paul Davies Pty Ltd

Building 8 – Engineering Building

Southern façade (western end)

Source: Paul Davies Pty Ltd

Building 8 – Engineering Building

Southern façade – steel window detail

Source: Paul Davies Pty Ltd

Building 8 – Engineering Building

Elevated bridge link between the Engineering Building and the Engineering Workshop

Source: Paul Davies Pty Ltd

Building 8 – Engineering Building

Minor Southern Entrance

Source: Paul Davies Pty Ltd

Building 8 – Engineering Building

Minor Southern Entrance and elevated bridge link between the Engineering Building and the Engineering Workshop

Source: Paul Davies Pty Ltd

Building 8 – Engineering Building

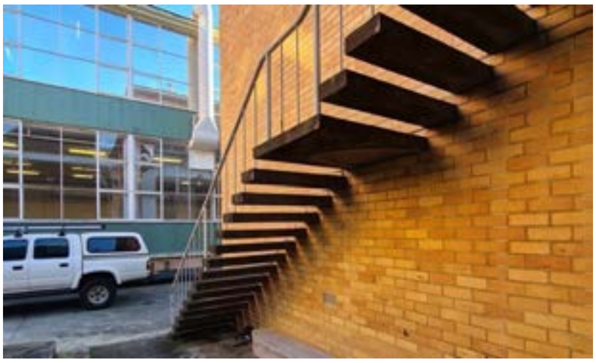
South-eastern wing (eastern façade)

Source: Paul Davies Pty Ltd

Building 8 – Engineering Building

Cantilevered concrete stair to south elevation of the south-eastern wing

Source: Paul Davies Pty Ltd



Building 8 – Engineering Building

Detail of cantilevered concrete stair

Source: Paul Davies Pty Ltd

Early Photos

Building 8 – Engineering Building

1960 Photograph

Model of the Projected School of Engineering to be Built at Sandy Bay for the Hobart University

Source: Archives Office of Tasmania; Item Number: PH30/1/3606

Building 8 – Engineering Building

1960 Photograph

North-eastern facades

Source: Libraries Tasmania Online Collection; Item Number AA193-1-394

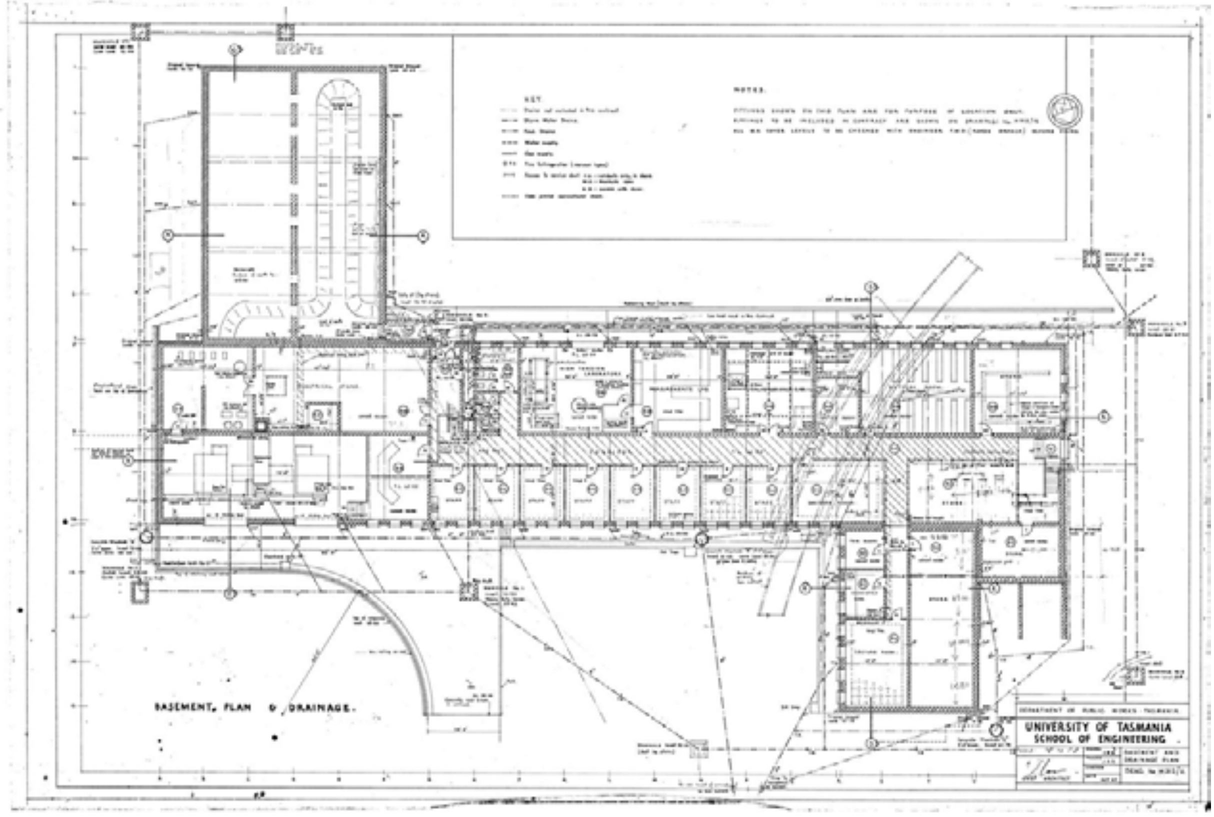
Building 8 – Engineering Building

1960 Photograph

Northern facades; Geography Building (image left), Engineering Building (image right)

Source: Libraries Tasmania Online Collection; Item Number AA193-1-399

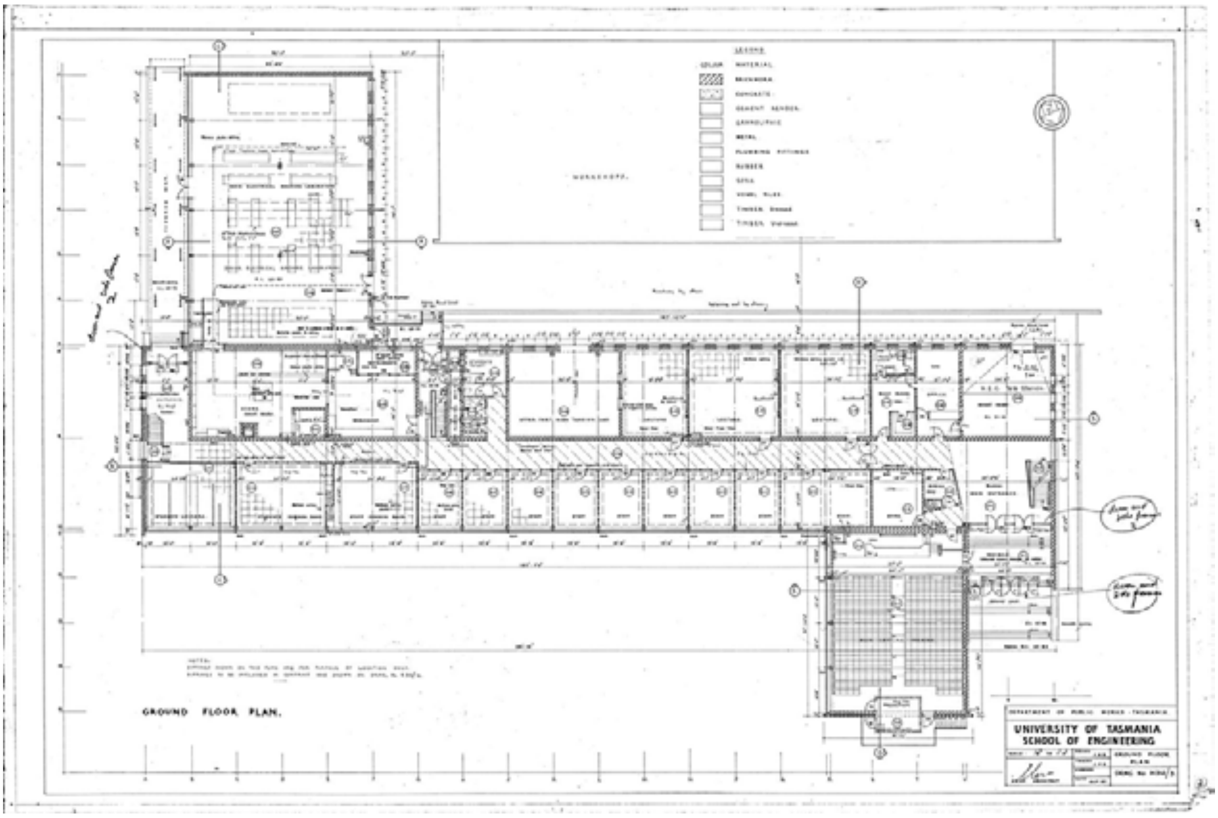
Key Plans



Building 8 – Engineering Building

Basement Plan – University of Tasmania School of Engineering. Prepared by Department of Public Works -Tasmania. Chief Architect C.D Rose, 1957

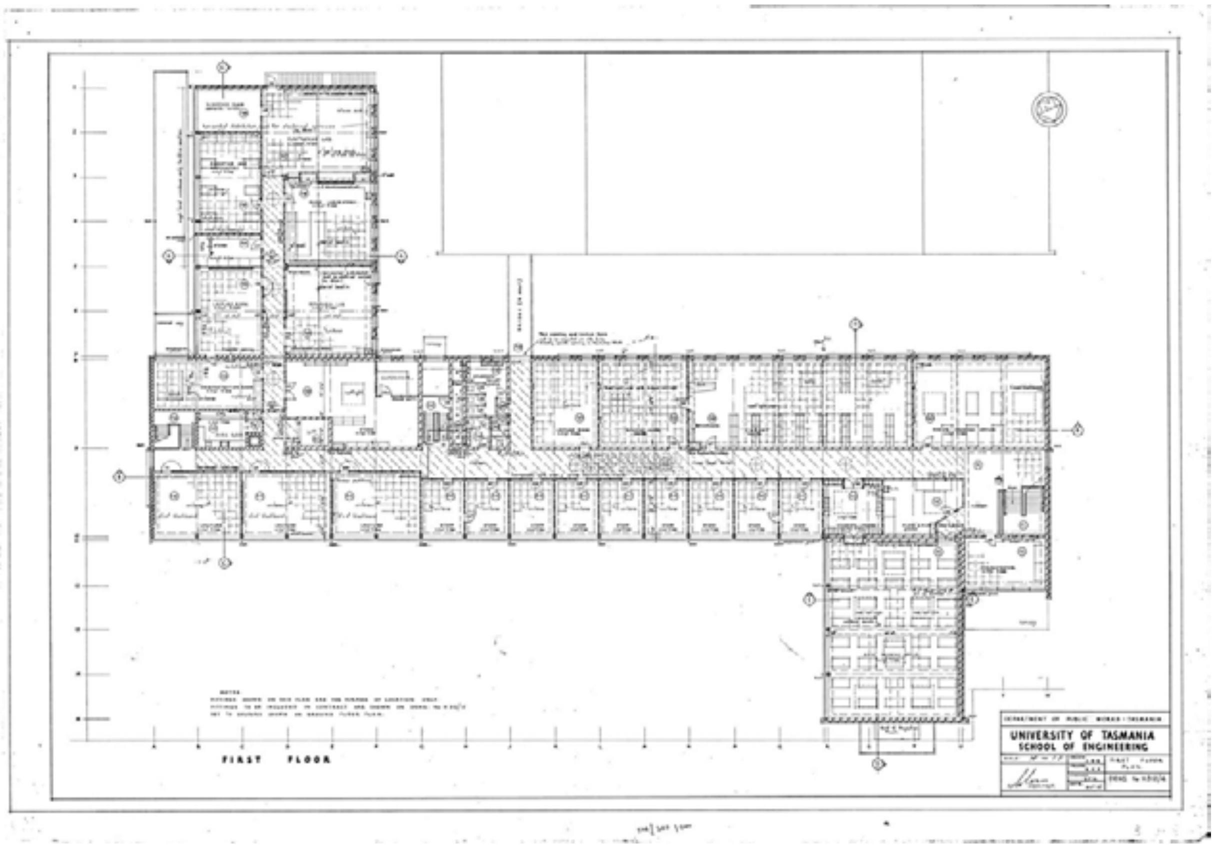
Source: Hanger 1-010.tif



Building 8 – Engineering Building

Ground Floor Plan – University of Tasmania School of Engineering. Prepared by Department of Public Works -Tasmania. Chief Architect C.D Rose, 1957

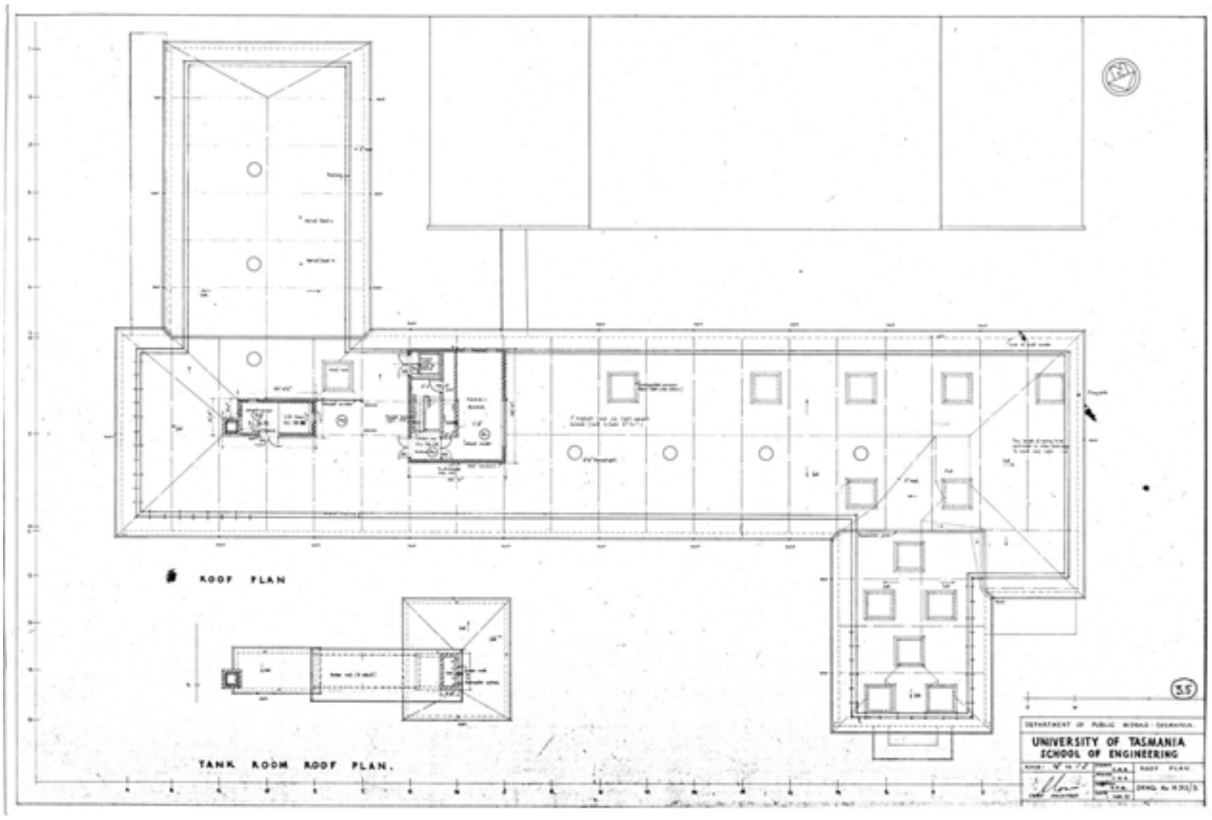
Source: Hanger 1-011.tif



Building 8 – Engineering Building

First Floor Plan – University of Tasmania School of Engineering. Prepared by Department of Public Works -Tasmania. Chief Architect C.D Rose, 1957

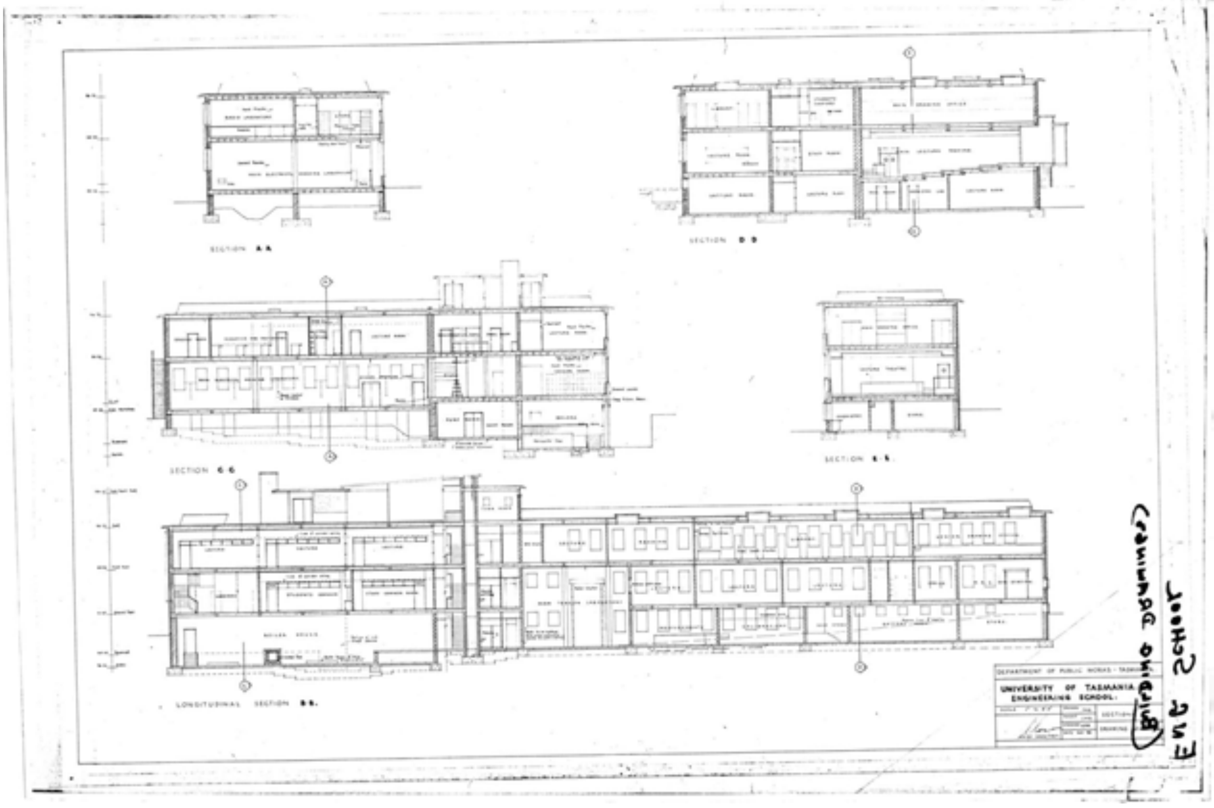
Source: Hanger 1-012.tif



Building 8 – Engineering Building

Tank Room Roof Plan – University of Tasmania School of Engineering. Prepared by Department of Public Works -Tasmania. Chief Architect C.D Rose, 1957

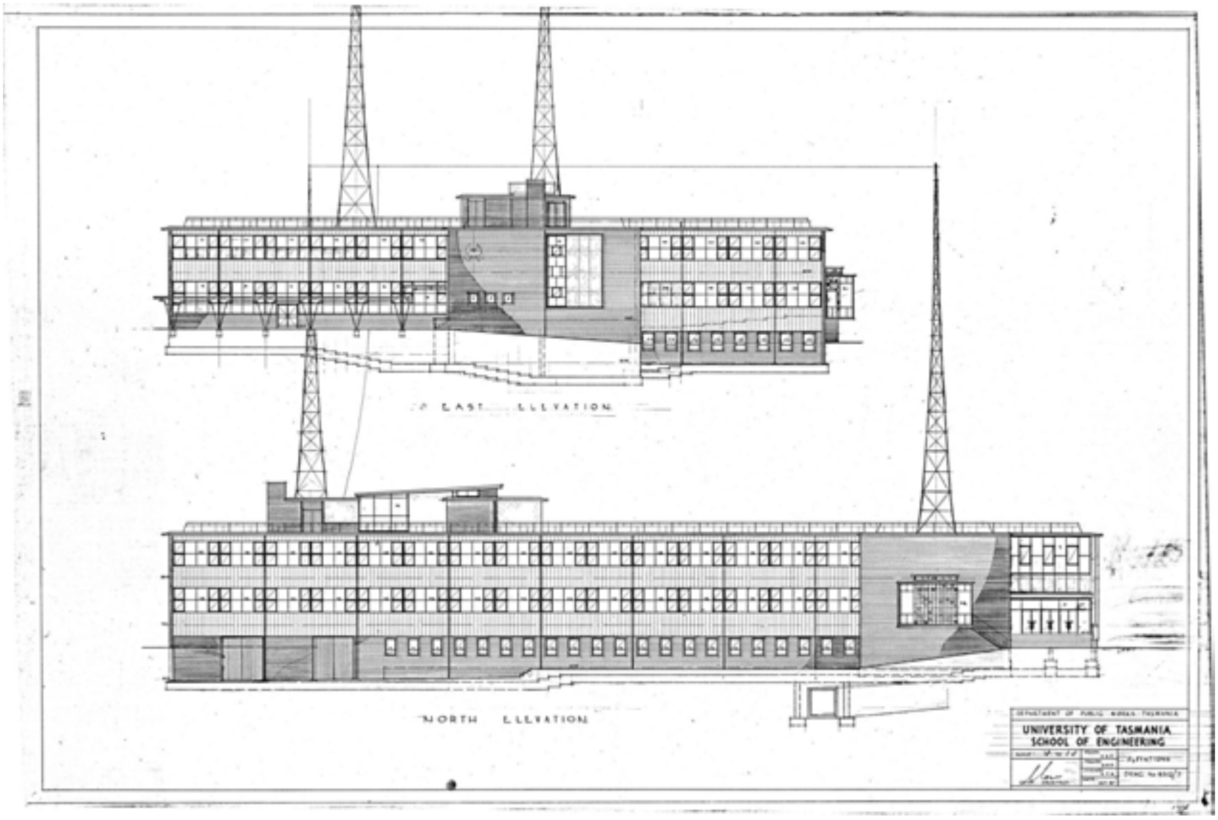
Source: Hanger 27-010.tif



Building 8 – Engineering Building

Sections – University of Tasmania School of Engineering. Prepared by Department of Public Works -Tasmania. Chief Architect C.D Rose, 1957

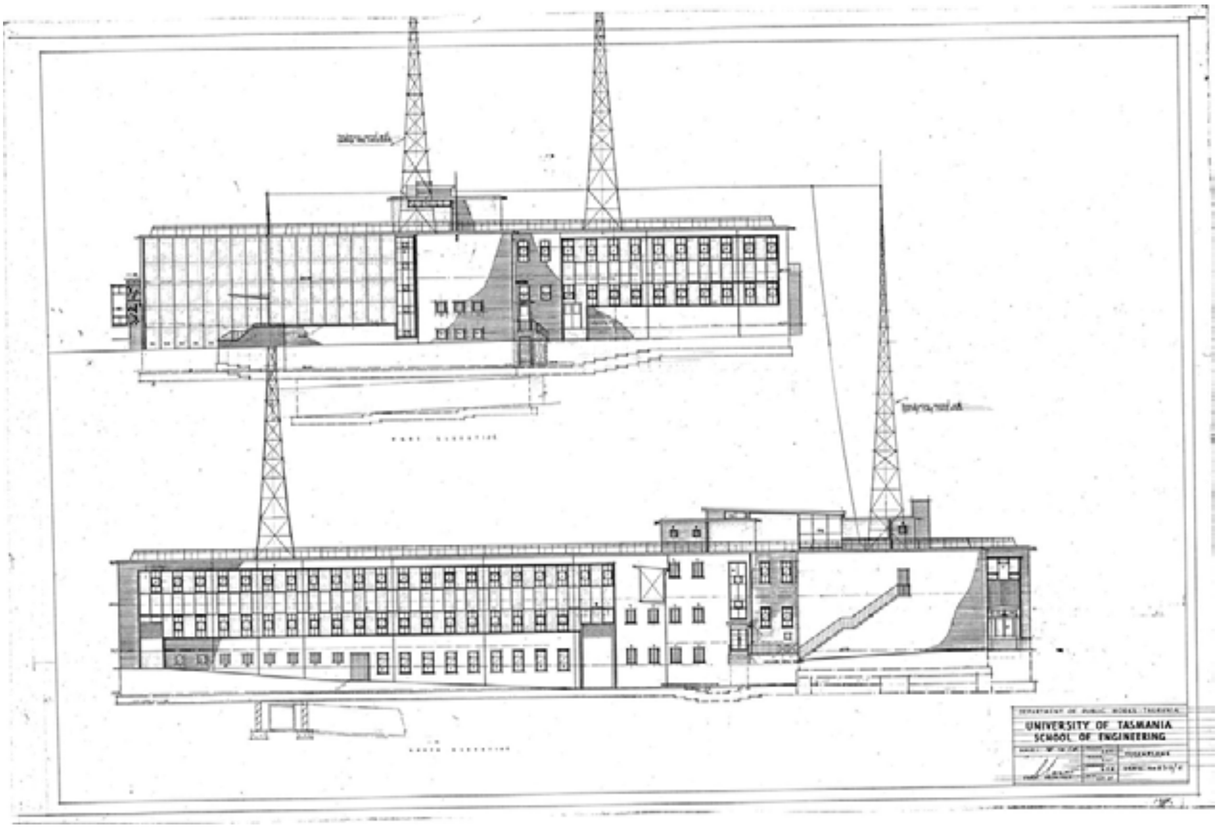
Source: Hanger 27-011.tif



Building 8 – Engineering Building

Elevations – University of Tasmania School of Engineering. Prepared by Department of Public Works -Tasmania. Chief Architect C.D Rose, 1957

Source: Hanger 27-012.tif



Building 8 – Engineering Building

Elevations – University of Tasmania School of Engineering. Prepared by Department of Public Works -Tasmania. Chief Architect C.D Rose, 1957

Source: Hanger 27-013.tif

Building 9
Surveying Building

Building No:	Building Name:	Previous Name:
9	Surveying Building	Surveying
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1979	Philp Lighton Floyd and Beattie	1979
Date of Major Extension	**Architect for Extension**	**Description**
1989	Drafting Services Tasmania	Additions

Description of Current Building

Exterior Form	The Surveying Building was built as a modest single storey northern extension to the Engineering Building in 1979. The building consists of undecorated blonde face brick, vertically proportioned aluminium windows with brick on edge sills, and thick and flat rectangular eaves overhang with a panelled colorbond metal fascia covering the edge of the low pitched roof. The building has a rectangular form that is stepped in plan towards the east. A further extension to the Surveying Buildings was built in 1989 to the east and north. This extension was designed and built to match the 1979 building in detailing and materiality.
Interior Form	Interior not accessible during site inspection
Significance	The building does not have heritage significance.
Key Elements	-
Condition	The building appears to be in reasonable condition, however a detailed inspection was not conducted.

Current Photos

Building 9 – Surveying Building

North-western corner, 1989 addition

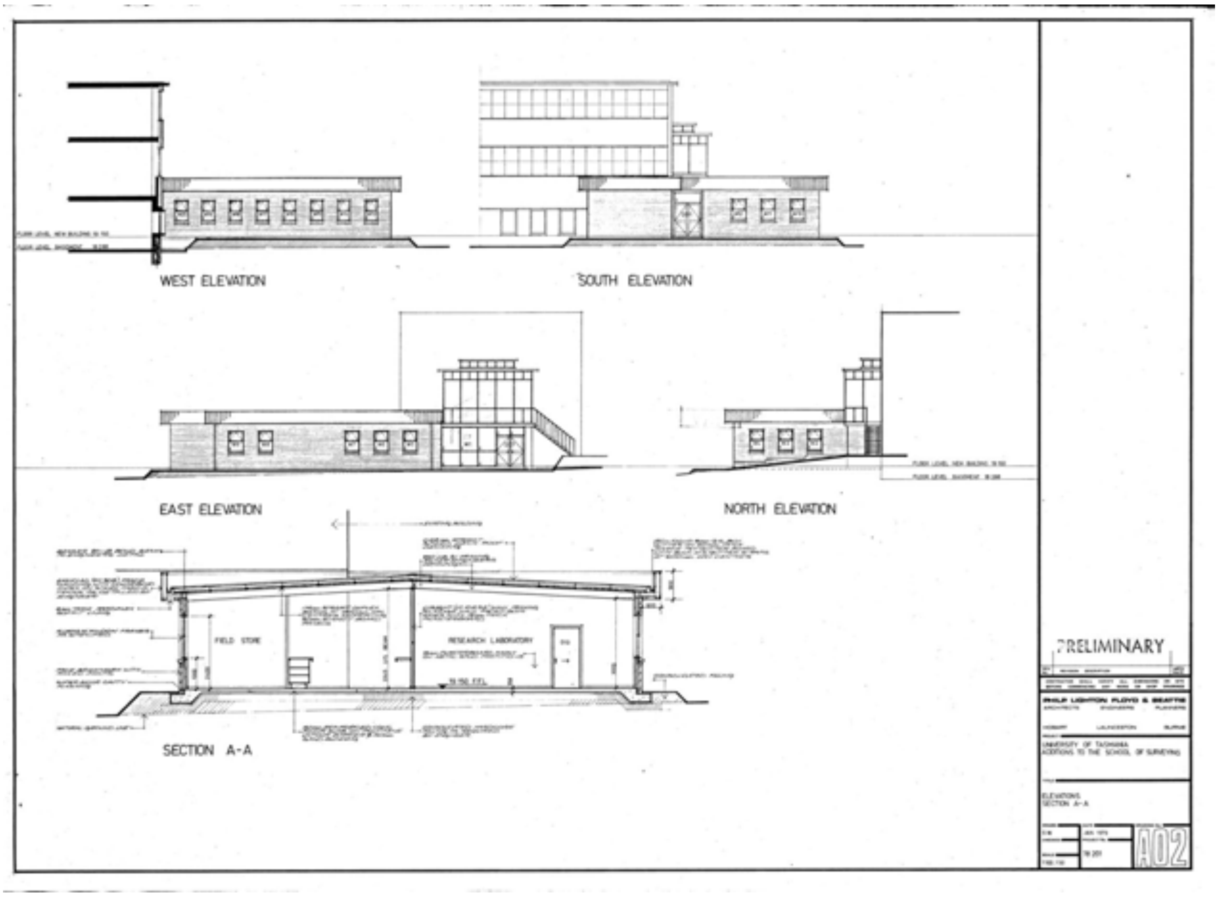
Source: Paul Davies Pty Ltd

Building 9 – Surveying Building

North-eastern corner, original 1979 building

Source: Paul Davies Pty Ltd

Key Plans



Building 9 – Surveying Building

Elevations and Section – School of Surveying. Prepared by Philp Lighton Floyd and Beattie, 1979.

Source: Hanger 30-005.tif

Building 10
Centenary Building

Building No:	Building Name:	Previous Name:
10	Centenary Building	Centenary Building
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1989	Michael Viney and Associates with Forward Consultants	-
Date of Major Extension	**Architect for Extension**	**Description**
2006	B Hill /P Gard	Minor interior alterations Levels 2, 3 & 4

Description of Current Building	
Exterior Form	The Centenary Building is a four storey post-modernist building centred between the Engineering Building and the Geology, Geography and CODES Building at the northern end of the middle campus facing Grosvenor Crescent. The building consists of two long rectangular wings of the same form and scale running north-south, separated by a central tiered promenade/courtyard with a three-storey glazed bridge link and foyer connecting the two wings. The glazed bridge link contains a lift in a circular painted and rendered blockwork shaft surrounded by a grid of four very large circular columns. The four columns and lift shaft continue through and above the glazed link with a large square roof form that is faced with a large sign with the "University of Tasmania" and the logo facing Grosvenor Crescent and the sporting fields beyond. The courtyard is open to the central green spaces of the middle campus at the southern side of the building. The wings feature two tones of horizontally banded blonde concrete block walls (each band is two courses high) with a regular grid of square windows. Each wing has a curved steel portal frame roof form. The building was located in the centre of the main campus vista towards the river and blocks views from the central campus area.
Interior Form	Interior not accessible during site inspection
Significance	The building is a major addition to the campus post 2000 and reflects the shift to Post Modernism that is seen in the campus buildings designed by Gary Forward. Forward and Viney were the main campus architects in the later part of the sites development and their design influence is seen broadly across the campus.

	Spatially the building location had a major adverse impact on the spatial qualities of the central campus, terminating the planned major view to the river, consequently the building has had an adverse impact on campus heritage values. The building is finely designed in itself but does not relate to the campus context successfully. As a recent building it is difficult to determine if it may have heritage significance in the future, at this juncture it does not have heritage significance.
Key Elements	-
Condition	The building appears to be in reasonable condition, however an extensive inspection was not conducted.

Current Photos

Building 10 – Centenary Building

Northern Façade facing Grosvenor Crescent (main entrance)

Source: Paul Davies Pty Ltd

Building 10 – Centenary Building

Northern Façade facing Grosvenor Crescent (main entrance)

Source: Paul Davies Pty Ltd

Building 10 – Centenary Building

Central Plaza between the eastern and western wings

Source: Paul Davies Pty Ltd

Building 10 – Centenary Building

Column Detail

Source: Paul Davies Pty Ltd

Building 10 – Centenary Building

Southern facade

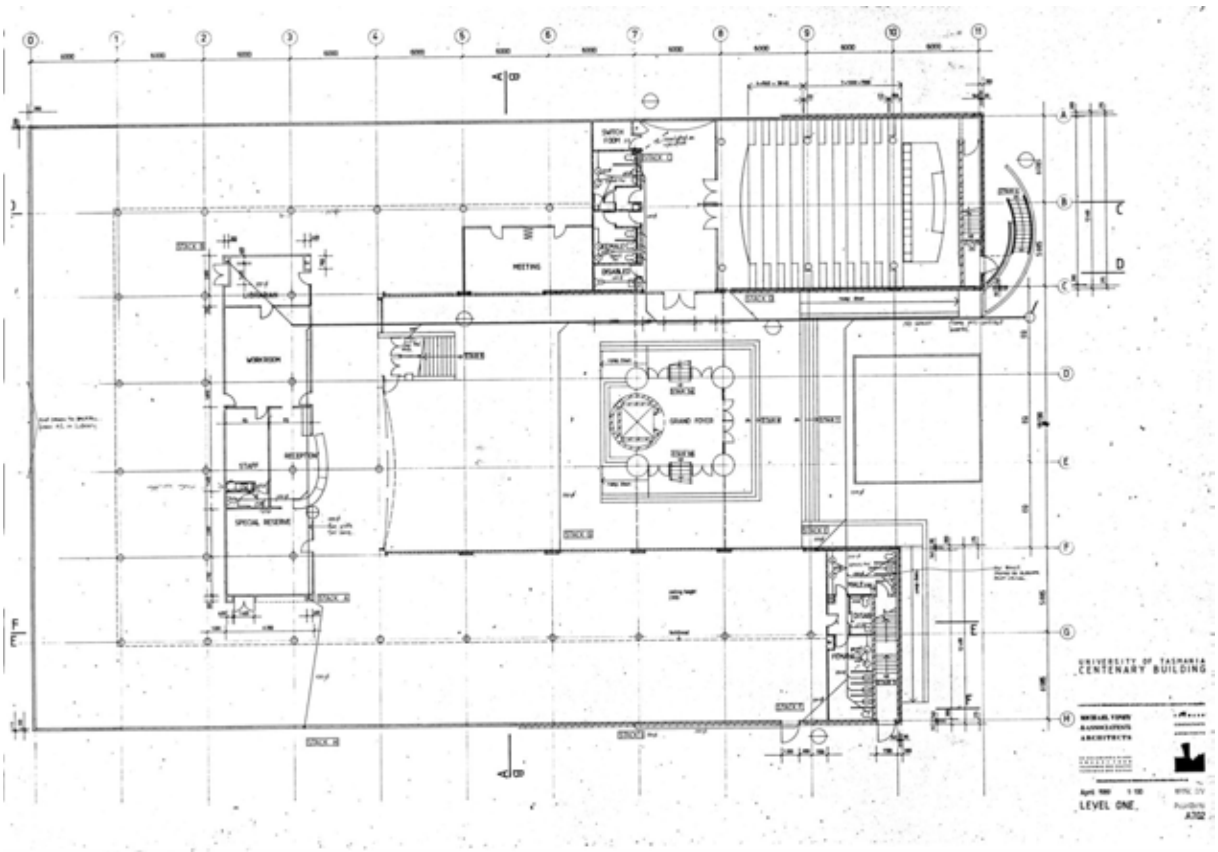
Source: Paul Davies Pty Ltd

Building 10 – Centenary Building

South-eastern corner

Source: Paul Davies Pty Ltd

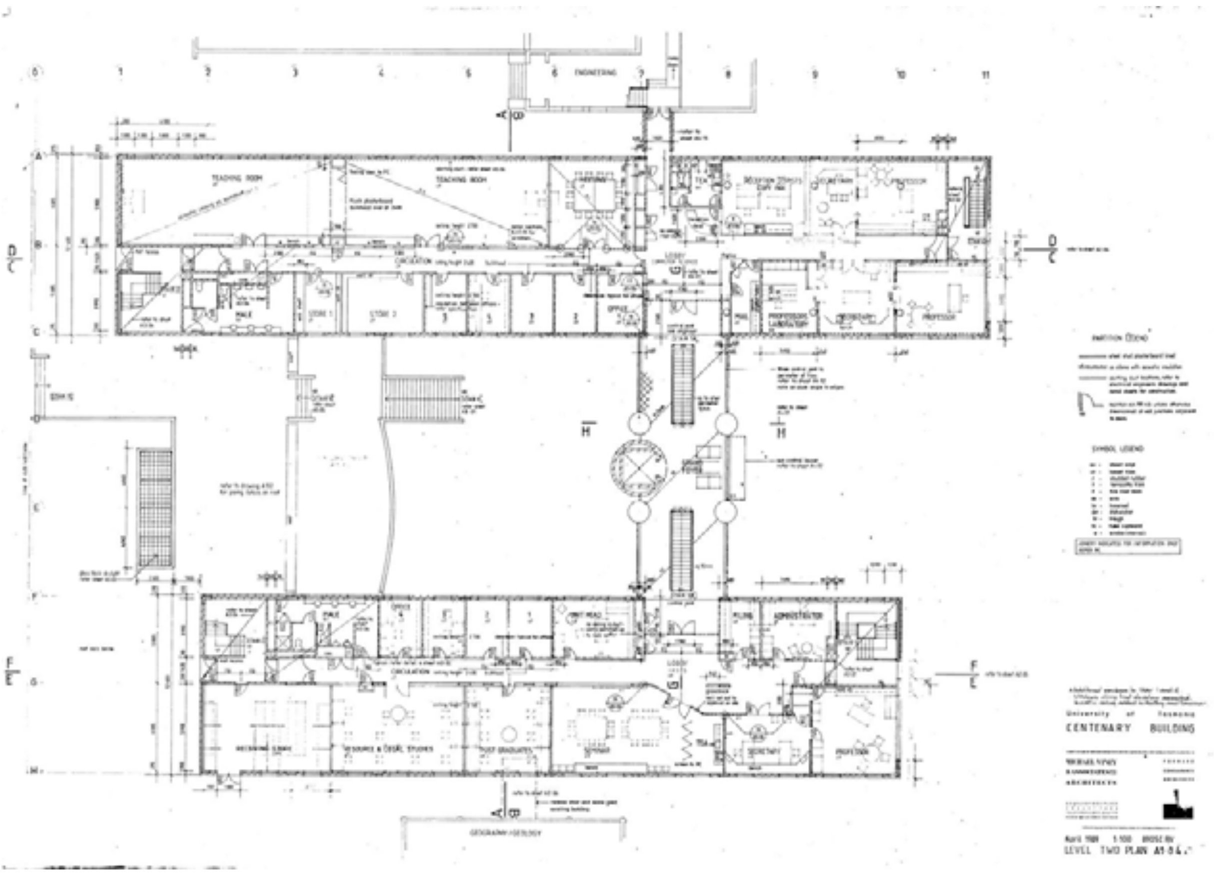
Key Plans



Building 10 – Centenary Building

Level 1 Floor Plan – Centenary Building. Prepared by Michael Viney and Associates Architects in association with Forward Consultants, 1989.

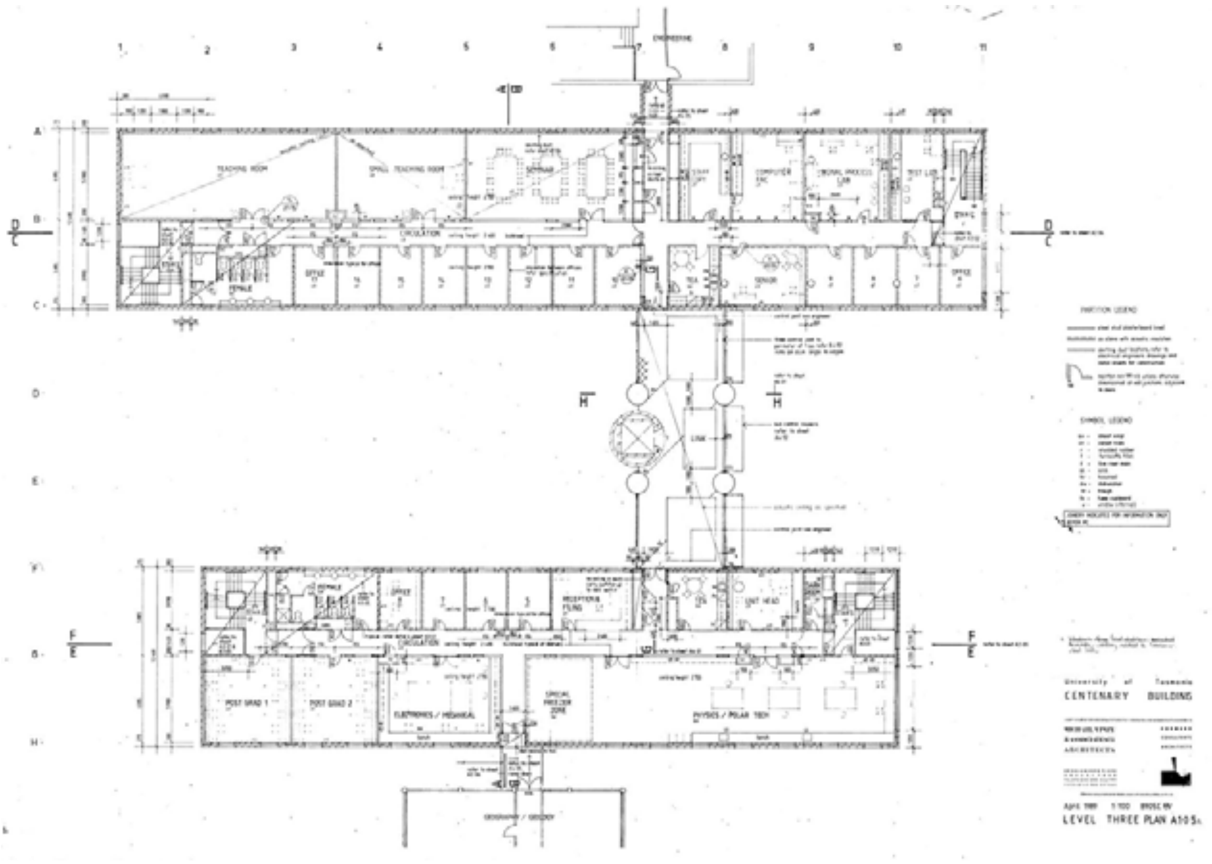
Source: Hanger 29-038.tif



Building 10 – Centenary Building

Level 2 Floor Plan – Centenary Building. Prepared by Michael Viney and Associates Architects in association with Forward Consultants, 1989.

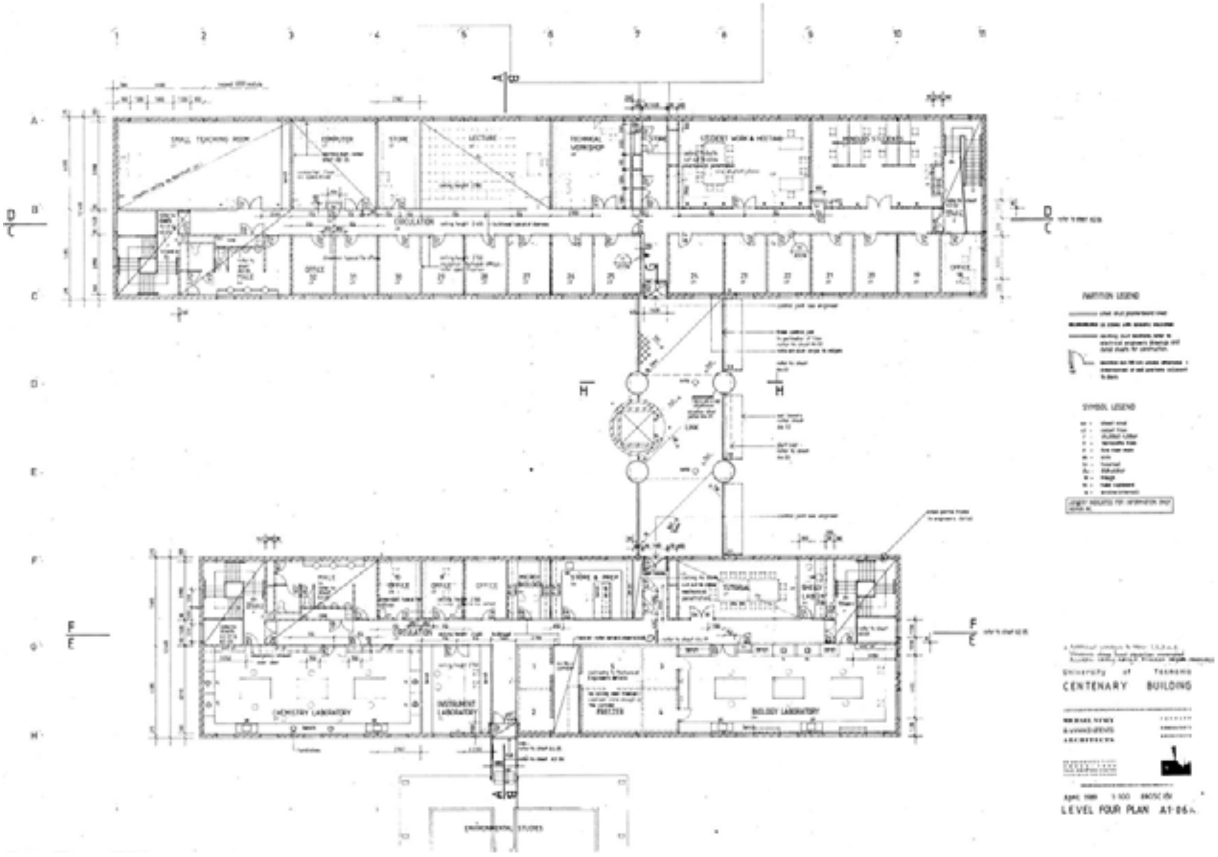
Source: Hanger 29-006.tif



Building 10 – Centenary Building

Level 3 Floor Plan – Centenary Building. Prepared by Michael Viney and Associates Architects in association with Forward Consultants, 1989.

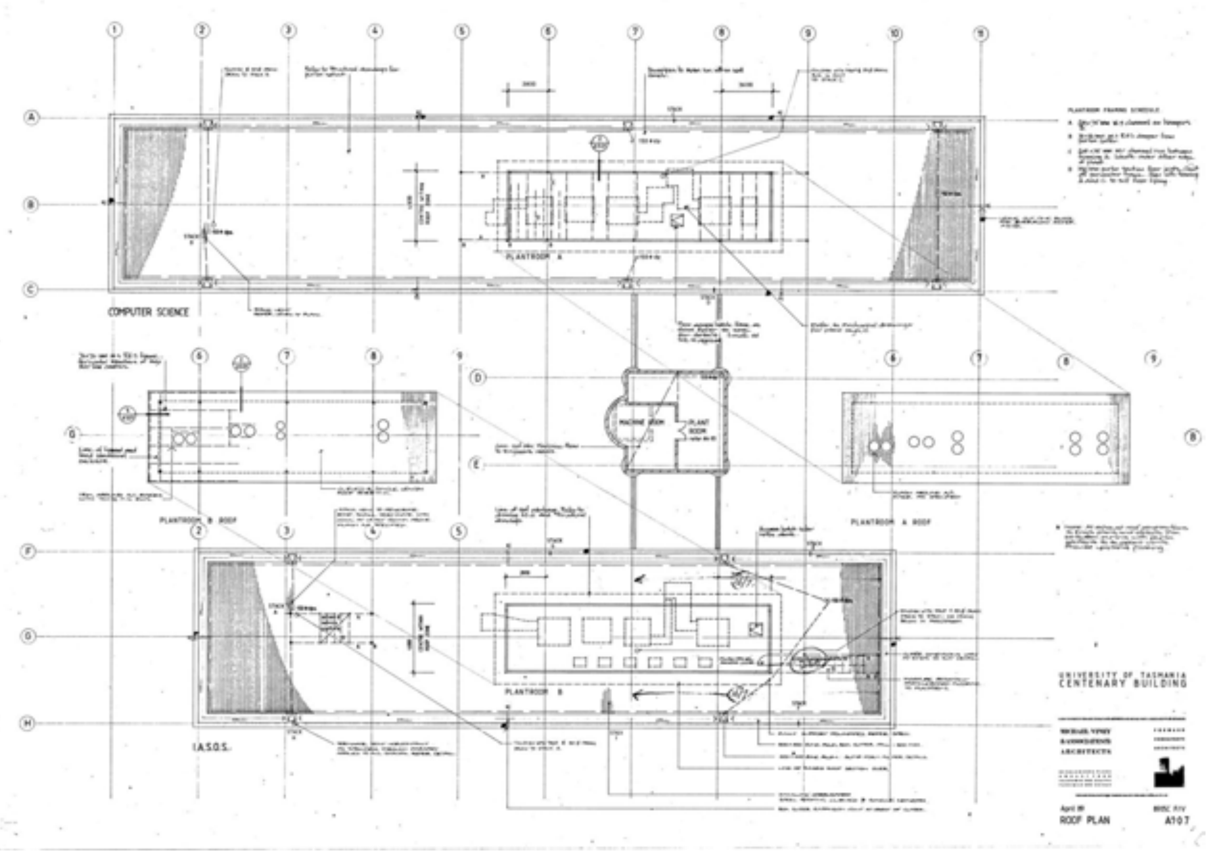
Source: Hanger 29-008.tif



Building 10 – Centenary Building

Level 4 Floor Plan – Centenary Building. Prepared by Michael Viney and Associates Architects in association with Forward Consultants, 1989.

Source: Hanger 29-010.tif



Building 10 – Centenary Building

Roof Plan – Centenary Building. Prepared by Michael Viney and Associates Architects in association with Forward Consultants, 1989.

Source: Hanger 29-012.tif

Building 11
Engineering Workshop

Building No:	Building Name:	Previous Name:
11	Engineering Workshop	Engineering Workshop
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1957	Department of Public Works Tasmania. Chief Architect C.D Rose	1959
Date of Major Extension	**Architect for Extension**	**Description**
1988	-	Single storey southern addition
Post 2000	-	Changes to north-western facade

Description of Current Building

Exterior Form	The Engineering Workshop is a large one and two-storey rectangular building nestled behind the Engineering Building to the south-west and connected to the Engineering Building via a glazed first floor bridge. The building is two storey along the western and eastern facades with a large single storey steel trussed saw tooth roof form in between. The eastern elevation features the same architectural language and materiality as the north-eastern façade of the Engineering with a light orange face brick base and ribbons of steel glazed windows with green vertical enamel panelling underneath running the full length of the façade to the ground and first floors. The western elevation has a light orange face brick base with steel framed with central entry doors and glazing to the full length of the ground and first floors with a horizontal band of painted white vertical enamel panelling between the ground and first floor windows. The north and south elevations are constructed from light orange face brick. The north elevation has a continuous cantilevered concrete awning running along the facade above the ground floor level, while the south elevation features the highlight glazing to the south-facing saw tooth trusses to the central single storey section. The ground floor contains large laboratories and some smaller research labs, storerooms and amenities. The first floor at the western end contains a single aerodynamics lab while the first floor at the eastern end, which is connected to the bridge link to Engineering, contains lecture rooms, research labs and staff offices. In 1988 a modest single storey extension with a matching light orange face brick walls and a flat roof was designed to the south of the original

	building. This extension is unremarkable and not architecturally or historically significant. The north-western steel framed windows were replaced some time after 2000 with aluminium windows that have altered the appearance of the building.
Interior Form	Interior not accessible during site inspection
Significance	The building is one of the early campus buildings to the design of the Public Works Department and retains a good level of overall integrity. It is clearly modernist building using new construction forms and materials in a modest and competent way. The building has moderate significance for its design quality (it is not an outstanding example of the period even though it does demonstrate the modernist approach to design on the campus) and it makes a contribution to the overall site layout form and consistency.
Key Elements	- its overall external form and massing - its relationship to the engineering building which was designed and built at the same time
Condition	The building appears to be in fair condition, however a detailed inspection was not conducted.

Current Photos

Building 11 – Engineering Workshop

North-western façade – Dobson Road (main entrance)

Source: Paul Davies Pty Ltd

Building 11 – Engineering Workshop

North-western corner

Source: Paul Davies Pty Ltd

Building 11 – Engineering Workshop

South-western corner

Source: Paul Davies Pty Ltd

Building 11 – Engineering Workshop

1988 southern extension

Source: Paul Davies Pty Ltd

Building 11 – Engineering Workshop

Eastern facade

Source: Paul Davies Pty Ltd

Building 11 – Engineering Workshop

View showing the central saw tooth roof form from the roof of the Chemistry Building looking north-east

Source: Paul Davies Pty Ltd

Early Photos

Building 11 – Engineering Workshop

1957 black and white print

Site Preparation for Engineering Workshop

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 5

Building 11 – Engineering Workshop

1957 black and white print

Under construction

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 6

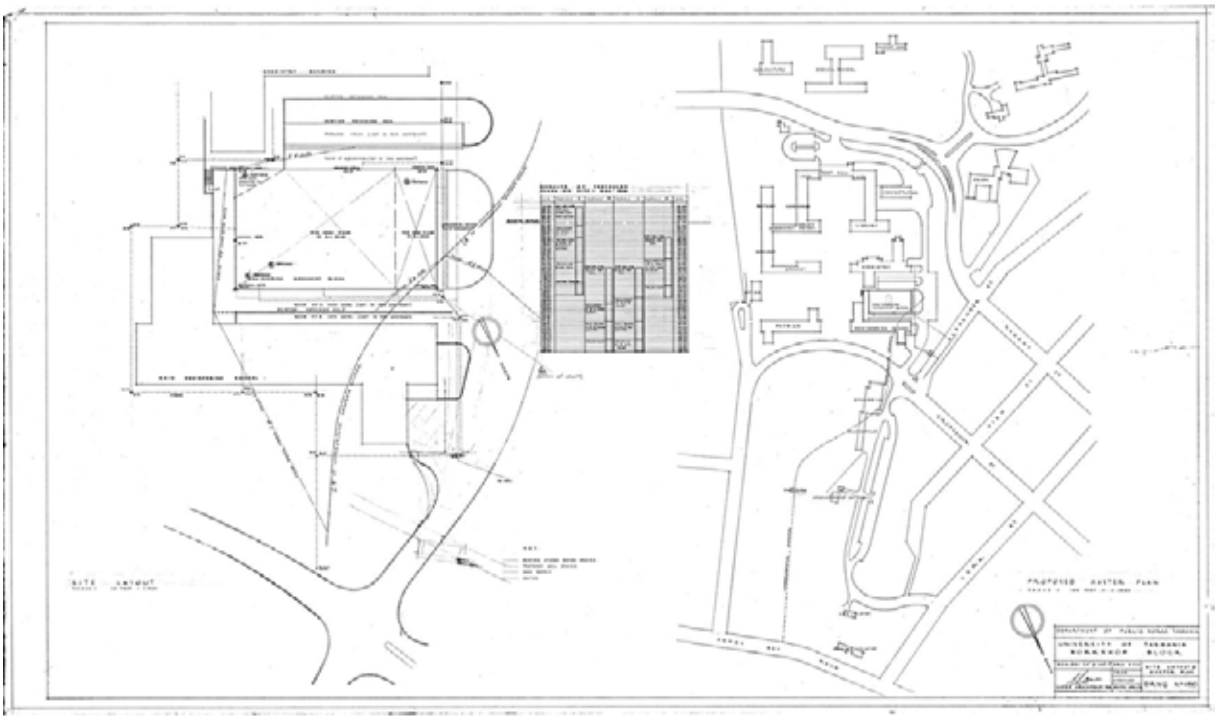
Building 11 – Engineering Workshop

1960 Photograph

Model of the Projected School of Engineering to be Built at Sandy Bay for the Hobart University

Source: Archives Office of Tasmania; Item Number: PH30/1/3606

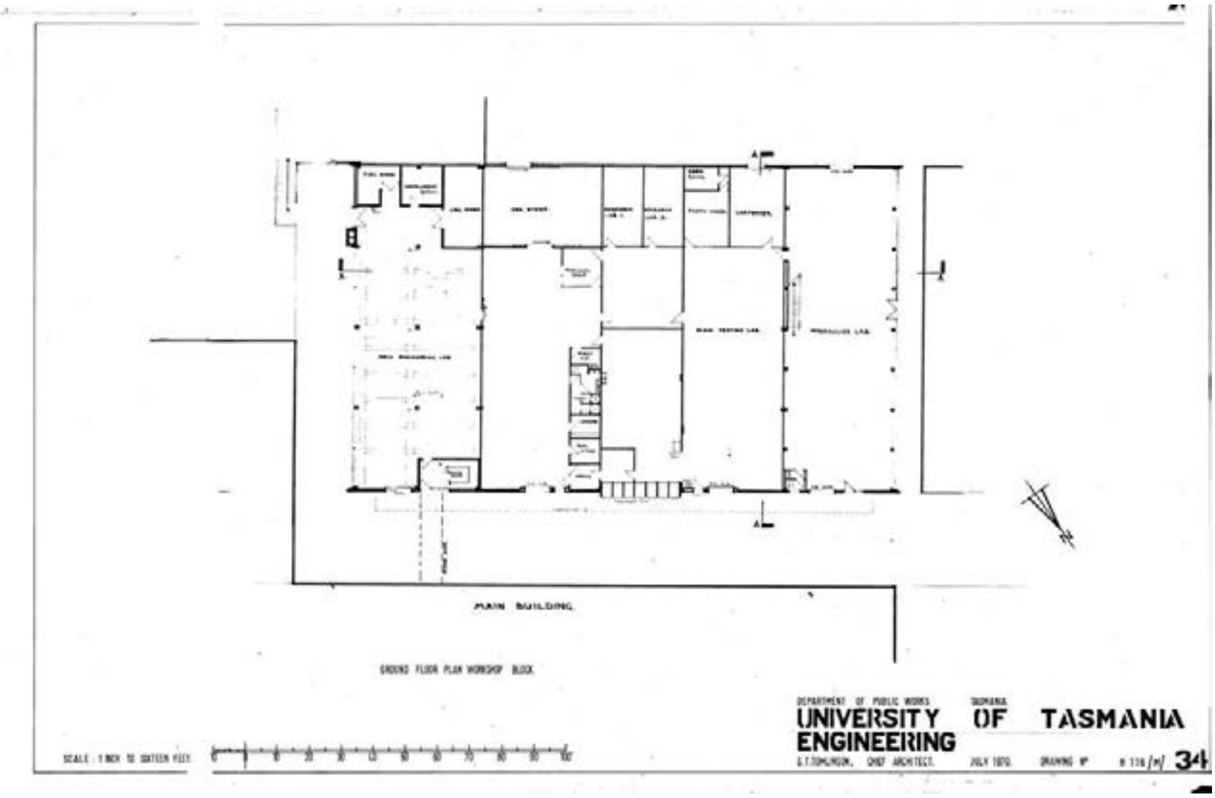
Key Plans



Building 11 – Engineering Workshop

Site Layout and Master Plan – Workshop Block. Prepared by Department of Public Works Tasmania, Chief Architect C.D Rose, 1959.

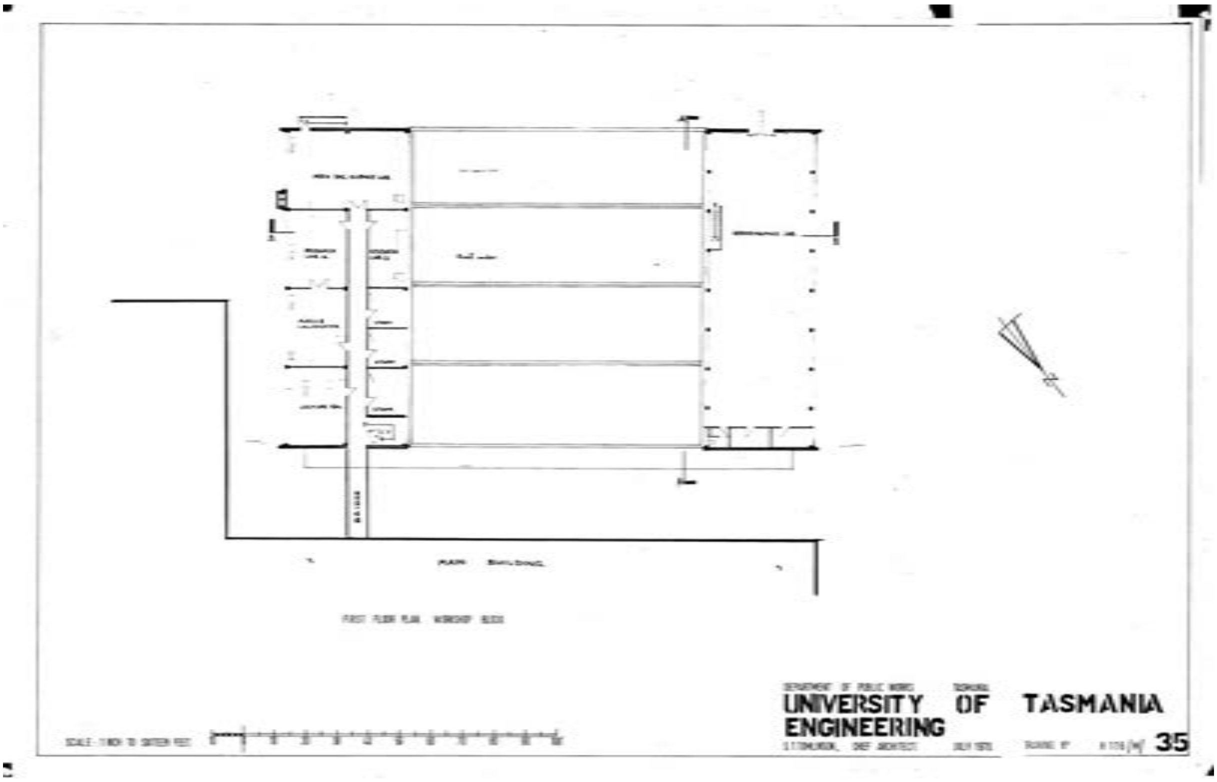
Source: Hanger 1-009.tif



Building 11 – Engineering Workshop

Ground Floor Plan – Engineering Workshop Block. Department of Public Works Tasmania, Chief S.T Tomlinson 1970s drawings from set. Original 1959 floor plans and elevations prepared by Department of Public Works Tasmania, Chief C.D Rose were not available.

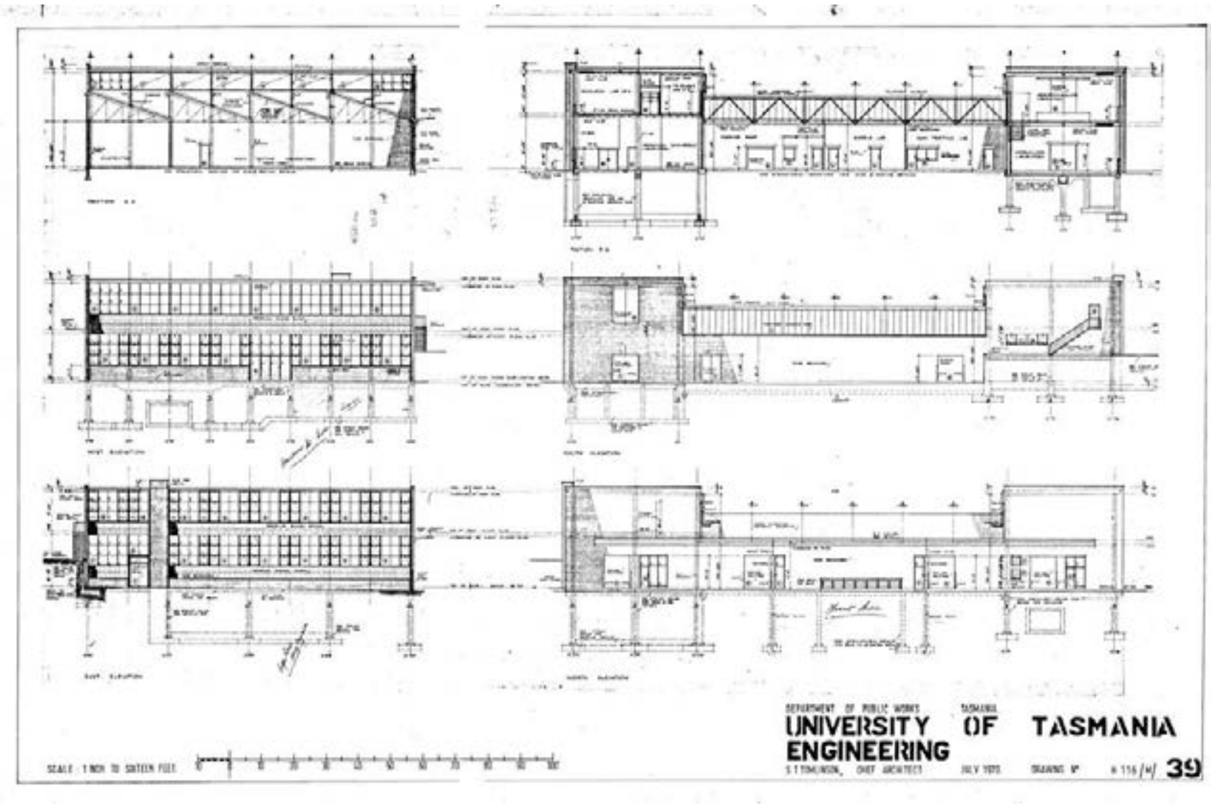
Source: Box 6-048.tif



Building 11 – Engineering Workshop

First Floor Plan - Engineering Workshop Block. Department of Public Works Tasmania, Chief S.T Tomlinson 1970s drawings from set. Original 1959 floor plans and elevations prepared by Department of Public Works Tasmania, Chief C.D Rose were not available.

Source: Box 6-049.tif



Building 11 – Engineering Workshop

Elevations and Sections - Engineering Workshop Block. Department of Public Works Tasmania, Chief S.T Tomlinson 1970s drawings from set. Original 1959 floor plans and elevations prepared by Department of Public Works Tasmania, Chief C.D Rose were not available.

Source: Box 6-053.tif

Building 12
Earth Sciences, Geography and Environment, CODES

Building No:	Building Name:	Previous Name:
12	Earth Sciences, Geography and Environment, CODES	Geography and Environment Geology-Geography Building

Date of Construction or Date of Original Drawings	Original Architect	Date Opened
1961	Department of Public Works - Tasmania. Chief Architect C.D Rose in association with Harry Hope and John Jacob.	1962

Date of Major Extension	Architect for Extension	Description
1969	Department of Public Works - Tasmania. Chief Architect S.T Tomlinson	Geology/Geography extension
1971	Department of Public Works - Tasmania. Chief Architect S.T Tomlinson in association with Lawrence Howroyd and Associates	Geology Building Extension (III)
1988	Forward Consultants	Environmental Studies Relocation – level 4 addition
1989	Michael Viney and Associates with Forward Consultants	CODES Building addition
1993	Forward Viney Woolan	Extension to Codes : new Levels 3 - 4

Description of Current Building	
Exterior Form	The original three-storey Geology and Geography building was designed as a ‘T’ shaped plan, with the top of the ‘T’ facing east. The building was set out on a regular 12’4” structural grid with a flat concrete roof. The main building entry foyer is via set of external stairs and shallow porch on the eastern façade (facing Clark Road) towards the centre of the building. The original drawings show a concave reinforced concrete hood over the main eastern entry, however it was built as a flat reinforced concrete hood. The main lecture theatre is located to the south-eastern corner on the ground floor, accessed directly off the main entrance foyer. Internally, a

centralcorridor runs down the middle of both the north-facing and the east-facing wings.

Externally, the rendered concrete structural column grid is expressed vertically to the elevations, which feature a curved concrete beam to the top of each bay to the top floor of the north, south and east elevation of the main north-facing wing.

The original design drawings nominate terrazzo slabs as the cladding material between the proud rendered concrete columns and the rows of steel framed windows to most of the building. However, the building as built features a rendered finish to the north-eastern wing, a geometric mosaic tile finish to part of the long north-facing wing, and painted light-weight panels (painted in an olive green to match the mosaic tile colours) to the remainder of the north and south façade of the north-facing wing.

The south-eastern wing also features rendered concrete columns expressed to the facades with blonde face brick spandrel panels below the rows of steel framed windows. The original finish for the outside of the east facing lecture theatre and main entrance façade was specified as a mosaic tile finish, however it was built with a decorative projecting blonde face brick pattern instead.

In 1969 extensions were planned to the south of the eastern wing (south of the original lecture theatre). This extension was designed and built to match the existing architectural language and materiality of the original south-east wing with rendered vertical columns and blonde face brick spandrels under the steel-framed windows.

In 1971 a small three-storey Geochemistry wing (Geology Building Extension III) was added towards the south-western end of the main north-facing wing. This new wing was located to connect directly to the original internal stairwell to the north-facing wing. This wing also features expressed rendered vertical columns with blonde face brick spandrels under the aluminium framed windows.

In 1988 a fourth floor was added on top of the main north-facing wing featuring a curved roof and a grid of tapering columns, with the new columns aligning with the original columns below. The curved roof is angled to be lower on the north elevation and higher on the south elevation.

A two-storey CODES building extension was added to the south-eastern wing in 1989. A further two-storey addition above the existing CODES building was completed in 1993 and a later extension was also added to the 1970s Geochemistry wing in 1994. A later three-storey glazed foyer and stair extension was made to the CODES wing to connect to the Physics building. The date and architect for this link extension is unknown at the time of writing.

Although the building has been extensively added to and altered over the years, the original form of the building is readily discernible and largely intact.

Interior Form	The main entrance foyer accessed from Clark Road features a detailed tessellated terrazzo inlay to the floor based on the MC Escher print *Regular Division of the Plane III* depicting interlinking mounted horsemen.

	The main circulation stair is adjacent and features a simple vertical steel balustrade with continuous timber handrail to both sides of the stair. Other aspects of the interior are relatively plain in character and detail
Significance	The original section of the building is one of the early campus buildings to the design of Hope and Jacob (their only campus building) and retains a reasonable level of integrity even with the numerous additions and changes. It is clearly modernist building using new construction forms and materials in a modest and competent way. The building has moderate significance for its design quality (it is not an outstanding example of the period even though it does demonstrate the modernist approach to design on the campus) and it makes a contribution to the overall site layout form and consistency. The later additions have detracted from its designed form and ability to be seen 'in the round'.
Key Elements	- Early exterior form of the building, particularly the main entry area and eastern façade - The entrance foyer, terrazzo pattern and entry stair
Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 12 – Geography, Geology and CODES

Northern Façade facing Grosvenor Crescent with the 1988 fourth floor visible on top

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

Northern Façade facing Grosvenor Crescent with the 1988 fourth floor visible on top

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

Northern Façade facing Grosvenor Crescent

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

Detail of the mosaic tile facade

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

North-eastern wing (western façade)

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

North-eastern wing

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

North-eastern wing (eastern façade)

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

Eastern wing - Clark Road entrance

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

Clark Road Entrance Foyer – detailed tessellated terrazzo floor inlay

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

Clark Road Entrance Foyer – detail of internal stair

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

Detail of where the 1969 southern extension occurs is evident with the double column and change in brickwork detail

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

1969 southern extension – Detail of the western façade of the eastern wing

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

1989 CODES Southern extension - eastern façade facing Clark Road

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

Western façade of the eastern wing

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

Southern façade of the northern wing with the 1988 fourth floor visible on top

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

Southern façade of the northern wing, 1970 Geochemistry wing in foreground

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

South-western corner, 1970 Geochemistry wing in foreground

Source: Paul Davies Pty Ltd

Building 12 – Geography, Geology and CODES

Southern façade of the south-western wing; 1970 Geochemistry wing in foreground

Source: Paul Davies Pty Ltd

Early Photos

Building 12 – Geography, Geology and CODES

1962 black and white print

During Construction

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 28

Building 12 – Geography, Geology and CODES

1962 black and white print

During Construction

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 29

Building 12 - Earth Sciences, Geography and Environment, CODES

1962 black and white print

During Construction

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 30

Building 12 - Earth Sciences, Geography and Environment, CODES

1960 Photograph

Eastern facade

Source: Libraries Tasmania Online Collection; Item Number AA193-1-397

Building 12 - Earth Sciences, Geography and Environment, CODES

1960 Photograph

Northern facades; Geography Building (image left), Engineering Building (image right)

Source: Libraries Tasmania Online Collection; Item Number AA193-1-399

Building 12 - Earth Sciences, Geography and Environment, CODES

1960 colour photograph

Northern facades

Source: Libraries Tasmania Online Collection; Item Number AA375-1-1135

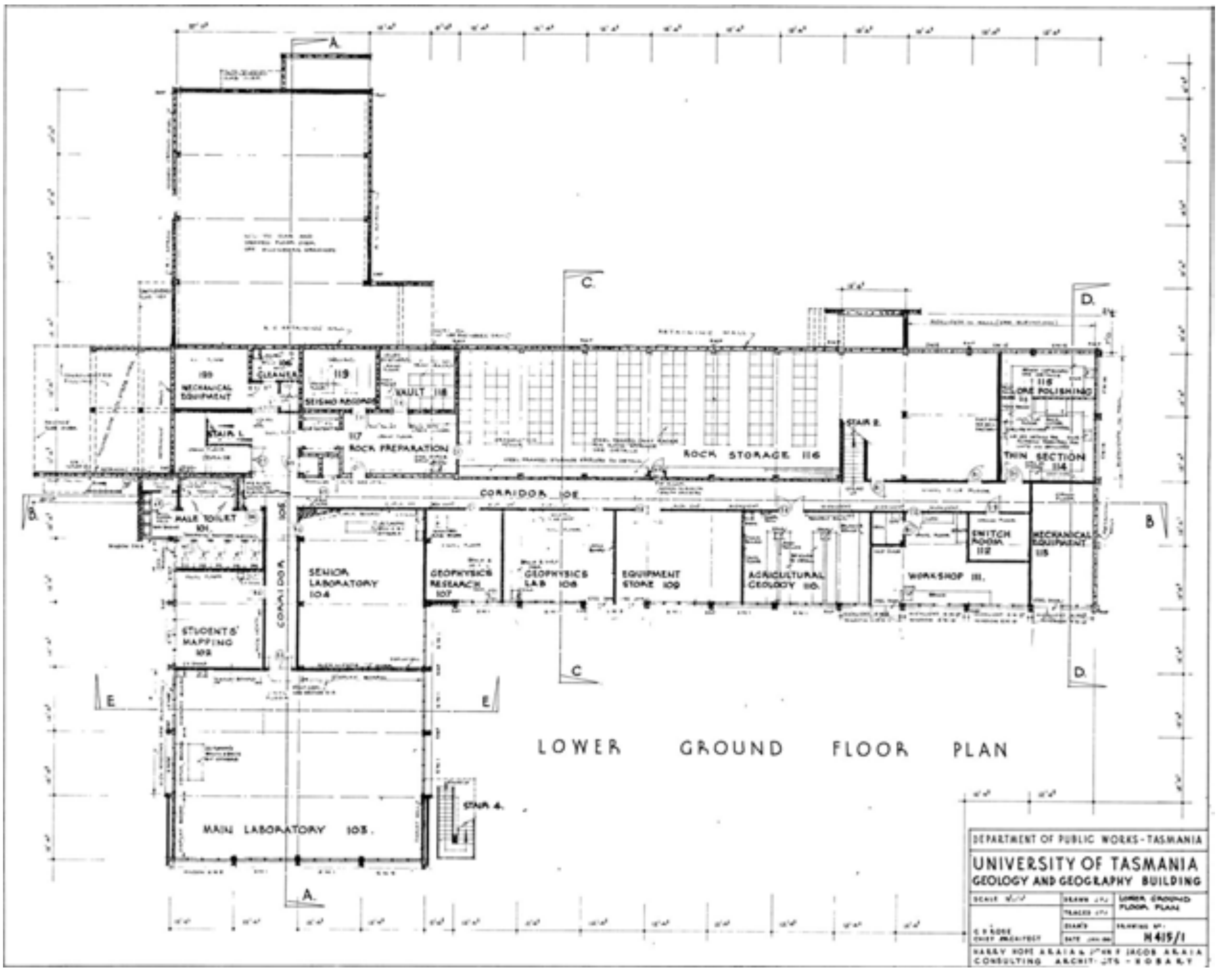
Building 12 - Earth Sciences, Geography and Environment, CODES

1960 colour photograph

Eastern facade

Source: Libraries Tasmania Online Collection; Item Number AA375-1-1136

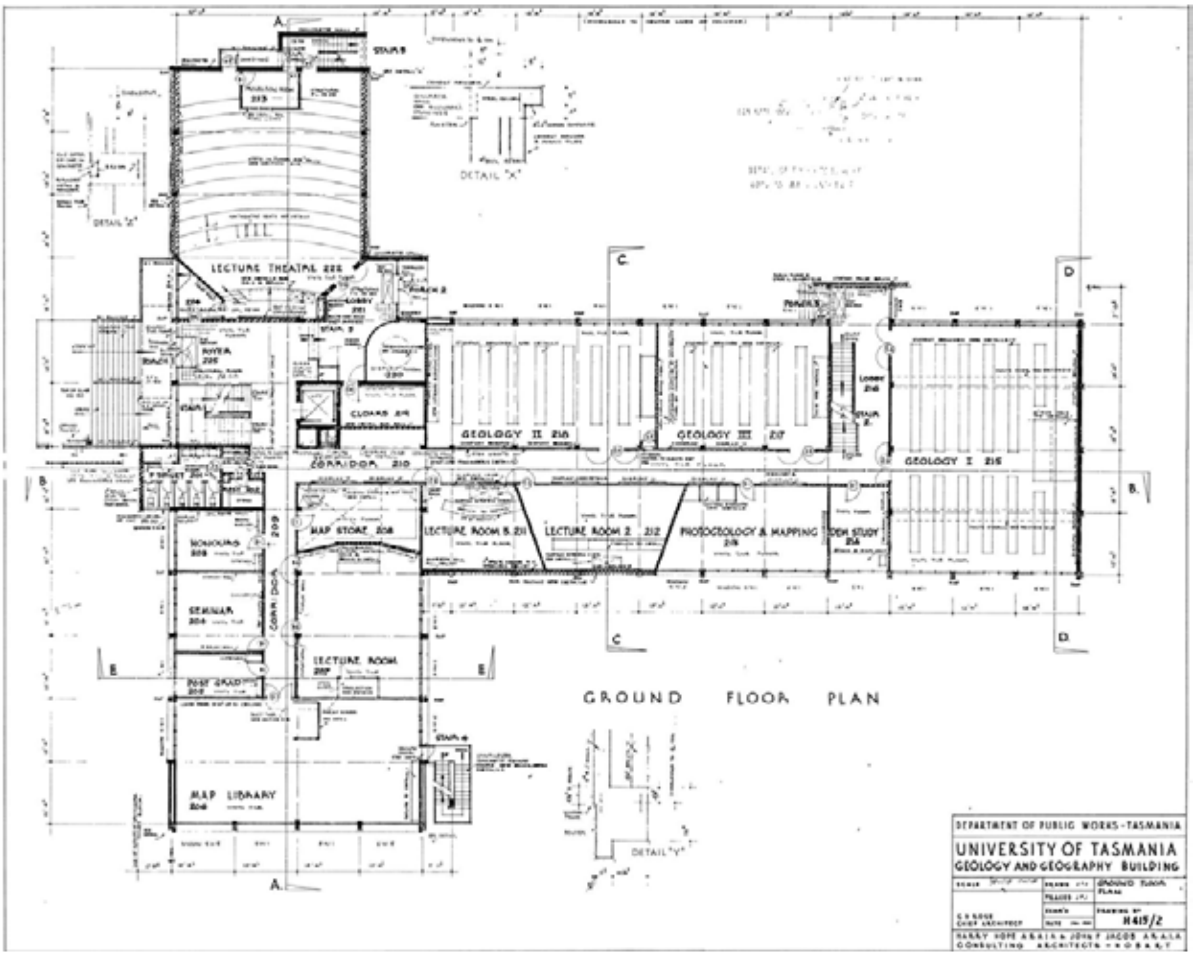
Key Plans



Building 12 - Earth Sciences, Geography and Environment, CODES

Lower Ground Floor Plan – Geology and Geography Building, University of Tasmania. Prepared by Department of Public Works - Tasmania Chief Architect C.D Rose in association with Harry Hope and John Jacob, 1961

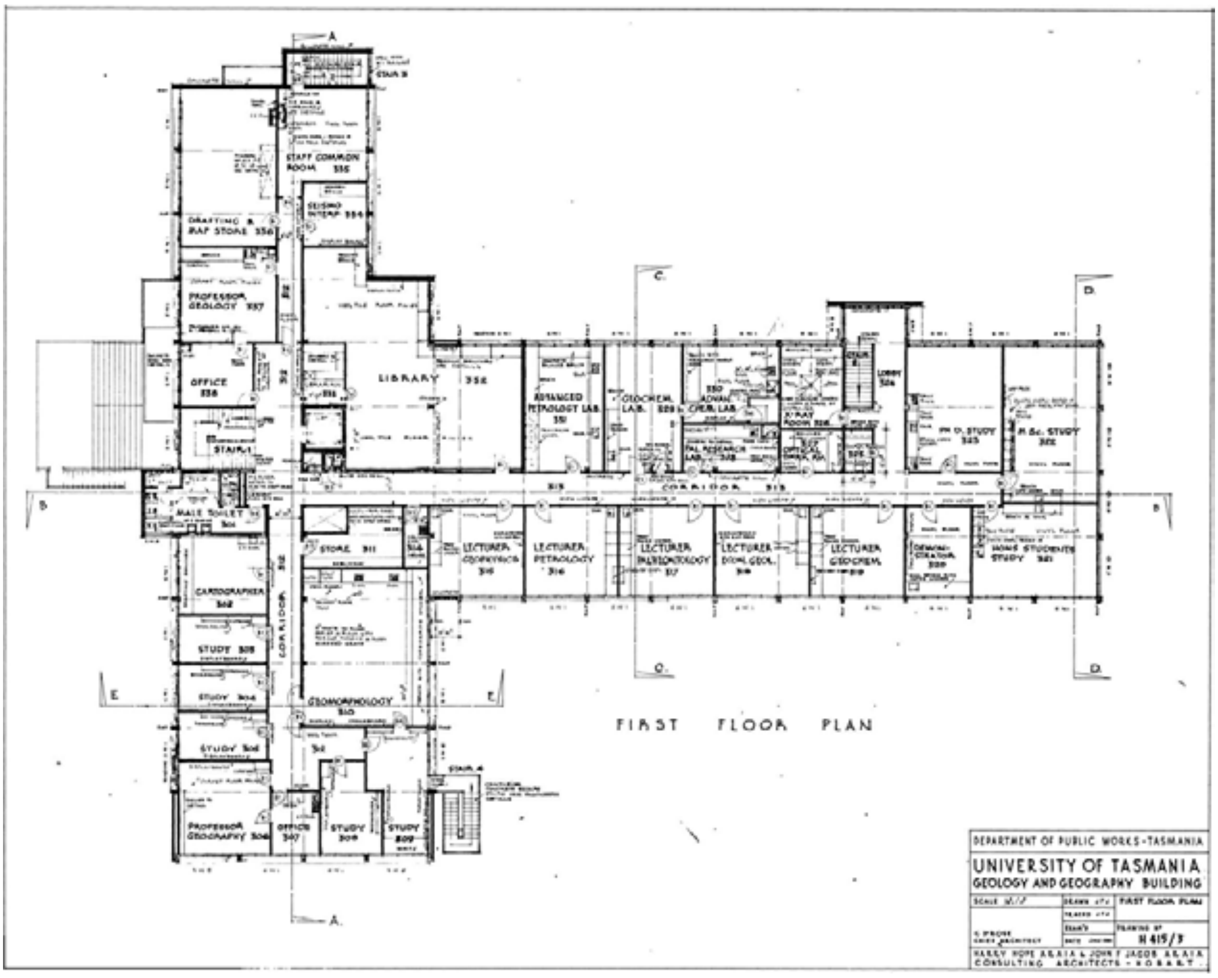
Source: Hanger 76-031.tif



Building 12 - Earth Sciences, Geography and Environment, CODES

Ground Floor Plan – Geology and Geography Building, University of Tasmania. Prepared by Department of Public Works - Tasmania Chief Architect C.D Rose in association with Harry Hope and John Jacob, 1961

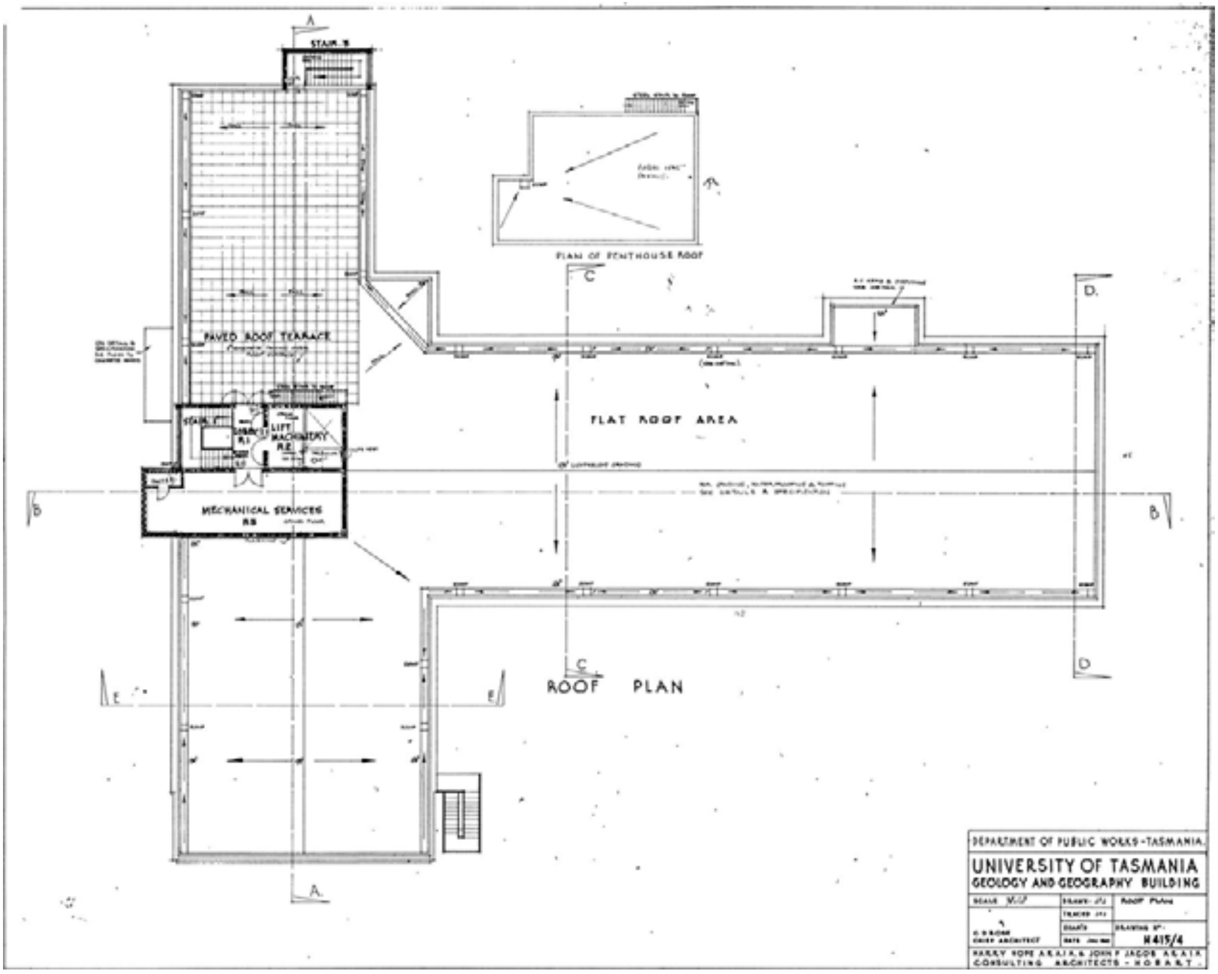
Source: Hanger 76-032.tif



Building 12 - Earth Sciences, Geography and Environment, CODES

First Floor Plan – Geology and Geography Building, University of Tasmania. Prepared by Department of Public Works -Tasmania Chief Architect C.D Rose in association with Harry Hope and John Jacob, 1961

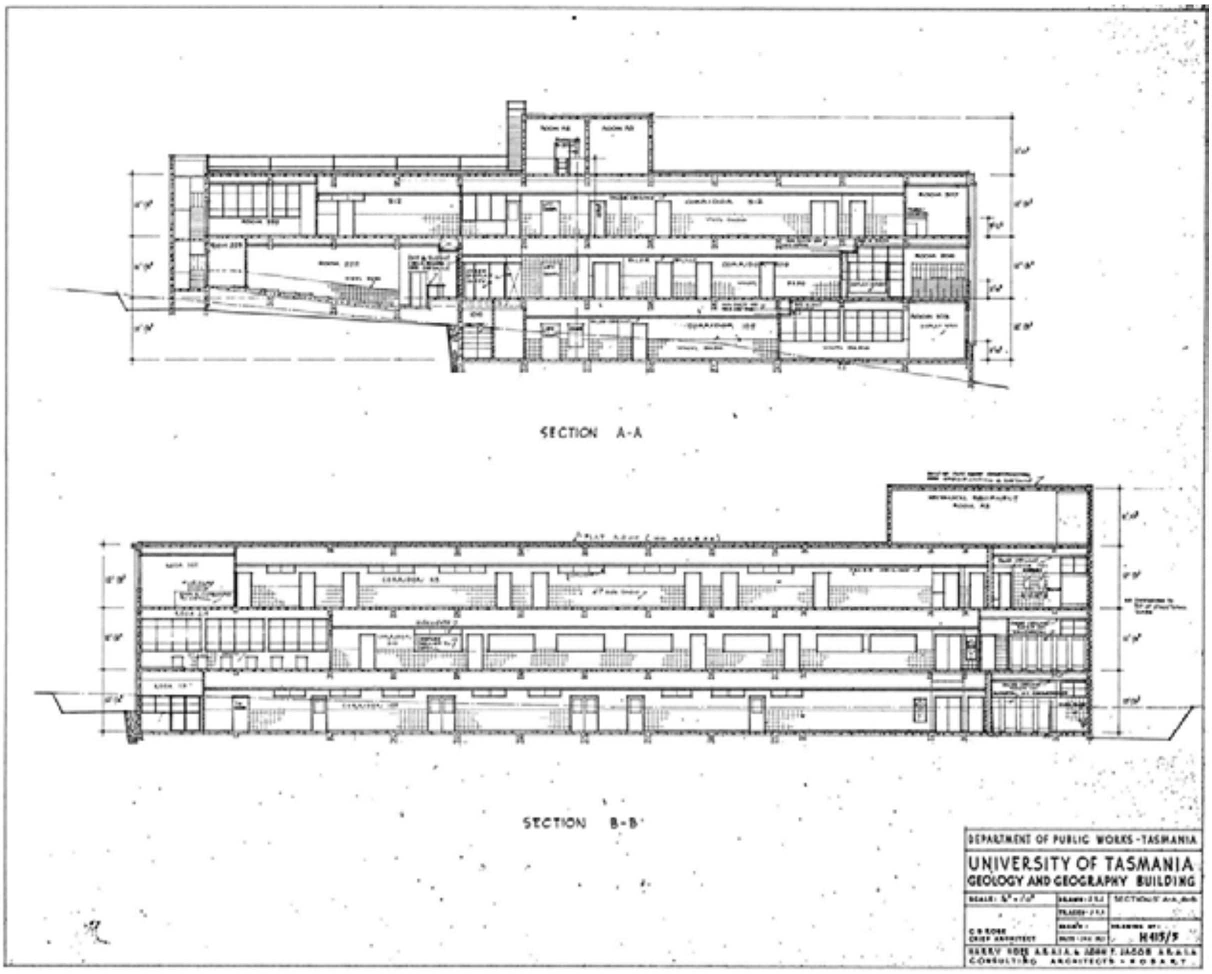
Source: Hanger 76-033.tif



Building 12 - Earth Sciences, Geography and Environment, CODES

Roof Plan – Geology and Geography Building, University of Tasmania. Prepared by Department of Public Works -Tasmania Chief Architect C.D Rose in association with Harry Hope and John Jacob, 1961

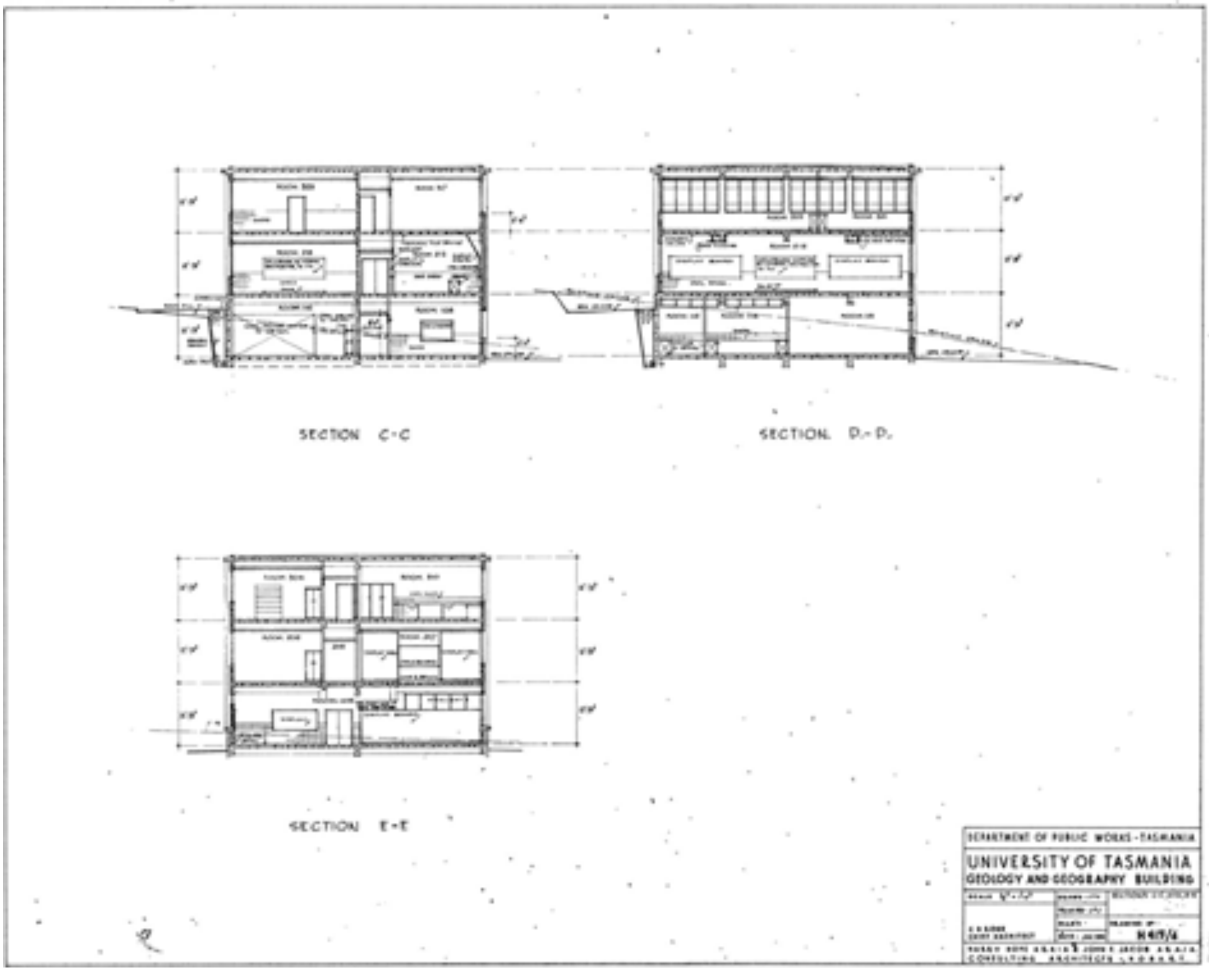
Source: Hanger 76-034.tif



Building 12 - Earth Sciences, Geography and Environment, CODES

Sections – Geology and Geography Building, University of Tasmania. Prepared by Department of Public Works -Tasmania Chief Architect C.D Rose in association with Harry Hope and John Jacob, 1961

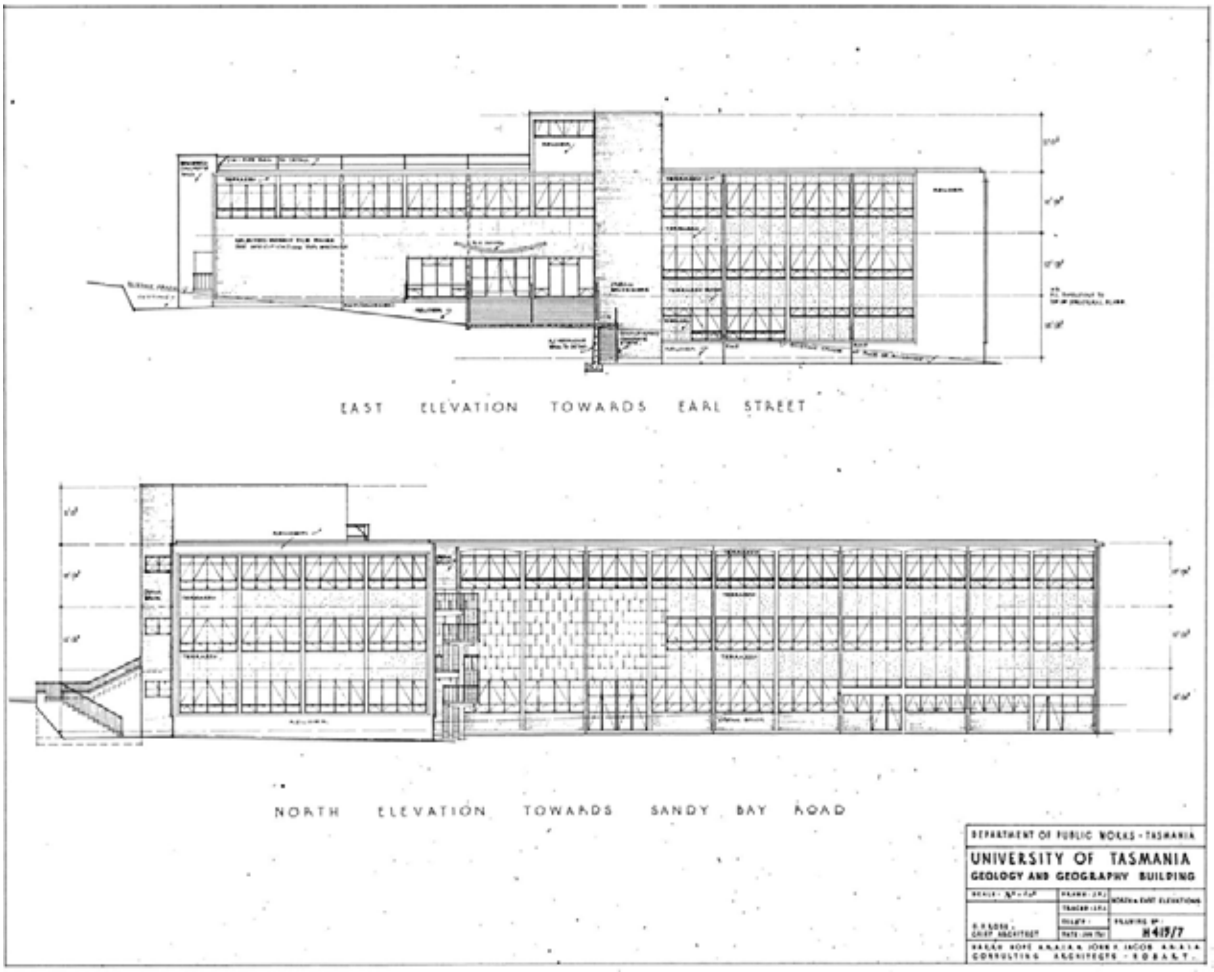
Source: Hanger 76-035.tif



Building 12 - Earth Sciences, Geography and Environment, CODES

Sections – Geology and Geography Building, University of Tasmania. Prepared by Department of Public Works -Tasmania Chief Architect C.D Rose in association with Harry Hope and John Jacob, 1961

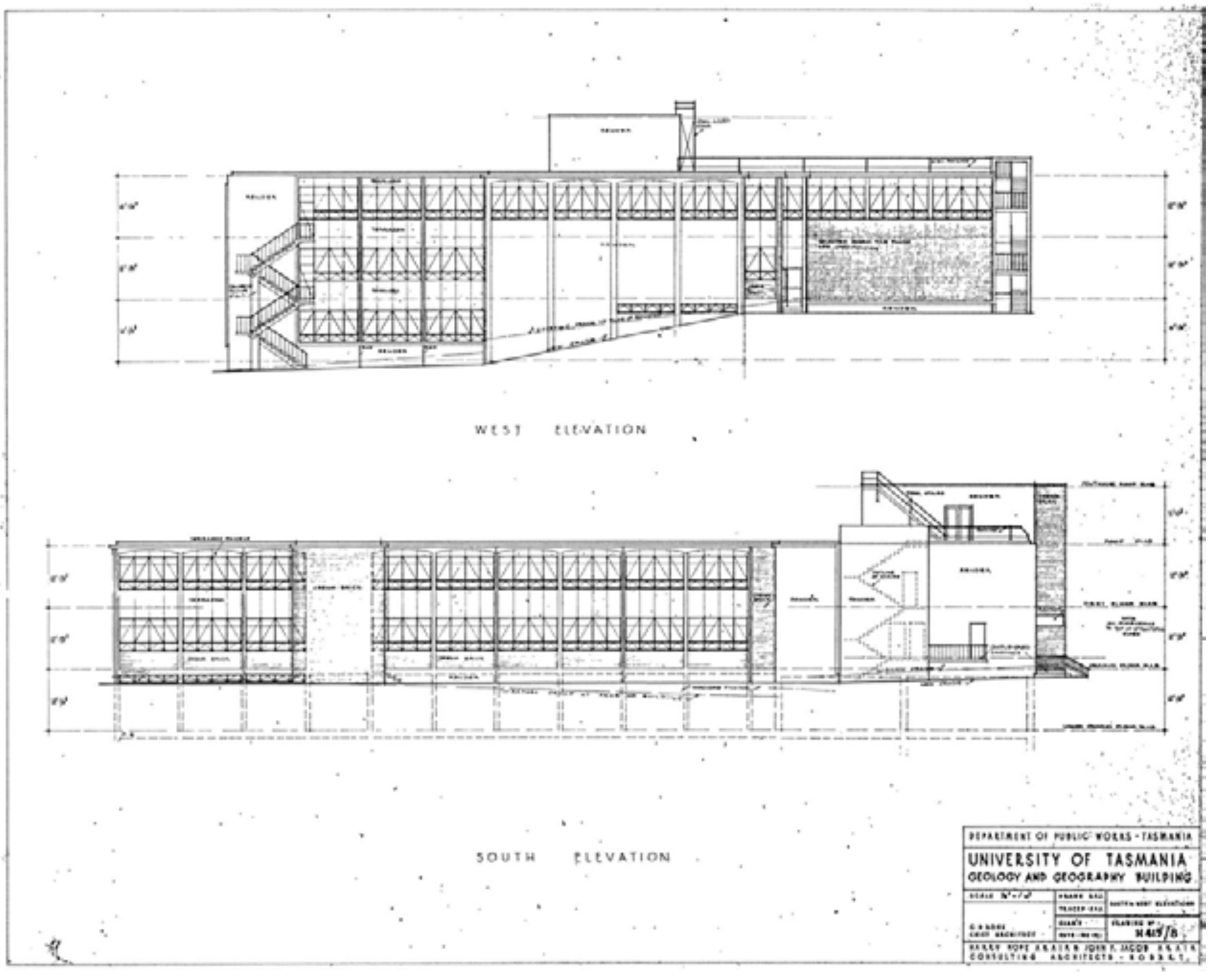
Source: Hanger 76-036.tif



Building 12 - Earth Sciences, Geography and Environment, CODES

Elevations – Geology and Geography Building, University of Tasmania. Prepared by Department of Public Works -Tasmania Chief Architect C.D Rose in association with Harry Hope and John Jacob, 1961

Source: Hanger 76-037.tif



Building 12 - Earth Sciences, Geography and Environment, CODES

Elevations – Geology and Geography Building, University of Tasmania. Prepared by Department of Public Works -Tasmania Chief Architect C.D Rose in association with Harry Hope and John Jacob, 1961

Source: Hanger 76-038.tif

Building 13
Physics

Building No:	Building Name:	Previous Name:
13	Physics	Physics
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1961	Department of Public Works - Tasmania in association with Bush Haslock Parkes Shugg and Moon (later Bush Parkes Shugg and Moon)	1962
Date of Major Extension	**Architect for Extension**	**Description**
1966	Department of Public Works - Tasmania. Chief Architect S.T. Tomlinson	New Mathematics Wing (Refer Building 14)
1967	Department of Public Works - Tasmania. Chief Architect S.T. Tomlinson	Physics extension
1988	Forward Consultants	IASOS – New infill to undercroft of area of existing building

Description of Current Building

Exterior Form

Physics is a four-storey T-shaped building with a lecture theatre adjacent to the T on the eastern side. The elevations feature a strong vertical grid of square concrete clad steel columns expressed on the façade with blonde face brick walls recessed behind the face of the columns. The north-eastern façade features ribbons of horizontal aluminium windows between each column. The concrete columns extend continuously from the base of the building to the top of the building and past the flat roof. The top of the columns are finished with a horizontal concrete beam floating above the face brick walls below. The original building was designed with the main entrance foyer and stairwell to be accessed via covered vaulted colonnade with arched openings to the lower ground floor of the north-eastern wing.

The new three storey Mathematics wing was designed to connect to the north-western end of the physics building in 1966. It also features expressed concrete clad steel columns with recessed face brick infill walls and horizontal ribbons of windows. The external columns to the Mathematics wings do not extend past the roof parapet as they do on the original physics building. The face brick for the extension is slightly darker than the original building.

In 1967 a three-storey extension was design to the south-eastern wing. The extension was built with the same structural system, architectural language, and materiality as the original building. Again, the face brick for the extension is slightly darker than the original building.

In 1983 an extension was made to the north-eastern wing and the original open vaulted colonnade entry was infilled with reconstituted stone cladding and square powder coated aluminium windows to the centre of each arched opening.

A further three-storey glazed foyer and stair extension was made to the north-eastern wing to connect the physics building and the Geology and Geography building. The date and architect for this link extension is unknown at the time of writing.

Interior Form

The entrance foyer and stairwell is located at the junction of the 'T'. The upper ground floor contains the lecture theatre volume at the eastern end of the building with classrooms located above the lecture theatre on the first floor. The main linear wing features a generous corridor along the northern-eastern façade to the upper ground floor and first floor with classrooms accessed from the corridor and located along the south-western façade. On the second floor the corridor shifts to be centrally located with a row of offices following the structural grid along the north-eastern façade and tutorial rooms along the south-western façade.

The main stairs feature terrazzo treads and a steel framed balustrade. The balustrade originally featured open steel rails that follow the angle of the stair, however it has since been modified to include solid panels to the inside faces of the balustrade to prevent climbing of the balustrade. Original timber panelling is still in-situ to the first and second floor foyers.

Significance

The original building adopted a different approach to modernism to adjacent buildings with a preference for solid wall panels and an arcaded undercroft with a lawn and water feature (not extant). The early design intent has been largely lost with the various additions and the simplicity and clarity of form is now overlaid with a range of elements that overwhelm the early form. Consequently, the buildings significance is diminished.

Overall, the early parts of the building have moderate significance and the various additions have little or no significance.

The entry stair and remnant foyer elements are the only internal features that retain significance, at a moderate level.

Key Elements

- remaining sections of original building form

- entry stair and foyer elements retaining their original materials and spatial arrangement.

Condition

The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 13 – Physics

Original North-eastern Façade

Source: Paul Davies Pty Ltd

Building 13 – Physics

Original North-eastern Façade

Source: Paul Davies Pty Ltd

Building 13 – Physics

Southern Wing, Southern Elevation showing the 1967 extension.

Source: Paul Davies Pty Ltd

Building 13 – Physics

Eastern Façade, Physics lecture theatre (image right)

Source: Paul Davies Pty Ltd

Building 13 – Physics

Eastern Façade, Physics lecture theatre (image left)

Source: Paul Davies Pty Ltd

Building 13 – Physics

Main Internal Stair and Foyer

Source: Paul Davies Pty Ltd

Building 13 – Physics

Timber panelling to the main internal foyer

Source: Paul Davies Pty Ltd

Building 13 – Physics

View of a typical internal corridor located on the north-eastern side of the building.

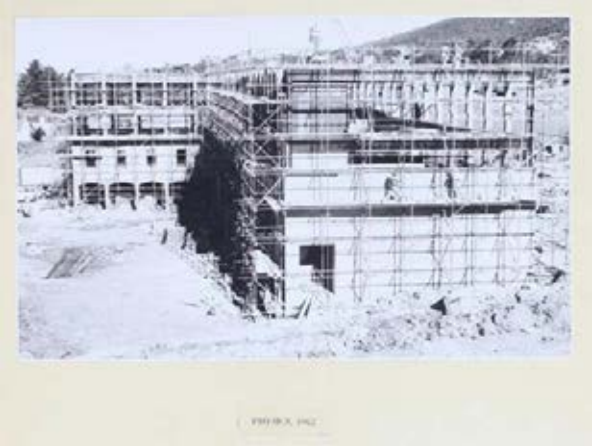
Source: Paul Davies Pty Ltd

Early Photos

Commencement of Physics

1962 black and white print

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 31



Building 13 – Physics

1962 black and white print

Under construction

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 26

Building 13 – Physics

1962 black and white print

Under construction

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 27

Building 13 – Physics

1965 black and white print

North-western facade

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 40

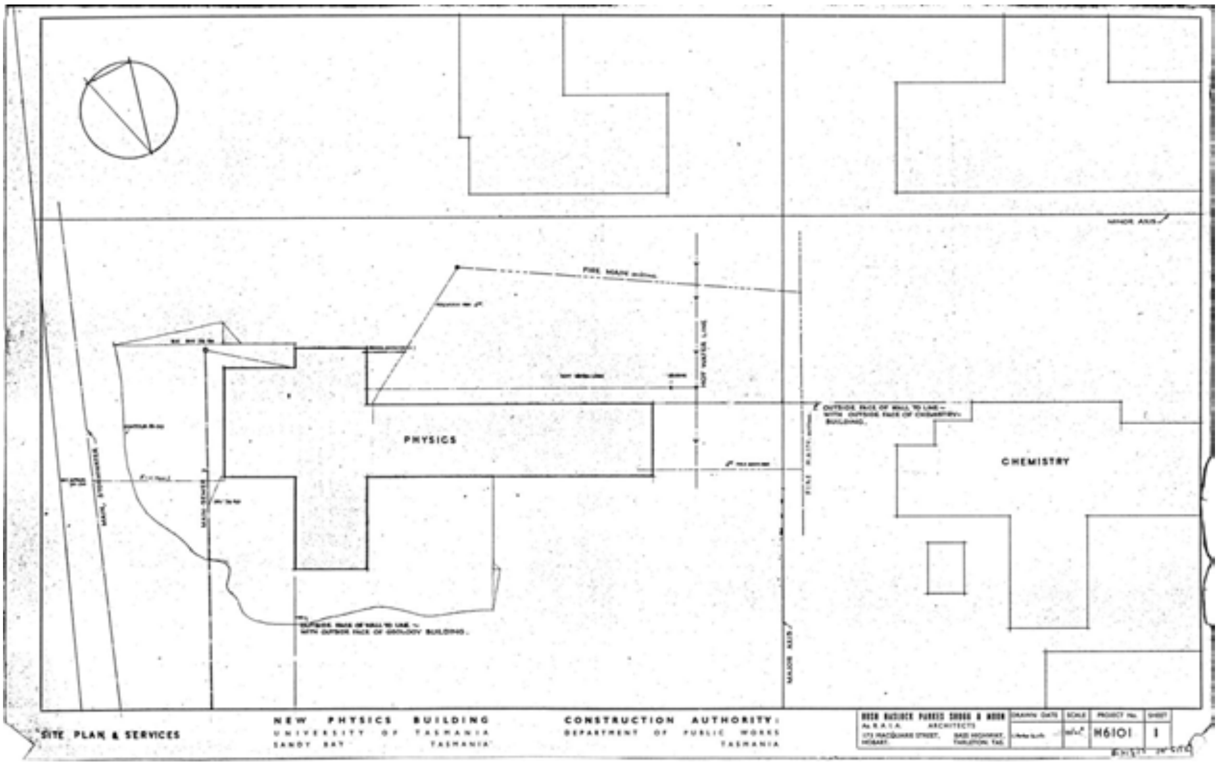
Building 13 – Physics

1960 colour photograph

Northern facade

Source: Libraries Tasmania Online Collection; Item Number AA375-1-1142

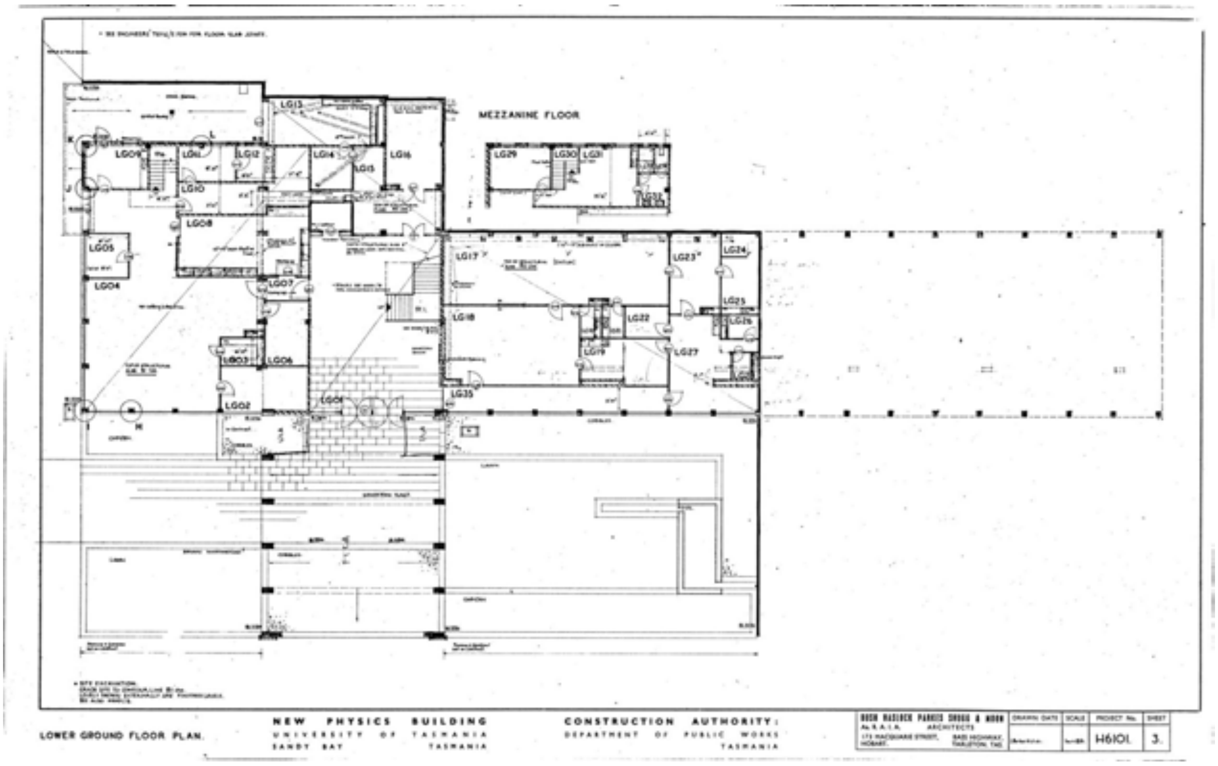
Key Plans



Building 13 – Physics

Site Plan and Services - Department of Public Works -Tasmania in association with Bush Haslock Parkes Shugg and Moon, 1961

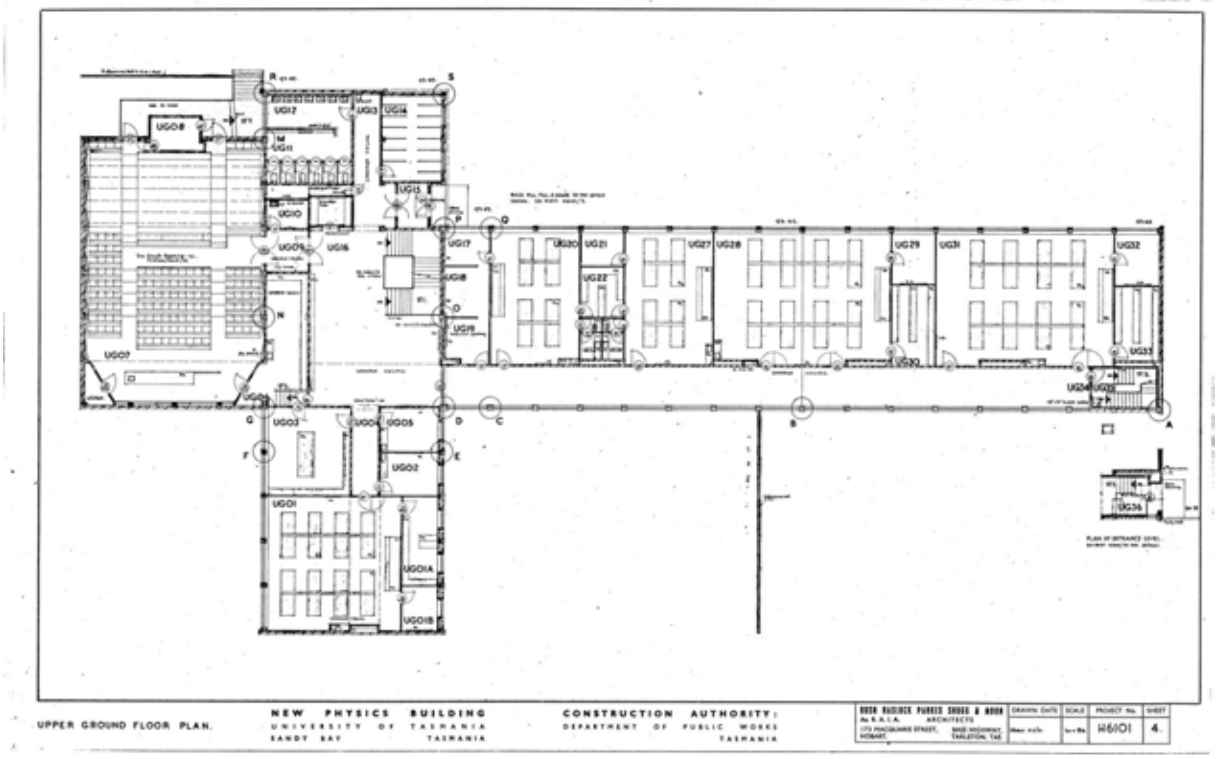
Source: Hanger 41-018.tif



Building 13 - Physics

Lower Ground Floor Plan - Department of Public Works -Tasmania in association with Bush Haslock Parkes Shugg and Moon, 1961

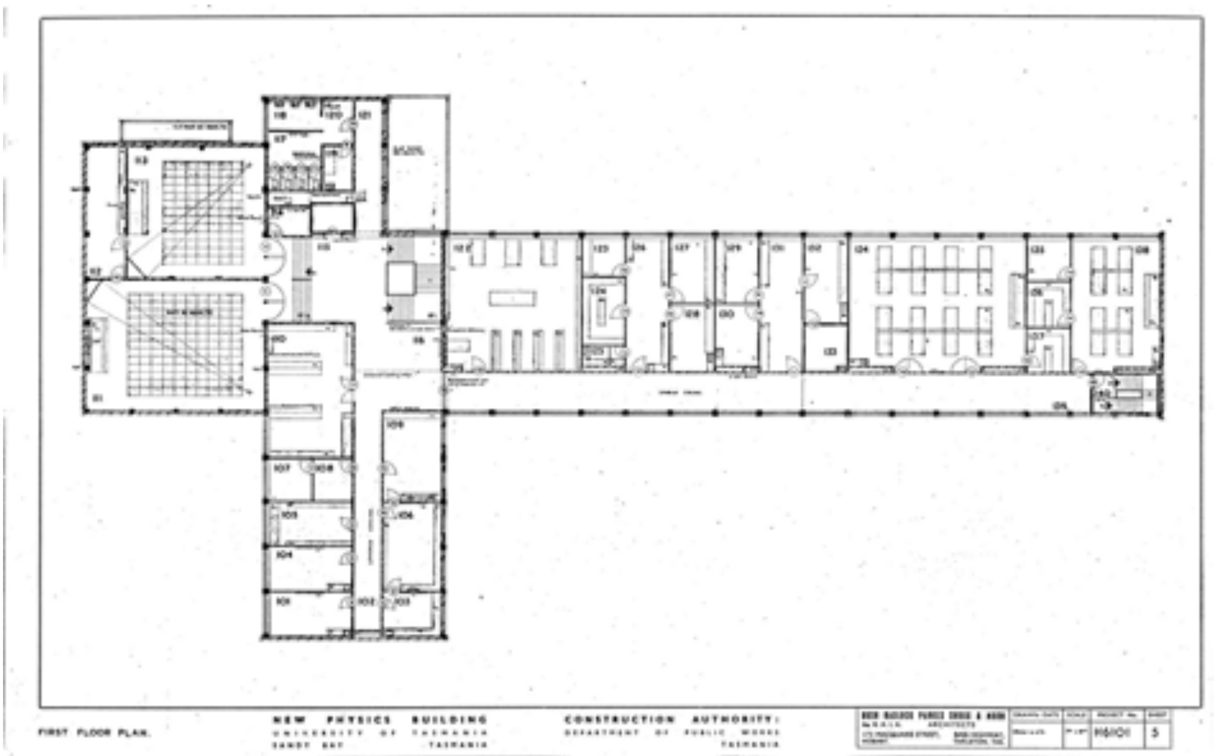
Source: Hanger 41-020.tif



Building 13 – Physics

Upper Ground Floor Plan - Department of Public Works -Tasmania in association with Bush Haslock Parkes Shugg and Moon, 1961

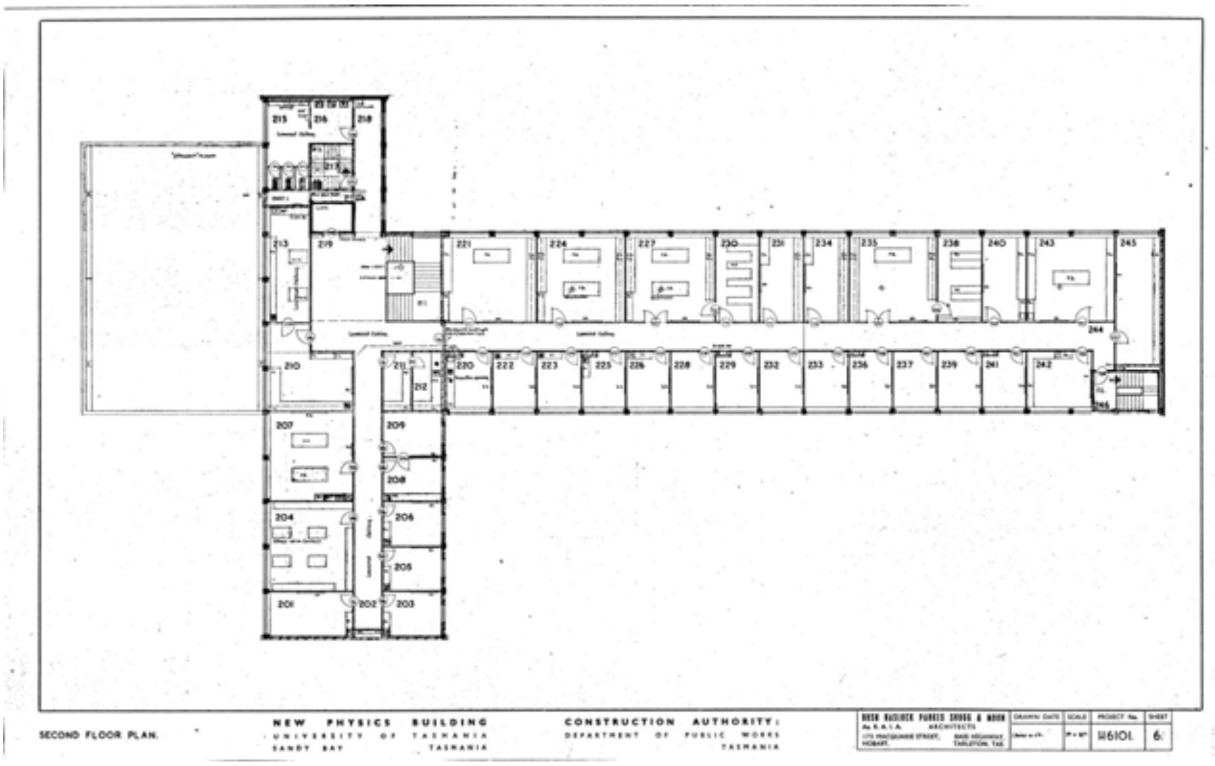
Source: Hanger 41-021.tif



Building 13 – Physics

First Floor plan - Department of Public Works -Tasmania in association with Bush Haslock Parkes Shugg and Moon, 1961

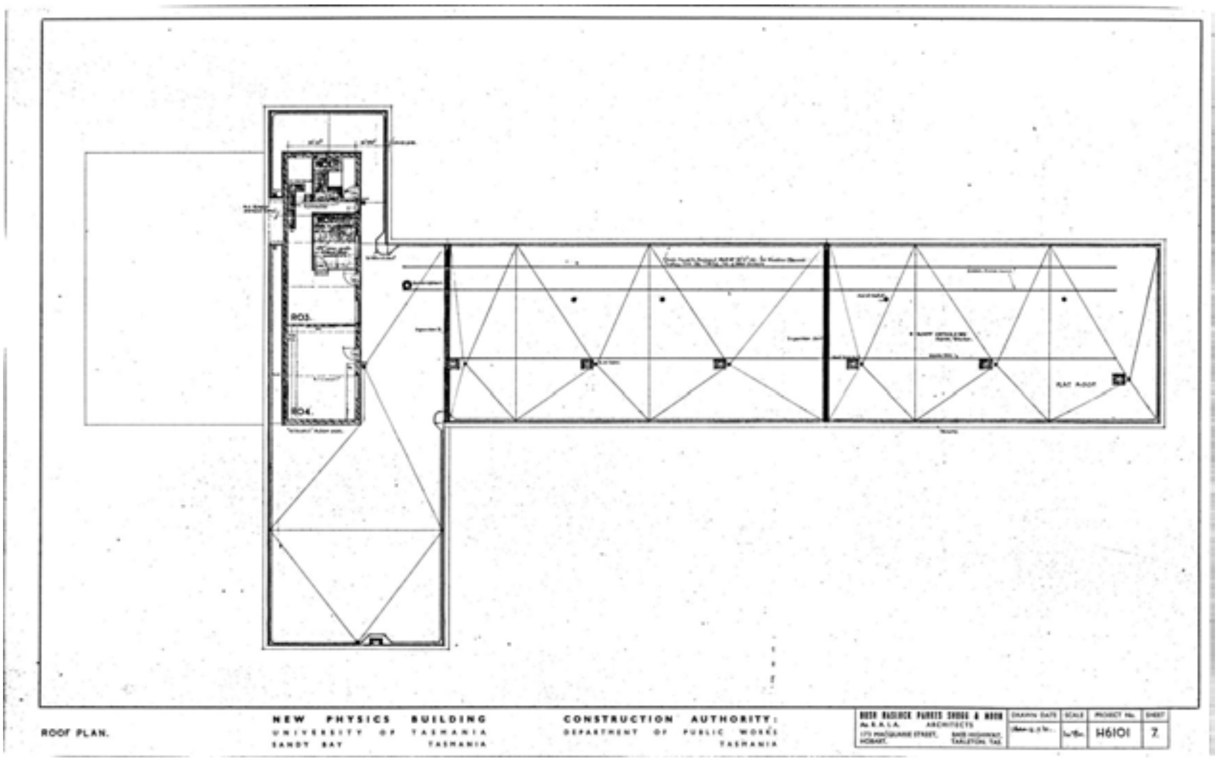
Source: Hanger 41-022.tif



Building 13 – Physics

Second Floor Plan - Department of Public Works -Tasmania in association with Bush Haslock Parkes Shugg and Moon, 1961

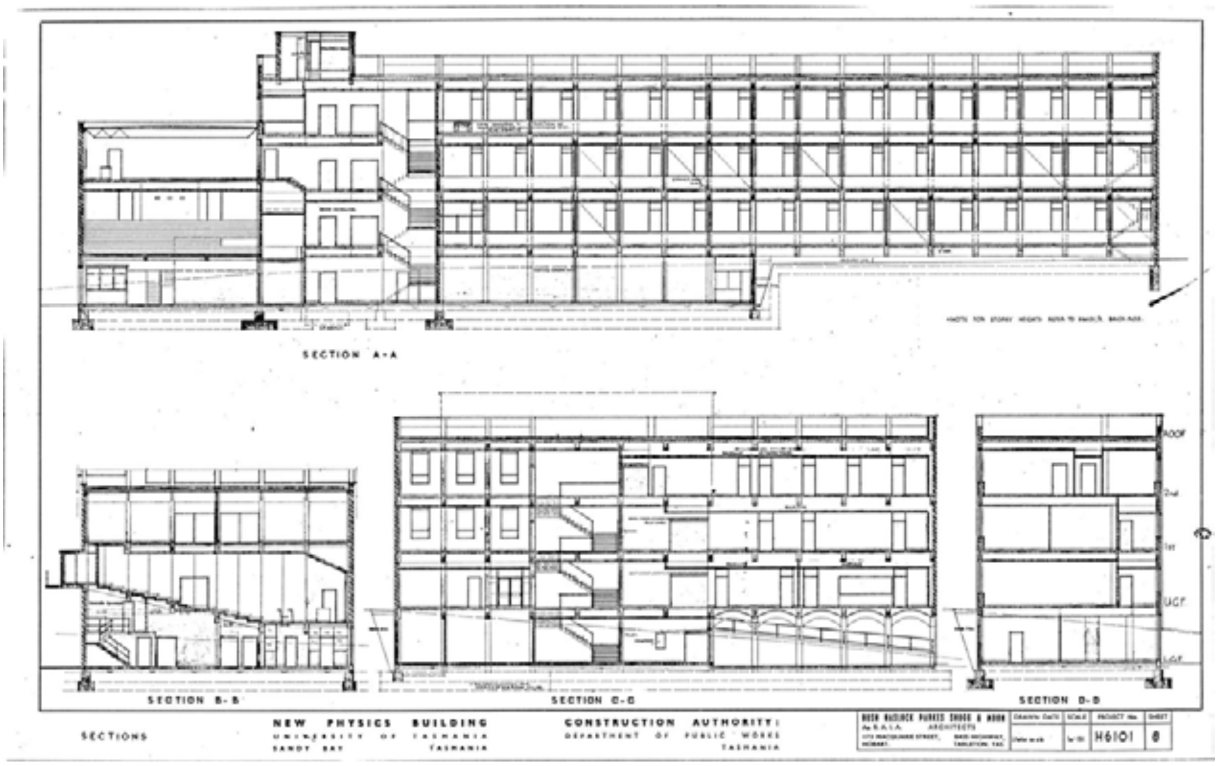
Source: Hanger 41-023.tif



Building 13 – Physics

Roof Plan - Department of Public Works -Tasmania in association with Bush Haslock Parkes Shugg and Moon, 1961

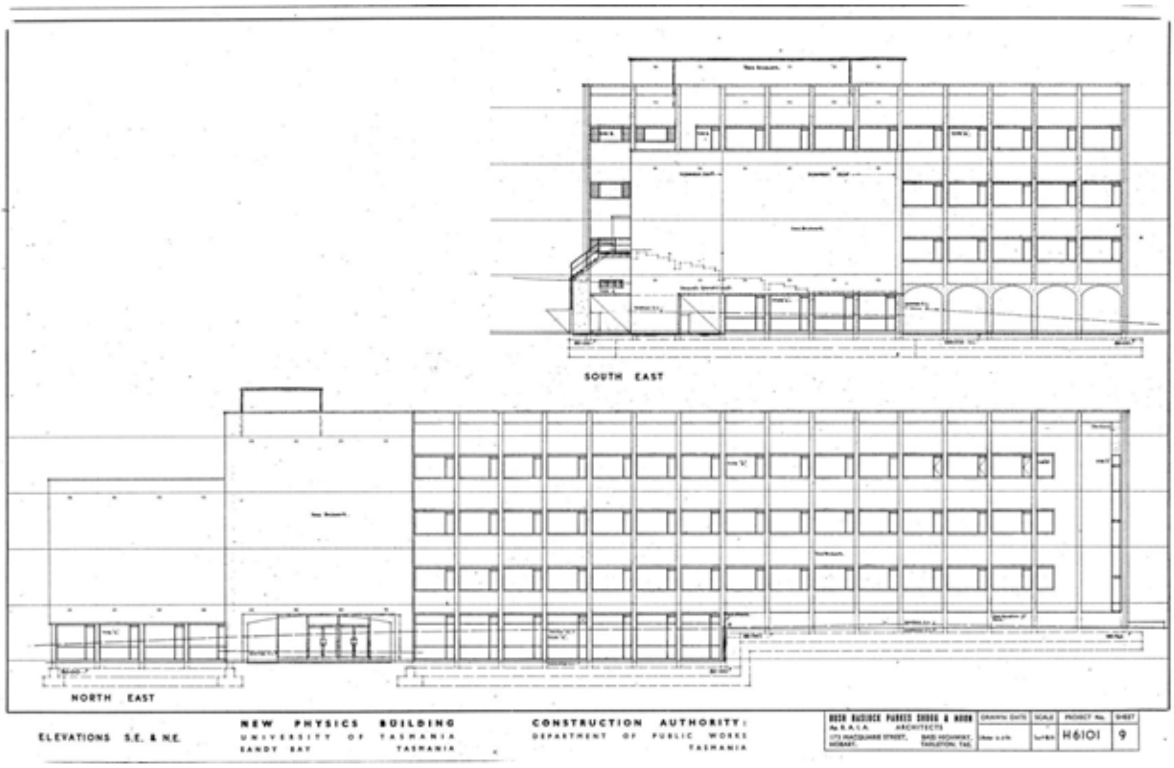
Source: Hanger 41-024.tif



Building 13 – Physics

Sections - Department of Public Works -Tasmania in association with Bush Haslock Parkes Shugg and Moon, 1961

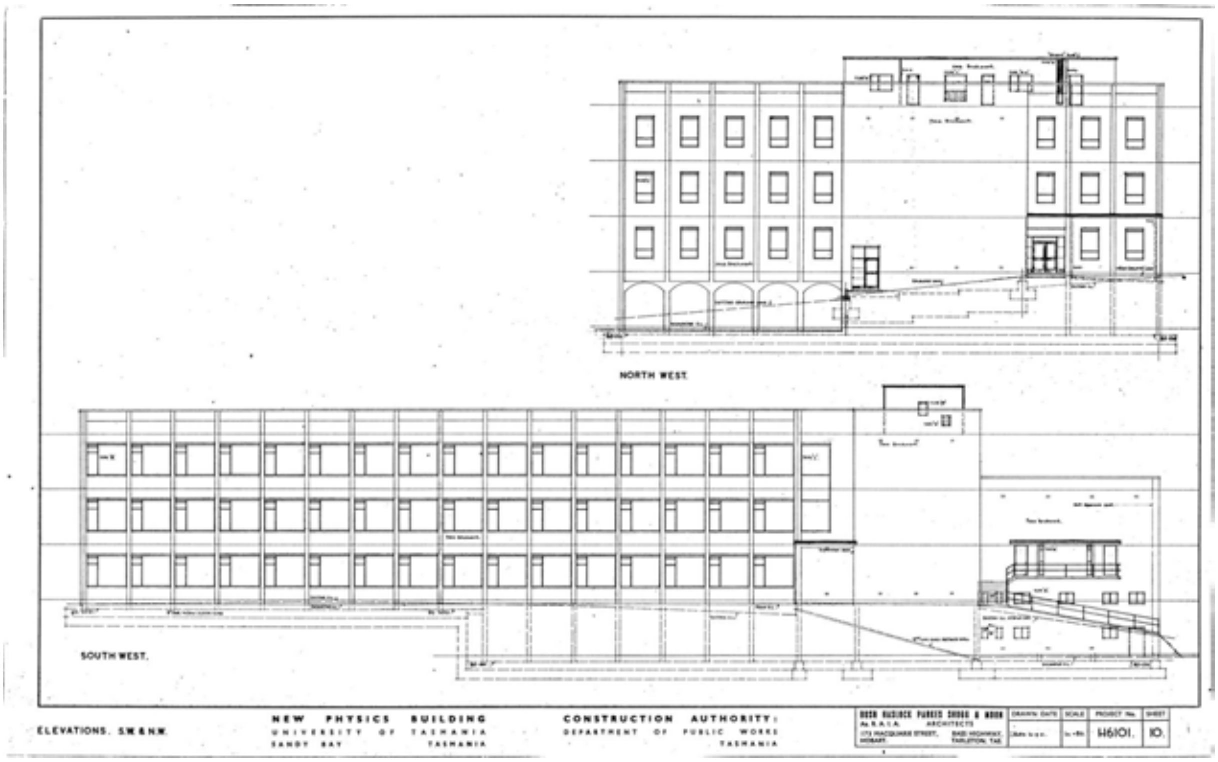
Source: Hanger 41-025.tif



Building 13 – Physics

Elevations S.E and N.E- Department of Public Works -Tasmania in association with Bush Haslock Parkes Shugg and Moon, 1961

Source: Hanger 41-026.tif



Building 13 – Physics

Elevations S.W and N.W - Department of Public Works -Tasmania in association with Bush Haslock Parkes Shugg and Moon, 1961

Source: Hanger 41-027.tif

Building 14
Mathematics

Building No:	**Building Name:**	**Previous Name:**
14	Mathematics	Mathematics
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1966	Department of Public Works - Tasmania. Chief Architect S.T. Tomlinson	-
Date of Major Extension	**Architect for Extension**	**Description**
Pre 1986	University of Tasmania: Buildings Branch	Mathematics Computing Wing
1986	University of Tasmania: Buildings Branch	Covered Linkway between Mathematics Building and Computing Wing

Description of Current Building

Exterior Form	The three storey Mathematics wing was designed to connect to the north-western end of the Physics building in 1966. It also features expressed concrete clad steel columns with recessed face brick infill walls and horizontal ribbons of aluminium windows similar to the Physics building. The external columns to the Mathematics wings do not extend past the roof parapet as they do on the original Physics building. The face brick for the extension is slightly darker than the original building. An external steel fire escape stair is featured on the window-less northern elevation. A single storey rectilinear face brick Mathematics Computing Laboratory was built as a free-standing building to the north of the Physics building and to the east of the Mathematics building in 1986. The building features modest detailing and small aluminium windows and is unremarkable in form and detail. This extension is intrusive to the original setting for the front garden forecourt for the original Physics building and the Mathematics wing extension.
Interior Form	The ground floor was designed to contain two lecture rooms at the northern end of the wing, with a central corridor servicing smaller tutor and research rooms to the eastern and western facades. The first floor features a library to the northern end, a central corridor and staff offices facing east and west. The second floor contains a central corridor with lecturer offices set-out between the regular structural column grid to the eastern and western facades. The detail of the internal staircase and

	balustrade is more modest than other examples seen on the campus (e.g. the Psychology/Arts Building). Floor levels do not align with the adjoining building resulting in a clumsy arrangement of ramps and stairs to gain access.
Significance	The building is not significant.
Key Elements	-
Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 14 – Mathematics

Northern-western corner, showing the external steel fire stair.

Source: Paul Davies Pty Ltd

Building 14 - Mathematics

Western façade

Source: Paul Davies Pty Ltd

Building 14 – Mathematics

Eastern façade, the single storey 1986 Mathematics Computing Building is shown in the foreground

Source: Paul Davies Pty Ltd

Building 14 – Mathematics

Detail of internal stair

Source: Paul Davies Pty Ltd

Early Photos

Building 14 – Mathematics

1952 black and white print

Mathematics Site

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 3

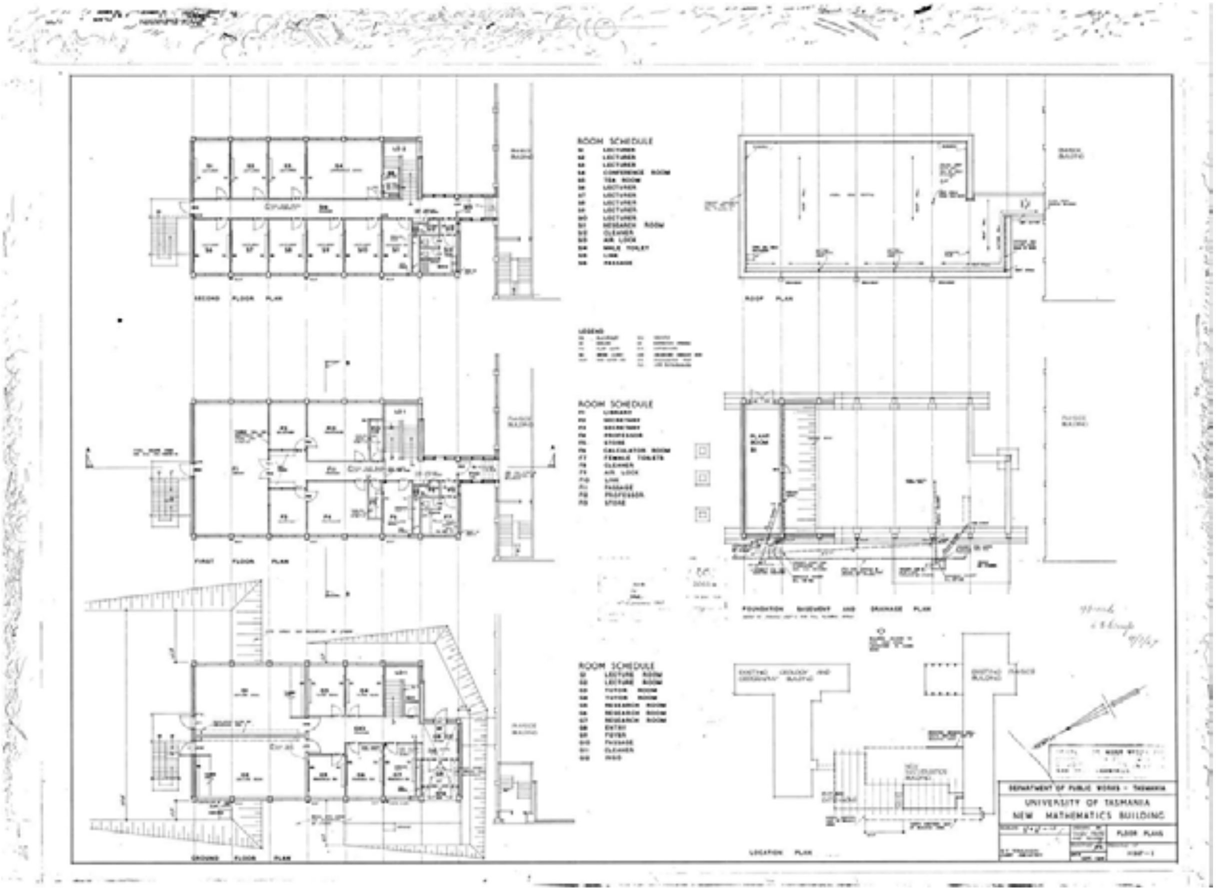
Building 14 – Mathematics

1968 black and white print

View of the north-western corner

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 44

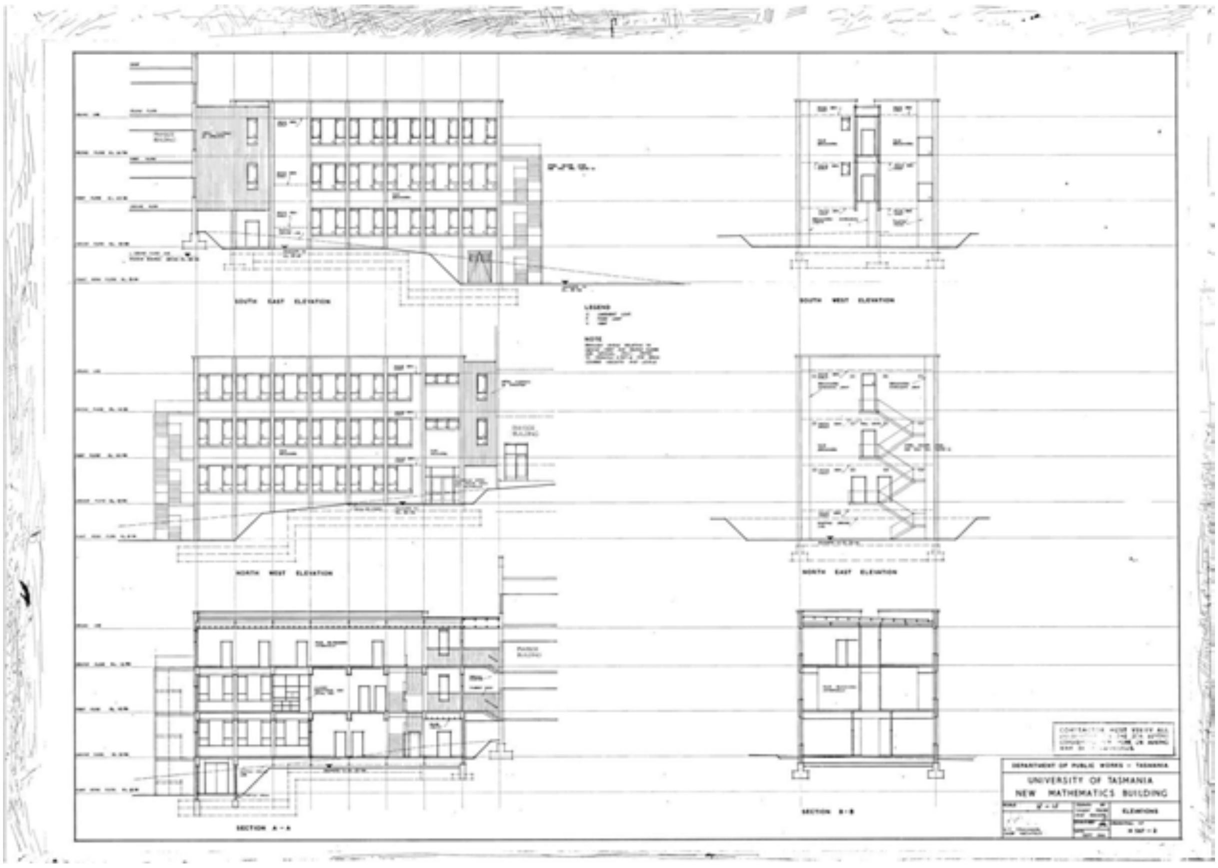
Key Plans



Building 14 – Mathematics

Plans - Department of Public Works -Tasmania. Chief Architect S.T. Tomlinson, 1966

Source: Hanger 49-022.tif



Building 14 – Mathematics

Elevations and Sections - Department of Public Works -Tasmania. Chief Architect S.T. Tomlinson, 1966

Source: Hanger 49-022.tif

Building 16
Tasmanian Institute of Agriculture

Building No:	Building Name:	Previous Name:
16	Tasmanian Institute of Agriculture	Bio Medical Library
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1972	Department of Public Works - Tasmania. Chief Architect S.T Tomlinson in association with Johnson Crawford and De Bavay	-
Date of Major Extension	**Architect for Extension**	**Description**
2002	Crawford Shurman	Extension Linking Life Sciences to the Tasmanian Institute of Agriculture

Description of Current Building

Exterior Form

The Tasmanian Institute of Agriculture is a well-designed two storey pre-cast concrete rectilinear building with a rectangular face brick box form to the north-west elevation. The original building was designed with the stairwell and amenity facilities located along the eastern side of the building. A staff room, librarians office and work room and store were located at the southern end, with the remainder of the ground and the whole of the first floor dedicated to the library collections. The two-storey face brick box to the west contained a cloak room on the ground floor and a group discussion room on the first floor, along with a fire escape stair.

The building has a dominant first floor which is finished with pre-cast concrete panels and narrow double-hung aluminium windows between repetitive decorative vertical pre-cast panels to all elevations. The first floor overhangs the ground floor which is finished with light-weight framing and full height glazing, contrasting with the heavy pre-cast concrete presence of the first floor. The red brick box also features narrow vertical strip windows to the north-east and north-west elevations.

Large steel roof trusses are used to span the open plan library to the first floor, with a row of square steel columns set in from the western edge of the room. The roof form is hidden behind the pre-cast concrete parapet.

A modern link building connects the Tasmanian Institute of Agriculture with the central southern wing of the Life Sciences building by Crawford Shurman. It is a well designed linking structure that won an Institute of Architects award.

Interior Form	Interior not accessible during site inspection
Significance	The original building, built as a free standing form, and the later link are both well-designed buildings. The earlier wing has moderate heritage significance and was one of the earlier built elements after the 1960's that continued the tradition of employing new designs and forms on the campus. It retains a high level of integrity.
Key Elements	- Overall form of the building and addition.
Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 16 – Tasmanian Institute of Agriculture

Western Elevation

Source: Paul Davies Pty Ltd

Building 16 – Tasmanian Institute of Agriculture

Southern Elevation

Source: Paul Davies Pty Ltd

Building 16 – Tasmanian Institute of Agriculture

Western Entrance

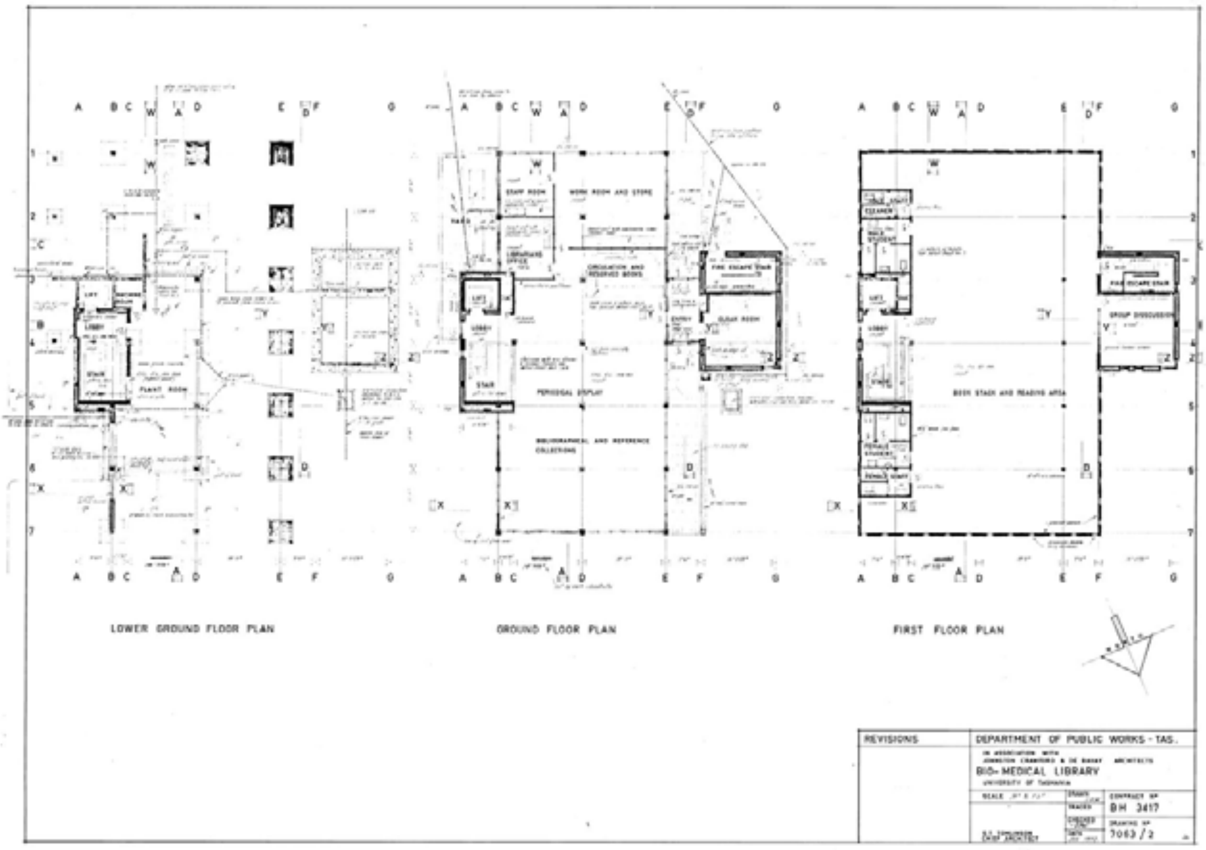
Source: Paul Davies Pty Ltd

Building 16 – Tasmanian Institute of Agriculture

Northern Elevation

Source: Paul Davies Pty Ltd

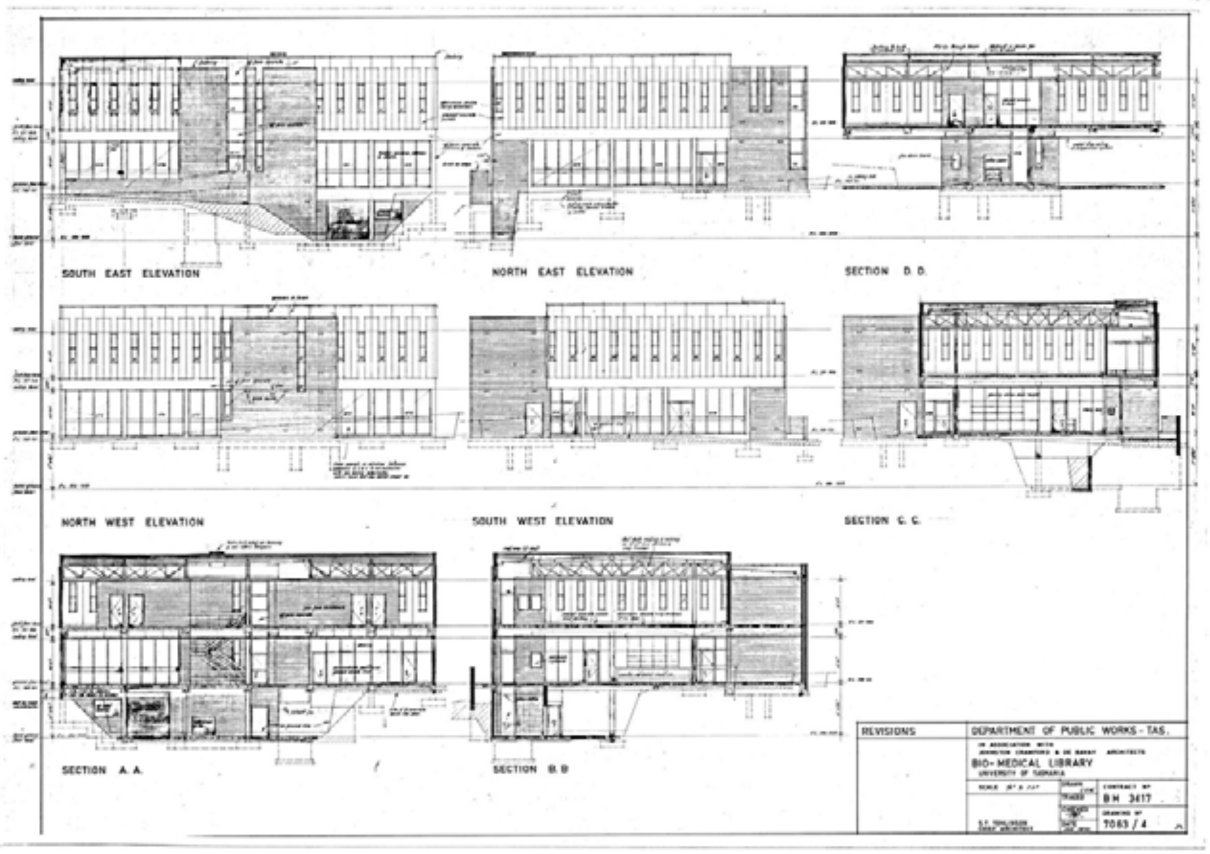
Key Plans



Building 16 – Tasmanian Institute of Agriculture

Floor Plans – Bio Medical Library, University of Tasmania. Prepared by Department of Public Works -Tasmania. Chief Architect S.T Tomlinson in association with Johnson Crawford and De Bavay,1972.

Source: Hanger 58-005.tif



Building 16 – Tasmanian Institute of Agriculture

Sections and Elevations – Bio Medical Library, University of Tasmania. Prepared by Department of Public Works -Tasmania. Chief Architect S.T Tomlinson in association with Johnson Crawford and De Bavay, 1972.

Source: Hanger 58-008.tif

Building 17
Chemistry, Central Science Laboratory

Building No:	Building Name:	Previous Name:
17	Chemistry, Central Science Laboratory	Chemistry
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1957	D. Hartley Wilson	1961
Date of Major Extension	**Architect for Extension**	**Description**
1967	Department of Public Works - Tasmania. Chief Architect S.T. Tomlinson	Alterations
1970/71	Department of Public Works - Tasmania. Chief Architect S.T. Tomlinson in association with Bush Park Shugg and Moon	South-eastern Extension
1979	J.N Pettifor – University Architect	Single Storey South Addition - accommodation for Pharmacy
1982	Heffernan and Viney Architects	Eastern Extension to the 1979-80 J.N. Pettifor wing
1995	Forward Viney Woolan	Additional Floor to the 1982 Heffernan & Viney Extension

Description of Current Building

Exterior Form

The original Chemistry Building is one of the finer early buildings built as part of the Sandy Bay Campus with a striking and generous two storey entrance foyer accessed from a grand two storey colonnade on the western façade. The two-storey entrance colonnade consists of four deep blade columns finished with rendered concrete to the blade ends and clad with polished granite to the sides.

The spine of the plan is a long rectilinear north-facing building, originally with one southern wing to the south-west and one northern wing to the north-east. The two-storey south-western wing is accessed directly from the main entrance foyer and contains a large lecture theatre on the ground floor, with lecture rooms above on the first floor accessed via a mezzanine bridge across the two-storey entrance foyer void. The ground floor of the four-storey spine of the building features large laboratories at the eastern end with a library at the western end.

The roof of the main building form features a striking colonnade of repeating tapered concrete columns to the northern side of a thin rectilinear built form along the southern side of the main roof containing a poisonous gases laboratory as well as lift machine rooms and extensive exhaust systems from the chemical laboratories throughout the building. The various plant and exhaust on the roof have been painted in the same blue colour and have an industrial sculptural quality.

The northern façade features a three-storey glazed curtain wall, with low height blonde face brick walls visible through the clear glazing to each floor. Some of the exhaust piping for the laboratory extraction fans punch through the glazed curtain wall and extend externally up to the flat roof top. The pipes are all painted in a matching light blue colour.

The western end of the main spine projects further west than the main entrance (located on the western side of the south-west wing) and features a four-storey windowless blonde face brick wall facing south adjacent to the main entrance. This wall features the building identification signage "Chemistry" in white cut-out lettering. Full height glazed curtain walls wrap around the three-storey form to the end of the main building to the west, again detailed to show the floor slabs and low-height blonde face brick walls to the first and second floors.

The east elevation of the northern wing also features a similar glazed curtain wall detail with low-height blonde face brick walls visible through the curtain wall however the curtain wall is broken up into a smaller grid to suit the two-storey scale of the wing.

The 1971 three-storey wing to the south-east is much simpler in detail than the original building, featuring simple blonde face brick walls and ribbons of horizontal aluminium windows. The southern entrance to this later wing has some architectural interest with four engaged piers running vertically up the face brick façade with two narrow vertical strips of aluminium framed windows between the expressed piers and adjacent to the aluminium framed entrance doors which are accessed under a projecting concrete awning with single circular column.

A further extension was designed in 1979 with two single storey skillion roofed forms located between the original southern wing and the 1971 southern wing to accommodate pharmacy.

The 1971 south-eastern wing was further extended to the east in 1982 to create the Central Science Laboratory and also features simple blonde face brick walls with ribbons of horizontal aluminium windows. An additional level was added to this extension in 1995 by Forward Viney Woollan in the same architectural language and materiality as the 1982 extension.

Interior Form

The impressive main entrance foyer features a double-height void space with a mezzanine bridge running along the back wall of the foyer. The soffit of the mezzanine bridge features an abstract sculptural artwork. The void also features a suspended sculptural work by Stephen Walker created in 1958 to the southern first floor blonde face brick wall to the foyer. Full height curtain wall glazing presents to the entrance behind the dramatic two storey colonnade. The floor is patterned marble. The foyer

	is generously scaled and provides a break out space for the main lecture theatre. The internal corridors of the original building feature blonde face brick walls with vinyl floors and vermiculite ceilings. The original staircases and balustrades are of a simple but well executed design. One such detail is a course of face brick work following the raked angle of the concrete stair stringer built into the wall. The continuous timber handrails which wind up the centre of the stairwell have an elegant curve at each landing. Although altered internally in parts, the building retains a large amount of original timber joinery to offices and laboratories. Some of the original signage is still intact in the form of room names etched into the hi-light glazing above internal doors. Some original sliding steel fire doors are still intact and in use in the building. Even though there have been additions to the southern side, the building retains a very high level of integrity both externally and internally.
Significance	The building is of high significance and is one of the outstanding buildings on the campus. Designed by D Hartley Wilson, who with Bolt was responsible for Christ College, it demonstrates a confidence in modernism and a finesse in massing and the use of materials that is only seen a few campus buildings. Despite extensive additions to one side, that are not of any particular significance, the building has retained a high level of integrity and has high aesthetic value.
Key Elements	- External form of the original building with materials and detailing - Entry foyer area with all finishes and the soffit sculpture - Lecture theatre and fitout - Internal face brick corridor walls and remaining timber joinery
Condition	The building appears in very good overall condition.

Current Photos

Building 17 - Chemistry, Central Science Laboratory

Western façade – Main Entrance (Dobson Road)

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

Detail of the double height main entrance foyer

(Dobson Road)

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

North-western corner

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

North-eastern corner

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

South-eastern corner

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

Eastern façade of the southern wing

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

Western façade of the southern wing

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

Southern façade of the southern wing

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

View of the western façade of the northern wing from the Chemistry building rooftop

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

View of the roof top

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

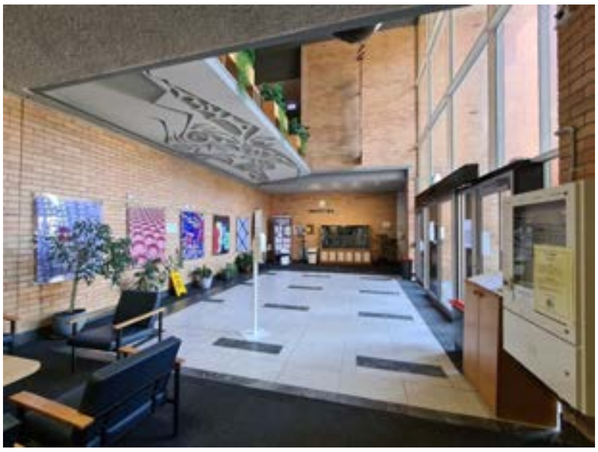
Detail of the tapered rectangular columns on the rooftop

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

View of the steel curtain glazing to the rooftop

Source: Paul Davies Pty Ltd



Building 17 - Chemistry, Central Science Laboratory

View of the double height main entrance foyer

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

Detail of the mural under the first floor mezzanine bridge to the entrance foyer

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

View of the double height main entrance foyer

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

View of the suspended and cantilevered artwork to the double height main entrance foyer. Sculpture by Stephen Walker 1958

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

View of the first floor walkway to the double height main entrance foyer

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

View of the first floor walkway and void to the double height main entrance foyer

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

Detail of display cabinetry and glassware apparatus on the first floor adjacent to the double height void to the main entrance

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

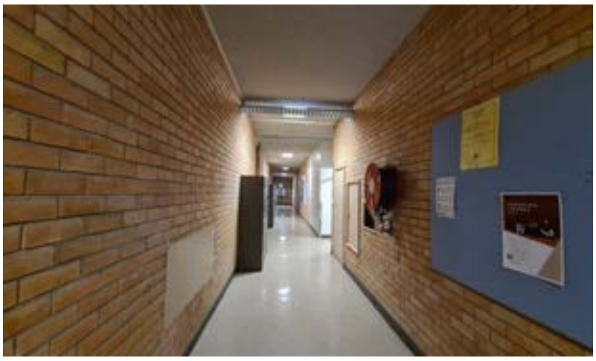
Typical original joinery and signage on the first floor

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

Typical original etched glass signage to the glazed hi-light windows above internal doors.

Source: Paul Davies Pty Ltd



Building 17 - Chemistry, Central Science Laboratory

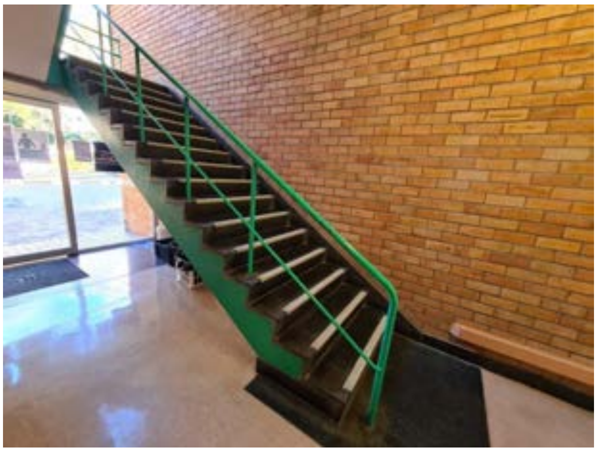
Typical face brick corridor to the ground floor

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

Typical timber joinery to labs

Source: Paul Davies Pty Ltd



Building 17 - Chemistry, Central Science Laboratory

Staircase located at the western entrance

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

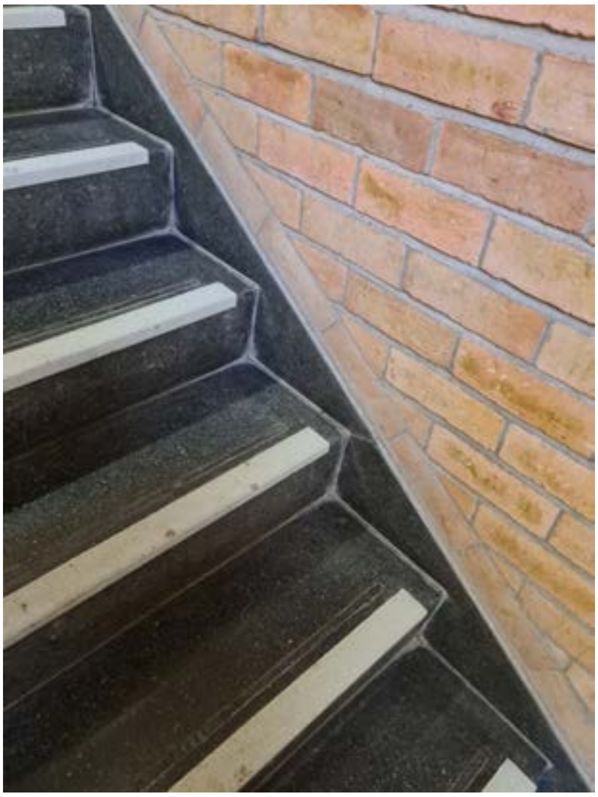
Typical timber joinery to labs

Source: Paul Davies Pty Ltd

Building 17 - Chemistry, Central Science Laboratory

Detail of original steel sliding fire doors

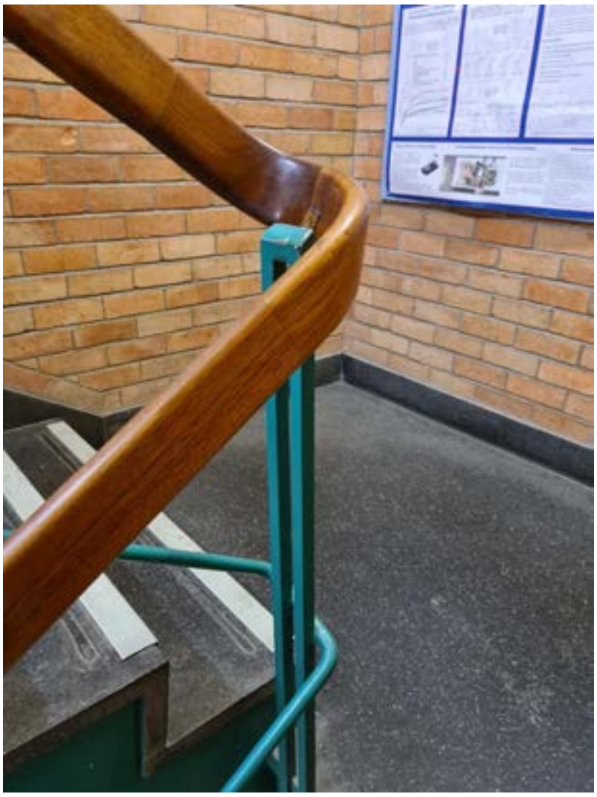
Source: Paul Davies Pty Ltd



Building 17 - Chemistry, Central Science Laboratory

Typical detail of raked brick skirting to the central stair

Source: Paul Davies Pty Ltd



Building 17 - Chemistry, Central Science Laboratory

Timber handrail detail to the central stair

Source: Paul Davies Pty Ltd

Early Photos

Building 17 - Chemistry, Central Science Laboratory

1961 black and white print

Under construction

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 19

Building 17 - Chemistry, Central Science Laboratory

1961 black and white print

Under construction

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 20

Building 17 - Chemistry, Central Science Laboratory

1960 Photograph

Western Facade

Source: Libraries Tasmania Online Collection; Item Number AA193-1-395

Building 17 - Chemistry, Central Science Laboratory

1965 Photograph

Chemistry Building (image left), Morris Miller Library (image right)

Source: Libraries Tasmania Online Collection; Item Number AB713-1-9256

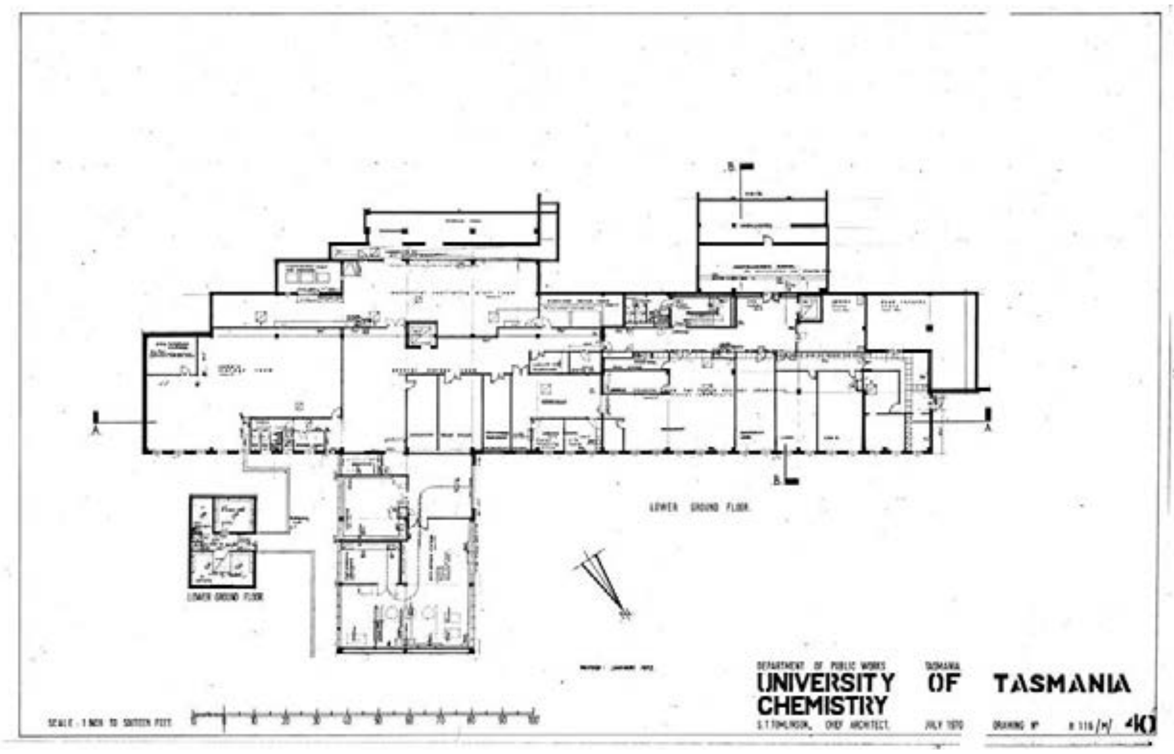
Building 17 - Chemistry, Central Science Laboratory

1969 Photograph

Main Entrance

Source: Libraries Tasmania Online Collection; Item Number AB713-1-11072

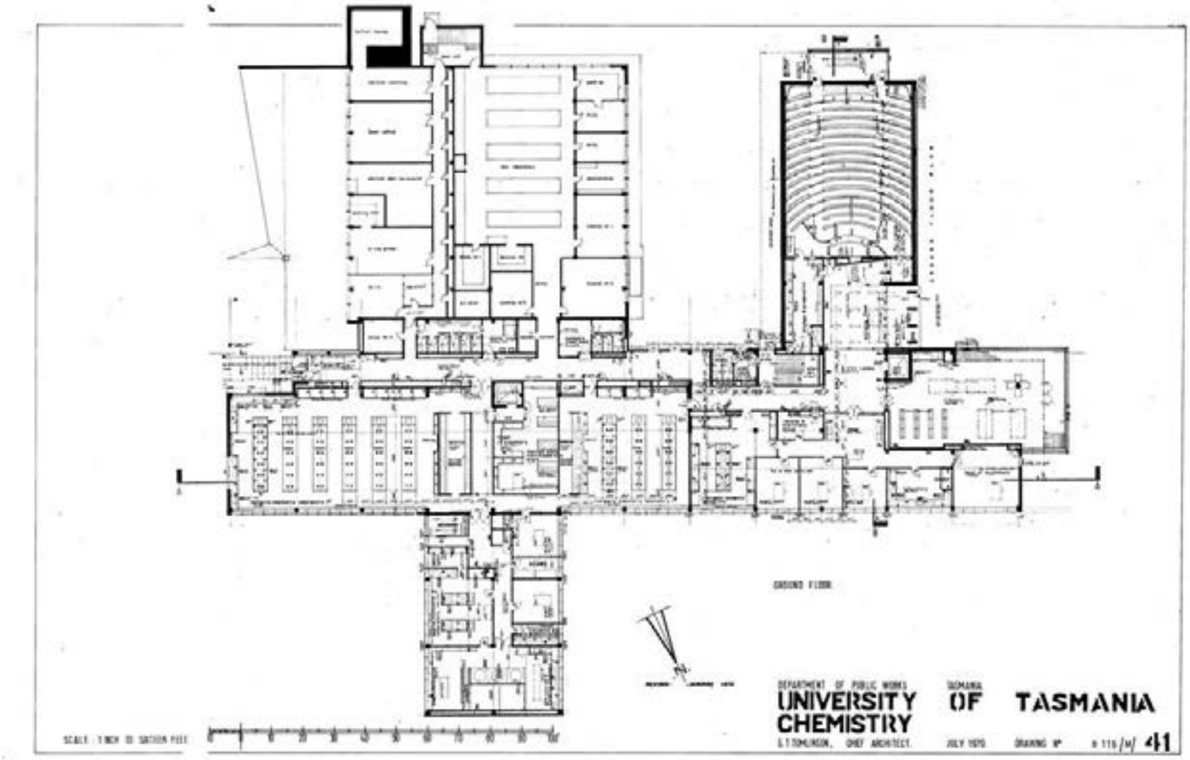
Key Plans



Building 17 - Chemistry, Central Science Laboratory

Lower Ground Floor Plan – Chemistry, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1957 plans prepared by D. Hartley Wilson were not available.

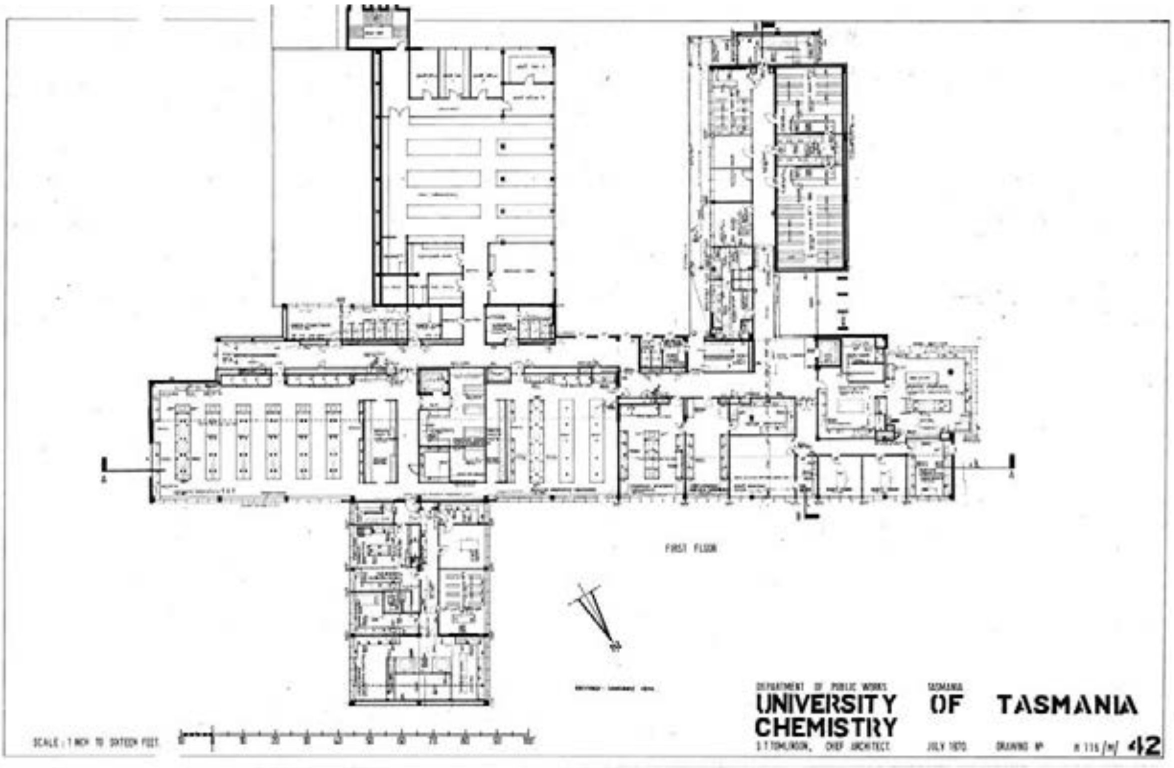
Source: Box 6-054.tif



Building 17 - Chemistry, Central Science Laboratory

Ground Floor Plan – Chemistry, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1957 plans prepared by D. Hartley Wilson were not available.

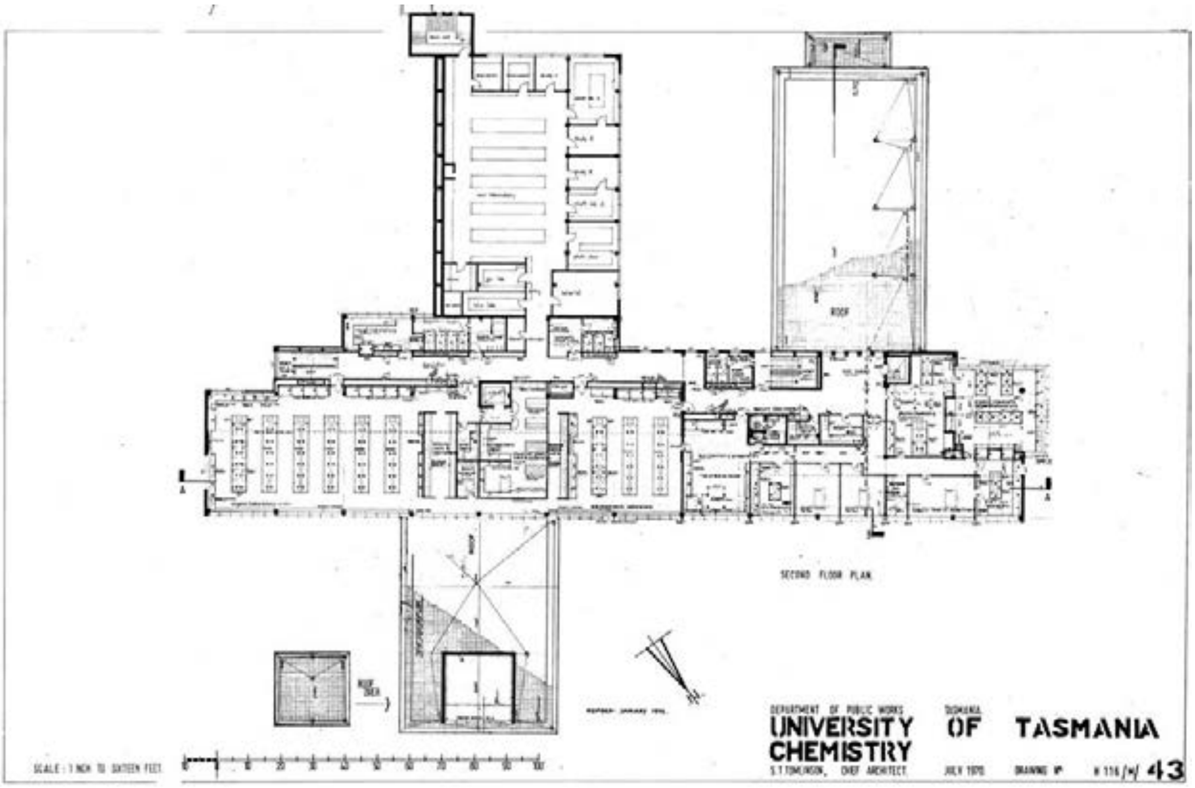
Source: Box 6-055.tif



Building 17 - Chemistry, Central Science Laboratory

First Floor Plan – Chemistry, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1957 plans prepared by D. Hartley Wilson were not available.

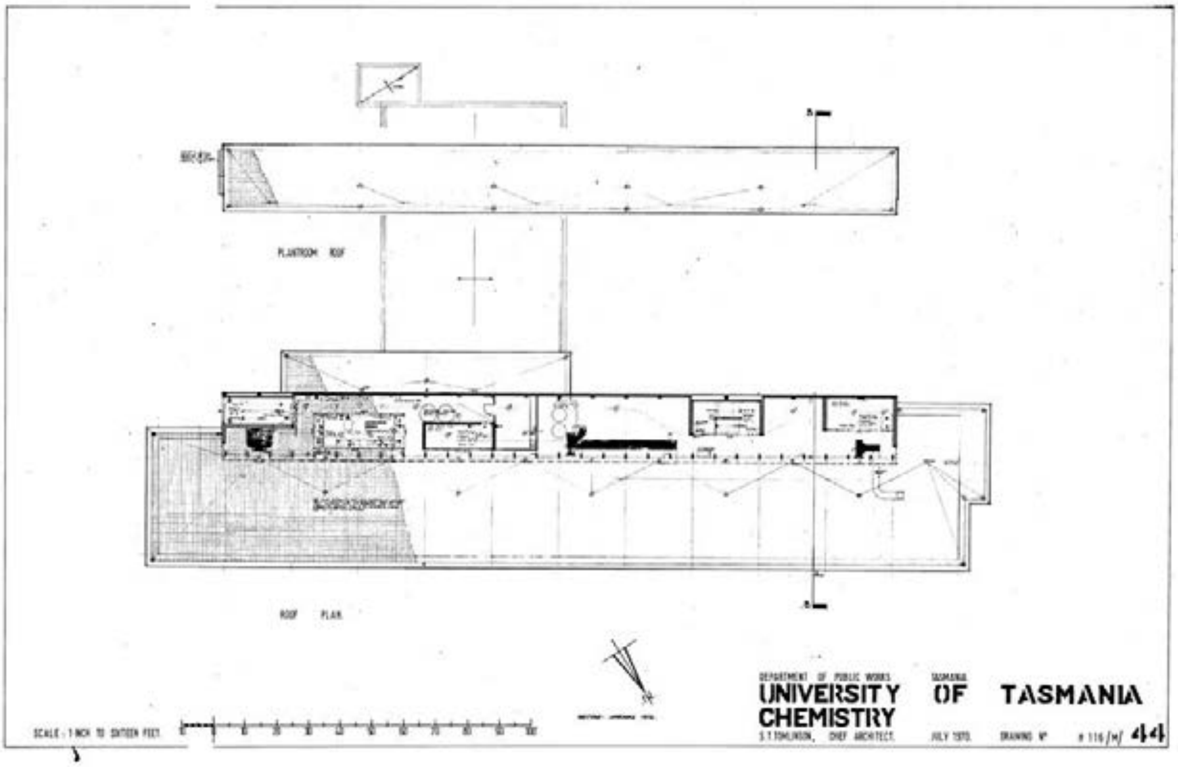
Source: Box 6-056.tif



Building 17 - Chemistry, Central Science Laboratory

Second Floor Plan – Chemistry, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1957 plans prepared by D. Hartley Wilson were not available.

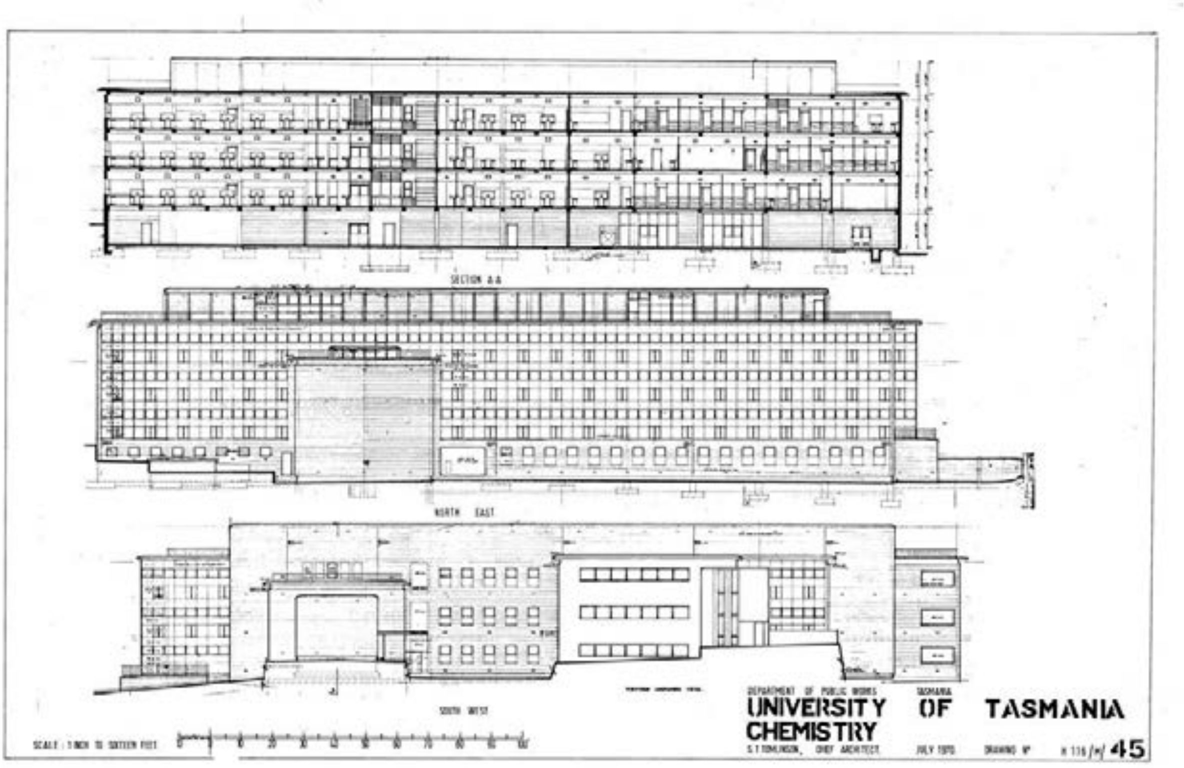
Source: Box 6-057.tif



Building 17 - Chemistry, Central Science Laboratory

Roof Plan – Chemistry, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1957 plans prepared by D. Hartley Wilson were not available.

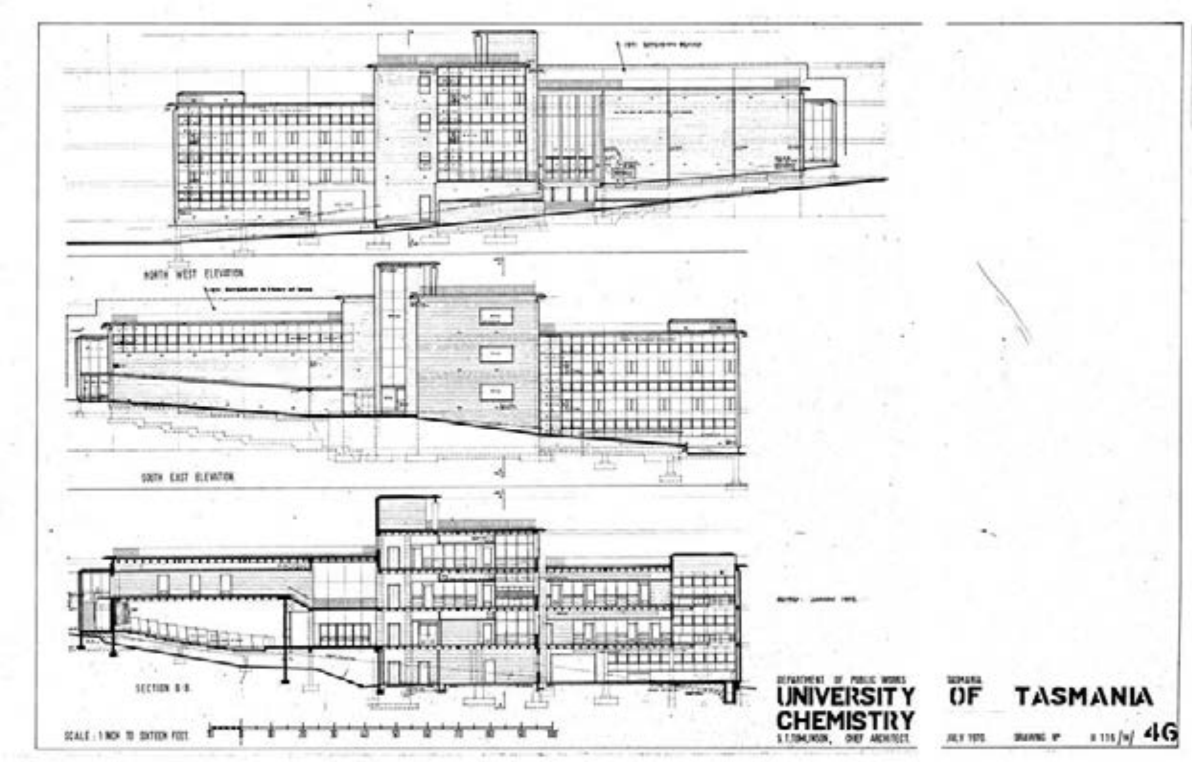
Source: Box 6-058.tif



Building 17 - Chemistry, Central Science Laboratory

Sections and Elevations – Chemistry, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1957 plans prepared by D. Hartley Wilson were not available.

Source: Box 6-059.tif



Building 17 - Chemistry, Central Science Laboratory

Sections and Elevations – Chemistry, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1957 plans prepared by D. Hartley Wilson were not available.

Source: Box 6-060.tif

Building 18
University Club

Building No:	Building Name:	Previous Name:
18	University Club	Staff House
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1971	Department of Public Works - Tasmania. Chief Architect S.T Tomlinson in association with Blythe and Blythe	1972
Date of Major Extension	**Architect for Extension**	**Description**
1974	Blythe and Blythe Architects	Addition (Stores)
1983	Chris Holland	First Floor Addition - Campus Credit Union
1986	Chris Holland	Ground and First Floor Extension - Campus Credit Union
1996	Forward Viney Woollan Architects	Refurbishment of South-eastern Entry

Description of Current Building

Exterior Form

The original University Club building was designed as a single storey rectilinear building orientated to the north-east with a level lawn terrace in front and a circular driveway and entrance on the southern side of the building. Due to the steep terrain of the site the building is set into the hill using cut and fill. Early drawings show the potential outlines for a future first floor and roof terrace. The building featured expressed vertical pre-cast concrete columns set-out on a regular 10 foot grid, with blonde face brick infill walls between. The north-eastern elevation had a symmetrical layout of aluminium framed windows, with narrow floor to ceiling windows broken into four panels and large fixed glass windows to every second bay. The original entry was via a small entry foyer with a concrete porch to the south-western elevation. The north-eastern side of the building featured a coffee bar and common room which could be split into two un-even sized rooms via an operable wall. The south-western side of the building contained the entry lobby, kitchen, store rooms, toilets and a small office.

A first floor addition containing a general office, small conference room and amenities was designed in 1983 by Chris Holland and is located above the original building at the north-western end. The extension is accessed via a concrete ramp from Alexander Street under a covered

	bronze tinted acrylic barrel vault entry porch supported by two white painted circular concrete columns. The entry lobby also features a similar pop-up barrel vault roof in the same material and on the same axis as the entry porch. The south-eastern elevation featured a predominately aluminium framed glazed façade. In 1986 further additions were made to the ground and first floor designed by Chris Holland. The extension to the ground floor included a new south-eastern entrance, a bar lounge with a TV and reading room, new toilets and a games room. The first floor extension included a new board room and extension to the general offices as well as an additional western fire escape to Alexander Street. The south-eastern entrance was refurbished in 1996 by Forward Viney Woollan Architects and this included a new painted panel cladding with panels rotated in elevation to be off-grid with the building form. This work received an Institute Architects award. There have been other alterations and extensions to this building however the drawings are not held in the university's records. The building has been extensively extended and altered during its lifetime and the rigorous modern clarity of the original building has been lost.
Interior Form	Interior not accessible during site inspection
Significance	The building has undergone significant change and is no longer recognisable to its original designed form. The additions generally are not significant including the 1996 additions which are interesting but which have no heritage significance.
Key Elements	-
Condition	The building appears to be in fair overall condition, however a detailed inspection was not conducted.

Current Photos

Building 18 – University Club

North-eastern façade (main entrance)

Source: Paul Davies Pty Ltd

Building 18 – University Club

Northern-eastern facade (main entrance)

Source: Paul Davies Pty Ltd

Building 18 – University Club

1986 first floor addition, north-western facade, rear entrance (Alexander Street)

Source: Paul Davies Pty Ltd

Building 18 – University Club

Detail of the rear entrance (Alexander Street) to the 1986 first floor addition.

Source: Paul Davies Pty Ltd

Building 18 – University Club

Southern façade of the 1986 first floor addition

Source: Paul Davies Pty Ltd

Building 18 – University Club

Southern façade and loading bay

Source: Paul Davies Pty Ltd

Building 18 – University Club

South-western corner

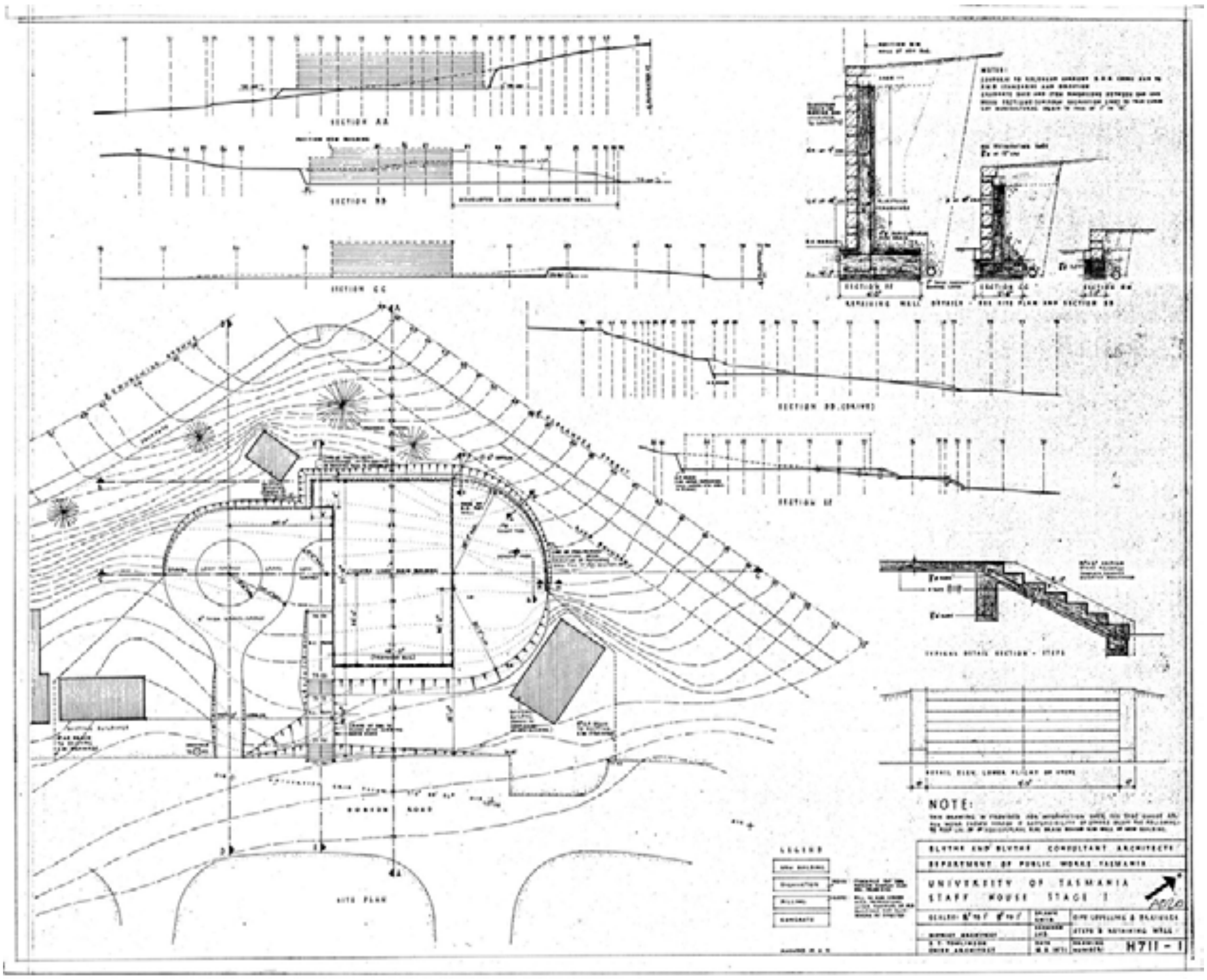
Source: Paul Davies Pty Ltd

Building 18 – University Club

South-eastern corner

Source: Paul Davies Pty Ltd

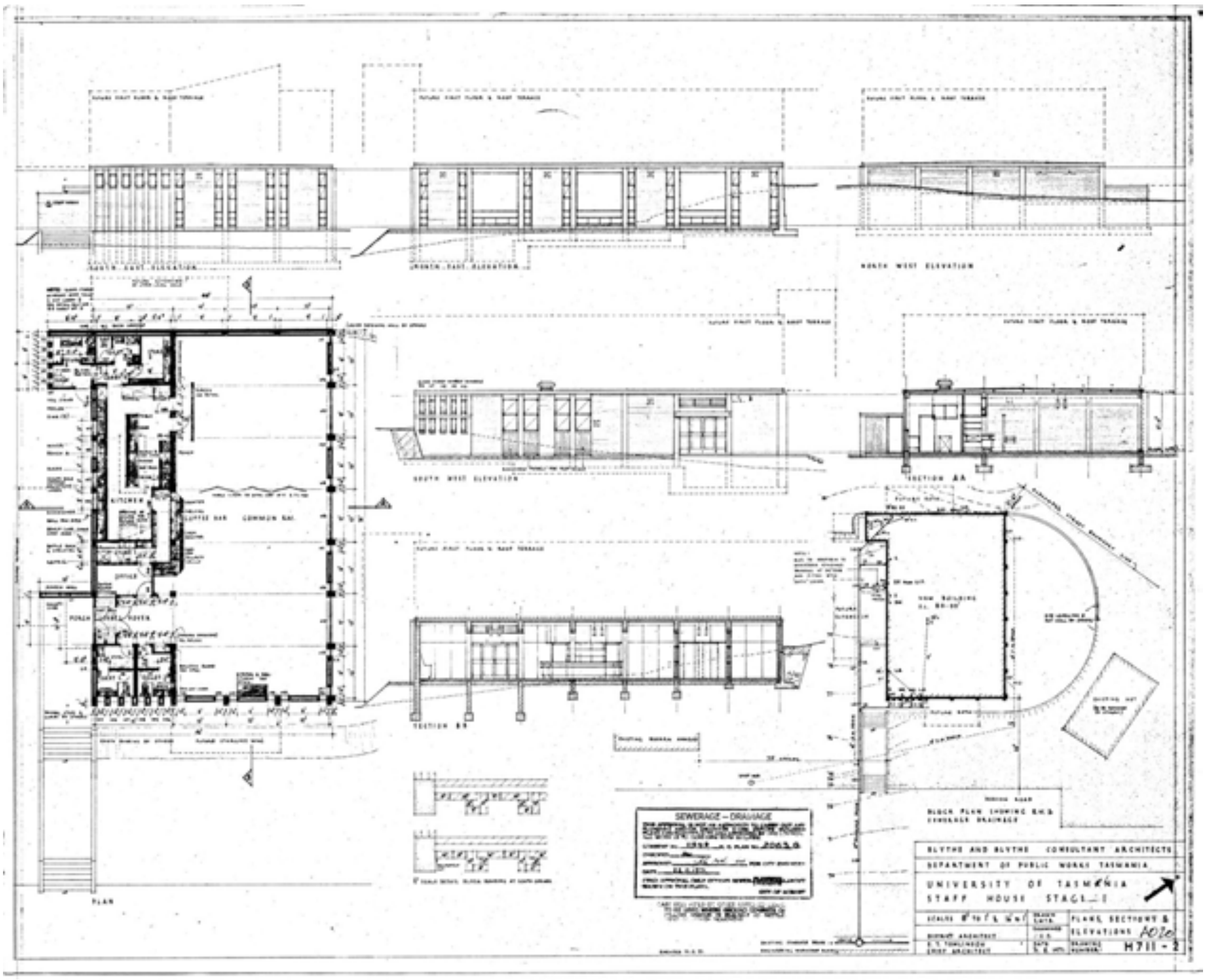
Key Plans



Building 18 - University Club

Site Plan - Staff House Stage 1, University of Tasmania. Prepared by Department of Public Works Tasmania, Chief Architect S.T Tomlinson in association with Blythe and Blythe Architects, 1971

Source: Hanger 24-013.tif



Building 18 – University Club

Plans Elevations and Sections – Staff House Stage 1, University of Tasmania. Prepared by Department of Public Works Tasmania, Chief Architect S.T Tomlinson in association with Blythe and Blythe Architects, 1971

Source: Hanger 24-014.tif

Building 20
Pharmacy Building

Building No:	Building Name:	Previous Name:
20	Pharmacy Building	-
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
2007	Bush Parkes Shugg and Moon	2008
Date of Major Extension	**Architect for Extension**	**Description**

Description of Current Building	
Exterior Form	The Pharmacy Building is a three storey south-western extension to the Chemistry Building. The building is a modern pre-cast concrete building containing teaching spaces, amenities and staff offices. The western elevation facing Dobson Road features a windowless grid of horizontal format pre-cast concrete panels to the single storey form. The three story form is framed at the western end with concrete wall blades projecting at either end and returning horizontally to the roof with blank concrete infill panels between, with the exception of two very quirky triangular windows with triangular 'folded' concrete hoods at the centre of the first and second floors. Ribbons of horizontal aluminium windows to the northern façade of the first and second floors are completely screened with steel mesh on an exterior steel frame for solar protection.
Interior Form	Interior not accessible during site inspection
Significance	The building is a well-designed addition to the campus of recent origin. It does not have heritage significance but fits comfortably within the setting of the very significant chemistry and library buildings.
Key Elements	-
Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 20 - Pharmacy

Western façade facing Dobson Road

Source: Paul Davies Pty Ltd

Building 20 - Pharmacy

Northern facade

Source: Paul Davies Pty Ltd

Building 20 - Pharmacy

View of the Pharmacy Building from the Chemistry Building rooftop

Source: Paul Davies Pty Ltd

Building 21
TUU Building

Building No:	Building Name:	Previous Name:
21	TUU Building (Tasmanian University Union Building)	Union Building
Date of Construction or Date of Original Drawings	Original Architect	Date Opened
1957	S.W.T. Blythe	1959
Date of Major Extension	Architect for Extension	Description
1960-61	S.W.T Blythe	Additions Stage 3
1967	Department of Public Works - Tasmania. Chief architect S.T. Tomlinson in association with Blythe and Blythe	Additions - Stage 4
Post 1967	Blythe and Blythe	Additions - Stage 5
1976-77	Blythe and Blythe	Alterations
1980	Blythe Yeung Associates	Alterations and Additions
1984	Philp Lighton Floyd Beattie	Bar
1987-88	Michael Viney and Associates	Alterations
1989	Drafting Service Tasmania	Small Addition
1996	Gaetano Palmese Design Studio	Alterations
2004 (?)	Jacob Allom Wade	University Bar*
Description of Current Building		
Exterior Form	The original Union Building was designed as two single storey flat roofed buildings with a north-facing U-shaped building around a central garden courtyard separated from the western cafeteria wing by a second smaller garden courtyard and covered way. Both wings featured a regular expressed structural column grid with blonde face brick panels and full-width steel framed windows between each structural bay. In 1960-61 a first floor was added to both buildings in a matching architectural style and materiality to the original building. The addition	

continued the expressed structural column grid and blonde face brick panels with large divided steel framed windows between the column grid. The decorative projecting brick motif above the entrance canopy was built at this time. An additional floor was added above the original ground floor cafeteria containing two further cafeterias and a central servery. These works were by the same architect and retained the integrity of the early design.

A further two storey northern extension to the cafeteria was added in 1976-77 in a similar style to the original building.

In 1980 the original north facing courtyard was infilled with a two-storey addition containing a book exchange and activities room to the ground floor and a large upper common room to the first floor. An infill addition containing a Discotheque with skillion roof was also added to the south. These alterations significantly altered the original building plan and included bricking up existing openings and creating new openings. In 1984 the Discotheque was extended to include a bar.

In 1987-88 the northern side of the building underwent further extensive alterations and additions to expand the activities area on the first floor and included lifting part of the roof and installing a curved roof with high-light glazing. The new northern façade to the three-storey extension is postmodernist in detailing. The elevation presents a hierarchy of window opening sizes with small square windows to the painted blockwork walls to the lower ground floor, medium sized square windows to the blond face brick of the ground floor, and larger four-pane square windows to the blond face brick first floor. The centre of the façade contains full-height glazed walls (broken into smaller square panes) and glass blocks to the northern entrance with a narrow curved northern balcony, with a fully glazed curved wall to the elevated ground floor, and a very small juliette balcony with hinged double doors at the centre of the first floor.

Other alterations and additions are evident from the site inspection, however the date and architect for these works are not known at the time of writing.

The building has been extensively altered and added to over its lifespan and the clarity and expression of the original building has been completely obscured.

Interior Form	Post-modern alterations to the interior are very dominant, with the 1987-88 curved void and balustrade to the linear central stair being one such example. The interiors feature strong primary paint colours, such as a bright yellow, blue and red. Vinyl floors are used to the corridor and circulation spaces with brightly colour vinyl squares interspersed within the more neutral background vinyl colour. The interiors of the building have been significantly altered over time and there is little intact original fabric remaining.
Significance	While the original design and first addition appeared to have heritage significance, the extent of change and the numerous additions have removed all heritage significance from the building.
Key Elements	-

Condition	The building appears to be in fair overall condition, however a detailed inspection was not conducted.

Current Photos

Building 21 – Tasmania University Union

Eastern Façade – Main Entrance facing Dobson Road

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

Eastern Façade – south-western wing

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

Eastern Façade – Main Entrance facing Dobson Road

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

Eastern Façade – Note decorative brick motif above entrance canopy

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

Eastern Façade – with post-modern alterations

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

External stair to eastern facade

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

Northern facade of the 1987-88 additions

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

Northern façade of the western wing

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

External stair and ramp to the northern wing

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

Two-storey link between the eastern and western wings and light-weight tensile fabric canopy over the courtyard between the two wings

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

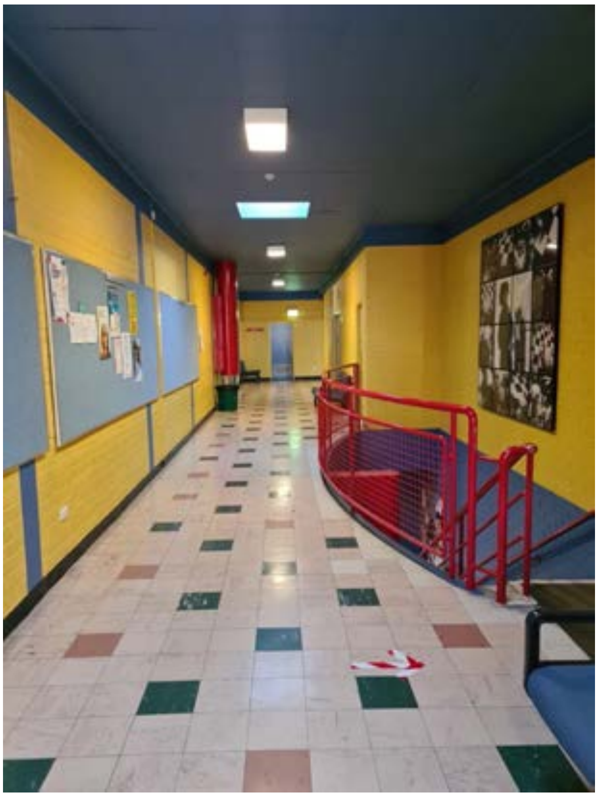
View of the two-storey link between the eastern and western wings

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

View of the south-western courtyard behind the Uni Bar

Source: Paul Davies Pty Ltd



Building 21 – Tasmania University Union

Post-modernist first floor corridor

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

Stair and void to the post-modernist addition

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

Interior of the original entrance foyer

Source: Paul Davies Pty Ltd

Building 21 – Tasmania University Union

Interior of the auditorium on the first floor of the post-modernist addition

Source: Paul Davies Pty Ltd

Early Photos

Building 21 – Tasmania University Union (Union Building)

1958 black and white print

Under construction

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 11

Building 21 – Tasmania University Union (Union Building)

Union Building: Stage 1

1958 black and white print

Eastern facade

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 24

Building 21 – Tasmania University Union (Union Building)

Union Building : Stage 3

1962 black and white print

Eastern facade

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 35

Building 21 – Tasmania University Union (Union Building)

1963 black and white print

Northern facade

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 36

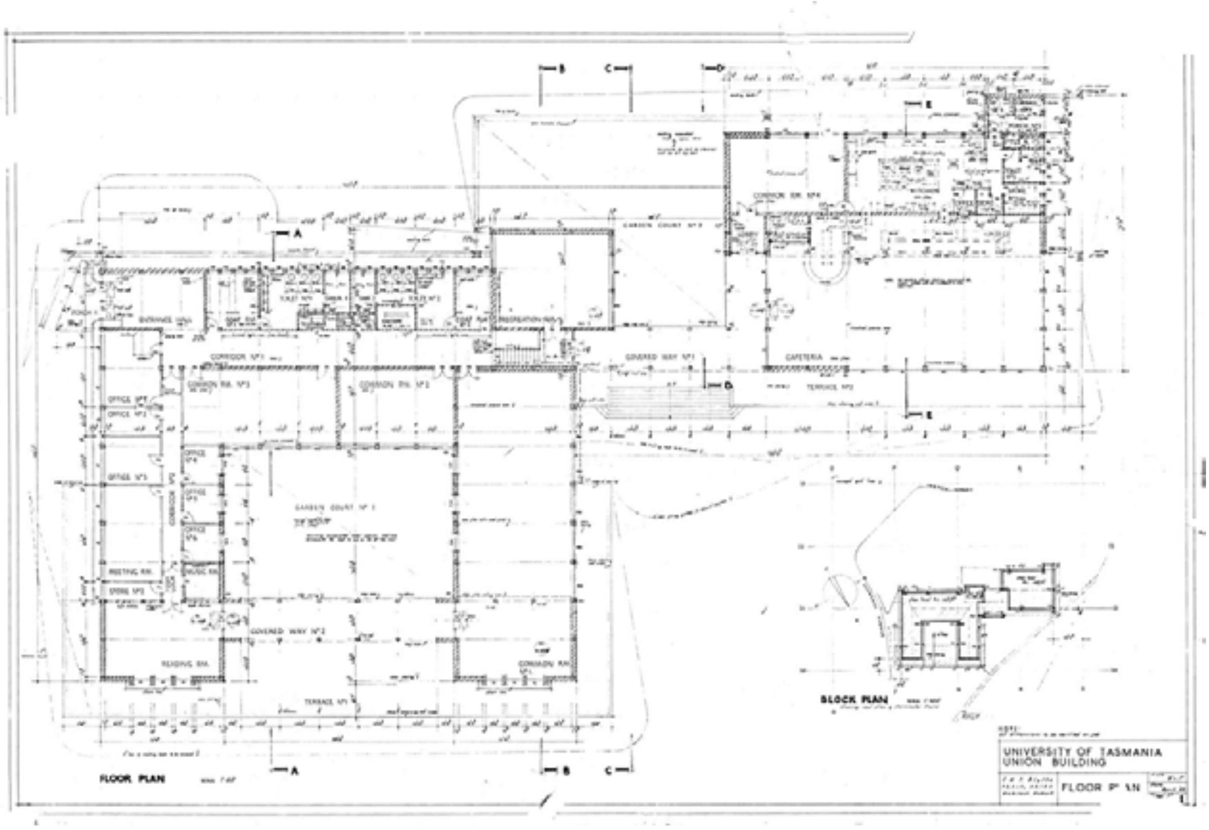
Building 21 – Tasmania University Union (Union Building)

1960 black and white print

North-eastern facades

Source: Libraries Tasmania Online Collection; Item Number AA193-1-393

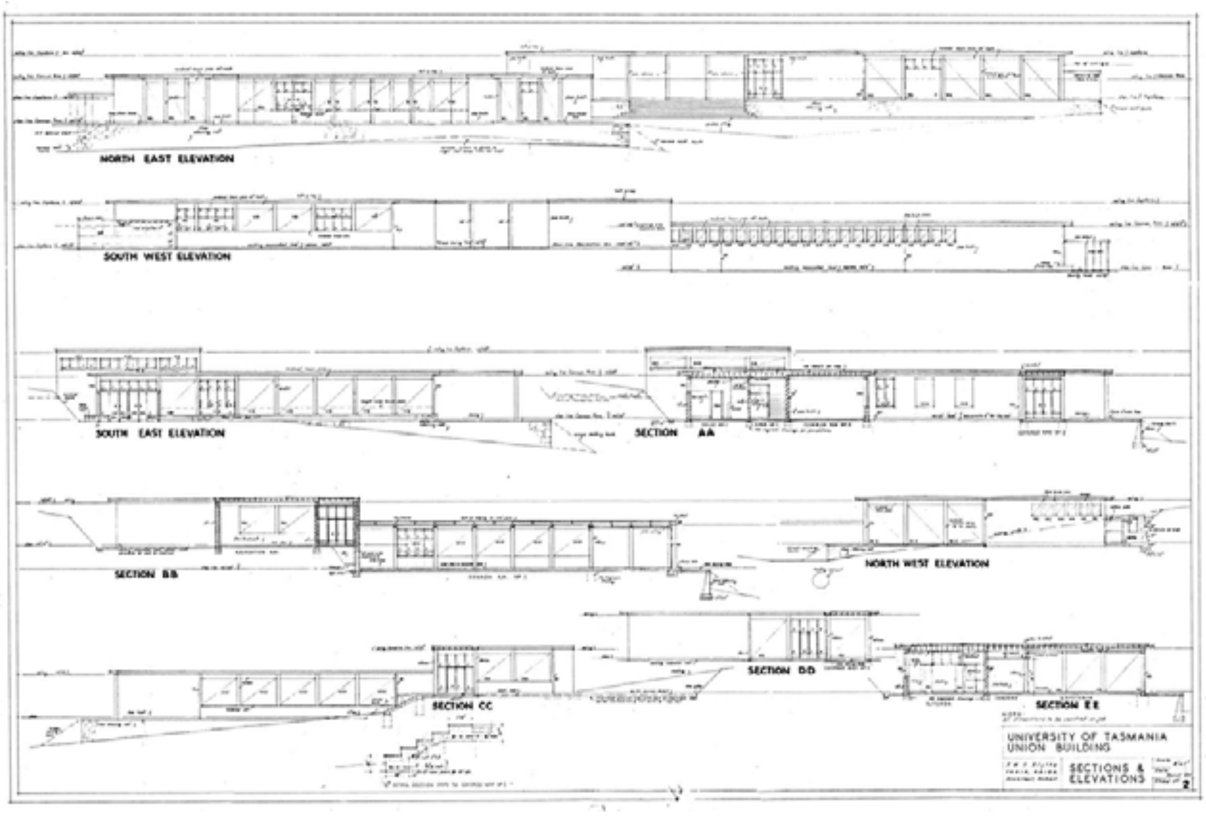
Key Plans



Building 21 – Tasmania University Union

Floor Plan – University of Tasmania Union Building. Prepared by S.W.T Blythe, 1957

Source: Hanger 51-042.tif



Building 21 – Tasmania University Union

Sections and Elevations – University of Tasmania Union Building. Prepared by S.W.T Blythe, 1957

Source: Hanger 51-043.tif

Building 22
Administration Building

Building No:	Building Name:	Previous Name:
22	Administration Building	Administration Building
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1962	Department of Public Works - Tasmania in association with Philp Lighton Floyd Beattie	1965
Date of Major Extension	**Architect for Extension**	**Description**
1970	Department of Public Works – Tasmania. Chief Architect S.T Tomlinson in association with M. G. Vincent	Stage 2 Addition
1984		Alterations

Description of Current Building

Exterior Form

The Administration Building, as originally designed, was a three-storey rectilinear building orientated to the north-east with a two-storey transverse wing at the centre of the building projecting to the south. The building features blonde face brick, aluminium windows and aluminium spandrels. The northern façade facing the Morris Miller Library originally featured an open colonnade to the ground floor, which was later infilled.

The ground floor contains a central corridor running east-west with offices either side to the north and south facades. The first floor, which is directly accessible via bridge from the service road behind the building to the south, due to the steep fall of the land, contains a main entrance foyer with offices to the western side of the building and amenities to the south-eastern corner. The original planning allowed for a potential connecting bridge element to the future Great Hall Building to be designed at the centre of the campus.

The second floor contains a central corridor with offices located within the regular 12' structural grid along the northern façade. The council chamber is located in the transverse projecting box which cantilevers over the main southern entrance. The original design drawings show the projecting council chamber walls were to be clad in a reconditioned stone facing, however they ended up being finished with the same blonde face brick as the rest of the building but with a grid of decorative projecting bricks to the southern façade.

In 1968 a new three-storey perpendicular wing was designed to the north-west containing a central corridor and offices facing east and west. The

	new wing used the same architectural language and materiality as the original north elevation, with exposed concrete slab edges, blonde face brick, and aluminium windows with aluminium spandrels. A later two-storey glazed alteration to the southern entrance foyer is evident from the site inspection, however the date and architect for these alterations is unknown.
Interior Form	Interior not accessible during site inspection
Significance	As designed and first built the building was a modest example of modernism with several interesting design elements but was not an exemplar modernist building. Early photographs show that it had a well-balanced main elevation with the framing around the windows, the elevated brickwork and the small and slot windows adding some interest to the otherwise simple design. The form of the building was adversely impacted by the main addition that changed the proportions of the building. Other changes such as infilling the arcade further affected its intended form. The building has moderate heritage significance noting that the main addition was an early addition and also formed part of the original design concept.
Key Elements	- Original elements of main front façade.
Condition	The building appears to be in fair overall condition, however a detailed inspection was not conducted.

Current Photos

Building 22 – Administration Building

Southern Façade facing Dobson Road

Source: Paul Davies Pty Ltd

Building 22 – Administration Building

First floor cantilever over main entrance

Source: Paul Davies Pty Ltd

Building 22 – Administration Building

Southern façade and modern addition to the original entrance

Source: Paul Davies Pty Ltd

Building 22 – Administration Building

Eastern elevation and bridge to the University Centre

Source: Paul Davies Pty Ltd

Building 22 – Administration Building

Overview of the Administration Building from the hill to the south of Churchill Avenue

Source: Paul Davies Pty Ltd

Building 22 – Administration Building

Northern elevation, note the original colonnade to ground floor has been infilled.

Source: Paul Davies Pty Ltd

Early Photos

Building 22 – Administration Building

1965 black and white print

Southern façade

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 41

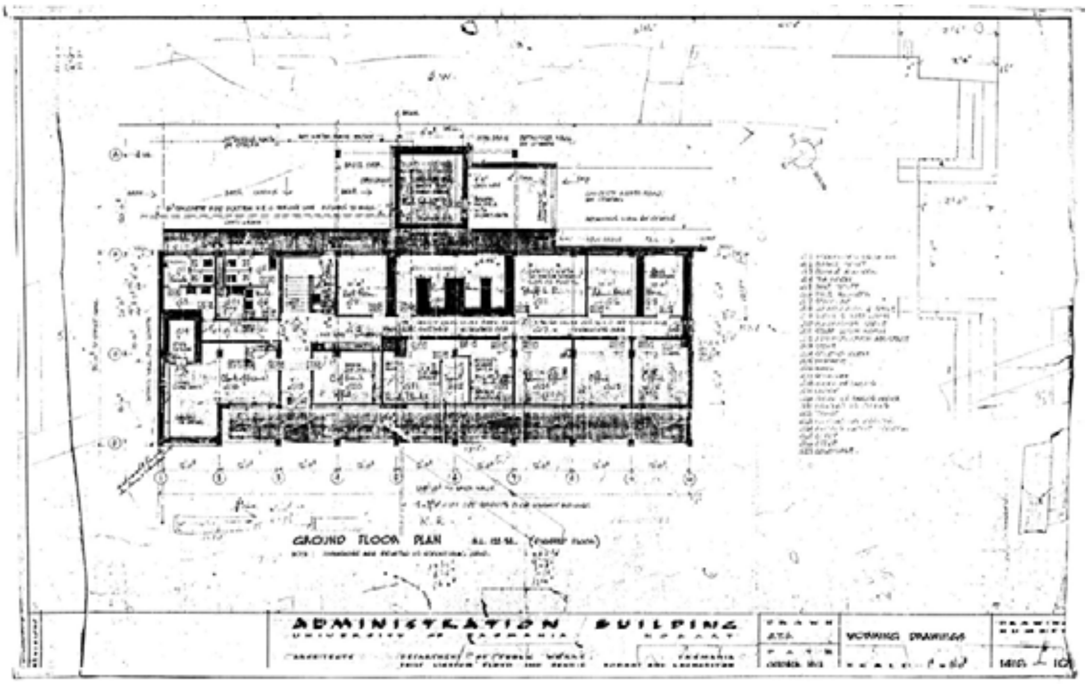
Building 22 – Administration Building

1960 Photograph

North-western façade – Administration Building (image left), Life Sciences Building under construction (image right)

Source: Libraries Tasmania Online Collection; Item Number AA193-1-398

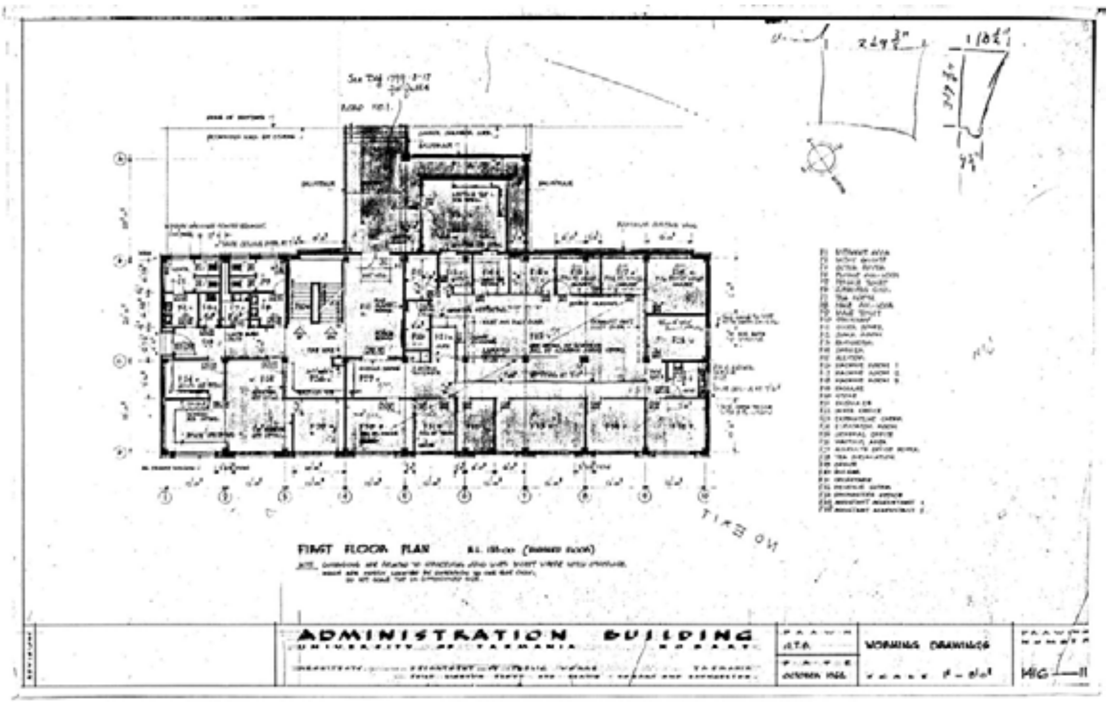
Key Plans



Building 22 – Administration Building

Ground Floor Plan – Administration Building. Prepared by Department of Public Works -Tasmania in association with Philp Lighton Floyd Beattie, 1962

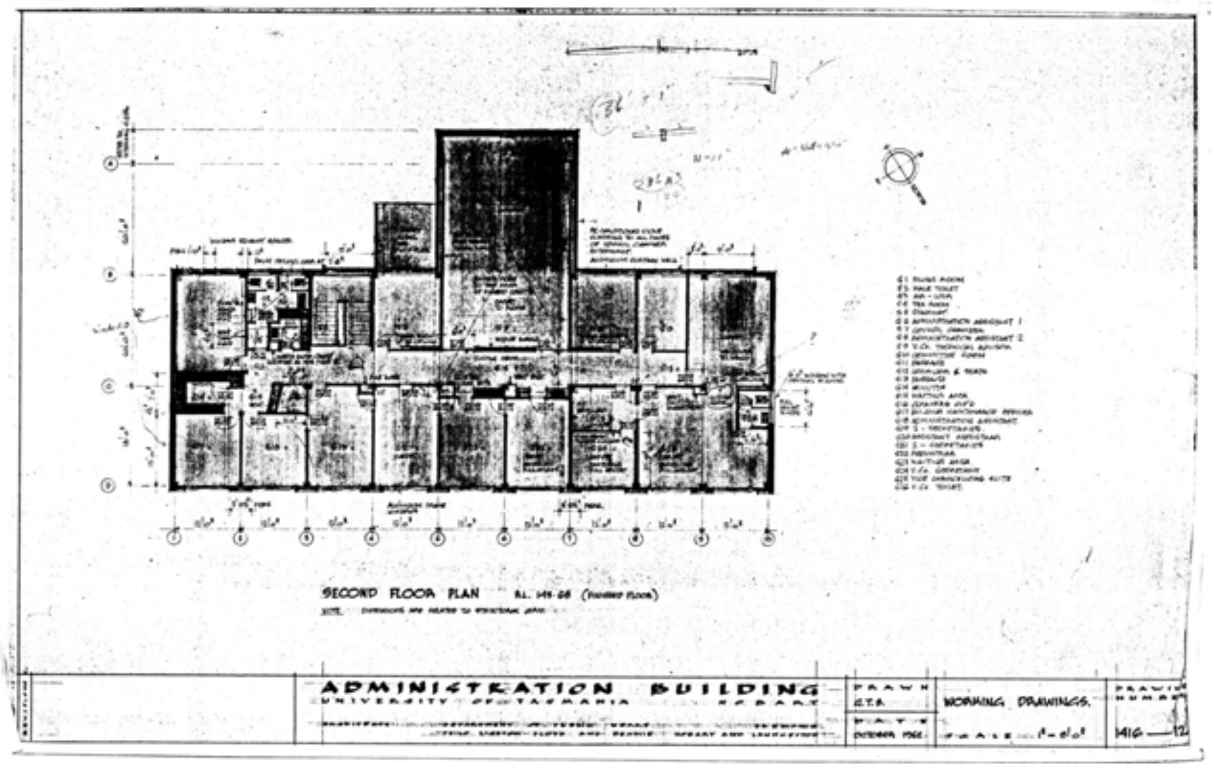
Source: Hanger 35-022.tif



Building 22 – Administration Building

First Floor Plan – Administration Building. Prepared by Department of Public Works -Tasmania in association with Philp Lighton Floyd Beattie, 1962

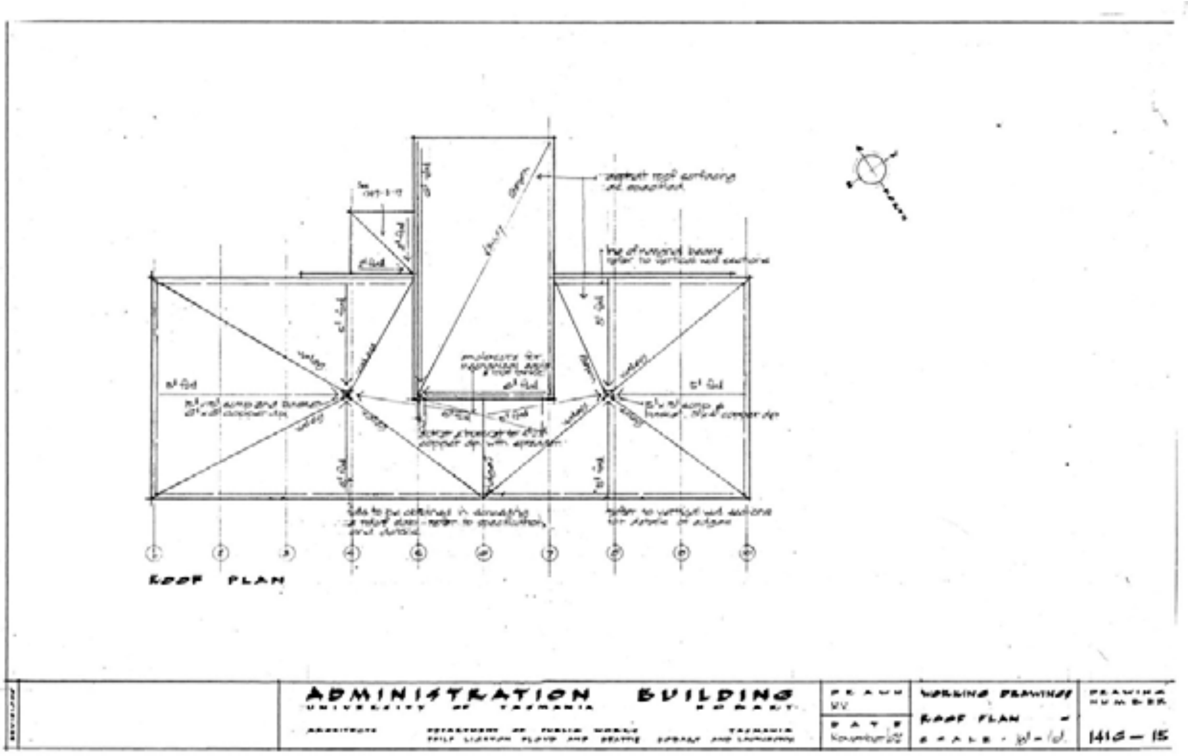
Source: Hanger 35-023.tif



Building 22 – Administration Building

Second Floor Plan – Administration Building. Prepared by Department of Public Works -Tasmania in association with Philp Lighton Floyd Beattie, 1962

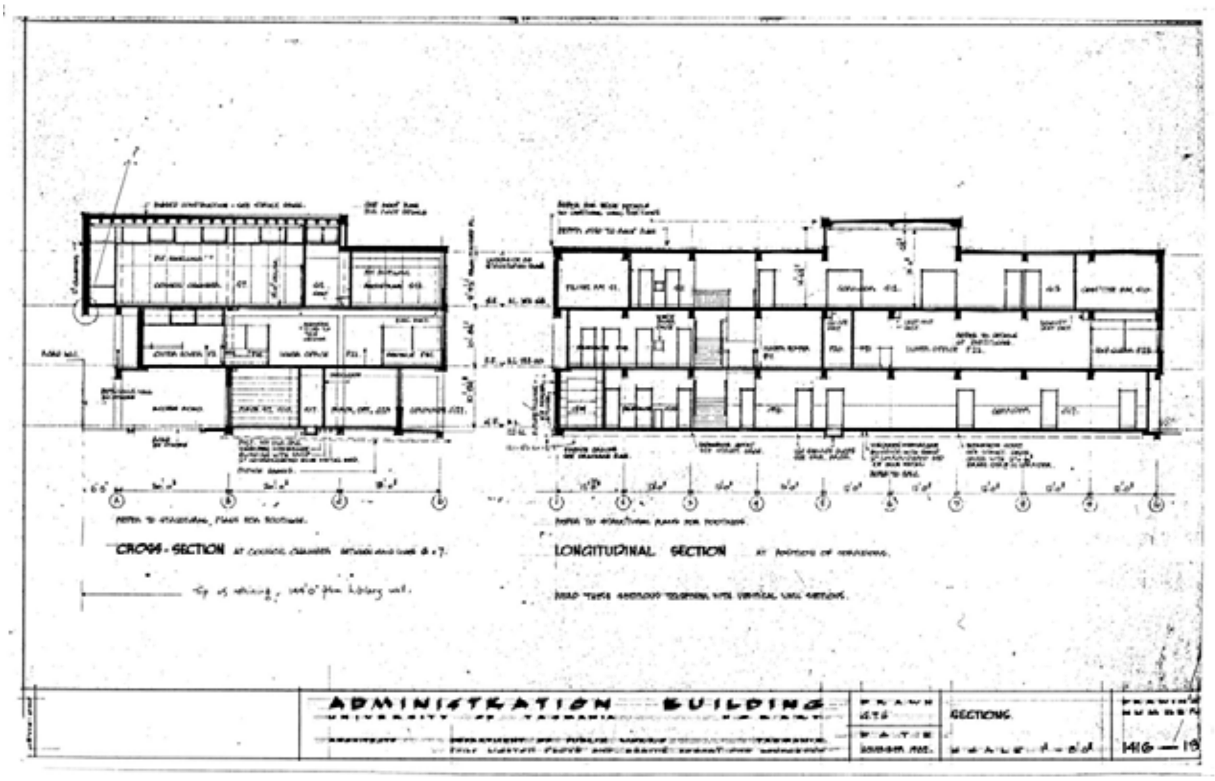
Source: Hanger 35-024.tif



Building 22 – Administration Building

Roof Plan – Administration Building. Prepared by Department of Public Works -Tasmania in association with Philp Lighton Floyd Beattie, 1962

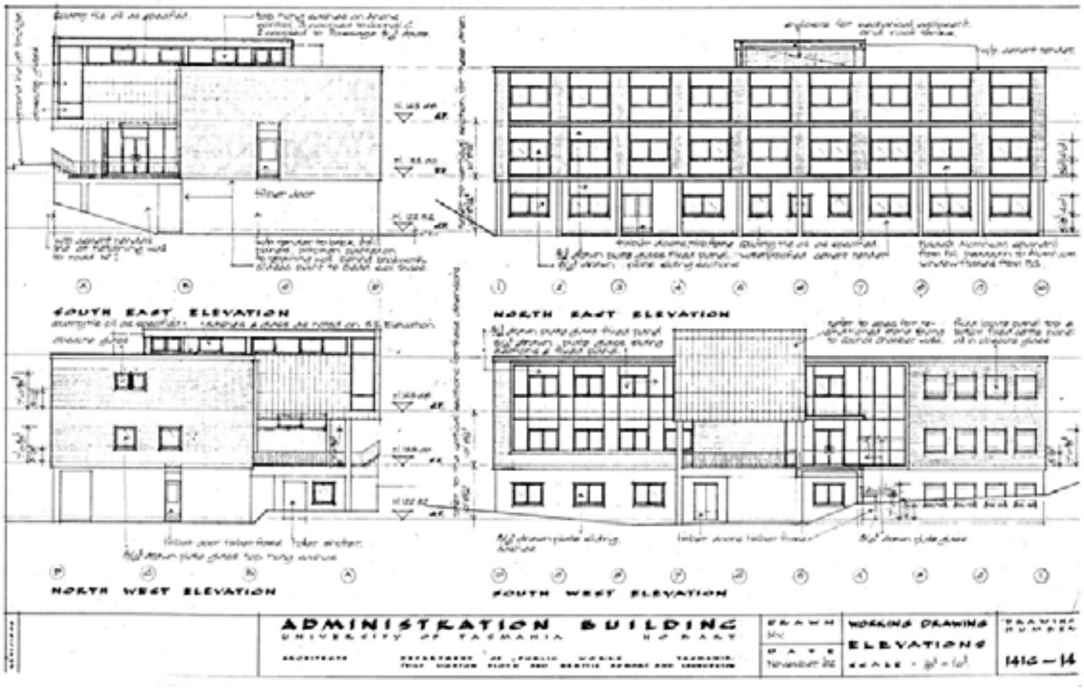
Source: Hanger 35-031.tif



Building 22 – Administration Building

Sections – Administration Building. Prepared by Department of Public Works -Tasmania in association with Philp Lighton Floyd Beattie, 1962

Source: Hanger 35-025.tif



Building 22 – Administration Building

Elevations – Administration Building. Prepared by Department of Public Works -Tasmania in association with Philp Lighton Floyd Beattie, 1962

Source: Hanger 35-026.tif

Building 23
Library, Morris Miller

Building No:	Building Name:	Previous Name:
23	Library, Morris Miller	Library
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1958	John F.D. Scarborough	1959
Date of Major Extension	**Architect for Extension**	**Description**
1968	Department of Public Works - Tasmania. Chief architect S.T. Tomlinson	Extension

Description of Current Building

Exterior Form

The Morris Miller Library is T-shaped in plan and features a regular 23' structural column grid. The northern wing, running east to west was originally two storeys high (now four storeys) whilst the southern wing was originally three storeys (now five storeys). The 1968 building extensions use the same structural grid, architectural language, and materiality of the original building. It appears that exactly the same detail and materiality was applied and the whole building reads coherently as a single designed structure. The original plans were not sited and it is possible that the building as finally built was the early design and that only the lower floors were initially constructed.

The main entrance is via a covered undercroft at the southern end of the central southern wing. The east and west wings generally mirror each other with a continuous fully glazed curtain wall to the northern façade featuring horizontal bands of aluminium glazed windows with bright red coloured glass spandrels and external horizontal aluminium louvres for solar protection. This glazed curtain wall is book ended by two identical solid blonde face brick walls at either end of the building. A fully glazed staircase features in the both the south-eastern corner of the east wing and south-western corner of the west wing, with the remainder of the façade finished with window-less blonde face brick. The ribbons of horizontal aluminium windows with bright red colour glass spandrels are also used on the southern façade of the both the east and west wings.

Although originally designed and built at the same time, the southern wing has a different architectural expression to the north-facing east-west wing. The east and west façades of the southern wing present sandstone-clad vertical columns with rows of horizontal aluminium windows installed between the expressed column grid. Pre-cast concrete spandrel panels finished with textured natural stone aggregate align with the window mullions to form a regular rhythm to the façade between the columns.

	The windows to the western façade of the southern wing have continuous rows of vertical aluminium louvres to provide solar protection. The entrance foyer has had modern alterations, however the date and architect for the alterations is not known noting that the work is similar to other post modern building entries that were built around the campus by Viney and Forward.
Interior Form	The building features a generous two-storey central rectangular void space to the south of the intersection of the wings. The eastern wing also contains large two-storey void spaces to the north and south facades. The main library stair and amenities are located in a block at the centre of the intersection of the wings. Further stairs are located at the eastern and western ends of the building and at the centre of the southern wing. The building is largely intact and has a spacious light-filled feeling, primarily due to the generous main stair, void spaces and continuous glazing to the facades.
Significance	The library is of high heritage significance and is one of a small group of innovative and exemplary modernist buildings on the campus. Designed by John F Scarborough, one of Australia's leading library and institutional architect at the time, it forms part of a folio of work he designed across Australia that is recognised widely
Key Elements	The external form, materiality and detail of the building apart from the new entry. The immediate setting. A broadly open internal spatial arrangement commensurate with the library use. The external stairs expressed on each end of the building with glazed walls
Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 23 – Library, Morris Miller

Southern wing and main entrance via building under-croft

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

North-eastern corner

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

Eastern elevation of the eastern wing, note glazed curtain wall to the stair circulation

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

View of the northern elevation of the Library from the Chemistry building rooftop

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

Southern façade of the western wing

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

North-western corner

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

Northern facade

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

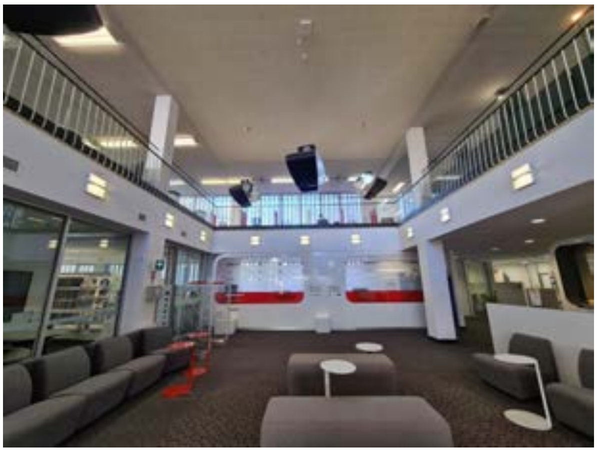
Detail of the coloured glass curtain wall to the northern facade

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

Double height void space with mezzanine beyond the main entrance to the library

Source: Paul Davies Pty Ltd



Building 23 – Library, Morris Miller

Double height void space with mezzanine beyond the main entrance to the library

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

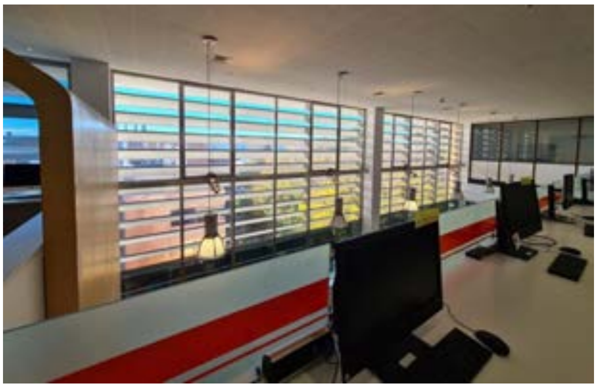
View of the double height void space to the southern side of the eastern wing

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

View of the central circulation stair

Source: Paul Davies Pty Ltd



Building 23 – Library, Morris Miller

View of the shaded northern windows to the double height void space to the northern side of the eastern wing

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

Detail view of the aluminium glazed windows and external louvre blades for solar protection.

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

View of the shaded northern windows to the double height void space to the northern side of the eastern wing

Source: Paul Davies Pty Ltd

Building 23 – Library, Morris Miller

Interior view of the fourth floor of eastern wing

Source: Paul Davies Pty Ltd

Early Photos

Building 23 – Library, Morris Miller

1959 black and white print

Excavation for Library

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 15

Building 23 – Library, Morris Miller

1959 black and white print

Foundations for Library

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 16

Building 23 – Library, Morris Miller

1965 black and white print

South-western facades

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 38

Building 23 – Library, Morris Miller

1970 black and white print

View of the eastern façade

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 54

Building 23 – Library, Morris Miller

1960 colour photograph

South-western facades

Source: Libraries Tasmania Online Collection; Item Number AA375-1-1133

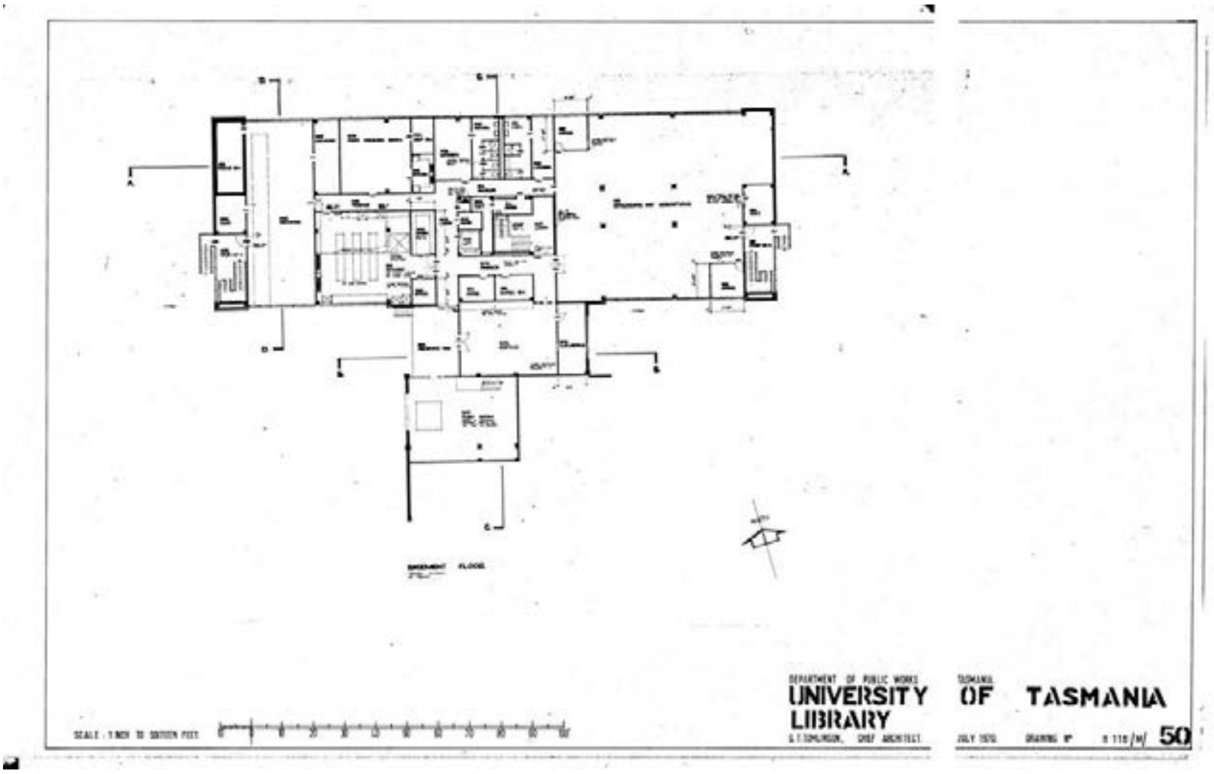
Building 23 – Library, Morris Miller

1965 Photograph

Chemistry Building (image left), Morris Miller Library (image right)

Source: Libraries Tasmania Online Collection; Item Number AB713-1-9256

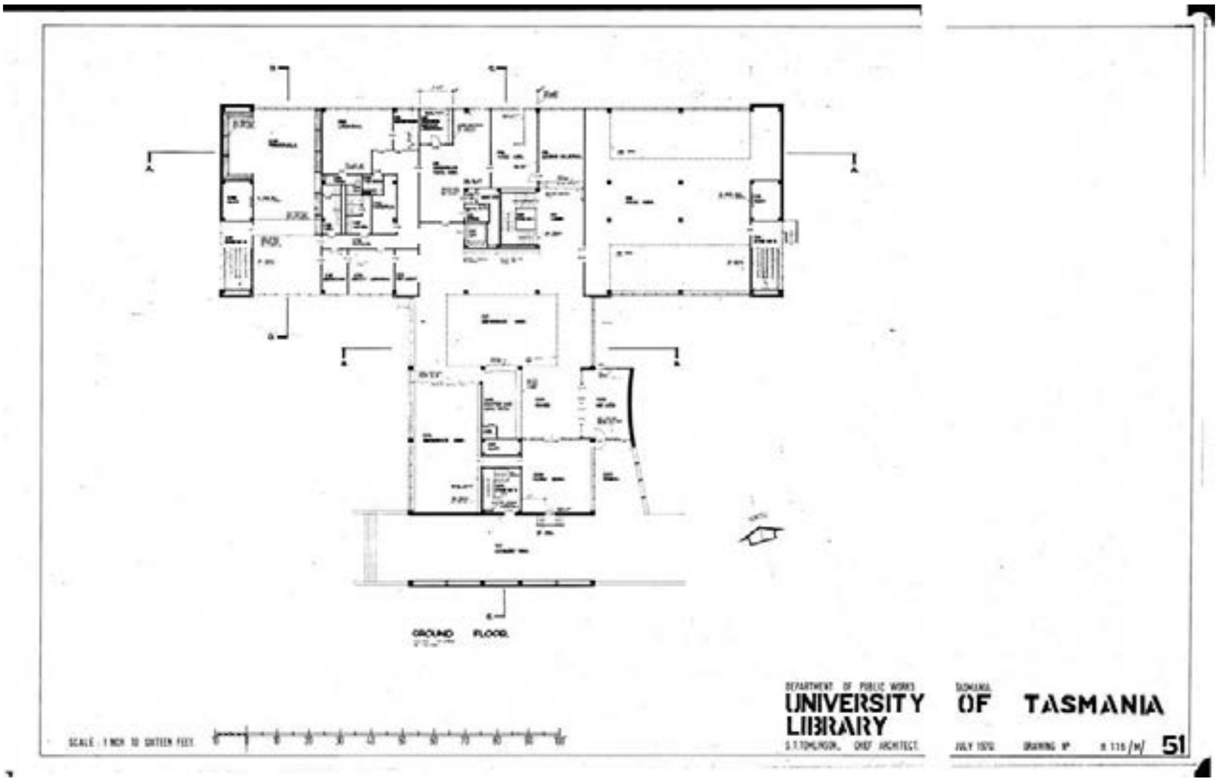
Key Plans



Building 23 - Library, Morris Miller

Basement Floor Plan – Library, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1958 plans prepared by John F.D. Scarborough were not available.

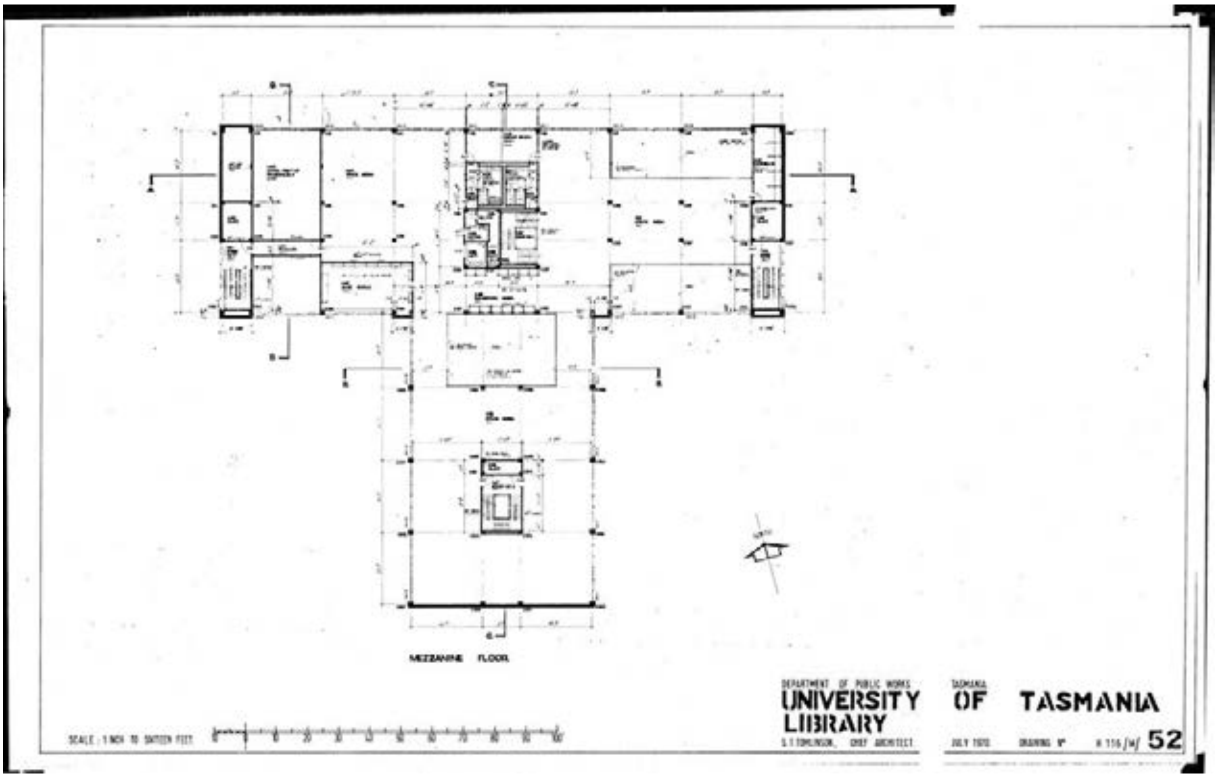
Source: Box 6-061.tif



Building 23 - Library, Morris Miller

Ground Floor Plan – Library, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1958 plans prepared by John F.D. Scarborough were not available.

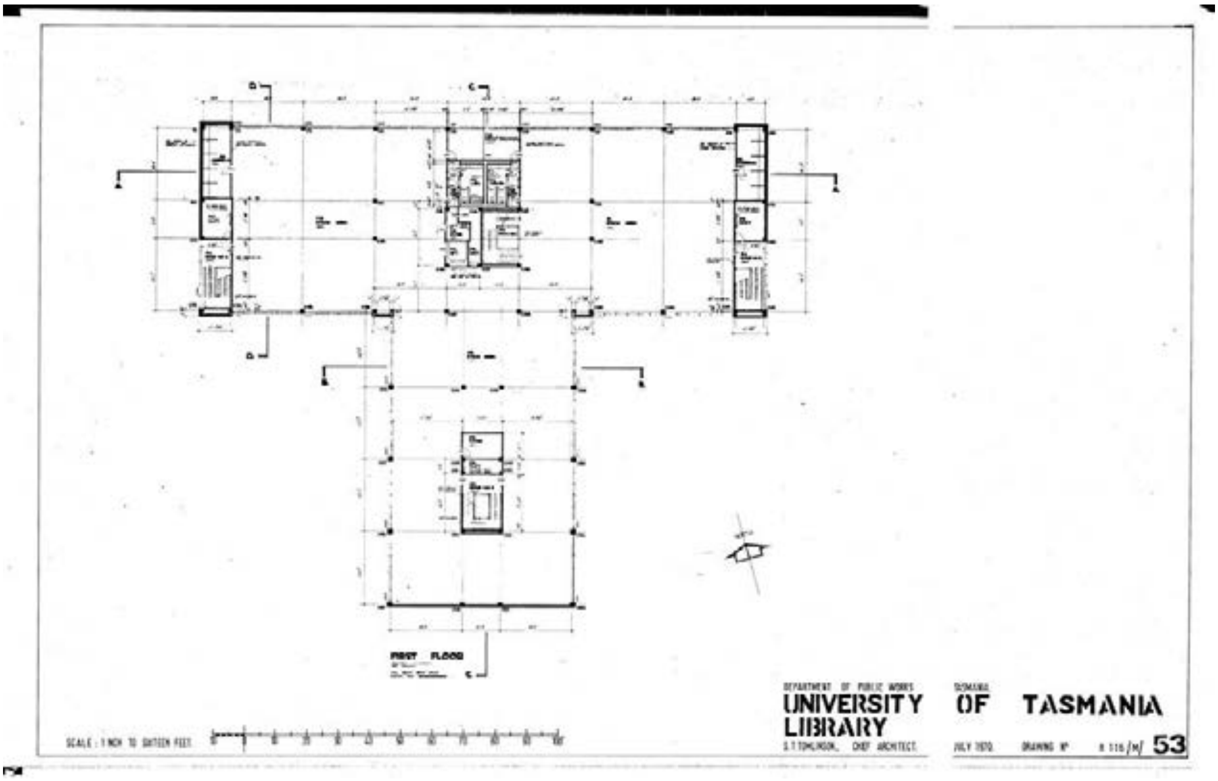
Source: Box 6-062.tif



Building 23 - Library, Morris Miller

Mezzanine Floor Plan – Library, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1958 plans prepared by John F.D. Scarborough were not available.

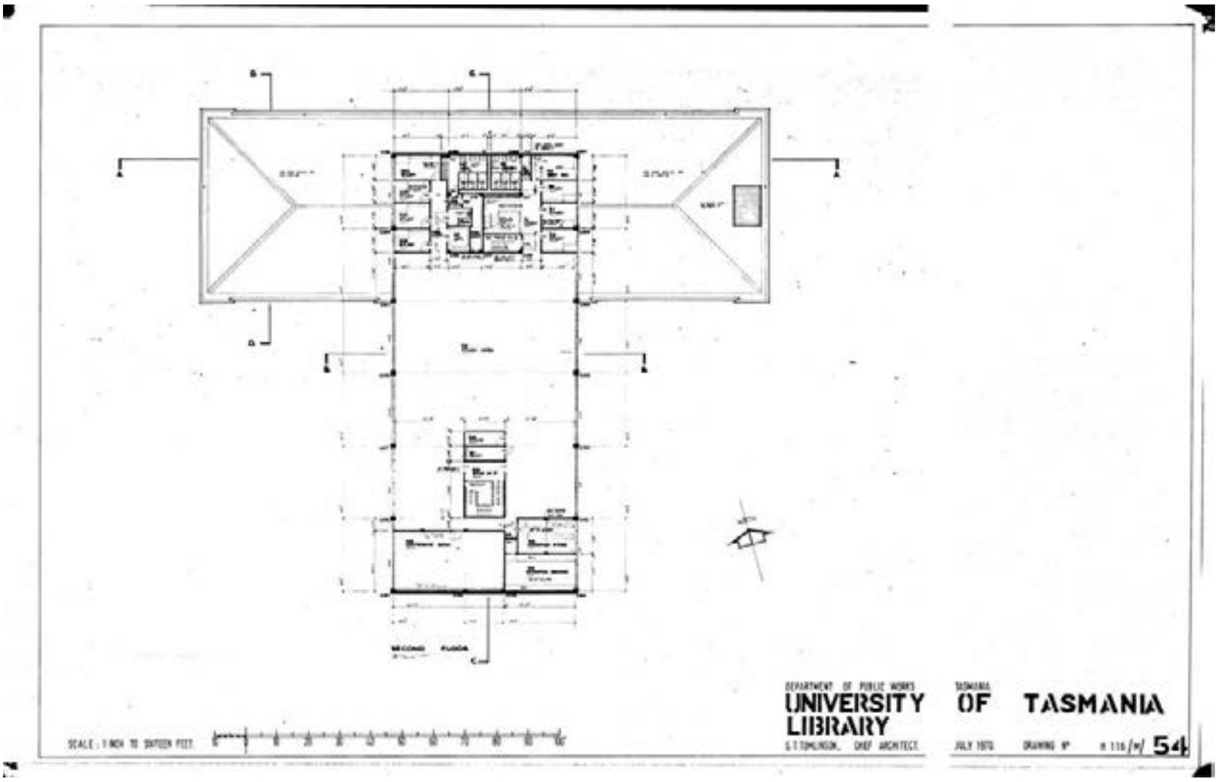
Source: Box 6-063.tif



Building 23 - Library, Morris Miller

First Floor Plan – Library, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1958 plans prepared by John F.D. Scarborough were not available.

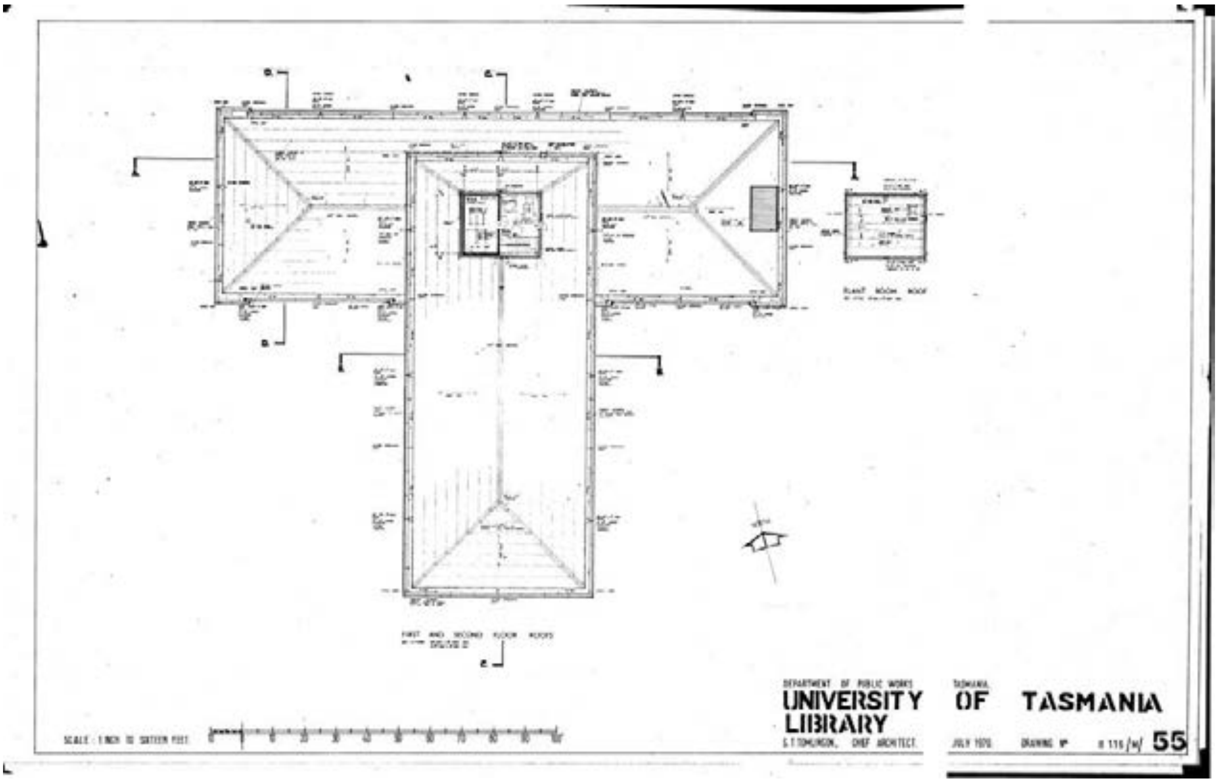
Source: Box 6-064.tif



Building 23 - Library, Morris Miller

Second Floor Plan – Library, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1958 plans prepared by John F.D. Scarborough were not available.

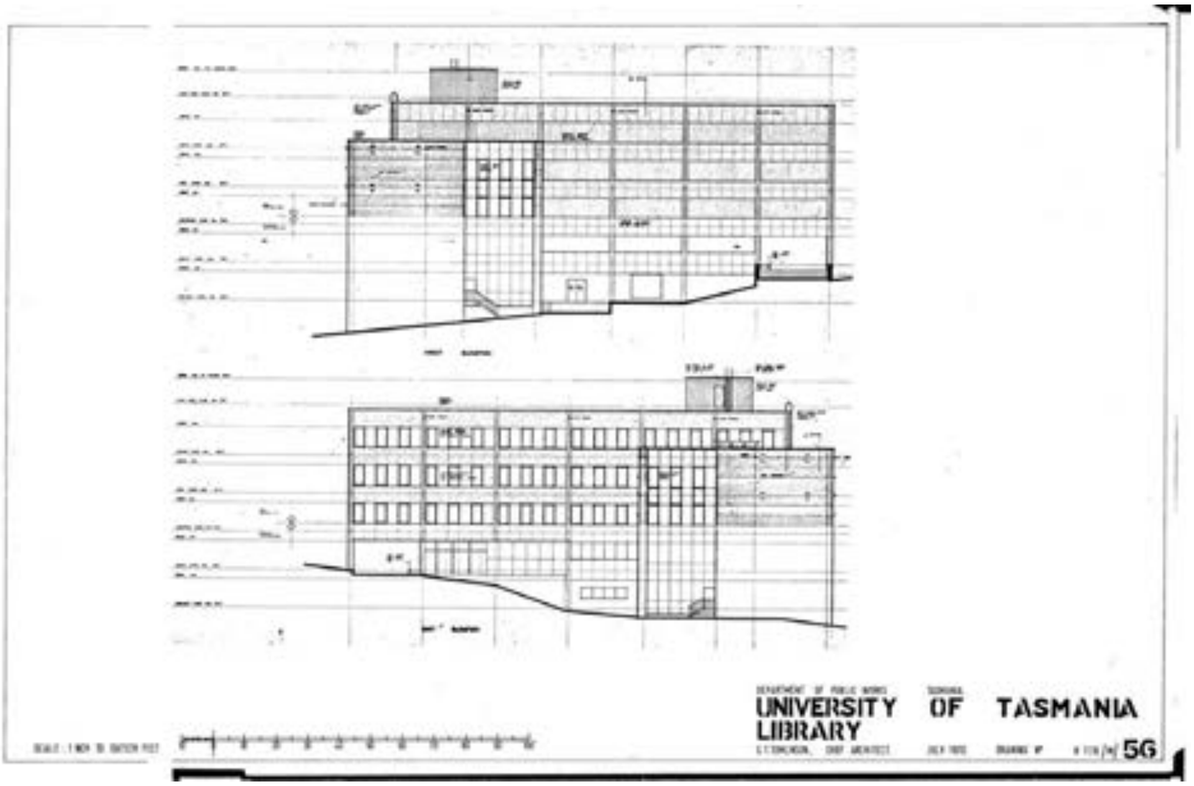
Source: Box 6-065.tif



Building 23 - Library, Morris Miller

Roof Plan – Library, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1958 plans prepared by John F.D. Scarborough were not available.

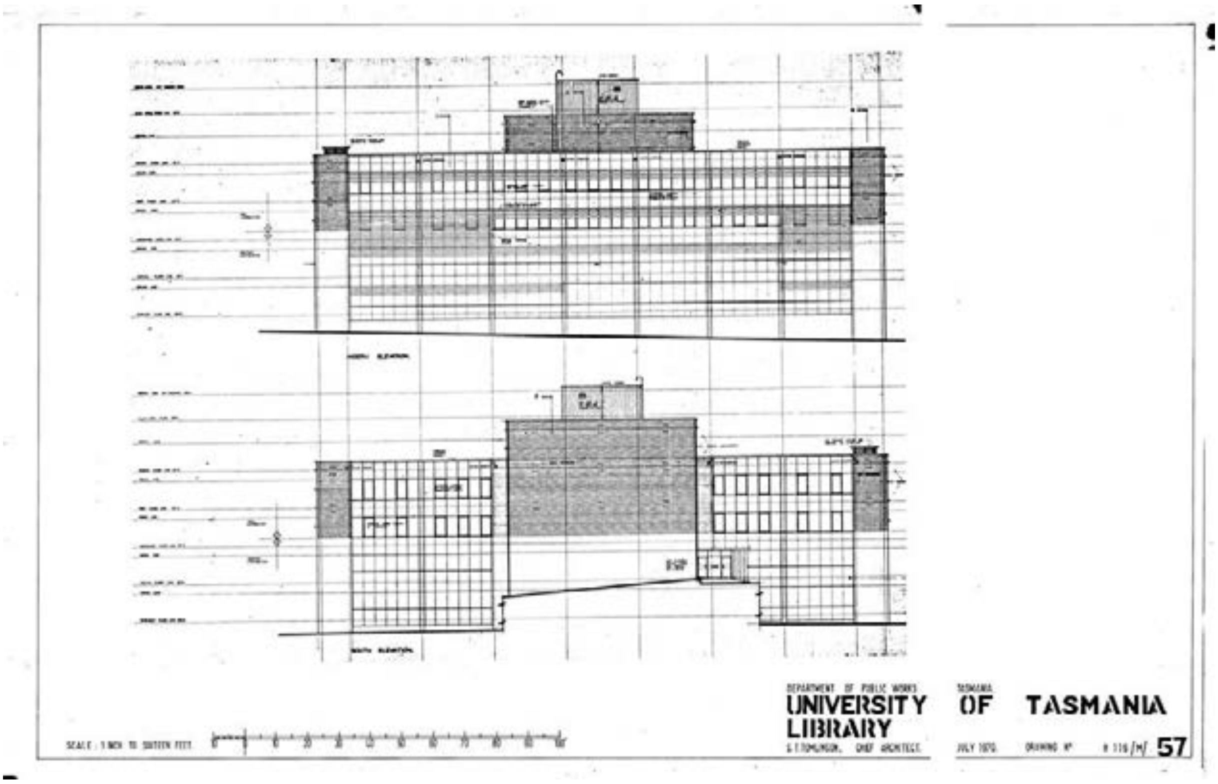
Source: Box 6-066.tif



Building 23 - Library, Morris Miller

Elevations – Library, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1958 plans prepared by John F.D. Scarborough were not available.

Source: Box 6-067.tif



Building 23 - Library, Morris Miller

Elevations – Library, University of Tasmania. Department of Public Works Tasmania, Chief Architect Tomlinson 1970s Drawings from set. Original 1958 plans prepared by John F.D. Scarborough were not available.

Source: Box 6-068.tif

Building 24
Studio Theatre

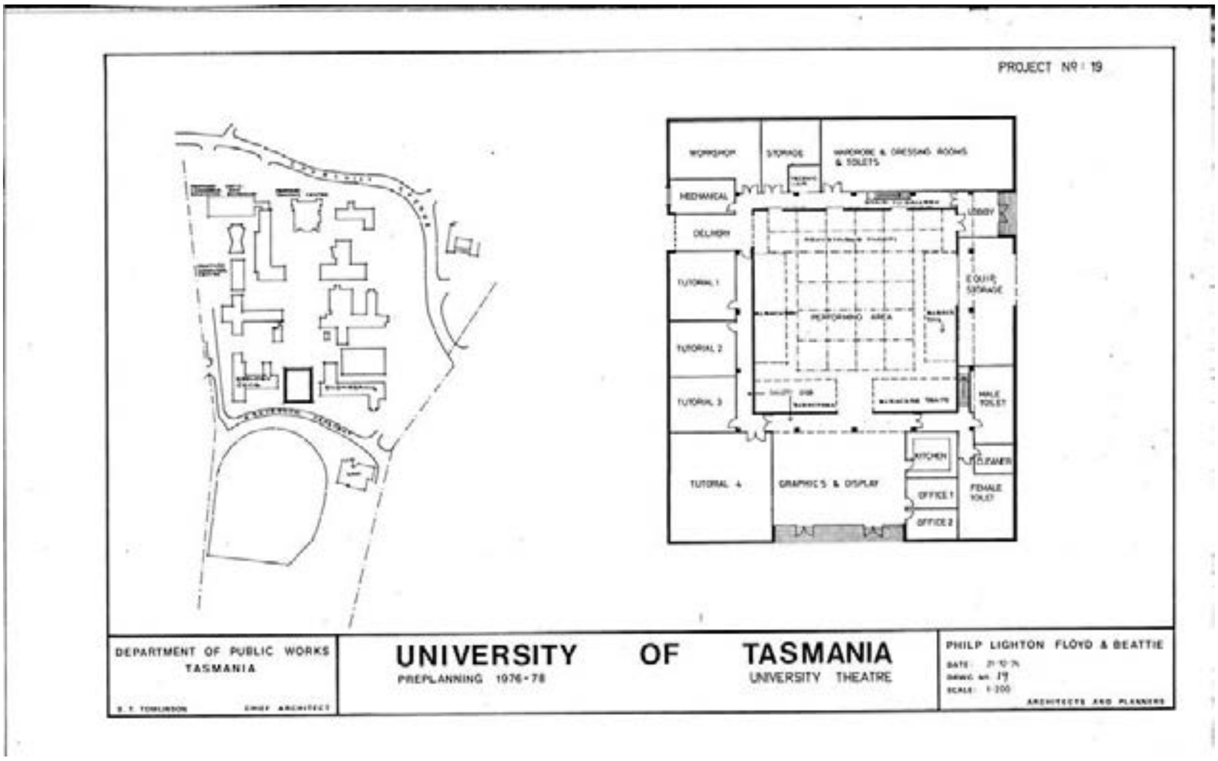
Building No:	Building Name:	Previous Name:
24	Studio Theatre	-
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1980	Philp Lighton Floyd Beattie	-
Date of Major Extension	**Architect for Extension**	**Description**
-	-	-

Description of Current Building

	The early drawings by Philp Lighton Floyd & Beattie from 1974 show a rectangular built form for the Studio Theatre to be located at the bottom of the middle campus facing Grosvenor Crescent between the Geology and Engineering Buildings (where the 1989 Centenary Building is now located). However, the building, to a quite different design was eventually built as a western extension to the University Centre at the top of the middle campus beside the University Centre building. This followed the earlier masterplan that located a Great Hall in that position.
Exterior Form	The plan for the building features irregular rooms to the lower ground floor containing change rooms, wardrobe, stores rooms and amenities. The auditorium on the ground floor is octagonal in plan with an access passage and gallery wrapping around the space. The roof form over the auditorium is an octagonal pyramid clad in Colorbond metal roof deck. The exterior is finished with split rock blockwork and colorbond metal fascias to match the University Centre adjacent. A glazed entrance foyer accessed from Dobson Road forms the link to the University Centre adjacent.
Interior Form	The interior of the theatre space is a typical black box theatre with minimal finishes but with a gallery and extensive theatre fitout
Significance	The building is squeezed between existing buildings and occupies an uncomfortable setting, to the point where it is difficult to read it as a building separate from the University Centre. The building has no heritage significance.
Key Elements	-

Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

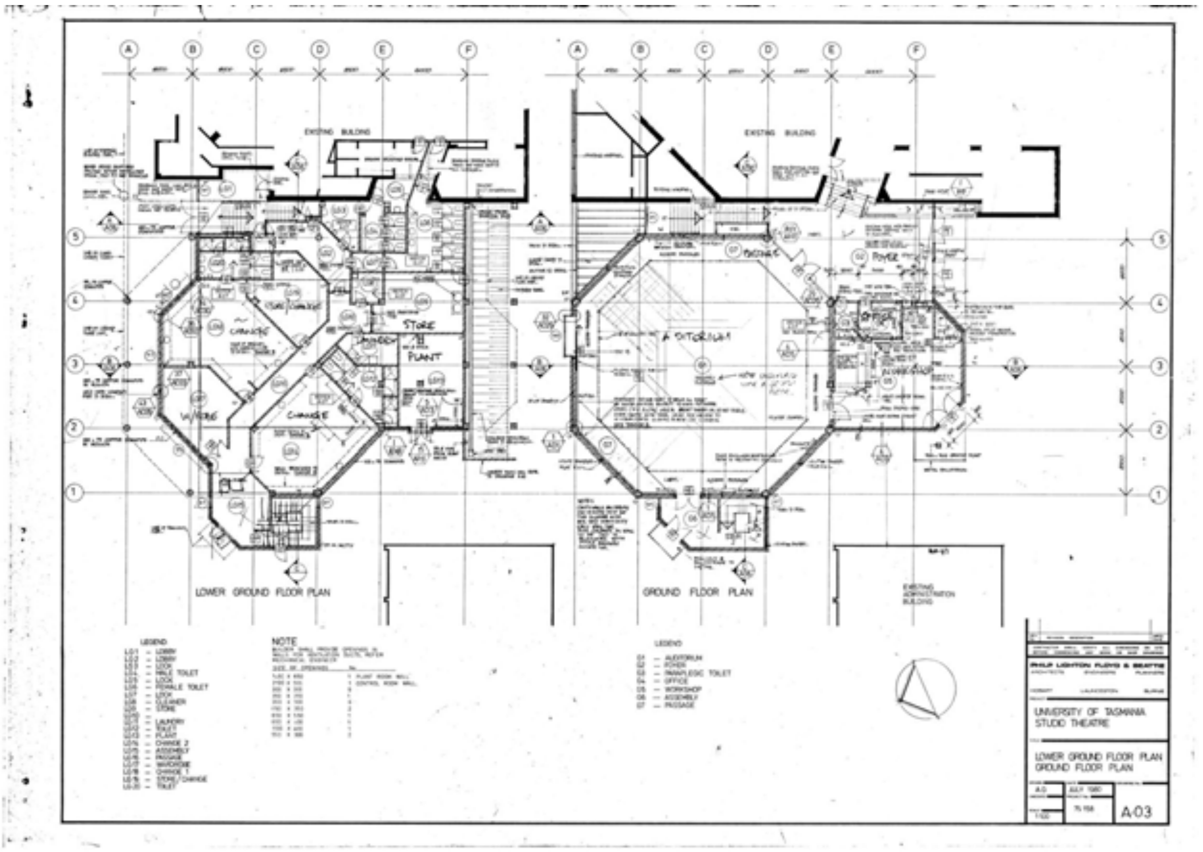
Key Plans



Building 24 – Studio Theatre

Preplanning 1976-1978 – Studio Theatre, University of Tasmania. Prepared by Philp Lighton Floyd Beattie, 1974

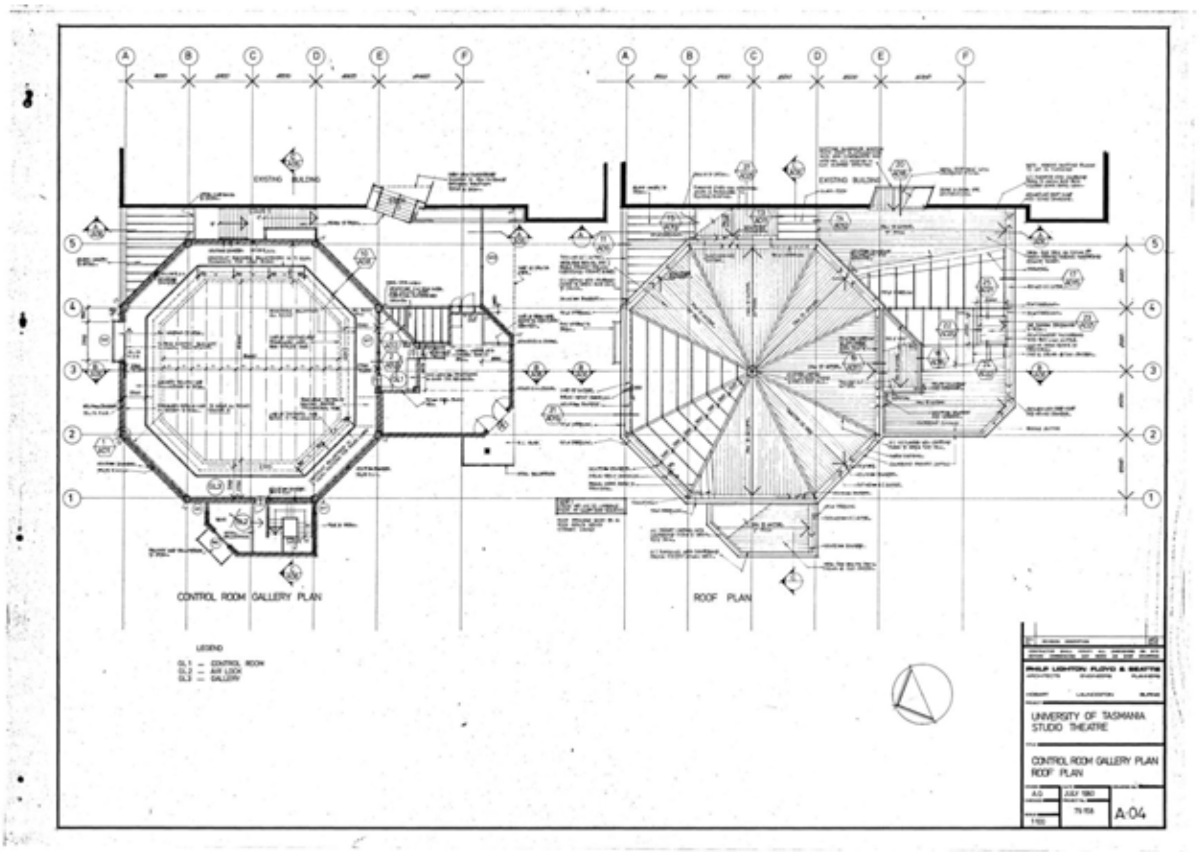
Source: Box 1a-001.tif



Building 24 – Studio Theatre

Lower Ground Floor and Ground Floor Plan – Studio Theatre, University of Tasmania. Prepared by Philp Lighton Floyd Beattie, 1980

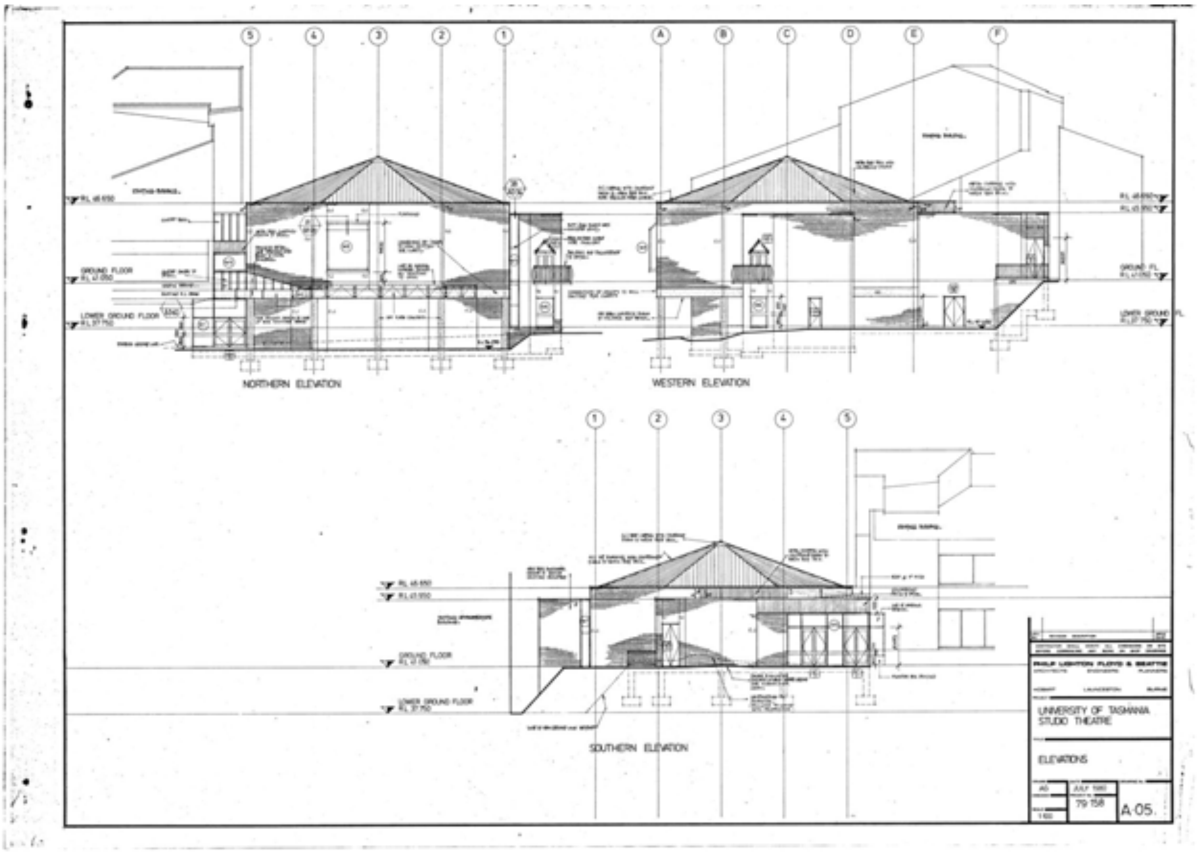
Source: Hanger 36-006.tif



Building 24 – Studio Theatre

Control Room Gallery and Roof Plans – Studio Theatre, University of Tasmania. Prepared by Philp Lighton Floyd Beattie, 1980

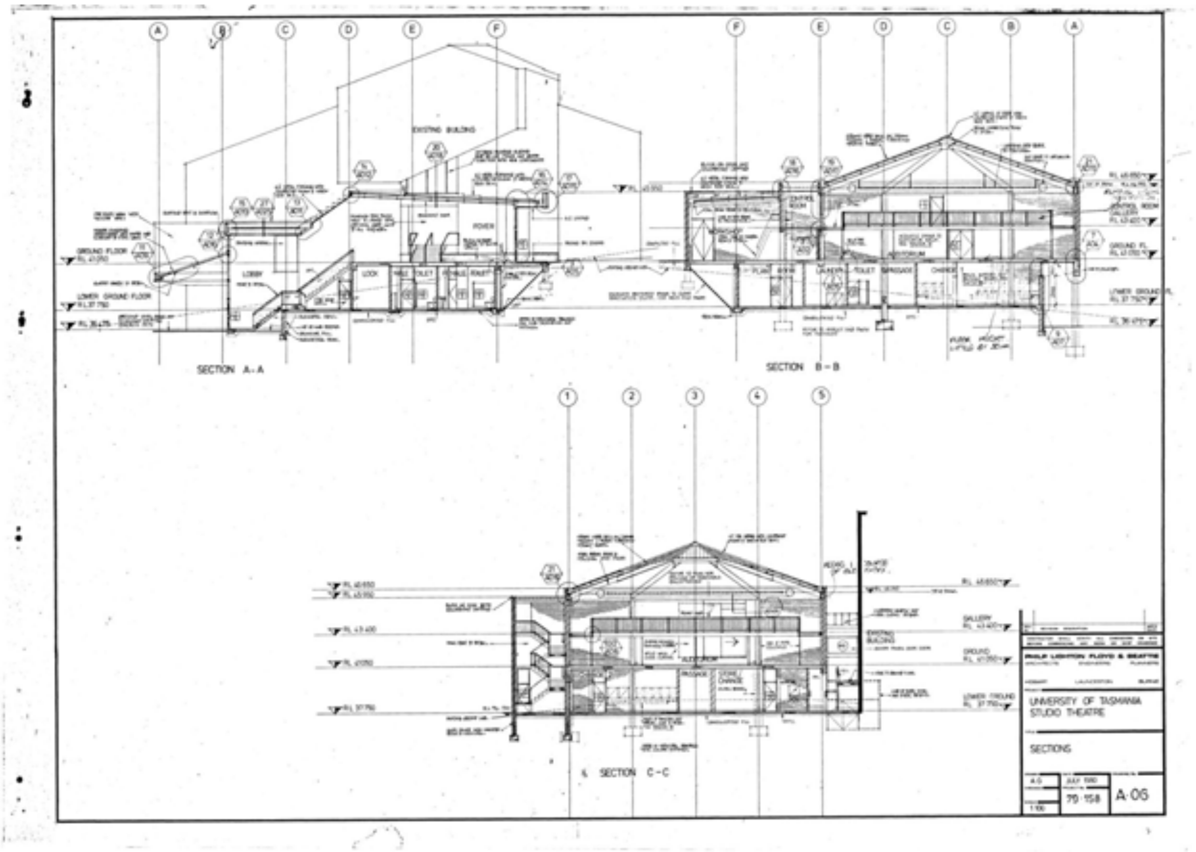
Source: Hanger 36-010.tif



Building 24 – Studio Theatre

Elevations – Studio Theatre, University of Tasmania. Prepared by Philp Lighton Floyd Beattie, 1980

Source: Hanger 36-007.tif



Building 24 – Studio Theatre

Sections – Studio Theatre, University of Tasmania. Prepared by Philp Lighton Floyd Beattie, 1980

Source: Hanger 35-009.tif

Building 25
University Centre

Building No:	Building Name:	Previous Name:
25	University Centre Lazenby's café, Classics museum, John Elliot	Teaching Centre

Date of Construction or Date of Original Drawings	Original Architect	Date Opened
1974	Philip Lighton Floyd Beattie in association with Civil and Civic	c1980

Date of Major Extension	Architect for Extension	Description
1990	Michael Viney Architects	Extension for Organ
1995	Eastman Heffernan Walch & Button	Alterations for University Bistro

Description of Current Building

Exterior Form

The original Teaching Centre was designed to sit at the centre of the southern end of the middle campus between the Arts/Psychology Building and the Administration Building. The central lawn terrace of the middle campus terminates with the Teaching Centre. The original building was designed with a dynamic but symmetrical floor plan, containing a fine arts gallery on the north side of the ground floor accessed via a glazed entrance, which steps up a half level to the classics museum on the south side of the building. A large four hundred seat lecture theatre and a two hundred and forty seat lecture theatre are located on the first floor, which due to the fall of the site is accessed on grade via a main foyer on the southern side of the theatres (from the university carpark off Churchill Avenue). The elevations consist of dynamic irregular, but symmetrical, overlapping forms. The second floor contains two eighty seat theatre volumes located symmetrically at the south-eastern and south-western corners and projecting above the roof line for the main auditorium. The main lecture theatre roof forms are built from large-span steel trusses.

In 1990 a small extension was added to the main auditorium to allow a new organ to be installed at the northern end of the theatre.

In 1995 alterations were made to the original ground floor fine art gallery to be converted into a university bistro.

The additions do not relate to the original design.

Interior Form	The interior comprises a range of spaces including theatres, galleries and a museum and at the lower level the main campus café. The spaces are functional. The main theatre contains a fine pipe organ.
Significance	The building has had various additions and changes and was built in a style that appears to be at odds with the character of the campus. The building has no heritage significance.
Key Elements	-
Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

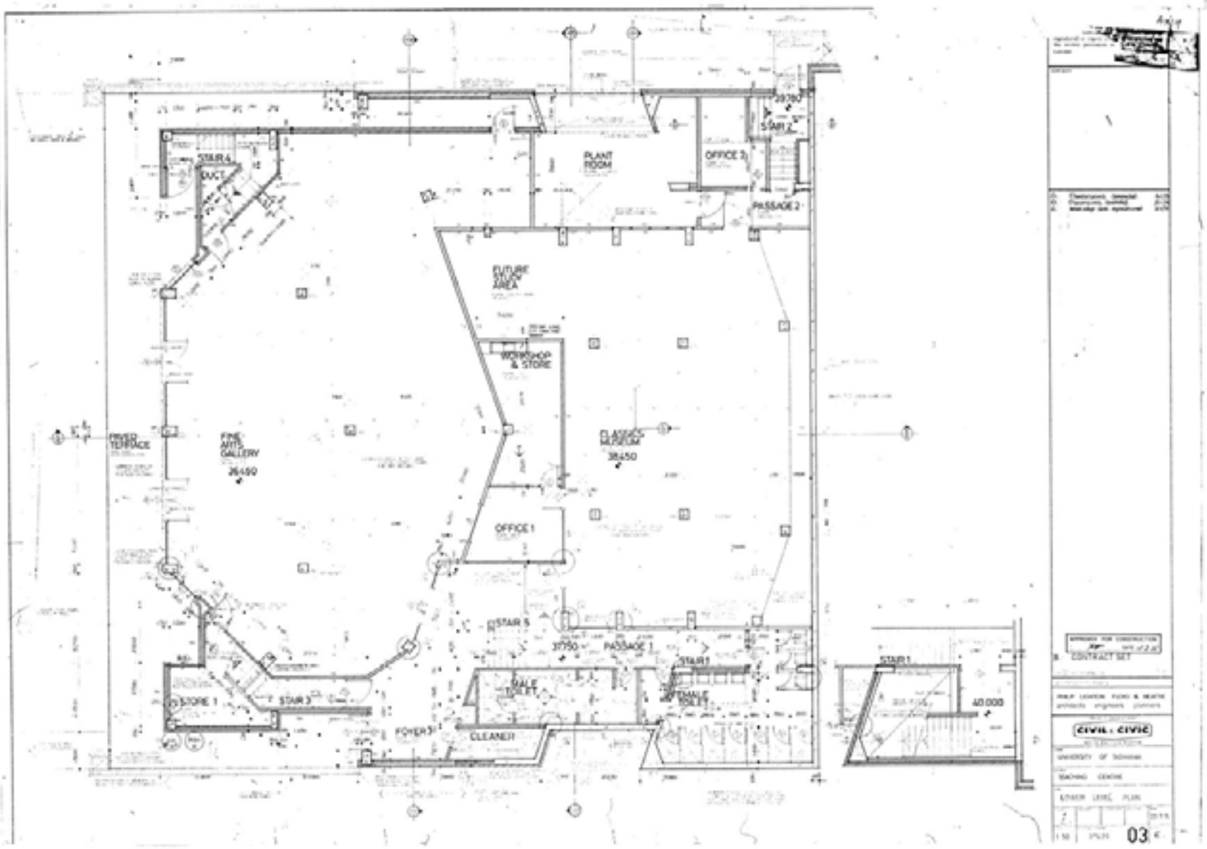
Current Photos

Building 25 – University Centre

Northern facade

Source: Paul Davies Pty Ltd

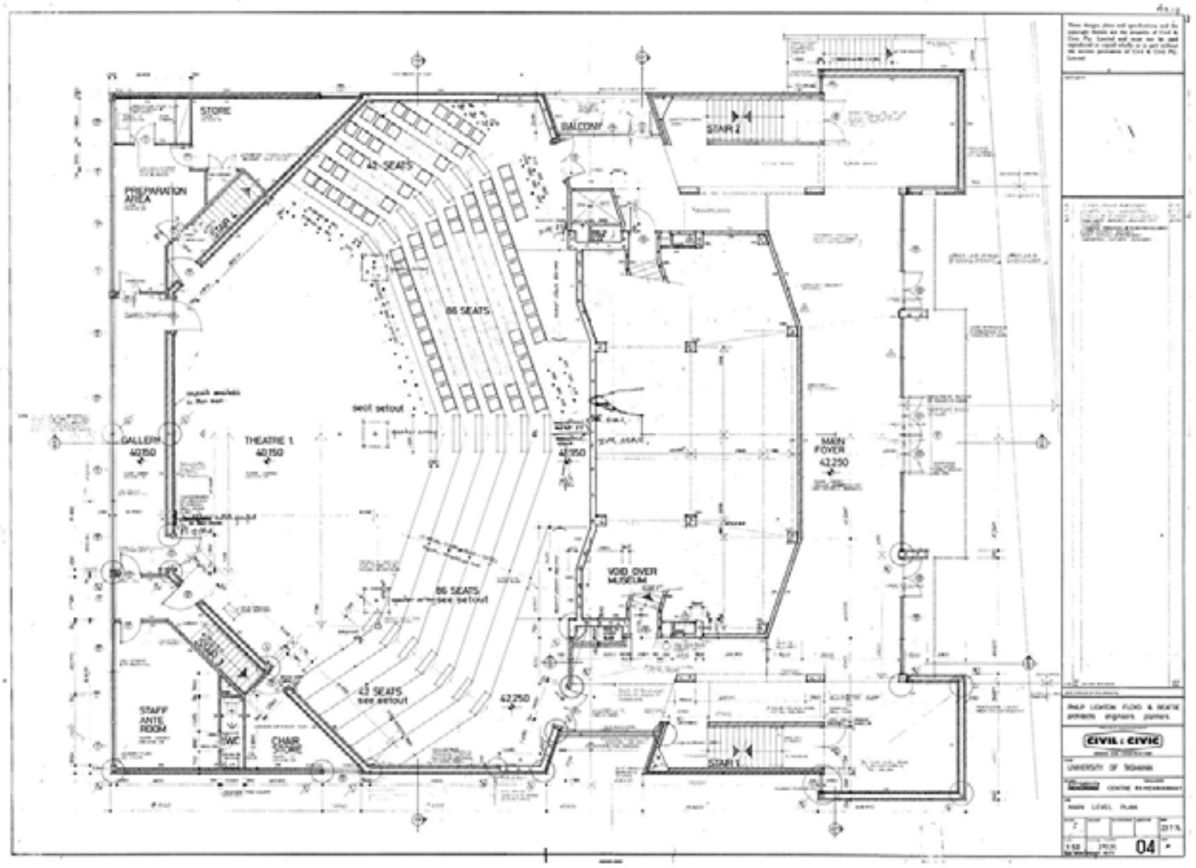
Key Plans



Building 25 – University Centre

Lower Level Plan – Teaching Centre University of Tasmania. Prepared by Philp Lighton Floyd Beattie in association with Civil and Civic Design and Construction, 1974

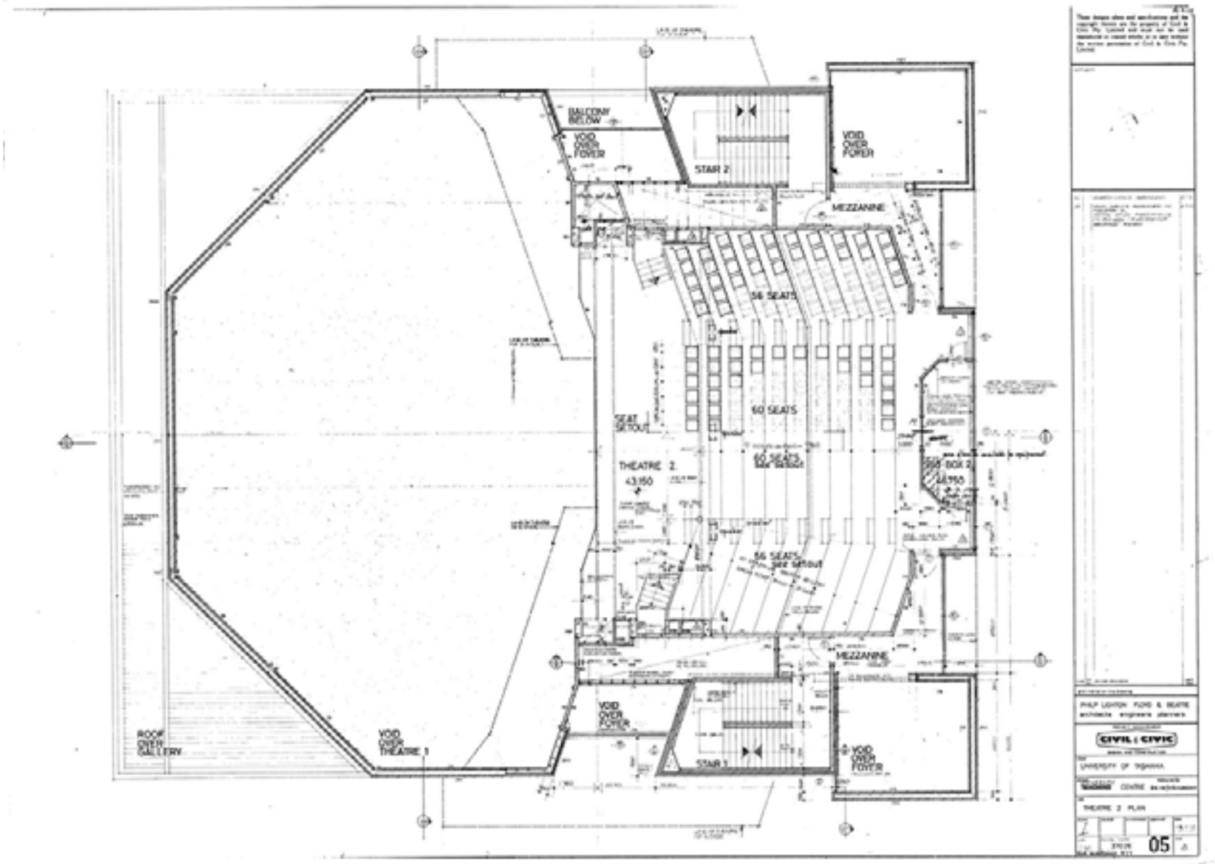
Source: Hanger 68-010.tif



Building 25 – University Centre

Main Level Plan – Teaching Centre University of Tasmania. Prepared by Philp Lighton Floyd Beattie in association with Civil and Civic Design and Construction, 1974

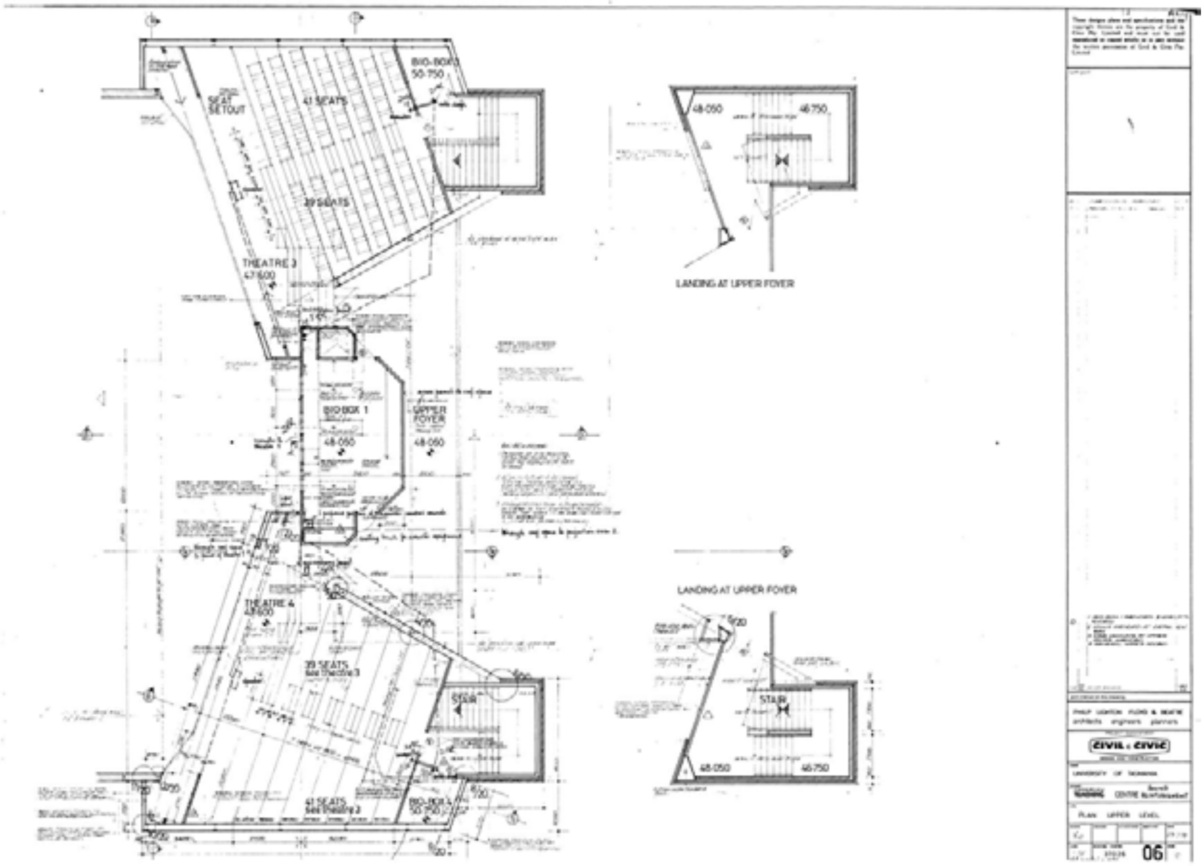
Source: Hanger 68-011.tif



Building 25 – University Centre

Theatre 2 Plan – Teaching Centre University of Tasmania. Prepared by Philp Lighton Floyd Beattie in association with Civil and Civic Design and Construction, 1974

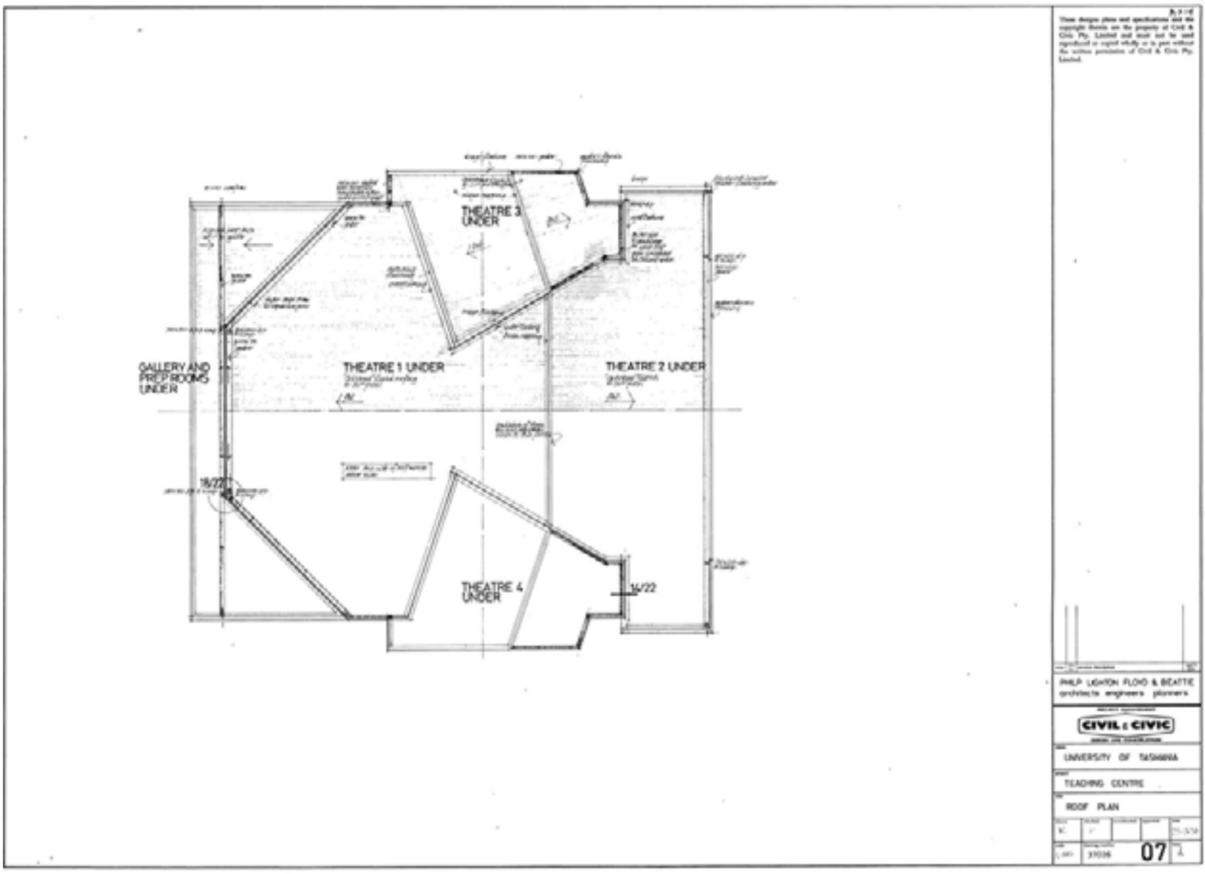
Source: Hanger 68-012.tif



Building 25 – University Centre

Plan Upper Level– Teaching Centre University of Tasmania. Prepared by Philp Lighton Floyd Beattie in association with Civil and Civic Design and Construction, 1974

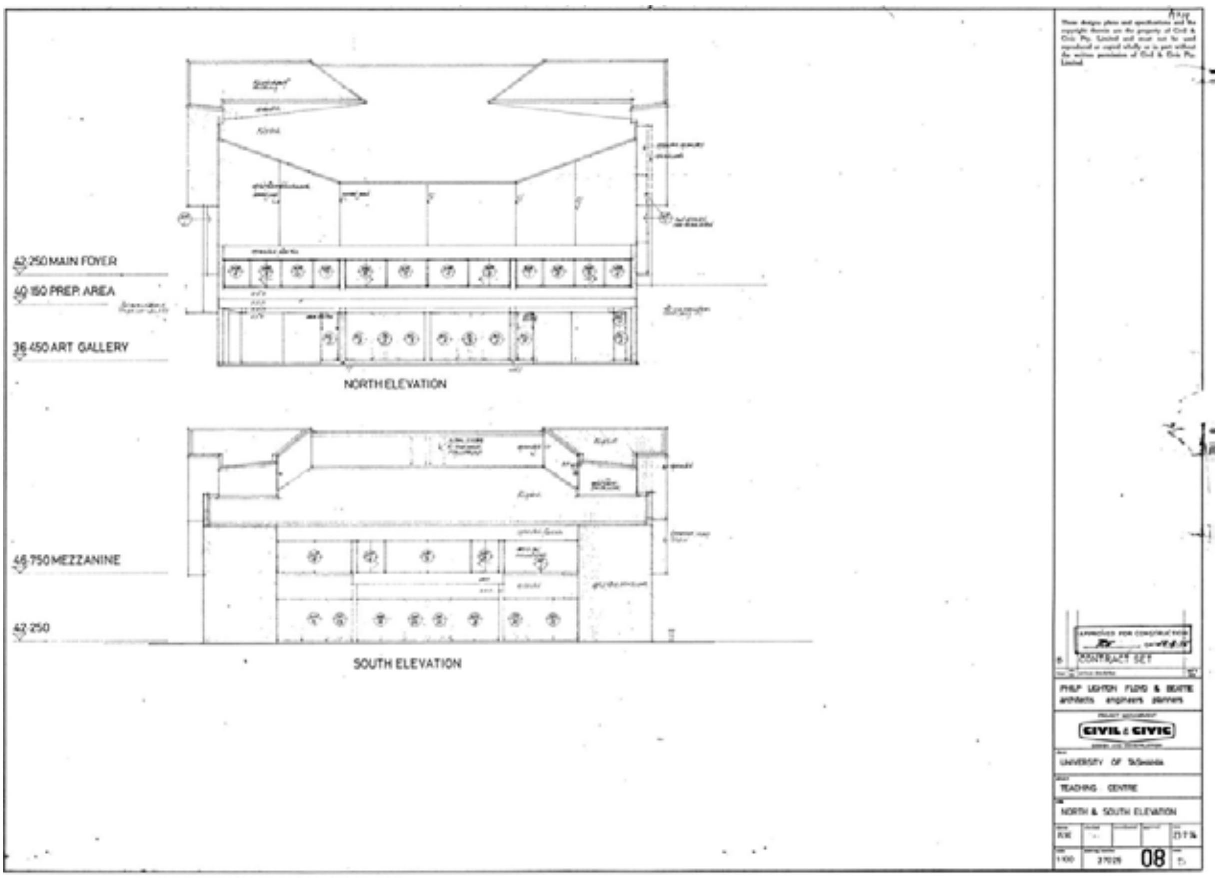
Source: Hanger 68-013.tif



Building 25 – University Centre

Roof Plan – Teaching Centre University of Tasmania. Prepared by Philp Lighton Floyd Beattie in association with Civil and Civic Design and Construction, 1974

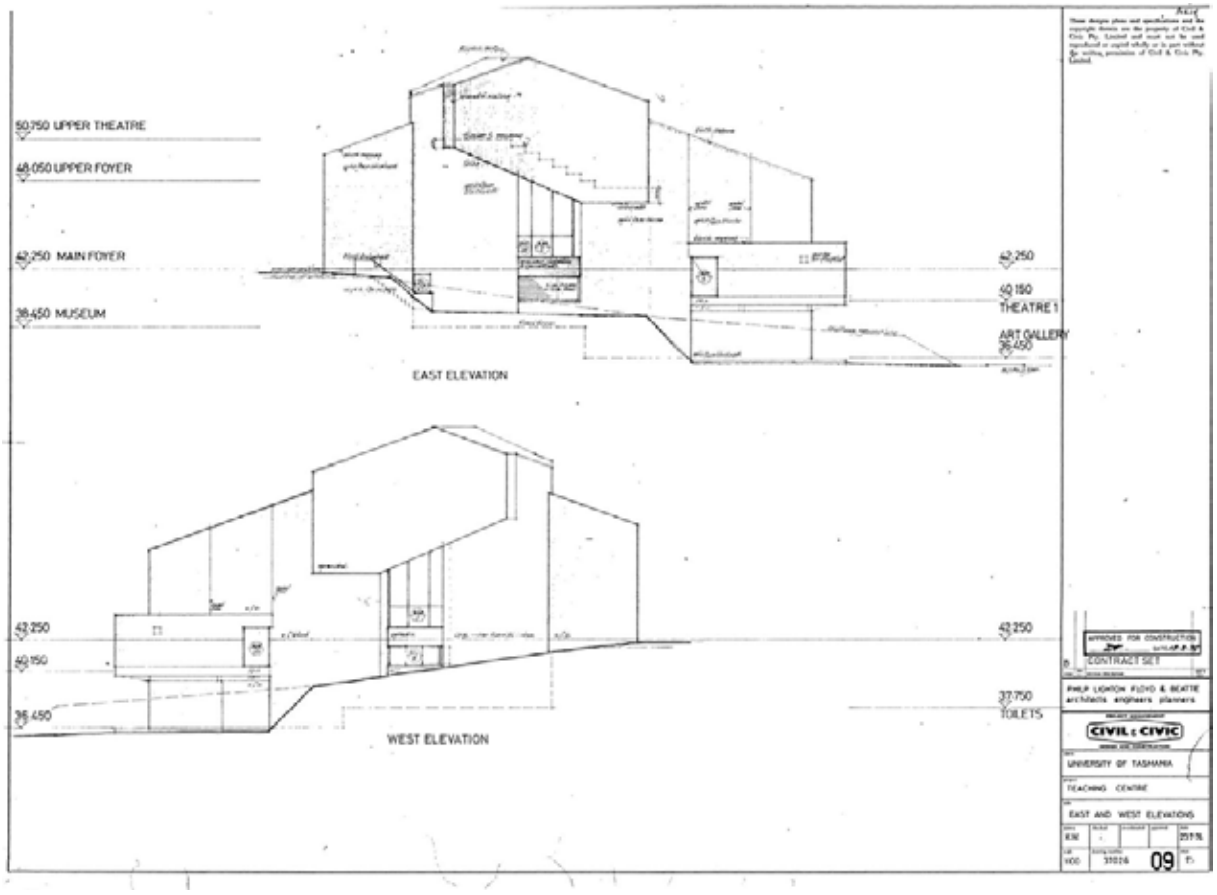
Source: Hanger 68-014.tif



Building 25 – University Centre

Elevations – Teaching Centre University of Tasmania. Prepared by Philp Lighton Floyd Beattie in association with Civil and Civic Design and Construction, 1974

Source: Hanger 68-015.tif



Building 25 – University Centre

Elevations – Teaching Centre University of Tasmania. Prepared by Philp Lighton Floyd Beattie in association with Civil and Civic Design and Construction, 1974

Source: Hanger 68-016.tif

Building 26
Psychology, Social Sciences

Building No:	Building Name:	Previous Name:
26	Psychology, Social Sciences	Arts
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1959	R Brian Howroyd with Cooper and Vincent	1962
Date of Major Extension	**Architect for Extension**	**Description**
1981	ToM	Alterations - accommodation for Sociology
1984	University of Tasmania : Buildings branch - ToM	Alterations
1989		Infil Breezeway

Description of Current Building

Exterior Form	The building is constructed with a steel frame and light-weight external cladding set between a framed perimeter structural system with infill panels. The building is T-shaped with the east west wing comprising a central corridor with small office spaces along its length with larger work spaces in the eastern wing. The internal structural grid adopts every second fin on the exterior of the building. The exterior has a strongly gridded structure with coloured spandrel panels and regular aluminium framed glazing. Stairs are marked by a set of punched out window forms with an irregular arrangement. They are reminiscent of the influence of Le Corbusier in his sculpted building forms. The simple form of the building is modulated by a two level terrace along the main frontage that adjoins the main entry and features a shallow decorative pool. Level changes on the site are well handled with the lower floors set below the pool and a seamless integration of the quite large form into the topography. It is one of the few campus buildings to retain elements of its setting as designed and built. The building massing is simple but sophisticated with the stqirs marked on the external façade by plain rendered walls with irregularly located windows, possibly drawn from the work of Le Corbusier. The building was designed in the round and a part from the removal of the western triangular stair (replaced with a new link to the adjoining building) and has retained its external form without additions.

The main building entry has been redesigned with new doors and is on the middle floor level. The foyer extends through the building with a rear entry leading to the Arts Theatre building which was designed in relation to it.

The building forms part of a group of buildings from the same period that feature brightly coloured infill wall panels, in this case lime green, that add vitality to the overall built form.

Interior Form

The interior is basic apart from the entrance area and stairs which are finely detailed and executed using stone and terrazzo finishes, well detailed joinery elements and finely crafted stairs and openings. Other areas of the building have utilitarian finishes commensurate with the need for large numbers of offices and teaching spaces.

The main entrance, while having altered doors retains most of its designed form and finishes and is one of the finer spaces within the campus. The secondary stair is also a finely detailed stair with matching fenestration to the main stair. The stairs are distinguished with the random arrangement of small windows.

Significance

The Arts Building is significant as one of the core defining buildings on the campus. It is an exceptionally well-designed building that captured with the library and arts theatre building are the peak of post war modernism in Tasmania. While a very simple building in many respects, its response to its scale, the topography, the central campus walkway and its function is sophisticated with a fine design sense that has created a balanced and complete building that has defied additions and change. This alone is a testament to its design success.

Only a handful of buildings remain on the campus without significant intervention. The former Arts Building has had almost no external change and very little intrusive internal change. It remains largely as built.

Its interiors are modest apart from the entry foyer and stair and the secondary stair (the third stair was removed) which are both finely crafted examples of detailed design form the early 1960s. Adaptation of the building will need to retain the public entry and stair spaces and insert any new elements carefully around them.

Another aspect of significance is the relationship of the building to the site and its pivotal role in defining the central campus area. With the library (opposite) they form the pivotal focus of the campus with a balanced arrangement of spaces, elements and site features. Each responds to the topography with elegance and ease creating a level walkway in a north-south direction that characterises how the early site masterplan addressed the topography by creating relatively levelled areas across the contours with the central space stepping up the slope.

Key Elements

The building is significant for:

- its external form generally as seen from all directions
- the coloured spandrel panels
- the aluminium window system
- the small stair and entry windows
- the two-level walkway along the main façade
- the reflection pool
- the entry area, stairs and all remaining finishes
- the secondary stairs and their finishes
- its spatial relationship to the Arts Theatre
- its spatial relationship to the central walkway area

Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 26 – Psychology, Social Sciences

Western façade

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Western façade

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Southern façade of the northern wing

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Northern corner

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Detail of the main entrance on the western facade

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Detail of the pond and garden adjacent to the main entrance

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Western Façade detail

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Detail of the original green floor tiles and marbled wall panel adjacent to the main entrance

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

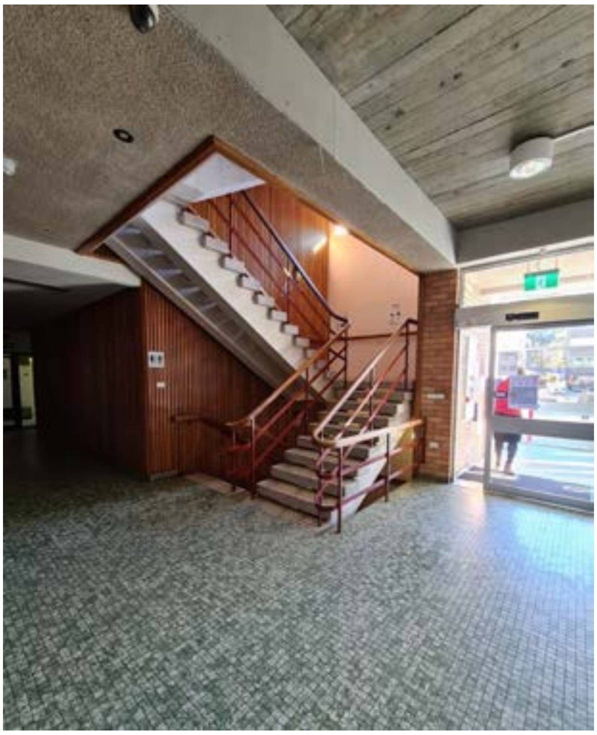
Detail of the eastern facade

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Detail of the southern link between the Psychology and Humanities buildings

Source: Paul Davies Pty Ltd



Building 26 – Psychology, Social Sciences

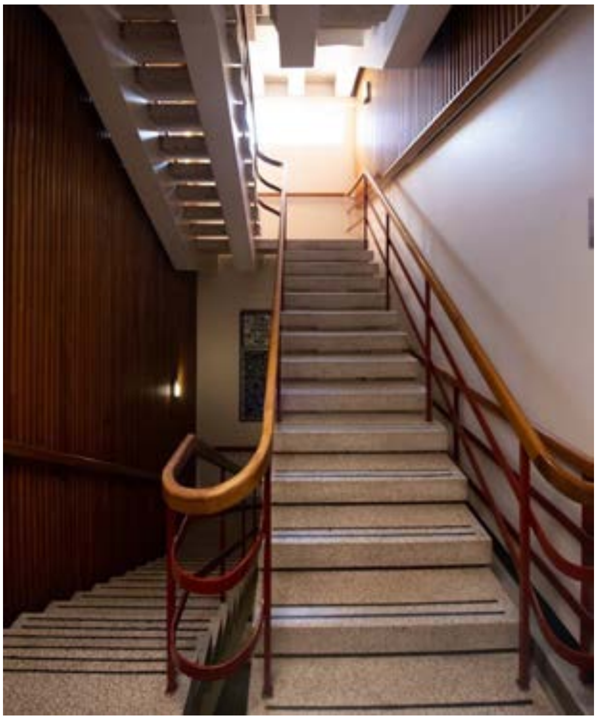
View of the main entrance foyer and stair

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Detail of the main entrance foyer stair

Source: Paul Davies Pty Ltd



Building 26 – Psychology, Social Sciences

Detail of the northern stair

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Detail of the timber handrail

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Detail of the underside of the stair

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Detail of stair and handrail

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Detail of the marble wall panelling to the main entrance foyer and exposed concrete ceilings

Source: Paul Davies Pty Ltd

Building 26 – Psychology, Social Sciences

Typical classroom

Source: Paul Davies Pty Ltd

Early Photos

Building 26 – Psychology, Social Sciences (Arts Building)

1958 black and white print

Foundations for Arts Building

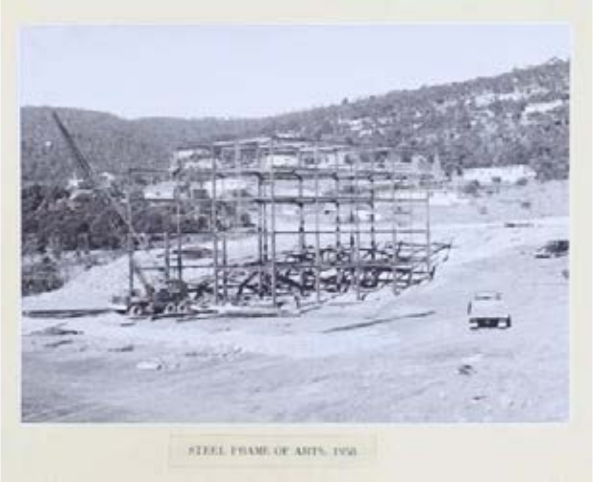
Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 10

Building 26 – Psychology, Social Sciences (Arts Building)

1958 black and white print

Pile-Driving for Arts

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 14



Building 26 – Psychology, Social Sciences (Arts Building)

1958 black and white print

Steel Frame of Arts

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 13

Building 26 – Psychology, Social Sciences (Arts Building)

1962 black and white print

North-eastern facades

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 21

Building 26 – Psychology, Social Sciences (Arts Building)

1962 black and white print

Eastern façade, concrete slabs for the Arts Theatre are shown in the foreground

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 22

Building 26 – Psychology, Social Sciences (Arts Building)

1965 black and white print

Western facade

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 37

Building 26 – Psychology, Social Sciences (Arts Building)

1960 black and white print

South-western facades

Source: Libraries Tasmania Online Collection; Item Number AA193-1-392

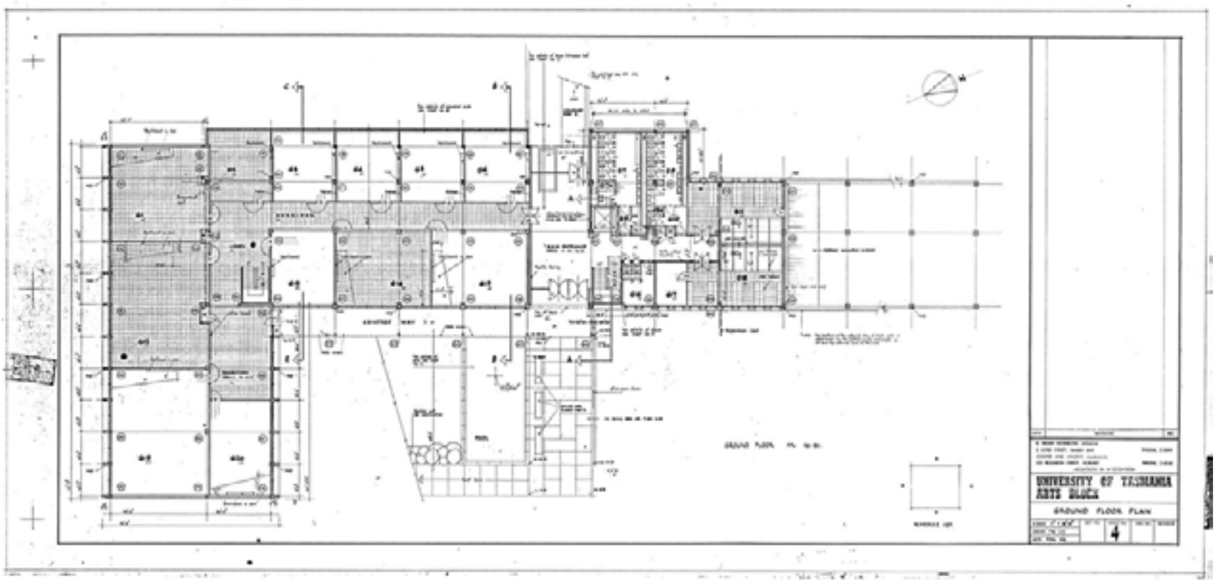
Building 26 – Psychology, Social Sciences (Arts Building)

1969 photograph

Main entrance

Source: Libraries Tasmania Online Collection; Item Number AB713-1-11071

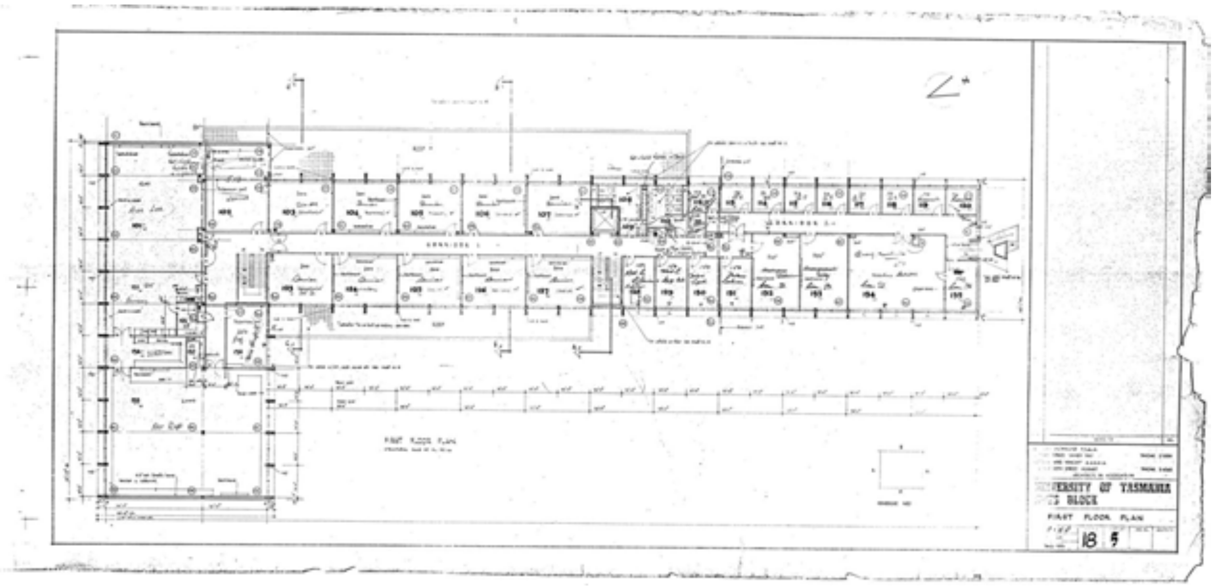
Key Plans



Building 26 – Psychology, Social Sciences (Arts Building)

Ground Floor Plan – University of Tasmania Arts Block (now known as Psychology and Social Sciences). Prepared by R Brian Howroyd with Cooper and Vincent, 1959.

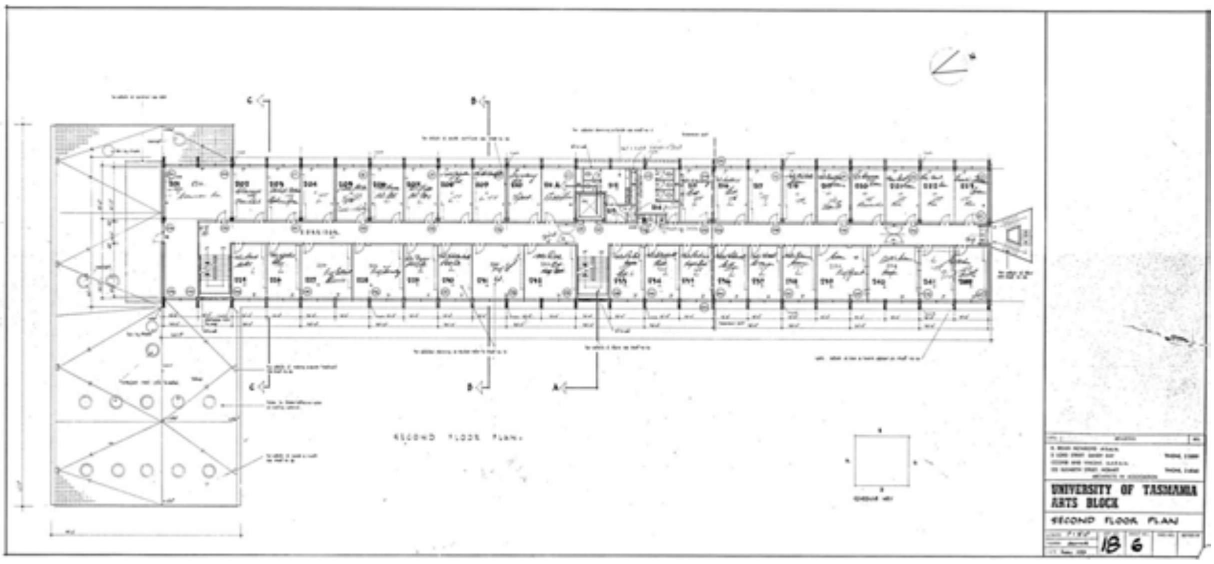
Source: Hanger 74-027.tif



Building 26 – Psychology, Social Sciences (Arts Building)

First Floor Plan – University of Tasmania Arts Block (now known as Psychology and Social Sciences). Prepared by R Brian Howroyd with Cooper and Vincent, 1959.

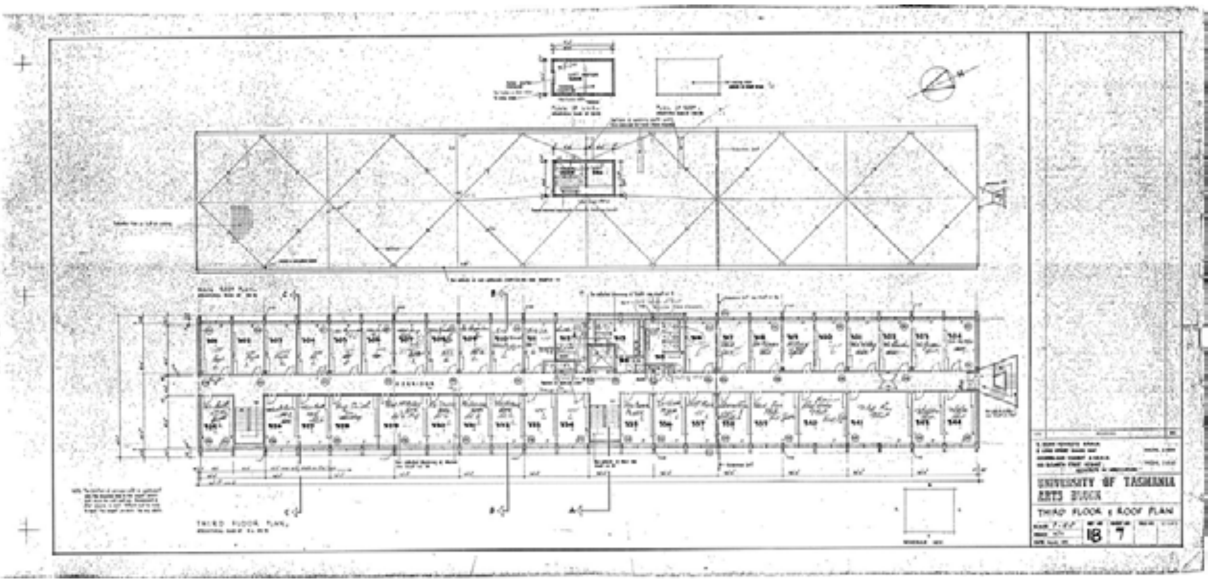
Source: Hanger 74-028.tif



Building 26 – Psychology, Social Sciences (Arts Building)

Second Floor Plan – University of Tasmania Arts Block (now known as Psychology and Social Sciences). Prepared by R Brian Howroyd with Cooper and Vincent, 1959.

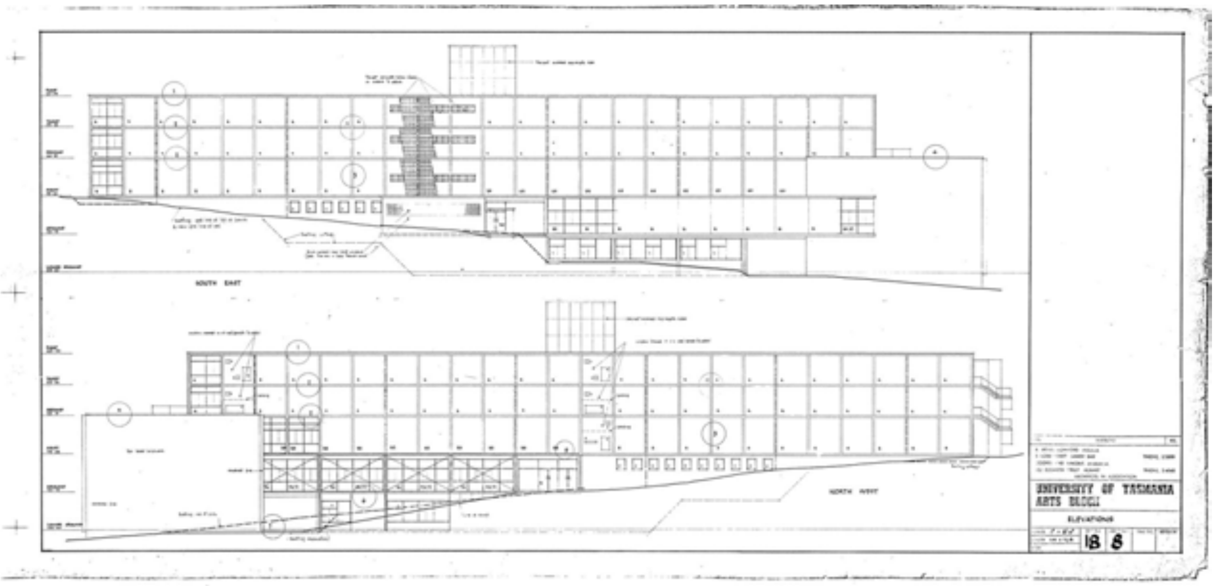
Source: Hanger 74-029.tif



Building 26 – Psychology, Social Sciences (Arts Building)

Third Floor and Roof Plan – University of Tasmania Arts Block (now known as Psychology and Social Sciences). Prepared by R Brian Howroyd with Cooper and Vincent, 1959.

Source: Hanger 74-030.tif



Building 26 – Psychology, Social Sciences (Arts Building)

Elevations – University of Tasmania Arts Block (now known as Psychology and Social Sciences). Prepared by R Brian Howroyd with Cooper and Vincent, 1959.

Source: Hanger 74-031.tif

Building 28
Psychology Research Centre

Building No:	Building Name:	Previous Name:
28	Psychology Research Centre	Computer Centre Building Computer Centre Information Science

Date of Construction or Date of Original Drawings	Original Architect	Date Opened
1974	Philp Lighton Floyd & Beattie	

Date of Major Extension	Architect for Extension	Description
1985	Architecture & Urban Design Partners in association with Trinity Projects Pty Ltd	First Floor Addition
1988	Drafting Services (Tasmania)	Toilet Block Annex
1990	Forward & Viney	Northern Extension
1997	Drafting Services (Tasmania)	Interior Alterations

Description of Current Building

Exterior Form

The original 1974 building was a single storey steel framed rectilinear face brick building with the main entrance on the northern façade. The eastern elevation featured a regular grid of glazing, while the west elevation was predominately face brick with a small amount of glazing. The main computer room was located at the centre of the building on the western side with an off-centre straight corridor running from the northern entrance through to the south side of the building. Staff offices run along the eastern façade within the structural column grid. The building had a low pitched roof hidden by a deep fascia which wraps around the whole building.

In 1985 a new first floor addition was designed which included a deck, external stairs and entrance foyer to the southern side of the building and a concrete bridge to the northern entrance. There is no internal staircase between the floors shown on the drawings. The first floor contained a series of offices around the perimeter of the building with central amenities and meeting room surrounded by a continuous corridor. The first floor responds the regular grid of the original ground floor and matches the materiality with matching face brick and a deep fascia band wrapping around the building to the new roof. A horizontal ribbon of aluminium windows runs the full length of the eastern and western facades.

	A single storey northern extension was designed in 1990 and is square in plan containing a teaching room, lecture room and offices. This building reads as a separate form to the earlier building and has a separate curved steel roof.
Interior Form	Interior not accessible during site inspection
Significance	The building, as it is now found with its various additions and changes sits on the fringe of the central campus and has no direct part in the layout of the central campus area. As first built and as later changed the building does not display any characteristics that mark it as a building of importance The building has no heritage significance.
Key Elements	-
Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

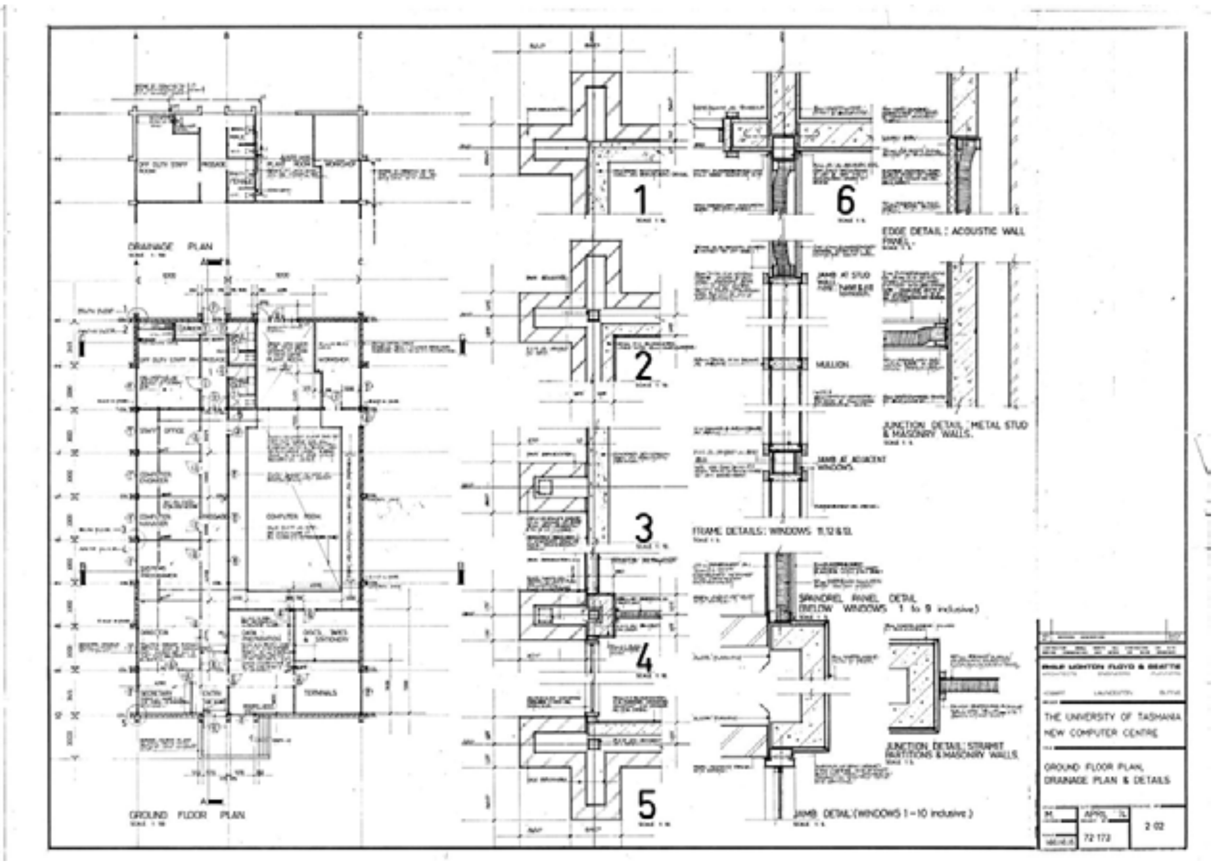
Current Photos

Building 28 – Psychology Research Centre

North-eastern corner with the 1990 extension in the foreground

Source: Paul Davies Pty Ltd

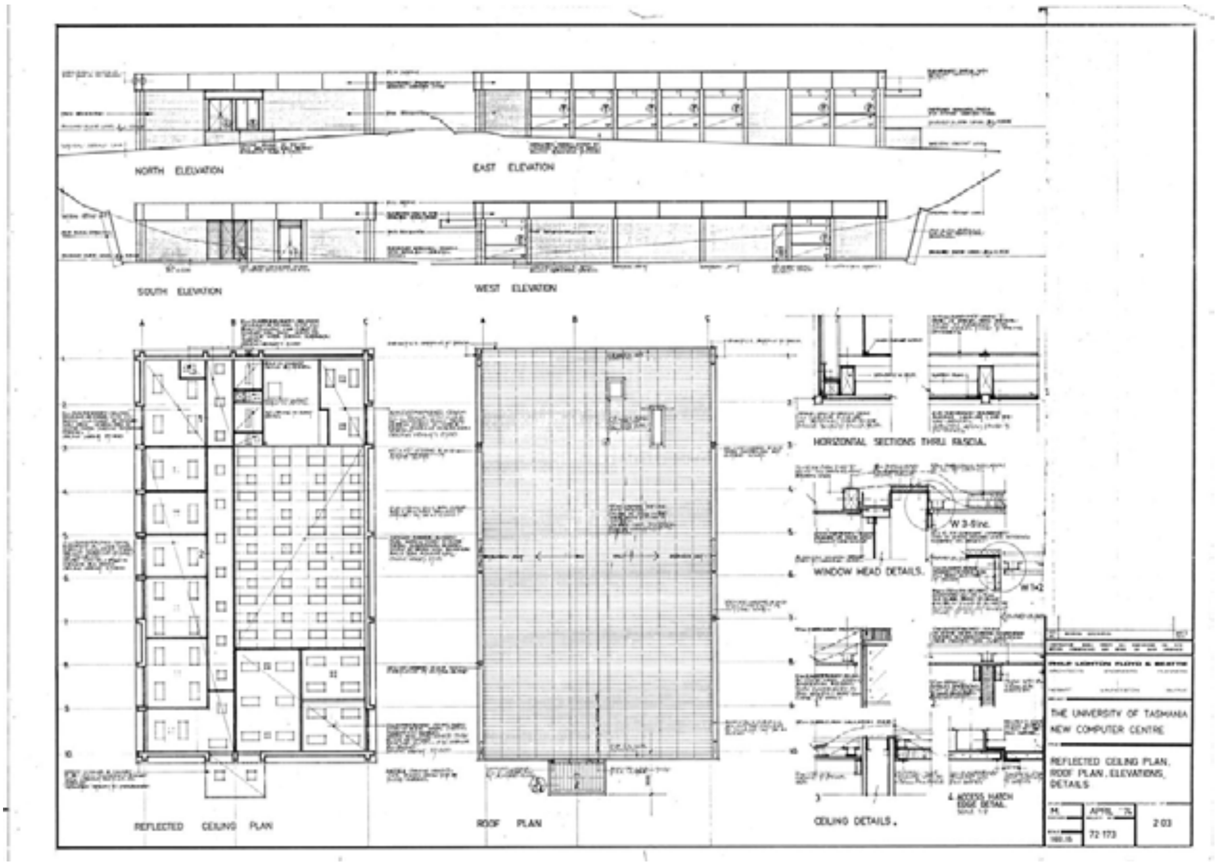
Key Plans



Building 28 – Psychology Research Centre

Ground Floor Plan. Drainage Plan and Details – New Computer Centre, University of Tasmania. Prepared by Philp Lighton Floyd Beattie, 1974

Source: Hanger 33-027.tif



Building 28 – Psychology Research Centre

Reflected Ceiling Plan, Roof Plan, Elevations and Details – New Computer Centre, University of Tasmania. Prepared by Philp Lighton Floyd Beattie, 1974

Source: Hanger 33-028.tif

Building 29
Humanities Building

Building No:	Building Name:	Previous Name:
29	Humanities Building	Arts Commerce Education Building
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1974	Philp Lighton Floyd and Beattie	
Date of Major Extension	**Architect for Extension**	**Description**
-	-	-

Description of Current Building

Exterior Form	The Humanities Building is a four storey rectilinear building connected to the Arts/Psychology Building at the western end via a two-storey glazed bridge link to the second and third floors. The building has a shallow pitched hipped roof behind an off-form concrete parapet beam. The building has a strong and regular architectural expression with the edges of the off-form concrete floor beams exposed to the façades and custom off-form concrete window sill sections set below the vertically proportioned aluminium framed windows. The external wall panels between the windows are a warm orange face brick finished with a brick on edge course to the top and bottom of each panel. This detailing wraps continuously around all four facades. The main entrance, located at the centre of the building to the south features an off-form concrete waffle slab canopy supported on two square concrete columns recessed from the edges of the canopy. The building shows a marked departure from the construction of the 1950s and 1960s building with its use of an exposed concrete edge beam and the use of load-bearing internal masonry walls in contrast the lightly framed earlier structures. The outcome is a heavier form of construction using brick as the walling with regular windows. The construction form also makes the building less adaptable. The Connection the adjacent building involved removing the original triangular external stair on that building. The building was located uncomfortably close to the Arts Theatre and compromises its setting, the treatment of the rear area at ground level suggests the building was squeezed onto this part of the site.
Interior Form	The building features a fairly deep floor plan and as such is generally laid out with rooms around the perimeter of the building from the ground to third floor. A continuous rectangular 'doughnut' corridor wraps around large completely internal rooms and the amenities blocks at the centre of

	the floorplate. The interior finishes include concrete block walls creating a quite utilitarian appearance. The lower ground floor contains storage to the north-eastern corner of the building. The interiors do not exhibit any details of interest.
Significance	The building is interesting in relation to the overall evolution of campus buildings, demonstrating a shift away from innovation into more standard forms of construction. It is not an outstanding or innovative building and does not have heritage value.
Key Elements	-
Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 29 – Humanities Building

Southern Facade

Source: Paul Davies Pty Ltd

Building 29 – Humanities Building

Southern Façade, main entrance

Source: Paul Davies Pty Ltd

Building 29 – Humanities Building

Southern facade

Source: Paul Davies Pty Ltd

Building 29 – Humanities Building

Detail of cast concrete ceiling to the entrance portico

Source: Paul Davies Pty Ltd

Building 29 – Humanities Building

Northern facade

Source: Paul Davies Pty Ltd

Building 29 – Humanities Building

Northern façade entrance

Source: Paul Davies Pty Ltd

Building 29 – Humanities Building

South-eastern corner

Source: Paul Davies Pty Ltd

Building 29 – Humanities Building

North-eastern corner

Source: Paul Davies Pty Ltd

Building 29 – Humanities Building

Glazed link between Humanities (image right) and Psychology (image left) - south elevation

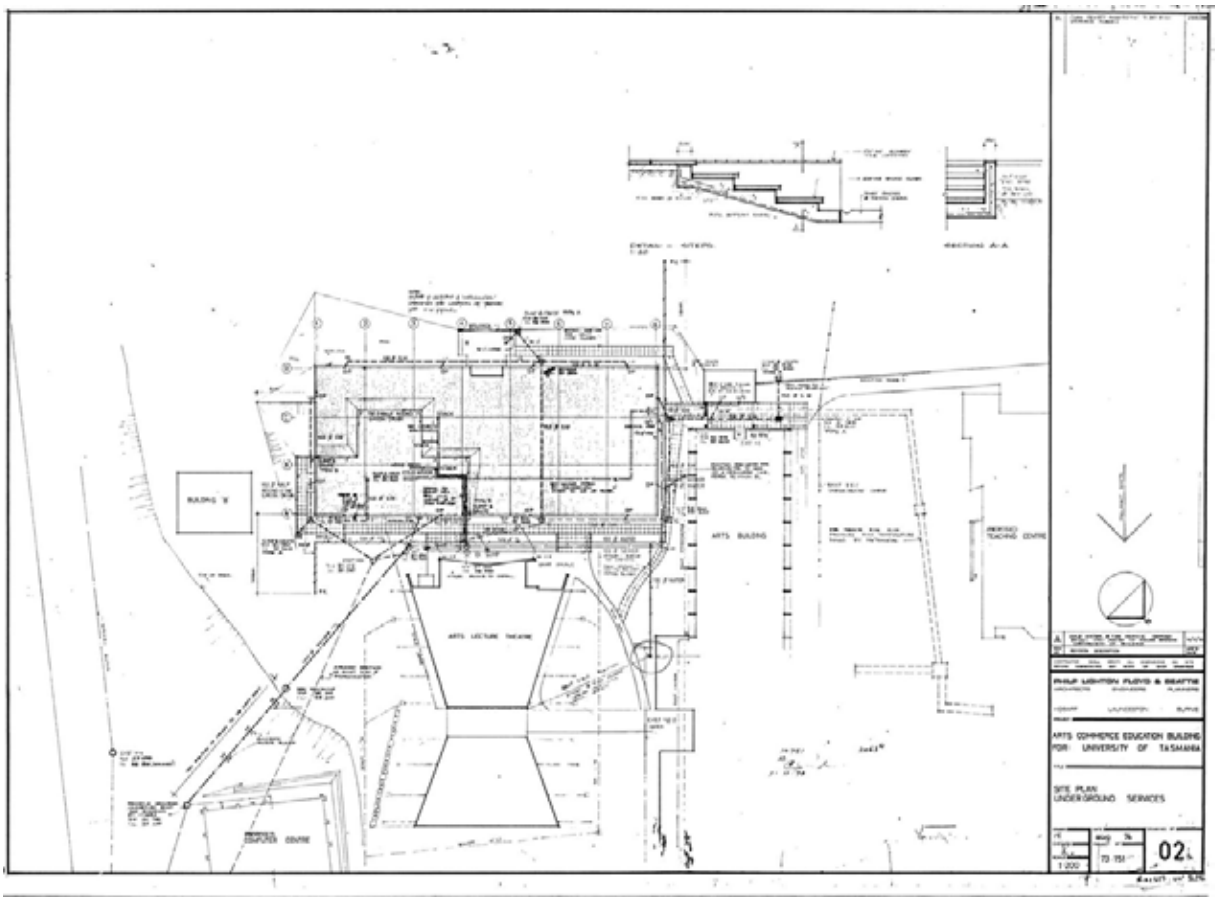
Source: Paul Davies Pty Ltd

Building 29 – Humanities Building

Glazed link between Humanities (image left) and Psychology (image right) – north elevation

Source: Paul Davies Pty Ltd

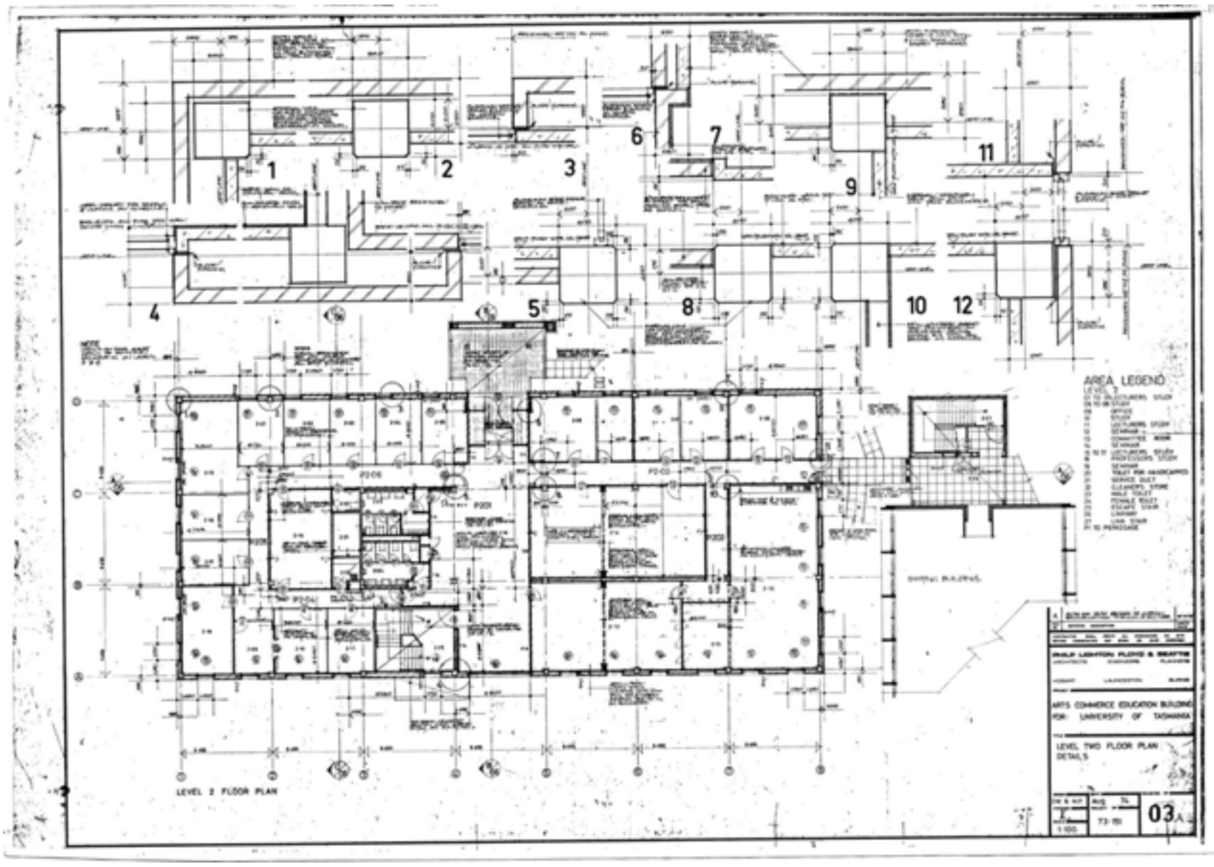
Key Plans



Building 29 – Humanities Building

Site Plan and Underground Services – Arts Commerce Education Building (Now known as Humanities Building). Prepared by Philp Lighton Floyd Beattie, 1974

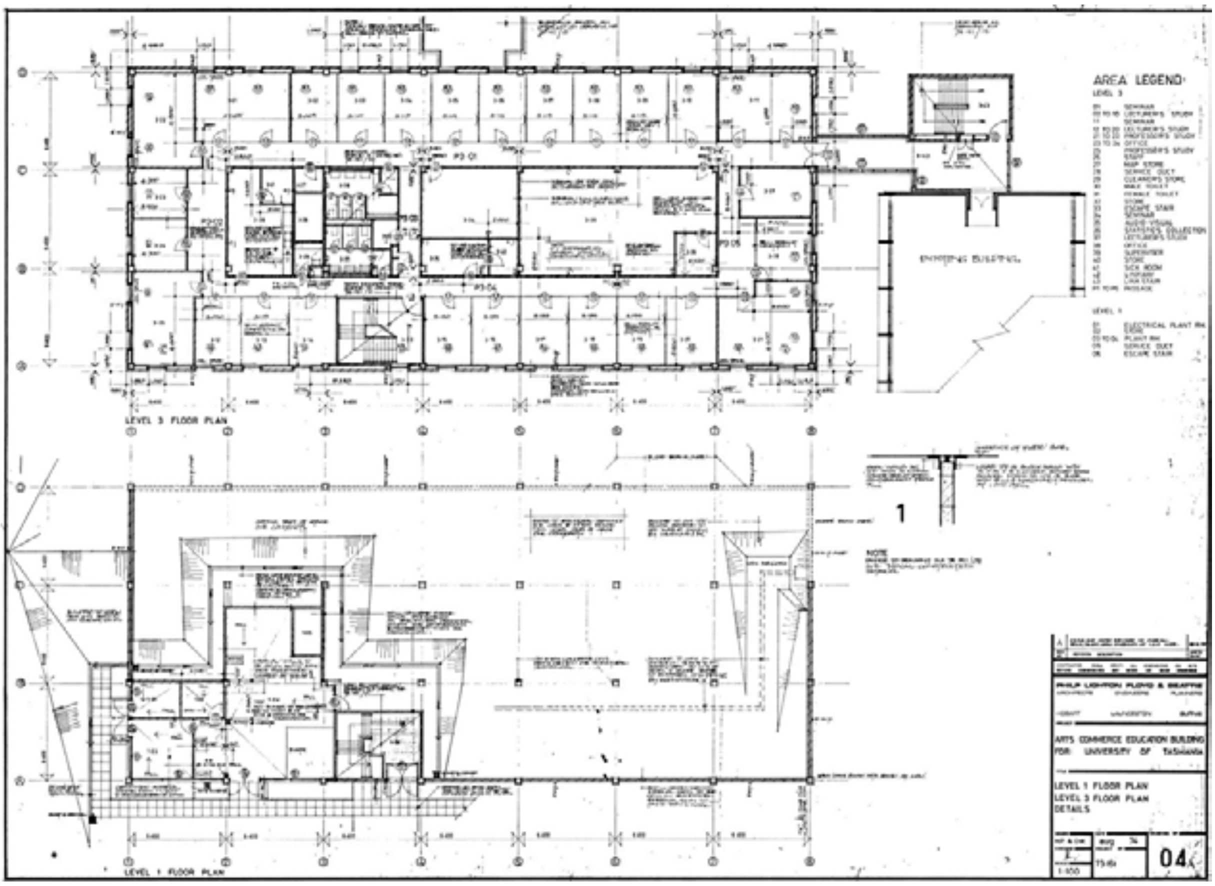
Source: Hanger 66-005.tif



Building 29 – Humanities Building

Level Two Floor Plan and Details – Arts Commerce Education Building (Now known as Humanities Building). Prepared by Philp Lighton Floyd Beattie, 1974

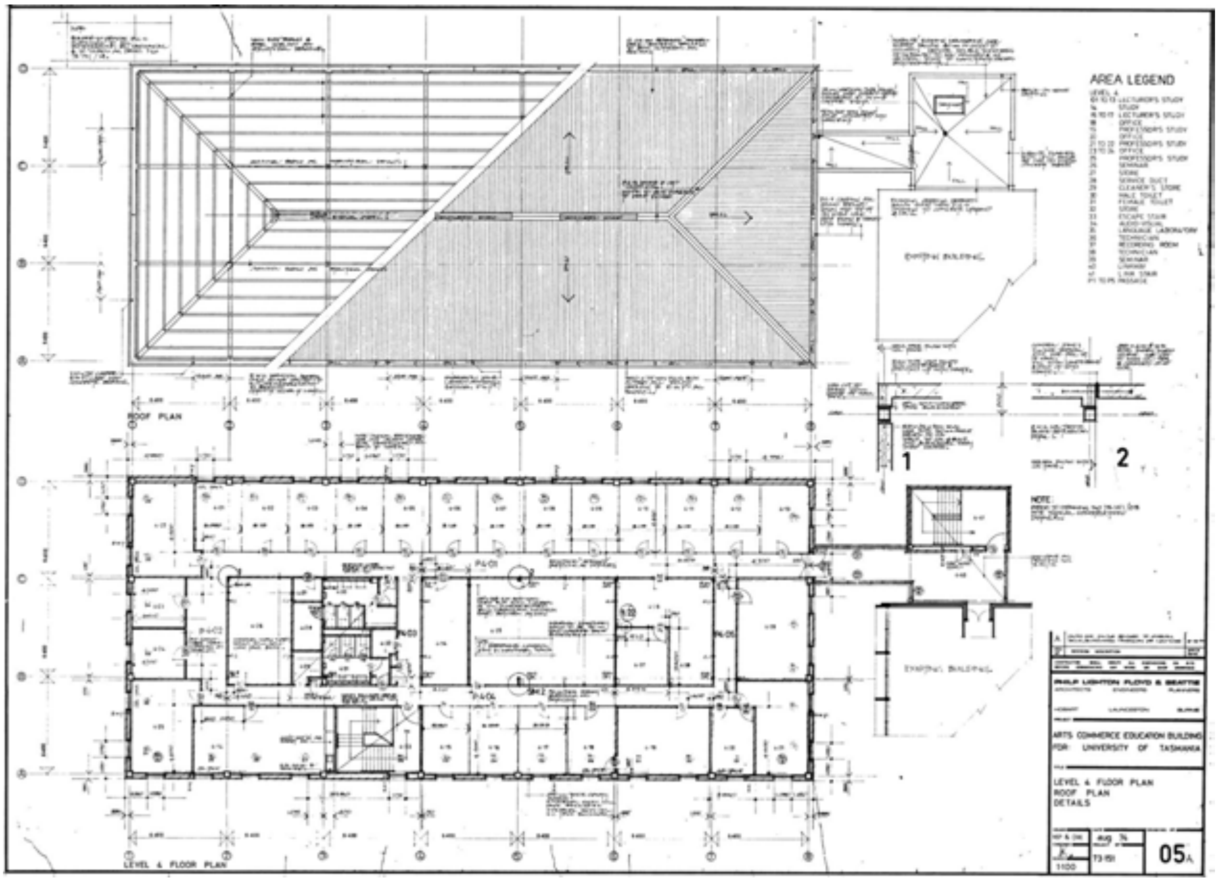
Source: Hanger 66-006.tif



Building 29 – Humanities Building

Levels 1 and 2 Floor Plans and Details – Arts Commerce Education Building (Now known as Humanities Building). Prepared by Philp Lighton Floyd Beattie, 1974

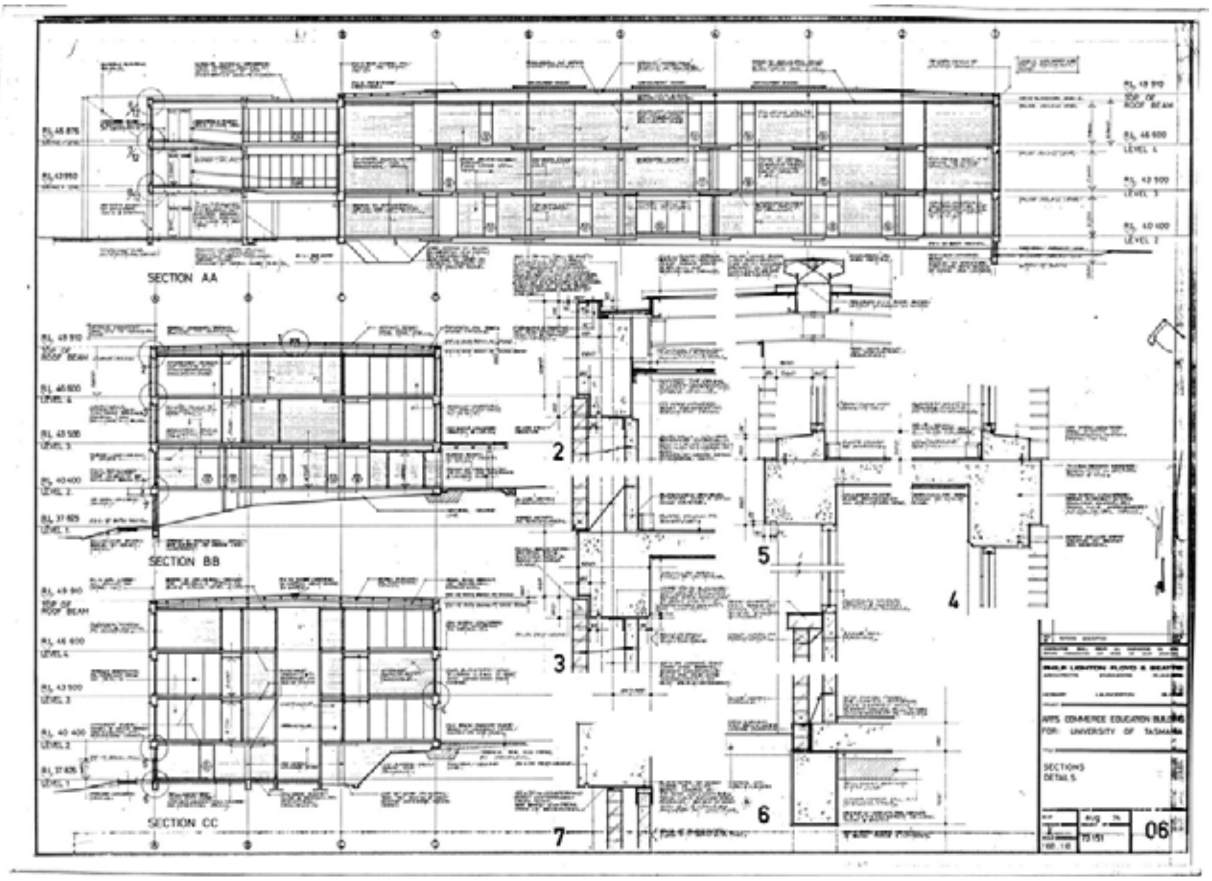
Source: Hanger 66-007.tif



Building 29 – Humanities Building

Level 4 and Roof Plan and Details – Arts Commerce Education Building (Now known as Humanities Building). Prepared by Philp Lighton Floyd Beattie, 1974

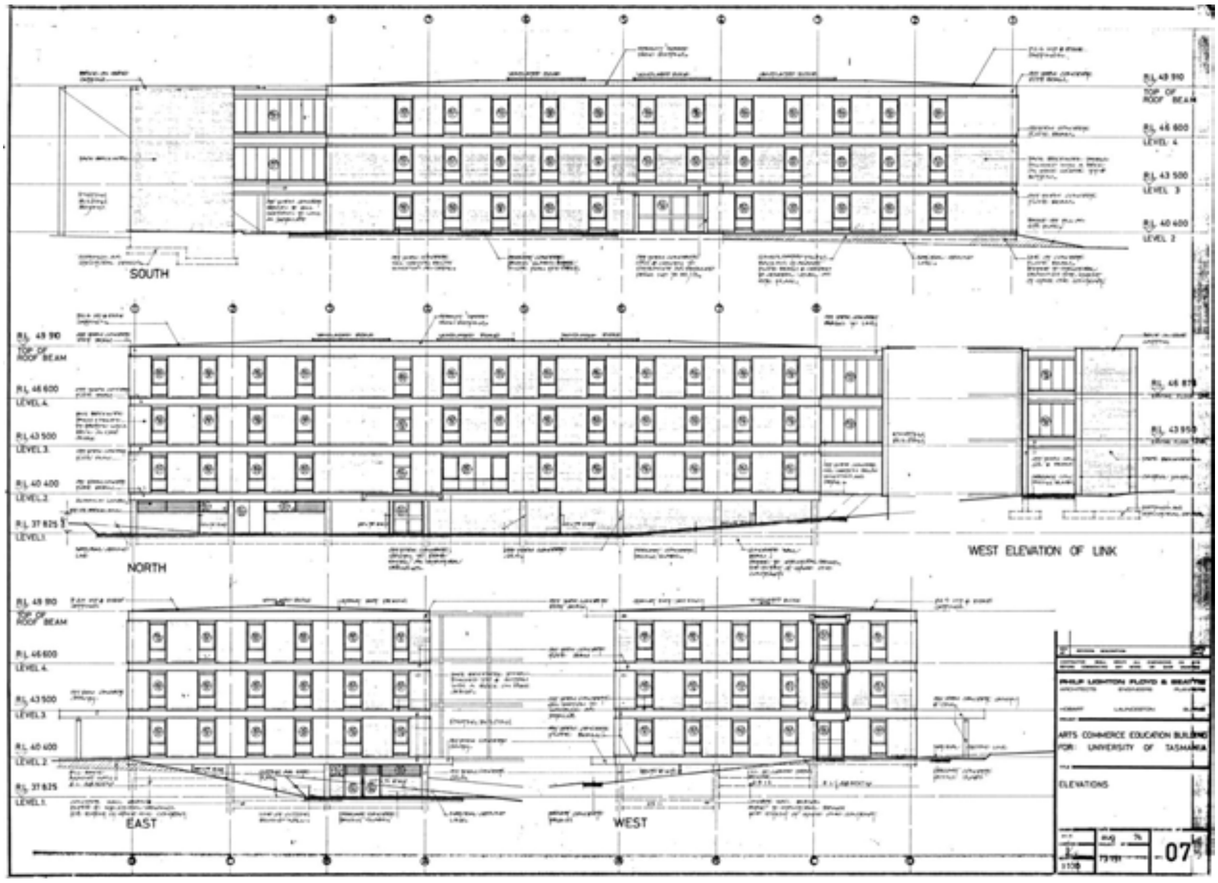
Source: Hanger 66-008.tif



Building 29 – Humanities Building

Sections and Details – Arts Commerce Education Building (Now known as Humanities Building). Prepared by Philp Lighton Floyd Beattie, 1974

Source: Hanger 66-009.tif



Building 29 – Humanities Building

Elevations – Arts Commerce Education Building (Now known as Humanities Building). Prepared by Philp Lighton Floyd Beattie, 1974

Source: Hanger 66-010.tif

PAUL DAVIES PTY LTD ARCHITECTS HERITAGE CONSULTANTS

Building 32
Corporate Services Building

Building No:	Building Name:	Previous Name:
32	Corporate Services Building	Maintenance and Services Depot
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1963 - 1964	W. M. Sampson and Harry Oldmeadow Architects	1966
Date of Major Extension	**Architect for Extension**	**Description**
2008	Philp Lighton Architects	Third-storey addition and alterations

Description of Current Building

Exterior Form	The original 1966 Maintenance Building is a long L-shaped building constructed from a regular grid of steel columns and beams with a red face brick facade. It is two-storey on the northern side of the building and single storey on the southern side (as the hill rises behind the building). The ground floor of the northern façade features 6 bays of projecting curved concrete hoods, the most distinct architectural feature of the building, and the first floor presents a horizontal ribbon of high-level aluminium windows. The original garage located on the southern side features a pop-up curved truss roof with hi-light glazing to the north and south. In 2008 a major three-storey extension designed by Philp Lighton Architects was completed to the south-eastern corner of the original building to adapt the Maintenance Building into the Corporate Services Building. The extension includes a new three-storey glazed entrance foyer to the north-eastern side of the original building. The glazed corner to the first and second floor lift foyers has external steel-framed steel mesh screens to provide solar protection. Metal horizontal awnings and coloured vertical panels have been added above and between the horizontal ribbon of windows on the first floor of the original building to provide solar protection. The curved roof over the former garage space has been retained with the original glazing being replaced. The addition received an Institute of Architects award.
Interior Form	Interior not accessible during site inspection
Significance	While an early building on the campus, it was a utilitarian structure that was not designed with the finesse of the faculty buildings and did not have the design quality of the major significant buildings on the site.

	The early form is discernible but is now a minor part of the form of the building created by the 2008 additions to a point where the building has no heritage significance.
Key Elements	-
Condition	The building appears to be in reasonable condition, however an extensive inspection was not conducted.

Current Phoos

Building 32 – Corporate Services Building

Northern façade

Source: Paul Davies Pty Ltd

Building 32 – Corporate Services Building

Northern façade

Source: Paul Davies Pty Ltd

Building 32 – Corporate Services Building

Western façade

Source: Paul Davies Pty Ltd

Building 32 – Corporate Services Building

South-western corner

Source: Paul Davies Pty Ltd

Building 32 – Corporate Services Building

Southern façade

Source: Paul Davies Pty Ltd

Building 32 – Corporate Services Building

Western façade of the south-eastern wing

Source: Paul Davies Pty Ltd

Early Photos

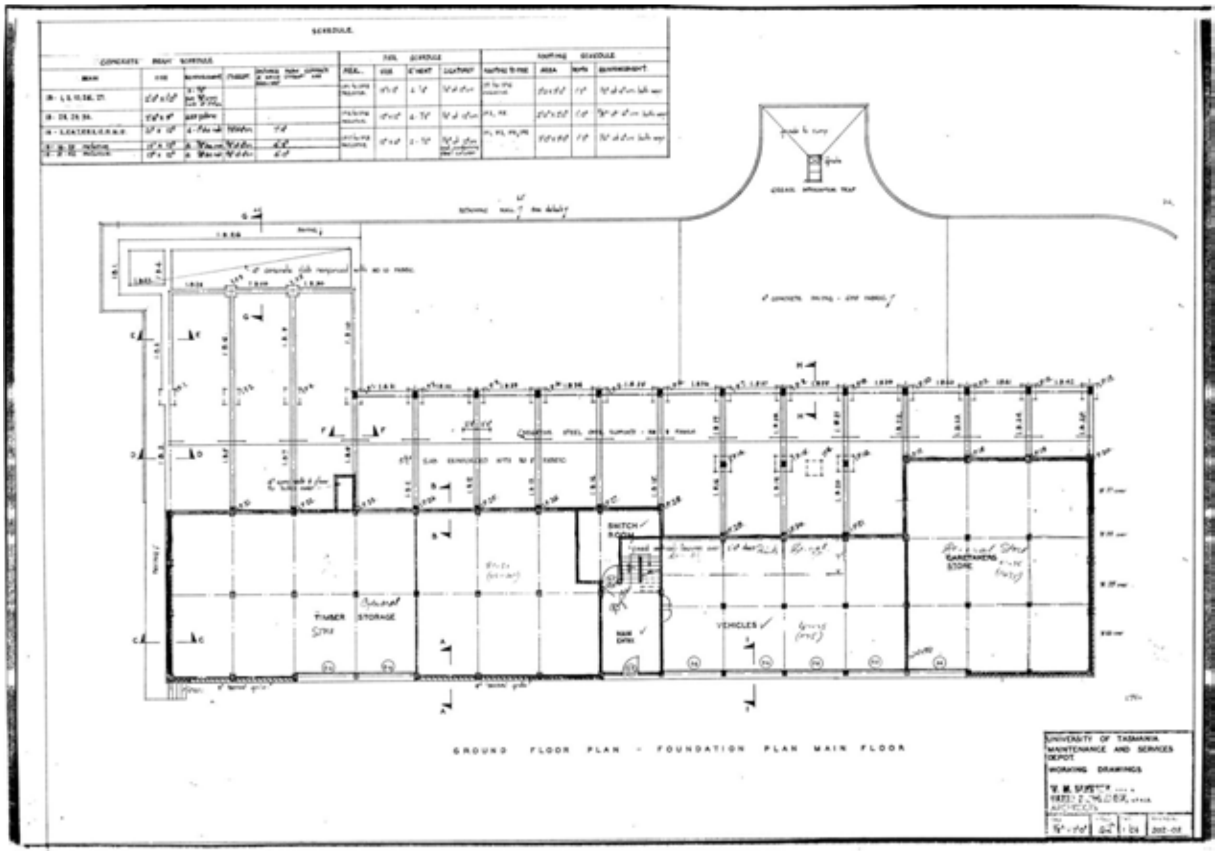
Building 32 – Corporate Services Building (Maintenance Building)

1966 black and white print

View of the north-western facades

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 42

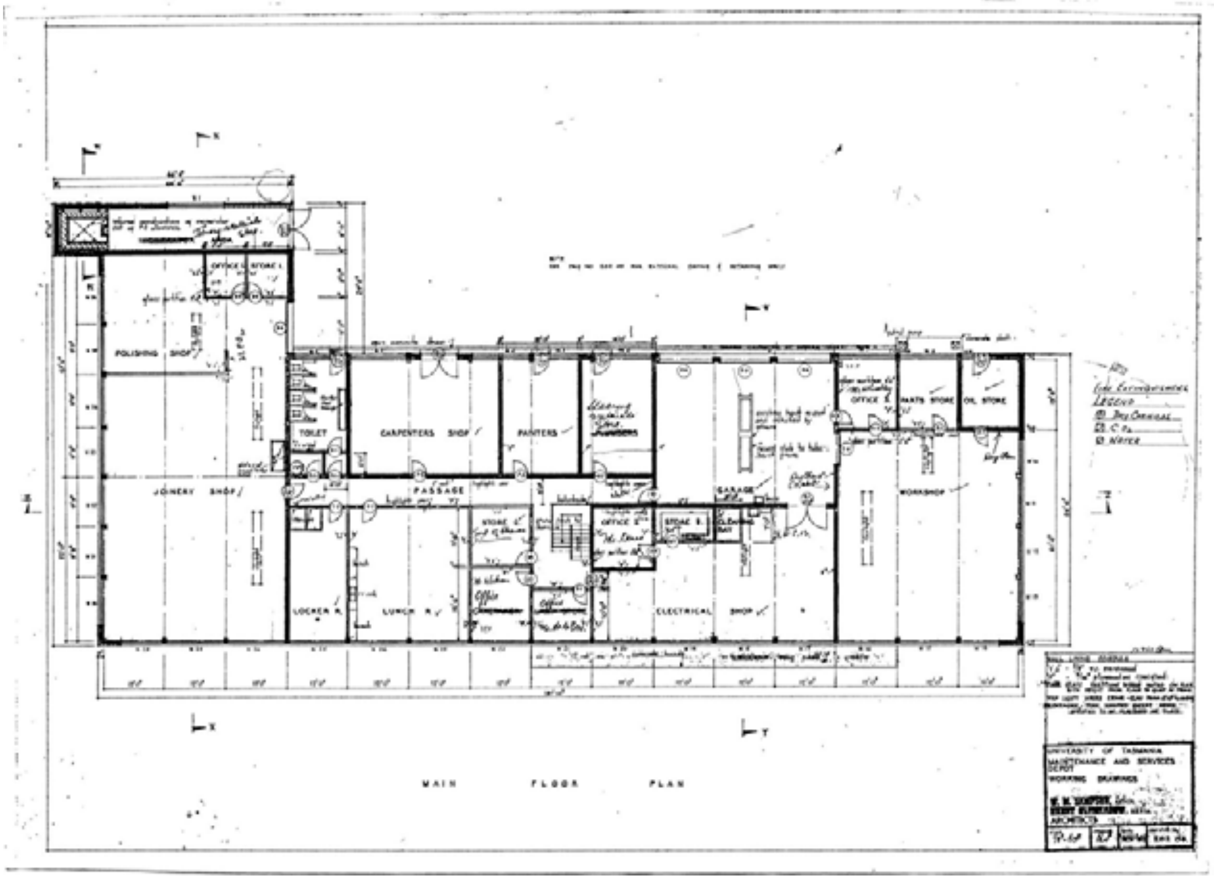
Key Plans



Building 32 – Corporate Services Building

Ground Floor and Foundation Plan – Maintenance and Services Depot. Prepared by W. M. Sampson and Harry Oldmeadow, 1964.

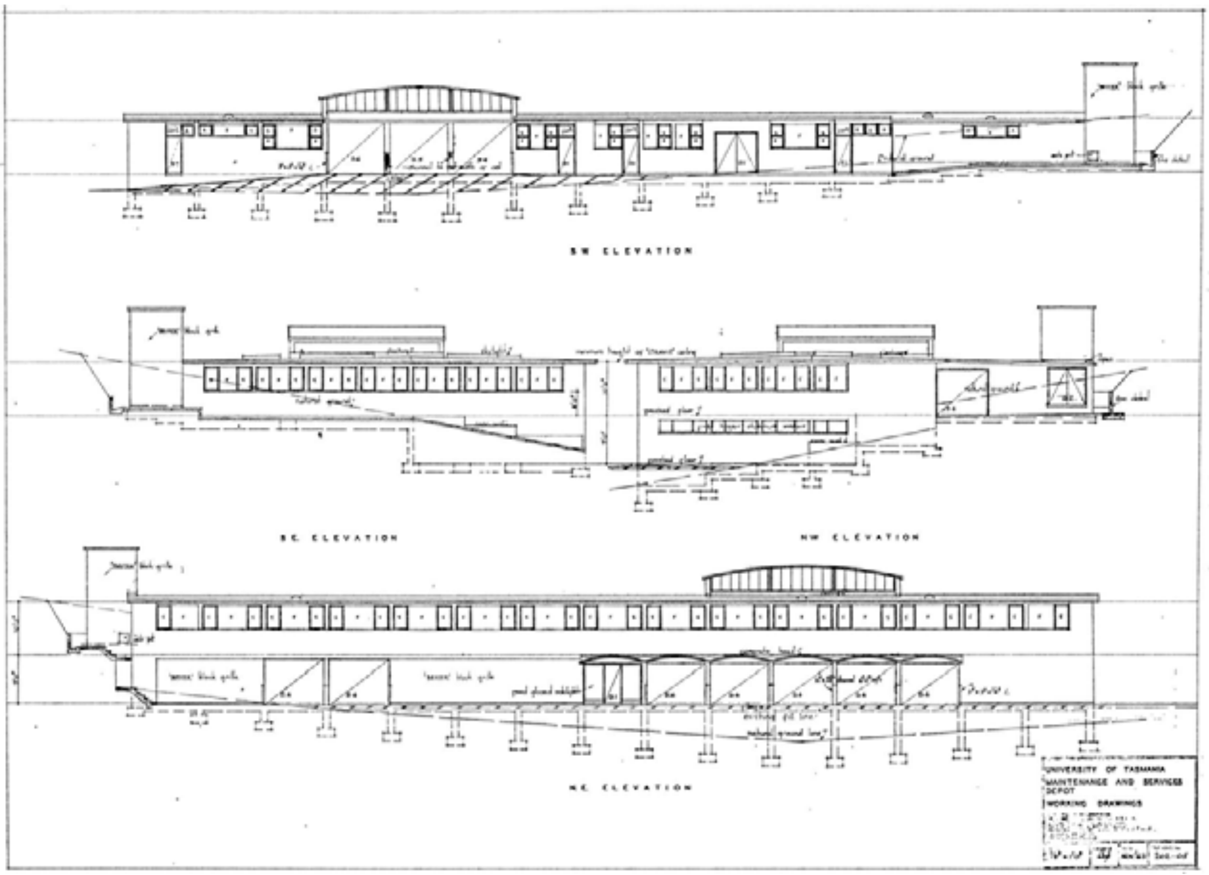
Source: Hanger 82-009.tif



Building 32 – Corporate Services Building

Main Floor Plan – Maintenance and Services Depot. Prepared by W. M. Sampson and Harry Oldmeadow, 1964.

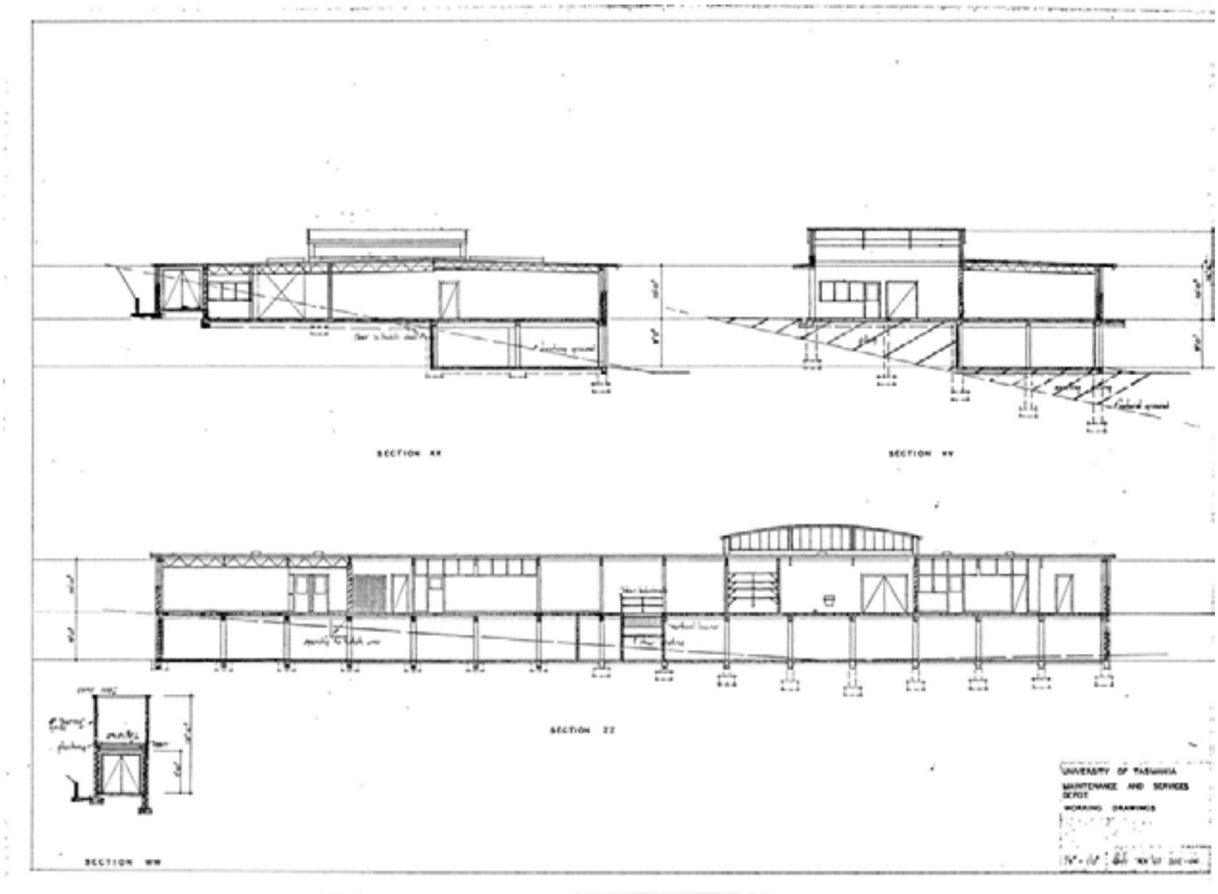
Source: Hanger 82-010.tif



Building 32 – Corporate Services Building

Elevations – Maintenance and Services Depot. Prepared by W. M. Sampson and Harry Oldmeadow, 1964.

Source: Hanger 82-011.tif



Building 32 – Corporate Services Building

Sections – Maintenance and Services Depot.Prepared by W. M. Sampson and Harry Oldmeadow, 1964.

Source: Hanger 82-012.tif

Building 32a
Boiler House

Building No:	Building Name:	Previous Name:
32a	Boiler House	Boiler House
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1972	Department of Public Works – Tasmania. Chief Architect S.T Tomlinson in association with Philp Lighton Floyd Beattie	-
Date of Major Extension	**Architect for Extension**	**Description**
-	-	-

Description of Current Building	
Exterior Form	The boiler house is a rectangular single storey building with a steeply pitched skillion roof which follows the approximate slope of the site. The east, west and south facades feature 'heather brown' extruded face bricks. The northern façade consists of a full length and height curtain glass wall constructed from ¼" wire cast glass in 'Aluminex' glazing bars.
Interior Form	Interior not accessible during site inspection.
Significance	The building is not of heritage significance.
Key Elements	-
Condition	The building appears to be in fair overall condition, however a detailed inspection was not conducted.

Current Photos

Building 32a – Boiler House

Eastern elevation

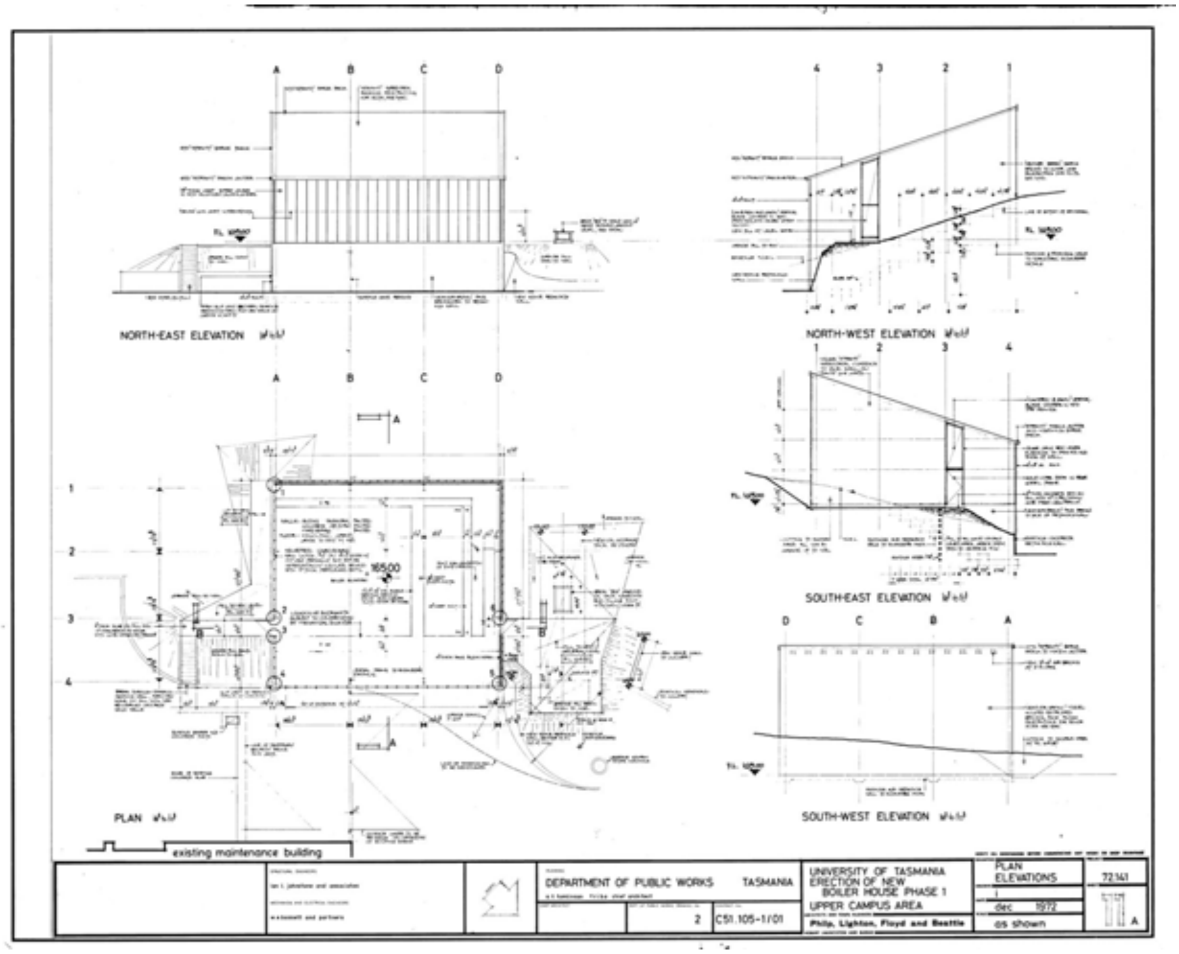
Source: Paul Davies Pty Ltd

Building 32a – Boiler House

Northern elevation

Source: Paul Davies Pty Ltd

Key Plans



Building 32a – Boiler House

Plans and Elevations – New Boiler House Phase 1, University of Tasmania. Prepared by Department of Public Works – Tasmania. Chief Architect S.T Tomlinson in association with Philp Lighton Floyd Beattie, 1972.

Source: Box 17-020.tif

Building 34
Life Sciences Building

Building No:	Building Name:	Previous Name:
34	Life Sciences Building Agricultural Science Plant Science Zoology	Life Sciences

Date of Construction or Date of Original Drawings	Original Architect	Date Opened
1962	Department of Public Works – Tasmania in association with Johnston Crawford & De Bavay	1962

Date of Major Extension	Architect for Extension	Description
1965	Johnston Crawford & De Bavay	Agriculture Addition
1970-73	Department of Public Works - Tasmania. Chief architect S.T. Tomlinson in association with Johnson Crawford and De Bavay.	Zoology - Biology Addition
1976	University of Tasmania - Architects Branch?	Addition
1978	Philp Lighton Floyd Beattie Architects	New Solvent Store
1986-87	Michael Viney and Associates	Northern Lecture Theatre Extension
1995	Forward Viney Woolan	Eastern Extension – Second Floor

Description of Current Building

Exterior Form

The original section of the Life Sciences Building is a long rectilinear building orientated to face north, with views across the middle and lower campus towards Sandy Bay. The building has a regular 10’ expressed structural column grid with a dark grey stack bond block spandrel panel between the horizontal ribbons of ground and first floor steel-framed windows. The spandrel panels below the ground floor windows and above the first-floor windows are painted render, with a band of red face brick enclosing the building sub-floor at the base. The exposed column and beam structure features an unusual detail, with the columns along the north and south façade slightly proud of the glazed walls and rendered panels behind, however the dark grey stacked bond block spandrel panels intersect with the proud columns adding three-dimensional interest to the façade.

In 1965 a southern wing was added towards the centre of the original building to accommodate the Faculty of Agriculture. This extension also included an additional floor to part of the original north-facing building adjacent to the new wing with a three-storey glazed entrance foyer and stair well. The southern extension was built with a similar architectural language as the original building, however red face brick was used for the spandrel panels instead of the dark grey stacked bond.

The Zoology and Biology Addition was planned from 1970-73 as another extension to the south of the original building towards the eastern end. It was designed with a bridge connection off the eastern stair landing between the first and second floor of the original building. This extension also featured expressed concrete columns to the facades with face brick spandrels and ribbons of windows between the columns.

A major four-storey addition was added to the north of the original building in 1987 and is monolithic in scale and form. A large semi-open fire escape stair is located at the northern end and the four-storey blonde face brick adjacent contains three large bold squares made from smaller square glass bricks to the fire escape stair foyer. The western façade has a strong horizontality, and the façade is broken into horizontal strips by the ribbons of aluminium framed windows with blonde face brick walls between. There are no vertical elements used on this façade. This extension is highly visible from the top of the middle campus and Churchill Avenue below due both to the steep topography, siting, and dominant mass of the building.

In 1995 an additional floor with a sprung curved zincalume roof was added to the existing two-storey eastern wing of the original building. This extension features face brick work and a continuous horizontal ribbon of aluminium framed windows; however, the exposed column grid of the original building was not carried through to the façade of the addition.

The building has little internal decorative elements and relied on its rhythmic linear façade pattern for its design effect. The various additions have largely removed the design integrity of the building.

Interior Form

The internal layout is relatively basic with central corridors flanked by a range of rooms with larger spaces located at the ends of the building. There are two stairs, neither related to the main entrance which is an interesting and somewhat counterintuitive approach to access. The main lecture theatres are at one end with a separate lobby and doors to each side of the lobby.

The original internal staircases feature pre-cast green terrazzo treads with slender square steel balusters fixed through the overhanging edge of each tread with custom tapered brass covers to hide the bolted fixings above and below the treads. A continuous moulded timber handrail wraps around the centre of each stair. The walls of the stairwell feature full-height timber panelling.

Significance	In its designed and built form the building would have been a striking form on the elevated hillside overlooking the campus. Its very long linear form with its relentless façade rhythm would have dominated the visual form of the upper campus. Additions and, in particular the northern additions that are quite poorly designed in relation to the earlier building form, have diminished any significance the building may have had. Consequently, the building has very limited heritage significance.
Key Elements	Remaining elements of the original building in its external form have some significance.
Condition	The building appears to be in fair overall condition, however a detailed inspection was not conducted.

Current Photos

Building 34 – Life Sciences Building

North-western corner of the 1986-87 northern wing

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

Western elevation of the 1986-87 northern wing

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

Original building – north elevation

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

Original building – north elevation

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

Southern and western facades

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

South-western corner

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

Western façade of the 1970-73 southern extension

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

Western façade of the original west wing

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

Elevated concreted walkway to the south side of the original central wing

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

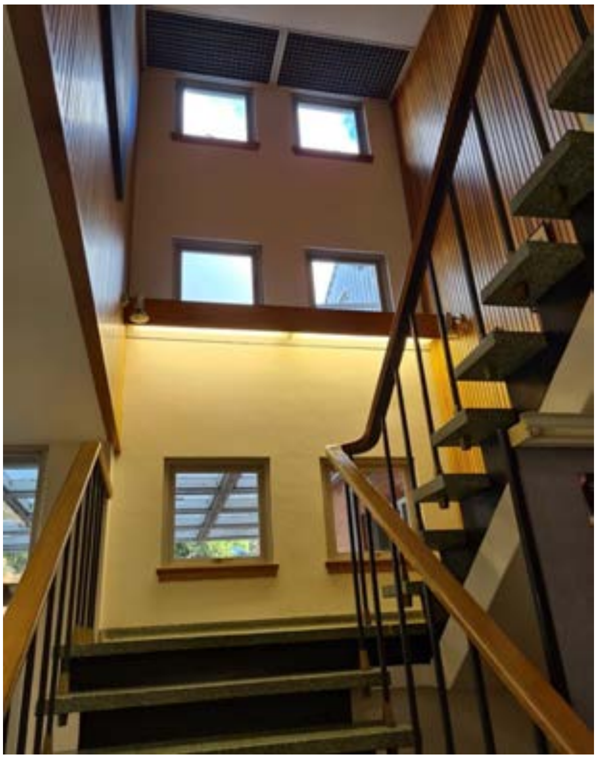
Northern façade to the western wing

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

Central stair to the main entrance foyer of the original central wing

Source: Paul Davies Pty Ltd



Building 34 – Life Sciences Building

Central stair to the main entrance foyer of the original central wing

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

Central stair to the main entrance foyer of the original central wing, detail of the timber wall panelling

Source: Paul Davies Pty Ltd

Building 34 – Life Sciences Building

Typical central corridor of the original central wing with original timber joinery

Source: Paul Davies Pty Ltd

Early Photos

Building 34 – Life Sciences Building (Agricultural Science)

1965 black and white print

North-western facades

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 39

Building 34 – Life Sciences Building (Agricultural Science)

1968 black and white print

South-western facades

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 43

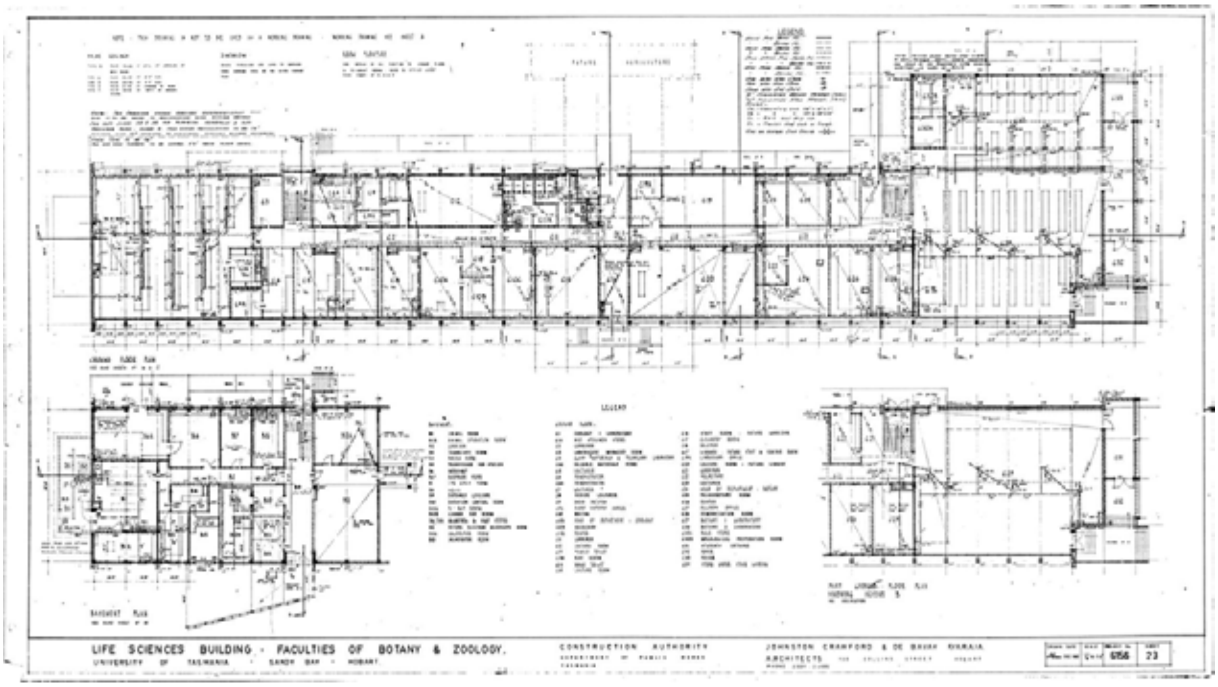
Building 34 – Life Sciences Building (Agricultural Science)

1960 Photograph

Northern facades– Administration Building (image left), Life Sciences Building under construction (image right)

Source: Libraries Tasmania Online Collection; Item Number AA193-1-398

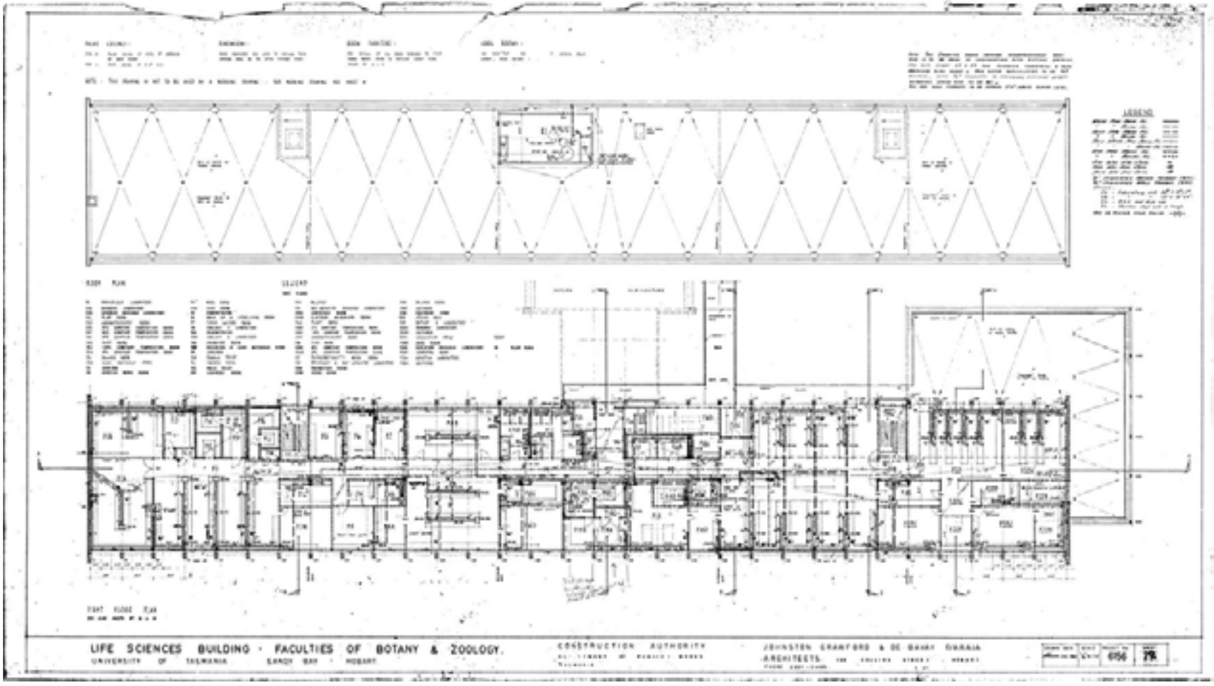
Key Plans



Building 34 – Life Sciences Building

Basement and Ground Floor Plan – Life Sciences Building Faculties of Botany and Zoology. Prepared by Johnson Crawford and De Bavay Architects, 1962

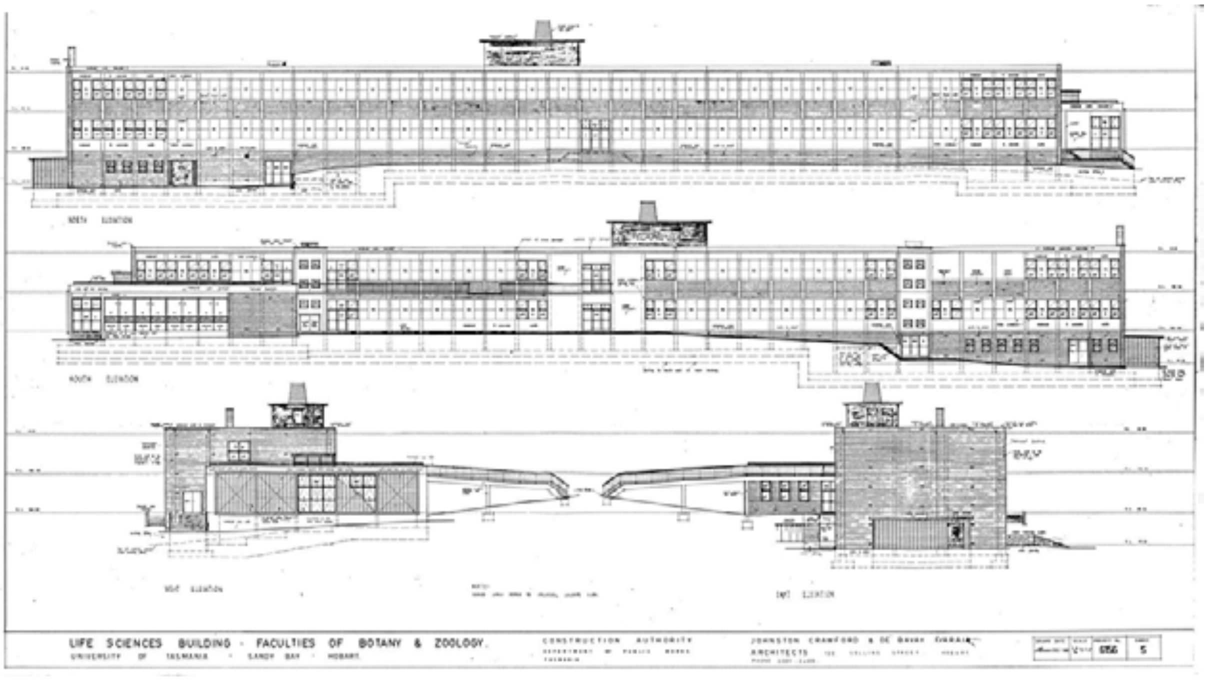
Source: Hanger 61-047.tif



Building 34 – Life Sciences Building

First Floor and Roof Plan – Life Sciences Building Faculties of Botany and Zoology. Prepared by Johnson Crawford and De Bavay Architects, 1962

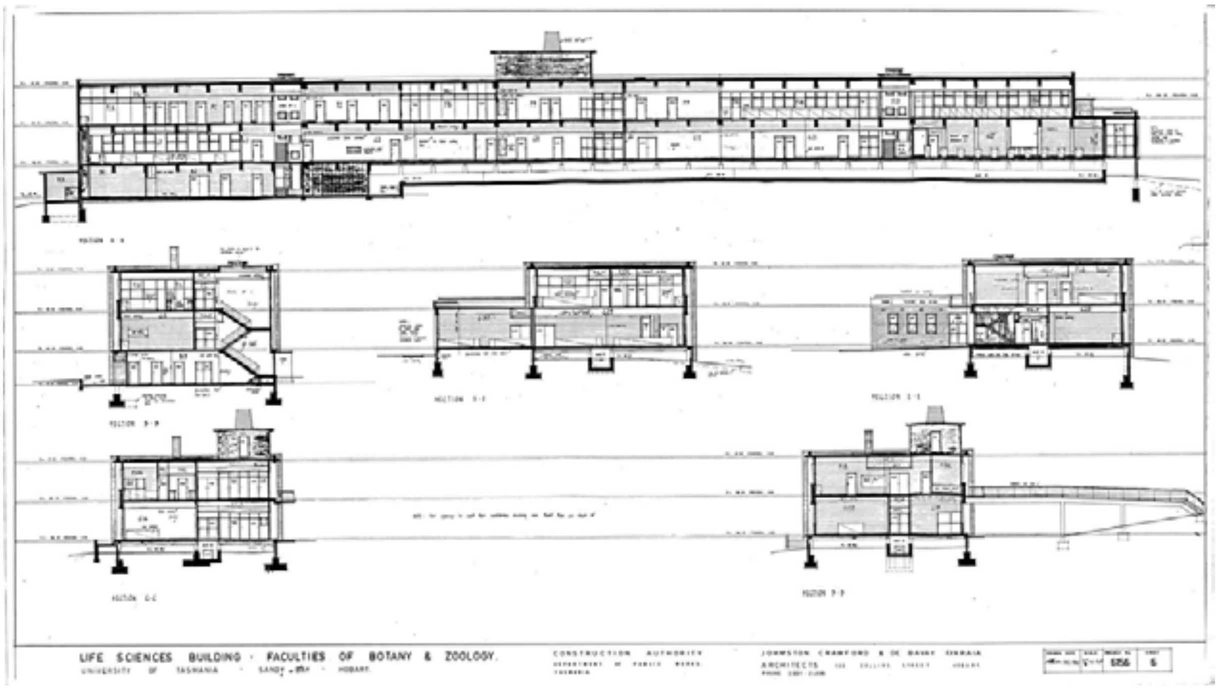
Source: Hanger 61-048.tif



Building 34 – Life Sciences Building

Elevations – Life Sciences Building Faculties of Botany and Zoology. Prepared by Johnson Crawford and De Bavay Architects, 1962

Source: Hanger 61-043.tif



Building 34 – Life Sciences Building

Sections – Life Sciences Building Faculties of Botany and Zoology. Prepared by Johnson Crawford and De Bavay Architects, 1962

Source: Hanger 61-044.tif

Building 36
Herbarium, Tasmanian

Building No:	Building Name:	Previous Name:
36	Herbarium, Tasmanian	-
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1987	Michael Viney and Associates	1989?
Date of Major Extension	**Architect for Extension**	**Description**
-	-	-

Description of Current Building

Exterior Form	The Herbarium is a single storey rectilinear building with curved concrete and glass brick walls to the north-eastern and north-western corners. The building is located on the slope to the south of Churchill Avenue. The building is oriented to face north with aluminium framed glass doors and windows to the northern façade. A small curved concrete verandah roof runs along the northern elevation with circular concrete columns. The building is low-scale, dug in to the hill behind, painted in a forest green, and surrounded by fairly dense vegetation and as such is fairly hidden from view. It is partially buried form with access over its concrete roof. The plans show a series of offices located along the northern elevation with a corridor and the specimen vault located directly behind to the south. This would appear to be a design to manage thermal conditions for specimens. The building has a distinct post-modern character with its use of glass blocks. The building won an Institute of Architects award.
Interior Form	Interior not accessible during site inspection
Significance	The building is an interesting design for the campus and unrelated to any other building form on the site. Possibly driven by the desire to manage thermal conditions, burying the building was an innovative approach. The building is not of heritage significance.
Key Elements	-
Condition	The building appears to be in reasonable condition, however an extensive inspection was not conducted.

Current Photos

Building 36 – Herbarium, Tasmanian

North-eastern corner

Source: Paul Davies Pty Ltd

Building 36 – Herbarium, Tasmanian

North-eastern corner

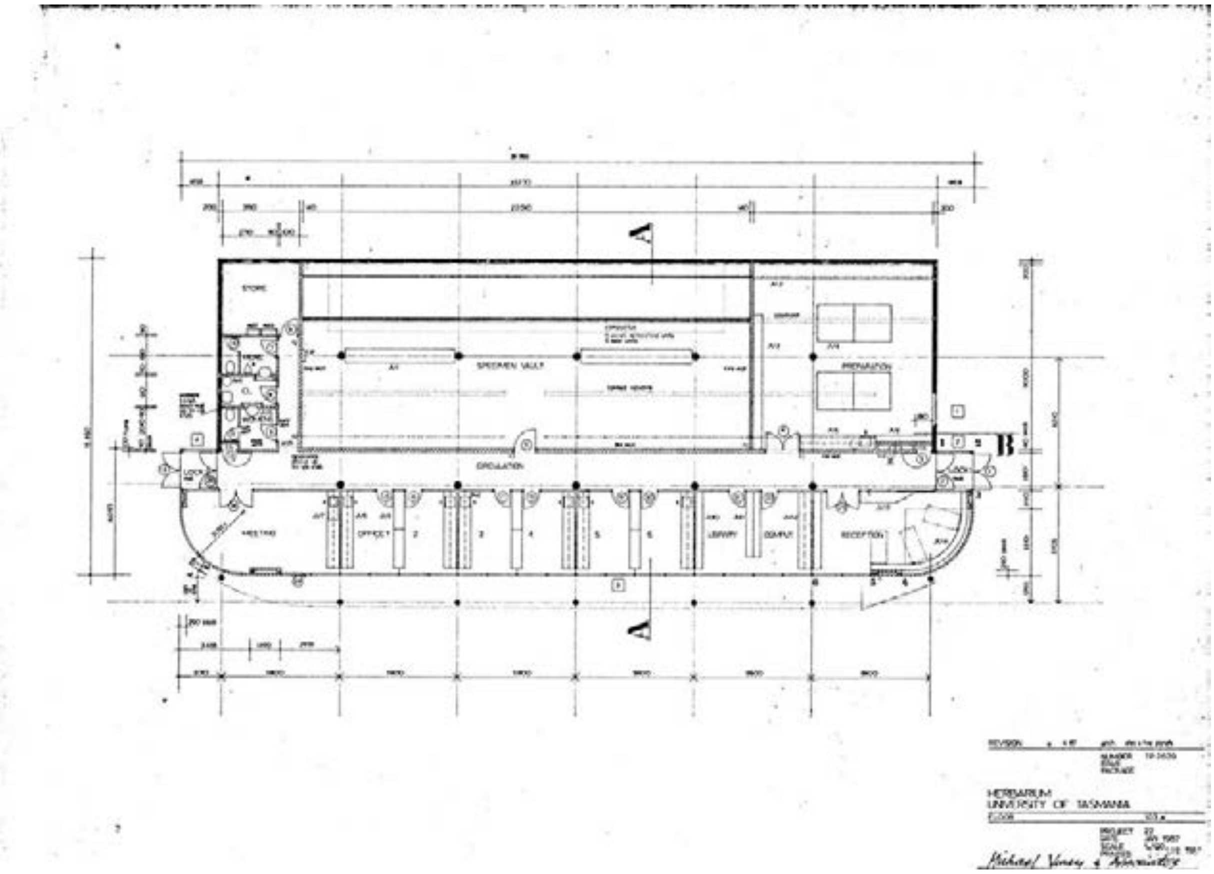
Source: Paul Davies Pty Ltd

Building 36 – Herbarium, Tasmanian

Western facade

Source: Paul Davies Pty Ltd

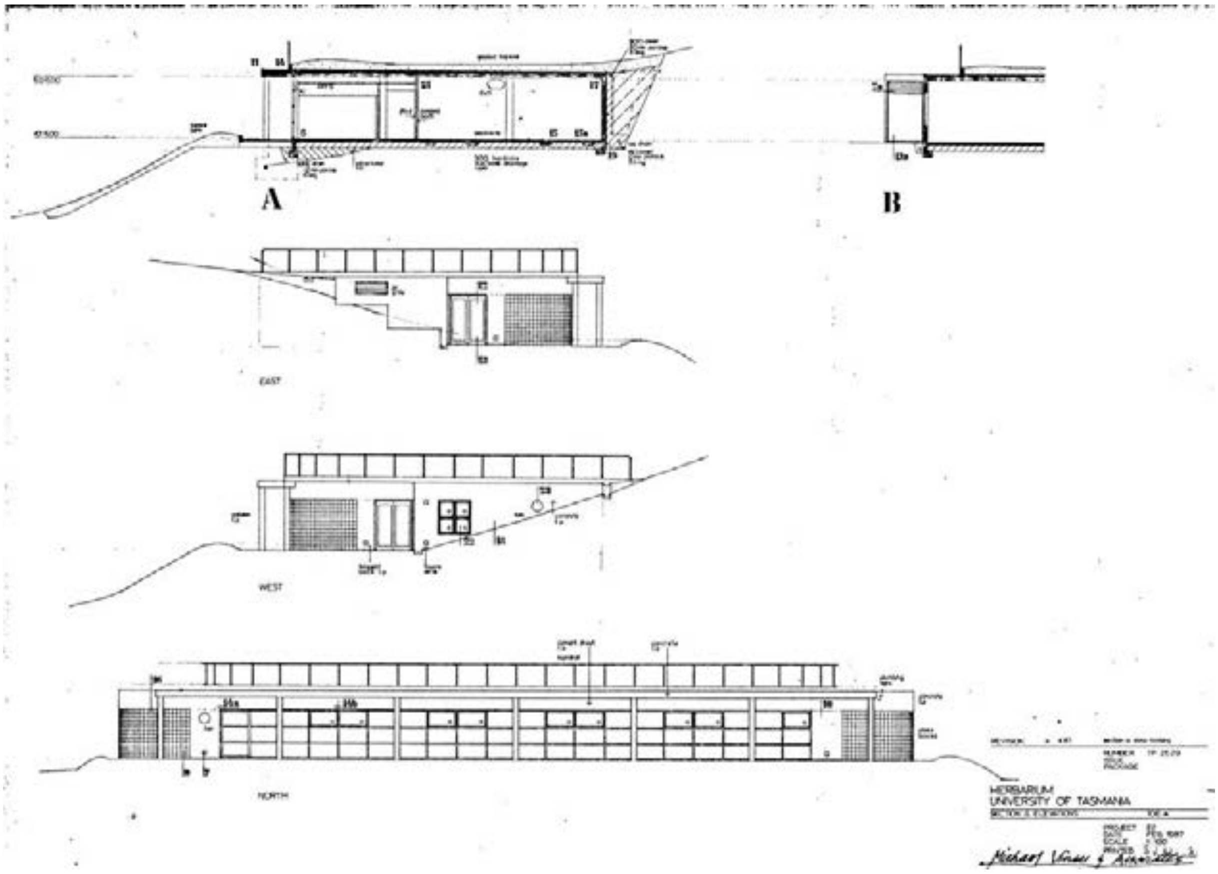
Key Plans



Building 36 – Herbarium, Tasmanian

Floor Plan – Herbarium University of Tasmania. Prepared by Michael Viney and Associates, 1987

Source: Hanger 70-004.tif



Building 36 – Herbarium, Tasmanian

Section and Elevations – Herbarium University of Tasmania. Prepared by Michael Viney and Associates, 1987

Source: Hanger 70-007.tif

Building 38
Research House

Building No:	Building Name:	Previous Name:
38	Research House	Vice Chancellor's Residence Vice Chancellor's Lodge
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1957	Department of Public Works Tasmania	1959
Date of Major Extension	**Architect for Extension**	**Description**
1967	Department of Public Works Tasmania	Additions

Description of Current Building

Exterior Form

The Vice Chancellor's Residence was designed as a two-storey red face brick house overlooking the Campus and Sandy Bay and orientated to the north-east. The original house contained a study, lounge, dining room, and breakfast room/kitchen along the north-eastern side of the building on the ground floor with the entrance, stairwell, guestroom, and bathrooms and utilities located on the south-western side. The first floor contained three north-east facing bedrooms with the stairwell and bathrooms on the south-western side. The first floor has a low-pitch gable end roof.

The building was set in a tiered garden that over time has established plantings although it is no longer maintained as a garden.

In 1967 the first floor was extended towards the east, creating a much larger master bedroom with a separate dressing room and additional bathroom and W.C. The wall between bedroom 2 and bedroom 3 was also removed to create a much larger bedroom with built-in robes. The carport was enclosed as a further space and the ground floor was also extended at the other end of the building.

A later post-modern refurbishment to the south-western entrance is evident with a new entry ramp and expressed steel gable end frame to the new covered entrance porch. There are now external exit stairs from the first floor addition.

The building was accessed by a separate driveway, separating the residence from student parts of the campus.

Interior Form	The interior has been heavily altered to create office use and while rooms remain from its use as a residence most of the residential fitout has been removed.
Significance	The building has some significance as an early element of the campus development as a bespoke VC residence, however the numerous changes to the building and use have had a major impact on the integrity and form of the building that has diminished any significance it may have had. The building in its current form has low heritage significance.
Key Elements	-
Condition	The building appears to be in fair overall condition, however a detailed inspection was not conducted.

Current Photos

Building 38 – Research House

North-western facade

Source: Paul Davies Pty Ltd

Building 38 – Research House

North-western facade

Source: Paul Davies Pty Ltd

Building 38 – Research House

North-eastern facade

Source: Paul Davies Pty Ltd

Building 38 – Research House

North-eastern façade and open verandah

Source: Paul Davies Pty Ltd

Building 38 – Research House

South-western facade

Source: Paul Davies Pty Ltd

Building 38 – Research House

South-eastern corner

Source: Paul Davies Pty Ltd

Building 38 – Research House

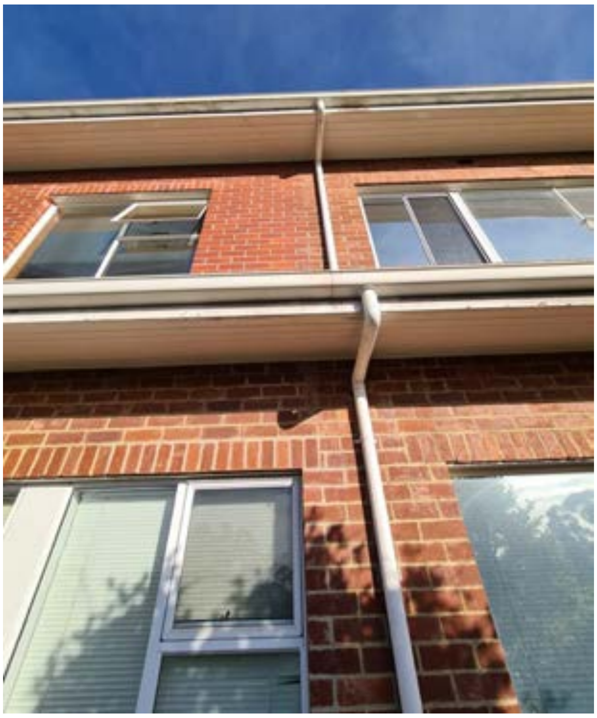
Southern facade

Source: Paul Davies Pty Ltd

Building 38 – Research House

North-eastern corner

Source: Paul Davies Pty Ltd



Building 38 – Research House

Evidence of the first floor extension to the east can be seen in the change in brickwork on the first floor and evidence of the former mitred corner to the first floor eaves lining.

Source: Paul Davies Pty Ltd

Building 38 – Research House

Postmodern addition to the south-western façade to create a new entrance

Source: Paul Davies Pty Ltd

Early Photos

Building 38 – Research House (Vice Chancellor's Lodge)

1959 black and white print

View from the Union Building

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 23

Building 38 – Research House (Vice Chancellor's Lodge)

1959 black and white print

Churchill Avenue and French Street

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 18

Building 38 – Research House (Vice Chancellor's Lodge)

1967 black and white print

Northern facade

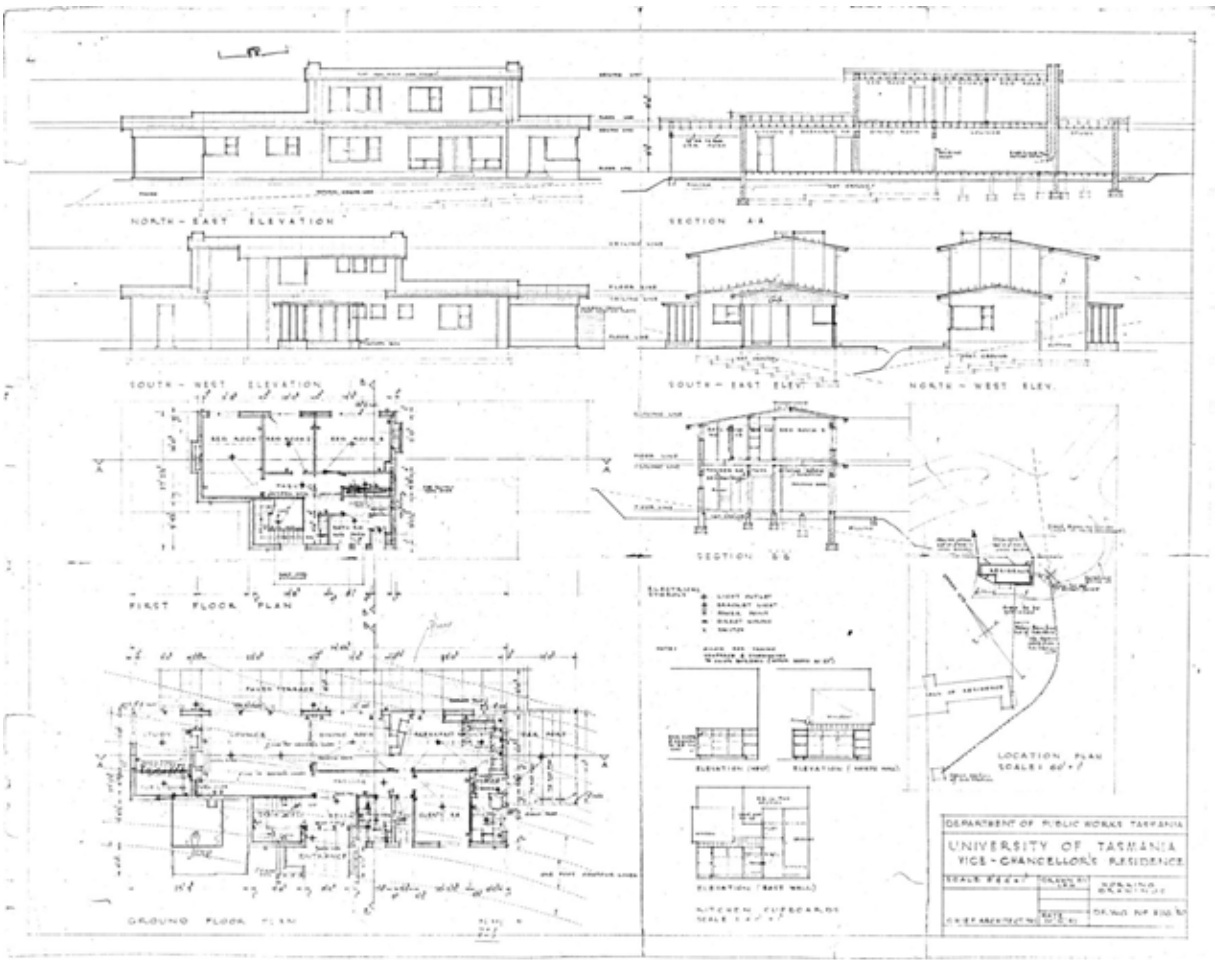
Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 49

View of the Campus from the Vice Chancellor's Lodge

1967 black and white print

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 50

Key Plans



Building 38 – Research House

Plans Elevations and Sections – Vice Chancellors Residence, University of Tasmania. Prepared by Department of Public Works Tasmania, 1957

Source: Box 17-031.tif

Building 40
Hytten Hall

Building No:	Building Name:	Previous Name:
40	Hytten Hall Education, English Language	Hytten Hall – Hall of Residence The Centre for Education
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1952-1955	Philp Lighton in association with John FD Scarborough (Original 1952 design by John F.D. Scarborough)	1959
Date of Major Extension	**Architect for Extension**	**Description**
Drawings not dated. Pre 1967	Department of Public Works Tasmania. Chief Architect S. T. Tomlinson	New southern residential wing
1967	Department of Public Works Tasmania. Chief Architect S. T. Tomlinson	Additional tutorial space
1980	JN Pettifor – University Architect	Conversion to The Centre for Education
1994	Eastman Heffernan Walch & Button	Lecture Room Addition

Description of Current Building

Exterior Form	Hytten Hall is a four storey, predominately linear, red face brick building orientated north-east with beautiful views across the main campus below towards Sandy Bay. The original building consisted of two long linear wings either side of a projecting central glazed staircase and entry foyer. The building is one of the earlier transitional modernist buildings on the campus and has a low pitched, but visible, gable roof form with overhanging eaves to the north-eastern and south-western façades. There is a small step in plan in the set out of the wings at the central staircase. The north-eastern elevation displays a hierarchy of the internal spaces with a small linear projecting balcony built in front of the large common spaces on the first floor. The first-floor common areas also have a much higher floor to ceiling height than the accommodation floors and this is expressed on the north-eastern façade with full-height glazing to these rooms.

A four storey southern extension was built off the rear of the original central entry foyer and staircase between 1959 and 1967 (the drawings are not dated) with a very narrow central corridor and single bedrooms either side. The extension is perpendicular to the original building and spans over the driveway below. This extension also features red face brick facades, with the edges of the concrete slabs for each floor painted white and visible on the exterior. The brickwork under the regular aluminium framed windows is a slightly recessed panel of four solider courses, which creates a strong repetitive rhythm to the regular façade.

The original building and the southern extension were heavily altered internally in 1980 to convert the building from residential student accommodation to The Centre for Education. Many of the internal walls were removed to create classrooms, tutorial rooms and staff rooms. Some of the original windows on the first floor of the north-eastern elevation were also altered during these works.

A single storey rectangular lecture room addition was added to the north-eastern corner of the original building in 1994. This extension is unremarkable and not significant.

Interior Form

The original building contained individual study bedrooms to the ground floor on the northern-eastern side of the building, with shared amenity facilities located on the south-western side of the building. The first floor contained the kitchen and dining room in the eastern wing, and the common room, reading room and library in the western wing. The second and third floors contained study bedrooms along the north-eastern side, again with shared amenity facilities located on the south-western side of the building.

The main central staircase is a generous stair finished with a green terrazzo, which forms a continuous run of treads, risers and landings. The edge of the terrazzo overhangs the edge of the stair structure and is exposed. A simple painted steel handrail wraps continuously around the centre of the staircase.

The interior of both the original building and extension were heavily altered during the 1980 conversion to The Centre for Education. Many internal walls were removed during these works. Some of the original timber joinery to the corridors on the third floor were retained (i.e. hi-light glazing with reeded glass to the corridors).

Significance

Hytten Hall is an interesting early campus building in that it was designed by a prominent architect who also designed one of the more significant campus buildings and that it flirts with modernism but is not a modernist building. It is a large and quite awkward building more related to the architecture of the 12940s and early 1950s than the modernism that defined the campus.

The building has heritage significance and externally retains a reasonable level of integrity. Internally the building is severely altered but remnant fitout remains. However, none of the interior fitout with the possible exception of the stair well and its glazed wall are significant.

The building remains in a fine setting of grassland and bushland.

	Overall the building has moderate heritage significance in relation to its remaining original sections. The later additions have no heritage significance.
Key Elements	-
Condition	The building appears to be in average overall condition, however a detailed inspection was not conducted.

Current Photos

Building 40 – Hytten Hall

North-eastern façade

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

North-eastern façade, with central glazed staircase and main entrance foyer

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

North-eastern façade of the eastern wing

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

North-eastern façade of the western wing

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

Central glazed main entrance foyer and staircase

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

Western façade of the southern extension wing

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

Detail of the western façade of the southern extension wing. The extension is evident in the brickwork and the double column.

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

Junction of the original building wing with the southern wing

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

Southern façade of the original western wing

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

Eastern façade of the southern extension wing

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

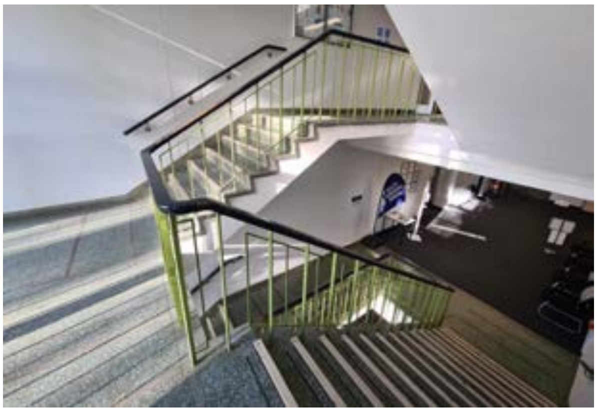
Eastern façade of the original eastern wing

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

Western façade of the original western wing

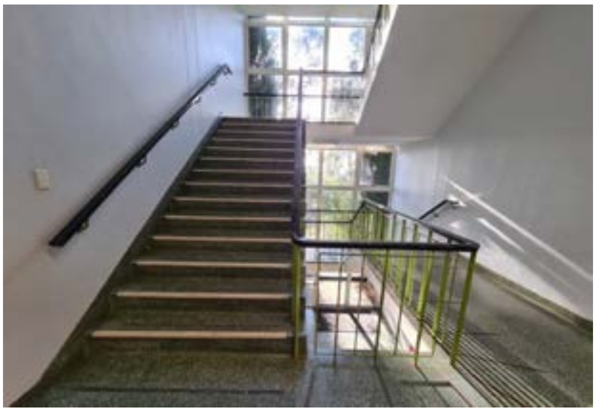
Source: Paul Davies Pty Ltd



Building 40 – Hytten Hall

View of the main central stair to the original building

Source: Paul Davies Pty Ltd



Building 40 – Hytten Hall

View of the main central stair to the original building

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

View of the southern corridor to the original western wing

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

Detail of an original steel window to the southern corridor of the original western wing

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

Typical corridor and painted timber joinery to the original building

Source: Paul Davies Pty Ltd

Building 40 – Hytten Hall

Typical classroom of the original building

Source: Paul Davies Pty Ltd

Early Photos

Building 40 – Hytten Hall

1957 black and white print

Under Construction

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 9

Building 40 – Hytten Hall

1958 black and white print

Under Construction, northern facade

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 17

Building 40 – Hytten Hall

1968 black and white print

Addition to Hytten Hall, western facade

Source: University of Tasmania, Collection UT460 – Pictorial History of Sandy Bay Campus Buildings; Item 51

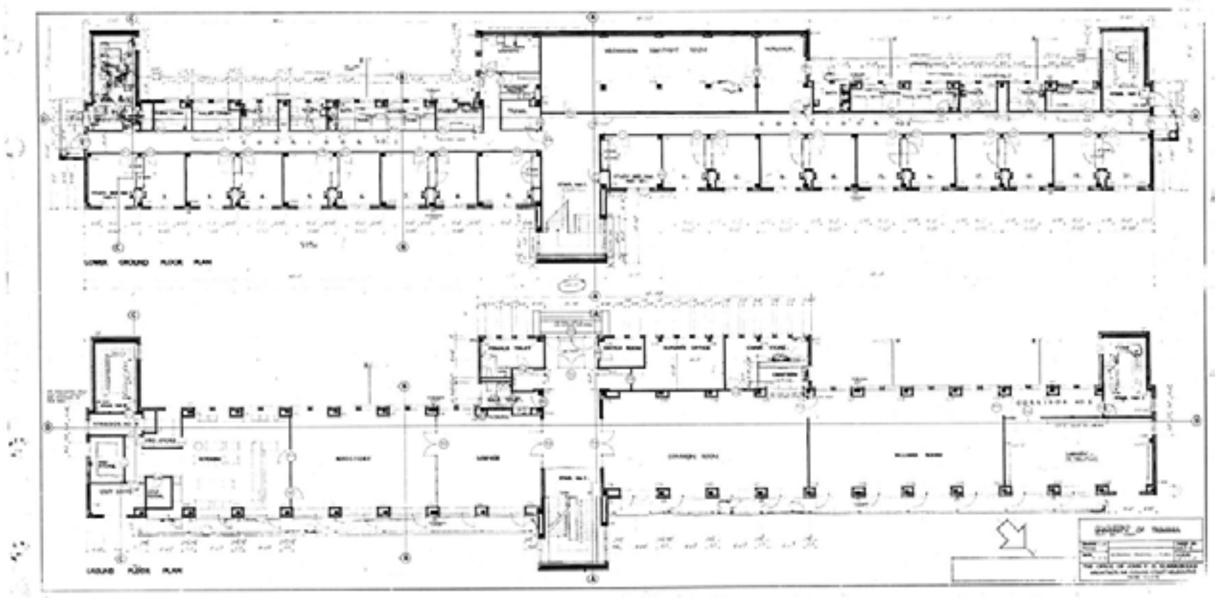
Building 40 – Hytten Hall

1960 Photograph

Northern facade

Source: Libraries Tasmania Online Collection; Item Number AA193-1-396

Key Plans



Building 40 – Hytten Hall

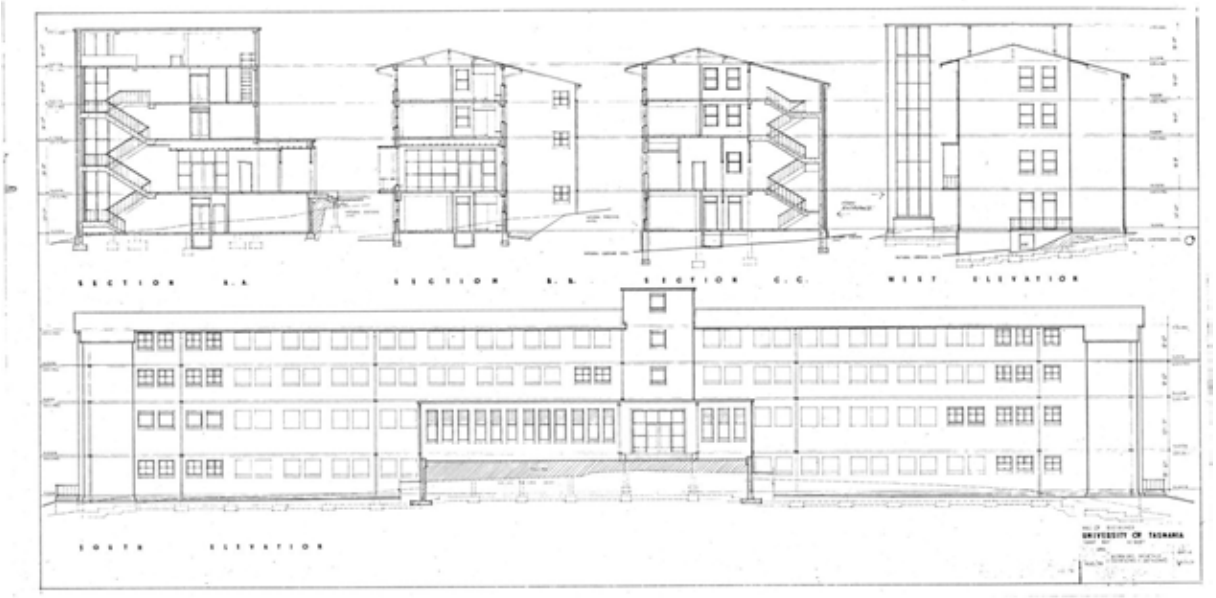
Floor Plans – Hall of Residence, University of Tasmania. Prepared by John F.D Scarborough, 1952.

Source: Hanger 38-039.tif

Building 40 – Hytten Hall

Elevations – Hall of Residence, University of Tasmania. Prepared by John F.D Scarborough, 1952.

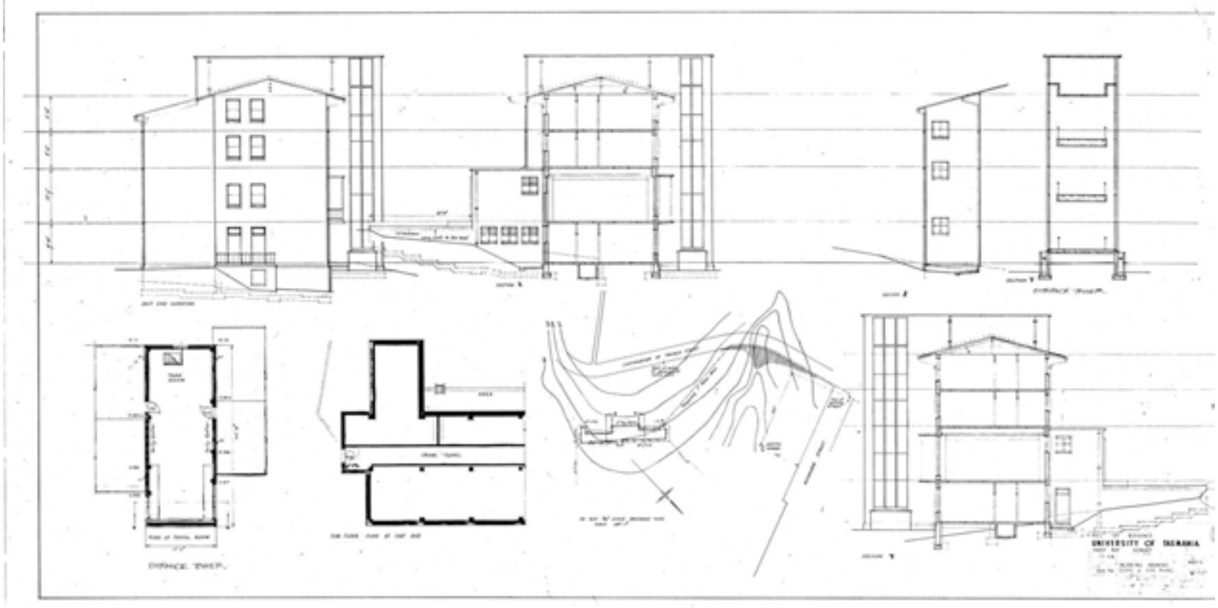
Source: Hanger 38-041.tif



Building 40 – Hytten Hall

Elevation and Sections – Hall of Residence, University of Tasmania. Prepared by John F.D Scarborough, 1952.

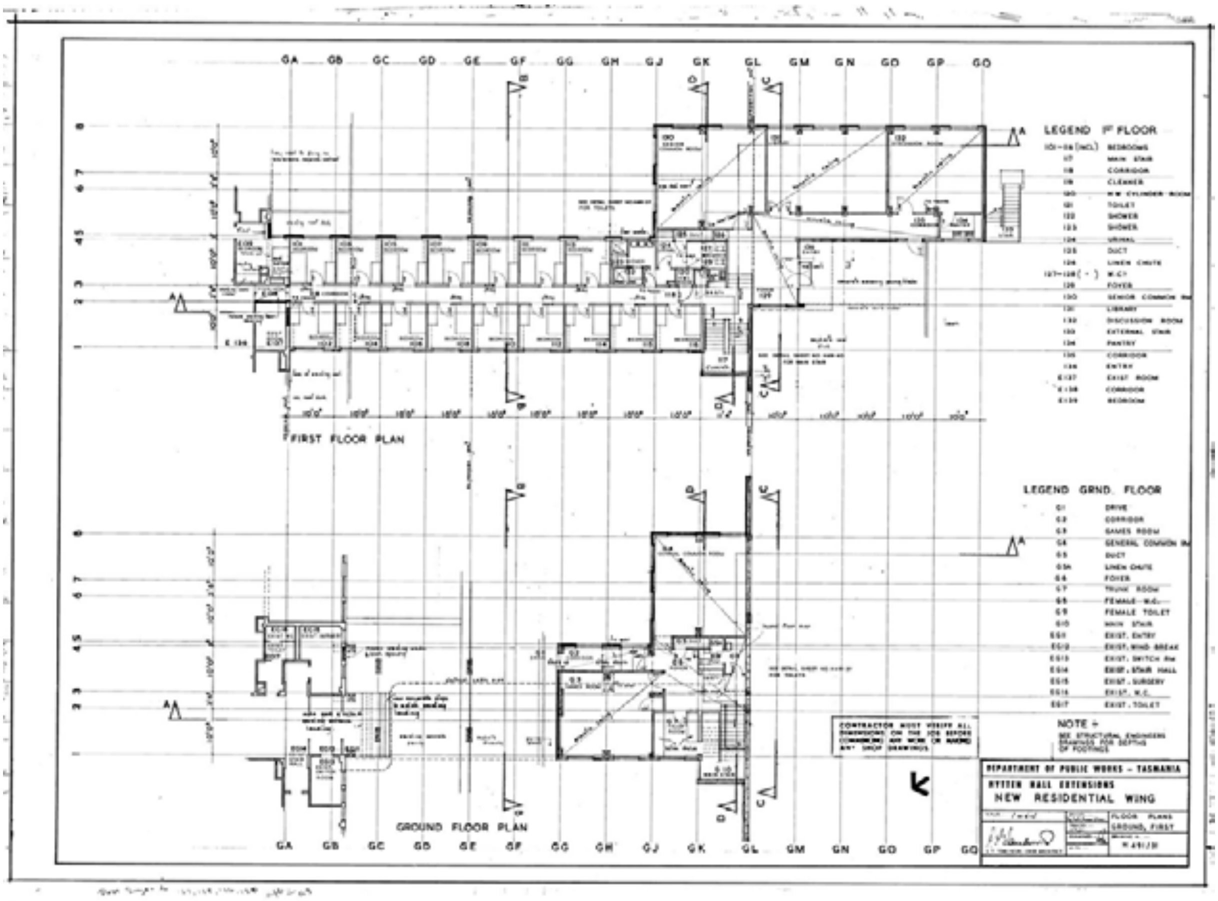
Source: Hanger 38-042.tif



Building 40 – Hytten Hall

Elevations and Sections – Hall of Residence, University of Tasmania. Prepared by John F.D Scarborough, 1952.

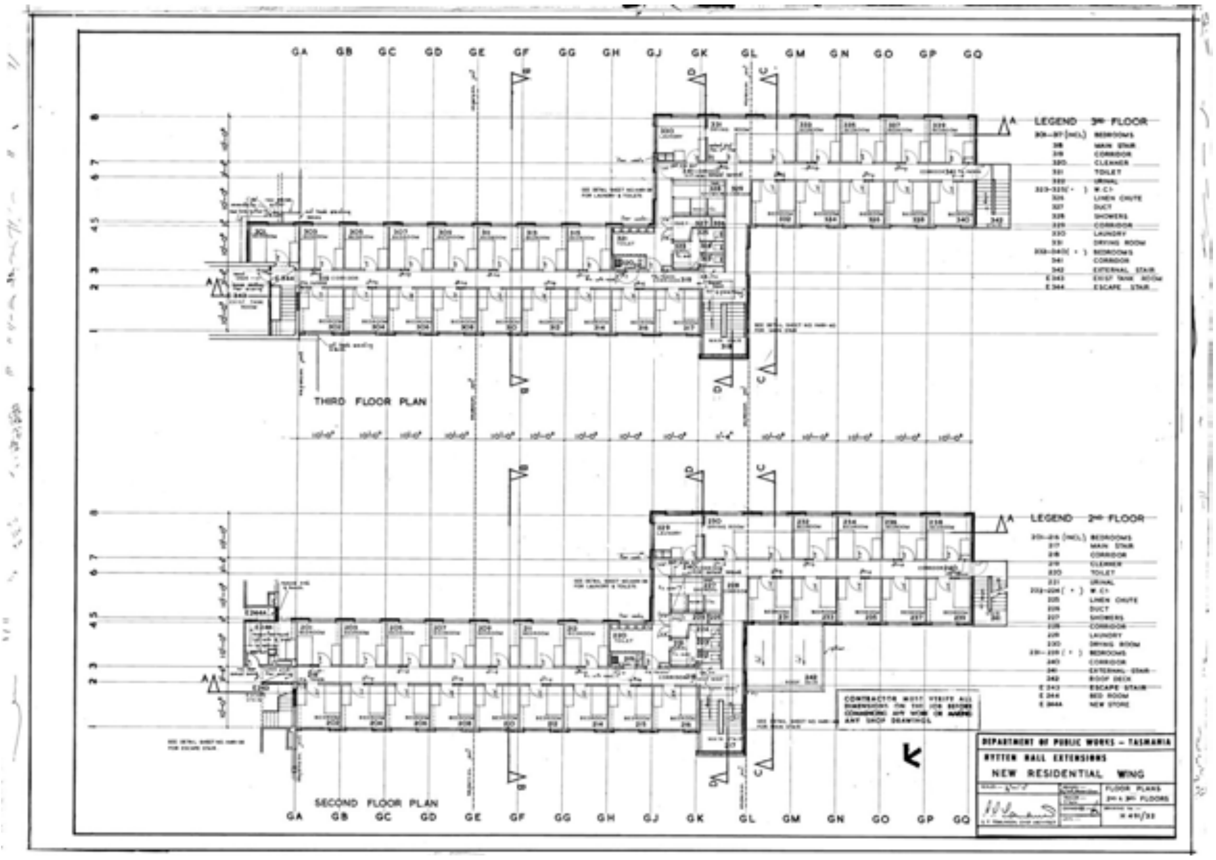
Source: Hanger 38-043.tif



Building 40 – Hytten Hall

Plans - Hytten Hall Extensions: New Residential Wing, University of Tasmania. Prepared by Department of Public Works Chief Architect S.T Tomlinson, Pre 1967.

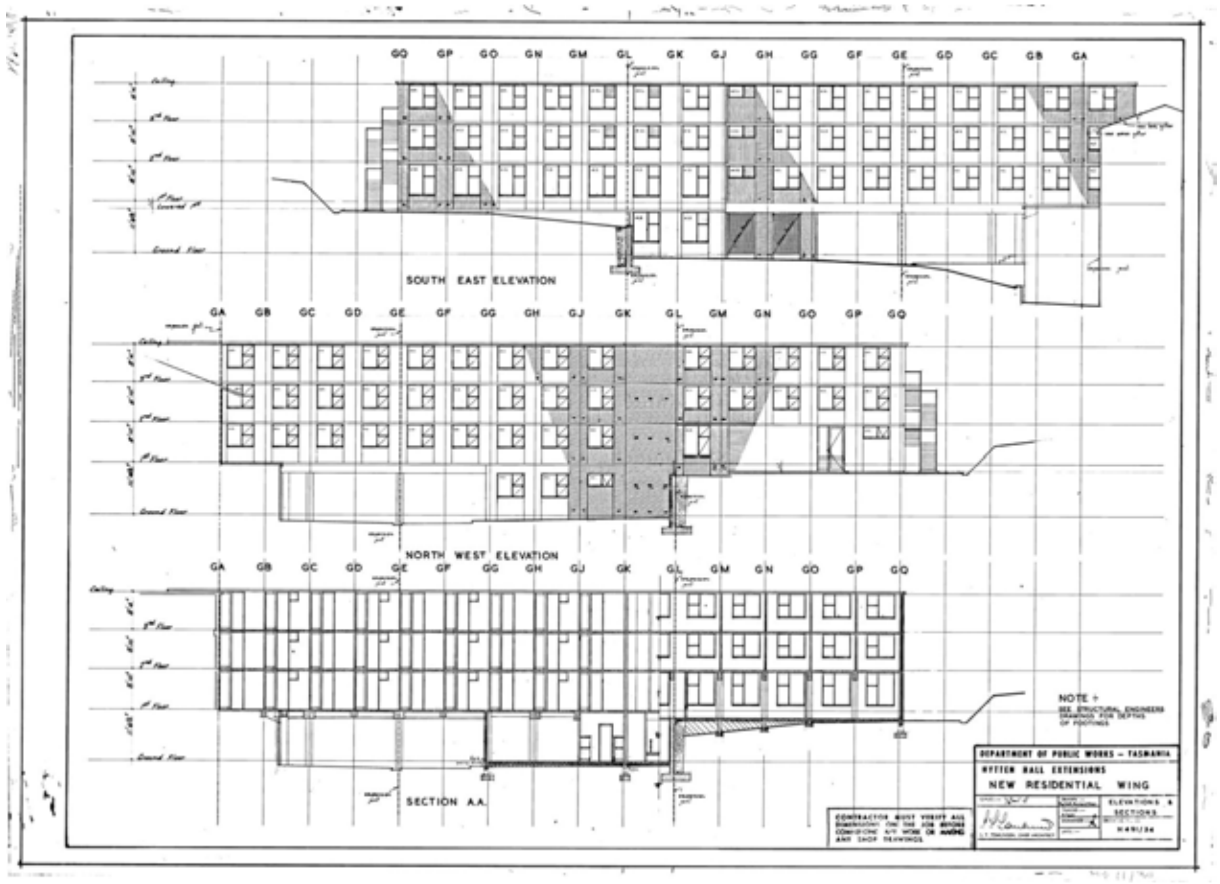
Source: Hanger 38-006.tif



Building 40 – Hytten Hall

Plans - Hytten Hall Extensions: New Residential Wing, University of Tasmania. Prepared by Department of Public Works Chief Architect S.T Tomlinson, Pre 1967.

Source: Hanger 38-007.tif



Building 40 – Hytten Hall

Elevations - Hytten Hall Extensions: New Residential Wing, University of Tasmania. Prepared by Department of Public Works Chief Architect S.T Tomlinson, Pre 1967.

Source: Hanger 38-009.tif

Building 40a
Old Commerce Building

Building No:	Building Name:	Previous Name:
40a	Old Commerce Building International Pathway College	Economics and Commerce
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1991-92	Forward Viney Woolan (Sketch design 1991)	1993
Date of Major Extension	**Architect for Extension**	**Description**
2020		Conversion to student housing

Description of Current Building

Exterior Form	The Old Commerce Building is a linear five storey post-modern concrete block building orientated to the north-east with views across the campus to Sandy Bay below. The first floor features a series of large circular 'port hole' windows along the north-eastern façade. Two attached single storey lecture theatres with parallel segmental barrel vault roofs are located projecting forward of the main bulk of the building at the north-western end. The lecture theatres are finished with blank square-format green concrete block walls with curved parapets which follow the roof lines beyond. The building features a central glazed main foyer, stairs and lift shaft, with the stairs contained within a large vertical cylindrical volume on the southern side of the building. The foyer to the ground and first floor features a double-height void space while the second to fourth floor foyers share a separate three storey atrium. The building is finished with horizontal stripes of contrasting blockwork, alternating with four courses of green blockwork and then four courses of blonde blockwork along the full length and height of the building. Steel framed mesh awnings project over the ribbon of horizontal aluminium framed windows to the top three floors. The overall form is substantial on the campus and the design is not related to any aspect of the campus character. The main entry has a formal courtyard with expansive stairs.
Interior Form	The original building was designed to contain two lecture theatres, seminar and tutorial rooms, computer rooms, student lounge, staff offices and facilities. On the ground and first floors, the main circulation corridor is brightly lit with natural lights as it runs along the front of the building on the north-eastern side with large seminar and computer rooms located behind the corridor on the southern side. The second and third floors

	revert to a central corridor with offices either side. The corridor shifts to the south side of the building to the western wing of the fourth floor as this wing contains north-east facing seminar, conference and tea rooms which open on to a generous roof deck at the western end. The eastern wing of the building was undergoing construction works during the site inspection and was not accessible, however the works appeared to be converting the eastern wing to residential student accommodation. The use of a curved stair and a range of random curved forms relates to other campus work of Forward where the style of the building dominates the functional arrangement of the building. Recently the building has been adapted for residential and college type uses, the changes were largely internal. The public spaces have been retained. The building achieved an Institute of Architects award.
Significance	The building is a well-designed post-modern building that dominates the upper campus form but has little contextual relationship to the earlier developments around it. It does not have heritage significance.
Key Elements	-
Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 40a – International Pathway College

North-eastern facade

Source: Paul Davies Pty Ltd

Building 40a – International Pathway College

North-eastern facade

Source: Paul Davies Pty Ltd

Building 40a – International Pathway College

Western end of the north-eastern facade

Source: Paul Davies Pty Ltd

Building 40a – International Pathway College

Detail of the exterior of the western lecture theatre

Source: Paul Davies Pty Ltd

Building 40a –International Pathway College

Western end of the north-eastern facade

Source: Paul Davies Pty Ltd

Building 40a – International Pathway College

Eastern end of the north-eastern facade

Source: Paul Davies Pty Ltd

Building 40a –International Pathway College

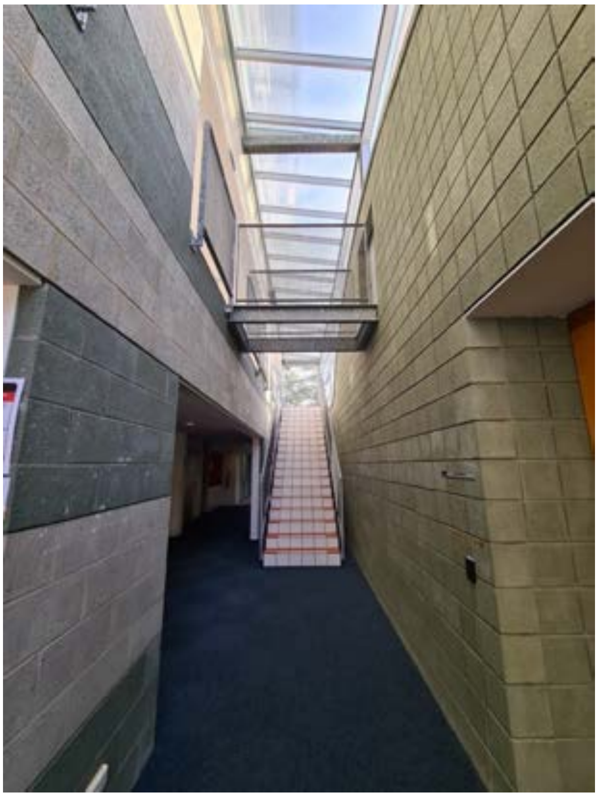
Western fire exit stairs

Source: Paul Davies Pty Ltd

Building 40a –International Pathway College

Typical corridor running along the north-eastern side of the building

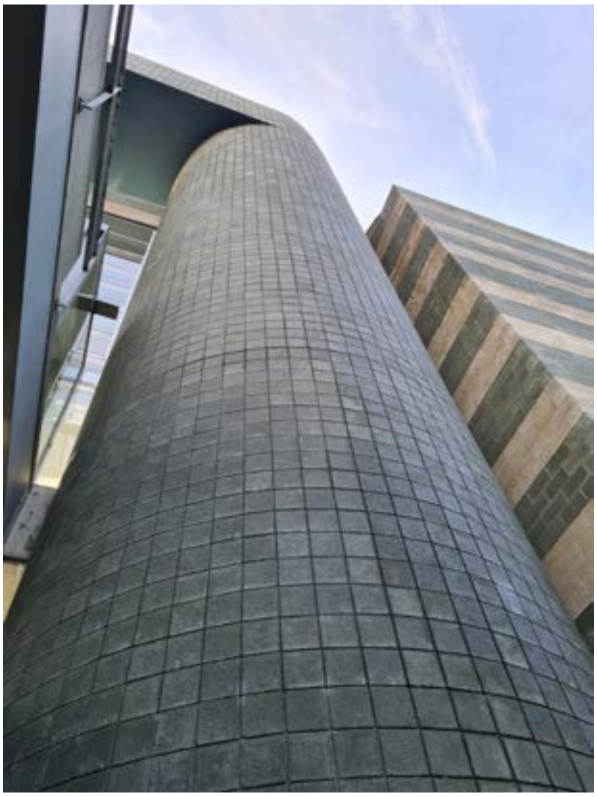
Source: Paul Davies Pty Ltd



Building 40a –International Pathway College

Detail of the void space between the western lecture theatre and the main building

Source: Paul Davies Pty Ltd

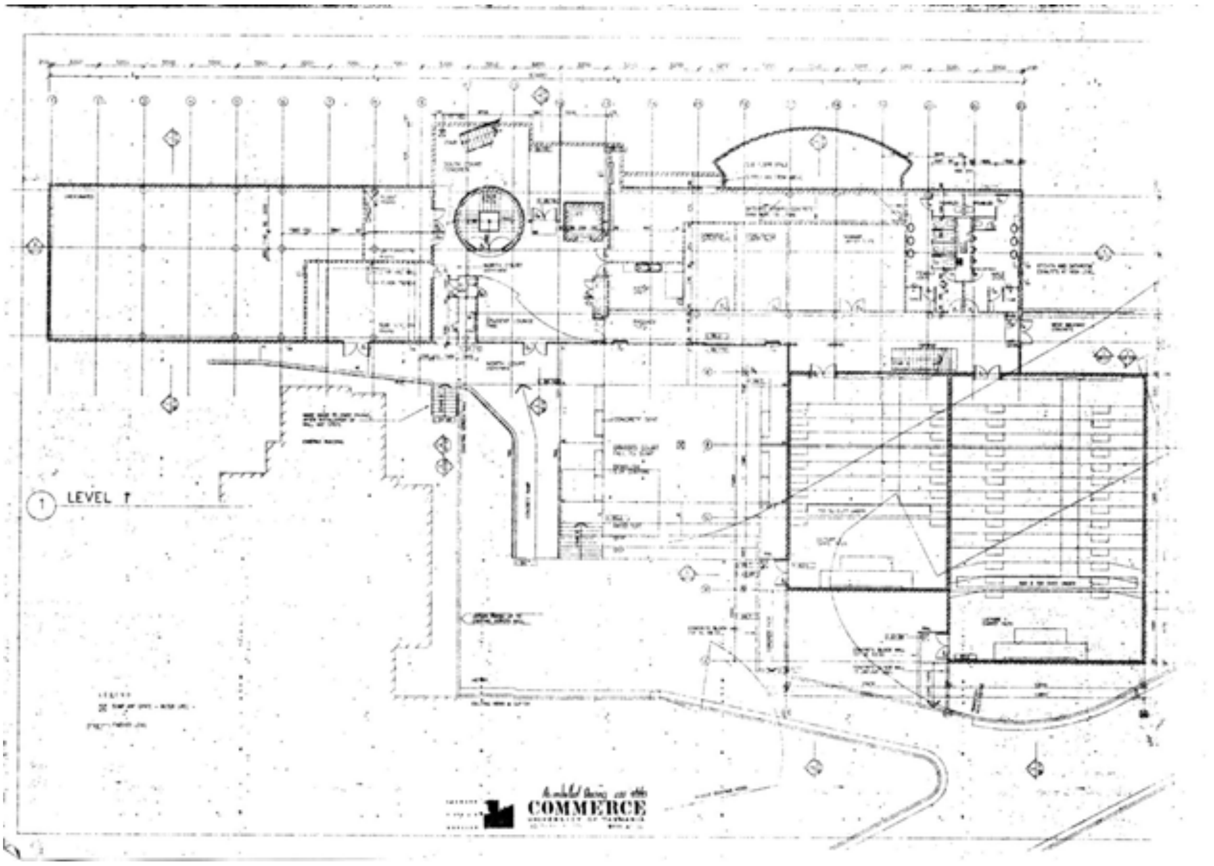


Building 40a –International Pathway College

Detail of the large circular columns located on the southern side of the building

Source: Paul Davies Pty Ltd

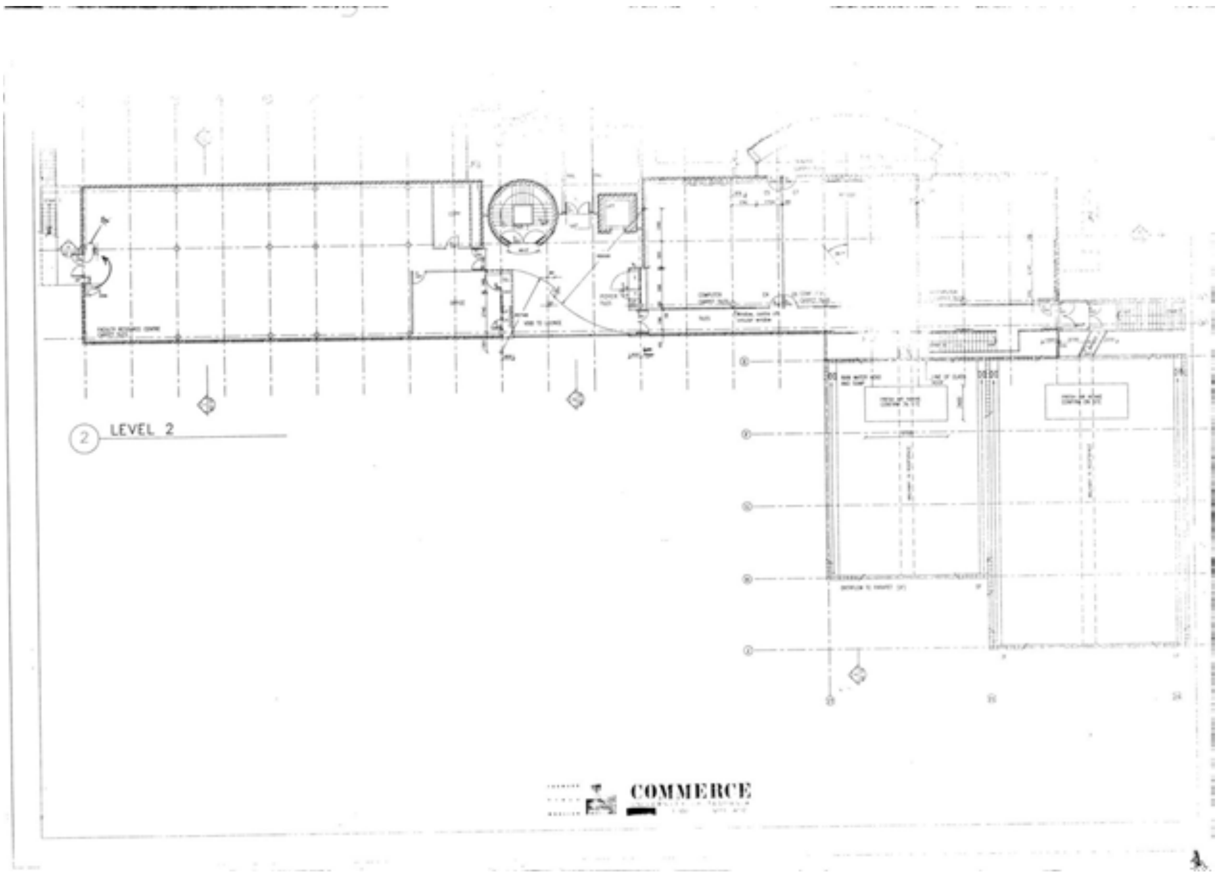
Key Plans



Building 40a – International Pathway College

Ground Floor Plan – Commerce, University of Tasmania. Prepared by Forward Viney Woolan, 1992

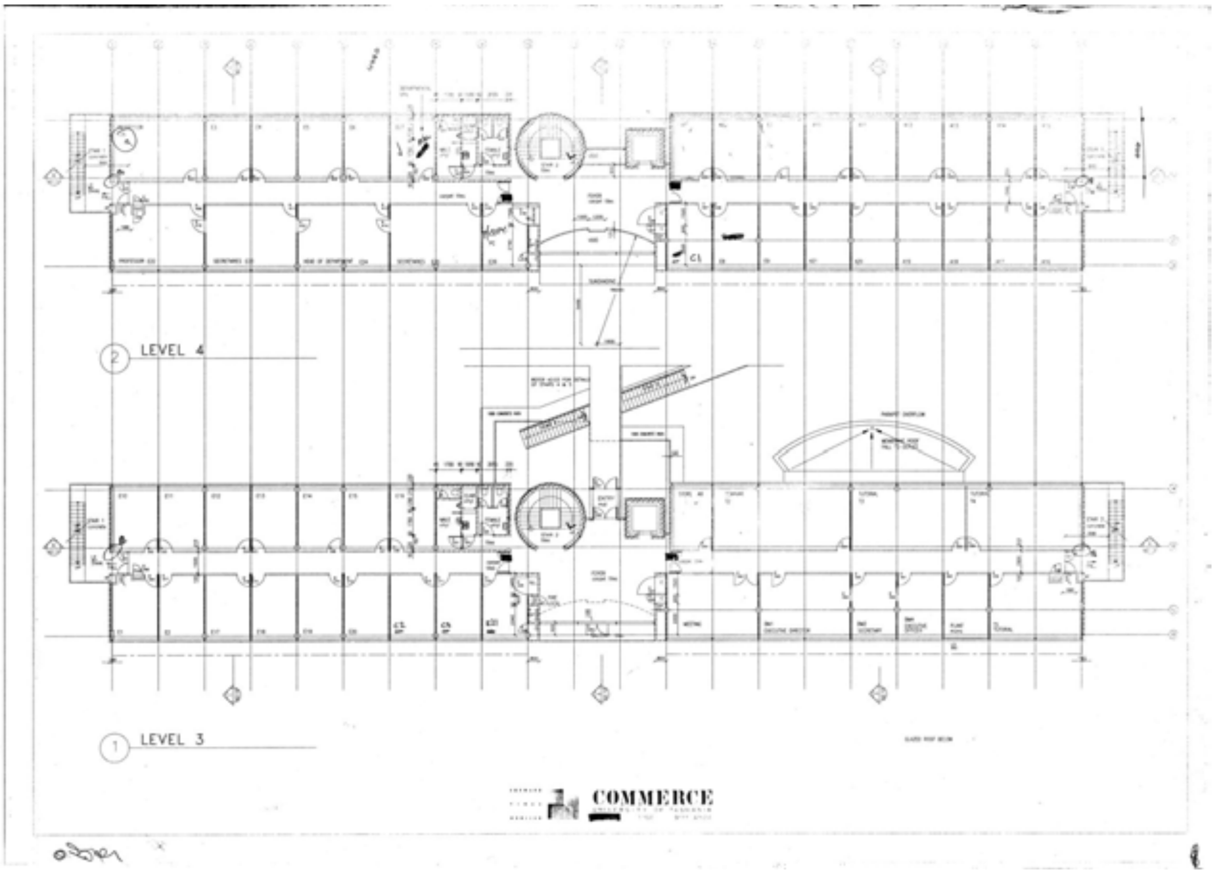
Source: Floor Plan Level 01.tif



Building 40a – International Pathway College

First Floor Plan – Commerce, University of Tasmania. Prepared by Forward Viney Woolan, 1992

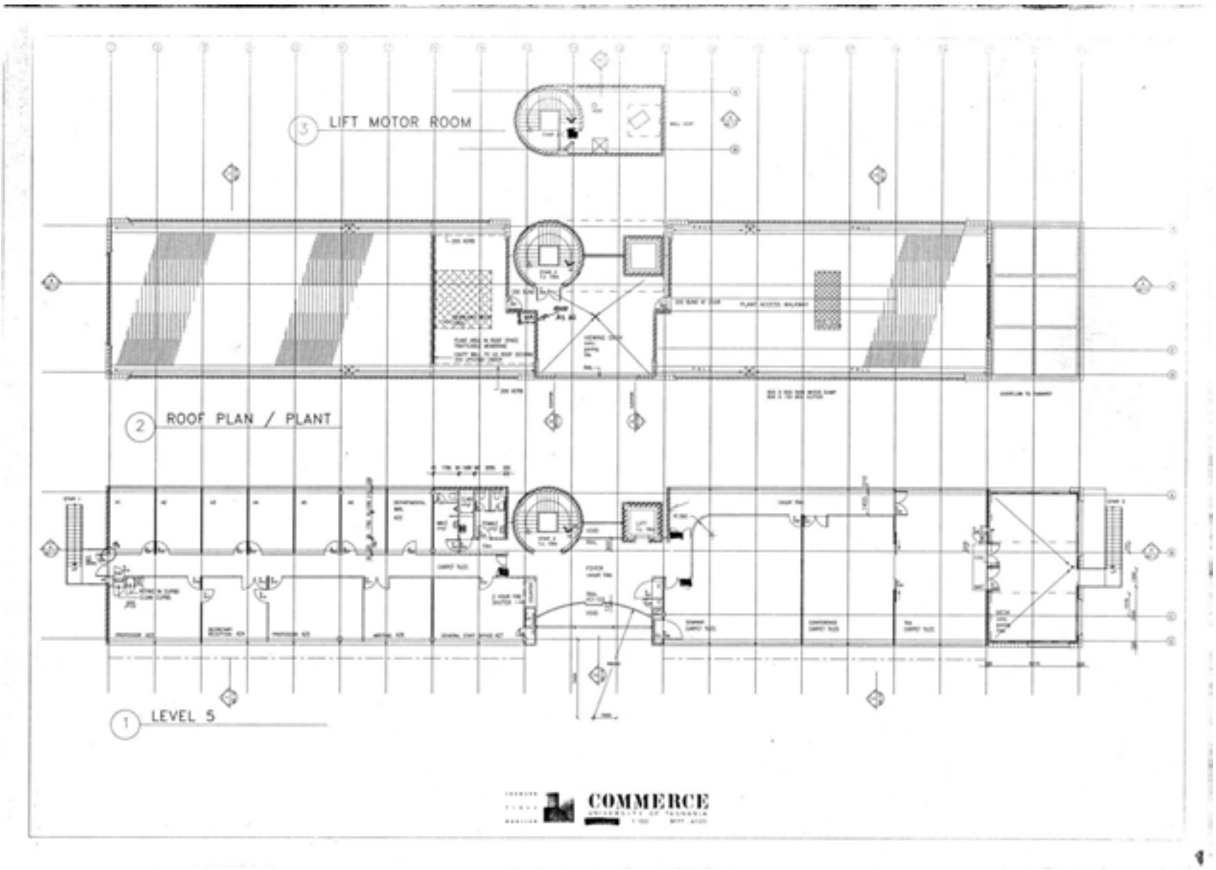
Source: Floor Plan Level 01.tif



Building 40a – International Pathway College

Levels 3 and 4 Floor Plans – Commerce, University of Tasmania. Prepared by Forward Viney Woolan, 1992

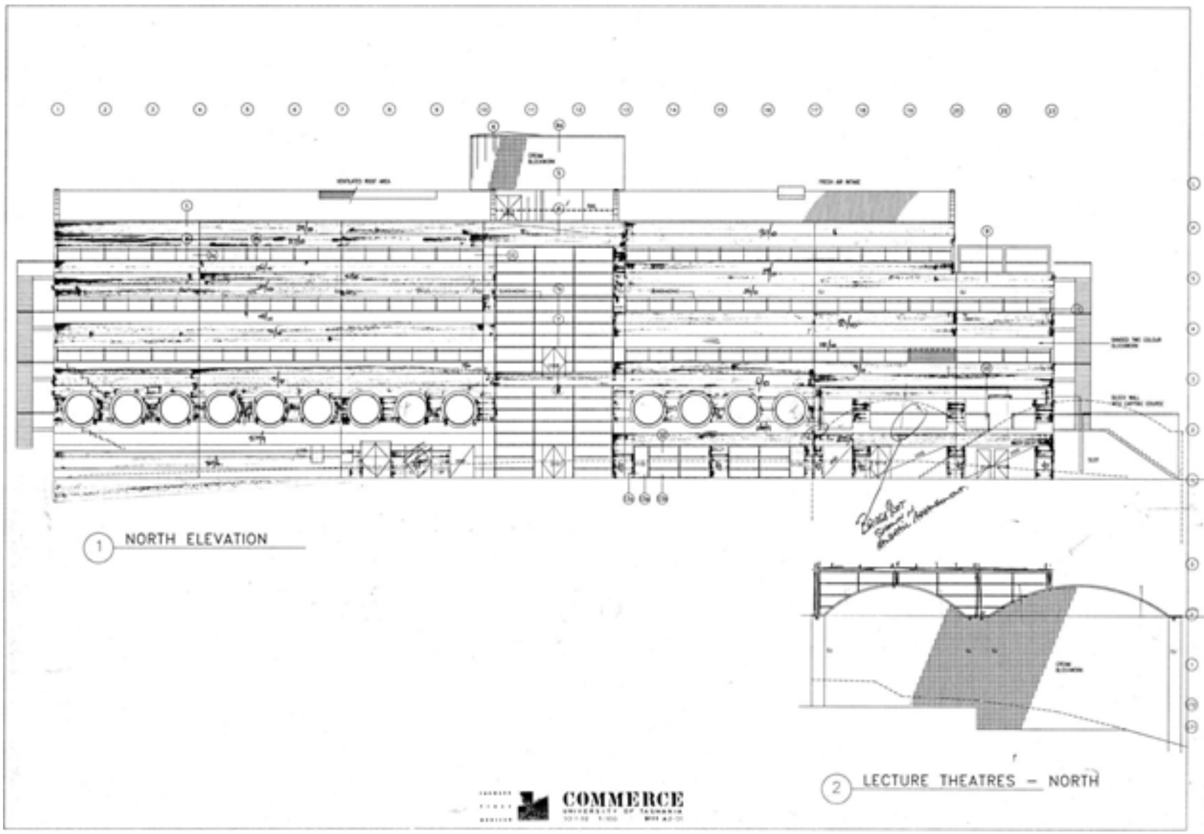
Source: Floor Plans Levels 3 &4.tif



Building 40a – International Pathway College

Level 5 and Roof Plan – Commerce, University of Tasmania. Prepared by Forward Viney Woolan, 1992

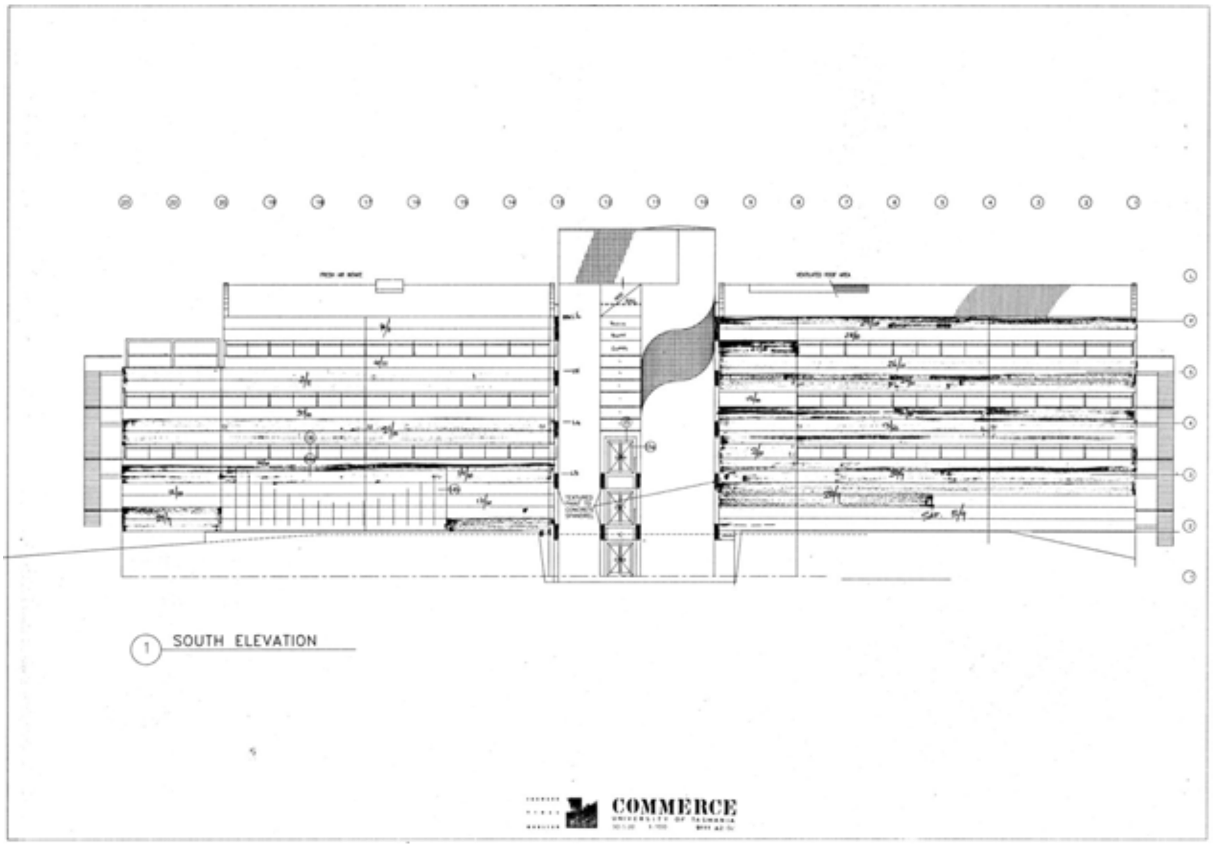
Source: Floor Plans Levels 5,6,7.tif



Building 40a – International Pathway College

North Elevation – Commerce, University of Tasmania. Prepared by Forward Viney Woolan, 1992

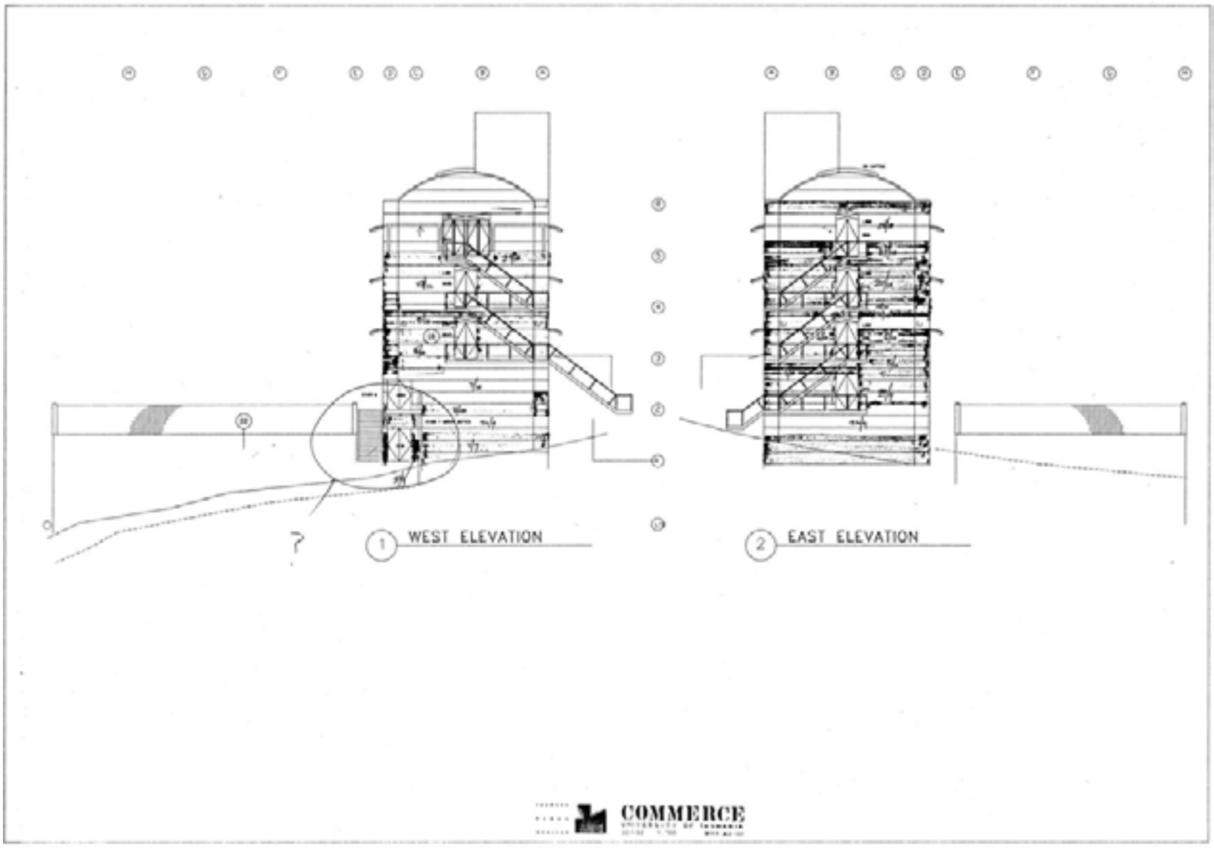
Source: Elevations North.tif



Building 40a – International Pathway College

South Elevation – Commerce, University of Tasmania. Prepared by Forward Viney Woolan, 1992

Source: Elevations South.tif



Building 40a – International Pathway College

East and West Elevations – Commerce, University of Tasmania. Prepared by Forward Viney Woolan, 1992

Source: Elevs East & West.tif

Building 40b
Old Commerce Annex

Building No:	Building Name:	Previous Name:
40b	Old Commerce Annex	Staff Quarters and Janitors Residence The Centre for Education Arts & Crafts Building
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1958	Philp Lighton Floyd and Beattie	1959
Date of Major Extension	**Architect for Extension**	**Description**
1980	J. N. Pettifor – University Architect	Major adaptation to the Centre for Education Arts & Crafts Building

Description of Current Building

Exterior Form	The Old Commerce Annex is modest two-storey rectilinear red face brick building with a low pitched gable roof. The building is orientated facing east. The original lower ground floor contained a carport, two laundries and two entry stairs. The southern end of the ground floor contained a compact two bedroom unit accessed via a dedicated staircase. The centre of the ground floor contained four bedrooms to the eastern façade with a common corridor, common room, pantry, store and bathroom located on the western side. The northern end of the ground floor contained a small studio apartment with living room, kitchenette, bathroom and small bed alcove. The building was converted to The Centre for Education Arts and Crafts Building in 1980. The interior of the building was significantly altered with many of the internal walls being removed in order to create studios for woodwork, sculpture, pottery and fibre. Some of the original windows were removed and new windows and doors were also introduced to the original facades as part of these works.
Interior Form	Interior not accessible during site inspection
Significance	While an early campus building, the building used traditional forms and materials in contrast with the shift to modernism that was taking place elsewhere on the campus. It is not a distinctive or innovative building and has low heritage significance.
Key Elements	-

Condition	The building appears to be in fair overall condition, however a detailed inspection was not conducted.

Current Photos

Building 40b – Old Commerce Annex

North-eastern corner

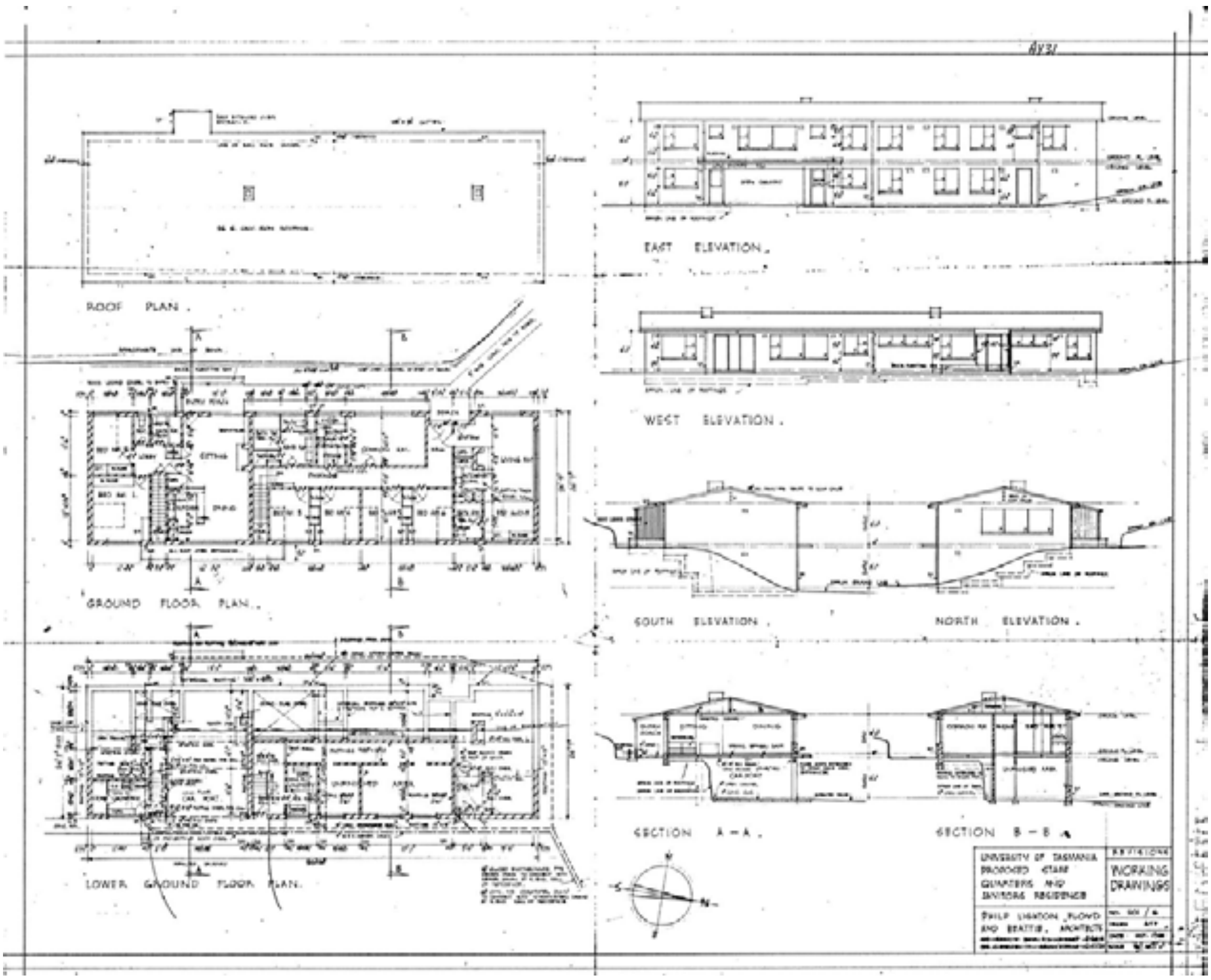
Source: Paul Davies Pty Ltd

Building 40b – Old Commerce Annex

Eastern elevation

Source: Paul Davies Pty Ltd

Key Plans



Building 40b – Old Commerce Annex

Plans Elevations and Sections – University of Tasmania Proposed Staff Quarters and Janitors Residence. Prepared by Philp Lighton Floyd Beattie Architects, 1958.

Source: Plans, Elevs & Sects 2.tif

Building 49
Old IMAS Building

Building No:	Building Name:	Previous Name:
49	Old IMAS Building	-
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
-	-	-
Date of Major Extension	**Architect for Extension**	**Description**
2018	Preston Lane	Alterations

Description of Current Building

Exterior Form	The Old IMAS Building is a three-storey building which steps in plan, featuring dark brown pebblecrete horizontal panels to the façade. The two-storey southern corner, containing a stairwell, has full-height curtain wall glazing. The main entrance is located in a stepped form to the north-east of the stairwell and also features matching full-height curtain glazing and a dynamic suspended steel and glass awning canopy to the entrance. The pebblecrete panels continue around the eastern façade, which features regular 'punched-out' square aluminium windows and a fully glazed projecting bay with a shallow curved plan to the first floor.
Interior Form	Interior not accessible during site inspection
Significance	The building does not have heritage significance.
Key Elements	-
Condition	The building appears to be in fair overall condition, however a detailed inspection was not conducted.

Current Photos

Building 49 – Old IMAS Building

South-western elevation

Source: Paul Davies Pty Ltd

Building 50
Rugby Pavilion

Building No:	Building Name:	Previous Name:
50	Rugby Pavilion	-
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
1959	Department of Public Works - Tasmania. Chief Architect C.D Rose	-
Date of Major Extension	**Architect for Extension**	**Description**
1961	Department of Public Works - Tasmania. Chief Architect C.D Rose	Clubhouse addition to changerooms

Description of Current Building

Exterior Form

The Rugby Pavilion is a single storey red face brick building with a minimal pitch concrete roof facing the main football field at the north-eastern end of the Lower Campus. The almost flat concrete roof extends beyond the external walls below creating an eaves overhang around the building. The building is orientated to face east with a timber framed glazed wall and small external balcony to the social room. A small basement storage area is located below the social room due to the steep fall of the land. External concrete stairs wrap along the southern side of the building, leading to the recessed main entrance porch, which is covered with the same flat concrete roof as the rest of the building and has a balustrade and a row of slender full height circular steel columns along the eastern side of the entrance porch. The remainder of the southern façade is broken into a section with a painted rendered wall and high-level horizontal aluminium windows and a section with a red face brick wall and three small square high level aluminium windows. The western façade is book-ended by red face brick sections of walls, with a section of painted rendered wall between, again with banks of high-level horizontal aluminium windows. The northern elevation steps in plan, presenting a red face brick wall to the north-western corner, a section of painted rendered wall with high-level horizontal aluminium windows to the centre adjacent to a set of external concrete steps leading to the recessed main entrance porch with the same detail as the main entrance from the south side followed by a red face brick wall with a large timber framed window to the social room.

A generous entrance foyer connects the main entrances behind the social room to the southern and northern facades. The foyer extends through the centre of the building, with two Perspex sky dome skylights providing natural lighting to the otherwise windowless centre of the building. A small kitchen is located to the south of the central foyer. The western side

	of the building contains two separate change rooms including showers, WCs and locker room facilities.
Interior Form	Interior not accessible during site inspection.
Significance	The building has moderate significance as one of the early buildings on the campus that related to the development of the sports facilities on the lower campus area. The design of the building is modest and it is not an outstanding example of its style from the period. It is representative of the work being designed by Public Works at the time.
Key Elements	-
Condition	The building appears to be in fair overall condition, however a detailed inspection was not conducted.

Current Photos

Building 50 – Rugby Pavilion

Eastern façade (facing playing field)

Source: Paul Davies Pty Ltd

Building 50 – Rugby Pavilion

North elevation

Source: Paul Davies Pty Ltd

Building 50 – Rugby Pavilion

North-Western corner

Source: Paul Davies Pty Ltd

Building 50 – Rugby Pavilion

East Elevation

Source: Paul Davies Pty Ltd

Building 50 – Rugby Pavilion

North-eastern corner

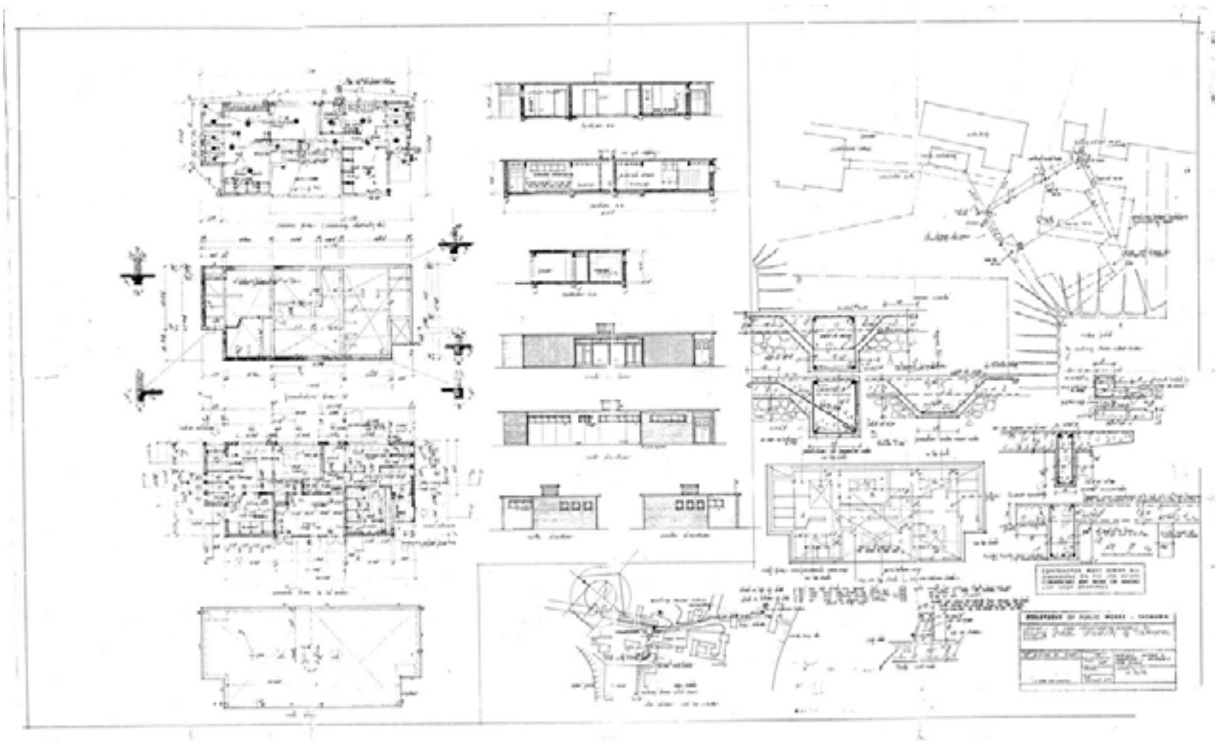
Source: Paul Davies Pty Ltd

Building 50 – Rugby Pavilion

South-eastern corner

Source: Paul Davies Pty Ltd

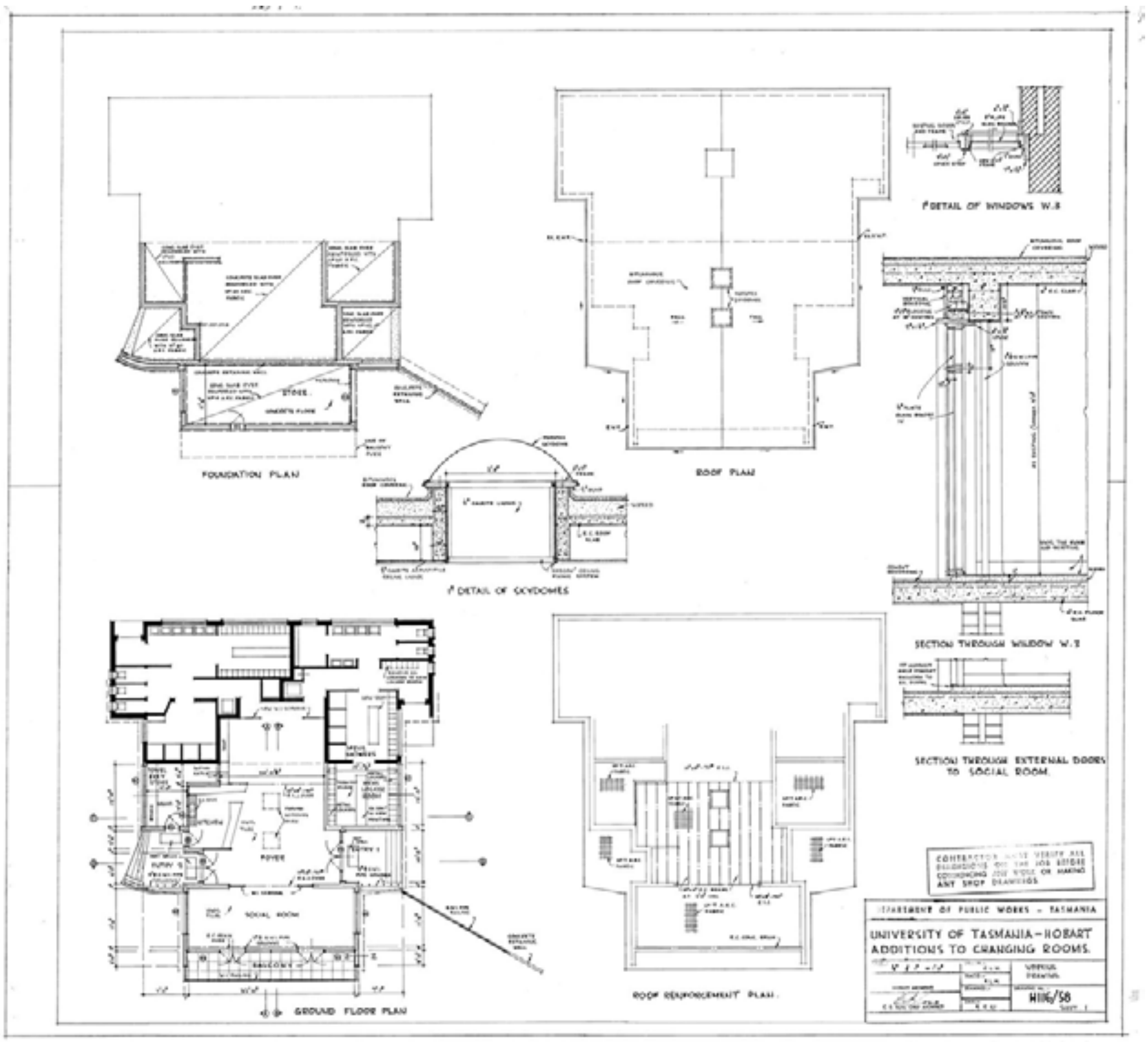
Key Plans



Building 50 – Rugby Pavilion

Stage 1 New Changerooms to Playing fields, University of Tasmania. Prepared by Department of Public Works -Tasmania. Chief architect C.D Rose, 1959.

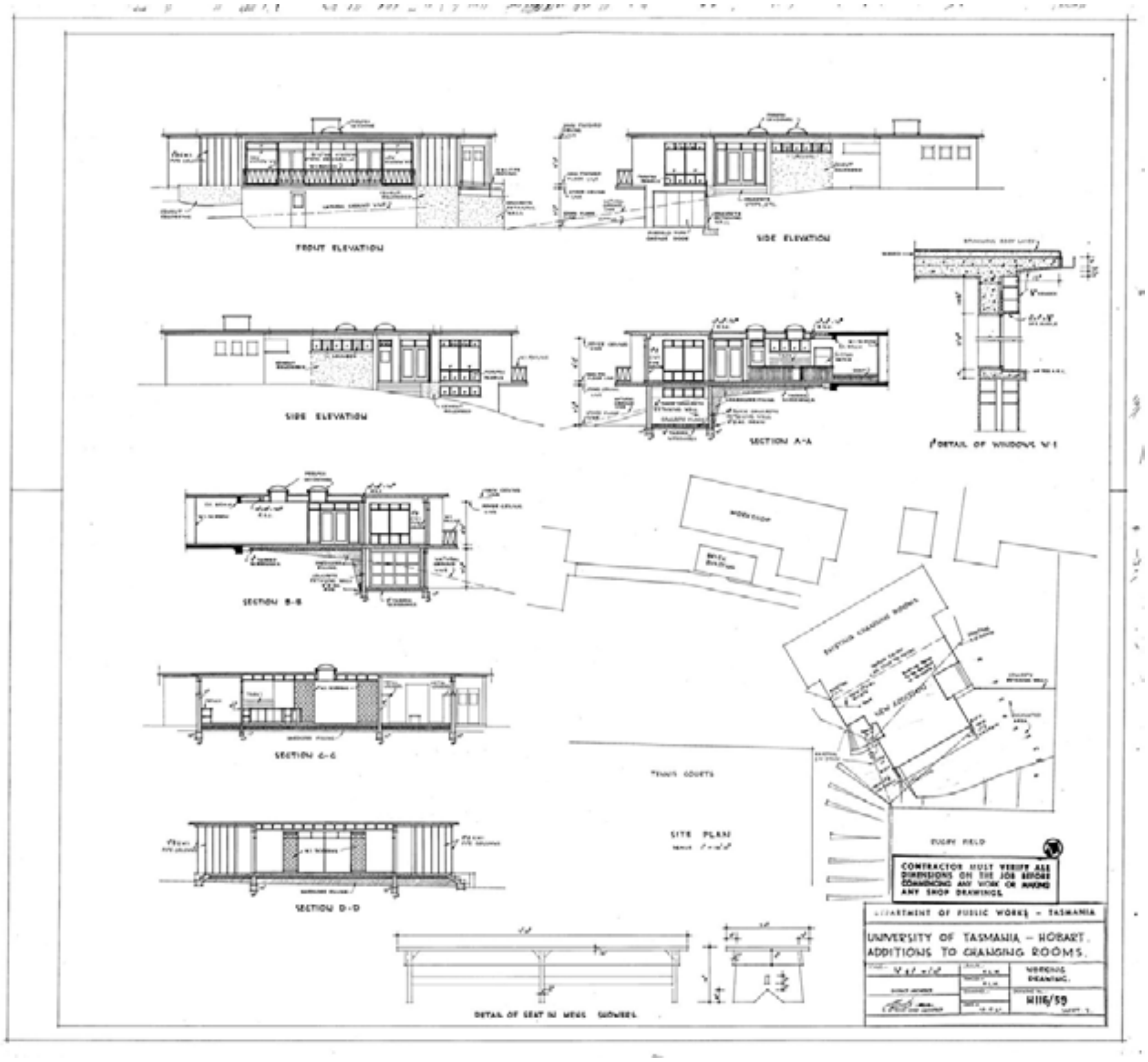
Source: Hanger 20-091.tif



Building 50 – Rugby Pavilion

Floor Plans - University of Tasmania Additions to Changerooms. Prepared by Department of Public Works -Tasmania. Chief architect C.D Rose, 1961.

Source: Hanger 20-071.tif



Building 50 – Rugby Pavilion

Elevations and Sections - University of Tasmania Additions to Changerooms. Prepared by Department of Public Works -Tasmania. Chief architect C.D Rose, 1961.

Source: Hanger 20-072.tif

Building 52
Community Health Clinic

Building No:	Building Name:	Previous Name:
52	Community Health Clinic	Child Health Centre

Date of Construction or Date of Original Drawings	Original Architect	Date Opened
1984	University of Tasmania - Buildings Branch	-

Date of Major Extension	Architect for Extension	Description
-	-	-

Description of Current Building	
Exterior Form	The Community Health Clinic is a small and modest rectilinear single storey blonde face brick with a flat roof. The building contains a waiting room, a small WC, a consultation room and feed room. The building is located between the Lady Gowrie Child Care Centre and the University Gym and faces south-east.
Interior Form	Interior not accessible during site inspection
Significance	The building has no heritage significance.
Key Elements	-
Condition	The building appears to be in fair overall condition, however a detailed inspection was not conducted.

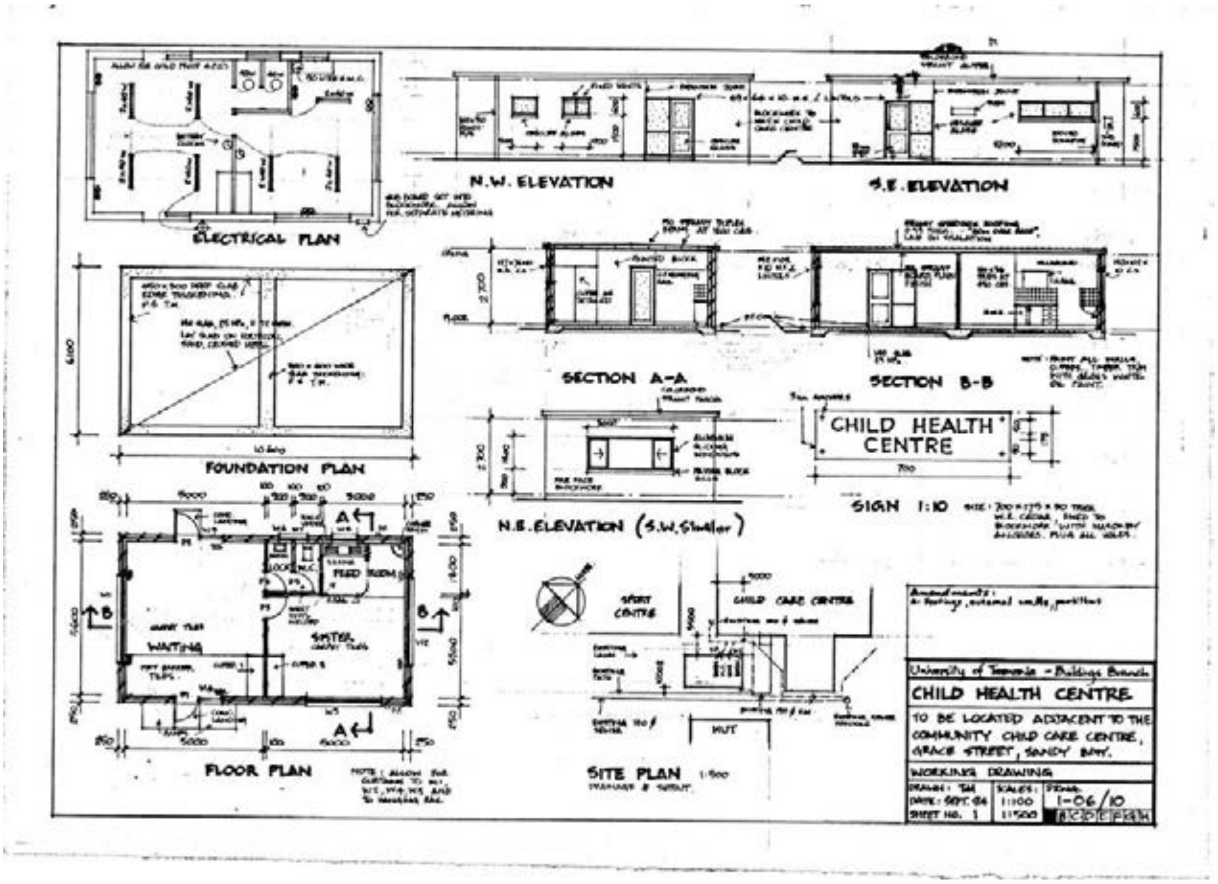
Current Photos

Building 52 – Community Health Clinic

Eastern facade

Source: Paul Davies Pty Ltd

Key Plans



Building 52 – Community Health Clinic

Working Drawing – Child Health Centre, University of Tasmania. Prepared by University of Tasmania Buildings Branch, 1984

Source: Box 9-002.tif

Building 53
Childcare Cottage

Building No:	Building Name:	Previous Name:
53	Childcare Cottage	Former Rifle Range Managers House

Date of Construction or Date of Original Drawings	Original Architect	Date Opened
c1880s	-	c1880s

Date of Major Extension	Architect for Extension	Description
1988	Drafting Services Tasmania	New Annex
c1990	Drafting Services Tasmania	Extension to Annex
c1990	Drafting Services Tasmania	Alterations within Extension to Annex
1991	Drafting Services Tasmania	Infil link between cottage and Annex
1994	Sue Small	Landscape Works

Description of Current Building

Exterior Form

The early building is a simple timber farm cottage, well detailed and built but not an individually highly significant building for its form or detail. It was more than a modest cottage and even with its various additions over time demonstrated good typical design elements of the time, weatherboard cladding, half-timbered gable ends, a typical two gable roof form around a small front verandah (now enclosed), etc.

The building has undergone change with windows having different sash forms but the exterior of the earlier sections remain quite intact.

The various additions have detracted from the form and integrity of the cottage but are all capable of removal to recover the simple earlier form. The building appears to have been built as a five room dwelling based on its layout with a central hallway, four of the rooms having fireplaces (now removed). The roof form of the main house remains intact.

Interior Form

The building was not available for inspection, however drawings indicate the following internal changes:

- removal of many walls and details
- removal of fireplaces

	- removal of early fitout generally - changes to the rear elevation with additions - infilling the front verandah.
Significance	The early part of the building is significant as a remnant structure that pre-dated the rifle range use, was then used as a caretakers residence for that use and was then incorporated into the university campus uses. The building has undergone significant change including numerous additions, internal changes and has been relocated on the site during university use. The building has high significance for its links to the early development uses of the site and as the only building that pre-dates the university and rifle range developments.
Key Elements	- The early external built form and detailing It is noted that its current location does not form part of its overall significance as it has been relocated, however, if the building were to be relocated again it should remain within the general area of the early farm and rifle range.
Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 53 – Childcare Cottage

South-eastern elevation

Source: Paul Davies Pty Ltd

Building 53 – Childcare Cottage

South elevation

Source: Paul Davies Pty Ltd

Building 53 – Childcare Cottage

South-eastern elevation

Source: Paul Davies Pty Ltd

Building 53 – Childcare Cottage

View of north eastern corner

Source: Paul Davies Pty Ltd

Building 53 – Childcare Cottage

eastern elevation

Source: Paul Davies Pty Ltd

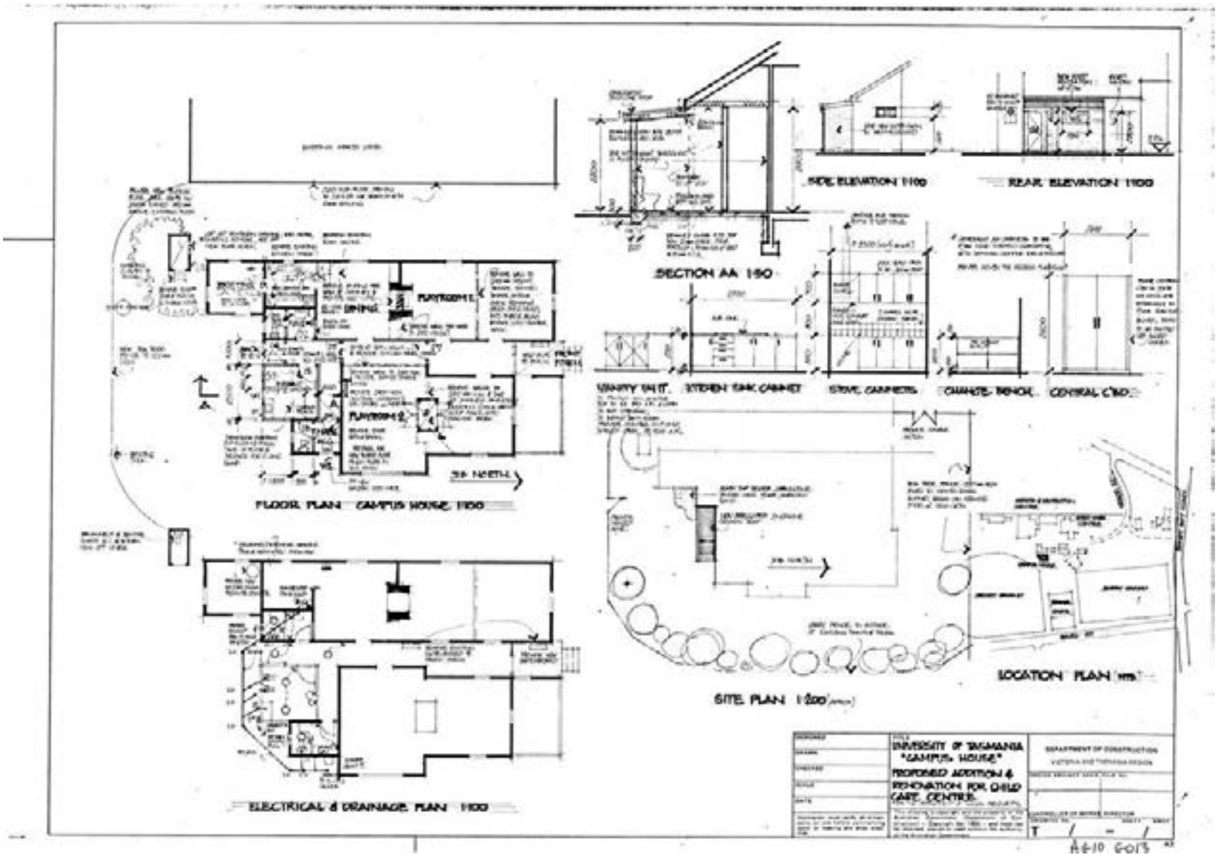
Early Photos

Building 53 – Childcare Cottage

Sandy Bay campus facing Mt Wellington. The cottage can be seen to the lower far left of the image behind the rifle range clubhouse, the building on the far right is the golf course club house.

Source: University of Tasmania Library Special & Rare Collections

Key Plans



Building 53 – Childcare Cottage

Proposed addition and Renovation for Child Care Centre. Prepared by the Department of Construction Victoria and Tasmania Region for the Department of Social Security, 1984. These plans are the earliest available of the former Rifle Managers Residence. The adjacent sports hub to the north was demolished sometime between 1988-91.

Source: Hanger 22-004.tif

Building 53a
Brick Store Room

Building No:	Building Name:	Previous Name:
53a	Brick Store Room	Former Rifle Range Storage Building
Date of Construction or Date of Original Drawings	**Original Architect**	**Date Opened**
c1914	-	c1914
Date of Major Extension	**Architect for Extension**	**Description**
-	-	-

Description of Current Building	
Exterior Form	The building is a small brick shed with a skillion corrugated iron roof and a pair of doors on one of the long elevations and a small window on an end elevation. It has rendered heads to the openings. Gwenda Lord in her publication describes it as a former ammunition store for the rifle range. It would appear to be the only element of that use of the site that remains.
Interior Form	The interior is a brick lined single space used for storage.
Significance	The building is of moderate heritage significance for its association with the rifle range use. It is not a distinctive or exceptional structure but rather a utilitarian shed, built for a specific storage purpose. It survived presumably as it was brick and was capable of ongoing store room use.
Key Elements	- The form of the building
Condition	The building appears to be in good overall condition, however a detailed inspection was not conducted.

Current Photos

Building 53a – Brick Store Room

Eastern elevation

Source: Paul Davies Pty Ltd

Building 53a – Brick Store Room

Western elevation

Source: Paul Davies Pty Ltd

REPORTING TO INFORM THE MASTERPLAN DESIGN

Transport Strategies

Complete Streets

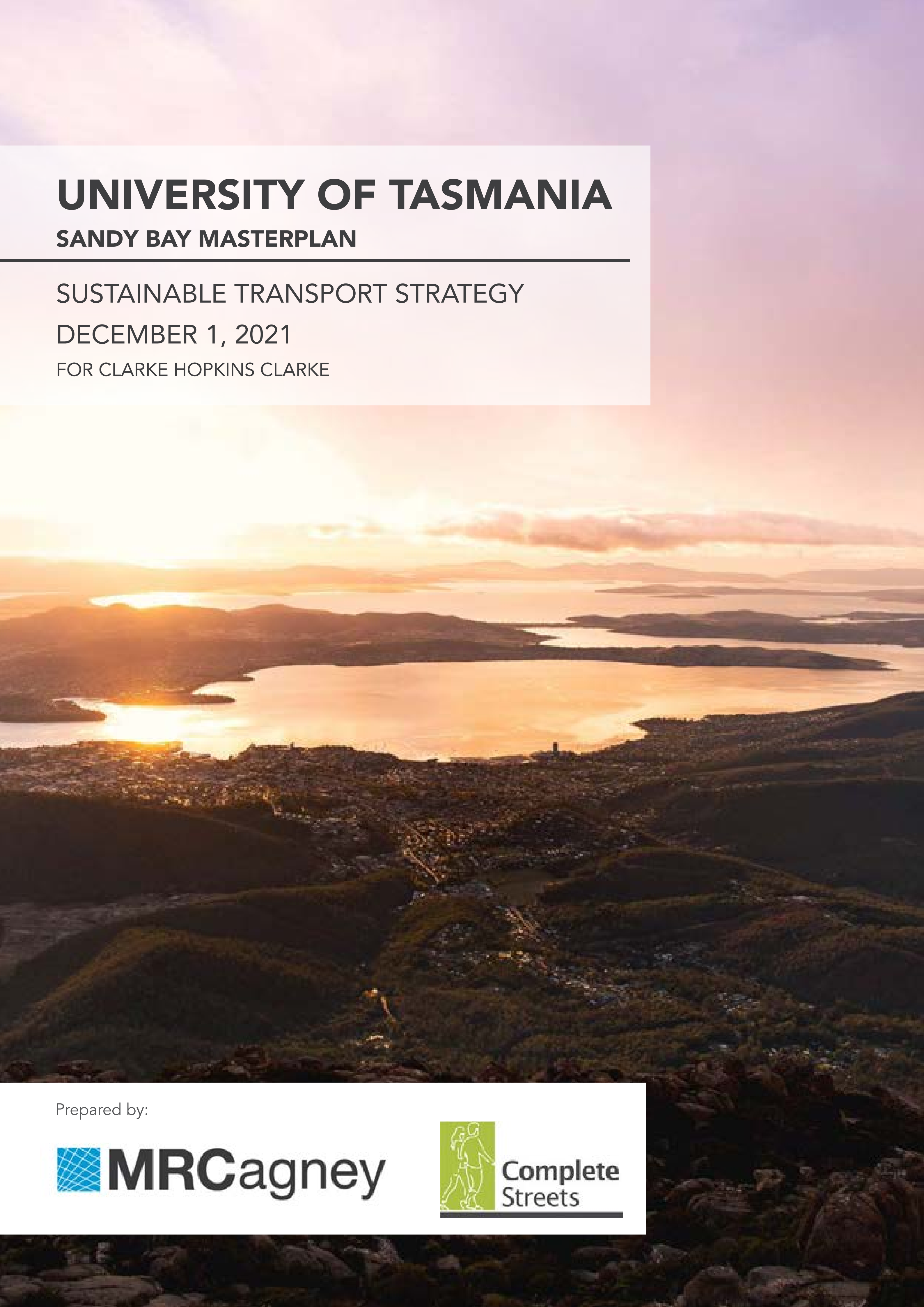
UNIVERSITY OF TASMANIA

SANDY BAY MASTERPLAN

SUSTAINABLE TRANSPORT STRATEGY

DECEMBER 1, 2021

FOR CLARKE HOPKINS CLARKE



Prepared by:

MRCagney

Complete Streets

VERSION	DATE	ISSUED FOR	ISSUES BY
Draft Version 1	July 23, 2021	Initial Draft	Steven Burgess, Director
Draft Version 2	July 27, 2021	Externalise report	Steven Burgess, Director
Draft Version 3	August 8, 2021	Revised parking strategies + comments	Steven Burgess, Director
Draft Version 4		Internal issue only	
Draft Version 5	November 2, 2021	CHC comments	Steven Burgess, Director
Final Version	December 3, 2021	UPPL comments	Steven Burgess, Director

This report has been commissioned by ClarkeHopkinsClarke Architects Pty Ltd, on behalf of UTAS Properties Pty Ltd (UPPL) to develop sustainable transport strategies pertaining to and in support of the development of the UTAS Sandy Bay Masterplan for the purpose of a Planning Scheme Amendment or as otherwise set out in this report. This report may only be used and relied on by ClarkeHopkinsClarke Architects Pty Ltd and UTAS Properties Pty Ltd (UPPL) for this purpose or as otherwise set out in this report.

Contents

> **"The Site will be a place that celebrates and enhances its natural assets, honours its social, cultural, and Aboriginal heritage, and looks to create an evolving, vibrant mixed-use precinct to live, work, learn and play.**
>
> **It will set a new standard for urban renewal in Tasmania and nurture a community that is inclusive and accessible to all, leaving a more sustainable legacy for people now and into the future."**

EXECUTIVE SUMMARY

The purpose of this report is to provide sustainable transport principles and methodologies to assist in the development of a Masterplan for the UTAS Sandy Bay Campus. The Masterplan will provide long term direction for the extensive redevelopment of the site.

EXECUTIVE SUMMARY (CONT)

The principles applied to developing the sustainable transport outcomes are:

- Road space that facilitates movement and access from a variety of modes without adding unnecessary private vehicle trips to the network;
- The right amount of parking in the right place;
- Quality on site active transport infrastructure as well as develop improved active transport to/ from the site;
- Improved public transport options servicing the site;
- Provide high quality demand responsive public transport on site.

To achieve this the development will have to manage its modal demand by:

- Providing for 25-35% of trips by public transport;
- Offering some parking on site in central locations;
- 25-35% of trips by active transport;

Providing the appropriate amount of road space to ensure the investors and tenants enjoy a happy healthy liveable place.

The major recommendations for the Masterplan to achieve the sustainable transport goals for the redevelopment of the UTAS Sandy Bay Campus by UPPL are as follows:

- Improve pedestrian access to the site in association with City of Hobart (street trees, better footpaths);
- Commence on-demand bus service between Sandy Bay and City campus for future expansion;
- Maximise active and public transport within the site through exemplar paths and trails as well as on site electric bikes and on-demand public transport;
- Minimise parking provision on site;
- Centralise or 'unbundle' parking from specific buildings where appropriate;
- Create bus superstops in Precinct 1 (Sandy Bay Road), Precinct 2 (Churchill Ave) and in Precinct 5;
- Initiate an extended ferry trial;
- Deliver a new signalised intersection on Sandy Bay Road between York Street and Earl Street;
- Deliver a new signalised intersection at Churchill Avenue and TT Flynn Street;
- Construct a two-lane roundabout to access Precinct 5 on Proctors Road.

1.0 INTRODUCTION

Complete Streets Pty Ltd supported by MRCagney Pty Ltd have been appointed by Clarke Hopkins Clarke (CHC) to assist in the development of the UTAS Sandy Bay Masterplanby UTAS Properties Proprietary Limited (UPPL) is a wholly owned subsidiary of the UTAS, which it has created to manage the transformation of its Sandy Bay and Newnham campuses. This enables the University to focus on its core business of learning, teaching and research with impact for and from Tasmania.

Complete Streets have developed sustainable transport principles and a methodology that enable UPPL to deliver on a sustainable transport strategy with enough flexibility to adapt to potential market changes and provide some long-term planning certainty for UPPL and potential investors.

1.1 PRINCIPLES:

To deliver on the goals for the site, transport targets for implementation are the following:

- Road space that facilitates movement and access from a variety of modes without adding unnecessary private vehicle trips to the network;
- The right amount of parking in the right place at the right price;
- Quality on site active transport infrastructure as well as develop improved active transport to/from the site;
- Improved public transport options servicing the site;
- Provide high quality demand responsive public transport on site.

1.2 METHODOLOGY:

To achieve the above there is a requirement to manage mode demand and provide alternatives to private vehicle travel by:

- Providing for 25-35% of trips by public transport;
- Offering some parking on site in central locations;
- 25-35% of trips by active transport;
- Providing the appropriate amount of road space to ensure the investors and tenants enjoy a happy healthy liveable place.

1.3 ADVANTAGES:

Developing a strategy in this manner will:

- Allow the development to prosper without adding unnecessary traffic stress to the Hobart road and street network;
- Minimise negative impact and maximise opportunities for the local community;
- Provide future focused outcomes and appeal to a broader contemporary market;
- Be complimentary to the UTAS brand and will reinforce its position as a valued Tasmanian corporate citizen.

1.4 ISSUES:

The aspiration for the site of becoming a globally iconic, locally distinctive place will require the transport strategy to extend and push for new innovative solutions and ways of achieving the desired outcomes.. This may require:

- Negotiation with City of Hobart regarding a sustainable provision for private vehicles and more appropriate provision for active, shared and public transport;
- Negotiation with the community regarding a sensible provision for private vehicles;
- Negotiation with Tasmanian Department of State Growth (DSG) on the provision of future public transport services;
- High quality and amenity of active transport facilities;
- Initiation of on-demand public transport;
- New public transport vehicles and services;

1.5 INFORMATION

Information relied upon in the preparation of this report includes:

- Howarth Fisher and Associates “UTAS Sandy Bay Campus Traffic Engineering Report – Preliminary Investigations/Constraints Report/ Options” November 2019.
- Development yields and initial parking supply from Clarke Hobsons Clarke development yield table received July 14, 2021.
- Traffic generation: 2002 RTA Guide to Traffic Generating Development and ITE Guide for Land Use Traffic Generation (10th Edition).
- Metro timetables Hobart Network - Metro Tasmania Metro Tasmania
- Hobart City Deal (Southern outlet Transit Lane + Future Ferry Service).
- University of Tasmania Travel Behaviour Survey 2019 Update Report

2.0 EXISTING CONDITIONS

The UTAS Sandy Bay Campus has long been a feature of the Hobart landscape and community. UTAS is continuing its move of academic functions in the Hobart central activity district, leaving the site available to accommodate alternate future uses. Some of the remnant uses on the site will be sport and recreation and student accommodation.

2.1 LAND USE

The current land use is education supported by some retail, sport and recreation and student accommodation. From the Howarth, Fisher and Associates report it is evident that this land use generates significant traffic, with a relatively unique demand profile associated with the current land use. We have assumed a similar distribution profile (where people come to/from), but a different demand profile based on a different land use of mixed use residential, retail, commercial, open space, sport + recreation (see Appendix A).

2.2 PARKING

UTAS have informed us that there are currently 1286 parking spaces on site, with significant utilisation (90%) during semester. This is in and of itself not really relevant to the new proposal due to the significantly different land uses. Contemporary approaches to parking are changing rapidly and UPPL's provision will be influenced by a number of factors, including road network capacity, community expectations, environmental footprint and the availability of alternate transport modes. There are common mechanisms used to transition from a high parking supply in the initial stages of development, to a more sustainable supply in the long term.

2.3 TRANSPORT OPTIONS

Currently the site is accessible by a range of modes. Approximately 50% of people currently arrive by car. This is a much better than the rest of Greater Hobart Compared to other cities. The rest of Hobart makes 80% of trips by car, as there is no motivation not to drive. There is little to no traffic congestion around Hobart and the parking is mostly free. The redevelopment of the UTAS site in Sandy Bay will require an innovative approach to address this condition and enable an appropriate scale of development and a diversity of transport options.

2.3.1 ACTIVE TRANSPORT

The UTAS site has a great walking and cycling catchment as shown in the isochronic diagrams below. The catchment is from the centre of the site and from the western end of the site for walking and bike riding. The diagrams show what area is within 10 minutes bike ride or 10 minutes' walk from these locations.

Bikes on Sandy Bay Rd (source)

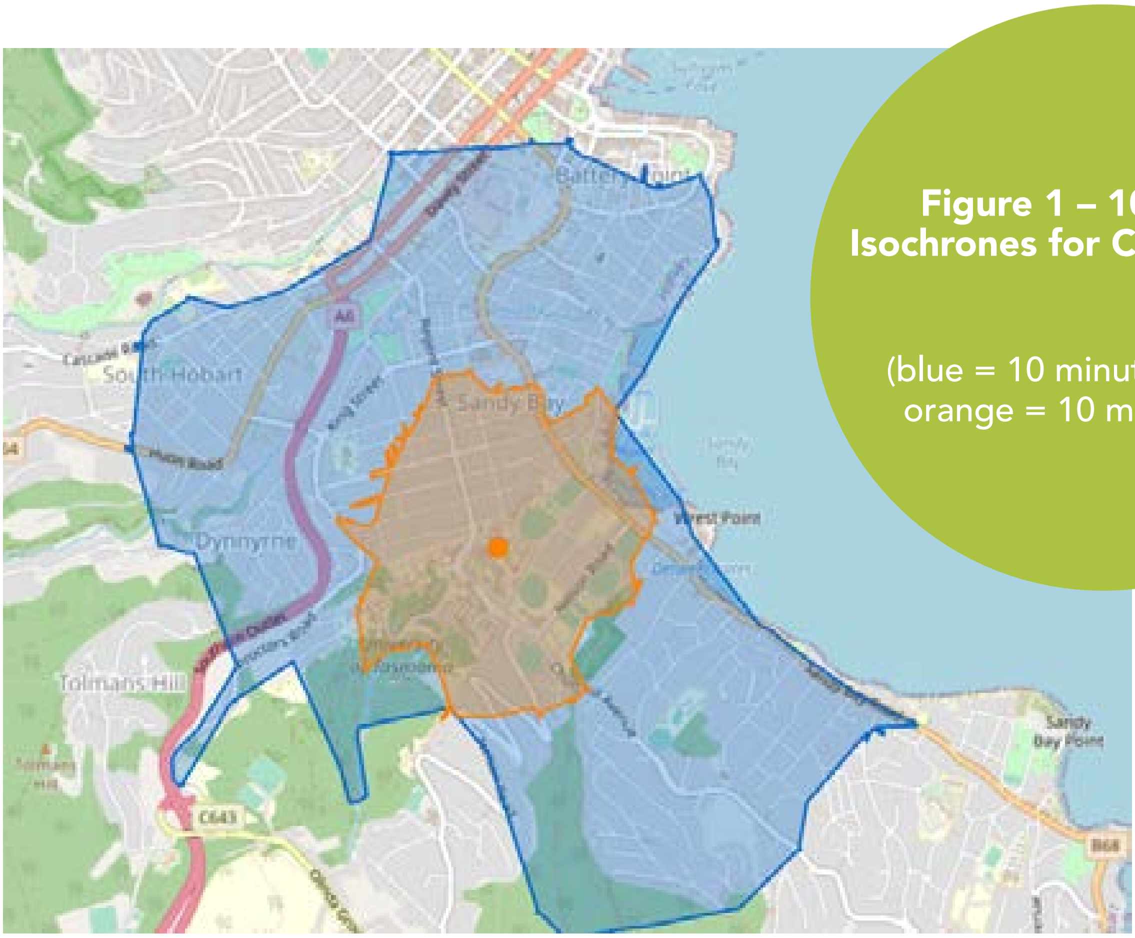


Figure 1 – 10 Minute Isochrones for Centre of Site

(blue = 10 minute bike ride, orange = 10 minute walk)

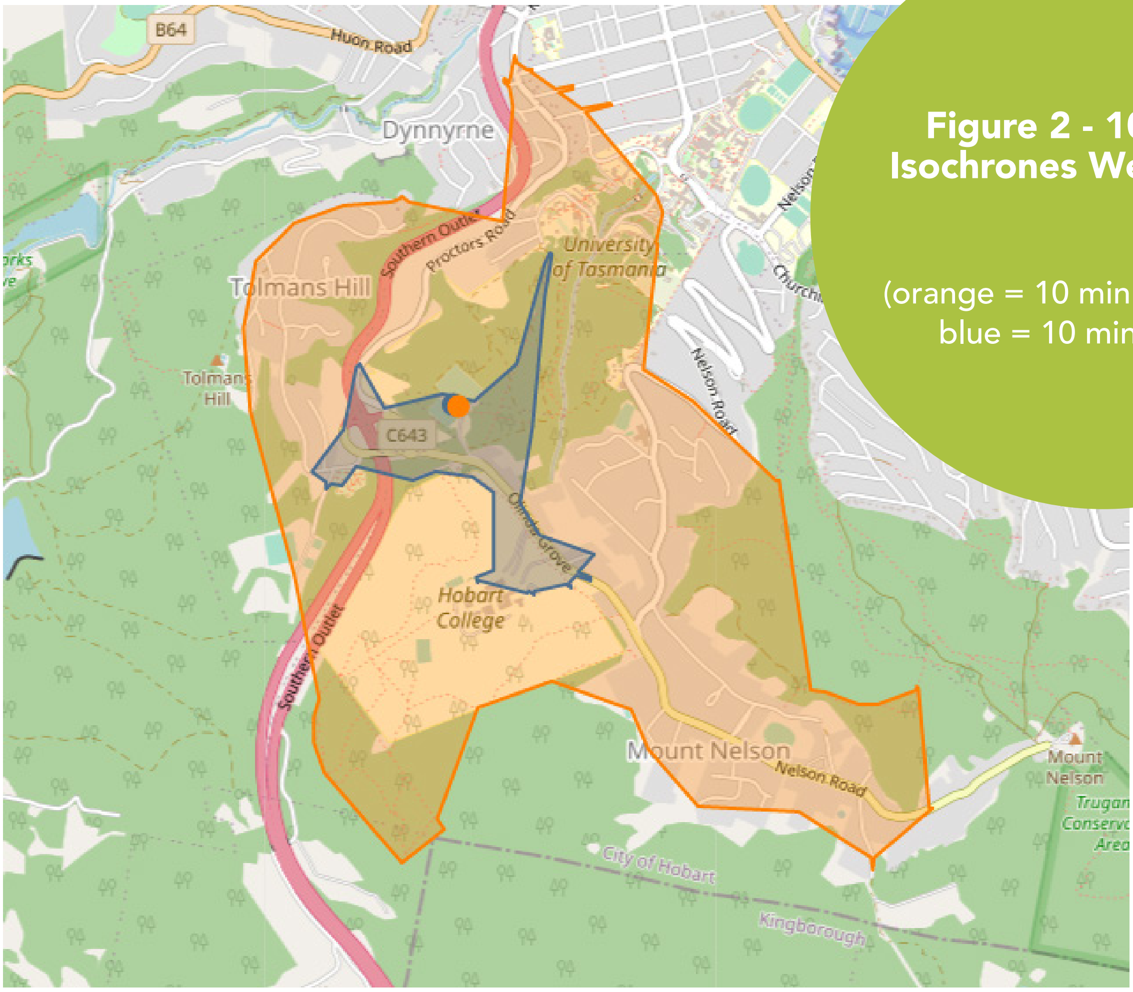


Figure 2 - 10 minute Isochrones Western End

(orange = 10 minute bike ride, blue = 10 minute walk)

2.3.1 ACTIVE TRANSPORT (CONT)

From the middle of the site, a 10 minute bike ride gets you all the way to Battery Point and down to Lipscombe Avenue and could also take you into Mount Nelson. Walking gets you to some vibrant catchments in Sandy Bay to the north, but very limited access to the south due to the Lambert Rivulet and also the difficulty in crossing Sandy Bay Road.

Notwithstanding there is a good 10-minute catchment for both bike riding and walking, the trip is not necessarily a convenient or comfortable trip . There are no continuously protected bike lanes, the footpaths are narrow and there are almost no street trees. The city as a whole with very few exceptions is generally discouraging of bike riding and walking trips, with limited and low- quality infrastructure. The permeability of active modes is also challenging, with low priority at road crossings and topographical barriers through the existing movement ways. These are issues that can be addressed through an appropriate contemporary approach to active transport with the redevelopment of the University site.

Internal to the site, UPPL will have a much bigger influence on the active transport environment and can include more options such as shared e-bikes and shared e-scooters. The ability to access a variety of land used within the site without private car use is key to the potential of the UTAS site.

2.3.2 BUSES

Sandy Bay Campus of the University of Tasmania is one of the best serviced sites by bus in Tasmania. As shown below, it is serviced by routes 402, 427,422, 428, 426, 429 along Sandy Bay Road, by routes 401, 501 and 601 along Churchill Avenue and routes 410, 413, 415, 416, 417, X58, 716 and 718. This is a significant amount of bus infrastructure, however, the competing mode, the private car, has had much more infrastructure (streets, roads and car parks) supply it to take patronage away from the bus. This is important to acknowledge, as car infrastructure is very expensive to supply for both the developer and for the community. The more trips that can be converted to bus trips will make a major difference to the financial sustainability of the development as well as the economic sustainability of the City.

Metro Buses (Leon Sharpe)

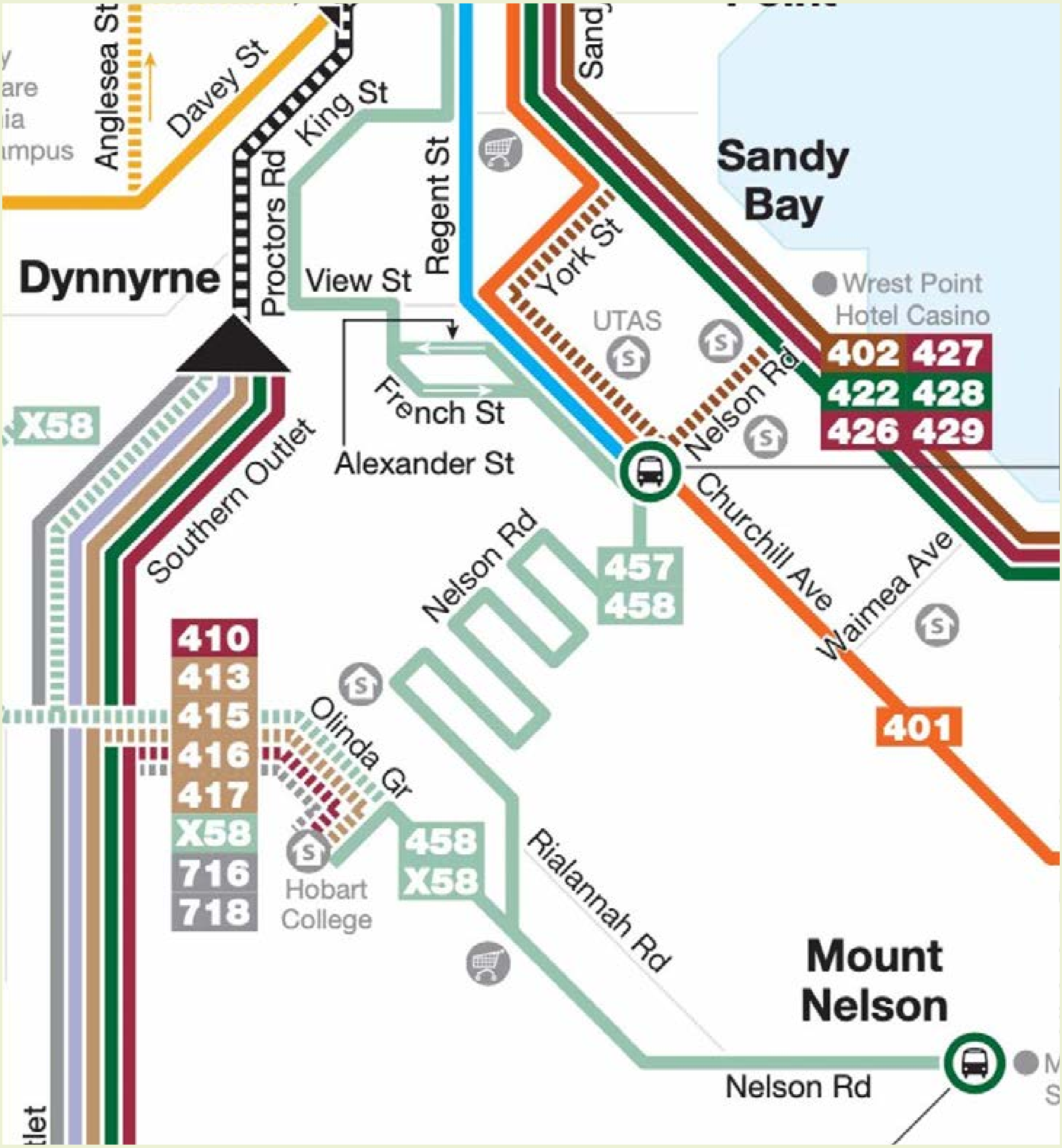


Figure 3 – Sandy Bay Bus Network

2.3.3 CAR TRAFFIC

Howarth, Fisher and Associates prepared a traffic report in 2019 detailing the traffic issues with the current operations. There were very few issues identified. One was access out of York Street on to Sandy Bay Road, the other was access out of Earl Street on to Sandy Bay Road. These two issues are not necessarily associated with volume generated by the University, but with the volume of traffic on Sandy Bay Road Access to Sandy Bay Road will be an issue to be managed for the development in the future.

Image source

2.4 EXISTING ISSUES

There some interesting transport issues associated with the University site. Some of these might be associated with the existing use but others will need to be addressed with the redevelopment. These issues are:

- Parking – the supply of car parking is a significant factor in mode choice. Parking oversupply will induce inappropriate traffic volumes; however, undersupply can induce parking intrusion off site. This delicate balance must be addressed in a Hobart context;

- Pedestrian infrastructure –there is a significant opportunity to reduce the car traffic load on the network by improving pedestrian access to the site. High quality footpaths and street trees can be part of a significantly improved Regent Street and Sandy Bay Road to compliment what will be exemplar on site pedestrian;

- Bike riding infrastructure – there is an unprotected bike lane on Sandy Bay Road allowing access to the site, particularly from the south, however, on a highly trafficked 50km/h road, it is really only suitable for very experienced riders. Currently there are no specific bike riding facilities to access the site via Regent Street, Churchill Avenue or Proctors Road. This creates a significant opportunity to increase the number of bike riders to and from the site. There are several opportunities for UPPL, in conjunction with the City of Hobart to significantly improve biking facilities to the site, which will benefit the site and the City as a whole;

- On-site movement – active on-site movement is limited by the car-based environment on campus. The site is bisected by Regent Street/ Churchill Avenue as well as by Grosvenor Crescent. The value of the sites to the market will depend significantly on reducing internal car movements and exchanging them for active and public transport trips which will be addressed in the strategy.

- Car access to Sandy Bay Road – The 2019 Fisher, Howarth and Associates traffic report on the site highlights traffic issues associated with the current use of the site. The intersection of York Street and Sandy Bay Road, and the intersection of Earl Street and Sandy Bay Road are underperforming. Careful consideration will have to be given to adding load to these intersections.

2.5 UNIVERSITY OF TASMANIA TRAVEL BEHAVIOUR SURVEY (TBS)

The TBS is a biennial on-line survey conducted by the University of Tasmania to establish travel behaviour. Complete Streets has been provided access to the latest pre-COVID data, which is the results from the 2019 survey.

Both staff and students use public and active transport more than the broader Hobart population, students more so.

It is relevant that both students and staff at the Hobart CBD campus used their car significantly less. Reasons for this are obvious, more direct bus routes, less parking availability and a better walking catchment.

The future use of the site will be so different from the current use, it is hard to make this data exactly relevant or transferable.

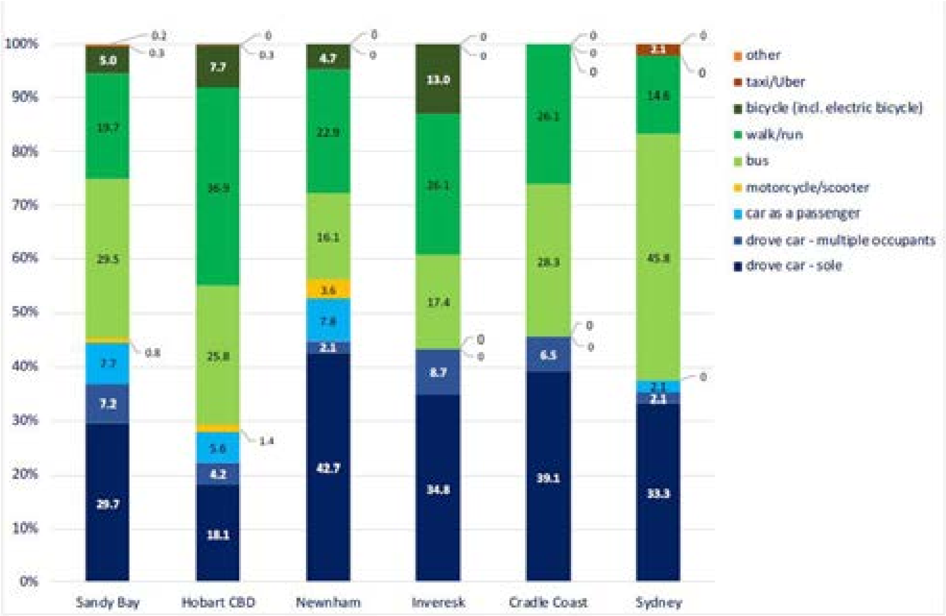


Figure 3.4: Main Mode Share 2019 – Students – by campus and campus groupings

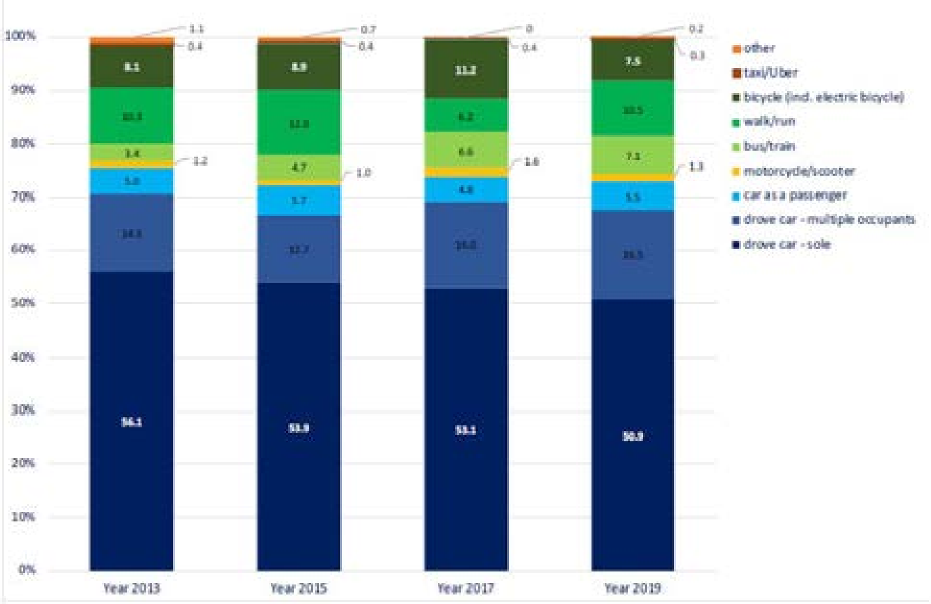


Figure 3.14: Main Mode Share 2013, 2015, 2017, 2019 – Staff – All University of Tasmania

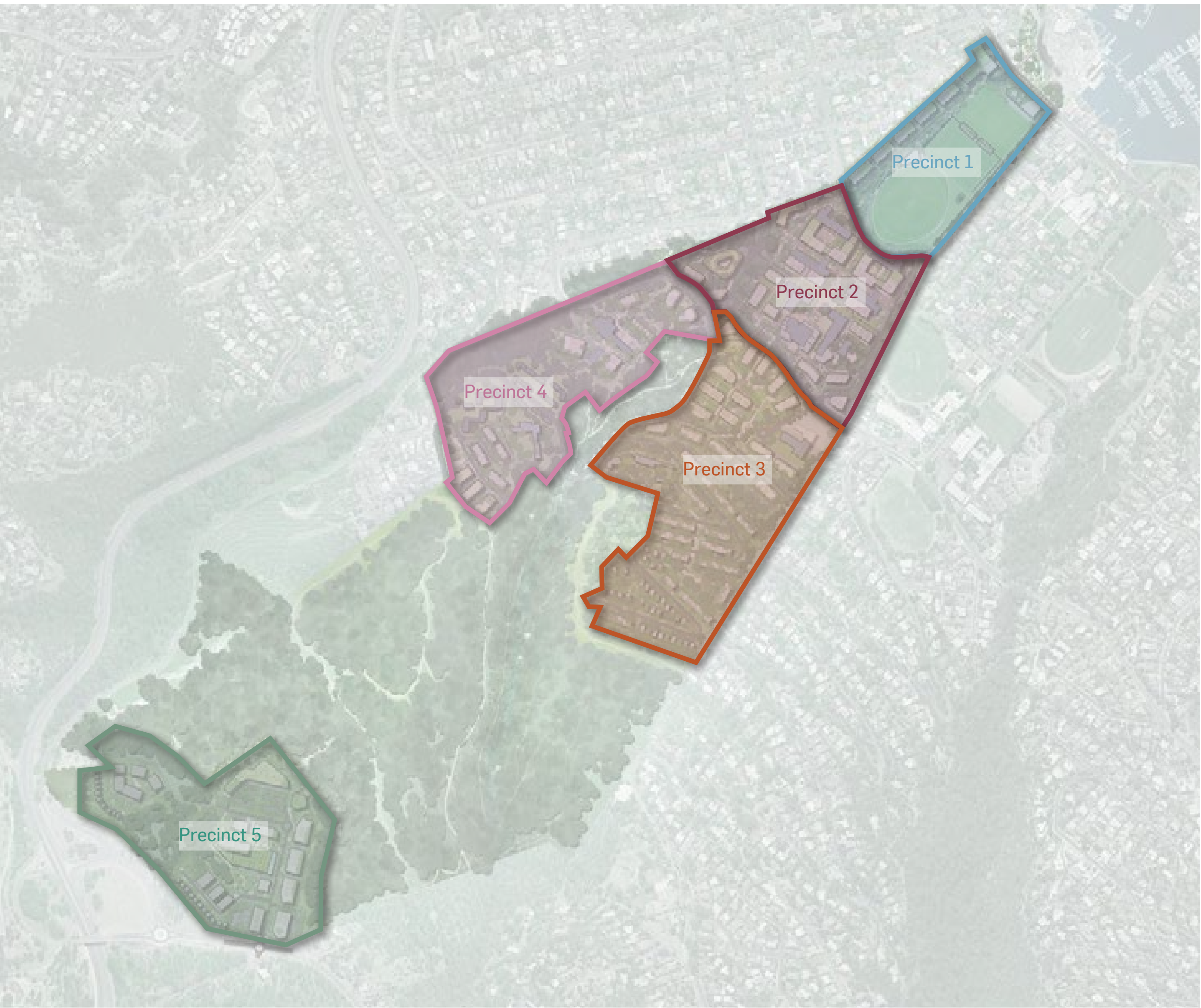
3.0 PROPOSED DEVELOPMENT

The University of Tasmania, Sandy Bay Campus is for all intents and purposes relocating all its academic functions from the site. Majority of the site will be redeveloped or re-used, whilst some student accommodation and sporting facilities and grounds in the lower campus will remain.

The intent is to create a series of quality walkable mixed-use precincts of a variety of densities that will cater for a diverse range of activities and patrons.

3.1 MASTERPLAN CONCEPT

The Master Plan proposes five distinct precincts which will have their own range of offerings, activities and character



Sandy Bay MP Precinct Plan

Figure 4 – Precinct Plan

4.1 ON-SITE MOVEMENT

It is estimated that 25% of the trips will be within the site, and not impact on the external network, in the fullness of time however this figure may in fact be higher. People will be able to access employment, shopping and recreation within the site preventing a lot of external trips on the network. We have to make sure that as many of these trips as possible within the site are made by active or public transport. Car trips within the site will detract from the liveability of the site as well as the commercial viability of the site and the economic benefit to the broader community. There will have to be strategies developed to prevent this.

4.2 ON-SITE PARKING

Parking is a traffic generating land use and is a large cost element in any development. Minimising the on site parking supply to the lowest practical level will be one of the key factors to a successful development. There will have to be some upfront supply to address a transition from a car-based site to a sustainable site. There are common strategies to deal with this, such us unbundling, or physically separating parking from dedicated sites and locating it so it can be shared. Parking can be managed as a separate land use so that tenants that don't need parking aren't obliged to buy it. In some cases, the demand for parking can diminish due to a more diverse on site land offerings, or better active and public transport. In these cases parking, particularly at grade parking, can be redeveloped for other more productive uses.

4.3 PEDESTRIAN MOVEMENT

Pedestrians like clean, green and safe places. They are the key ingredient to successful villages and towns. To be successful, each of the precincts, while they will have slightly different pedestrian environments (detached housing, medium density, mixed use), will encourage pedestrian movement to be the first-choice mode. This will be achieved with outstanding pedestrian facilities as well as demand management of the private car. The development requires a high amount of pedestrian activity through all precincts to achieve its objectives.

It will be difficult to make bike riding a significant element in the transport mix for this site due to the street design around the site currently lacking appropriate bike riding infrastructure. Converting some trips to and from the site to bike riding trips will be beneficial for the liveability, and hence viability of the site, as well as being beneficial to the city overall. Improving, in concert with the City of Hobart, bike riding facilities on Sandy Bay Road, Regent Street and Churchill Avenue should be a key attribute of this development.

4.5 PUBLIC TRANSPORT

Public transport will be required to do much of the heavy lifting as this site develops. There will need to be new on-demand services within the site, supplementary Metro bus services to the city, supplementary Metro bus services to the southern suburbs and ferry services to the city.

4.6 CAR TRAFFIC

There are some issues with accessing the site using private vehicles. Access via Churchill Avenue/Regent Street and access via Proctors Road/Olinda Grove is workable. Access via Sandy Bay Road is problematic and will require some trip demand management and some additional infrastructure.

5.0 TRANSPORT STRATEGIES

5.1 ON-SITE MOVEMENT SOLUTIONS

It is expected that at least 25% of all movements generated will occur within the site.

It is considered the best way to deal with these internal trips will be to make them 100% carbon free, and made 100% by active or public transport. This should be fully implementable within 5 years. This is very early and will require some innovative, but not extensive investment. High quality walking trails should dominate the site, along with street cross section with adequate footpaths, shade and awnings. These should be suitable for pedestrians and bike riders and also should be made useable by an internal driverless electric on-demand public transport service should be implemented from the start of the development.

An example of this is illustrated below in Figure 9. To make this process easier, it is recommended UPPL continue ownership of all the roads and streets on the site to better facilitate this outcome. Tasmania is potentially a significant manufacturer of Hydrogen fuel cells which should provide an opportunity to negotiate with the operator to convert some on demand vehicles to hydrogen technology.

Street cross sections as well as generous off street trails, illustrated below in figures 4 to 7, will provide maximum opportunities for a significant amount of on-site waking. Additionally, an on-site electric bike hire, either site specific or as part of a larger city-wide commercial operation as shown in Figure 10 below would benefit the site. Micro mobility options have been tried in many cities with mixed success.

They are now legal in Tasmania, and a commercial operator may choose to investigate an installation on the University site, which UPPL should anticipate. The footpath and trail conditions illustrated will facilitate their use.

Figure 5 – proposed street cross section (source Playstreet)

Figure 6 – mixed traffic street cross section (source Playstreet)

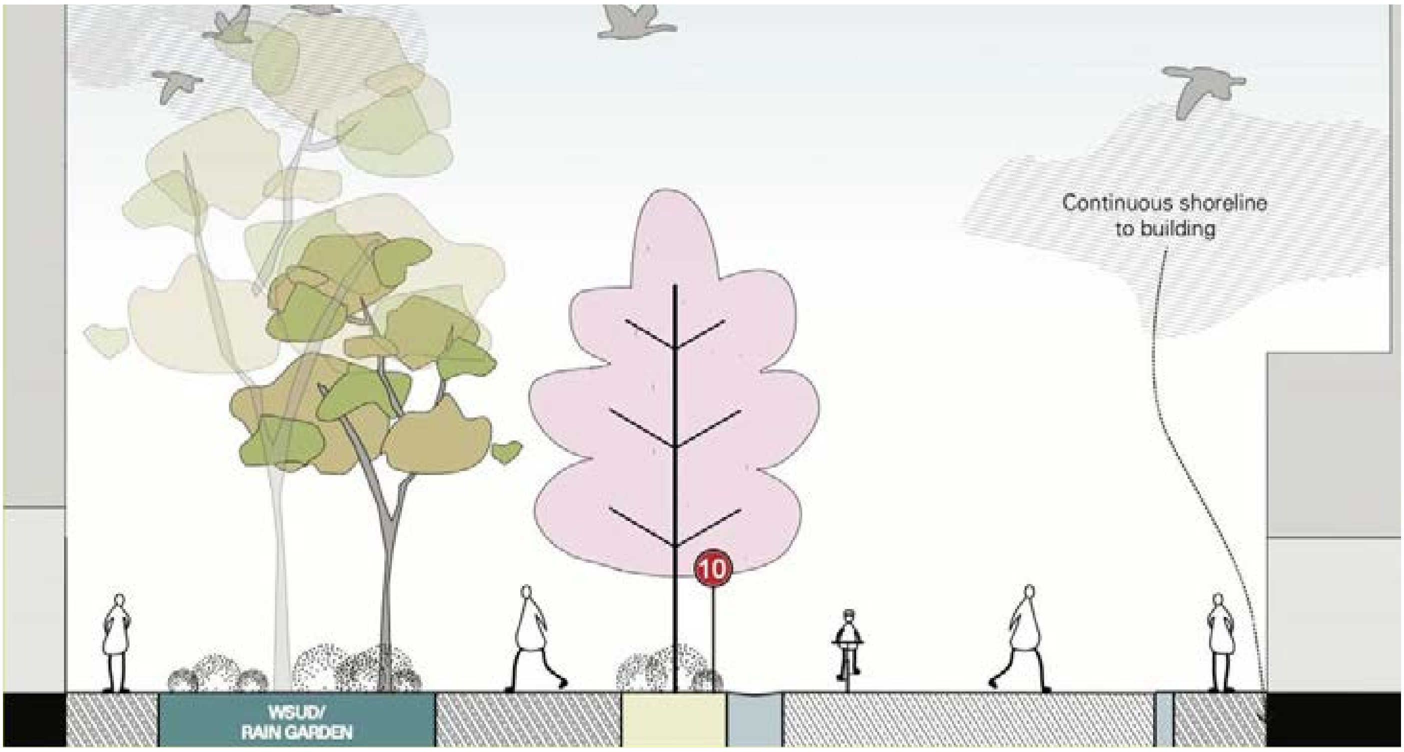


Figure 7 – mixed traffic street cross section (source Playstreet)

Figure 8 – Quality Off-Street Shared Paths (source)

Figure 9 – Internal On-Demand Autonomous Bus (source)

Figure 10 & 11 – Commercial Electric Bike Hire & Commercial Micro-Mobility Station

The on-demand bus can be delivered in a number of ways. UPPL could be the operator, Metro could be the operator, or another commercial entity. The services run on demand within a specified area. It would take patrons from anywhere in the site to common destinations (bus superstops, sporting grounds, shopping facilities etc). They would service the immediately surrounding suburbs as well

Figure 12 – On-Demand Service Vehicle with App

5.2 ON-SITE PARKING SOLUTIONS

Complete Streets recommends taking a more contemporary approach to on-site parking. One that maximises the development opportunities for the site, returns maximum benefit to the community and creates minimum traffic on the external and network and within the site.

Hobart has a small active central activity area but is still surrounded by some relatively low- density suburbs that are difficult to serve with active or public transport. Additionally, Hobart is relatively congestion free and parking is also mostly free, and any charges are miniscule (less than $5 per hour). This will change over time which will allow the governments to more confidently invest in active and public transport. For this reason, the supply of parking on site will not be linear. It will be supplied at varying rates, such that there will be adequate supply to make early investors comfortable, but diminishing over time as active and public transport options become available, to a more sustainable level. The exact level of supply can be refined as the program of development becomes clearer.

Additionally, it is recommended that the parking supply not always be attached to each individual building. The reasons for this are:

- Creates more walking, active and safe streets;
- Better main street retail performance;
- More efficient use of parking, night time and
- daytime uses can share spaces;
- Only people who need parking have to pay for it.

It should also be considered that the total build out parking supply be leased to a commercial car park operator to build, own and operate. The operator will offer a selection of long term leases for residents, long term leases for commercial premises and casual parking. This will ensure that the site has the right amount of parking in the right place at the right price.

5.3 PEDESTRIAN MOVEMENTS

Pedestrians make vibrant places. They are the determining factor in prosperous places. There are key pedestrian facilities that need to be put in place to ensure the success of the proposed development as discussed below.

5.3.1 SANDY BAY ROAD

Precincts 1 and 2, and to a slightly lesser extent Precinct 3, are within easy walking distance to the Sandy Bay shopping village, but it is a difficult and unpleasant walk. Sandy Bay Road needs wider footpaths, more street trees and more crossing points if it is to attract pedestrians to take car traffic off the network.

This would need to be established in conjunction with the City of Hobart. This is important for the subject site, but also for other commercial centres in Sandy Bay to be able to attract patrons from the site without generating traffic. This is out of the control of UPPL, however it would be extremely beneficial to the development of the site to discuss improving pedestrian access along Sandy Bay Road with the City of Hobart, which should at least include a significant street tree program and wider footpaths to connect the site with some of the great destinations in and around Sandy Bay.

There will be an opportunity for UPPL to directly influence the design and operation of Sandy Bay Road along its frontage. It is recommended that Sandy Bay Road be widened to accommodate a wider footpath and some significant street trees to compliment any works to address car traffic or public transport.

Crossing Sandy Bay Road is problematic in general, and specifically for the site. Traffic is too fast, and the volume too consistent to cross safely for the majority of the day. The development must facilitate a better crossing, particularly to give access from the site to any future ferry services.

5.3.2 CHURCHILL AVENUE AND REGENT STREET

Churchill Avenue and Regent Street provide adequate pedestrian access to the site. However, they could also benefit from more street trees and wider footpaths. UPPL could contribute to this in the immediate vicinity of the site and establish a long- term program to improve pedestrian access to the site from the surrounding Sandy Bay catchment.

Streets don't have to be wide to clean, green and safe, and tree lining streets approaching the site will greatly improve the appeal of the site to pedestrians as shown in Figure 13.

5.4 BIKE RIDING SOLUTIONS

Internal bike riding solutions are discussed in section 3.1. There are no realistic opportunities to increase bike riding options to the site. Sandy Bay Road, Churchill Avenue, Regent Street Proctors Road and Olinda Grove are unsuitable for safe bike trips. Currently there are about 8% of trips to and from the site by bike, however this can be expected to drop as low as 4%, similar to the background bicycle use, with the changes in land use away from education.

Figure 13 – Narrow Tree Lined Street

5.5 PUBLIC TRANSPORT SOLUTIONS

There are three major elements to the public transport strategy, new on-demand services, augmented bus services and ferry services. From Table 2 it can be seen that the public transport load from the development of the site could be as high as 1800 trips per day. The following is recommended.

5.5.1 ON DEMAND SERVICE

UPPL in conjunction with Metro Tasmania and possibly other commercial partners should immediately implement an on-demand bus service. This should be done even before the development commences and start by shuttling people from the existing campus and surrounding neighbourhoods into the city.

Over time this service can be adjusted to move people internally from say precinct 1 to precinct 5. It should also move people from the surrounding suburb to two new super bus stops. One in Precinct 1 and one in Precinct

5. The on-demand services will be provided by a combination of vehicles. Internally by the battery (possibly hydrogen cell in the future) driverless buses as described in Section 4.1 and externally with a 12-seater van or similar.

5.5.2 AUGMENTED BUS SERVICE

Bus services to the site are at least adequate, however, due to the suburban nature of Hobart's land use, the site is only really accessible by bus from the southern suburbs, or the city. The northern and eastern suburbs catchment requires a change of service. That is people would have to change buses. This is often a very efficient way of moving people around the city, however the Hobart bus network is not set up to cater for service changes, and customers are made to pay such a large time penalty relative to travel time. For the foreseeable future, until the State Government implements a full network and service review, the site will remain difficult to access from the northern and eastern suburbs.

Service can be improved to the Southern suburbs and the city:

- A superstop should be built in Precinct 5 in association with the commercial facility. This will service the 410, 413, 415, 416, 417, X58, 716 and 718 routes;
- These services will be able to, on completion, access the new Transit Lane on the Southern Outlet and the new bus lanes in Macquarie and Davey Street;
- On demand services can collect customers from within the site with no time penalty for change over;
- On demand services will be able to collect patrons from the surrounding suburbs with very little time penalty for change over;
- The superstop would also include lockable bike storage and a pick up for shared electric bikes;
- A superstop should be installed on Sandy Bay Road in front of Precinct 1. This would service the 402, 427, 422, 428, 426 and 429 services.
- The stop would be serviced internally and externally by an on-demand bus service;
- This superstop should also incorporate lockable bike storage and a pick up for shared electric bikes.
- Superstops could contribute significantly to the urban vitality of the site.

Figure 14 – Bus Superstops

Figure 15 – Derwent Ferry (source)

5.3 FERRY SERVICES

Hobart has a profitable commercially run ferry service between Brooke Street pier and MONA. There is also an imminent new trial ferry service between Bellerive and the CBD. There is an opportunity to feed off these services and be part of new service that
could expand to provide access to the site from the east and from the north. These services would be supplemented by coordination with existing bus routes and supplemented by on demand services.

Initially it is recommended that a services that has at least 3 stops on the western shore (in addition to the CBD stop), two north of the city and one south of the city. Additionally, there should be two stops on the eastern shore.

It is recommended UPPL participate in, if not initiate this trial. Any trial should ensure that there is a stop near the Sandy Bay site, and that it is serviced by on demand bus services from the site as well as a convenient crossing of Sandy Bay Road.

5.6 CAR TRAFFIC SOLUTIONS

It is anticipated that car traffic to and from will only represent about 40% of trips initially and even less long term, due to the strategies outlined above.

6.0 SUMMARY

The major outcomes of the Complete Streets examinations into sustainable transport issues associated with the redevelopment of the University of Tasmania Sandy Bay Campus by UPPL are as follows:

- Improve pedestrian access to the site in association with City of Hobart (street trees, better footpaths);
- Commence on-demand bus service between Sandy Bay and City campus for future expansion;
- Maximise active and public transport within the site through exemplar paths and trails as well as on site electric bikes and on-demand public transport;
- Minimise parking provision on site;
- Centralise or 'unbundle' parking from specific buildings where appropriate;
- Create bus superstops in Precinct 1 (Sandy Bay Road), Precinct 2 (Churchill Ave) and in Precinct 5;
- Initiate an extended ferry trial;
- Deliver a new signalised intersection on Sandy Bay Road between York Street and Earl Street;
- Deliver a new signalised intersection at Churchill Avenue and TT Flynn Street;
- Construct a two-lane roundabout to access Precinct 5 on Proctors Road.

REPORTING TO INFORM THE MASTERPLAN DESIGN

Civil Engineering Assessment

GHD

UTAS Sandy Bay Masterplan for PSA

Civil Engineering Assessment

Commercial in Confidence

UTAS Properties Pty Ltd

05 December 2021

→ The Power of Commitment

Limitations

This report has been prepared for CHC Architects Pty Ltd and may only be used and relied on by CHC Architects Pty Ltd and UTAS Properties Pty Ltd (UPPL) for the purpose agreed between GHD and CHC Architects Pty Ltd as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than CHC Architects arising in connection with this Report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this Report were limited to those specifically detailed in the Report and are subject to the scope limitations set out in the Report.

The opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the date of preparation of the Report. GHD has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD described in this Report (refer section 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

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S4	H	F.Haynes	S.Rolls	On File	S.Rolls	On File	5 Dec 2021

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Appendices

Executive Summary

This Report including the Executive Summary is subject to the Limitations defined at the commencement of this Report.

The purpose of this Report is to outline the proposed Civil servicing strategy and constraints of the Site Masterplan developed for a Planning Scheme Amendment Submission (PSA) submission.

GHD was engaged to undertake a review of the civil services (stormwater, sewer, water) at the University of Tasmania (UTAS) Sandy Bay site (Site) for the purpose of informing the Masterplan being prepared by ClarkeHopkinsClarke Architects (CHC) for a PSA submission

The Site encompasses a significant portion of bushland along with the University campus and includes approximately 105 hectares of land from Sandy Bay Road through to Olinda Grove on Mount Nelson.

Our review has identified that the proposed Masterplan is able to be serviced by stormwater, sewer and water infrastructure as described by the following report.

1. Introduction

GHD Pty Ltd (GHD) has been engaged by ClarkeHopkinsClarke Architects Pty Ltd (CHC) to perform high level investigations as part of a constraints review of the existing service infrastructure (stormwater, sewer, water) at the University of Tasmania (UTAS) Sandy Bay Site (Site). The constraints review is intended to determine how the existing stormwater, sewer and water services may impact the proposed redevelopment of the Site to support the development of a Masterplan for a Planning Scheme Amendment (PSA) submission.

1.1 Purpose

The purpose of this report is to outline the proposed Civil servicing strategy and constraints of the Site Masterplan developed for PSA submission.

1.2 Scope

GHD's scope of work for this commission includes:

- Performing a desktop assessment as part of a constraints review of the existing Site stormwater, sewer and water infrastructure using publicly available (from The List and https://hobartcc.maps.arcgis.com) and available UTAS services drawings that identifies:
  - Connection points to the public water, sewer, and stormwater network owned by TasWater and the City of Hobart (CoH).
  - The indicative location and purpose of TasWater and CoH owned services within the development Site.
  - The likely connection sizes required for the sewer and water services based on the selected Masterplan (using an equivalent person assessment based on the proposed building use and occupancy numbers provided by the architectural team).
- Preparing a summary report (this Report) for water, sewer and stormwater services that identifies:
  - Location of relevant on-Site major trunk routes.
  - Identification of spatial allowance for major utilities trunk routes / headworks, infrastructure and service areas/corridors.
  - Water, sewer and stormwater infrastructure development strategy including:
    - Concept stormwater management strategy for the Site that furthers the objectives of the State Stormwater Strategy.
    - Concept infrastructure assessment necessary to implement the proposed use and development under the Masterplan including the capacity/existing demand, surplus capacity and thresholds for key infrastructure upgrades for services for water, sewerage, electricity and stormwater
  - Constraints to the development of the Masterplan such as:
    - Inability to service the Site with water, sewer, stormwater.
    - Presence of service mains through the Site that affects the location of buildings.
    - Known issues such as the potential for flooding.
    - Other similar issues.
    - Recommendations for further investigations.
- Limited consultation with third party asset owners TasWater (Water and Sewer services) and CoH (Stormwater services).

GHD's scope of work excludes:

- Undertaking trade waste assessments, hydraulic or hydrologic modelling during this stage of the project
- Reticulation design.
- Survey and condition assessments of existing infrastructure

1.3 Assumptions

GHD has made the following assumptions during this preliminary assessment:

- Our assessment includes reliance on the accuracy of publicly available infrastructure data (CoH GIS and LISTMap published data) with regard to size, location, position and material.
- Sewer and water analysis has been undertaken utilising the development schedule provided by CHC and included at Appendix A for reference.
- The development will generally include the augmentation, upgrade or renewal of UTAS existing privately owned Site infrastructure within the Site to service the development as needed (i.e., sewer, water and stormwater services constraints that may affect the Masterplan for the development have only been investigated for third party owned services).
- Other assumptions as described throughout this Report.

2. Background

The assessment is based on the below extent of development.

Figure 2.1 Precinct Plan

2.1 Location and extent

The proposed Masterplan encompasses approximately 105 hectares of land spanning from Sandy Bay Road to Olinda Grove (Figure 2.2). The Site contains both heavily developed land on the lower portion (the existing main University campus) along with large areas of undeveloped bushland on the higher slopes. The Site is intersected by Churchill Avenue.

Figure 2.2 Site extent

The lower portion of the Site is currently well serviced due to its largely urban landscape, whereas service availability in the upper portion of the Site is scarce due to its more natural and undeveloped condition. The Site also contains two significant natural watercourses, Proctor's Creek and Rifle Range Creek, both of which collect overland flow from the upper Mt. Nelson catchments and flow down the Site, before being piped into large culverts and discharged into the Derwent River.

2.2 Easements

The proposed water, sewer and stormwater is generally proposed to be constructed within the proposed road corridors. Where authority services are installed in private land, easements are required around the assets in favour of the asset owner. However, as the assets are proposed to be owned, operated, and maintained by UTAS, only joining to the authority infrastructure at the boundary of the Site, and roads within the Site are also proposed to be owned, operated, and maintained by UTAS, no easements are required. However, in some circumstances, an easement may be beneficial to protect assets from damage. Similarly, if the assets and roads were handed over to the relevant authorities in the future, no easements within the road reserve would be required (although easements in other areas would be required).

If there is a mix of private and authority infrastructure within the Site, there is a high likelihood that easements around the services would be required. A summary of likely easements for major infrastructure is provided below. Note that it is unlikely these easements could be provided for with the currently proposed road corridors due to the width or easements required compared to the available road reserve width (4 m + 3 m + 3 m + 9 m + 4 m +electrical + telecoms > proposed road reserve of 20 m).

Table 2.1 Indicative Easement Widths (if required)

Infrastructure	Authority	Easement
Water Main (<DN300)	TasWater	4.0 m[Note 1]
Sewer Main	TasWater	3.0 m[Note 2]
Trunk Stormwater (DN3000)	CoH	9.0 m (3.0 m each side of asset)
Stormwater <= DN450	CoH	3.0 m

TasWater easements are based on the requirements within the TasWater Supplement to the Melbourne Regional Water Authority (MRWA) edition of Water Services Association of Australia (WSAA). Note that where the sewer or water main is running along the Site boundary, the easements can be reduced.

As noted above, easements have not been provided for in the current Masterplan.

2.3 Proposed Typical Road Services Corridor

A typical road services corridor has been developed to verify the expected services can be located within the road corridor. As an example, the extension to Dobson Road from Grosvenor Crescent to Sandy Bay Road (adjacent sports fields) is provided below.

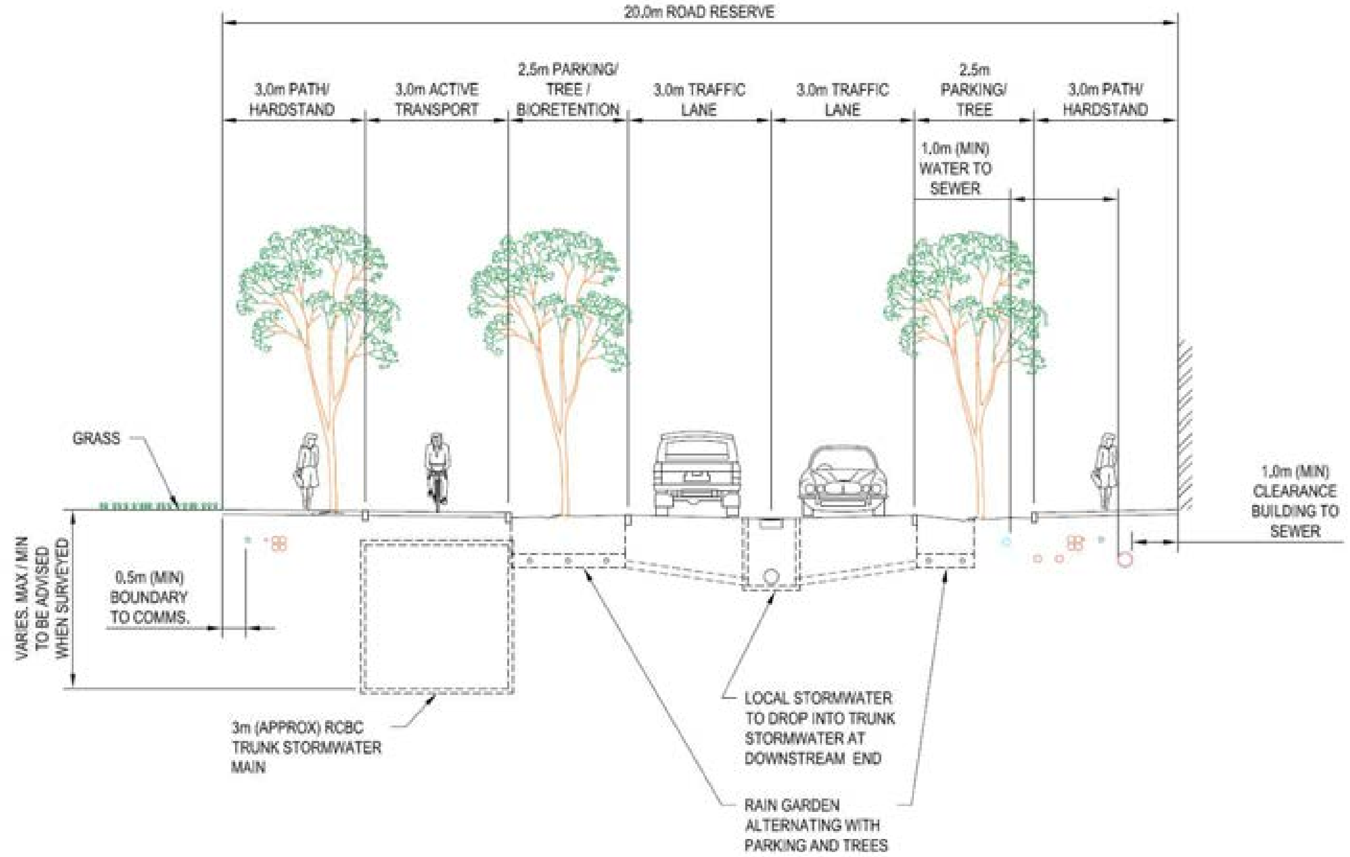


Figure 2.3 Typical Road Services Corridor

[Note 1] *TasWater Supplement to Water Supply Code of Australia WSA 03 - 2011-3.1 MRWA Edition V2.0*, Issue Number: PUBLIC 04 clause 5.4.4

[Note 2] *TasWater Supplement to WSA 02-2014-3.1 WSAA Gravity Sewerage Code of Australia (Melbourne Retail Water Agencies Edition) Version 2.0*, clause 5.2.8

3. Stormwater

3.1 Existing Stormwater

3.1.1 General Information

Upon review of publicly available GIS Data (https://hobartcc.maps.arcgis.com (See Figure 3.1) and the existing Site survey file provided by UTAS Infrastructure Services & Development (ISD) the following existing stormwater conditions and infrastructure can be identified:

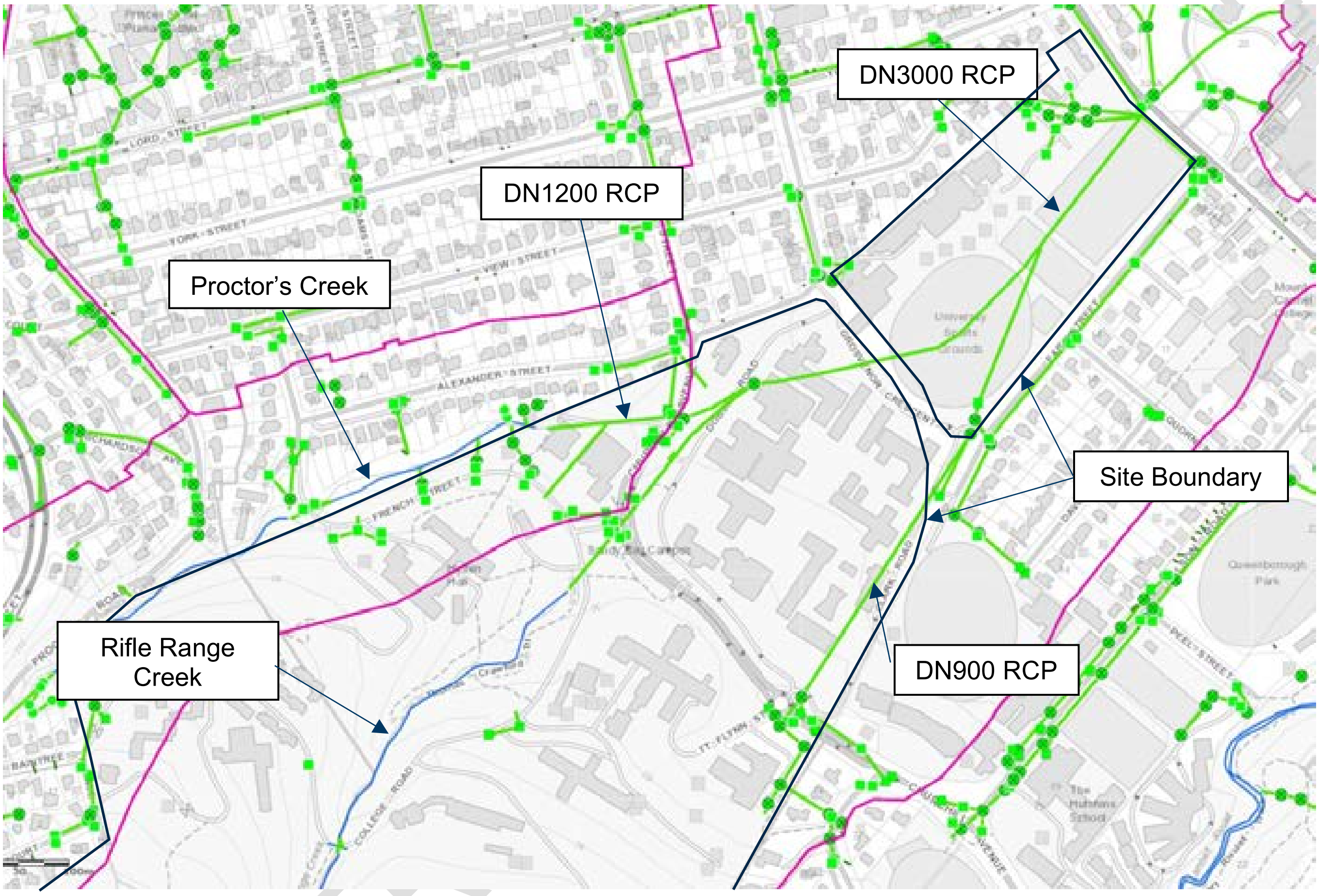


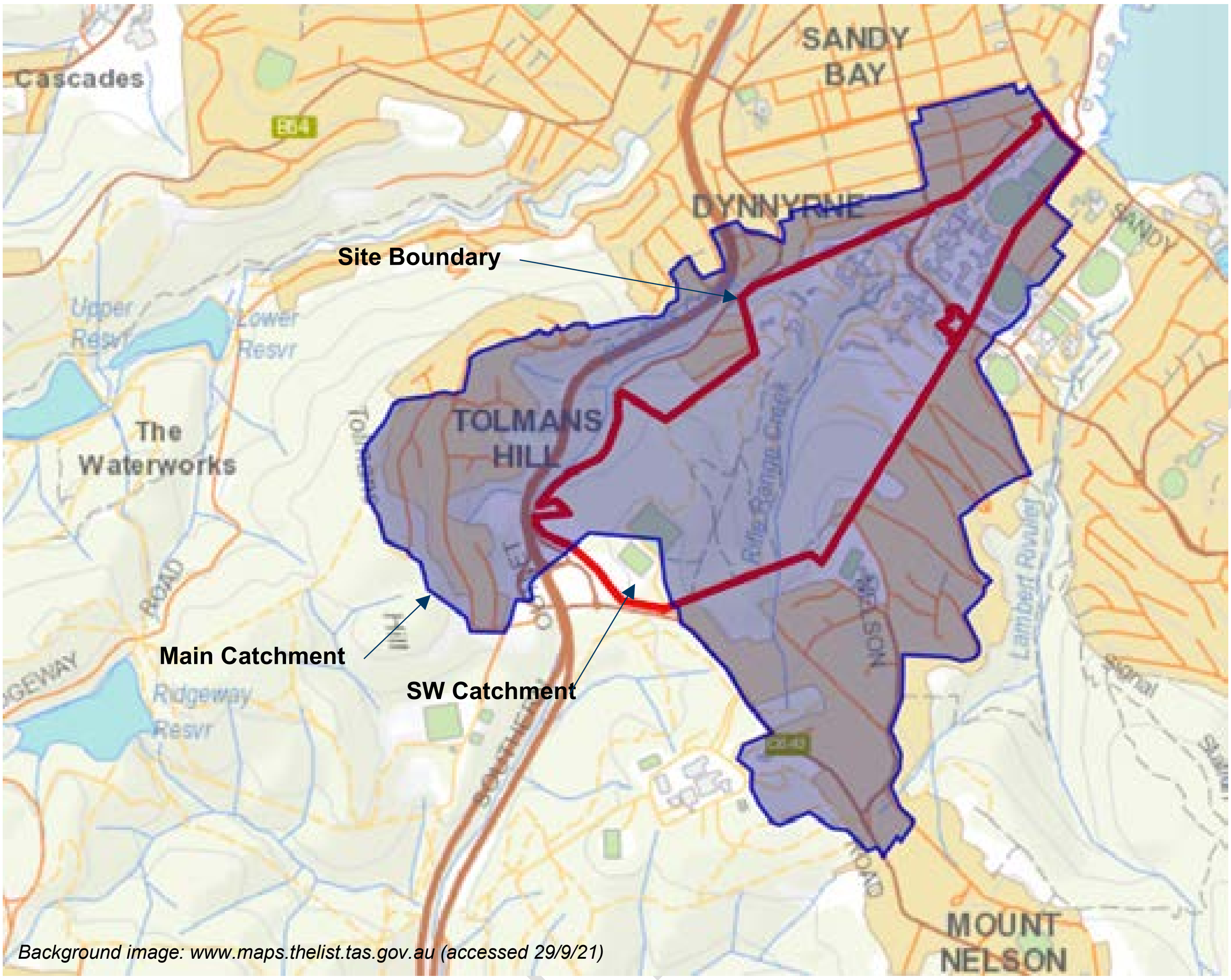
Figure 3.1 ***HCC Stormwater network***

Note: The pink coloured lines in the image above indicate drainage catchment areas (for the full map refer to: https://hobartcc.maps.arcgis.com/apps/OnePane/basicviewer/index.html?appid=e338c4c59aa448608f0b11db6f3b7285)

The total contributing catchment is provided in Figure 3.2. The majority of the Site drains towards Sandy Bay Road and then to the Derwent River together with minor areas external to the Site. A portion of Precinct 5 drains to the southwest as depicted below. Approximate catchment areas are:

Table 3.1 ***Catchment Areas***

Catchment	Area
Total contributing catchment draining to Sandy Bay Road	279.3 ha
- Internal to Site	100.5 ha
- External to Site	178.8 ha
Catchment draining to the south west	5.2 ha



Background image: www.maps.thelist.tas.gov.au (accessed 29/9/21)

Figure 3.2 Total Catchment Area

3.1.2 Stormwater Observations

Refer to above Figure 3.1 and Appendix B for locations of below infrastructure.

- The Site contains two significant natural watercourses, Rifle Range Creek and Proctors Creek.
- Rifle Range Creek is shown to originate from 65 Olinda Grove, Mount Nelson (LISTMap) and flows downslope through the UTAS Site before feeding a DN1200 RCP culvert upslope of French Street. This DN1200 culvert continues downslope underneath Churchill Avenue and Dobson Road before connecting with an additional DN1200 culvert (from Proctors Creek) adjacent the UTAS Engineering Workshop. Stormwater flow is further conveyed from this point via a single DN1800 RCP culvert which is transitions to a DN3000 under the UTAS Engineering building and runs underneath the University Football and Rugby Grounds, before crossing Sandy Bay Road and discharges into the Derwent River at Marieville Esplanade. Note: while the CoH GIS has DN3000 as referred to above, the survey undertaken as part of this project nominates a 2400 x 1200 RCBC along a slightly different route. The overall approach is, however not effected by the updated survey information and so the DN3000 nomenclature has been carried through in this section despite at least part of the pipeline being 2400 x 1200 RCBC.
- Proctors Creek is shown to originate from Proctors Saddle (LISTMap) and is fed by a small stormwater network located at the Southern Outlet/Tolmans Hill/Mt. Nelson interchange. The creek then flows to the northern edge of Proctors Road, is piped under the road via an DN1200 RCP at Baintree Avenue, collecting another small catchment consisting of residential housing (Baintree Avenue, Oberon Court) along with UTAS

owned apartments and Hytten Hall. The creek is piped underneath French Street via a DN1050 RCP culvert and continues downslope north of French Street collecting road runoff before being converted to pipe flow just upstream of the Refectory. A DN1200 RCP conveys flow from this point under Churchill Avenue and Dobson Road to the above-mentioned pit located outside the UTAS Engineering Workshop.

- The Southern Boundary of the Site features a DN900 RCP culvert that originates at a collection of roadside drainage structures on Churchill Avenue, near the roundabout used to access Hill Street Grocer. From this point the culvert runs downslope uninterrupted underneath the Psychology Research centre and across Clark Road until reaching a manhole located at the intersection of Grosvenor Crescent, Earl Street and Clark Road. From this point the pipeline trends north across the football oval and connects to the DN3000 Culvert underneath the existing tennis courts.
- As mentioned in Section 2.1, the upper portion of the Site features little to no authority owned formal stormwater infrastructure. Authority owned infrastructure upslope of Churchill Avenue is limited to a small network of DN300/DN150 CoH (HCC) maintained pipelines servicing the Baintree Avenue and Oberon Court area, a similar sized cluster of DN300/DN450 HCC pipelines services the area surrounding Hill Street Grocer and the lower portion of Nelson Road. There is also a limited amount of HCC owned roadside drainage servicing French Street, which is discharged to Proctors Creek.
- The Grace Street Carpark located on the lower slopes of the Site adjacent Sandy Bay Road features several HCC owned assets. Two DN600 RCP culverts run in parallel across the carpark from Grace Street and connect into the DN3000 RCP via an HCC manhole at the bottom of the Site. A mix of public infrastructure and private infrastructure service the extent of the Grace Street parking area.
- Although a large majority of the HCC owned assets on the Site are currently built over, any demolition of existing buildings and reconstruction on or over these assets will be subject to HCC CoH easements.
- The privately owned stormwater drainage network is concentrated around the main campus area (Precincts 1,2 and lower slopes of Precinct 3) bounded by Churchill Avenue and Sandy Bay Road and ranges in size from DN100 to DN450. Most connections to HCC owned infrastructure are sized at DN300.

3.1.3 Existing Stormwater Connections

Existing connections to HCC owned infrastructure, Proctors Creek, and Rifle Range Creek are summarised in Table 3.2 and shown by the drawings contained in Appendix B.

Table 3.2 Existing stormwater connections to HCC infrastructure and natural water courses

Type/Size	ISD Site File ID	HCC GIS ID	Description
Manhole DN100	AE06S01	DM41796	Roof Drainage from 301 Sandy Bay Road to DN600 culvert
Manhole DN225	AF06S01	DM41784	Runoff from Grace Street Carpark to DN600 culvert
Branch DN100	-	-	Roof Drainage to DN3000 culvert from UTAS Rugby Pavilion
Branch DN225	-	-	DN225 network appears to collect runoff from tennis court, cricket net area and discharge to DN3000 culvert
Branch DN150	-	-	Roof Drainage to DN3000 culvert from UniGym and Childcare facility
Manhole DN225	AK09S02		Roof and runoff from UTAS Cricket Pavilion
Manhole DN225	AM14S01	-	Roof and runoff collection from IMAS building and Law building
Branch DN450	From Manhole AN16S03	-	Significant connection to DN3000 culvert, including roof and surface water runoff from Dobson Road side entry pits, the Engineering building and workshop, Chemistry building, Centenary building, portions of the Geography and Geology building, portions of the Maths and the Physics building and the central footway.

Type/Size	ISD Site File ID	HCC GIS ID	Description
Manhole DN300	AP19S05	-	Connection into DN1200 culvert, collecting runoff from Dobson Road and the Chemistry building
Manhole DN300	AS22S01	-	Connection into DN1200 Culvert fed by Rifle Range Creek, collecting roof and runoff from the University Centre, the central footway and Morris Miller Library
Manhole DN300	AU22S01	-	Connection into DN1200 Culvert fed by Rifle Range Creek, consisting of roof drainage, and run off from the Administration building and Dobson Road.
Manhole DN300	AR11S03	DM45281	Road run off via side entry pits on corner of Clark Road and Grosvenor Crescent to DN900 Culvert
Manhole DN300	-	DM45289	Roof drainage and run off from Geography and Geology building to DN900 Culvert
Branch DN300	From Manhole AU12S01	-	Road run off via side entry pits on Clark Road to DN900 Culvert
Branch DN300	From Manhole AW15S01	-	Roof drainage and surface run off from the University Centre and Psychology Research Annexe to DN900 Culvert
Manhole DN300	AZ14S01	-	Roof drainage and surface run off from the Arts building, Humanities building, Arts Lecture Theatre and Churchill Avenue carpark to DN900 culvert
Manhole DN300	BD18S01	DM48517	Significant connection for drainage upslope of Churchill Avenue. Includes roof drainage and surface run off from the Hill Street Grocer complex, Life Sciences building and Corporate Services building. Connects to DN900 culvert via manhole in Churchill Avenue
Headwall DN300	From Manhole AY26S01	-	Discharge to Rifle Range Creek including roof drainage and surface run off from the Agricultural Sciences building and portions of the Life Sciences building
Headwall Unknown	From Manhole BD29S01	-	Discharge to Rifle Range Creek from Old Medical Sciences Building under College Road
Headwall Unknown	BD32S01	-	Discharge to Rifle Range Creek from C.S.I.R.O complex, assumed mixture of both roof and surface run off
Headwall Unknown	BM28S01	-	Roof drainage from Agriculture building, appears to discharge to hill side
Headwall Unknown	From Manhole BE37S01	-	Roof and run off drainage from UTAS Apartments discharging to Rifle Range Creek
Headwall Unknown	From Manhole BG36S01	-	Surface run off from UTAS Apartment complex roadside parking
Manhole Unknown	BA43S01	-	Roof and surface run off from remaining portion of UTAS apartment complex. No connection shown on ISD Site file but assumed to Discharge to Proctors Creek
Headwall Unknown	From Manhole AZ33S01	-	Surface run off from upper Commerce building carpark, discharging to Rifle Range Creek
Headwall DN225	From Manhole AX29S01	-	A portion of the roof and surface run off from Hytten Hall discharging to Rifle Range Creek
Headwall DN300	From Manhole AV35S01	DB45590	Roof and surface run off from Commerce building ang Hytten Hall, piped under French Street and discharging into Proctors Creek
Headwall DN300	AS32S01	-	Road run off from French Street discharging to Proctors Creek
Headwall DN300	AR30S01	-	Road run off from French Street discharging to Proctors Creek
Headwall DN300	AR29S02	-	Road run off from French Street discharging to Proctors Creek
Note: “-“ signifies no information present on either the ISD Site file or HCC GIS data.			

3.2 Proposed Stormwater

3.2.1 State Stormwater Strategy

The Site development is required to be managed in accordance with the State Stormwater Strategy. The purpose of the State Stormwater strategy is to provide planning and design objectives along with general advice to ensure future developments incorporate the appropriate stormwater management to obtain planning approval and reduce the potential for negative stormwater impacts.

Any new development that results in an increase of impervious area exceeding 500 m^2 is subject to stormwater management targets regarding both quality and quantity.

The management targets specific to the planning and design phase of new developments as set out in the State Stormwater Strategy are as follows:

- The construction phase of the project shall be managed through the use of a Soil and Water Management Plan (SWMP). This plan should be developed throughout the design and planning stage of a project and include the latest best practice methods to combat sediment transportation and soil erosion during construction. Local CoHs will often require the SWMP to be submitted for assessment as part of the development approval package.
- The operational life of the development must also be considered during the design and planning phase, ensuring that any long-term effects the development has on waterway health are reduced as much as possible. This leads to the two major targets of stormwater management, quality, and quantity.
- As defined by the State Stormwater Strategy, any new development should be designed to meet the following stormwater quality targets
  - 80% reduction in the average annual load of the Total Suspended Solids (TSS) based on typical urban TSS concentrations.
  - 45% reductions in the average annal load of Total Phosphorus (TP) based on typical urban TP concentrations.
  - 45% reduction in the average annual load of Total Nitrogen (TN) based on typical urban TN concentrations.
- The above targets have been selected to align with other stormwater quality targets across Australia along with knowledge regarding the impacts of urban stormwater on natural waterways and best practice stormwater treatment systems
- With regard to quantity, the State Stormwater Strategy lists flood management and human safety as the two largest drivers of managing the quantity of urban stormwater runoff.

Further to the requirements listed above, the CoH has identified that they are open to relocation of the existing trunk stormwater main however, they note:

- Under the existing planning scheme, any new pipelines are required to be sized to convey the stormwater flows for the complete fully developed catchment including the catchment above the Site (developed to the extent allowed under the existing planning scheme with no flood mitigation, as well as the Site). This results in an oversizing of the pipes as the actual flows from the upstream catchment should be limited to existing flows by stormwater detention in the upstream catchment by the planning scheme.
- The Site planning constraints will impact the fully developed catchment required for the development.
- Ownership and ongoing maintenance of the pipelines will need to be resolved between UTAS and CoH.
- Peak Runoff from the Site will need to be no more than existing runoff in the 5% AEP event and be safe in the 1% AEP event, and
- Confirmed no buildings can be built over stormwater pipelines.

3.2.2 Stormwater Management Options

3.2.2.1 Design Criteria

CoH typically requires new road drainage infrastructure to be designed to convey the 5% AEP in the pit and pipe system and the 1% AEP safely overland.

Due to the impact of overland flow downstream of Sandy Bay Road, it is anticipated that the Trunk Drainage culverts will be required to convey no less than the downstream infrastructure up to and including the 1% AEP. Mitigating the flood impacts downstream of the development will need to be considered further in later design stages.

3.2.2.2 Trunk Drainage Relocation

The large trunk stormwater pipelines (RCBC) are proposed to be relocated along the proposed road corridor adjacent to the sports fields. The existing stormwater trunk drainage has been surveyed and appears to be 2400 x 1800 RCBC although CoH's GIS indicates a 3000 RCBC.

Under current CoH policy, the relocation of the trunk drainage would require the proposed pipeline to have sufficient capacity to convey stormwater from the upstream catchment developed to the full extent allowable under the planning scheme. It is unclear at this time what extent of development will be allowable under the rezoning of the UTAS Site, however it is not anticipated to produce significantly more stormwater runoff than the Site under fully developed condition in line with this Masterplan. The required size of the relocated section of stormwater pipeline adjacent to the sports fields (i.e., within Precinct 1) is anticipated to be approximately 3100 x 2400 RCBC. A model of the catchment stormwater infrastructure will be required to confirm the pipeline sizes prior to relocation once the exact geometry and planning scheme allowances are confirmed.

CoH Stormwater Engineers have advised that detention within the upstream catchment is currently not considered in the required size of relocated stormwater infrastructure (include detention within upstream stages of the Site development).

3.2.2.3 Downstream Infrastructure Augmentation

The development of the Site will increase the impervious area and so increase the runoff from the Site. One way of managing the increase in stormwater flows is to increase the size (or number) of downstream stormwater infrastructure. This option has been considered but due to the difficulty in crossing several landowner's land, and the difficulty in constructing infrastructure under Sandy Bay Road, this option has been dismissed.

3.2.2.4 On Site Stormwater Detention (Flood Mitigation)

The impact of the increased runoff can be mitigated by the short-term storage of stormwater during rainfall events for slow release. Large volumes of stormwater detention to delay stormwater run-off and reduce the peak flow of the development during a minor storm event will be required to enable these precincts to discharge safely to the existing watercourses or infrastructure.

This detention can be provided in several different ways, including but not limited to underground or above ground tanks fitted with low-flow orifices, detention basins or gardens. These elements, specifically the tanks, can be deployed on a single, large scale, or a multiple, small scale, offering flexibility to the developer and how to approach the stormwater quantity strategy.

Storage sizes, locations, and outflows are being considered and will be further developed in design of development. However, the current recommended option is to utilise the oval within Precinct 1 as an above ground detention basin to limit the 5% AEP (and rarer) flood event peak flow leaving the Site to the existing peak flow. Refer to Appendix B for proposed location.

The advantages of this option are:

- During frequent rainfall events and dry periods, the oval can be utilised for recreational activities including Australian Rules Football, and Cricket matches and training.
- A Site wide detention storage (for example above ground at the Oval) could reduce the requirement for detention at any stages constructed after that stage.

The possible disadvantages include:

- Likely requirement for maintenance and possible reinstatement of the oval following infrequent rainfall events (i.e., 5% AEP events and rarer).
- Stormwater infrastructure upstream of the oval will not benefit from the detention reducing stormwater flows resulting in the requirement for larger culverts and pipelines upstream of the oval.

The infrastructure associated with the detention basin at the oval will require ongoing maintenance (e.g., ensuring inlets and outlets are free of debris and other blockages, management of the access to the underground assets, mowing and landscape management, etc.).

We understand UTAS may choose to develop areas of the Site uphill of the oval prior to the oval. If large portions of the Site are developed prior to the oval, it is recommended that smaller detention storage for flood mitigation is constructed adjacent to the developed areas. This may eliminate the need and advantages of a central above ground detention at the oval.

3.2.2.5 Stormwater Quality

Typical WSUD elements that are used broadly across new developments include:

- Stormwater retention (above or below ground tanks to store rainwater prior to reuse for irrigation or similar).
- Vegetated swales.
- Filter or buffer strips.
- Biofiltration basins.
- Constructed wetlands.
- Proprietary products such as filter systems, filter beds.

Each stage of development will be designed to treat stormwater flows from the area such that total suspended solids are reduced by 80%, total phosphorus by 45%, and total nitrogen by 45%. The design of the mechanism for achieving these targets will be determined during design, however, a preliminary concept is described in the following paragraphs.

Locations and types of stormwater quality treatment are being developed. An example road cross section for the road access in Precinct 1 is included below with allocated areas for bioretention / raingardens alternating with trees and parking along the roadway. The expected approximate areas required for treatment by bioretention / raingardens is tabulated below. These areas are based on assumed impervious areas based on the type of development proposed. The relationship to bioretention area is based on *Water Sensitive Urban Design: Engineering procedures for stormwater management in Tasmania*[1] as adopted by CoH for design of WSUD features. These areas will vary depending on impervious area throughout the development.

It is noted that nodal treatment is likely to be required in landscaped areas throughout the Precincts. Other treatment measures may be substituted for bioretention areas to meet the same treatment targets. The extent and layout of these features will be determined in later design stages.

In addition to these measures, proprietary gross pollutant traps or sediment removal devices (e.g., Humeceptor, First Defence) are proposed at any outlets to creeks and immediately downstream of large parking areas.

Table 3.3 Indicative Bioretention Areas

Location	Approximate Precinct Development area (m^2)	Assumed Impervious Area (m^2)	Bioretention area (m^2)
Precinct 1	79,200	50,150	500
Precinct 2	97,800	68,450	680
Precinct 3	163,500	98,100	980
Precinct 4	149,800	52,400	520
Precinct 5	106,600	32,000	320

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[1] https://www.derwentestuary.org.au/water-sensitive-urban-design/ (accessed 29/9/21)

No attempt has been made to locate the treatment areas on the Site. The indicative treatment areas are provided based on impervious area as a guide to the amount of treatment only.

3.2.2.6 Construction Management

Construction activities including earth moving and demolition mobilise significant amounts of sediment. A Construction Management Plan will be required including the management of soil and water during construction. It is anticipated that construction will progress in stages with each stage requiring the management of soil and water on Site using infrastructure such as:

- sediment basins.
- cut off drains.
- minimisation of disturbed areas.
- revegetation; and
- sediment fences.

3.3 Staging

Stormwater infrastructure staging will be tied to the development staging. However, some services within other development stage boundaries will need to be constructed prior to a particular development stage. Expected constraints around staging of development and stormwater services are listed below.

- Staged relocation of the Trunk Stormwater within Precinct 1 is required prior to other works commencing within Precinct 1.
- Construction of detention storages (at source) within the stage being developed (or the Oval as a large above ground stormwater detention) is required prior to any development increasing the impervious area within the Site.
- Soil and Water management is required during construction whenever earthworks are performed, or soil is disturbed / susceptible to erosion.
- Stormwater Quality treatment is required for each stage of development prior to completion of that stage.
- A continuous overland flow path should be provided through downstream stages prior to development of the stage upstream of the overland flow path.
- Road works may trigger the need for construction of stormwater infrastructure downstream of the works, especially if the road works result in changes of finished surface level or trafficable areas.

In Precinct 3, it is recommended that development stages commence at the lower end of the Precinct. If upper parts of the Precinct are developed first, the road and associated stormwater downhill of the developed area will need to be constructed prior to development to allow access to the development.

Staging of the development will impact on the size of stormwater pipelines as CoH has advised that any new pipework will be required to be sized for a fully developed upstream catchment without flood mitigation through stormwater detention (refer section 3.2.2.2). This requirement removes the advantage of local detention on downstream pipe sizes where the new downstream pipe is in a different development stage.

4. Sewer

4.1 General Information

A review of the publicly available GIS data (LISTMap) and existing Site survey file was completed, and the following existing infrastructure identified:

- The Site is bounded on the Southern and Western sides by a TasWater owned gravity trunk main of varying size (DN150 – DN375). The trunk main originates on contour 230 m approximately 250 m upslope of Olinda Grove and follows the path of the Southern Outlet before turning downslope at Proctors Road. The main follows contour 220 around Olinda Grove Sports Fields and back to Brinsmead Road, heads down slope and effectively follows the Site boundary downslope, crossing Churchill Avenue, running under Clark Road, under the footpath of Earl Street and finally connecting into the DN525 Trunk main in Sandy Bay Road. The future development of the Site will need to cater for any easements imposed on this main, which may vary from a minimum of 3.0 m to a maximum of 6.0 m (or greater as advised by TasWater).
- A DN150 gravity reticulation main runs the length of Earl Street on the lower slopes of the Site, parallel to the gravity trunk main as described above. This line also terminates at the DN525 gravity trunk main in Sandy Bay Road.
- The Northern side of the Site features a DN150 gravity reticulation main, originating with a small network servicing the Baintree avenue and Oberon Court area, before moving downslope parallel with Proctors Creek, through the back of residential properties in Alexander Street. From the Alexander Street/Regent Street/Grosvenor Street Roundabout, the main runs down Grosvenor Street, along the Site boundary behind the Law, IMAS and Sports and Recreation buildings. The main continues through the Grace Street carpark and finally connects to the DN525 trunk main in Sandy Bay Road.
- As was the case with the private stormwater infrastructure, the majority of the private sewer services in place are centred around the main campus bounded by Churchill Avenue and Grosvenor Crescent.

The existing sewer network is shown by drawing 12549540-SK002 and SK003 included in Appendix B.

4.2 Existing Sewer Connections

The known connection points from ISD Site file and from analysis of the TasWater GIS data available on LISTMap are summarised in Table 4.1 and shown by the drawings contained in Appendix B.

Table 4.1 Summary of existing sewer connections

Type/Size	ISD Site File ID	TasWater ID	Main ID/Size	Location
Manhole DN150	AK15F03	A647537	A651336 DN150	Behind Law Building
Manhole DN150	AE08F01	A629719	A629785 DN225	Grace Street Carpark
Branch DN150	-	A647389	A651020 DN150	Earl Street
Branch DN100	-	-	A651970 DN375	Clark Road Adjacent Arts Amphitheatre
Branch DN150		A647212	A650546 DN300	Churchill Avenue Hill Street Grocer frontage
Manhole DN100	BI19F01	A647145	A651968 DN300	STEPS Building
Manhole DN100	BO23F1	A648660	A651957 DN300	Agriculture Building
Manhole DN150	AV36F01	A647329	A651929 DN150	UTAS Apartments Assumed connection to TasWater Manhole A647329

Type/Size	ISD Site File ID	TasWater ID	Main ID/Size	Location
Manhole DN150	AU34F01	A647346	A651051 DN250	Commerce Building and Hytten Hall Assumed connection to TasWater Manhole A647346

4.3 Proposed Sewer

4.3.1 Demand

Concept demand calculations for sewer services have been carried out using an Equivalent Tenements Assessment based on building use and occupancy numbers provided to GHD in the form of the Development Schedule for the Masterplan for PSA submission.

Where ET rates are based upon number of persons/visitors/rooms/basins/students and only Gross Building Floor Area (GBFA) has been provided, general assumptions based upon the floor area have been made.

Example: Education facility with $1600m^2$ floor area: $\frac{1600m^2}{10m^2\ per\ student} = 160$ students

Sewer demand calculations were carried out using the Equivalent Tenements method as outline in WSA 02-2014-3.1 and the TasWater Supplement. Table 4.2 below displays the results of the calculations.

Note: The development schedule nominates a bedroom split for residential apartments of 70% 2 bedroom, 20% 3 bedroom and 10% 1 bedroom, therefore the Unit rating for the residential apartments has been factored to 0.775 to suit the above Site split.

Table 4.2 Sewer demand calculations

Ref	Use	ET Code	Description	No.	Unit	Unit Rating	ET
Precinct 1							
1	Commercial - Sports science / Community: Sports Social Clubs and Childcare on top floor	BE04	Office	6660	GBFA (m^2)	0.006	39.96
		BE01	Single Retail	100	GBFA (m^2)	0.003	0.3
		CF06	Community Centre/hall	2,600			6.5
2	Serviced Apartment with small retail on ground floor	RA	Apartment - Site Bedroom Split*	72	Dwellings	0.775	55.8
		BE01	Single Retail	380	GBFA (m^2)	0.003	1.14
3	Mixed Use - Residential/Retail	RA	Apartment - Site Bedroom Split*	31	Dwellings	0.775	24.025
		BE01	Single Retail	120	GBFA (m^2)	0.003	0.36
4	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.775	24.8
5	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.775	24.8
6	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.775	24.8
7	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	41	Dwellings	0.775	31
9	Indoor Sports	CF06	Community Centre/hall	3,500			8.75
10	Carpark (under Soccer Fields)	CF09	Public amenities Block (per WC)	4	WC	0.6	2.4
11	Soccer Field 1						
12	Soccer Field 2						
14	Sports Pavilion – Footy Club	SF01	Sports Stadium	500			1.25
15	Residential Apartment	RA	Apartment - Site Bedroom Split*	24	Dwellings	0.775	18.6
						SUBTOTAL	**267.585**

Ref	Use	ET Code	Description	No.	Unit	Unit Rating	ET
Precinct 2							
1a	Residential terraces within Engineering Bldg. - Reuse	RA	Apartment - Site Bedroom Split*	22	Dwellings	0.775	17.05
1b	Residential Apartments	RA	Apartment - Site Bedroom Split*	41	Dwellings	0.775	31.775
1c	Residential Apartments	RA	Apartment - Site Bedroom Split*	51	Dwellings	0.775	39.525
1d	Residential Apartments	RA	Apartment - Site Bedroom Split*	45	Dwellings	0.775	34.875
2a	Residential Terraces within Geology Bldg. - Reuse	RA	Apartment - Site Bedroom Split*	15	Dwellings	0.775	11.625
2b	Residential Apartments	RA	Apartment - Site Bedroom Split*	30	Dwellings	0.775	23.25
2c	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
2d	Residential Apartments	RA	Apartment - Site Bedroom Split*	18	Dwellings	0.775	13.95
3	Residential Apartments – Chemistry Blg Reuse	RA	Apartment - Site Bedroom Split*	140	Dwellings	0.775	108.5
4	Commercial / Education / makers space - Physics Blg. Reuse	BE04	Office	15300	GBFA (m^2)	0.006	91.8
		CF05	Community Centre/hall	850			2.125
5	Commercial / Co-work - Morris Miller Blg. Reuse	BE04	Office	8100	GBFA (m^2)	0.006	48.6
5	Community Library - Morris Miller Blg. Reuse	CF05	Community Centre/hall	1500	GFA (m^2)		3.75
6	Aged Care (RAC)	AP01	Nursing Home/Aged Care	91	Beds	0.971	88.361
8	Office (Commercial -- Social Sciences Blg. Reuse)	BE04	Office	9900	GBFA (m^2)	0.006	59.4
		BE01	Single Retail	300	GBFA (m2)	0.003	0.9
9	Retail Centre (Supermarket)	BE02	Supermarket	3500	GBFA (m^2)	0.003	10.5
		BE01	Single Retail	500	GBFA (m2)	0.003	1.5
9a	Resi Podium 2 Storey TH/Soho	RM02	Unit - 2 bedroom	16	Dwellings	0.75	12
9b	Residential Apartments	RA	Apartment - Site Bedroom Split*	38	Dwellings	0.775	29.45
9c	Residential Apartments	RA	Apartment - Site Bedroom Split*	54	Dwellings	0.775	41.85
9d	Residential Apartments	RA	Apartment - Site Bedroom Split*	49	Dwellings	0.775	37.975
10	Perf. Arts / f&b / Museum	BE01	Single Retail	300	GBFA (m^2)	0.003	0.9
		CF06	Community Centre/hall	2000			5
11	Theatre / Church	CF06	Community Centre/hall	500			1.1
12	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
13	New Pedestrian Bridge						0
14	Carpark (Basement carpark along Churchill Rd)	CF09	Public amenities Block (per wc)	4	WC	0.6	2.4
15	Mixed Use - Residential/Retail	RA	Apartment - Site Bedroom Split*	37	Dwellings	0.775	28.675
		BE01	Single Retail	400	GBFA (m^2)	0.003	1.2
16	Mixed Use - Residential/Retail	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.775	25.575
		BE01	Single Retail	300	GBFA (m^2)	0.003	0.9
18	Residential Apartments	RA	Apartment - Site Bedroom Split*	68	Dwellings	0.775	52.7

Ref	Use	ET Code	Description	No.	Unit	Unit Rating	ET
19	Medical Centre	BE01	Single Retail	3200	GBFA (m^2)	0.003	9.6
20	Community House (Relocated Cottage)	CF06	Community Centre/hall	120	GFA (m^2)		0.3
21	Retirement Living (apartments)	RA	Apartment - Site Bedroom Split*	81	Dwellings	0.775	62.775
						SUBTOTAL	**975.061**
Precinct 3							
1	Residential Apartments	RA	Apartment - Site Bedroom Split*	49	Dwellings	0.775	37.975
2a	Residential - Mixed Use - small retail on ground floor	RA	Apartment - Site Bedroom Split*	45	Dwellings	0.775	34.875
		BE01	Single Retail	100	GBFA (m^2)	0.003	0.3
2b	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	45	Dwellings	0.775	34.875
		BE01	Single Retail	100	GBFA (m^2)	0.003	0.3
2c	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	45	Dwellings	0.775	34.875
		BE01	Single Retail	100	GBFA (m^2)	0.003	0.3
2d	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	43	Dwellings	0.775	33.325
2e	Residential - Mixed Use - small retail on ground floor	RA	Apartment - Site Bedroom Split*	45	Dwellings	0.775	34.875
		BE01	Single Retail	100	GBFA (m^2)	0.003	0.3
2f	Residential Apartments	RA	Apartment - Site Bedroom Split*	43	Dwellings	0.775	33.325
3a	Residential Apartments	RA	Apartment - Site Bedroom Split*	65	Dwellings	0.775	50.375
3b	Residential Apartments	RA	Apartment - Site Bedroom Split*	65	Dwellings	0.775	50.375
3c	Residential Apartments	RA	Apartment - Site Bedroom Split*	65	Dwellings	0.775	50.375
4	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
5	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
6	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
7	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
8	Health (Family Health Services - existing in Corporate Services Bldg.)	BE07	Medical Centre	1500	GFA (m^2)		3.75
8	Childcare	CF01	Childcare centre/ Pre-school	90	GBFA (m^2)	0.1	9
9	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
10	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
11	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
12	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
13	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	18	Dwellings	0.775	13.95
14	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	5	Dwellings	0.775	3.875
17	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	22	Dwellings	0.775	17.05
18	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	15	Dwellings	0.775	11.625
19	Residential - Single Lot	RE01	Residential - Single Lot	6	Dwellings	1	6
20	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	29	Dwellings	0.775	22.475

Ref	Use	ET Code	Description	No.	Unit	Unit Rating	ET
21	Residential - Single Lot	RE01	Residential - Single Lot	7	Dwellings	1	7
22	Residential - Single Lot	RE02	Residential - Single Lot	13	Dwellings	1	13
23	Residential - Single Lot	RE03	Residential - Single Lot	16	Dwellings	1	16
						SUBTOTAL	**743.375**
Precinct 4							
1	Residential Apartments	RA	Apartment - Site Bedroom Split*	40	Dwellings	0.775	31
2	Residential Apartments	RA	Apartment - Site Bedroom Split*	58	Dwellings	0.775	44.95
3	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	7	Dwellings	0.775	5.425
4	School	CF02		313	Students	0.057	17.841
5	Residential Apartments	RA	Apartment - Site Bedroom Split*	24	Dwellings	0.775	18.6
8	Residential Apartments	RA	Apartment - Site Bedroom Split*	25	Dwellings	0.775	19.375
9	Residential Apartments	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.775	25.575
10	Residential Apartments	RA	Apartment - Site Bedroom Split*	29	Dwellings	0.775	22.475
11	Residential Apartments	RA	Apartment - Site Bedroom Split*	24	Dwellings	0.775	18.6
12	Residential Apartments	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.775	25.575
13	Residential Apartments	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.775	25.575
						SUBTOTAL	**254.991**
Precinct 5							
1	Adventure Tourism Centre	BE04	Office	500	GBFA (m^2)	0.006	3
2	Eco-Hotel	AS03	Services - Hotel/Motel/Resort	120	Rooms	0.45	54
3	Spa	BE05	Hairdresser/Beauty Salon	20	Basin	0.8	16
4	Retail Centre	BE01	Single Retail	3900	GBFA (m^2)	0.003	11.7
5	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	28	Dwellings	0.775	21.7
		BE04	Office	800	GBFA (m2)	0.006	4.8
6	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	34	Dwellings	0.775	26.35
		BE01	Single Retail	200	GBFA (m^2)	0.003	0.6
7	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
8	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	37	Dwellings	0.775	28.675
9	Residential - Single Lot	RE01	Residential - Single Lot	17	Dwellings	1	17
10	Eco-Learning Centre	CF06	Community Centre/hall	500	GFA (m^2)		1.25
11	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	28	Dwellings	0.775	21.7
		BE04	Office	800	GBFA (m^2)	0.006	4.8
12	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	14	Dwellings	0.775	10.85
		BE01	Single Retail	200	GBFA (m^2)	0.003	0.6

Ref	Use	ET Code	Description	No.	Unit	Unit Rating	ET
13	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	29	Dwellings	0.775	22.475
		BE01	Single Retail	300	GBFA (m^2)	0.003	0.9
14	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	26	Dwellings	0.775	20.15
		BE01	Single Retail	300	GBFA (m^2)	0.003	0.9
15	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	26	Dwellings	0.775	20.15
		BE01	Single Retail	300	GBFA (m^2)	0.003	0.9
16	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	24	Dwellings	0.775	18.6
17	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.775	27.9
18	Residential - Over Retail (5.4)	RA	Apartment - Site Bedroom Split*	24	Dwellings	0.775	18.6
		BE01	Single Retail	300	GBFA (m^2)	0.003	0.9
						SUBTOTAL	**382.4**
						TOTAL	**2624**

4.3.2 Likely Connection Sizes

Utilising the above ET calculations and relevant standards/codes of practice, likely connection sizes can be determined. For clarity, likely connections sizes will be presented for each defined area as nominated in Table 4.3, Table 5.3 and the Masterplan.

Due to the sloping nature of the Site and the presence of receiving infrastructure downslope of each precinct, it is highly likely to be able to utilise gravity reticulation to the desired connection points. It is therefore unlikely that any of the precincts will require new Sewage Pump Stations (SPS) to allow development. The existing location of sewer mains is therefore not likely to place a constraint on the future development.

The main limitation for the sewer servicing of the Site will be the receiving capacity of TasWater assets. The mains assets that will need to be tested for adequacy and current capacity include the DN150 gravity reticulation main on the Northern boundary of the Site for Precinct 4, the DN150 -DN375 gravity reticulation main on the Southern/Western boundary for Precinct’s 5,3,2,1, and finally the DN525 gravity trunk main in Sandy Bay Road.

Our preliminary assessment indicates that with Precinct 3 having a proposed sewer demand of 381, the connection of this Site upstream of the transition to DN225 sewer near View Street could cause a potential overloading of the existing sewer main for that area.

Additionally, Precinct 5, which ideally would connect to the main upstream of the DN150 at Brinsmead Road to Manhole A648409, is currently estimated to produce a total 278 ET, which would likely exceed the pipeline capacity. The length of DN150 main however may have more capacity than estimated, due to an increased grade (pipe capacity estimated with a slope of 1.67%).

Further investigation into the existing gradient of the sewer mains in these areas should be undertaken to determine if extra capacity is available.

It may be the preference of TasWater to direct flow from Precinct 1 and 2 to the DN150 reticulation main in Earl Street, therefore the receiving capacity of this asset may also limit the proposal. Consultation with TasWater has commenced. Preliminary advice has been received and the current Masterplan has been based on this advice. Ongoing consultation with TasWater will be required as the development progresses.

Any future development will also be required to adhere to any TasWater imposed easements on mains infrastructure within the Site, which can vary in width dependent on pipe size from 3.0 m up to 6.0 m or greater.

The gravity trunk main that traverses the upper slopes of the Site and flows down the Southern Boundary will be of particular concern, with a possible 6.0 m easement applied to its entire length (refer section 2.2 and 0).

Further information on easements can be found in Table 111-C MRWA-S-111 (MRWA standard drawings), or Section 5.2.8 of TasWater's Supplement to WSA 02-2014-3.1 MRWA Edition.

Augmentation of existing offsite TasWater SPS may also be required. TasWater has been contacted to provide advice on this and any other likely constraints due to sewer. Their preliminary advice has been incorporated into the Masterplan and included in this Report.

Likely connections sizes for sewer within the Site are determined from Table 5.6 of WSA 02-2014-3.1.

Table 4.3 Sewer Capacity Calculations (ET)

Area	Total ET	Connection Size	Comments
Precinct 1	268	Manhole A629717 (DN225 RC)	A single DN150 connection at a gradient of 1.67% has adequate capacity to service the Precinct. The area does however feature a number of buildings (indoor sports and health, sports ground etc.) that TasWater prefer to assess on a case-by-case basis. This is likely to increase the level of ET and therefore may require either multiple connections, steeper gradient or a larger connection
Precinct 2	975	Utilise existing UTAS connections to Manhole A647537 (DN150) and Manhole A647389 (DN150)	This Precinct has the largest demand across the Site, and this section of the university is currently serviced by two (2) DN150 and one (1) DN100 connections. To keep the internal sewer networks required smaller and simpler, it would be best to continue with multiple connections. If TasWater stipulate the requirement for one (1) connection, a DN225 has sufficient capacity.
Precinct 3	744	Manhole A3369682 (DN150) and Manhole A648660 (DN300)	This area features the lowest demand of the overall Site and is easily serviced by a DN150 connection at 1.67% grade The upper portion of this Precinct is currently serviced by several connections. The expected Site demand would either require two (2) DN150 connections or a single DN225
Precinct 4	255	Manhole A647449 (DN150)	Located adjacent to a TasWater DN150 reticulation main, the most logical connection solution for this area is two (2) DN150 connections at varying elevations i.e., one servicing the upper portion and one servicing the lower portion of the village
Precinct 5	382	Manhole A648464 (DN300) or similar along trunk main	The Site sits upslope of a TasWater DN300 gravity trunk main, thus the most logical connection would be a single DN225

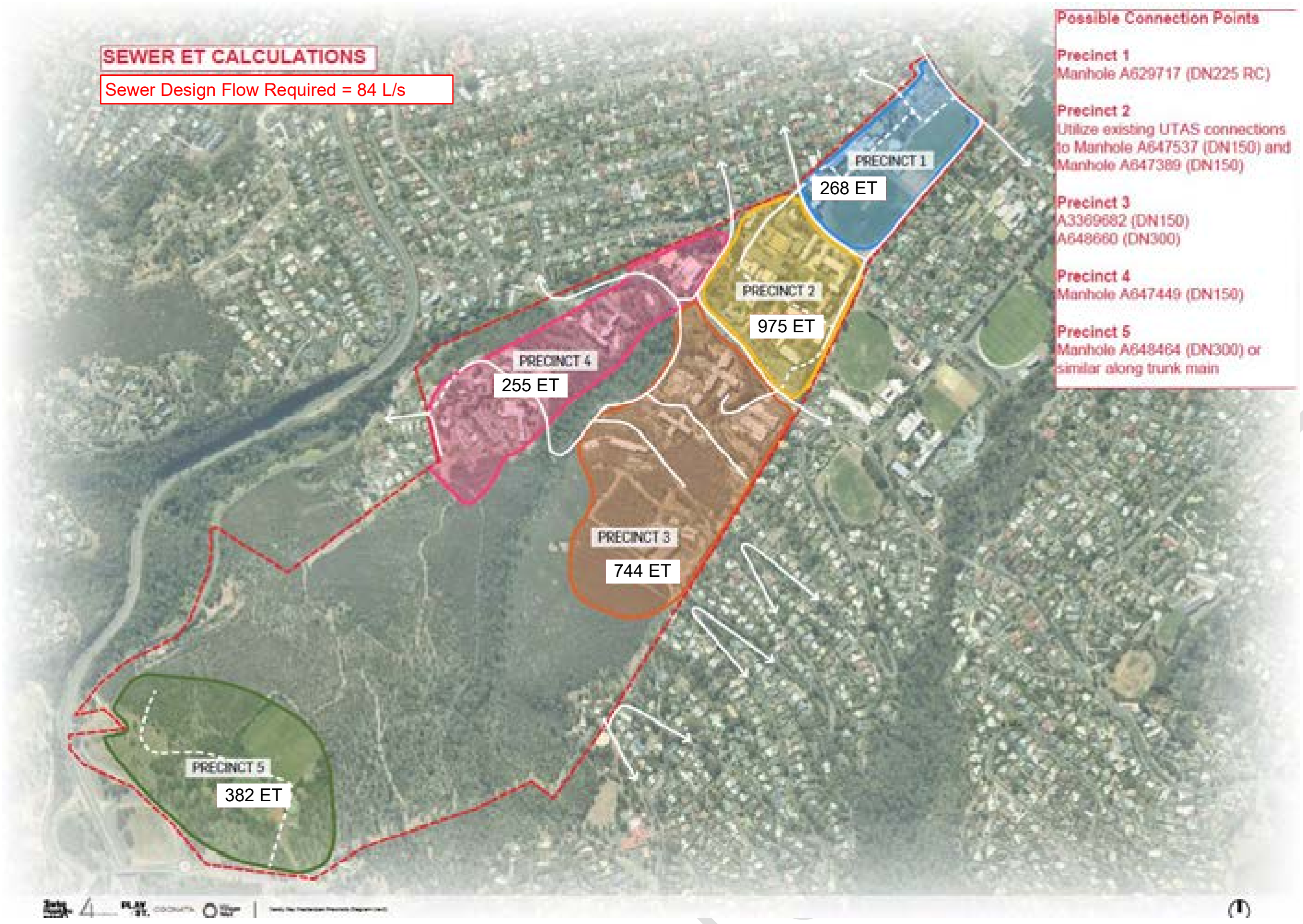

Figure 4.1 Proposed Sewer Loads and Connections for Masterplan for PSA submission

Through our consultation, TasWater has requested an assessment of the capacity of the existing sewer and water network that the proposed Site could connect to. GHD have completed a high-level analysis of the surrounding catchments and their contributions to sewer and water loadings. The demand contributions made by the existing UTAS buildings on the Site were not included in the analysis, on the assumption that the current demands would be replaced in the future by the proposed demands as outlined in section 4.3.1.

TasWater has also carried out a preliminary assessment of their related assets based on the initial yield study (dated 4 July), which indicated that the following minimum upgrades will be required to the TasWater assets:

- Provision of additional >169.7 kL storage will be required at the downstream Sewage Pump Station (SPS) “SELSP13 Sandy Bay No. 2 SPS” due to the UTAS development. This asset is overloaded under the current conditions due to changes not related to the UPPL development, so any increase in discharge to that SPS will result in an upgrade being required. TasWater will also need to upgrade that asset for their own purposes for an additional 391 kL of storage.
- Upgrading of Selfs Point STP secondary clarifiers will be required.
- Upgrading of the gravity sewer pipes (noting that these upgrades would likely be a minimum and addition upgrades may be required):
  - A650888, A650889 (DN150 to DN225 for ~116 m)
  - A651336, A651340 (DN150 to DN225 for ~125 m)
  - A650919* (DN225 to DN300 ~50 m)
- TasWater have also identified that they have some constraints with the 525 mm main within Sandy Bay Road, along with the 150 mm main within Precinct 5 that need to be considered.

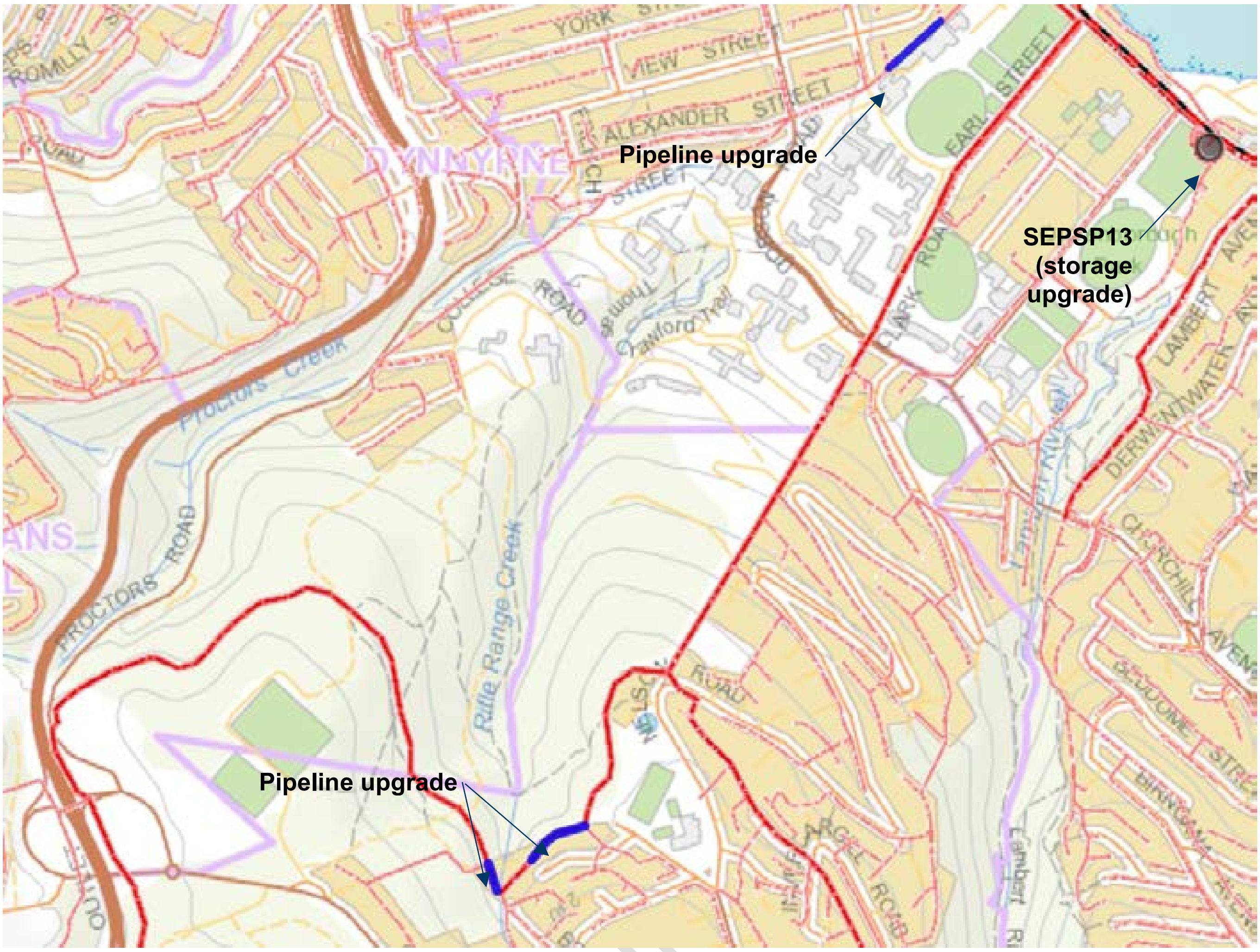

Figure 4.2 *Required Upgrades*

shows the approximate location of external infrastructure upgrades.

Further consultation will be required with TasWater to ensure the feasibility of the above-mentioned assets to handle the proposed loading from the developed Site.

Concept servicing plans are included in Appendix B based on the Masterplan for PSA submission. TasWater has not provided comment specific to this Masterplan. Ongoing discussion with TasWater will be required as the project progresses.

4.3.3 Staging

Sewer services staging will be tied to the development staging. However, some services within other development stage boundaries will need to be constructed prior to a particular development stage. Expected constraints around staging of development and sewer services are listed below:

- Existing sewer (servicing Site and external residential areas) through Precinct 1 to be relocated to future location as part of Precinct 1 works.
- All Sewer relocations and augmentation within each stage prior to completion of that stage of development.
- TasWater required upgrades prior to upstream development (refer section 4.3.2).
- Temporary works connecting proposed sewer gravity pipelines to existing systems in downstream stages of development prior to upgrades of the downstream system.
- TasWater has advised that SELSP13 Sandy Bay No.2 SPS requires upgrading. It is likely that this work will be required as part of the first stage of development as it is currently under capacity.

- TasWater has also advised the Selfs Point STP Clarifier No. 2 requires upgrading. It is unclear when in the development TasWater would require this work to be completed.

5. Water

5.1 General Information

A review of the publicly available GIS data (LISTMap) and existing Site survey file was completed, and the following existing infrastructure identified:

- The Site is covered by several TasWater owned water assets of varying sizes.
- There are two main lines running along the downhill (north-eastern boundary) of the Site in Sandy Bay Road, a DN250 MSCL reticulation main and a DN100 CICL reticulation main.
- The DN100 CICL reticulation main branches off onto Earl Street and services residential properties.
- A DN250 CICL reticulation main approaches the Site from Quorn Street and turns upslope, running up Earl Street across Grosvenor Crescent, up Grosvenor Street and connects to a DN375 in Regent Street
- The downhill (lower) portion of Churchill Avenue is serviced via a DN100 CICL reticulation main. The upper portion is serviced via a DN250 CICL reticulation main originating in French Street.
- The Hytten Hall, UTAS Apartment, Baintree Avenue and Oberon court area is serviced via a typical residential network of DN50 Cu, DN100 PVC-u and a DN200 DICL reticulation main.
- The DN200 DICL servicing the above area originates from the Mt. Nelson (Bend 7) Reservoir, which cuts diagonally across the upper slopes of the Site.
- The development will need to consider any easement conditions imposed on the mains listed above, which can be applied at varying widths as per Table 5.4.4 of the TasWater Supplement to WSA 03 – 2011-3.1 MRWA Edition 2.0.
- The upper portion of the Site at Olinda Grove is serviced via a DN100 CICL reticulation main.

The existing sewer network is shown by drawing 12549540-W0006 to W0010 included in Appendix B.

5.2 Existing Water Connections

The known water connection points from ISD Site file and from analysis of the TasWater GIS Data are summarised in Table 5.1 below and shown by the drawings contained in Appendix B.

Table 5.1 Summary of existing Site water connections

Type/Size	ISD Site File ID	TasWater ID	Lateral Line ID/Size	Main ID/Size	Location
Water Meter 50 mm	M89721907	L66265	DN50 A384787	DN100 A384746	Earl Street
Water Meter Unknown	89721904	-	-	-	Earl Street (No information on LISTMap)
Water Meter 150 mm	M85656536	L16447	A384742 DN100	A384744 DN100	Earl Street
Water Meter 50 mm	M931838	L66266	A384742 DN100	A384744 DN100	Earl Street
Water Meter 150 mm	M85654711 M676763	L66554	-	A384071 DN250	Grosvenor Crescent
Water Meter 20 mm	M786540	L95556	-	A384085 DN250	Grosvenor Street University Club Building
Water Meter 25 mm	M90188839	L95554	-	A384911 DN250	French Street TUU Building
Water Meter 100 mm	M90188839	L66273	-	A384911 DN250	French Street Refectory
Water Meter 50 mm	87118180	L16451	-	A384911 DN250	French Street Commerce Building

Type/Size	ISD Site File ID	TasWater ID	Lateral Line ID/Size	Main ID/Size	Location
Water Meter 150 mm	87118180	L16450	-	A384911 DN250	French Street Hytten Hall
Water Meter 25 mm	M809871	L450472	A3399911 DN100	A380300 DN200	College Road
Water Meter 100 mm	M809871	L450474	No ID listed DN100	A380300 DN200	College Road
Water Meter 100mm	861006507	L66275	-	A380300 DN200	College Road
Water Meter 100mm	06H701221	L16452	-	A380300 DN200	College Road
Water Meter 40mm	M865590	L66274	-	A380300 DN200	College Road
Water Meter 20mm	M672343	L95553	-	A381400 DN100	Wardens Lodge Baintree Avenue
Water Meter 100mm	-	L144349	-	A381687 DN200	C.S.I.R.O
Water Meter 40mm	M1005758	L66272	-	A378689 DN200	Mount Nelson Bend 7 Units
Water Meter 40mm	M1005751	L66271	-	A378689 DN200	Mount Nelson Bend 7 Units
Water Meter 40mm	120009890	L16449	-	A378652 DN100	Olinda Grove Sports Field
Water Meter 100mm	12048726	L16448	-	A378652 DN100	Olinda Grove Sports Field
Water Meter 50mm	M919319	L66270	-	A381687 DN200	Agriculture
Water Meter 40mm	M956110	L66268	A385745 DN50	A385763 DN100	Agriculture
Water Meter 50mm	M1016645	L66269	A385773 DN50	A385763 DN100	Agriculture
Water Meter 100mm	06HB14063	L150000	-	A384731 DN250	Hill Street Grocer
Water Meter 80mm	M80661932	L66267	-	A384911 DN250	Life Sciences
Water Meter 50mm	-	L450276	A3399436 DN50	A384911 DN250	Hill Street Grocer
Water Meter 25mm	-	L450275	A3385978 DN100	A384911 DN250	Hill Street Grocer
Note: "-" signifies no information present on either the ISD Site file or LISTMap GIS data.					

5.3 Proposed Water Supply

5.3.1 Demand

Concept demand calculations for water supply has been carried out using an Equivalent Tenements Assessment based on building use and occupancy numbers provided to GHD in the form of the Development Schedule for the Masterplan for PSA Submission.

Where ET rates are based upon number of persons/visitors/rooms/basins/students and only Gross Building Floor Area (GBFA) has been provided, general assumptions based upon the floor area have been made.

Example: Education facility with 1600m^2 floor area: $\frac{1600m^2}{10m^2\ per\ student} = 160$ students

Water demand calculations were carried out using the Equivalent Tenements (ET) method as outline in WSA 03-2014-3.1 and the TasWater Supplement. Table 5.2 below displays the results of the calculations.

Table 5.2 Water demand calculations

Ref	Use	ET Code	Description	No.	Unit	Unit Rating	ET
Precinct 1							
1	Commercial - Sports science / Community: Sports Social Clubs and Childcare on top floor	BE04	Office	6660	GBFA (m^2)	0.004	26.64
		BE01	Single Retail	100	GBFA (m^2)	0.002	0.2
		CF06	Community Centre/hall	2,600	GFA (m^2)		6.5
2	Serviced Apartments with small retail on ground floor	RA	Apartment - Site Bedroom Split*	72	Dwellings	0.517	37.224
		BE01	Single Retail	380	GBFA (m^2)	0.002	0.76
3	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	31	Dwellings	0.517	16.027
		BE01	Single Retail	120	GBFA (m^2)	0.002	0.24
4	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.517	17.061
5	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.517	17.061
6	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.517	17.061
7	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	41	Dwellings	0.517	21.197
9	Indoor Sports	CF06	Community Centre/hall	3,500	GFA (m^2)		8.75
10	Carpark (under Soccer Fields)	CF09	Public amenities Block (per wc)	4	WC	0.4	1.6
11	Soccer Field 1						
12	Soccer Field 2						
14	Sports Pavillion - Footy Club	SF01	Sports Stadium	500			1.25
15	Residential Apartment	RA	Apartment - Site Bedroom Split*	24	Dwellings	0.517	12.408
						SUBTOTAL	**183.979**
Precinct 2							
1a	Residential terraces within Engineering Bldg. - Reuse	RA	Apartment - Site Bedroom Split*	22	Dwellings	0.517	11.374
1b	Residential Apartments	RA	Apartment - Site Bedroom Split*	41	Dwellings	0.517	21.197
1c	Residential Apartments	RA	Apartment - Site Bedroom Split*	51	Dwellings	0.517	26.367
1d	Residential Apartments	RA	Apartment - Site Bedroom Split*	45	Dwellings	0.517	23.265
2a	Residential Terraces within Geology Bldg. - Reuse	RA	Apartment - Site Bedroom Split*	15	Dwellings	0.517	7.755
2a	Resi Podium 2 Storey TH/Soho	RM02	Unit - 2 bedroom	18	Dwellings	0.6	10.8
2b	Residential Apartments	RA	Apartment - Site Bedroom Split*	30	Dwellings	0.517	15.51
2c	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
2d	Residential Apartments	RA	Apartment - Site Bedroom Split*	43	Dwellings	0.517	22.231
3	Residential Apartments - Chemistry Blg Ruse	RA	Apartment - Site Bedroom Split*	140	Dwellings	0.517	72.38
4		BE04	Office	15300	GBFA (m^2)	0.004	61.2

Ref	Use	ET Code	Description	No.	Unit	Unit Rating	ET
	Commercial / Education / makers space - Physics Blg. Reuse	CF05	Community Centre/hall	850	GFA (m^2)		2.125
5	Commercial / Co-work - Morris Miller Blg. Reuse	BE04	Office	8100	GBFA (m^2)	0.004	32.4
5	Community Library - Morris Miller Blg. Reuse	CF06	Community Centre/hall	1500	GFA (m^2)		3.75
6	Aged Care (RAC)	AP01	Nursing Home/Aged Care	91	Beds	0.657	59.787
8	Office (Commercial -- Social Sciences Blg. Reuse)	BE04	Office	9900	GBFA (m^2)	0.006	59.4
		BE01	Single Retail	300	GBFA (m^2)	0.002	0.6
9	Retail Centre (Supermarket)	BE02	Supermarket	3500	GBFA (m^2)	0.002	7
		BE01	Single Retail	500	GBFA (m^2)	0.002	1
9a	Resi Podium 2 Storey TH/Soho	RM02	Unit - 2 bedroom	16	Dwellings	0.6	9.6
9b	Residential Apartments	RA	Apartment - Site Bedroom Split*	38	Dwellings	0.517	19.646
9c	Residential Apartments	RA	Apartment - Site Bedroom Split*	54	Dwellings	0.517	27.918
9d	Residential Apartments	RA	Apartment - Site Bedroom Split*	49	Dwellings	0.517	25.333
10	Perf. Arts / f&b / Museum	BE01	Single Retail	300	GBFA (m^2)	0.002	0.6
		CF06	Community Centre/hall	2000	GFA (m^2)		5
11	Theatre / Church	CF06	Community Centre/hall	500	GFA (m^2)		1.1
12	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
13	New Pedestrian Bridge						0
14	Carpark (Basement carpark along Churchill Rd)	CF09	Public amenities Block (per wc)	4	WC	0.4	1.6
15	Mixed Use - Residential/Retail	RA	Apartment - Site Bedroom Split*	37	Dwellings	0.517	19.129
		BE01	Single Retail	400	GBFA (m^2)	0.002	0.8
16	Mixed Use - Residential/Retail	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.517	17.061
		BE01	Single Retail	300	GBFA (m^2)	0.002	0.6
12	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
13	New Pedestrian Bridge						0
14	Carpark (Basement carpark along Churchill Rd)	CF09	Public amenities Block (per wc)	4	WC	0.4	1.6
15	Mixed Use - Residential/Retail	RA	Apartment - Site Bedroom Split*	37	Dwellings	0.517	19.129
		BE01	Single Retail	400	GBFA (m^2)	0.002	0.8
16	Mixed Use - Residential/Retail	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.517	17.061
		BE01	Single Retail	300	GBFA (m^2)	0.002	0.6
18	Residential Apartments	RA	Apartment - Site Bedroom Split*	68	Dwellings	0.517	35.156
19	Medical Centre	BE01	Single Retail	3200	GBFA (m^2)	0.002	6.4
20	Community House (Relocated Cottage)	CF06	Community Centre/hall	120	GFA (m^2)		0.3

Ref	Use	ET Code	Description	No.	Unit	Unit Rating	ET
21	Retirement Living (apartments)	RA	Apartment - Site Bedroom Split*	81	Dwellings	0.517	41.877
						SUBTOTAL	**676.685**
Precinct 3							
1	Residential Apartments	RA	Apartment - Site Bedroom Split*	49	Dwellings	0.517	25.333
2a	Residential - Mixed Use - small retail on ground floor	RA	Apartment - Site Bedroom Split*	45	Dwellings	0.517	23.265
		BE01	Single Retail	100	GBFA (m^2)	0.002	0.2
2b	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	45	Dwellings	0.517	23.265
		BE01	Single Retail	100	GBFA (m^2)	0.002	0.2
2c	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	45	Dwellings	0.517	23.265
		BE01	Single Retail	100	GBFA (m^2)	0.002	0.2
2d	Mixed Use - Residential	RA	Apartment - Site Bedroom Split*	43	Dwellings	0.517	22.231
2e	Residential - Mixed Use - small retail on ground floor	RA	Apartment - Site Bedroom Split*	45	Dwellings	0.517	23.265
		BE01	Single Retail	100	GBFA (m^2)	0.002	0.2
2f	Residential Apartments	RA	Apartment - Site Bedroom Split*	43	Dwellings	0.517	22.231
3a	Residential Apartments	RA	Apartment - Site Bedroom Split*	65	Dwellings	0.517	33.605
3b	Residential Apartments	RA	Apartment - Site Bedroom Split*	65	Dwellings	0.517	33.605
3c	Residential Apartments	RA	Apartment - Site Bedroom Split*	65	Dwellings	0.517	33.605
4	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
5	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
6	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
7	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
8	Health (Family Health Services - existing in Corporate Services Bldg.)	BE07	Medical Centre	1500	GFA (m^2)		3.75
8	Childcare	CF01	Childcare centre/ Pre-school	90	GBFA (m^2)	0.06	5.4
9	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
10	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
11	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
12	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
13	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	18	Dwellings	0.517	9.306
14	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	5	Dwellings	0.517	2.585
17	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	22	Dwellings	0.517	11.374
18	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	15	Dwellings	0.517	7.755
19	Residential - Single Lot	RE01	Residential - Single Lot	6	Dwellings	1	6
20	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	29	Dwellings	0.517	14.993
21	Residential - Single Lot	RE01	Residential - Single Lot	7	Dwellings	1	7
22	Residential - Single Lot	RE02	Residential - Single Lot	13	Dwellings	1	13
23	Residential - Single Lot	RE03	Residential - Single Lot	16	Dwellings	1	16
						SUBTOTAL	**510.529**

Ref	Use	ET Code	Description	No.	Unit	Unit Rating	ET
Precinct 4							
1	Residential Apartments	RA	Apartment - Site Bedroom Split*	40	Dwellings	0.517	20.68
2	Residential Apartments	RA	Apartment - Site Bedroom Split*	58	Dwellings	0.517	29.986
3	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	7	Dwellings	0.517	3.619
4	School	CF02		313	Students	0.037	11.581
5	Residential Apartments	RA	Apartment - Site Bedroom Split*	24	Dwellings	0.517	12.408
8	Residential Apartments	RA	Apartment - Site Bedroom Split*	25	Dwellings	0.517	12.925
9	Residential Apartments	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.517	17.061
10	Residential Apartments	RA	Apartment - Site Bedroom Split*	29	Dwellings	0.517	14.993
11	Residential Apartments	RA	Apartment - Site Bedroom Split*	24	Dwellings	0.517	12.408
12	Residential Apartments	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.517	17.061
13	Residential Apartments	RA	Apartment - Site Bedroom Split*	33	Dwellings	0.517	17.061
						SUBTOTAL	**169.783**
Precinct 5							
1	Adventure Tourism Centre	BE04	Office	500	GBFA (m^2)	0.004	2
2	Eco-Hotel	AS03	Services - Hotel/Motel/Resort	120	Rooms	0.3	36
3	Spa	BE05	Hairdresser/Beauty Salon	20	Basin	0.5	10
4	Retail Centre	BE01	Single Retail	3900	GBFA (m^2)	0.002	7.8
5	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	28	Dwellings	0.517	14.476
		BE04	Office	800	GBFA (m^2)	0.004	3.2
6	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	34	Dwellings	0.517	17.578
		BE01	Single Retail	200	GBFA (m^2)	0.002	0.4
7	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
8	Residential - Townhomes	RA	Apartment - Site Bedroom Split*	37	Dwellings	0.517	19.129
9	Residential - Single Lot	RE01	Residential - Single Lot	17	Dwellings	1	17
10	Eco-Learning Centre	CF06	Community Centre/hall	500	GFA (m^2)		1.25
11	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	28	Dwellings	0.517	14.476
		BE04	Office	800	GBFA (m^2)	0.004	3.2
12	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	14	Dwellings	0.517	7.238
		BE01	Single Retail	200	GBFA (m^2)	0.002	0.4
13	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	29	Dwellings	0.517	14.993
		BE01	Single Retail	300	GBFA (m^2)	0.002	0.6
14	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	26	Dwellings	0.517	13.442
		BE01	Single Retail	300	GBFA (m^2)	0.002	0.6
15		RA	Apartment - Site Bedroom Split*	26	Dwellings	0.517	13.442

Ref	Use	ET Code	Description	No.	Unit	Unit Rating	ET
	Residential - Mixed Use - Commercial on ground floor	BE01	Single Retail	300	GBFA (m^2)	0.002	0.6
16	Residential - Mixed Use - Commercial on ground floor	RA	Apartment - Site Bedroom Split*	24	Dwellings	0.517	12.408
17	Residential Apartments	RA	Apartment - Site Bedroom Split*	36	Dwellings	0.517	18.612
18	Residential - Over Retail (5.4)	RA	Apartment - Site Bedroom Split*	24	Dwellings	0.517	12.408
		BE01	Single Retail	300	GBFA (m^2)	0.002	0.6
						SUBTOTAL	**260.464**
						GRAND TOTAL	**1801.44**

* The Development schedule nominates a bedroom split or residential apartments of 70% 2 bedroom, 20% 3 bedroom and 10% 1 bedroom, therefore the Unit rating for the residential apartments has been factored to 0.517 to suit the above site split.

5.3.2 Likely Connection Sizes

Utilising the above ET calculations and relevant standards/codes of practice, likely connection sizes can be determined. For clarity, likely connections sizes will be presented for each defined area as nominated in Table 4.3, Table 5.3 and the CHC Masterplan.

The main constraints will be the adequacy of TasWater infrastructure to deliver the required flow to service future development. The Site is located in a favourable position, downslope of the Nelson Road – Bend 7 reservoir, and has access to the DN200 CICL reticulation main being fed from this reservoir. Precinct 5 sits upslope of the Bend 7 reservoir and will require connection to the main off Olinda Grove.

Further consultation with TasWater will need to be undertaken to determine the extent of the above-mentioned constraint and how future development of the Site will affect the rest of the surrounding areas in Sandy Bay. TasWater has been contacted to provide advice on this and any other likely constraints due to the requirement for a potable water supply. They have not raised any constraints.

As was the case with the sewer, any future development of the Site will need to adhere to any easement conditions imposed on existing infrastructure. This may impose some limitations on the layout of any development across Precinct 3 and 4, where the DN200 water reticulation main may have up to a 6.0 m with easement where no structures can be built (refer section 2.2).

Referencing Section 2.3.3 of TasWater's Supplement to WSA 03-2011-3.1, Table 3.2 of WSA 03-2011-3.1 can be used to size reticulation mains with the number of lots represented in the table being equivalent to the number for ET.

Table 5.3 Water Capacity Calculations (ET)

Area	Total ET	Connection Size	Comments
Precinct 1	184	DN100 Lateral line ID 4384742 (Earl St) DN250 CICL main ID A384085 (Grosvenor St)	The Precinct has access to 3 mains supply sources, a DN250 and DN100 in Sandy Bay Road, and a DN250 in Grosvenor Crescent. This allows some flexibility in connection location, and internal layout. 2 x DN150 connections, one from Sandy Bay Road to service the lower portion, and one from Grosvenor Crescent to service the upper portion is a logical option for supply

Area	Total ET	Connection Size	Comments
Precinct 2	677	DN250 CICL main ID A384085 (Grosvenor St) DN250 CICL main ID A384911 (Churchill Ave)	This area has access to multiple mains supply sources in Grosvenor Crescent (DN250), Earl Street (DN100), Churchill Avenue (DN250). This section of Site is currently serviced via two DN150 connections (Earl Street and Grosvenor Crescent) and an additional DN50 Connection from Earl Street. Two additional DN150 (or one DN150 and one DN100) connections would most likely be required from the DN250 main located in Churchill Avenue to service the upper portion
Precinct 3	511	DN250 CICL main ID A384911 (Churchill Ave) DN100 DICL main ID A385763 (Nelson Rd) DN100 DICL main ID A385763 (Nelson Rd) DN200 CICL main ID A381687 (Nelson Rd)	Precinct 3 has several options for connection along Churchill Ave and Nelson Road. Assumed connection locations provided in Appendix B with options for interconnectivity from Nelson Rd.
Precinct 4	170	DN200 (Max capacity of 400 ET)	This section of the Site already features two DN100 connections and other smaller (<DN100) taken from the DN200 main originating at Mt. Nelson Bend 7 to service the UTAS apartment complex. This main should provide more than adequate flow to service the proposed development.
Precinct 5	260	DN100 A378975 (Olinda Grove)	The current buildings are serviced by a DN100 water main in Olinda Grove. This main may have to be upgraded to provide adequate servicing to the Precinct. Advice has not been received from TasWater regarding this item.

Figure 5.1 Proposed Water Demands and Connections

TasWater has advised that initial modelling indicates there is sufficient capacity in the existing water network to supply the proposed development. For such a large development, however, this will need to be revisited as more detailed plans become available.

Revised concept services plans are provided in Appendix B based on the Masterplan for PSA submission. TasWater has not commented specifically on the Masterplan. Ongoing discussion with TasWater will be required including confirmation of connection opportunities and pressure zones.

5.3.3 Existing Demand and Capacity

The Site is located in a favourable position, downslope of the Nelson Road – Bend 7 reservoir, and has access to the DN200 CICL reticulation main being fed from this reservoir. This is with the exception of Precinct 5, which Sites upslope of the reservoir and may face some difficulty to obtain adequate water service from the DN100 pipeline located in Olinda Grove.

Further consultation with TasWater will need to be undertaken to determine the extent of the above-mentioned constraint and how future development of the Site will affect the rest of the surrounding areas in Sandy Bay. TasWater has been contacted to provide advice on this and any other likely constraints due to the requirement for a potable water supply. TasWater's initial advice was received in late July 2021 and has been incorporated into the Masterplan for PSA submission.

5.3.4 Staging

Water supply services staging will be tied to the development staging. However, some services within other development stage boundaries will need to be constructed prior to a particular development stage. Expected constraints around staging of development and water supply services are listed below.

- Grosvenor Crescent Water Main will likely be required to be realigned as part of the Precinct 1 or 2 works.
- All water main relocations within each stage prior to completion of that stage of development

6. Summary

6.1 Site Constraints

GHD's investigation of the Site and concept civil services requirements have identified the following key constraints that require consideration in development of the Masterplan:

- Presence of significant third party owned infrastructure for water, sewer and stormwater services that require significant easements affecting the location of future buildings and infrastructure.
- Opportunity to reduce the requirement and impact of easements through:
  - Relocation and augmentation of services to suit Masterplan.
  - UTAS to own, maintain and operate civil services and roads with connection to authority services only at the Site boundary
  - Possible future handover of Site internal services and road reserves concurrently.
- New buildings proposed to be constructed over easements are unlikely to be approved by TasWater or CoH. Constraint addressed by relocation of services.
- Proposed Precincts 3, 4, and 5 are upslope of any existing formal stormwater infrastructure and will most likely be required to discharge to either Proctors or Rifle Range Creek. Stormwater quality will need to be addressed prior to discharge into the creeks.
- Peak flows into creek lines will need to be considered and potentially mitigated to retain the creek natural values
- Stormwater Detention for flood mitigation is required prior to stormwater leaving the Site.

6.2 External Works

Construction of the following civil services assets is expected external to the Site boundary:

- External Pipe augmentation:
  - A650888, A650889 (DN150 to DN225 for ~116 m)
  - A651336, A651340 (DN150 to DN225 for ~125 m)
  - A650919* (DN225 to DN300 ~50 m)
- Additional >169.7 kL storage at "SELSP13 Sandy Bay No. 2 SPS".
- Upgrading of Selfs Point STP secondary clarifiers

6.3 Internal Works

Construction of the following civil services assets is expected within the Site boundary:

- Site water reticulation
- Site sewer pipelines
- Site stormwater pit and pipe network
- Swales, endwalls and associated erosion control infrastructure
- Stormwater detention storage including:
  - Above ground storage at the oval
  - In ground storage (location and amount to be determined)
  - Above/in ground storage immediately downslope of Precinct 5
- Stormwater treatment infrastructure (within each Precinct) including:
  - Bioretention basins/swales

    - Vegetated swales
    - GPTs/proprietary secondary treatment devices
- Relocated and augmented large stormwater box culverts/pipes:
    - 3100 x 2400 RCBC (minimum)
    - Replacement of existing DN900 and DN1200 (replacement size approximately DN1200 and DN1800 respectively)
    - Large junction, inflow/outflow pits.

Roof rainwater storage for reuse (retention) has been considered by others and is not included in this Report but is to be considered as part of the development of each building with overflow discharging to the stormwater network.

Appendix A

Development Schedule

Sandy Bay Masterplan **Development Summary** **COMMERCIAL IN CONFIDENCE**

Revision 6B

17.11.21

Sandy Bay Masterplan_Rev3b	Lower Campus	Mid Campus	Upper Campus			Total
	Precinct 1	Precinct 2	Precinct 3	Precinct 4	Precinct 5	
RESIDENTIAL DWELLINGS	266 Includes Serviced Apartments	755	933	305	360	2,700
RETIREMENT LIVING (Apartments)		81				
RESIDENTIAL AGED CARE (Beds)		91				91
HOTEL (Rooms)					120 Rooms	120
STUDENT ACCOMODATION EXISTING (Rooms)				Existing		
COMMERCIAL (GFA m2)	3,600	18,400			800	22,800
RETAIL and F&B (GFA m2)	600	3,500 Supermarket 1,800 Specialty Retail	400		3,500 Supermarket 2,000 Specialty Retail	11,800
HEALTH AND WELLBEING (GFA m2)		3,200 Medical Centre	1,500 Health Services		Spa	5,700
TOURISM + RECREATION					Tourism Centre	500
COMMUNITY / EDUCATION / SPORTS	3,500m2 Indoor Sports Sports Social Clubs Childcare 500m2 Sports pavillion	Community House Performing Arts Theatre Makers Space Library Church/ Theatre	Childcare	Education / School	Eco Living Education	12,970

This scheme has been produced without planning advice or preliminary meetings with the responsible authorities and as suchmay not comply with building or other statutory regulations. It represents a possible development that may be achieved with full consultation and liaison with state government and other relevant authorities, however no warranty is given that the yield or layouts will be acceptable to the authorities or other interested parties. Hence ClarkeHopkinsClarke presents this information as a possible solution only, subject to council and other authorities approval.

This scheme and schedule have been prepared for preliminary masterplanning purposes only. The information herein is based on the limited information available at the time of preparation and is believed to be correct at the time of preparation however is not guaranteed.

Appendix B

Drawings

SERVICES LEGEND

PROPOSED

—W——W——W—	PROPOSED WATER MAIN
×W×——×—W—×—×	EXISTING WATER MAIN TO BE MADE REDUNDANT

EXISTING

—W— — —W— — —	EXISTING WATER MAIN

A	REVIEW ISSUE			
Rev	**Description**	**Checked**	**Approved**	**Date**

Author **Drafting Check**

Designer **Design Check**

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Project No. 12549540

Client UNIVERSITY OF TASMANIA

Project SANDY BAY CAMPUS REDEVELOPMENT

Status

Status Code

Drawing Title EXISTING WATER SERVICES
KEY PLAN

Size **A3**

Drawing No. 12549540-W0001

Rev A

Plot Date: 19 November 2021 - 12:23 AM Plotted by: Gez Chugg

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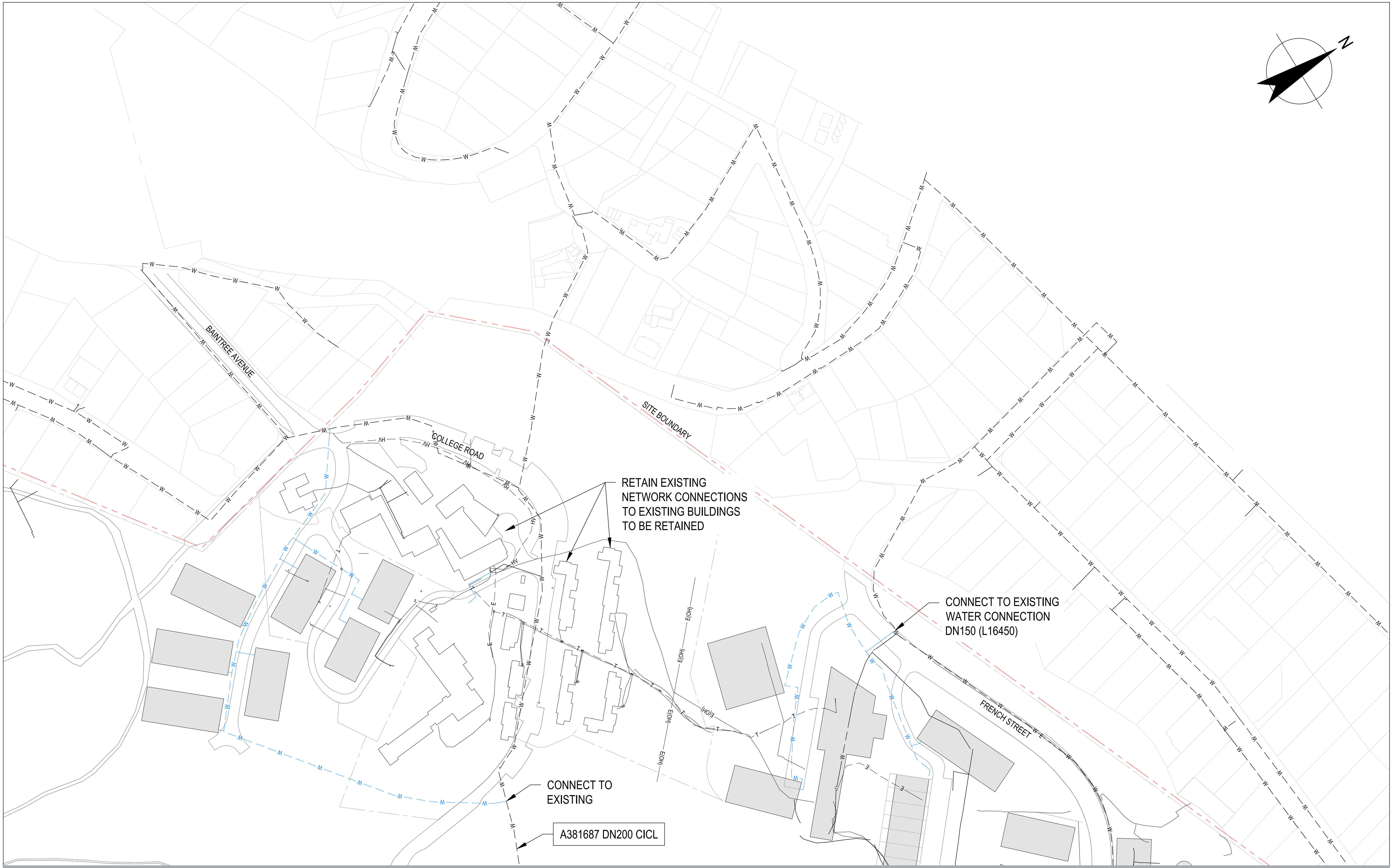

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Designer **Design Check**

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Drawing Title EXISTING WATER SERVICES
GENERAL ARRANGEMENT
SHEET 1 OF 4

Size A3

Drawing No. 12549540-W0002

Rev A

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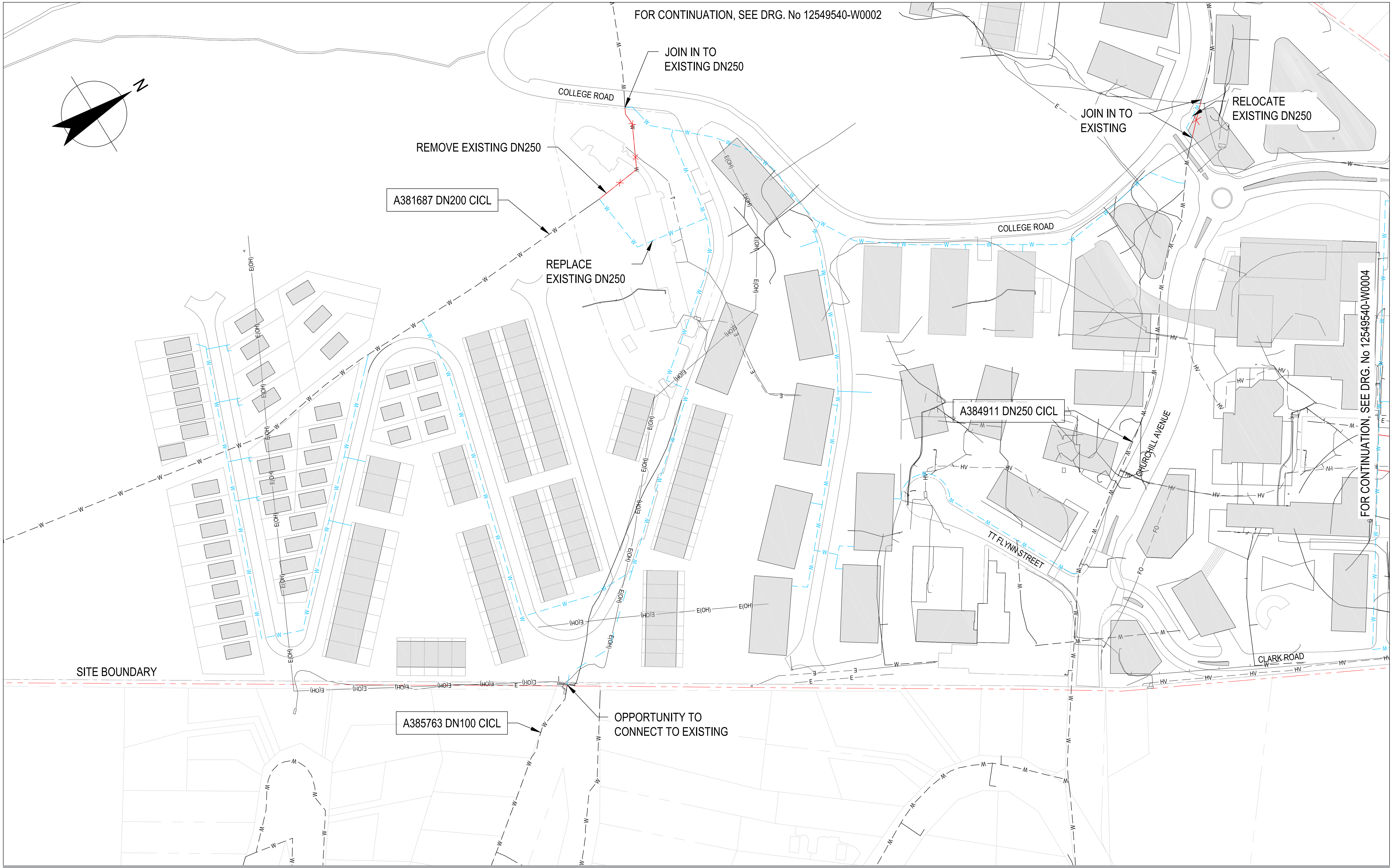

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Drawing Title EXISTING WATER SERVICES
GENERAL ARRANGEMENT
SHEET 2 OF 4

Size A3

Drawing No. 12549540-W0003

Rev A

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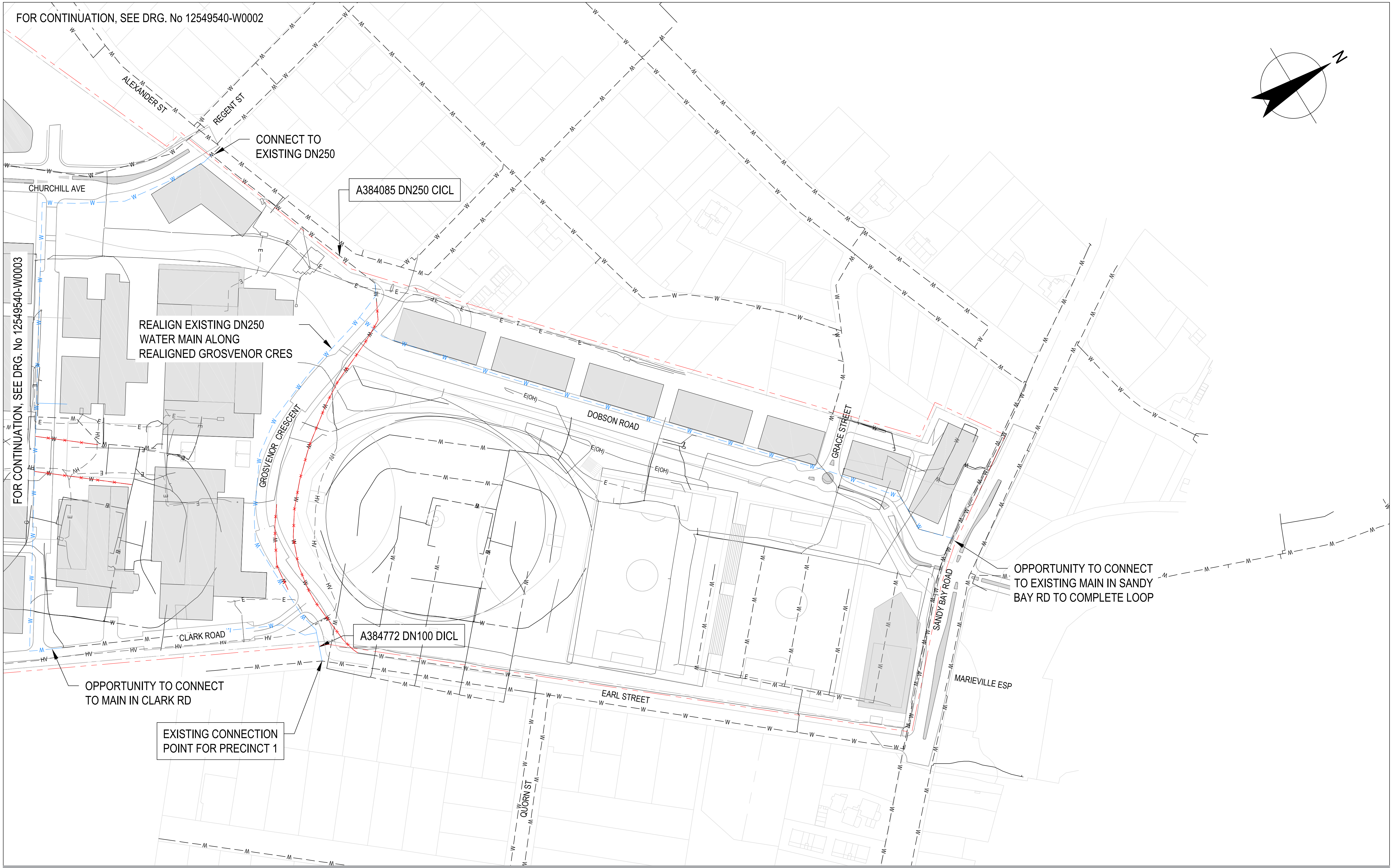

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Drawing Title EXISTING WATER SERVICES
GENERAL ARRANGEMENT
SHEET 3 OF 4

Size A3

Drawing No. 12549540-W0004

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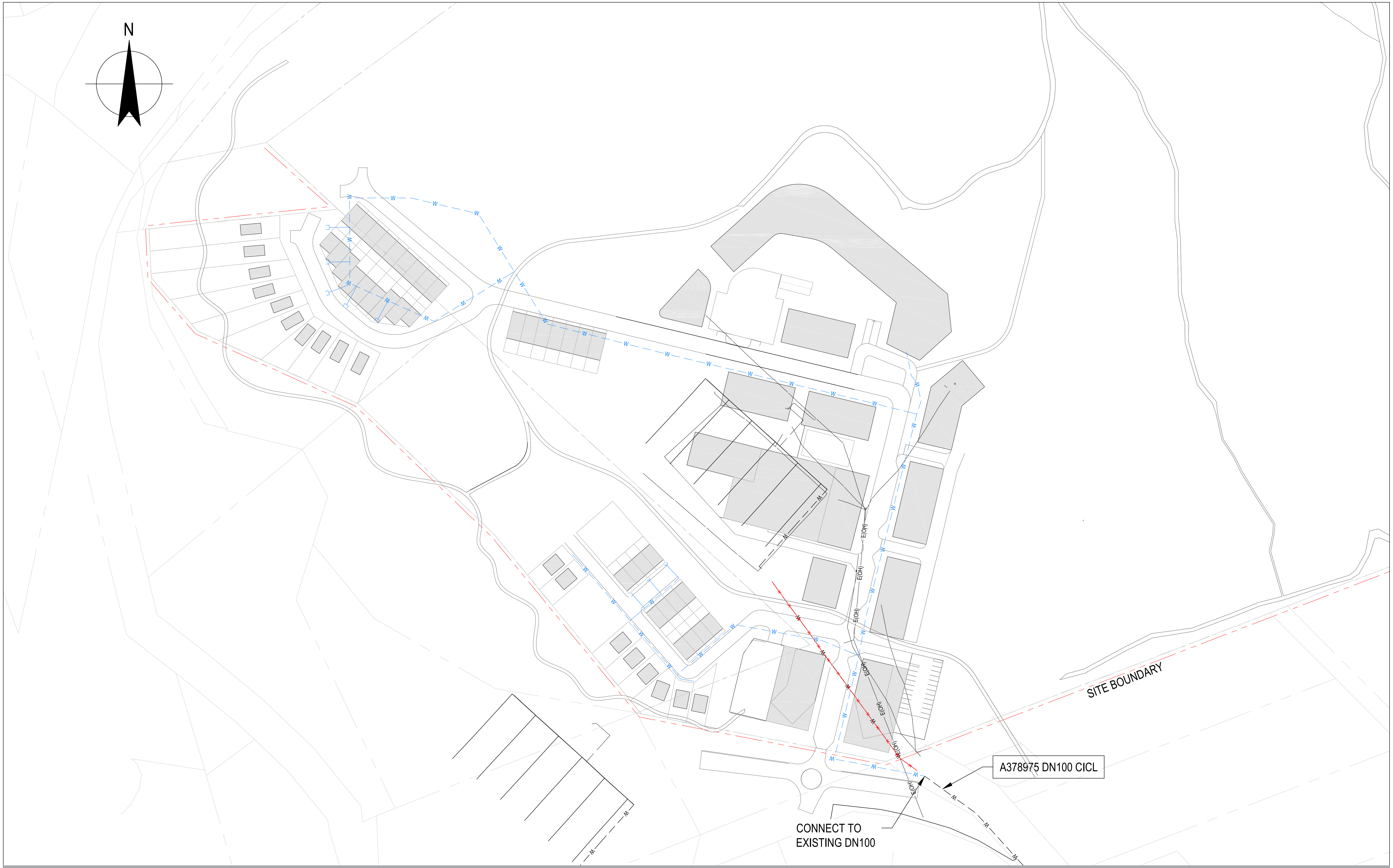

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Drawing Title EXISTING WATER SERVICES
GENERAL ARRANGEMENT
SHEET 4 OF 4

Size A3

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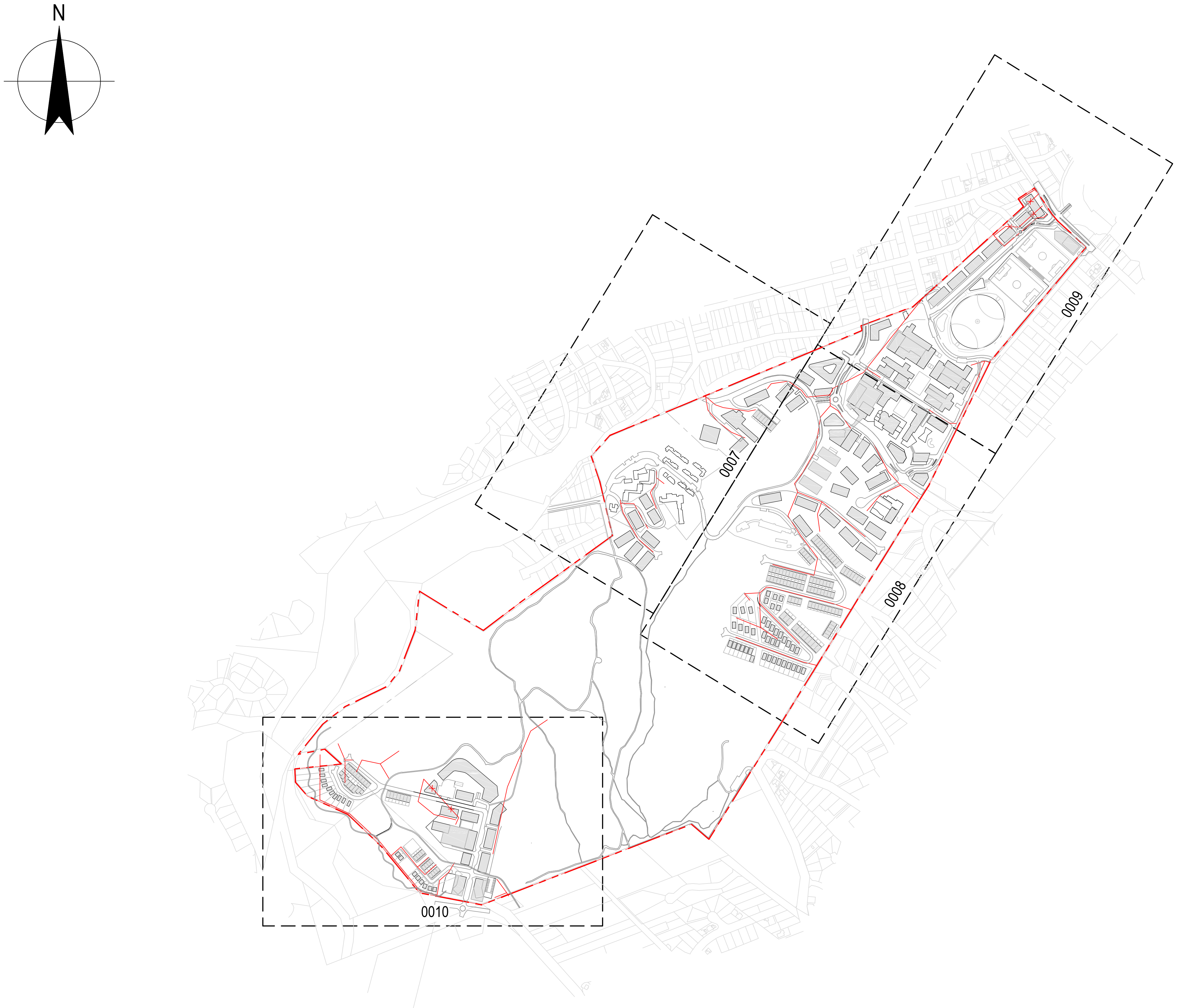

SERVICES LEGEND

PROPOSED

——S———S———S——	PROPOSED SEWER
×—S×——×——S——×——×	EXISTING SEWER TO BE MADE REDUNDANT

EXISTING

——S— — —S— — —	EXISTING SEWER
——RM— — —RM— — —	EXISTING SEWER RISING MAIN

Rev	Description	Checked	Approved	Date
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KEY PLAN

Size A3

Drawing No. 12549540-W0006

Rev A

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Designer **Design Check**

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Client UNIVERSITY OF TASMANIA

Project SANDY BAY CAMPUS REDEVELOPMENT

Status

Status Code

Drawing Title EXISTING SEWER SERVICES
GENERAL ARRANGEMENT
SHEET 1 OF 4

Size A3

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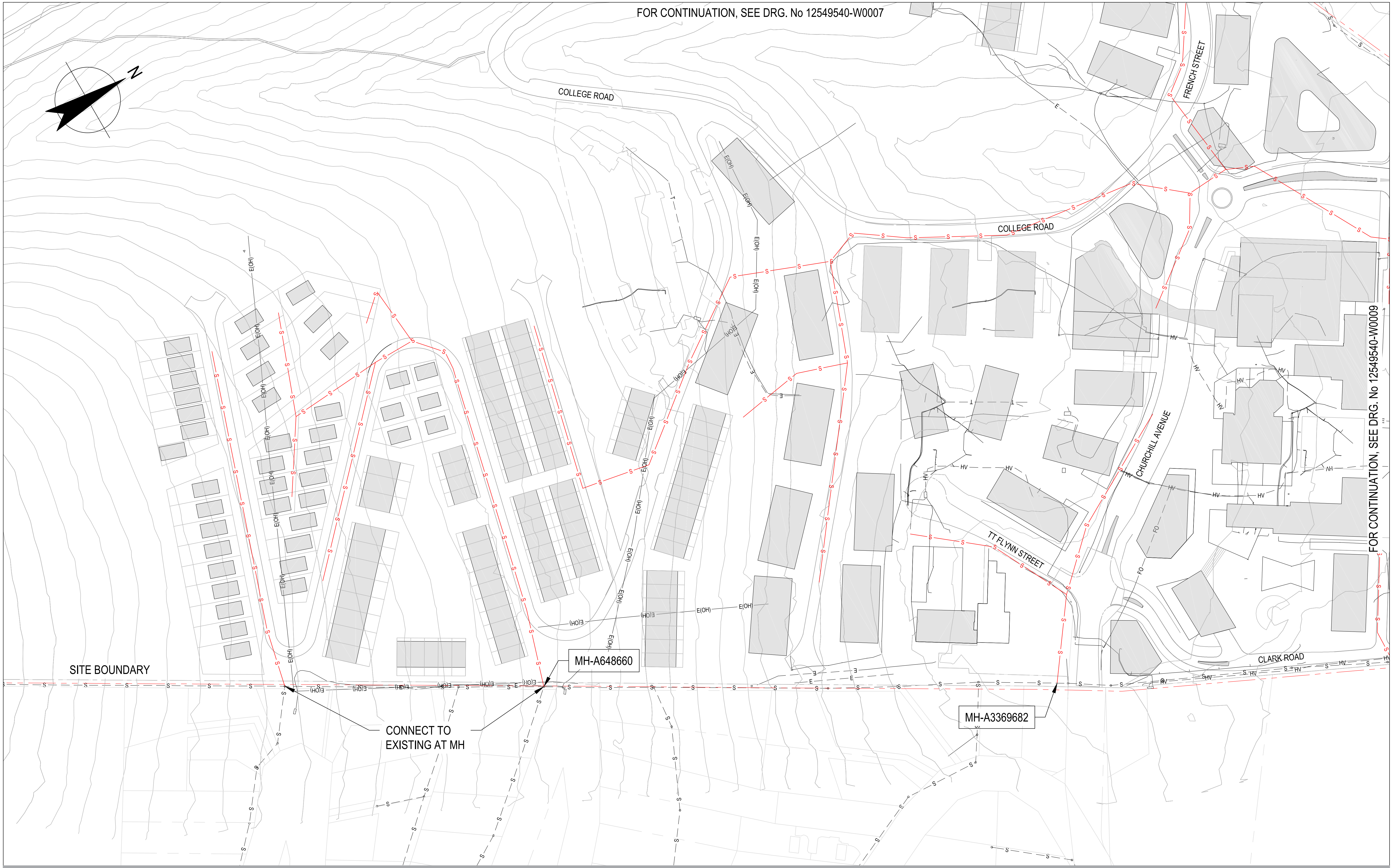

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Project No. 12549540

Client UNIVERSITY OF TASMANIA

Project SANDY BAY CAMPUS REDEVELOPMENT

Status

Status Code

Drawing Title EXISTING SEWER SERVICES
GENERAL ARRANGEMENT
SHEET 2 OF 4

Size A3

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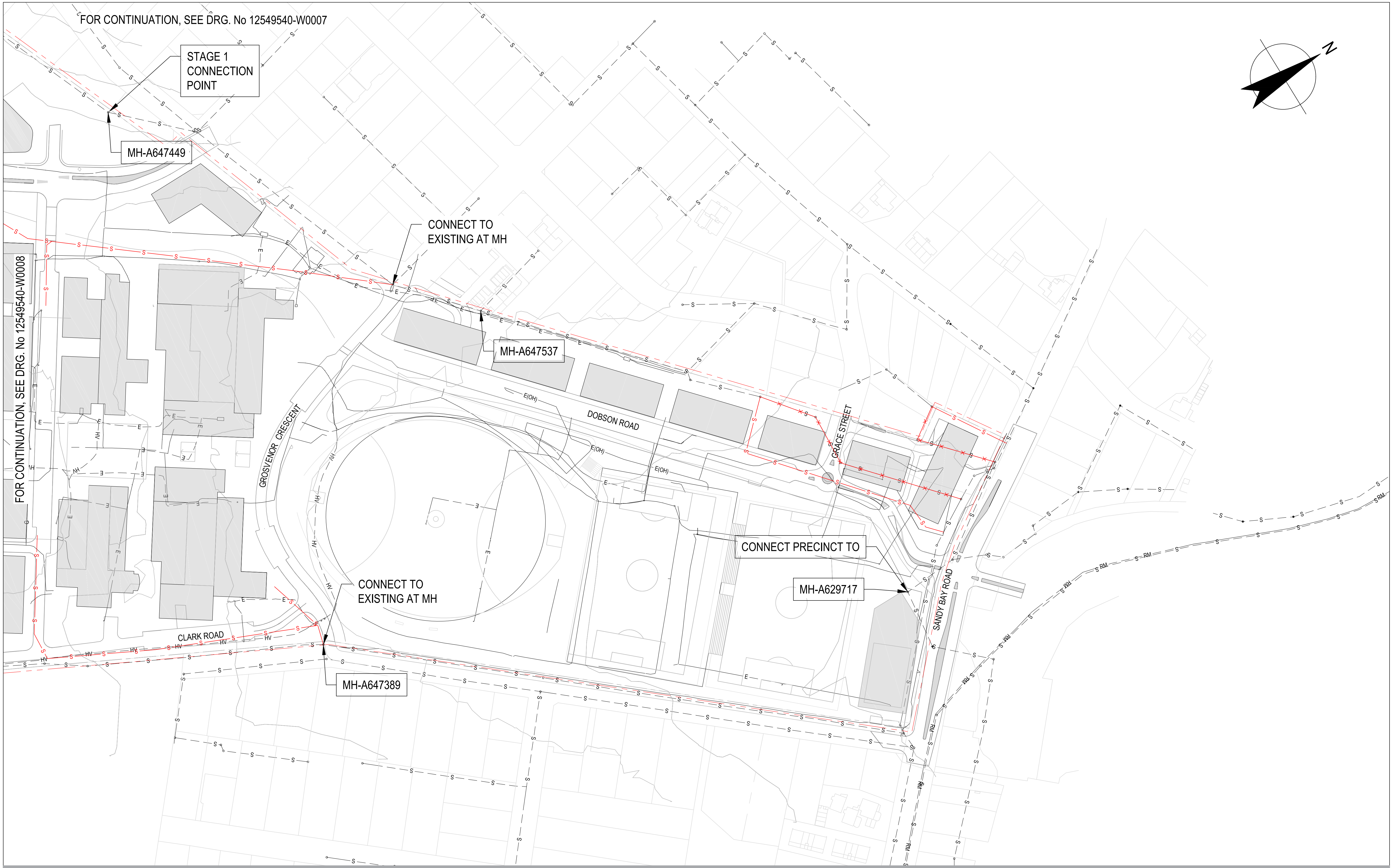

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SHEET 3 OF 4

Size A3

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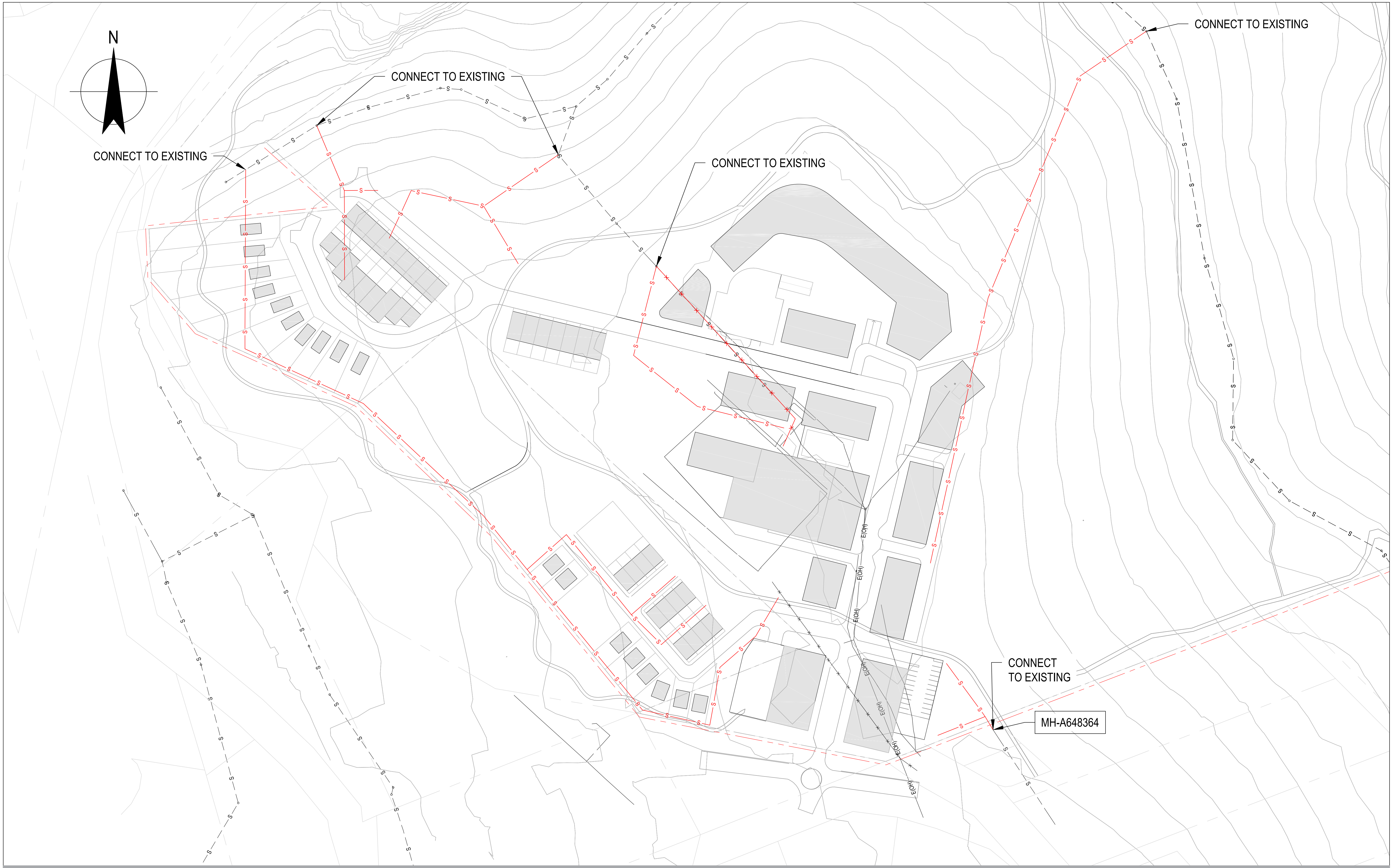

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SHEET 4 OF 4

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Drawing No. 12549540-W0010

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File Name: G:\32\12549540\CADD\Drawings\12549540-W0010.dwg

NOTES:

1. EXISTING STORMWATER INFRASTRUCTURE TO BE RETAINED AND UPGRADED IN AREAS WHERE ROADS AND/OR BUILDINGS RETAINED(NOT SHOWN)
2. STORMWATER TREATMENT TO BE INCLUDED IN STREETSCAPE WHERE PRACTICAL (NOT SHOWN)
3. DISCHARGES TO CREEKS AND NATURAL DRAINAGE PATHS TO BE TREATED PRIOR TO DISCHARGE. NUMBER OF DISCHARGES TO BE MINIMISED.
4. ONSITE DETENTION TO BE PROVIDED PRIOR TO DISCHARGE TO SYSTEM WITHOUT SUFFICIENT CAPACITY TO CONVEY ADDITIONAL FLOWS INCLUDING UPPER REACH OF PROCTORS CREEK AND FILE RANGE CREEK (NOT SHOWN)
5. SITE STORMWATER DETENTION TO BE PROVIDED AT OVAL ABOVE GROUND. OPTION TO UNDERGROUND DETENTION AT SAME LOCATION IF DESIRED.
6. SITE STORMWATER DISCHARGE TO MEET STATE STORMWATER STRATEGY TREATMENT TARGETS 80% TSS. 45% TP, 45% TN AT ALL STAGES OF DEVELOPMENT WHERE IMPERVIOUS AREA IS INCREASED.

SERVICES LEGEND

PROPOSED

—— SW —— SW ——	PROPOSED STORMWATER MAIN
—SW✕— ✕ —SW✕— ✕	EXISTING SW TO BE MADE REDUNDANT
→ → → → —	PROPOSED OVERLAND FLOW PATH

EXISTING

→ → → → —	EXISTING CREEK
— SW — — SW — —	EXISTING STORMWATER

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KEY PLAN

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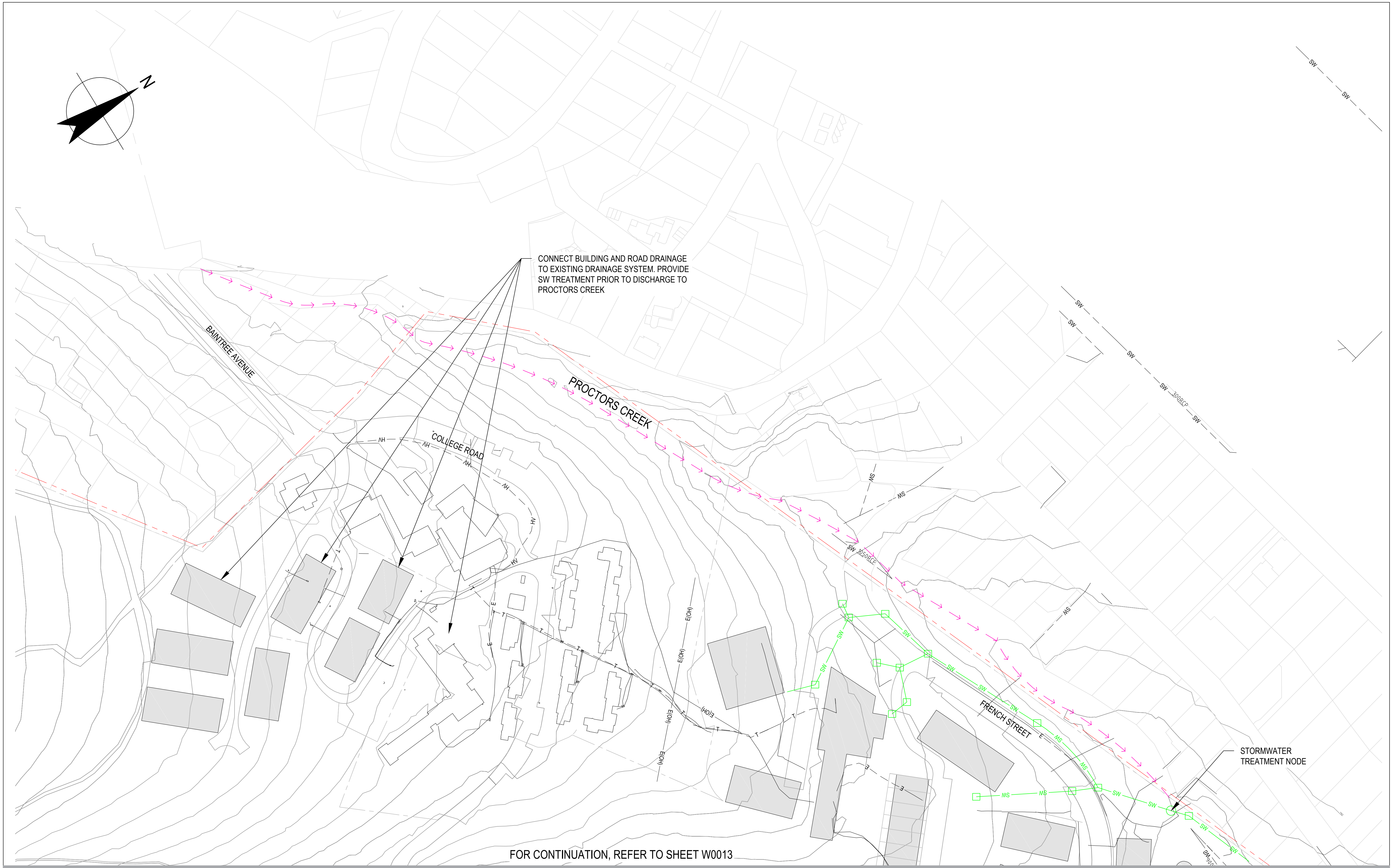

CONNECT BUILDING AND ROAD DRAINAGE TO EXISTING DRAINAGE SYSTEM. PROVIDE SW TREATMENT PRIOR TO DISCHARGE TO PROCTORS CREEK

STORMWATER TREATMENT NODE

FOR CONTINUATION, REFER TO SHEET W0013

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Drawing Title EXISTING STORMWATER SERVICE
GENERAL ARRANGEMENT
SHEET 1 OF 4

Size **A3**

Drawing No. 12549540-W0012

Rev A

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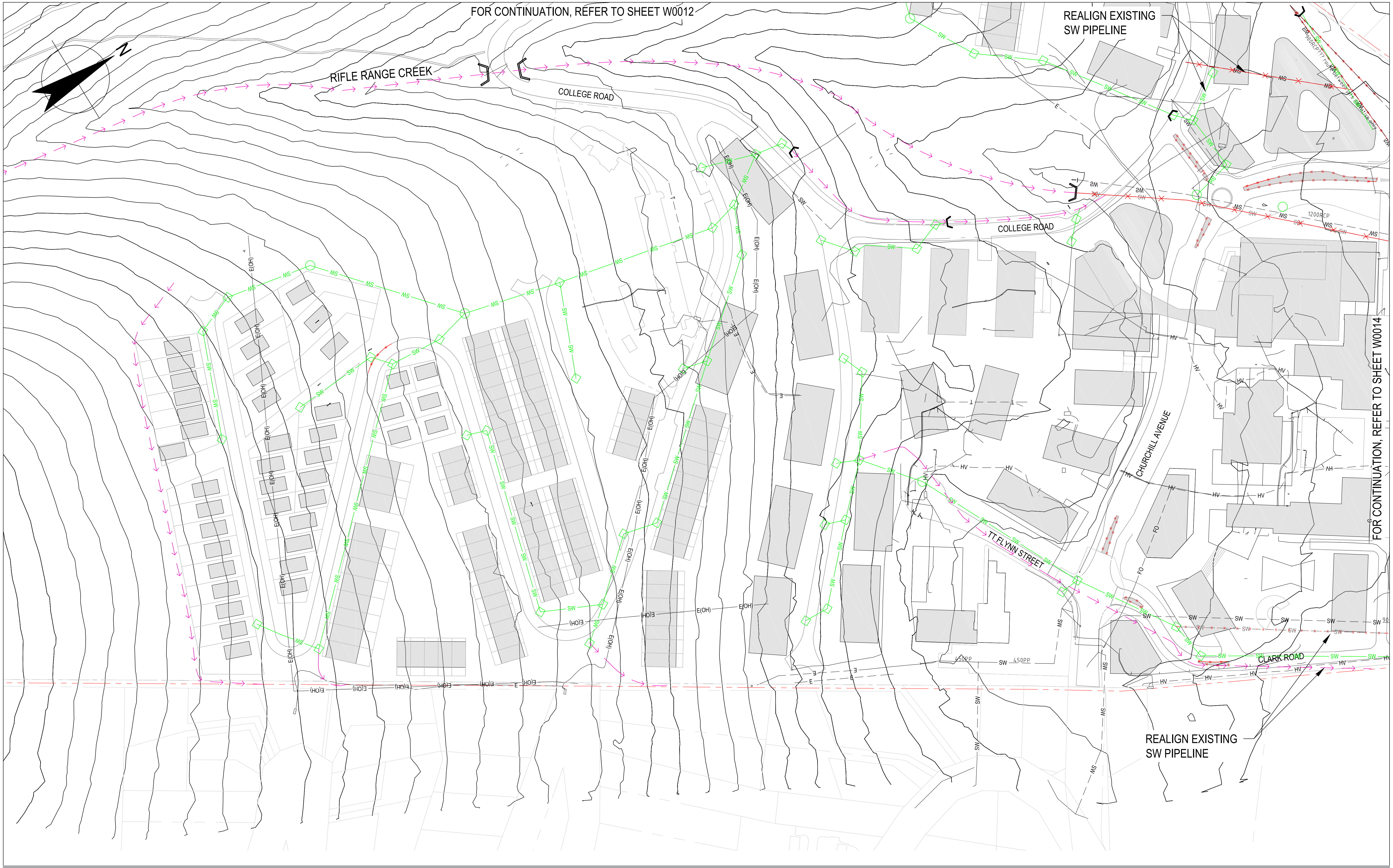

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Drawing Title EXISTING STORMWATER SERVICE
GENERAL ARRANGEMENT
SHEET 2 OF 4

Size **A3**

Drawing No. 12549540-W0013

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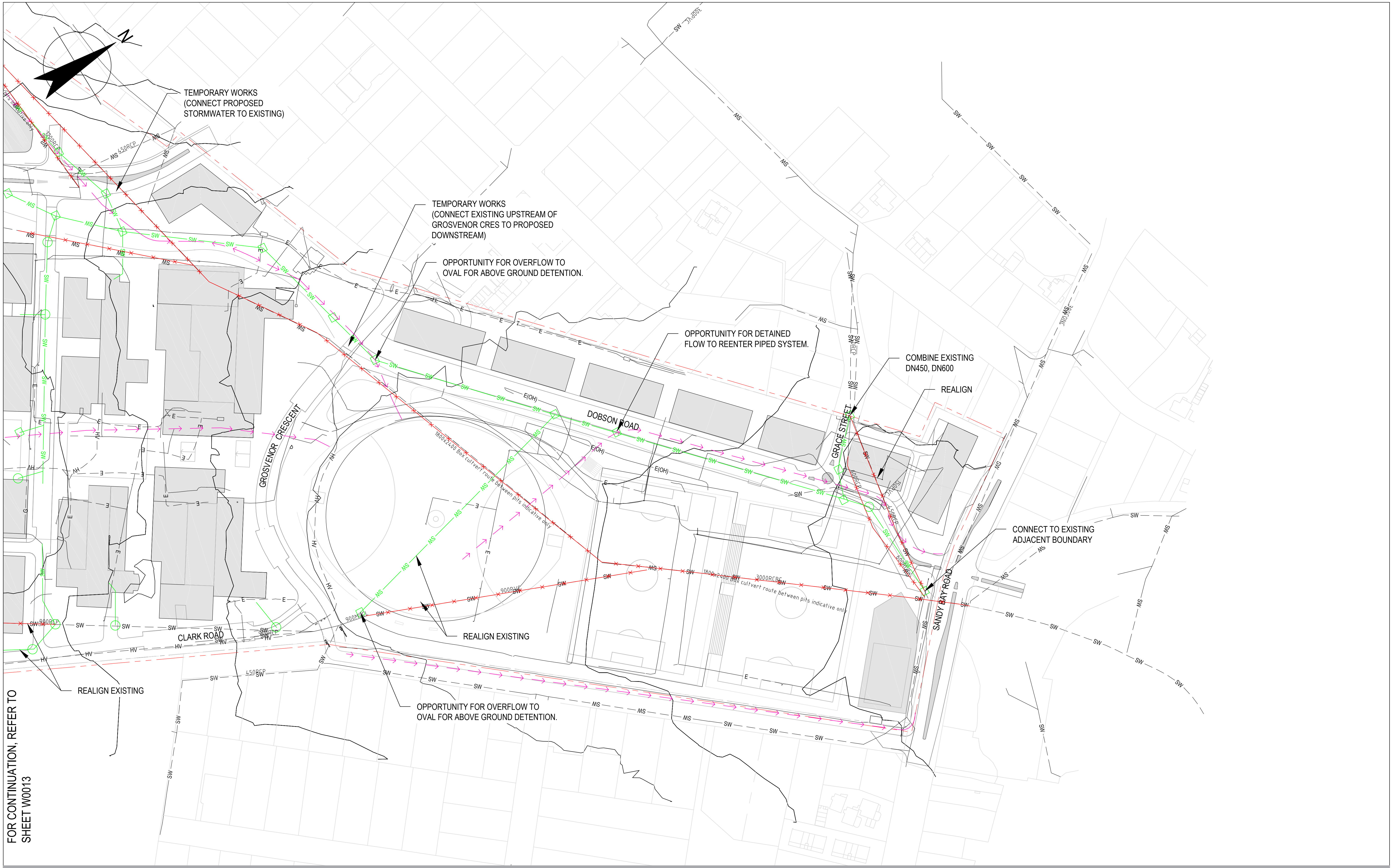

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SHEET 3 OF 4

Size A3

Drawing No. 12549540-W0014

Rev A

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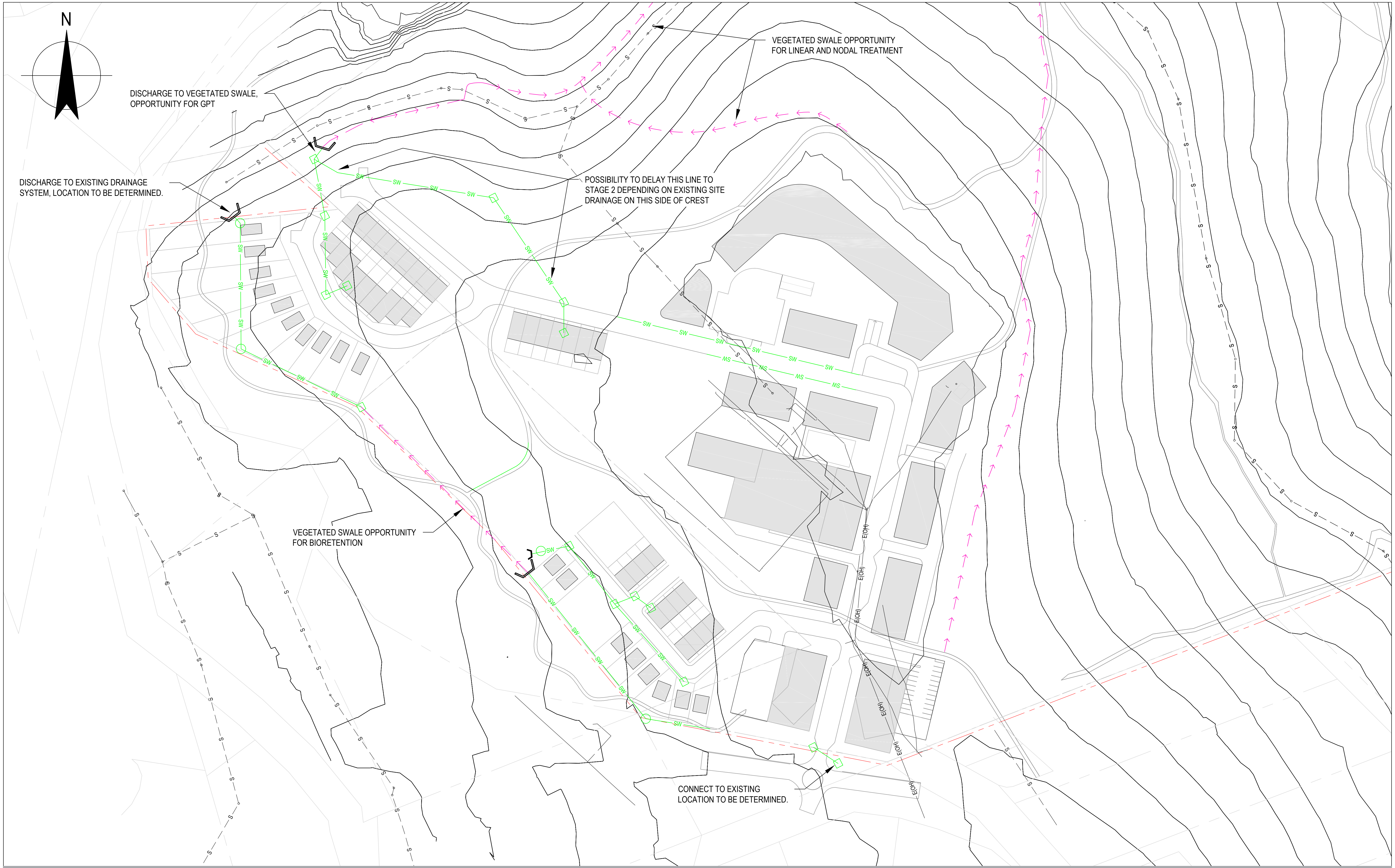

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Drawing Title
EXISTING STORMWATER SERVICE
GENERAL ARRANGEMENT
SHEET 4 OF 4

Size **A3**

Drawing No. 12549540-W0015

Rev A

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Appendix C

Water Supply Boundary Head

Table C.1 Total boundary heads (not pressures) for Peak Day & Peak Day plus Fire Flow at the nominated connection points

Precinct	Connection Pipe	Connection Point	Total Head - Peak Day (m)	Nominated Fire Flow (L/s)	Total Head - Peak Day + Fire Flow (m)
1	A384744	Near property connection A384742	128	20	123
1	A384085	At the end of Grosvenor Street	130	20	129
2	A384085	Near fire hydrant A382894	130	20	132
2	A384911	Near fire hydrant A382829	126	20	130
3	A384911	Near fire hydrant A382829	126	10	132
3	A385763	End of the pipe	212	10	197
4	A381687	Southern end of the pipe	220	10	228
5	A381687	Near fire hydrant A379090	225	10	232
5	A384911	At corner of French/Alexander streets	131	10	133
6	A378975	End of the pipe	346	20	321

The above total boundary heads are in the water mains themselves at the proposed connection points and do not include losses through the actual connections or associated pipework.

In some cases the total boundary head under fire flow is greater than that at Peak Hour. The reason for this is that fire flow is applied at 2/3 Peak Hour, as per Table 3.1.5 of the TasWater Supplement. In a large zone the total demand at 2/3 Peak Hour, even with fire flow applied, may be less than the zone demand at Peak Hour.

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REPORTING TO INFORM THE MASTERPLAN DESIGN

Environmental Site Assessment

GES

ENVIRONMENTAL SITE ASSESSMENT
UTAS SANDY BAYMASTER PLAN
September 2021

Report for ClarkeHopkinsClarke Architects on behalf of UTAS Properties Pty Ltd

Geo-Environmental Solutions P/L 29 Kirksway Place, Battery Point, 7004. Ph 6223 1839 E: Office@geosolutions.net.au

DOCUMENT CONTROL

Title	Version	Date	Author	Reviewed By
Environmental Site Assessment: UTAS Campus, Sandy Bay	Version 1	15 September 2021	M Downie	JP Cumming
Environmental Site Assessment: UTAS Campus, Sandy Bay	Version 2	22 September 2021	M Downie	JP Cumming
Environmental Site Assessment: UTAS Campus, Sandy Bay	Version 3	24 September 2021	M Downie	JP Cumming
Environmental Site Assessment: UTAS Campus, Sandy Bay	Version 4	3 December 2021	M Downie	JP Cumming

EXECUTIVE SUMMARY

This report presents the findings of an Environmental Site Assessment (ESA) undertaken by Geo-Environmental Solutions Pty. Ltd. (GES) at the UTAS Sandy BaySite at 2 Churchill Avenue, Sandy Bay, Tasmania - hereby referred to as 'The Site'. GES was commissioned by ClarkeHopkinsClarke Architects on behalf of UTAS Properties Pty Ltd to conduct the assessment as part of the master planning process for potential redevelopment of the Site. This ESA has been prepared by a suitably qualified and experience practitioner in accordance with procedures and practices detailed in National Environmental Protection Measure [Assessment of Site Contamination] (NEPM ASC; 2013).

The objective of the ESA was to conduct a field investigation to determine the current Site conditions and confirm the suitability of the Site for potential redevelopment. Given the size of the Site, a detailed Preliminary Site Assessment (PSI) was completed by GES in 2019 (GES 2019) to identify potentially contaminating activities and contaminants of potential concern.

The following key information was gathered during the PSI (GES 2019):

- The Site is zoned *Particular Purpose and Environmental Management* under the Hobart City Council *Interim Planning Scheme 2015* and is owned by the University of Tasmania.
- The geology of the Site is underlaid with Quaternary and Tertiary aged deposits on the lower elevations of the Site with significant fill deposits present in the current sports fields. The upper slopes of the Site are dominated by Jurassic dolerite with associated shallow clay soils. Extensive fill deposits are present under the sprots fields at Olinda Grove comprising of rock material excavated for construction of the nearby highway.
- There are a total of 2 registered bores located within 500m of the investigation area according to Mineral Resources Tasmania (MRT). One bore has been either capped or abandoned, and the second not in use for many years. Therefore, the possibility of residents accessing groundwater has been ruled out.
- Groundwater is inferred to be travelling in a easterly direction. The closest ecological receptor is the River Derwent; approximately 100m from the Site.
- The Site walkover confirmed that the Site is free from any commercial or industrial activities that involve significant sources of contamination such as bulk fuel storage and dispensing, manufacturing, automotive repairs & maintenance, or other industrial processes.
- Dangerous good were stored on the Site in a limited number of storage facilities around the Site, and fuel had been historically stored in a number of underground tanks on Site, all of which have long been decommissioned.
- Historical records showed the Site formerly hosted a rifle range with that was decommissioned prior to construction of Churchill Avenue and much of the nearby civil and residential infrastructure. Records indicate significant bulk earthworks took place after decommissioning of the Site, but there is some potential for residential heavy metal contamination from the range.
- It was concluded that there is likely to be localised contamination across the Site, but the Site has not hosted historical industrial activities and is unlikely to have extensive soil or groundwater contamination.

From the current (2021) soil assessment the following is concluded:

- <u>Environment:</u> There was Benzo(a)pyrene and heavy metals detected in a small number of samples in Precinct 1,3 & 5. There were a small number guideline exceedances and a possible risk to ecological receptors identified in the shallow soil assessment.
- <u>Human Health:</u> There were no human health guideline exceedances for dermal contact compared with CRC CARE 2011 HSL guideline limits, no human health guideline exceedances compared with NEPM 2013 HIL guideline limits for dust inhalation or ingestion.
- <u>Human Health:</u> There was a single human health guideline exceedance for shallow soil impacted with hydrocarbons in Precinct 3 for residential indoor vapour intrusion compared with CRC CARE HSL guideline limits.
- <u>Human Health:</u> There were a small number of human health guideline exceedances for shallow soil impacted with Benzo(a)pyrene in Precinct 1 when compared with NEPM 2013 HIL guideline limits for dust inhalation or ingestion.

- Excavated Soil Management: In terms of *IB105*, a small number of soil samples tested from Precinct 1, 3 & 5, are Level 2 and Level 3 Material, and classified as low-Level contaminated soil. It must be noted some of the heavy metal contaminants identified (manganese & chromium) are known to be naturally occurring in the local area such that further background profiling and assessment is recommended prior to any bulk earthworks.

From the current groundwater assessment, it is concluded that:

- Environment: There were Fresh Water and Marine Water guideline exceedances for Benzo(a)pyrene and copper in Precinct 1. A potential risk to the environment has been identified if groundwater is not managed during deep excavations or any dewatering/recovery operations.
- Human Health – There we were no human health guideline exceedances in the groundwater

GES recommends the following:

Soil impacted with contaminants in concentrations exceeding the applicable health and environmental guidelines was identified in small number of samples on the Site. The results indicate that soil contamination is likely to be localised to the identified areas of concern on the Site.

Further investigations must be undertaken in the areas of potential concern prior to any detailed design and planning for construction. The current information and any future investigation results must be evaluated to prepare the following management measures:

- Specific Soil and Water Management Plans (SWMP) will be required for the various Precincts and/or building areas to control the movement and erosion of soil from the Site that could impact ecological receptors.
- Specific Construction Environmental Management Plans (CEMP) will be required for the various Precincts and/or building areas to ensure health and safety values are maintained.
- Specific assessment of materials identified as potentially contaminated soil according to EPA IB105 must be undertaken with refence to local background Levels and possible reuse on Site.

Limited groundwater contamination was identified. To minimise the risk to future Site commercial workers during possible redevelopment, plus future trench works and ecological receptors, the following mitigation measures should be put in place as a minimum:

- Current groundwater monitoring bores should be maintained and standing water Levels and contaminant concentrations monitored prior to any detailed design and development on the Site.
- Any deep excavation and dewatering works as part of future redevelopment in Precinct 1 must have a specific groundwater management plan including disposal approvals.

The current Environmental Site Assessment has identified localised soil contamination over a limited area of the Site. The assessment has also identified contaminated groundwater is underlying the lower areas of the Site. Provided the recommendations and protection measures are implemented from this report including but not limited to further specific investigations and implementation of management plans then GES is satisfied that future redevelopment on the Site will not adversely impact on human health or the environment.

This report has been commissioned by ClarkeHopkinsClarke Architects Pty Ltd, on behalf of UTAS Properties Pty Ltd (UPPL) to perform an Environmental Site Assessment (ESA) pertaining to and in support of the development of the UTAS Sandy BayMasterplan for the purpose of a Planning Scheme Amendment or as otherwise set out in this report. This report may only be used and relied on by ClarkeHopkinsClarke Architects Pty Ltd and UTAS Properties Pty Ltd (UPPL) for this purpose or as otherwise set out in this report.

Table of Contents

Figures

Tables

ABREVIATIONS

AEC	Areas of Environmental Concern
AHD	Australian Height Datum
ALS	Analytical Laboratory Services
ANZECC	Australia and New Zealand Environment and Conservation Council
BGS	Below Ground Surface
BH	Borehole
BTEXN	Benzene Toluene Ethylbenzene Xylene Naphthalene
COA	Certificate of Analysis
COC	Chain of Custody
COPC	Contaminant of Potential Concern
CRC CARE	Corporative Research Centre for Contamination Assessment and Remediation of the Environment
CSM	Conceptual Site Model
DQO	Data Quality Objectives
EOH	End Of Hole
EIL	Ecological Investigation Levels
ESL	Ecological Screening Levels
EPA	Environmental Protection Authority
ESA	Environmental Site Assessment
GDA94	Geocentric Datum of Australia 1994
GES	Geo-Environmental Solutions Pty. Ltd.
HIL	Health Investigation Levels
HSL	Health Screening Levels
IL	Investigation Levels
LOR	Limits of Reporting
MDL	Mean Detection Limit
MRT	Mineral Resources Tasmania
NATA	National Association of Testing Authorities
NEPM ASC	National Environmental Protection (Assessment of Site Contamination) Measure
NHMRC	National Health and Medical Research Council
NL	Non Limiting
NRMMC	Natural Resource Management Ministerial Council
PAH	Polynuclear Aromatic Hydrocarbons
PCP	Physico-Chemical Parameters
PFAS	Perfluoroalkyl and Polyfluoroalkyl Substances
PHC	Petroleum Hydrocarbons
PID	Photo-Ionisation Detector
PPA	Preferential (PVI) Pathways Assessment
PVI	Petroleum Vapour Intrusion
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
USCS	Unified Soil Classification System

1 INTRODUCTION

1.1 General

This report presents the findings of a Environmental Site Assessment (ESA) undertaken by Geo-Environmental Solutions Pty. Ltd. (GES) at the UTAS Site at 2 Churchill Avenue, Sandy Bay, Tasmania - hereby referred to as 'The Site'. GES was commissioned by ClarkeHopkinsClarke Architects on behalf of UTAS Properties Pty Ltd to conduct the ESA as part of the master planning process for possible Site redevelopment. The Site location is presented in Figure 1 and the aerial photograph with the current layout is presented in Figure 2.

This ESA has been prepared by a suitably qualified and experience practitioner in accordance with procedures and practices detailed in National Environmental Protection Measure [Assessment of Site Contamination] (NEPM ASC; 2013) guidelines and key regulations and policies identified in the References section of this document. Personnel engaged in preparing this PSI are listed in Appendix 1 along with their relevant qualifications and years of experience.

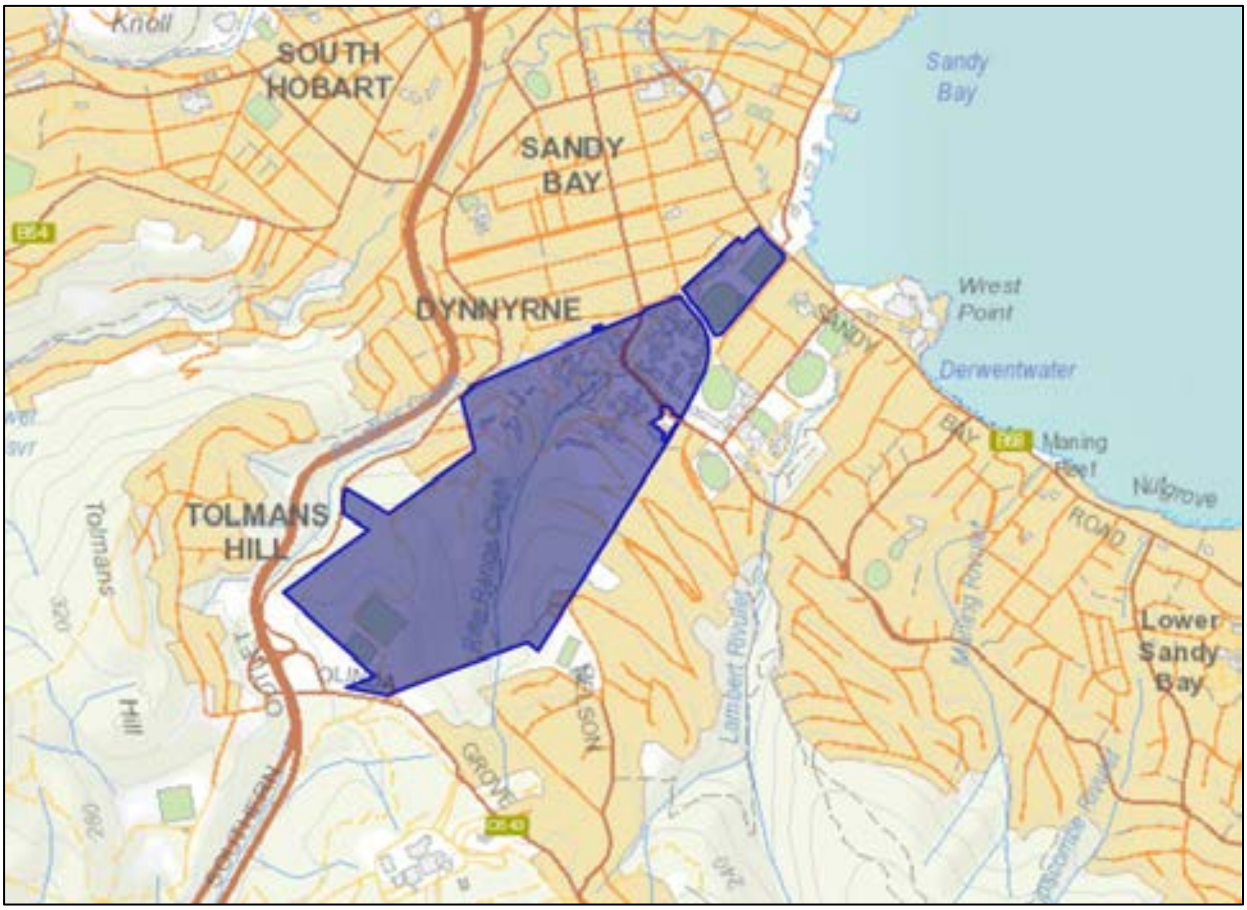


Figure 1 Site Location (Image C/O the LIST)

Figure 2 Existing Site Layout

1.2 Objectives

The objective of the ESA was to provide a preliminary assessment of the Site and assess the results against the Tasmanian Interim Planning Scheme criteria for a *Change of Use* and *Excavation Works* by assessing the actual contamination Levels at the Site and determine:

- Whether the Site is suitable for the proposed use/development;
- Whether any Site contamination presents an occupational health and safety risk to workers involved in redevelopment of the Site or future Site users;
- Whether any Site contamination is likely to present an environmental risk from excavation conducted during development at the Site; and
- Whether any specific remediation and/or protection measures are required to be implemented before use or excavation commences.

1.3 Scope of Works

The scope of works of this ESA was to:

- Review the Preliminary Site Investigation (GES 2019) and use this guide for the invasive soil investigation across the entire Site;
- Collect soil samples for laboratory analysis from geotechnical holes and further targeted soil bores across the Site, and report on the findings;

- Soil samples were tested for Total Recoverable Hydrocarbons (TRH), Benzene Toluene Ethylbenzene Xylene Naphthalene (BTEXN), Polynuclear Aromatic Hydrocarbons (PAHs), a suite of 15 Metals, OC/OP pesticides, VOC's, and Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) where deemed appropriate;
- All soil samples were sent to a National Association of Testing Authorities (NATA) accredited laboratory to determine the presence/ absence of contamination and at what Level;
- All samples were sent with quality assurance/quality control samples for analysis;
- All analytical results against were compared against NEPM ASC (2013) guidelines as well as other relevant guidelines for assessing hydrocarbon vapour and soil dermal contact risks; and
- Present the findings of the Site investigation, conduct a risk assessment and develop a conceptual Site model (CSM) plus present future contamination management recommendations.

1.4 Investigation Areas

The Site has been divided into five precincts for the master planning exercise; see the designated areas in **Figure** 3. For the current University of Tasmania's Site plan see Figure 4.

Precinct 1 – Lower Site adjacent to Sandy Bay Road

Area currently supporting the tennis courts and rugby oval with associated car parking, sport and recreation, Surveying and Law buildings plus a small number of office buildings close to Sandy Bay Road.

Precinct 2 – Mid Site building area

Main area of existing buildings on campus between Grosvenor Crescent and Churchill Avenue, including the university Library, theatre, Arts, Chemistry, Engineering, Mathematics buildings among others.

Precinct 3 – Upper Site (East of Rifle Range Creek)

This area of the campus extends from Churchill Avenue up the hill encompassing the Life Sciences buildings, Old Medicine Building, and the Horticultural Research Centre on the upper slopes close to bend 5 on Mt Nelson Road.

Precinct 4 – Upper Site (West of Rifle Range Creek)

This area of the campus extends from The Student Union Buildings up the hill encompassing the Old Hytten Hall and Commerce buildings, and the student accommodation buildings on the upper slopes on College Road.

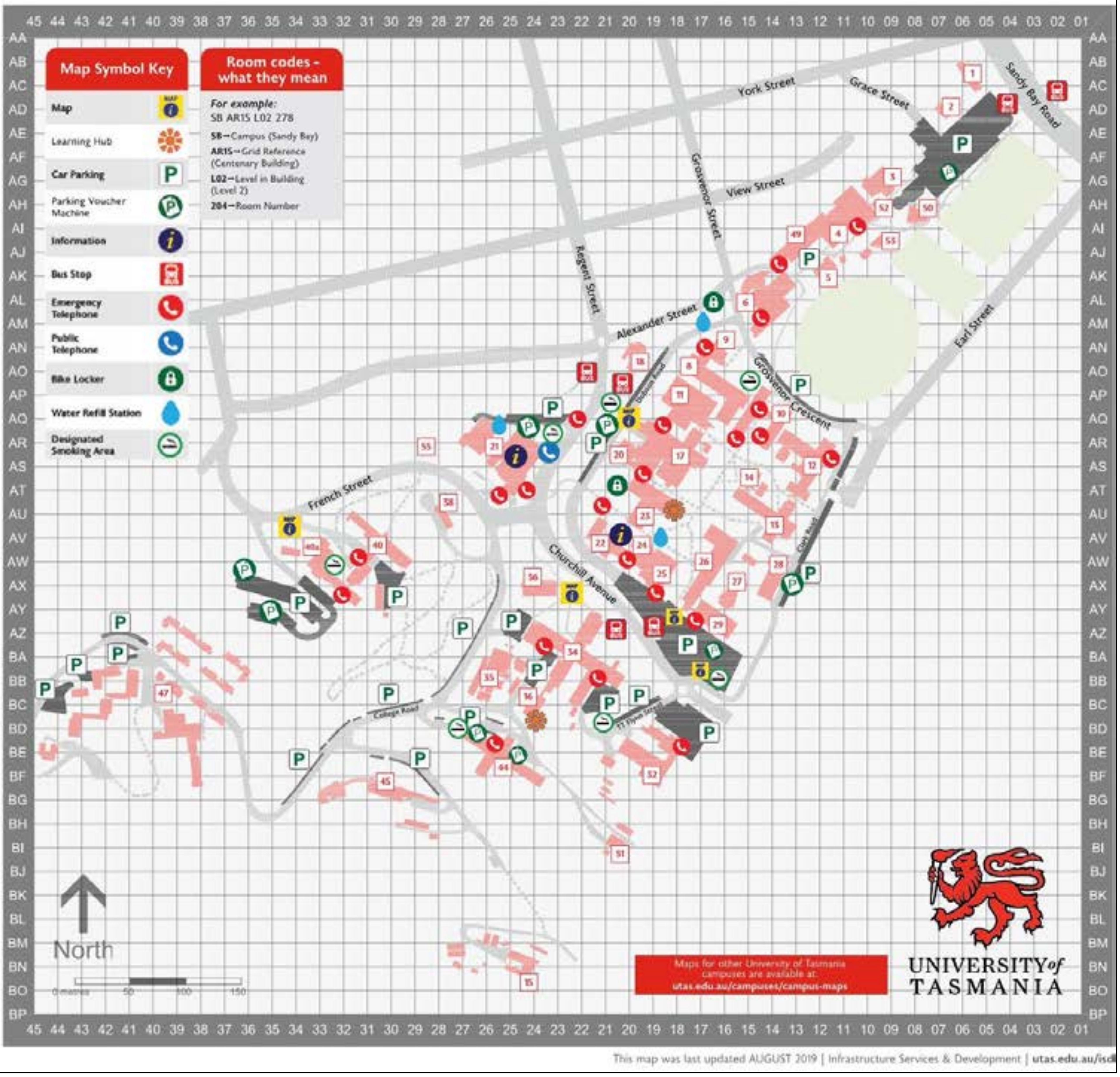
Precinct 5 – Olinda Grove area

This area of the campus is located on the very upper portion of the Site, and includes the existing University Soccer fields, storage and maintenance buildings.

Figure 3 Investigation Areas

Sandy Bay Campus

	Grid Ref.	No.
301 Sandy Bay Road	AC06	1
6 Grace Street	AD07	2
Accommodation Services	BB39	47
Administration Building	AW21	22
Agricultural Science	BA22	34
Arts Lecture Theatre	AX16	27
Centenary Building	AR15	10
Central Science Laboratory	AR19	17
Chemistry	AR19	17
Child Care Centre (Lady Gowrie)	AG10	3
Child Care Cottage	AJ10	53
Christ College	BB39	47
Classics Museum, John Elliott	AX19	25
CODES - Centre for Ore Deposit and Earth Sciences	AS13	12
Co-op Bookshop	AS25	21
Community Health Clinic	AH10	52
Computing and Information Technology	AR15	10
Corporate Services Building	BE20	32
Cricket Pavilion	AK12	5
CSIRO	BF31	45
Earth Sciences	AS13	12
Education	AW31	40
Engineering	AP16	8
Engineering Workshop	AQ18	11
English Language Centre	AW31	40
Financial Services	BE20	32
Geography and Environment	AS13	12
Graduate Research Office	AC06	1
Herbarium, Tasmanian	AX24	36
Horticultural Research Centre	BN25	15
Human Resources	BE20	32
Humanities	AZ16	29
Hytten Hall	AW31	40
Information Technology Services (ITS)	BE20	32
John Fisher College	BB39	47
Law	AL14	6
Lazenby's Cafe	AX19	25
Library, Morris Miller	AU19	23
Life Sciences Building	BA22	34
Life Sciences Glasshouse	BB26	35
Mathematics	AT15	14
National Tertiary Education Union (Tas. Div.)	AS25	21
Newsagency and post office	AS25	21
Office of Research Services	AC06	1
Old Commerce Building	AX33	40a
Old IMAS Building **University College & Surveying and Spatial Sciences**	AT13	49
Old Medical Sciences Building	BE26	44
Pharmacy	AR20	20
Physics	AU14	13
Plant Science	BA22	34
Psychology	AX17	26
Psychology Research Centre	AX14	28
Refectory (The Ref)	AS25	21
Research House	AU28	38
Research Office	AC06	1
Riawunna	AX17	26
Rugby Club	AI08	50
Sciences and Engineering, College of	AR15	10
Security	AD07	2
Social Sciences	AX17	26
Source Wholefoods	AR29	55
Steps Building	BI21	51
Student Administration	AU19	23
Tasmanian Institute of Agriculture (TIA)	BC24	16
Tasmanian Institute of Learning and Teaching (TILT)	AS25	21
Tasmanian School of Business and Economics (TSBE)	AR15	10
Tasmania University Union (TUU)	AS25	21
Trade Table Cafe	AR15	10
TUU Building	AS25	21
Unigym	AI11	4
University Apartments	BB39	47
University Centre	AX19	25
University Club	AO20	18
University Foundation	AO20	18
Zoology	BA22	34



Room codes - what they mean

For example:
SB AR15 L02 278
SB→Campus (Sandy Bay)
AR15→Grid Reference (Centenary Building)
L02→Level in Building (Level 2)
204→Room Number

Maps for other University of Tasmania campuses are available at:
utas.edu.au/campuses/campus-maps

This map was last updated AUGUST 2019 | Infrastructure Services & Development | **utas.edu.au/isd**

Figure 4 Campus Plan

2 SITE SETTING

2.1 Site Identification

Site details are presented in Table 1.

Table 1 Site Details

SITE LOCATION: UTAS Sandy Bay- 2 Churchill Avenue, Sandy Bay Tasmania.
INVESTIGATION AREA The entire title.
SITE ELEVATION Approximately 5-255 m AHD
SITE SURFACING The Site is a University that includes Classrooms, lecture theatres, Library's, laboratories, glass houses, agricultural plots, sports grounds and a large area of bushland on the southern half of the Site. Surfaces at the Site range from natural bushland and garden beds, to sports oval surfaces, concrete and asphalt Road and walkways plus concrete building footprints
TITLE REFERENCES The title references: CT 176312/1, 119071/1, 119071/2
SITE OWNER University Of Tasmania
PREVIOUS LANDUSE From the 1940's the Site has housed the University of Tasmania prior to that it hosted a Rifle Range.
SITE SURROUNDING LAND ZONING *Tasmanian Interim Planning Scheme 2015 – Inner Residential, General Residential, Low Density Residential, Rural Living, Environmental Management, Utilities and Recreation*
SITE LAND USE AND ZONING University Campus and associated grounds; zoned 'Particular Purpose'
PROPOSED LAND USE Unknown

3 SITE SUMMARY

3.1 Site Walkover

A Site visit was completed as part of the PSI (GES 2019). Over two hundred Site photographs were taken, of areas of interest and the information complied to present areas of potential concern for the investigation works. The Site walk over reveals a well-developed Site with numerous large education buildings, associated dangerous goods and chemical storage, a number of decommissioned underground fuel storage tanks, and evidence of considerable historical earthworks with significant cut/fill. Site walkover prior to drilling works to identify services revealed no discernible change in Site infrastructure since the 2019 assessment.

3.2 Current Site Conditions

The Site is currently operating as a University, the grounds are well kept and there is little evidence of contaminating activities.

3.3 Surface Coverings and Signs of Contamination

There is no visible evidence of major surface staining or Site contamination.

3.4 Acid Sulfate Soils

According to the Land Information Service Tasmania (LIST) database, the lower portion of Precinct 1 may contain low Level acid sulfate soils (ASS). Acid sulfate soils can be an issue for construction and excavation if sediments are exposed to oxygen, or infrastructure is placed into the acid bearing sediments.

Figure 5 Acid Sulfate Soils Mapping

3.5 Site Zoning

The Site is currently zoned Particular Purpose under the Hobart City Councils Interim Planning Scheme of 2015 with a small area at Olinda Grove zoned environmental management. The land use surrounding the Site a mixture of Inner Residential, General Residential, Low Density Residential, Rural Living, Environmental Management, Utilities and Recreation (Figure 6). For the purposes of the assessment the most sensitive potential future land use for the Site will be considered, that is residential according to NEMP (2013).

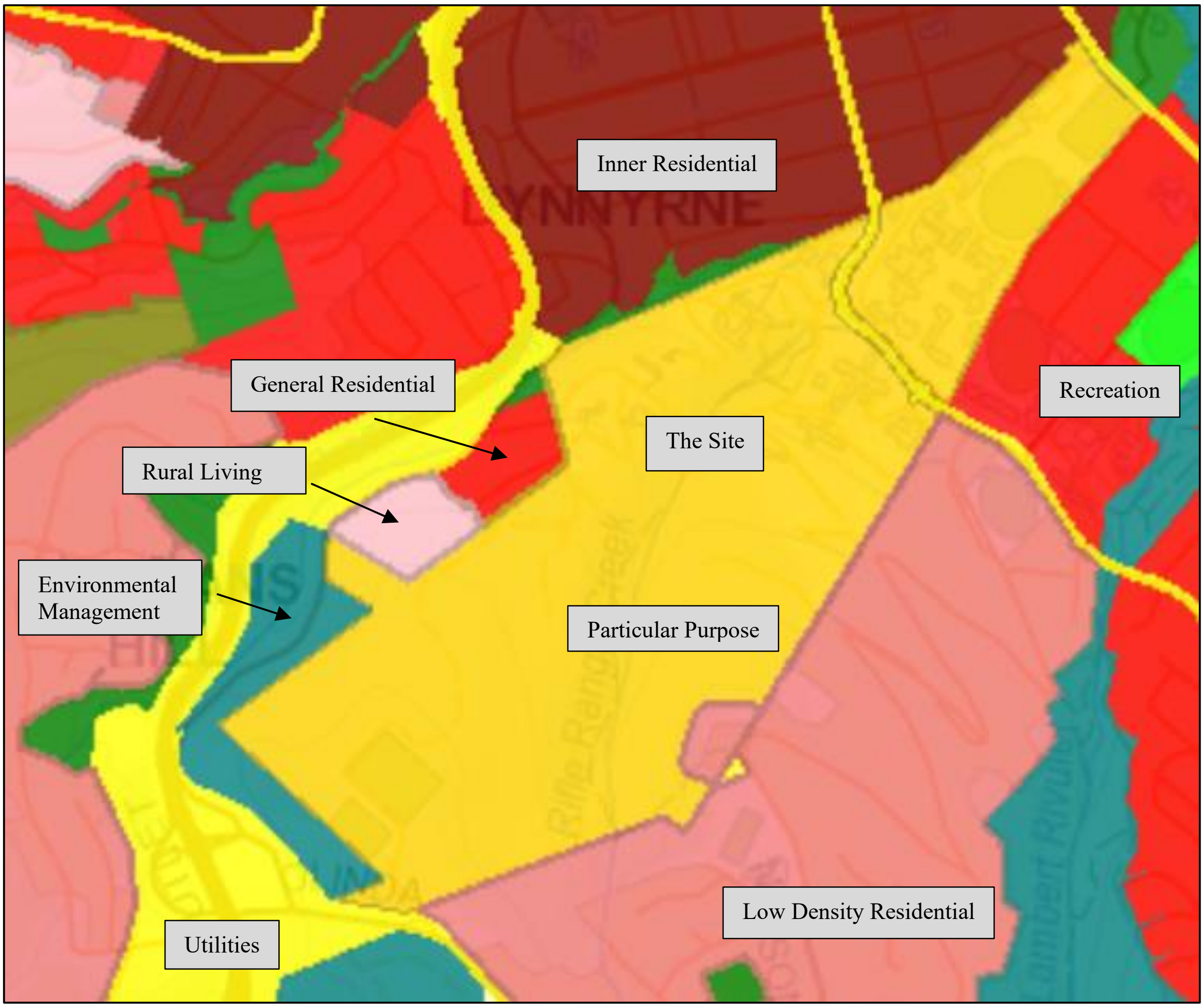


Figure 6 Hobart City Councils Interim Planning Scheme Zones (2015)

3.6 MRT Geology Mapping

The 1:25,000 scale geology map of the Greater Hobart area, see Figure 7; indicates the Site is underlain on the upper slopes to the south by Jurassic Dolerite, the centre and lower areas of the Site are underlain by Tertiary boulder deposits (dolerite) with some undifferentiated Quaternary sediments on and near Sandy Bay Road, on the northern edge of the title. The Site is surrounded by the same formations extending out on either edge of the Site except to the south where Permian sediments overlie the dolerite.

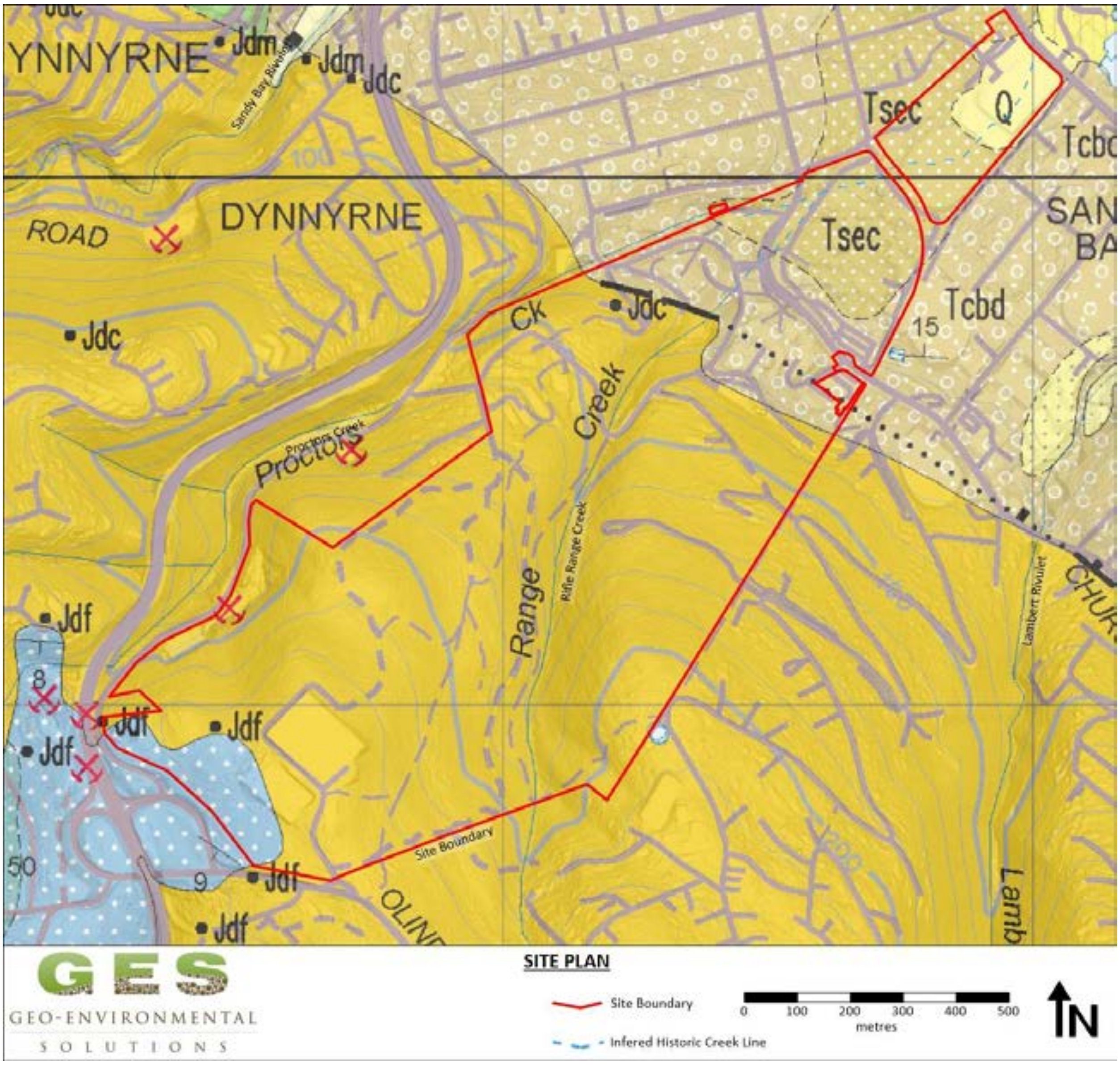


Figure 7 Mineral Resources Tasmania 1:25.000 Scale Mapping.

3.7 Site Topography, Drainage & Hydrogeology

There is a great variation in elevation of the Site, the lower north-eastern end of the Site is 5m above sea Level (ASL) the highest point, the south western end of the property is 255m ASL. Two creeks converge on the lower part of the Site; Proctors Creek and Rifle Range Creek; and drain towards the north east towards the River Derwent at Marieville Esplanade; see figure 8.

Figure 8 Topography and drainage

3.8 Groundwater

Potential Up-Gradient Contamination Sources

No specific potential up-gradient contamination sources have been identified however given the extensive bush area of the Site and the frequency of wildfires in this area there is the potential for all waterways to have PFAS contamination.

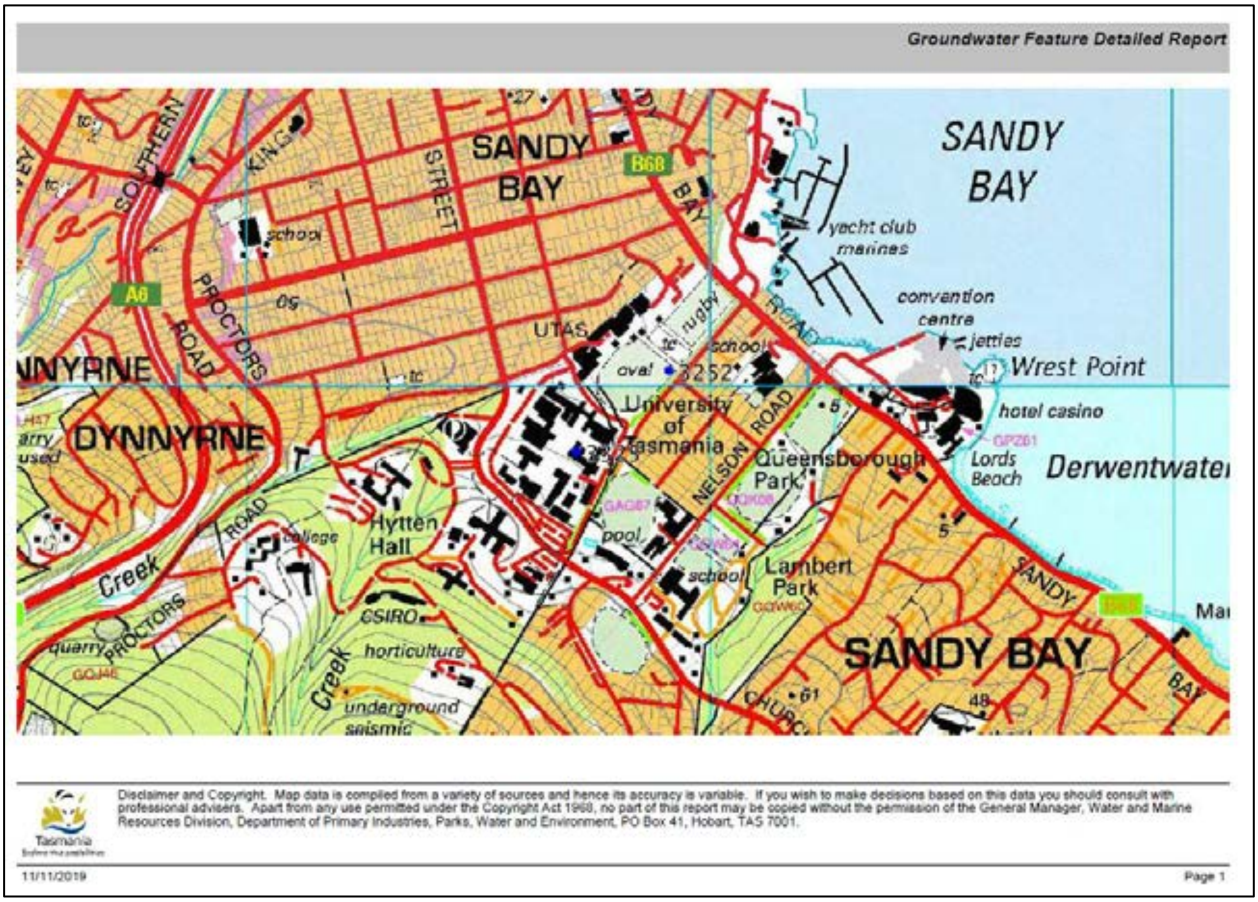
Downgradient Ecosystem Receptors

The closest downgradient ecosystem receptor is the River Derwent which is 120 m northeast of the Site at Marieville Esplanade.

3.9 Registered Water Bores

There are two groundwater bores listed on the 2 Churchill Avenue property according to the Department of Primary Industries, Parks, Water and Environment Groundwater Information Access Portal, see Appendix 3 for full report.

In summary, *Bore 3252* is situated on the oval above the Tennis Courts (Precinct 1), it was drilled by Gerald Spaulding Drillers P/L in 1897, bedrock was Tertiary Basalt and groundwater was struck at 24.4-36.6 m bgs and it is recorded as functioning. *Bore 3325* was drilled Mid Campus (Precinct 2), near the CODES and Physics buildings; there is limited information about this bore it is not known who drilled it, if water was struck and if it is in use.



Groundwater Feature Detailed Report

Disclaimer and Copyright. Map data is compiled from a variety of sources and hence its accuracy is variable. If you wish to make decisions based on this data you should consult with professional advisers. Apart from any use permitted under the Copyright Act 1968, no part of this report may be copied without the permission of the General Manager, Water and Marine Resources Division, Department of Primary Industries, Parks, Water and Environment, PO Box 41, Hobart, TAS 7001.

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Figure 9 Groundwater bore search results

3.10 Dangerous Goods Records (WorkSafe Tasmania)

WorkSafe Tasmania holds many dangerous goods records for the Site. Details of relevant dangerous goods records are presented in Table 2. A complete copy of the dangerous goods records is presented in the PSI report (GES 2019).

In summary, the Site hosted a total five (5) known underground fuel tanks; two (2) in front (decommissioned 2018), and one (1) behind the Corporate Services Building (decommissioned 2007), one (1) near to the Old Medical School (decommissioned 2006), and one (1) near Horticultural Research Centre (decommissioning status unknown).

There are several Solvent Stores around the campus including 1) behind the Chemistry/ Pharmacy building, 2) Life Sciences, 3) Horticulture Research Centre, 4) Geology Bunker, 5) Old Medical Building, and 6) Engineering Workshop. Flammable Liquids Stores have been noted at the following locations 1) Chemistry, 2) Life Sciences, 3) Pharmacy, and 4) CSIRO.

Table 2 Summary Table Workplace Standards Tasmania documentation, 2 Churchill Avenue

Precinct Number	File #	Details	Potentially contaminating activities
Entire Site	2343	Asset Management Service	Licence request for storage of Dangerous Goods; 24 Aug 1994. Decommissioning Record: Old Maintenance workshop – diesel pump and tank removed Change of use from tank storing Petrol to Diesel (2003); Dangerous goods licence to store petrol plus pump (1999-2000); Approval to keep 1 x 1000g u/g tank, D/Electric pump 1966; Approval to keep 2x 1000 u/g tanks 1 d/electric pump 1965; 1964 plans showing tank and pump corresponds with the area behind the Corporate Services Building (decommissioned 2007), List of Gas storage on campus; 1 Chemistry Building, 2 geology building and 3, Zoology.
1 Tennis Courts, etc	2344	Sports Pavilion	LPG storage documentation: Licence request for storage of Dangerous Goods; 24 Aug 1994; U24 file note to check compliance, 0.264 K/L LPG; 29 Feb 1984; Application for Licence, 3x0.285 K/L LPG; 5th Sep 1977; Record of Inspection, 3x0.285 K/L LPG; 29 Aug 1977; Approval to keep Dangerous goods, 3x45kg LPG in Cabinet; 16 May 1977; Installation Plan; LPG cylinders Site plan; 10th May 1977.
2 Mid Campus	2345	Chemistry	Records relating to Flammable Liquids Store 3.0 KL; LPG 1.320 KL.List of Gases stored on Site; UTAS to WSTReference to the Solvent Store. – various flammable liquids (1988); Chemistry Decanting Room Site Plan,
3 Mid Campus Life Sciences Horticultural Research Centre Geology Bunker	23457	Overall Campus	Tank storage at the following locations Engineering Building (Diesel AST), Corporate Services Building (UST); Old Medical Building (Diesel UST) and Horticultural Research Centre (UST). LPG storage at the following locations: Agricultural Science and central campus between Centenary Building and Chemistry Building Solvent storage at the following locations: Geology Bunker, Old Medical Building, Life Science Store, Engineering workshop.
3 Life Sciences	2346	Life Sciences	Life Science Glasshouses – fertilisers, herbicides, pesticides. Life Sciences Solvent Store - solvents and Flammable Liquids Store, since 1978. Records relating to Flammable Liquids Store 3.0 KL; LPG 0.550 KL (2003-2004).
2 Mid Campus	2347	Geology	LPG related documents: building plan 8th Aug 1977; Licence 24th Aug 1994; Pump and tank installation from The Shell Company of Australia Limited; 28th Oct 1980; licence 4x45k/g; 17th Nov 1980.
2 Mid Campus	2348	School of Pharmacy	Flammable Liquid Store 2.250 KL. Solvent Store,
3 Horticultural…	2890	Horticulture Research Centre	2001 Site plan: Diesel UST 2000L capacity, decommisisoned; Designated Solvent Store plus Two rooms designated to Chemical storage adjacent to the UST
2 Mid Campus	4536	Engineering	AST near the Plant Room; Site plan 2001. Approval to keep Dangerous goods, Bunker Oil (Diesel Storage) 20,500 kl 1st August 2001; Natural Gas Implementation; 20.5 KL Bunker Oil. 30th Oct 2006. Declaration that the Oil Fire Boiler Fuel Storage Tank was Removed; 28th August 2006. Application to keep Dangerous Goods, 3rd July 2003. File note to 'Keepers Licence' 22 August 2001. Declaration Dangerous Goods Installation 15th August 2001. Dangerous Goods Licence approval Memorandom, for Diesel Tank Installation - AST. 30 July 2001.
3 Life Sciences	4545	Old Medical Science	Rear of the Old Medical Science Building: Diesel UST capacity 9000Lt, Statutory Declaration of removal 2006. Solvent Store.
4 TUU Building	4662	TUU Building	LPG cylinders Site Manifest; 2 x 0.499 L, 27 Oct 2008 to 26 Oct 2009. Notice for Payment, 2 x 0.499 L LPG cylinders, 27 Oct to 26 Oct 2007; As above; 2006-2007; 2005-2006; 2004-2005. LPG Documentation: Fire extinguishers information to be kept near LPG cylinders 25th Oct 2004; Installation Compliance Checklist 19 Oct 2004; Approval to keep Dangerous goods, 2xLPG 1 September 2004. Photographs and Site plan on file.

Precinct Number	File #	Details	Potentially contaminating activities
3 Geology Bunker	9090	Geology Bunker	Geology Bunker, Mt Nelson: Site Plan, no date or other spatial references. Notice of Payment; Explosives; 1 July 2007 to 30 June 2008. & 1 July 2003 to 30 June 2004.Dangerous Goods Licence; Explosives; 1 July 2001 to 30 June 2002. Letter detailing storage requirements for explosives in a concrete underground seismic vault; 8th May 1973. Application for Licence for Magazine from the department of Mines to the Geology Department at the University Of Tasmania, 7th May 1973.
4 Hyatt Centre, Commerce	U23	Multi-Science Laboratory	Reference for request of a licence for the Centre for Education – Formally Hytten Hall LPG storage. Cancelled 18 March 1981; Multi Science Laboratory dismantled and Flammable liquids removed;1981. Details of Bulk storage, for 3x 45 LPG cylinders 8/9/77; 7/7/78; 23/7/79 & 27/8/80. Record of Inspection, 3x 45 LPG cylinders;29 Aug 1977. Approval for installation of 3x45kg bottle gas supply located on the first floor of the Arts Building at the university; 23 Dec 1976. Site plan 5 Jan 1977
4 TUU Building	U34	Central Store	Diesel tanks storage, Cancelled 22 March 1983.Inspection Report; Diesoleum 11 KL; 23 Aug 1983 licence not required - Cancelled Licence year: 80/81, 81/82, 82/83. 11 KL Changed to Diesoline 2 March 1983 *(distillate) Heating and fernace oil and lubricating oil are not subject to licencing.*17 Aug 1983. Application for keeping ….1x11000 (1x11.0kLl) petrol; 16 March 1981.Record of inspection underground (UST) 1x11000lt, Shell oil. 27 Feb 1981. Approval for installation for Pump & Tank at UTAS Central Store; 24 Oct 1980. Request to add concrete over the tank.

4 PRELIMINARY CONCEPTUAL SITE MODEL

4.1 Potential Contamination Issues

4.1.1 Areas of Potential Concern and potential contaminants

Given the size of the Site, each Precinct has been considered for potentially contaminating activities and contaminants of potential concern; See details below plus a diagrammatic representation of areas of concern in Figure 10 and summarised risks in Table 3.

Precinct 1 – Lower Site adjacent to Sandy Bay Road

- Activities hosted: Former Rifle Range, Sports Field, Rugby Rooms and Tennis Courts - uncontrolled fill
- Contaminants of Potential Concern: heavy metals, hydrocarbons

Precinct 2 – Mid Site building area

- Activities hosted: Former Rifle Range, footprint of buildings, footpaths, access Roads and general landscaping across the Campus, fuel storage tanks (UST's), Engineering Workshop Dangerous Goods Store, Solvent Store Pharmacy, Geology – Solvent Store.
- Contaminant of Potential Concern: heavy metals, hydrocarbons, solvents

Precinct 3 – Upper Site (South of Rifle Range Creek)

- Activities hosted: Life Science Glasshouses, Life Sciences Store LPG, solvents and Flammable Liquids Store, Old Medical Science diesel underground storage tank (UST), Steps building delivery area, Horticulture centre diesel UST, solvent store, general chemical store, machinery. Geology Bunker – explosives, bushland – fire-fighting reagents
- Contaminants of Potential Concern: Pesticides, hydrocarbons, heavy metals, Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS).

Precinct 4 – Upper Site (North of Rifle Range Creek)

- Activities hosted: TUU Building, old Hytten Hall and Commerce Buildings
- Contaminant of Potential Concern: hydrocarbons, heavy metals

Precinct 5 – Olinda Grove area

- Activities hosted: Grounds maintenance equipment Storage, fill, bushland – fire-fighting reagents
- Contaminant of Potential Concern: heavy metals, hydrocarbons, PFAS (in creek line)

4.2 Potential Human Receptors

Potential human receptors considered during this investigation include onSite current and future (mixed / residential land users); offSite current and future (mixed / residential); constructions workers during any future Site redevelopment (mixed / residential land users / trench worker specific) future trench works.

4.3 Potential Ecological receptors

Potential ecological receptors include the waterways of Proctors Creek and Rifle Range Creek plus the River Derwent at Marieville Esplanade and the bush land areas on the title and surrounding.

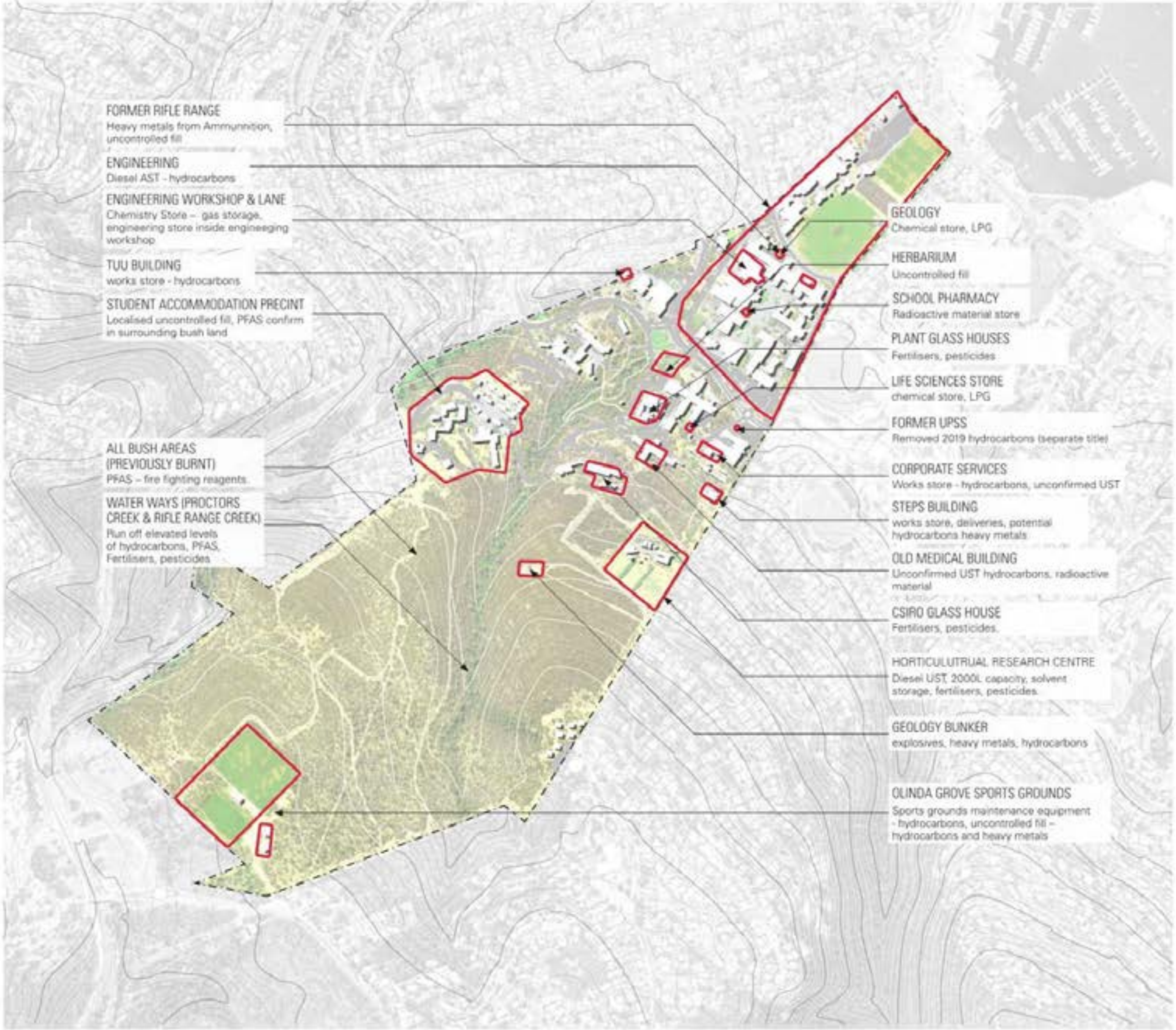


Figure 10 Areas of Potential Concern

Table 3 Preliminary Site Conceptual Model

Precinct #	Proposed Land Use	Potential Contamination Source	COPC	Pathway	Receptor
1 Tennis Crts & Sports field, rugby rooms	Mixed Use	Ammunition; Uncontrolled Fill	heavy metals, hydrocarbons	Dermal Contact, Dust Inhalation and soil Ingestion, Vapour inhalation, trench worker direct contact. Stormwater runoff	Human / Ecological
1 Ovals	Mixed Use	Ammunition; Uncontrolled Fill	heavy metals, hydrocarbons	Dermal Contact, Dust Inhalation and soil Ingestion, Vapour inhalation, trench worker direct contact. Stormwater runoff	Human / Ecological
1 Law School, carpark related buildings	Mixed Use	Ammunition; Uncontrolled Fill	heavy metals, hydrocarbons	Dermal Contact, Dust Inhalation and soil Ingestion, Vapour inhalation, trench worker direct contact. Stormwater runoff	Human / Ecological
2 Mid Site	Mixed Use	Ammunition, Uncontrolled Fill, Engineering diesel AST, Engineering workshop, Engineering Store, Pharmacy Store Staining on ground leaking from roller doors in lane way from the Chemistry Building Radiation source store near the pharmacy, Geology - Chemical store – corrosive chemicals	heavy metals hydrocarbons Solvents Radioactive material	Dermal Contact, Dust Inhalation and soil Ingestion, Vapour inhalation, trench worker direct contact. Stormwater runoff	Human / Ecological
4 TUU Building	Mixed Use	Maintenance workshop at the rear of the TUU Building	Hydrocarbons, heavy metals herbicides pesticides	Dermal Contact, Dust Inhalation and soil Ingestion, Vapour inhalation, trench worker direct contact. Stormwater runoff	Human / Ecological
3 Life Sciences	Mixed Use	Life Sciences Glasshouses; Works store behind Corporate Services Building, Area of former 2000L diesel underground storage tank (UST); decommissioned 2007. Behind Corporate Services Building, Life Sciences Store – flammable liquids, solvents, Old Medical Science, Former diesel UST – hydrocarbons, decommissioned 2006.	Fertilisers Herbicides Pesticides Hydrocarbons Solvents Heavy metals	Dermal Contact, Dust Inhalation and soil Ingestion, Vapour inhalation, trench worker direct contact. Stormwater runoff	Human / Ecological
4 Hyatt Centre Commerce	Mixed Use	Uncontrolled fill Bush areas - potential fire-fighting reagents -	Hydrocarbons heavy metals PFAS	Dermal Contact, Dust Inhalation and soil Ingestion, Vapour inhalation, trench worker direct contact. Stormwater runoff	Human / Ecological
3 Horticultural Research Centre	Mixed Use	Diesel UST 2000L capacity Solvent and chemical storage	Fertilisers Herbicides Pesticides Hydrocarbons Solvents Heavy metals	Dermal Contact, Dust Inhalation and soil Ingestion, Vapour inhalation, trench worker direct contact. Stormwater runoff	Human / Ecological
3 Geology Bunker	Mixed Use	Geology Bunker – explosives Bush areas - potential fire-fighting reagents -	Hydrocarbons heavy metals PFAS	Dermal Contact, Dust Inhalation and soil Ingestion, Vapour inhalation, trench worker direct contact. Stormwater runoff	Human / Ecological
5 Olinda Grove	Mixed Use	Uncontrolled fill, maintenance equipment storage area, Bush areas - potential fire-fighting reagents	Hydrocarbons heavy metals PFAS	Dermal Contact, Dust Inhalation and soil Ingestion, Vapour inhalation, trench worker direct contact. Stormwater runoff	Human / Ecological

5 FIELD INVESTIGATION PROCEDURES

5.1 Works Summary

Site investigation works comprised of soil sample excavation, and groundwater monitoring, which is summarised in Table 4.

Table 4 Summary of Site Investigation Work Dates

Scope	Date	Lab Report	Details
Drilling/ Soil Sample Collection	27th July 2021	EM2114845	10 primary soil samples, 2 QA/QC samples were collected from 5 test pits.
Drilling/ Soil Sample Collection	9th August 2021	EM2115765	28 primary soil samples, 3 QA/QC samples were collected from 21 bore holes and 5 compoSite surface soil sampling areas
Drilling/ Soil Sample Collection	11th-17th August 2021	EM2116538	16 primary soil samples, 2 QA/QC samples were collected from 3 bore holes
Drilling/ Soil Sample Collection	19th August 2021	EM2116910	2 compoSite samples were collected from 2 surface soil sampling areas
Drilling/ Soil Sample Collection	19th-25th August 2021	EM2116913	12 primary soil samples, 2 QA/QC samples were collected from 3 bore holes
Groundwater Sample Collection	9th September 2021	EM2118084	2 primary groundwater samples, 2 QA/QC samples were collected from 2 monitoring wells
Groundwater Sample Collection	13th September 2021	EM2118100	1 primary groundwater samples, 2 QA/QC samples were collected from 1 monitoring well

5.2 Soil Investigation

5.2.1 Borehole Drilling

Sampling was undertaken from over 30 discrete bore holes, and a number of compoSite grid sampling areas.

The bores were drilled by GES and Tasmanian drilling services using the industry recognized Geoprobe direct push drilling system or a geotechncial coring rig. In areas where access was limited sampling was undertaken with a 65mm hand auger. In addition, a number of test pits were excavated in deep fill deposits adjacent to the sports grounds at Olinda Grove to gauge fill properties and complete sampling for possible contaminants. Sampling locations were based upon the locations identified in the PSI, possible access to the areas, and any visible areas of possible contamination on Site such as machinery, dangerous goods stores, and decommissioned fuel tanks. Sampling locations for each Precinct can be found in figures 9 to 12.

It should be noted no invasive drilling or sampling was undertaken within existing buildings or storage facilities, or where underground services prevented access.

5.2.2 Soil Sampling

Soil sampling was conducted per the National Environmental Protection Measure (NEPM ASC 2013) and AS4482 sampling guidelines. Table 5 presents a summary of the soil assessment methodology adopted at the Site.

Table 5 Summary of Soil Sampling Methods

Activity	Details / Comments
Drilling Method	Geoprobe direct push drilling or geotechncial coring or hand auger.
Soil Logging	Logging the soil was conducted in accordance with the unified soil classification system (USCS) as detailed in AS1726 (1993).
Decontamination of Sampling Equipment	Quantum Clean Laboratory Detergent (R213) was used to decontaminate reusable sampling equipment between each borehole sampling event.
Soil Screening	In accordance with AS4482.2. Individual soil samples were collected at regular intervals below ground surface (BGS) and/or change in geology. Collected samples from the bore holes were screened for volatile fractions using a PhotoIonisation Detector (PID), all Levels were recorded at background Levels.
Laboratory Soil Sample Collection	In accordance with AS4482.2. All samples were collected using disposable nitrile gloves. Samples were selected for laboratory analysis at various depths. A minimum number of samples were carefully selected which would provide enough information to delineate soil contamination. CompoSite sampling only undertaken on bRoad areas where pesticides may have been applied to foliage or ground surface.
Sample preservation	Samples were placed into a jar for laboratory analysis. Soil jars were placed in a pre-chilled cool box with ice bricks.
Sample holding times	Sample holding times within acceptable range (based on NEPM ASC B3-2013), time from collection to extraction.

5.2.3 Soil Analysis

Primary and QC samples were submitted to Analytical Laboratory Services (ALS), Springvale, Melbourne for analysis. Approximately 70 primary soil samples were selected for analysis. Chain of Custody (COC) documentation was completed and is provided in Appendix 7 along with the Sample Receipt Notification (SRN) for each batch. Table 6 presents a summary of the laboratory analyses undertaken.

Table 6 Overview of Soil Analysis and Quality Control

Analytes	Primary Samples	Duplicate[a]	Rinsateb
TPH	19	1	1
BTEX	19	1	1
PAH	19	1	1
Suite 15 Metals	19	1	1

Sampling Quality Control Standards (AS4482):
a – Duplicate one (1) in twenty (20) primary samples
b – Single rinse sample per piece of equipment per day

Given metals were analysed, there was a requirement to assess the following soil physical properties to determine soil threshold investigation Levels: Soil grain class (sand/silt or clay); % Clay content; Cation exchange capacity (CEC); and Soil pH. The soil physical properties were based on knowledge of similar soil types encountered around the greater Hobart area.

5.3 Groundwater Assessment

5.3.1 Monitoring Well Establishment

A total of three (3) new wells were installed for the current investigation. The locations of the wells are illustrated in figure 11 & 12.

5.3.2 Well Sampling

Table 7 summarises the procedures for monitoring well gauging and sampling.

Table 7 Summary of Monitoring Well Gauging and Sampling Procedures

Activity	Procedure Details
Groundwater Gauging	All groundwater wells were gauged for standing water Levels (SWL) from top of casing (TOC) and the presence of Phase Separated Hydrocarbons (PSH) using a Solinst water/oil/air Interface Probe (IP).
Groundwater Extraction Method	Groundwater was extracted from the well using Geoprobe peristaltic pump.
Groundwater Purging	To ensure a representative groundwater sample could be collected, groundwater was purged three (3) times the volume of the well (6 x water column) or purged dry using the chosen groundwater extraction method for well development. The following physiochemical parameters (PCP's) were monitored whilst purging to ensure that the aquifer and groundwater parameters had stabilised to within 10% variation of the previous reading: • Reduction / Oxidation potential (REDOX); • Temperature; • pH; and • Electrical conductivity (EC).
Decontamination Procedure	Dedicated equipment was used for each monitoring well.
Sample preservation	Following groundwater purging, all groundwater samples were collected in laboratory supplied receptacles, labelled, chilled, and delivered with a COC to National Association of Testing Authorities (NATA) certified laboratories for analysis within the prescribed holding time.
Sample holding times	Sample holding times were within acceptable range (based on NEPM B3-2013) from collection to extraction.

5.3.3 Groundwater Analysis

Primary and QC groundwater samples were submitted to Analytical Laboratory Services (ALS), Springvale, Melbourne for analysis. A total of 3 primary samples were selected for analysis.

Table 8 presents a summary of the sample analysis including the QC sampling based on AS5667.1 and AS5667.11. Chain of Custody (COC) documentation was completed and is provided in Appendix 5 along with the Sample Receipt Notification (SRN).

Table 8 Overview of Groundwater Analysis and Quality Control

Analytes	Primary Samples	Duplicate[a]	Trip Blank[b]	Rinsate Blank[c]
TPH	3	1	-	1
BTEX	3	1	-	1
PAH	3	1	-	1
Lead	3	1	-	1

Sampling Quality Control Standards (AS4482):
a – Duplicate one (1) in twenty (20) primary samples
b– Trip blank one per eski where hydrocarbon odour is discernible – not required
c – Single rinse sample per sampling day

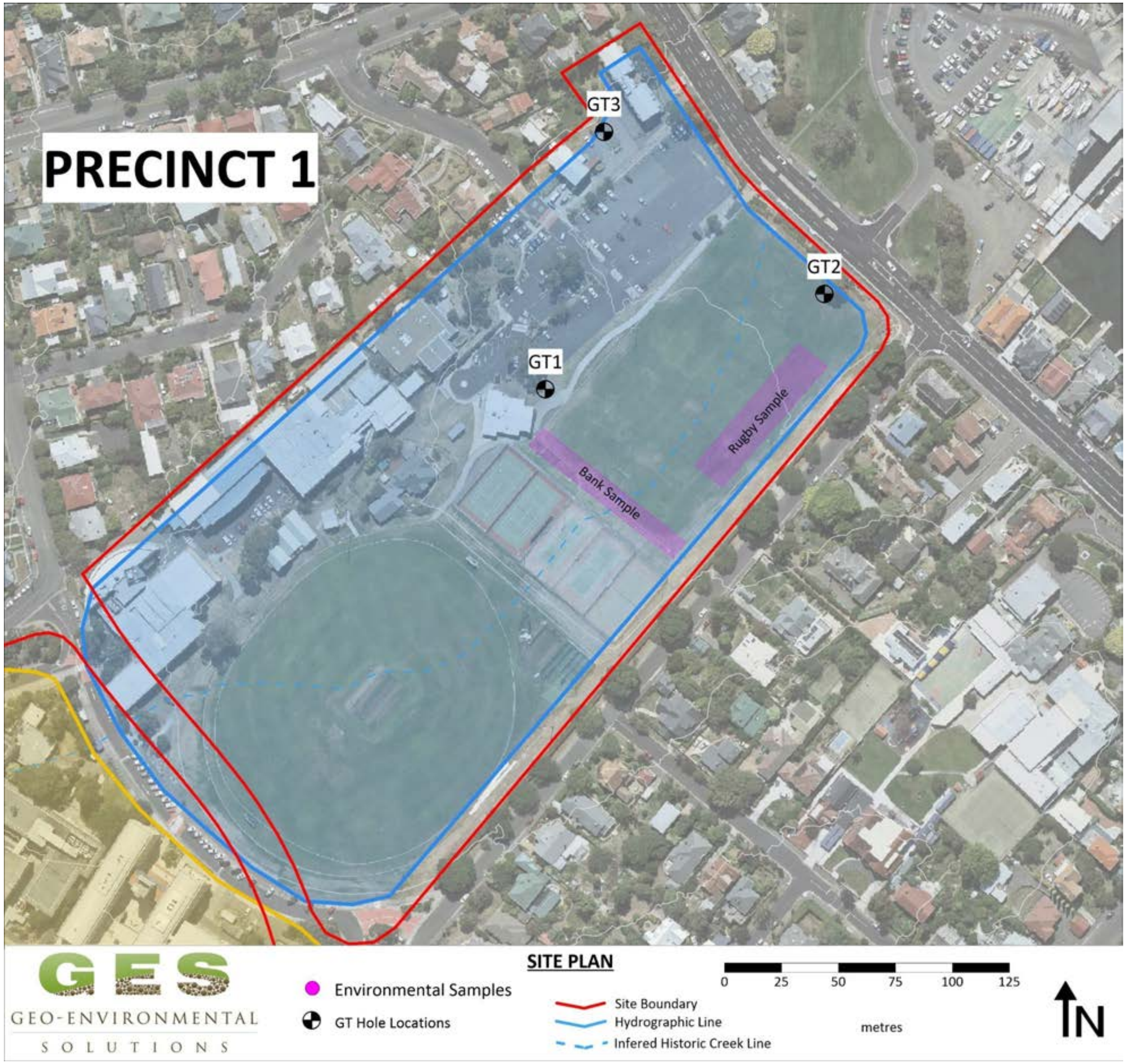


Figure 11 Precinct 1 sampling areas

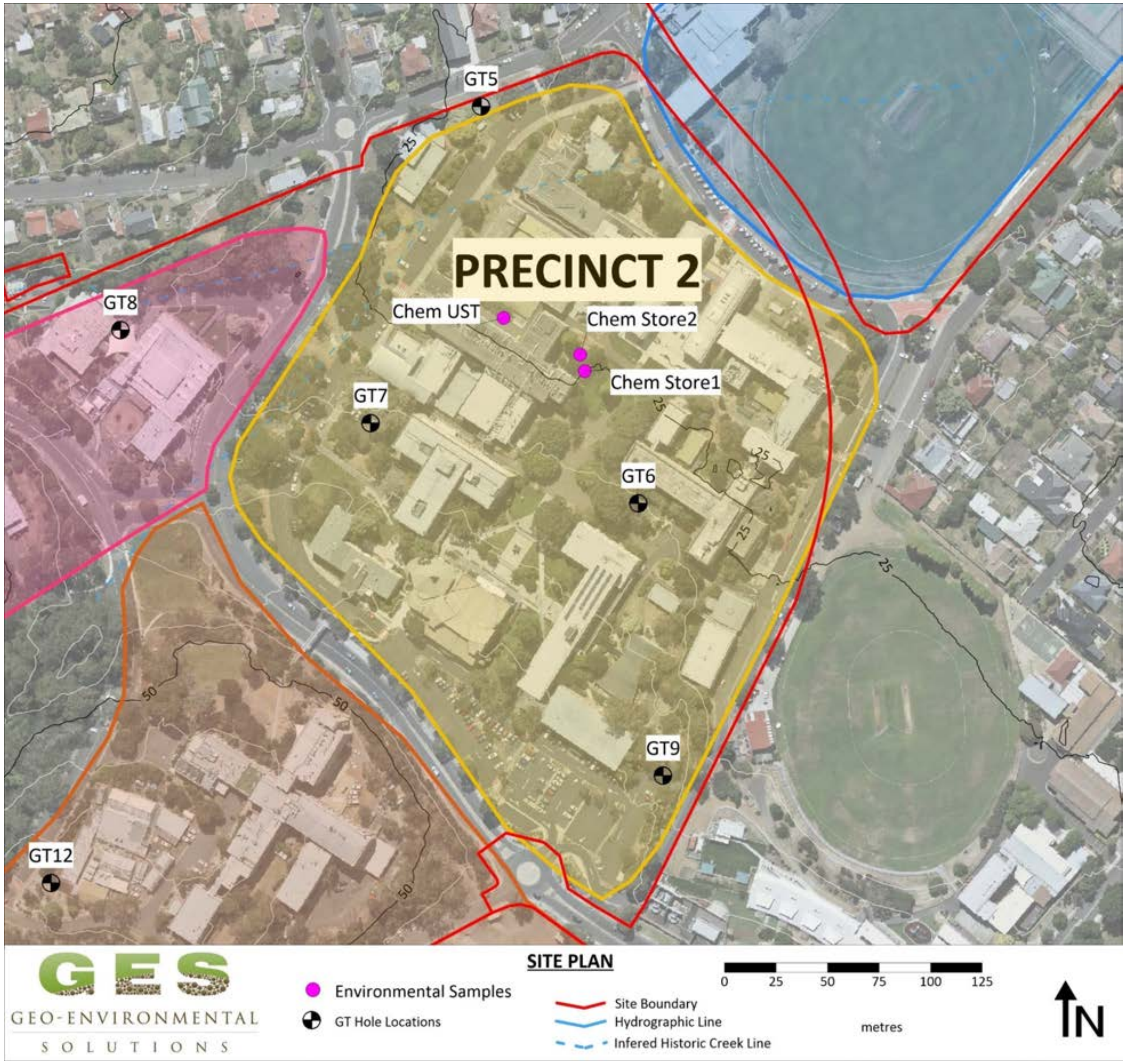


Figure 12 Precinct 2 sampling areas

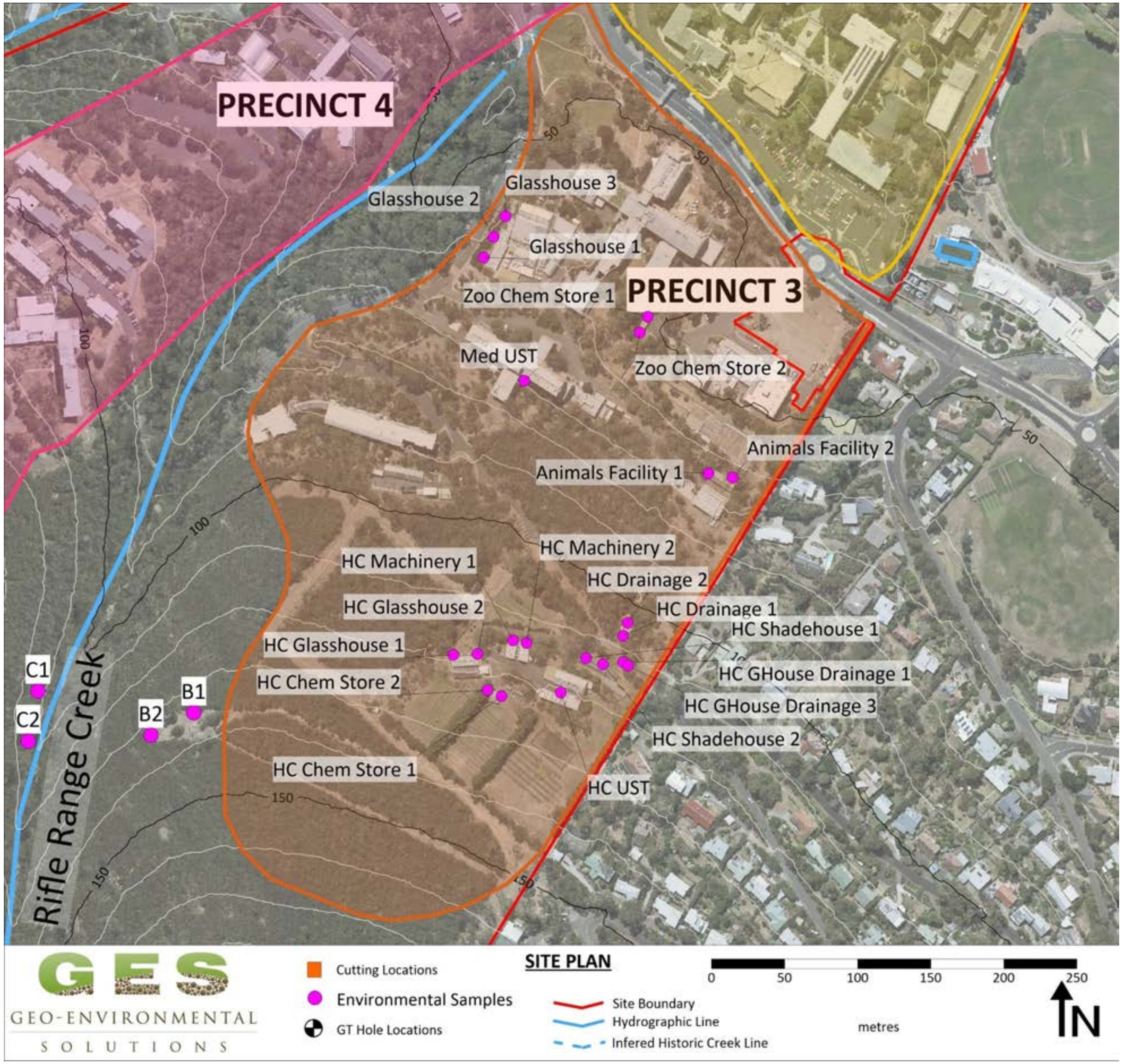


Figure 13 Precinct 3 sampling areas

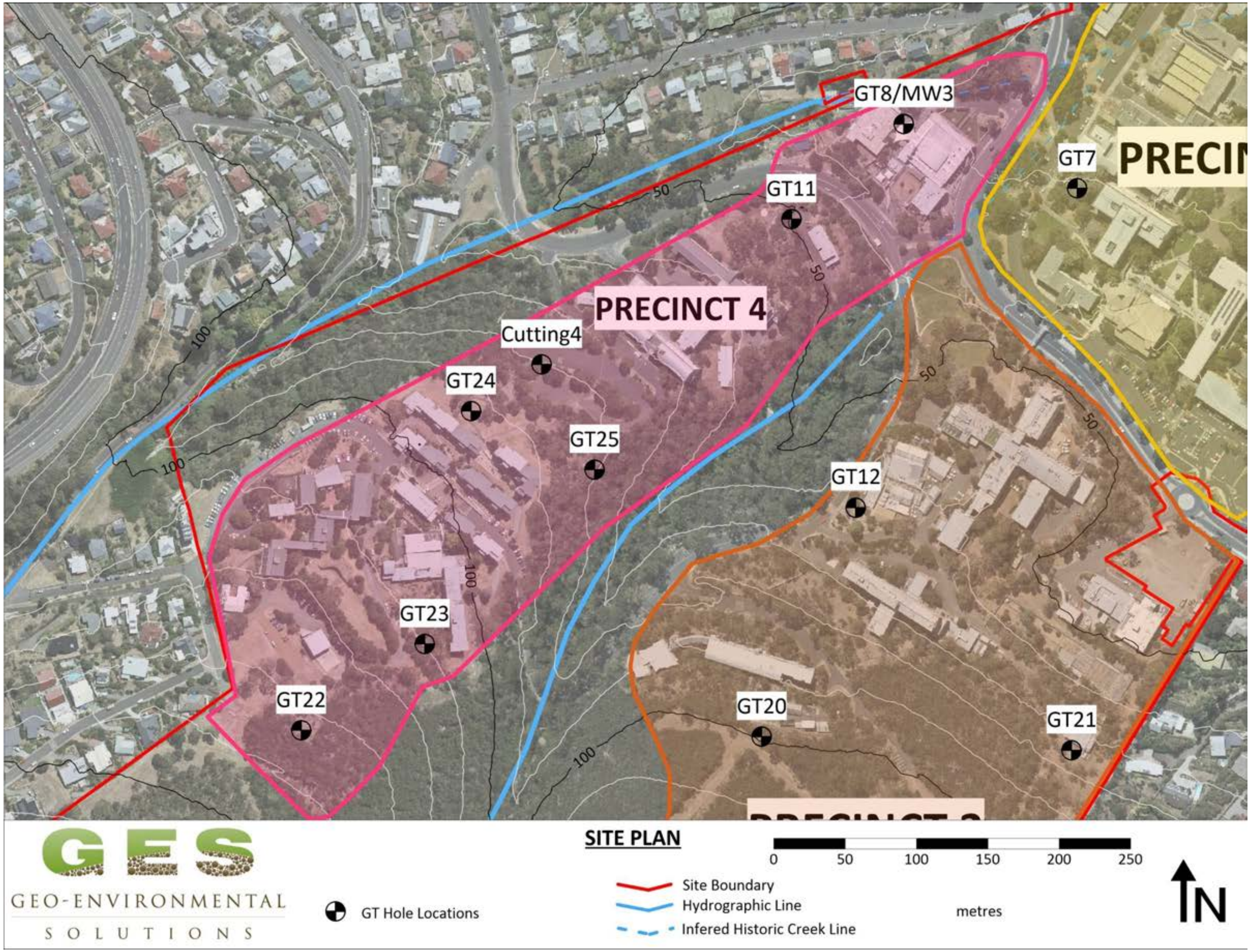


Figure 14 Precinct 4 sampling areas

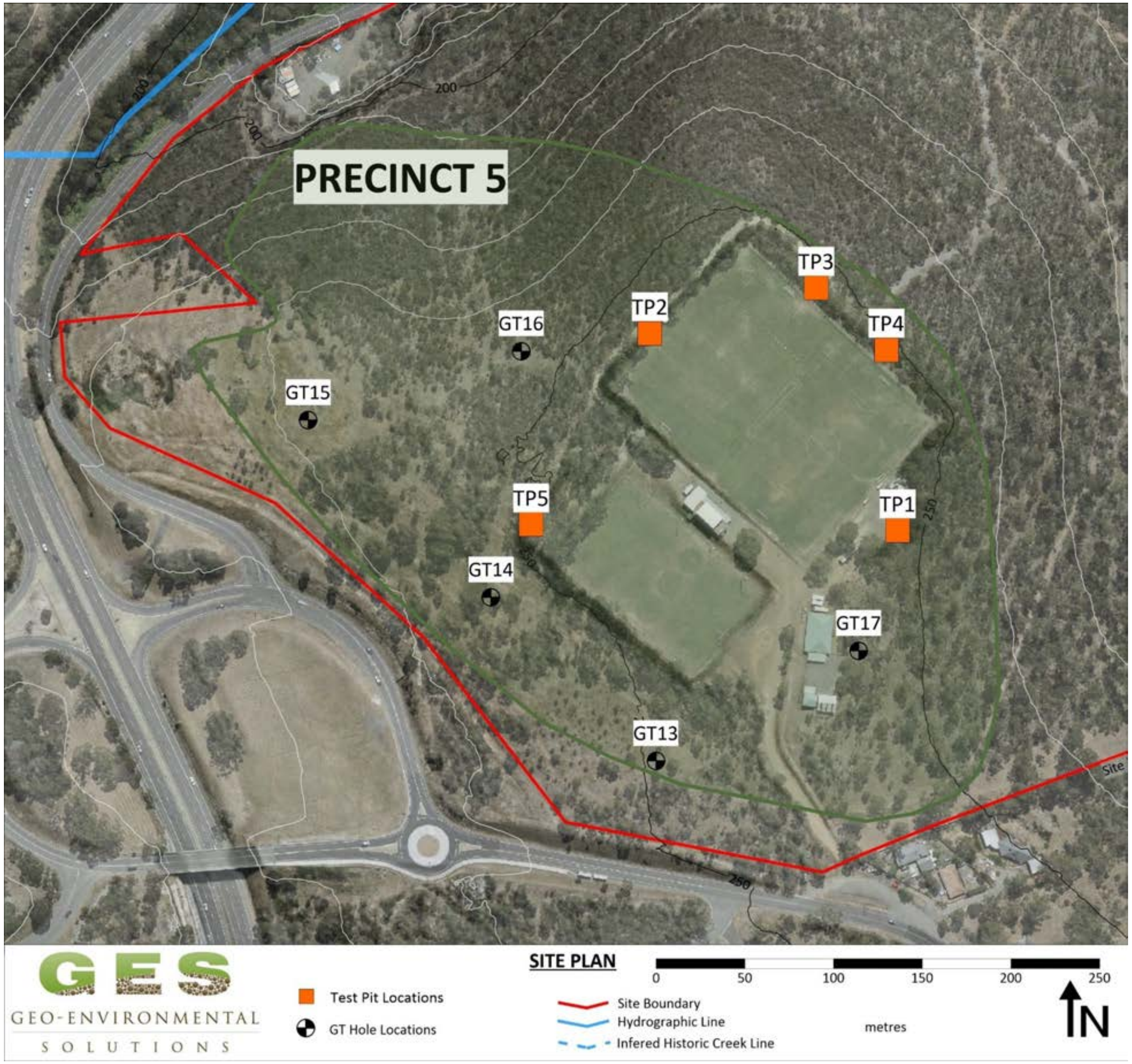


Figure 15 Precinct 5 sampling areas

6 QUALITY CONTROL

All Field and laboratory Quality Assurance and Quality Control (QA/QC) details and outputs are presented in Appendix 6.

6.1 Field

It is standard to expect up to 10% error in field duplication and up to 10% laboratory error. Therefore, in theory up to 20% error can be assumed on duplicate analysis. Some variation may exist in soil and groundwater because even though all efforts are made to split samples homogeneously, fragments of materials may bias samples in certain elements.

Relative Percentage Differences (RPDs) for the duplicate and triplicate samples where applicable are calculated using the method outlined below. The acceptance criteria used for the RPDs depend on the Levels of contaminants detected and the laboratory's Method Detection Limits. The closer the Levels detected are to the MDL the greater the acceptable RPD. RPDs are calculated as follows:

- RPD <50% for low Level results (<20 * MDL)
- RPD <30% for medium Level results (20-100 * MDL)
- RPD <15% for high Level results (>100 * MDL)
- No limit applies at <2 * MDL (Method Detection Limit)

Field soil QA/QC procedures and compliance are summarised in Table 9

Table 9 Soil Field QA/QC procedures and Compliance

QA/QC Requirement	Compliance	Comments
Appropriate sampling strategy used and representative samples collected	Yes	Sampling program was undertaken in accordance with AS4482.1-2005
Appropriate and well documented sample collection, handling, logging and transportation procedures.	Yes	Appropriate and well documented
Decontamination	Yes	Appropriate decontamination such as cleaning tools before sampling and between sample locations was undertaken
Chain-of-custody documentation completed	Yes	COC were completed in accordance with NEPM ASC Schedule B2, Section 5.4.5 and transported under strict COC procedures. The signed COC documents are included in this report, which includes the condition report on arrival of samples to the Laboratory, cross checking of sample identification and paperwork and preservation method.
Required number of duplicates Duplicate 1 per 20 primary samples	Yes	One duplicate sample collected and tested, for 19 primary samples, as per AS4482.1-2005.
QA/QC samples reported RPD's within indicated MDL guidelines.	Not complete	EM2114845 98% compliance, single duplicate pair for zinc, there was non-compliance. EM2116538 98% compliance, single duplicate pair for lead, there was non-compliance EM2116910 98% compliance, single duplicate pair for vanadium, there was non-compliance. EM2115765 91% compliance, duplicate pair for lead, zinc, barium, nickel, vanadium, chromium. Copper, there was non-compliance EM21156913 94% compliance, duplicate pairs for barium, there was non-compliance EM2118090 99% compliance, duplicate pair for TPH C10-40, there was non-compliance
Required numbers of rinse blank samples collected with no laboratory detections?	Yes	One rinse blank sample was collected per sampling set as per AS4482.1-2005
Trip blanks collected with no laboratory detections?	NA	According to AS4482.2-1999, soil trip blanks are required where volatile hydrocarbons are discernible. This was not required.
Field blanks collected with no laboratory detections?	NA	According to Australian Standards, there is no requirement to collect field blanks, unless there is concern with cross contamination risks.
Samples delivered to the laboratory within sample holding times and with correct preservative	Yes	All samples were sent to the laboratory with correct preservative, and within required holding time.

Table 10 Groundwater Sampling Field QA/QC procedures and Compliance

QA/QC Requirement	Completed	Comments
Appropriate sampling strategy used and representative samples collected	Yes	Sampling program was undertaken in accordance with AS4482.1-2005
Appropriate and well documented sample collection, handling, logging and transportation procedures.	Yes	Appropriate and well documented
Chain-of-custody documentation completed	Yes	All samples were transported under strict COC procedures and signed COC documents are included in this report.
Required number of duplicate samples collected (1:20)	Yes	3 Primary samples plus 1 duplicate sample were collected and selected for analysis.
QA/QC samples reported method detection limits within indicated guidelines.	Yes	Duplicate and primary samples reported no difference in results.
Required numbers of field and rinse blank samples collected	Yes	A rinse blank was collected with each sample set and analysis was clean.
Samples delivered to the laboratory within sample holding times and with correct preservative	Not complete	For EM2118084 & EM2118345 - All samples were sent to the laboratory within holding times and correct preservative except holding time breach for pH

6.2 Laboratory

Soil laboratory QA/QC procedures and compliance are summarised in Table 11.

Table 11 Soil Laboratory QA/QC Procedures and Compliance

QA/QC Requirement	Compliance	Comments
All analyses NATA accredited	Yes	ALS Laboratories is NATA Accredited. Appropriate analytical methods used, in accordance with Schedule B(3) of the NEPM ASC 2013. Acceptable laboratory limits of reporting (LORs) adopted.
Method Blanks: zero to <Practical Quantitation Limit (PQL)	Yes	There were no method blank value outliers in the QCI reports.
Laboratory Control Samples: 70% to 130% recovery for soil.	Yes	There were no laboratory control outliers in the QCI reports.
Duplicate Samples: 0% to <20% RPD.	Yes	There were no duplicate sample RPD outliers in the QCI reports.
Surrogates: 70% to 130% recovery	Yes	There were no surrogate recovery outliers in the QCI reports.
Analysis holding time outliers	Yes	There were no laboratory control outliers in the QCI reports.
Quality Control Sample Frequency Outliers	Not complete	For EM2114845: For ALS laboratory duplicates TRH – Semivolatile Fraction; PAH/Phenols For EM2115765: For ALS laboratory duplicates and matrix spikes TRH – Semivolatile Fraction; PAH/Phenols For EM2115765: For ALS laboratory duplicates and matrix spikes PAH/Phenols

Groundwater laboratory QA/QC procedures and compliance are summarised in Table 12.

Table 12 Groundwater Laboratory QA/QC Procedures and Compliance

QA/QC Requirement	Compliance	Comments
All analyses NATA accredited	Yes	ALS Laboratories is NATA Accredited. Appropriate analytical methods used, in accordance with Schedule B(3) of the NEPM ASC 2013. Acceptable laboratory limits of reporting (LORs) adopted.
Method Blanks: zero to <Practical Quantitation Limit (PQL)	Yes	There were no method blank value outliers in the QCI reports.
Laboratory Control Samples: 70% to 130% recovery for soil.	Yes	There were no laboratory control outliers in the QCI reports.
Duplicate Samples: 0% to <20% RPD.	Yes	There were no duplicate sample RPD outliers in the QCI reports.
Surrogates: 70% to 130% recovery	Yes	There were no surrogate recovery outliers in the QCI reports.
Analysis holding time outliers	Yes	There were no laboratory control outliers in the QCI reports.
Quality Control Sample Frequency Outliers	Not complete	For EM2118084: For ALS laboratory duplicates and matrix spikes TRH – Semivolatile Fraction; PAH/Phenols For EM2118345: For ALS laboratory duplicates and matrix spikes TRH – Semivolatile Fraction; PAH/Phenols

7 FIELD INVESTIGATION FINDINGS

7.1 Soil Bores

7.1.1 Geological Interpretation

See Appendix 4 for the Soil Bore logs. The material encountered across the Site was generally consistent with the MRT geology mapping. Clay soils were dominant across the entire study area, with minor areas of sandy topsoils, generally associated with landscaped areas.

Precinct 1 contains a significant amount of Site fill, in the vicinity of 2-3m in depth the fill is likely associated with the filling and Leveling of the land in the 1960s along the course of the former creek. The source of the fill in unknown, however aerial images and interviews completed as part of the PSI suggest that most of the material was sourced locally from reshaping of the Site and Roadworks. The quaternary and tertiary sediments that dominate the landscape in Precinct 1&2 feature deep profiles of clays overlying clayey gravels and weathered boulders deposits. The upper slope of the Site is almost completely dominated by Jurassic dolerite with shallow plastic lay soils overlying dolerite bedrock, ranging from deeply weathered on the lower slopes of Precinct 3, to slightly weathered hard dolerite in the upper slopes of Precinct, 3, 4 and 5. The upper slopes also feature localised cut/fill, predominantly with natural material sources from on Site that does not pose a contamination risk. The sports grounds at Olinda Grove also feature significant deposits of imported fill, sourced from the excavation of the nearby highway which also has a very low likelihood of contaminants.

7.1.2 Grain Class Interpretation

Grain size classifications are applied to all soils at the Site to determine threshold screening Level concentrations for hydrocarbons (and chromium) to assess soil ecological and human health risks.

Grain class threshold values are determined based on either the:

- sample grain size (in the case of ecological screening Levels or chromium limits); or
- average grain class overlying the sample point (when assessing petroleum vapour screening Levels) relative to the proposed finished floor Level.

CLAY grain size class has been applied to all results across the Site, and can be found in the associated results tables for each data set.

7.1.3 Soil Contamination Observations

No significant staining or odour of hydrocarbon contamination was observed during the soil investigation. Very minor surface staining on some carpark surfaces was noted and in machinery storage areas.

7.2 Site Groundwater

7.2.1 Borehole Hydrogeology & Well Construction

All wells sampled were newly installed monitoring wells. Table 13 presents a summary of the groundwater monitoring well construction details for relevant wells sampled during the current event.

Table 13 Summary of Well Construction and Aquifer Details

Well	DWS* (m)	Top of Screen (m)	Bottom of Screen (m)	Well Depth (m)	PSH Presence
MW1	5.9	3.0	24.8	24.8	No
MW2	2.35	1.5	20.0	20.0	No
MW3	13.9	3.0	18.0	18.4	No

DWS - Depth Water Struck

7.2.2 Hydraulic Gradient and Groundwater Flow Direction

Field results from the groundwater gauging are presented in Appendix 3. Groundwater depths for the gauging event are presented in Table 14. PSH was not detected (gauged) in any of the monitoring wells. Groundwater Levels have not been contoured.

Table 14 Summary of Groundwater Gauging Results

Monitoring Well	MW1	MW2	MW3
Well Depth (m)	24.8	20.0	18.0
Top of Casing (TOC) Height (mAHD)[1]	4.5	4.2	31.6
Groundwater Depth from TOC (m)	3.1	0.99	2.92
PSH Thickness (mm)	0	0	0
Corrected Groundwater Elevation (mAHD)	1.5	3.21	28.68

[1] No survey completed. Casing height above ground estimated at 0.5m.Elevation AHD taken from LiDAR.

Inferences about groundwater flow directions have been obtained gauging data during the groundwater investigation.

The groundwater flow direction is inferred to be to the east and the hydraulic gradient is determined to be approximately 2.6º based on surface elevations between MW2 and MW3, see Table 15.

Table 15 Summary of Inferred Site Groundwater Flow Directions and Rates

Details	**Result**
Groundwater flow direction from the Site	West
Hydraulic Gradient Calculations Upgradient Groundwater Elevation Downgradient Groundwater Elevation Distance Between Upgradient and Downgradient Points Hydraulic Gradient	28.68m AHD MW3 to 0.99m AHD MW2 600 m 2.6º

7.2.3 Hydraulic Conductivity

Slug testing has not been conducted in aquifers at the Site and inferences are made about the aquifer material hydraulic properties. The aquifer is inferred to comprise of a *boulder deposits and sediments* which would have a hydraulic conductivity in the order of *0.1 to 0.01 m per day* (Freeze & Cherry 1979).

7.2.4 Groundwater Flow Rates

Groundwater inferred flow rates are presented in Table 16.

Table 16 Summary of Inferred Groundwater Flow Rates at the Site

Applicable Wells	**Hydraulic Conductivity (m/year)**	**Hydraulic Gradient**	**Effective Porosity**	**Flow rate (m/year)**
	K	**i_h**	**δ**	**$(K \times i_h) / \delta$**
MW1	3.65 to 36.5	2.46 (0.68%)	0.25	9.9 to 99.2

7.2.5 Groundwater Physiochemistry

All purge volumes were attained or the wells were pumped dry before collecting a representative sample for physiochemical analysis and laboratory analysis. Physiochemical parameters were collected whilst purging and a representative value for the aquifer is presented in Table 17.

The following observations can be made during groundwater sampling activities:

- There was no discoloration to the groundwater, no colour was recorded for in any of the wells.

Table 17 Summary of Stabilised Groundwater Properties

Parameter	Range	Average	Comment
Temp (°C)	12.3 MW1 & to 14.9 MW3	13.28	Typical groundwater temperature for groundwater within southern Tasmania for autumn.
pH	7.41 MW1 to 7.36 MW3	7.38	Indicates slightly alkaline pH conditions for groundwater
Redox (mV)	-35.6 MW3 to 115.2 MW1	39.8	Indicates that reducing conditions exist beneath parts of the Site
EC (µs/cm)	1554 MW2 to 2544 MW3	2049	Indicates saline, low quality groundwater

7.2.6 PSH & Groundwater Contamination Observations

The following field observations were noted when collecting the groundwater samples:

- No odour or sheen was detected in any of the groundwater monitoring wells
- PSH was not observed in any monitoring wells.

8 SOIL ECOLOGICAL IMPACT ASSESSMENT

8.1 Protected Environmental Values

The requirement for protecting soil from contaminated activities in Tasmania is managed under the *Environmental Management and Pollution Control Act 1994* (EMPCA) which states in Part 5A:

(2) An area of land is a contaminated Site if –

> (a) there is in, on or under that area of land a pollutant in a concentration that –
>
> > (i) is above the background concentration; and
> >
> > (ii) is causing or is likely to be causing serious or material environmental harm or environmental nuisance, or is likely to cause serious or material environmental harm or environmental nuisance in the future if not appropriately managed;

Potential soil impact at the Site is assessed through application of the following environmental investigation guidelines.

8.2 NEPM ASC (2013) Guidelines

The following ecological investigation guidelines are to be addressed in order to assess acceptable Levels of risk to terrestrial ecosystems:

- NEPM ASC (2013) Ecological Investigation Levels (EIL's) – have been developed for selected metal and organic substances. EIL's depend on specific soil and physicochemical properties and land use scenarios and generally apply to the top two (2) metres of the soil profile (NEPM ASC 2013);
- NEPM ASC (2013) Ecological Screening Levels (ESL's) – have been developed for selected petroleum hydrocarbon compounds and total petroleum hydrocarbon fractions. ESL's bRoadly apply to coarse- and fine-grained soils and various land use scenarios within the top two (2) metres of the soil profile (NEPM ASC 2013).

Soil analytical results are compared against Ecological Screening Levels (ESL's) and Ecological Investigation Levels (EIL's) limits presented in Table 18.

Table 18 Summary of Soil Investigation Limits Considered at the Site based in NEPM (2013) ASC

Investigation Levels (IL)	**Analytes Investigated**						
	Hydrocarbons				**Metals**		**DDT**
	BTEX	**TRH (F1 to F4)**	**Benzo(a) pyrene (PAH)**	**Naphthalene (PAH)**	**Zn, Cu, Cr(III), Ni & As**	**Lead**	
ESL's	Analysed	Analysed	Analysed				
EIL's				Analysed	Not Analysed	Analysed	Not Analysed

8.3 Guidelines

8.3.1 Ecological Screening Levels

The following compounds were compared against NEPM (2013) Ecological Screening Levels (ESL's):

- BTEX;
- F1 to F4 TRH; and
- Benzo(a)pyrene

Selection of ESL threshold investigation limits are set out in the NEPM (2013) guidelines and require classification of the soil according to:

- Land use sensitivity:
    - Areas of ecological significance
    - Urban residential and public open space; and
    - Commercial and industrial.

- Dominant particle size passing through a 2 mm sieve into:
    - Coarse – sand sizes and greater; and
    - Fine – clay and silt sizes.

Adopted NEPM (2013) soil and land use classifications are presented below.

8.3.2 Ecological Investigation Levels

There was a requirement to classify the soil according to physicochemical properties given that the above listed compounds. Adopted physicochemical parameters are presented in the results tables.

Selection of EIL threshold investigation limits are set out in the NEPM (2013) guidelines and require classification of the soil per specific soil and physicochemical properties which are presented in the results tables. The adopted land use scenarios presented in Table 19.

Table 19 Adopted Land Use Scenario for the Various Soil Bores

Land Use Scenario	Applicable Soil Bores
Areas of Ecological Significance	
Urban Residential & Public Open Space	All soil bores
Commercial & Industrial	

Based on a preliminary assessment of Site soil conditions, the following physicochemical properties are applied to assess guideline EIL's:

- Clay content consistent with field observations;
- A soil pH and cation exchange capacity (CEC) consistent with Table 20.

Table 20 Cation Exchange and Clay content, Adopted For the Site

USCS	Clay %	CEC	pH
R	100.00	10.00	4.5
GW	0.00	10.00	4.5
GP	0.00	10.00	4.5
GM	10.00	15.00	4.5
GC	30.00	20.00	4.5
SW	0.00	10.00	4.5
SP	0.00	10.00	4.5
SM	10.00	15.00	4.5
SC	20.00	20.00	4.5
ML	30.00	20.00	4.5
CL	100.00	35.00	4.5
OL	50.00	35.00	4.5
MH	30.00	35.00	4.5
CH	100.00	45.00	4.5
OH	100.00	60.00	4.5
PT	100.00	80.00	4.5
P	0.00	0.00	4.5
CM	100.00	35.00	4.5
CM	100.00	35.00	4.5
Rock	0.00	10.00	4.5

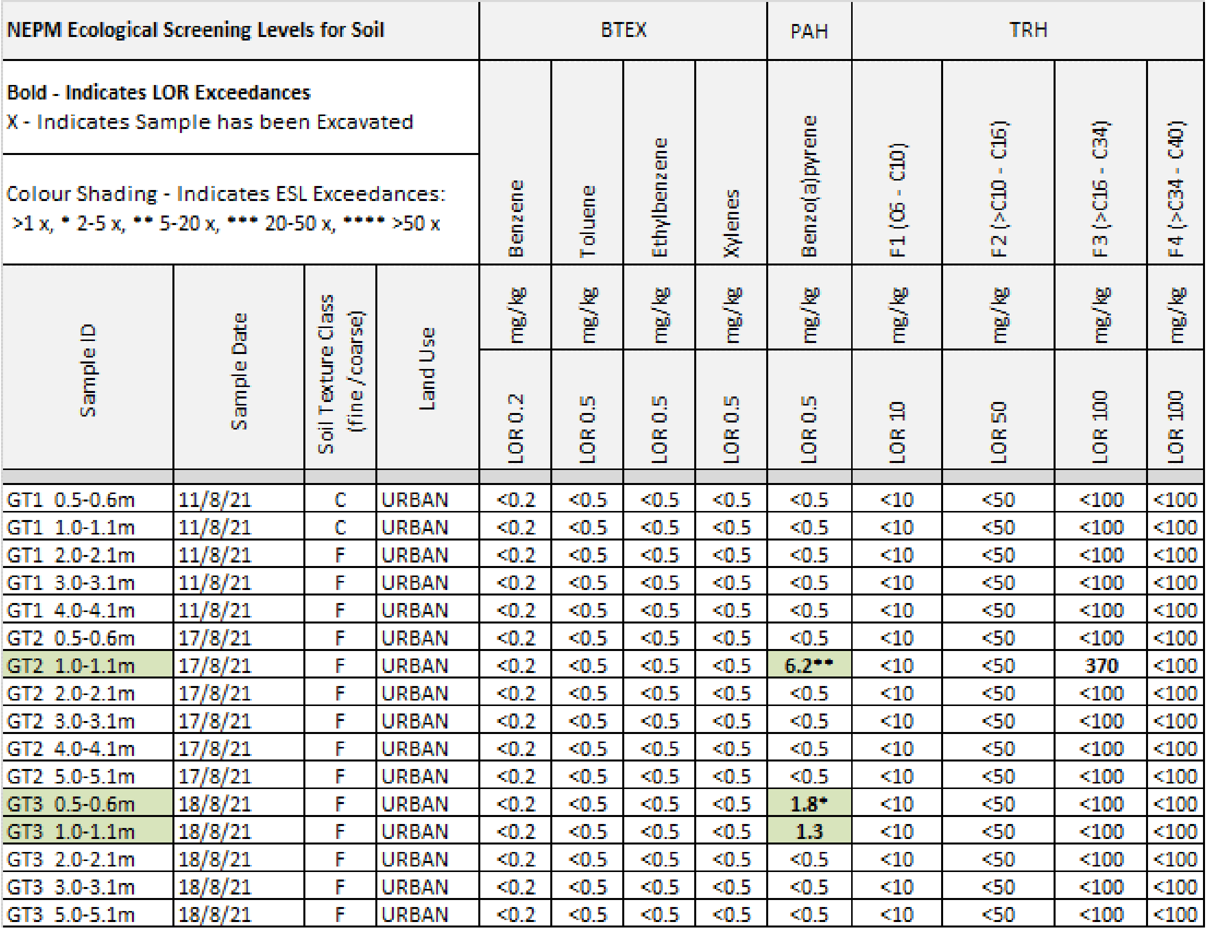
8.4 Findings

8.4.1 Ecological Screening Levels

Laboratory analytical results for soil samples are presented in Appendix 8. Table 21 to Table 24 compares soil analytical results against relevant NEPM ESL's. Concentrations which exceeded laboratory Levels of reporting (LOR) would be highlighted in bold, and ESL exceedances would be highlighted with a coloured cell. The results tables are split into each Precinct on the Site with a small number of samples across two Precincts in different sampling events.

Table 21 for Precinct 1 (lower area of Site) shows guideline exceedances for benzo(a)pyrene (Benzo(a)pyrene) in shallow soils in GT2 & GT3 with a potential risk to ecological receptors identified is soil is disturbed. Benzo(a)pyrene is widespread in soils and fill around Hobart as it is a carbon combustion product.

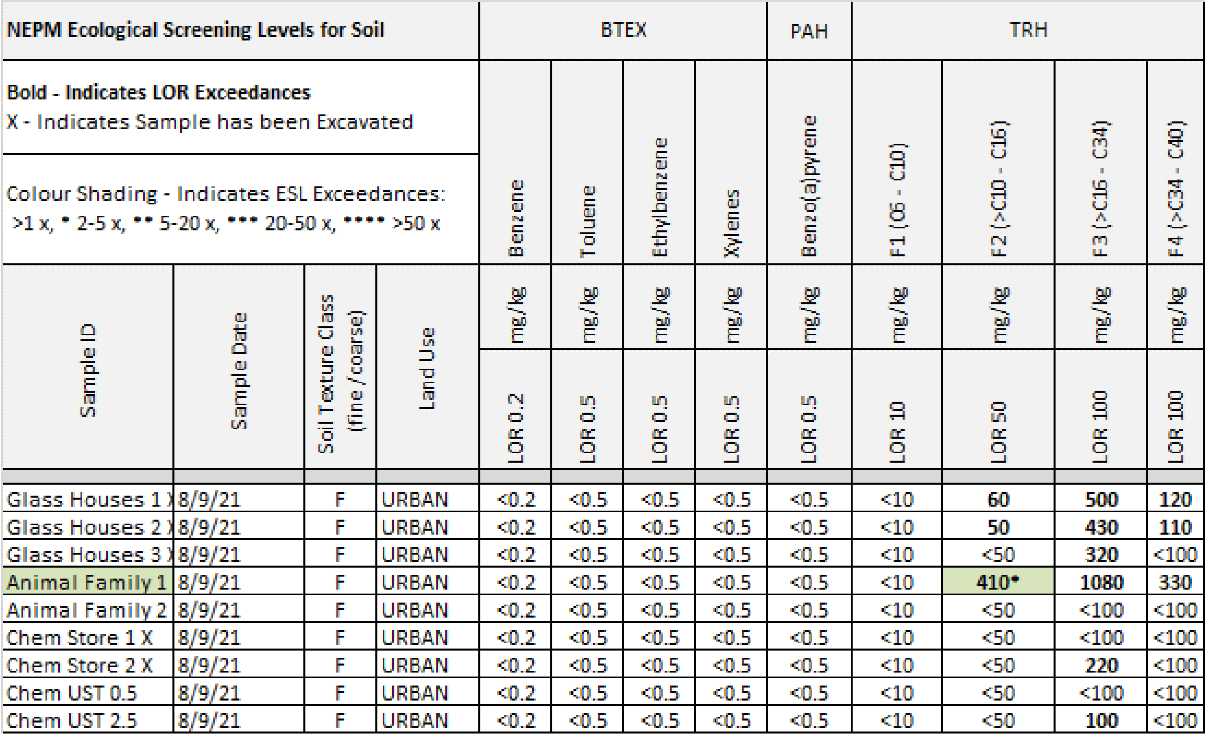
Table 21 Summary of Soil Analytical Results Compared with Ecological Screening Level's – Precinct 1



NEPM Ecological Screening Levels for Soil				BTEX				PAH	TRH			
Bold - Indicates LOR Exceedances X - Indicates Sample has been Excavated Colour Shading - Indicates ESL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x				Benzene	Toluene	Ethylbenzene	Xylenes	Benzo(a)pyrene	F1 (C6 - C10)	F2 (>C10 - C16)	F3 (>C16 - C34)	F4 (>C34 - C40)
Sample ID	Sample Date	Soil Texture Class (fine /coarse)	Land Use	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 0.5	LOR 10	LOR 50	LOR 100	LOR 100
GT1 0.5-0.6m	11/8/21	C	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT1 1.0-1.1m	11/8/21	C	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT1 2.0-2.1m	11/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT1 3.0-3.1m	11/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT1 4.0-4.1m	11/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT2 0.5-0.6m	17/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT2 1.0-1.1m	17/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	**6.2****	<10	<50	**370**	<100
GT2 2.0-2.1m	17/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT2 3.0-3.1m	17/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT2 4.0-4.1m	17/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT2 5.0-5.1m	17/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT3 0.5-0.6m	18/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	**1.8***	<10	<50	<100	<100
GT3 1.0-1.1m	18/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	**1.3**	<10	<50	<100	<100
GT3 2.0-2.1m	18/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT3 3.0-3.1m	18/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
GT3 5.0-5.1m	18/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100

Table 22 for Precinct 2 & 3 shows guideline exceedances for F2 TRH in shallow soils in a storage area beneath the old animals facility with a potential risk to ecological receptors identified is soil is disturbed.

Table 22 Summary of Soil Analytical Results Compared with Ecological Screening Level's – Precinct 2 & 3



NEPM Ecological Screening Levels for Soil				BTEX				PAH	TRH			
Bold - Indicates LOR Exceedances X - Indicates Sample has been Excavated Colour Shading - Indicates ESL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x				Benzene	Toluene	Ethylbenzene	Xylenes	Benzo(a)pyrene	F1 (C6 - C10)	F2 (>C10 - C16)	F3 (>C16 - C34)	F4 (>C34 - C40)
Sample ID	Sample Date	Soil Texture Class (fine /coarse)	Land Use	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 0.5	LOR 10	LOR 50	LOR 100	LOR 100
Glass Houses 1 X	8/9/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	**60**	**500**	**120**
Glass Houses 2 X	8/9/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	**50**	**430**	**110**
Glass Houses 3 X	8/9/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**320**	<100
Animal Family 1	8/9/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	**410***	**1080**	**330**
Animal Family 2	8/9/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
Chem Store 1 X	8/9/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
Chem Store 2 X	8/9/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**220**	<100
Chem UST 0.5	8/9/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
Chem UST 2.5	8/9/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**100**	<100

Note – former animals facility mislabelled in laboratory as animal family.

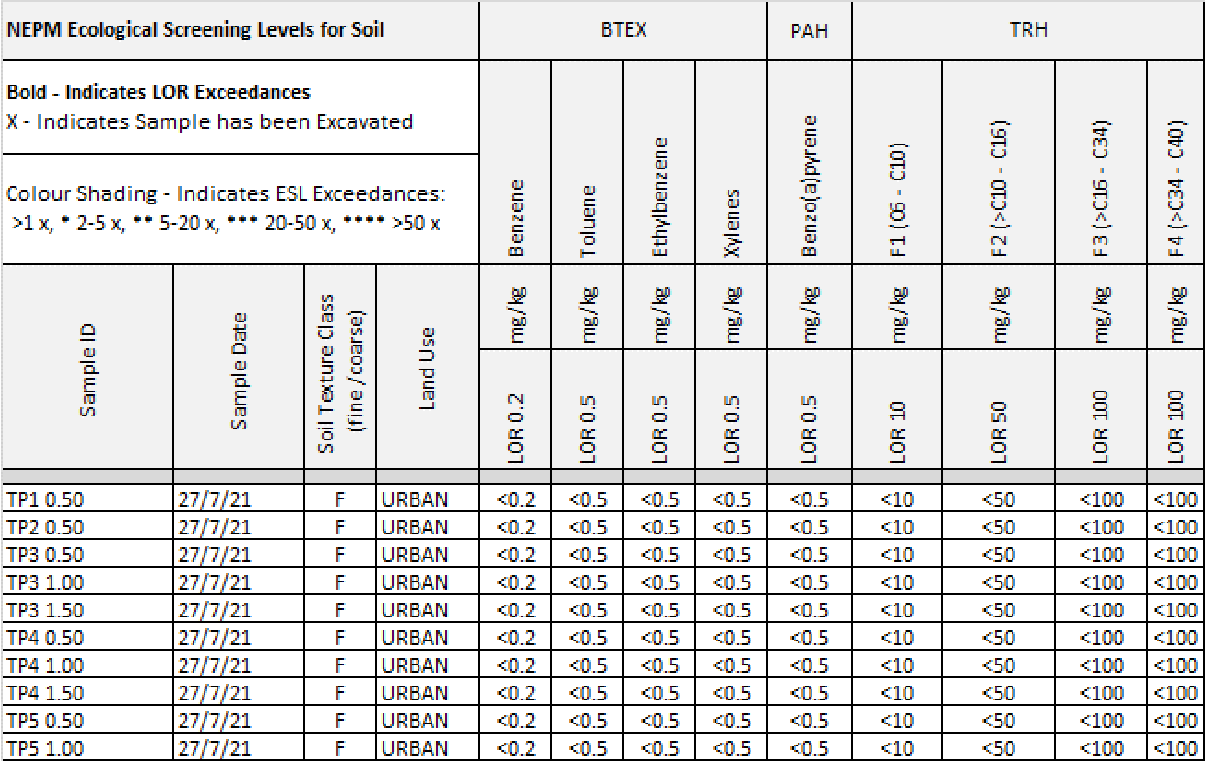
Table 23 for Precinct 3 shows no guideline exceedances and no potential risk to ecological receptors.

Table 23 Summary of Soil Analytical Results Compared with Ecological Screening Level's – Precinct 3

NEPM Ecological Screening Levels for Soil				BTEX				PAH	TRH				PFASs	
Bold - Indicates LOR Exceedances X - Indicates Sample has been Excavated Colour Shading - Indicates ESL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x				Benzene	Toluene	Ethylbenzene	Xylenes	Benzo(a)pyrene	F1 (C6 - C10)	F2 (>C10 - C16)	F3 (>C16 - C34)	F4 (>C34 - C40)	PFOS	PFOA
Sample ID	Sample Date	Soil Texture Class (fine / coarse)	Land Use	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 0.5	LOR 10	LOR 50	LOR 100	LOR 100	LOR 0.0002	LOR 0.0002
200 BH01 CHEM 0	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
200 BH02 CHEM 0	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
MED BH01 UST 0.	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
MED BH02 UST 0.	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
HC BH01 UST 0.50	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**250**	**540**	----	----
HC BH01 UST 1.50	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
HC BH01 UST 2.00	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
HC BH01 DRAINA	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
HC BH02 DRAINA	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**190**	<100	----	----
HC AREA 1 0.20 X	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC AREA 2 0.20 X	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC AREA 3 0.20 X	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC AREA 4 0.20 X	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC AREA 5 0.20 X	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH01 MACHIN	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**110**	<100	----	----
HC BH02 MACHIN	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**170**	<100	----	----
HC BH01 CHEM 0.	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**100**	<100	----	----
HC BH02 CHEM 0.	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
HC BH01 G HOUS	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH02 G HOUS	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH01 G HOUS	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH02 G HOUS	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH01 SHADE 0	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH02 SHADE 0	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH01 BUNKER	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH02 BUNKER	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH01 CREEK 0.	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	0.0004	<0.0002
HC BH02 CREEK 0.	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	0.0002	<0.0002

Table 24 for Precinct 5 shows no guideline exceedances and no potential risk to ecological receptors.

Table 24 Summary of Soil Analytical Results Compared with Ecological Screening Level's – Precinct 5



NEPM Ecological Screening Levels for Soil				BTEX				PAH	TRH			
Bold - Indicates LOR Exceedances X - Indicates Sample has been Excavated Colour Shading - Indicates ESL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x				Benzene	Toluene	Ethylbenzene	Xylenes	Benzo(a)pyrene	F1 (C6 - C10)	F2 (>C10 - C16)	F3 (>C16 - C34)	F4 (>C34 - C40)
Sample ID	Sample Date	Soil Texture Class (fine /coarse)	Land Use	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 0.5	LOR 10	LOR 50	LOR 100	LOR 100
TP1 0.50	27/7/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
TP2 0.50	27/7/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
TP3 0.50	27/7/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
TP3 1.00	27/7/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
TP3 1.50	27/7/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
TP4 0.50	27/7/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
TP4 1.00	27/7/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
TP4 1.50	27/7/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
TP5 0.50	27/7/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
TP5 1.00	27/7/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100

8.4.2 Ecological Investigation Levels

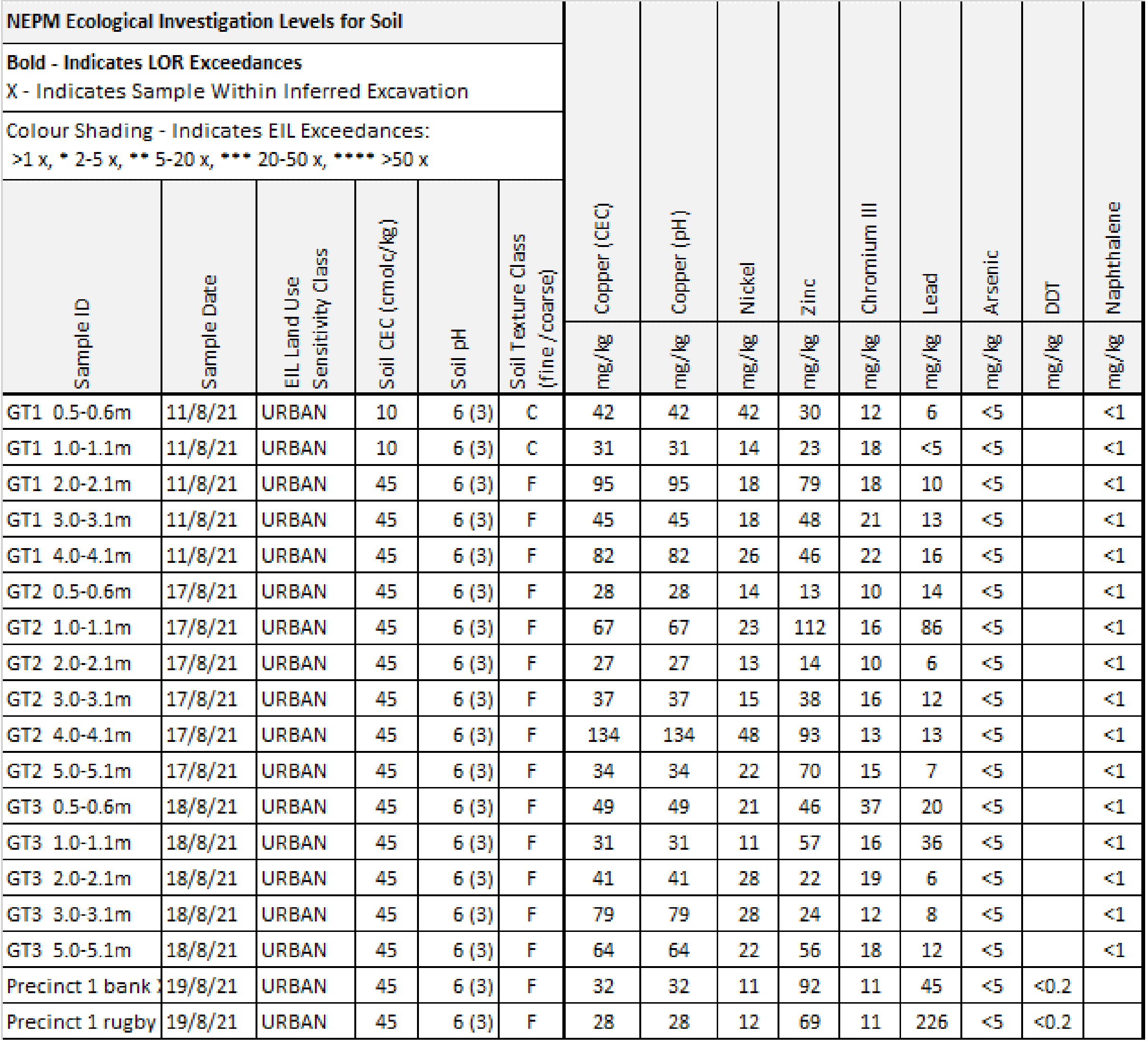
Laboratory analytical results for soil samples are presented in Appendix 8.

Table 25 for Precinct 1 shows no guideline exceedances and no potential risk to ecological receptors.

Table 25 to Table 29 compares soil analytical results against relevant ecological investigation limits (EIL's). Concentrations which exceeded laboratory LOR would be highlighted indicated in bold, and EIL exceedances would be highlighted with a coloured cell.

Table 25 for Precinct 1 shows no guideline exceedances and no potential risk to ecological receptors.

Table 25 Soil Analytical Results Compared Against Ecological Investigation Levels – Precinct 1



NEPM Ecological Investigation Levels for Soil

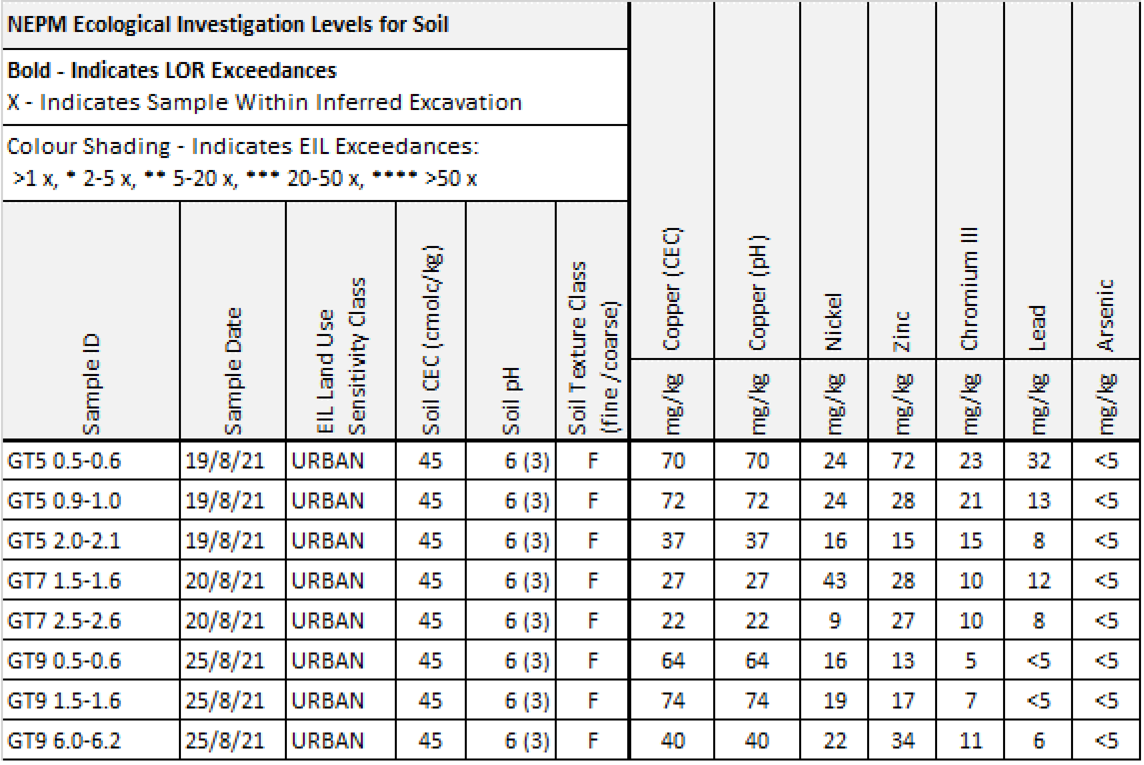
Bold - Indicates LOR Exceedances
X - Indicates Sample Within Inferred Excavation

Colour Shading - Indicates EIL Exceedances:
>1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x

Sample ID	Sample Date	EIL Land Use Sensitivity Class	Soil CEC (cmolc/kg)	Soil pH	Soil Texture Class (fine /coarse)	Copper (CEC)	Copper (pH)	Nickel	Zinc	Chromium III	Lead	Arsenic	DDT	Naphthalene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
GT1 0.5-0.6m	11/8/21	URBAN	10	6 (3)	C	42	42	42	30	12	6	<5		<1
GT1 1.0-1.1m	11/8/21	URBAN	10	6 (3)	C	31	31	14	23	18	<5	<5		<1
GT1 2.0-2.1m	11/8/21	URBAN	45	6 (3)	F	95	95	18	79	18	10	<5		<1
GT1 3.0-3.1m	11/8/21	URBAN	45	6 (3)	F	45	45	18	48	21	13	<5		<1
GT1 4.0-4.1m	11/8/21	URBAN	45	6 (3)	F	82	82	26	46	22	16	<5		<1
GT2 0.5-0.6m	17/8/21	URBAN	45	6 (3)	F	28	28	14	13	10	14	<5		<1
GT2 1.0-1.1m	17/8/21	URBAN	45	6 (3)	F	67	67	23	112	16	86	<5		<1
GT2 2.0-2.1m	17/8/21	URBAN	45	6 (3)	F	27	27	13	14	10	6	<5		<1
GT2 3.0-3.1m	17/8/21	URBAN	45	6 (3)	F	37	37	15	38	16	12	<5		<1
GT2 4.0-4.1m	17/8/21	URBAN	45	6 (3)	F	134	134	48	93	13	13	<5		<1
GT2 5.0-5.1m	17/8/21	URBAN	45	6 (3)	F	34	34	22	70	15	7	<5		<1
GT3 0.5-0.6m	18/8/21	URBAN	45	6 (3)	F	49	49	21	46	37	20	<5		<1
GT3 1.0-1.1m	18/8/21	URBAN	45	6 (3)	F	31	31	11	57	16	36	<5		<1
GT3 2.0-2.1m	18/8/21	URBAN	45	6 (3)	F	41	41	28	22	19	6	<5		<1
GT3 3.0-3.1m	18/8/21	URBAN	45	6 (3)	F	79	79	28	24	12	8	<5		<1
GT3 5.0-5.1m	18/8/21	URBAN	45	6 (3)	F	64	64	22	56	18	12	<5		<1
Precinct 1 bank	19/8/21	URBAN	45	6 (3)	F	32	32	11	92	11	45	<5	<0.2	
Precinct 1 rugby	19/8/21	URBAN	45	6 (3)	F	28	28	12	69	11	226	<5	<0.2	

Table 26 for Precinct 2 shows no guideline exceedances and no potential risk to ecological receptors.

Table 26 Soil Analytical Results Compared Against Ecological Investigation Levels – Precinct 2



NEPM Ecological Investigation Levels for Soil

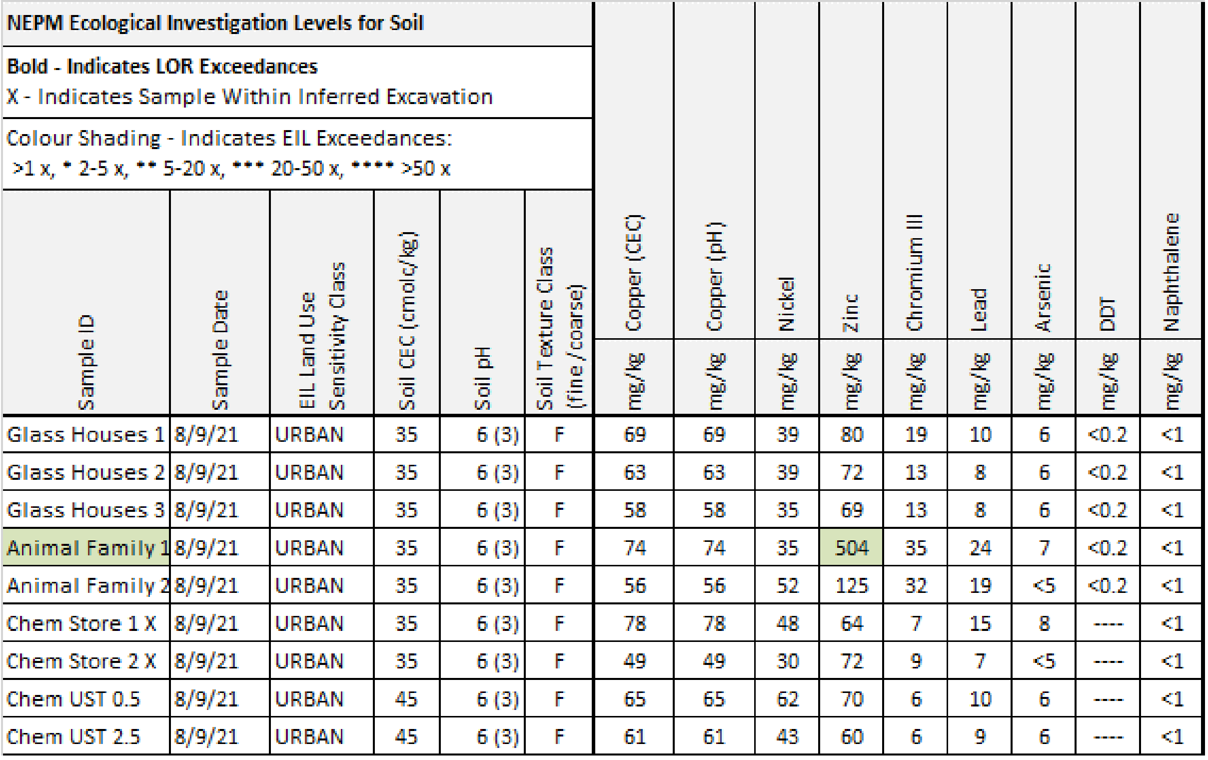
Bold - Indicates LOR Exceedances
X - Indicates Sample Within Inferred Excavation

Colour Shading - Indicates EIL Exceedances:
>1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x

Sample ID	Sample Date	EIL Land Use Sensitivity Class	Soil CEC (cmolc/kg)	Soil pH	Soil Texture Class (fine /coarse)	Copper (CEC) mg/kg	Copper (pH) mg/kg	Nickel mg/kg	Zinc mg/kg	Chromium III mg/kg	Lead mg/kg	Arsenic mg/kg
GT5 0.5-0.6	19/8/21	URBAN	45	6 (3)	F	70	70	24	72	23	32	<5
GT5 0.9-1.0	19/8/21	URBAN	45	6 (3)	F	72	72	24	28	21	13	<5
GT5 2.0-2.1	19/8/21	URBAN	45	6 (3)	F	37	37	16	15	15	8	<5
GT7 1.5-1.6	20/8/21	URBAN	45	6 (3)	F	27	27	43	28	10	12	<5
GT7 2.5-2.6	20/8/21	URBAN	45	6 (3)	F	22	22	9	27	10	8	<5
GT9 0.5-0.6	25/8/21	URBAN	45	6 (3)	F	64	64	16	13	5	<5	<5
GT9 1.5-1.6	25/8/21	URBAN	45	6 (3)	F	74	74	19	17	7	<5	<5
GT9 6.0-6.2	25/8/21	URBAN	45	6 (3)	F	40	40	22	34	11	6	<5

Table 27 for Precinct 2 & 3 shows guideline exceedances for zinc in shallow soils in a storage area beneath the old animals facility with a potential risk to ecological receptors identified is soil is disturbed.

Table 27 Soil Analytical Results Compared Against Ecological Investigation Levels – Precinct 2 & 3



NEPM Ecological Investigation Levels for Soil

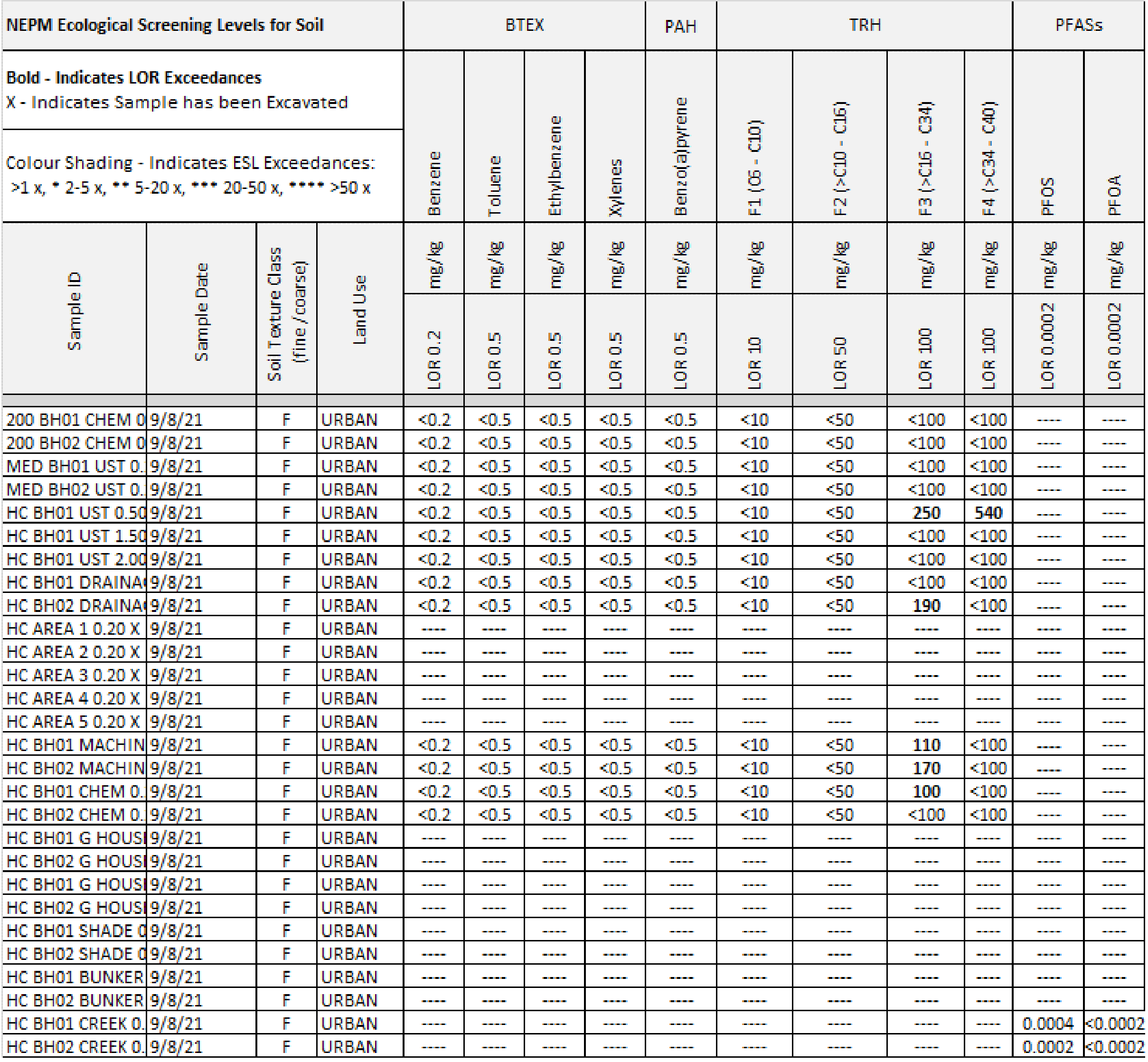
Bold - Indicates LOR Exceedances
X - Indicates Sample Within Inferred Excavation

Colour Shading - Indicates EIL Exceedances:
>1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x

Sample ID	Sample Date	EIL Land Use Sensitivity Class	Soil CEC (cmolc/kg)	Soil pH	Soil Texture Class (fine /coarse)	Copper (CEC) mg/kg	Copper (pH) mg/kg	Nickel mg/kg	Zinc mg/kg	Chromium III mg/kg	Lead mg/kg	Arsenic mg/kg	DDT mg/kg	Naphthalene mg/kg
Glass Houses 1	8/9/21	URBAN	35	6 (3)	F	69	69	39	80	19	10	6	<0.2	<1
Glass Houses 2	8/9/21	URBAN	35	6 (3)	F	63	63	39	72	13	8	6	<0.2	<1
Glass Houses 3	8/9/21	URBAN	35	6 (3)	F	58	58	35	69	13	8	6	<0.2	<1
Animal Family 1	8/9/21	URBAN	35	6 (3)	F	74	74	35	504	35	24	7	<0.2	<1
Animal Family 2	8/9/21	URBAN	35	6 (3)	F	56	56	52	125	32	19	<5	<0.2	<1
Chem Store 1 X	8/9/21	URBAN	35	6 (3)	F	78	78	48	64	7	15	8	----	<1
Chem Store 2 X	8/9/21	URBAN	35	6 (3)	F	49	49	30	72	9	7	<5	----	<1
Chem UST 0.5	8/9/21	URBAN	45	6 (3)	F	65	65	62	70	6	10	6	----	<1
Chem UST 2.5	8/9/21	URBAN	45	6 (3)	F	61	61	43	60	6	9	6	----	<1

Table 28 for Precinct 3 shows no guideline exceedances and no potential risk to ecological receptors.

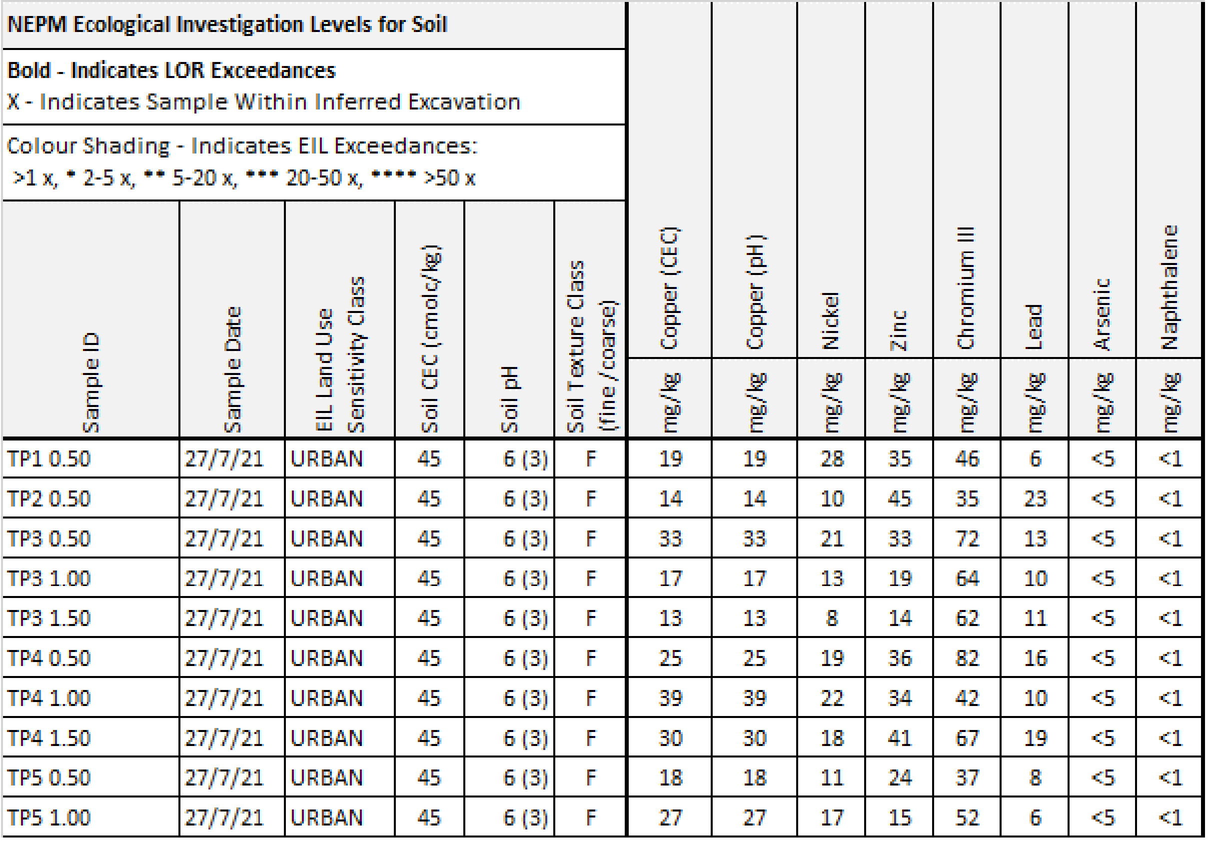
Table 28 Soil Analytical Results Compared Against Ecological Investigation Levels – Precinct 3



NEPM Ecological Screening Levels for Soil				BTEX				PAH	TRH				PFASs	
Bold - Indicates LOR Exceedances X - Indicates Sample has been Excavated Colour Shading - Indicates ESL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x				Benzene	Toluene	Ethylbenzene	Xylenes	Benzo(a)pyrene	F1 (C6 - C10)	F2 (>C10 - C16)	F3 (>C16 - C34)	F4 (>C34 - C40)	PFOS	PFOA
Sample ID	Sample Date	Soil Texture Class (fine / coarse)	Land Use	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 0.5	LOR 10	LOR 50	LOR 100	LOR 100	LOR 0.0002	LOR 0.0002
200 BH01 CHEM 0	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
200 BH02 CHEM 0	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
MED BH01 UST 0.	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
MED BH02 UST 0.	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
HC BH01 UST 0.50	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**250**	**540**	----	----
HC BH01 UST 1.50	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
HC BH01 UST 2.00	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
HC BH01 DRAINA	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
HC BH02 DRAINA	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**190**	<100	----	----
HC AREA 1 0.20 X	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC AREA 2 0.20 X	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC AREA 3 0.20 X	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC AREA 4 0.20 X	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC AREA 5 0.20 X	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH01 MACHIN	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**110**	<100	----	----
HC BH02 MACHIN	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**170**	<100	----	----
HC BH01 CHEM 0.	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**100**	<100	----	----
HC BH02 CHEM 0.	9/8/21	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100	----	----
HC BH01 G HOUS	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH02 G HOUS	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH01 G HOUS	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH02 G HOUS	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH01 SHADE 0	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH02 SHADE 0	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH01 BUNKER	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH02 BUNKER	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	----	----
HC BH01 CREEK 0.	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	0.0004	<0.0002
HC BH02 CREEK 0.	9/8/21	F	URBAN	----	----	----	----	----	----	----	----	----	0.0002	<0.0002

Table 29 for Precinct 5 shows no guideline exceedances and no potential risk to ecological receptors.

Table 29 Soil Analytical Results Compared Against Ecological Investigation Levels – Precinct 5



NEPM Ecological Investigation Levels for Soil

Bold - Indicates LOR Exceedances
X - Indicates Sample Within Inferred Excavation

Colour Shading - Indicates EIL Exceedances:
>1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x

Sample ID	Sample Date	EIL Land Use Sensitivity Class	Soil CEC (cmolc/kg)	Soil pH	Soil Texture Class (fine / coarse)	Copper (CEC)	Copper (pH)	Nickel	Zinc	Chromium III	Lead	Arsenic	Naphthalene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
TP1 0.50	27/7/21	URBAN	45	6 (3)	F	19	19	28	35	46	6	<5	<1
TP2 0.50	27/7/21	URBAN	45	6 (3)	F	14	14	10	45	35	23	<5	<1
TP3 0.50	27/7/21	URBAN	45	6 (3)	F	33	33	21	33	72	13	<5	<1
TP3 1.00	27/7/21	URBAN	45	6 (3)	F	17	17	13	19	64	10	<5	<1
TP3 1.50	27/7/21	URBAN	45	6 (3)	F	13	13	8	14	62	11	<5	<1
TP4 0.50	27/7/21	URBAN	45	6 (3)	F	25	25	19	36	82	16	<5	<1
TP4 1.00	27/7/21	URBAN	45	6 (3)	F	39	39	22	34	42	10	<5	<1
TP4 1.50	27/7/21	URBAN	45	6 (3)	F	30	30	18	41	67	19	<5	<1
TP5 0.50	27/7/21	URBAN	45	6 (3)	F	18	18	11	24	37	8	<5	<1
TP5 1.00	27/7/21	URBAN	45	6 (3)	F	27	27	17	15	52	6	<5	<1

8.4.3 Summary of Ecological Investigation and Screening Level Results

Laboratory analytical results for soil samples taken across the Precincts show very little soil impact from contaminants above NEPM ecological guidelines for urban land. Shallow soil impact with common urban contaminants such as Benzo(a)pyrene from combustion products, heavy chain F2 TRH from surface oil spills, and zinc from rusting galvanised steel was found in a very small number of samples. It is likely that such shallow soil impacts may occur over a wider area on the Site where there is localised storage of equipment and machinery and historical fill. The Levels encountered suggest low Level impacts may be present, and future soil and water management plans (SWMP) and construction management plans (CMP) must ensure adequate soil and water controls are in place for all excavations. Further targeted soil sampling is also recommended in areas of potential contamination once more formal development plans have been formulated for the Site.

9 SOIL HUMAN HEALTH DIRECT CONTACT ASSESSMENT

9.1 Guidelines

Guidelines presented herein are based on potential exposure of human receptors to soil impact which may include:

- Trench workers repairing or building services (typically to 1 m bgs). This classification is not dependent on the land use class.
- OnSite inhabitants which may be exposed to potential shallow soil impact in non-paved areas of the Site; and
- OnSite excavation works which may include potential swimming pools (up to 3 m bgs); basement carparks; and deep foundations.

9.1.1 Land Use Classification

The NEPM (2013) guidelines have been referenced to ensure that the correct land use and density category has been adopted for the Site and the surrounding properties (where applicable). As per NEPM (2013) guidelines, the adopted land use class is dependent on the building density and the opportunity for soil access by Site occupants (exposure to potentially impacted soil). Aspects needing to be considered include:

- Whether the Site is of sensitive land use such as a residential with gardens, or commercial sensitive use such as a childcare centre, in which case land use Class A is applicable;
- The percentage of paved area to determine direct contact exposure risk and therefore classification as low or high density; and
- Classification based on residential, recreational or commercial/industrial setting.

9.1.2 Adopted Land Use Classification

The adopted land use class is presented in Table 30. Land use class is based on the opportunity for soil access as per NEPM ASC 2013 guidelines. Soil access is anticipated to include future construction workers during Site redevelopment, future commercial workers, future users of public open space, and future trench workers conducting routine maintenance.

Table 30 Summary of Land Use Setting and Density for Determining Exposure Risk

Soil Bores	Construction Phase	Location	Land Use	Pathway	Land Use Class
All soil	During	Site	Construction worker and trench workers	ALL	D and trench worker specific
		OffSite	Nearby commercial land users	DI	D
	Post	Site	Future trench workers	ALL	D and trench worker specific
			Future commercial workers	ALL	D
			Future potential recreational land users	ALL	C
			Future potential residential land users	ALL	A - Possible future residential land use

DC – Dermal Contact - Trench Worker Guidelines (CRC CARE 2013)
DI – Dust Inhalation - HIL Guidelines (NEPM ASC 2013)
SI – Soil Ingestion - HIL Guidelines (NEPM ASC 2013)
ALL – All of above

9.1.3 Health Investigation & Screening Levels

The main exposure pathways and methods for assessing heath risk from contaminated soils are presented in Table 31.

Table 31 Summary of Exposure Pathways and Preliminary (Tier 1) Methods for Assessing Human Exposure Risk

Exposure Scenario	**Contaminant Type**	**Tier 1 Assessment Method**	**Reference**
Vapour Inhalation – Indoor (PVI)	Petroleum Hydrocarbons	HSL's (addressed in PVI sections)	NEPM ASC (2013)
Vapour Inhalation – Trench (PVI)			CRC CARE (Friebel & Nadebaum, 2011)
Dermal Contact		HSL's	
Dust Inhalation	Lead, PAH's	Health Investigation Levels (HIL's)	NEPM ASC (2013)
Soil Ingestion			

PVI – Petroleum Vapour Intrusion

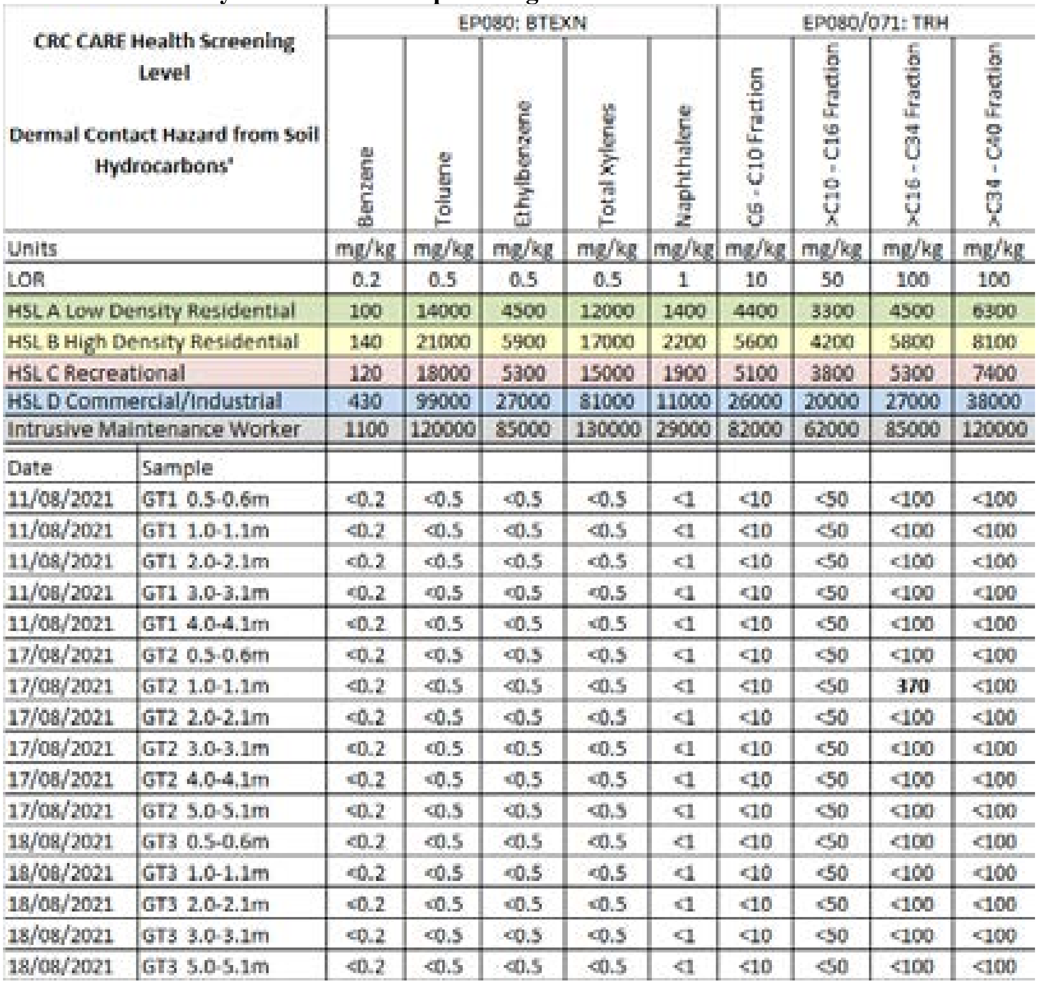
9.2 Findings

9.2.1 Dermal Contact - Petroleum Hydrocarbons

Laboratory analytical results for soil samples are presented in Appendix 8. Table 32 to Table 35 present soil hydrocarbon analytical results compared against CRC CARE (Friebel & Nadebaum, 2011) Health Screening Levels (HSL) guidelines for assessing dermal contact risk. Concentrations which exceeded laboratory LOR are highlighted in bold, and any HSL exceedances would be highlighted with a coloured cell indicating the highest HSL land used class which is exceeded.

Table 32 for Precinct 1 shows no guideline exceedances and therefore no risk identified.

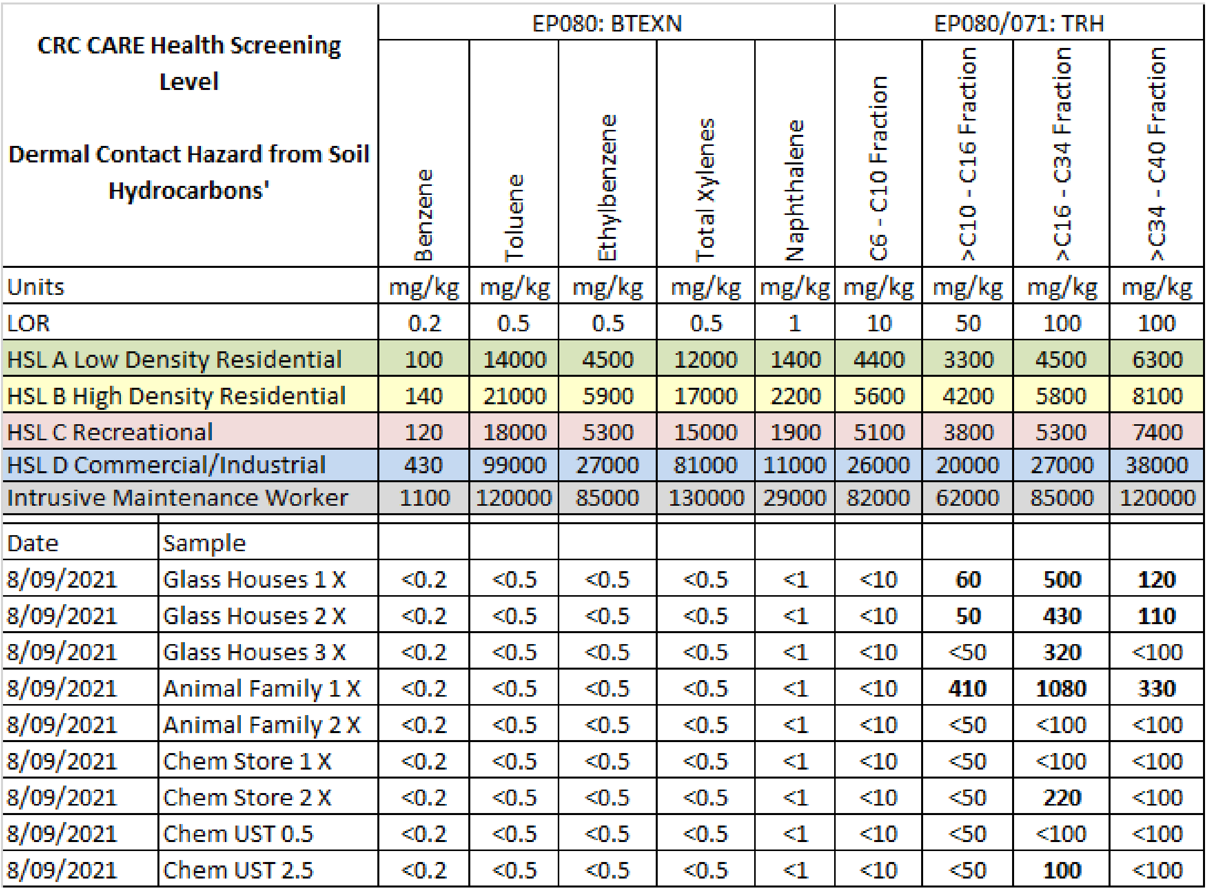
Table 32 Soil Analytical Results Compared Against CRC CARE Guidelines for Dermal Contact -Precinct 1



CRC CARE Health Screening Level **Dermal Contact Hazard from Soil Hydrocarbons'**		EP080: BTEXN					EP080/071: TRH			
		Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		0.2	0.5	0.5	0.5	1	10	50	100	100
HSL A Low Density Residential		100	14000	4500	12000	1400	4400	3300	4500	6300
HSL B High Density Residential		140	21000	5900	17000	2200	5600	4200	5800	8100
HSL C Recreational		120	18000	5300	15000	1900	5100	3800	5300	7400
HSL D Commercial/Industrial		430	99000	27000	81000	11000	26000	20000	27000	38000
Intrusive Maintenance Worker		1100	120000	85000	130000	29000	82000	62000	85000	120000
Date	Sample									
11/08/2021	GT1 0.5-0.6m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
11/08/2021	GT1 1.0-1.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
11/08/2021	GT1 2.0-2.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
11/08/2021	GT1 3.0-3.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
11/08/2021	GT1 4.0-4.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/08/2021	GT2 0.5-0.6m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/08/2021	GT2 1.0-1.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**370**	<100
17/08/2021	GT2 2.0-2.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/08/2021	GT2 3.0-3.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/08/2021	GT2 4.0-4.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
17/08/2021	GT2 5.0-5.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
18/08/2021	GT3 0.5-0.6m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
18/08/2021	GT3 1.0-1.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
18/08/2021	GT3 2.0-2.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
18/08/2021	GT3 3.0-3.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
18/08/2021	GT3 5.0-5.1m	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100

Table 33 for Precinct 2 & 3 shows no guideline exceedances and therefore no risk identified.

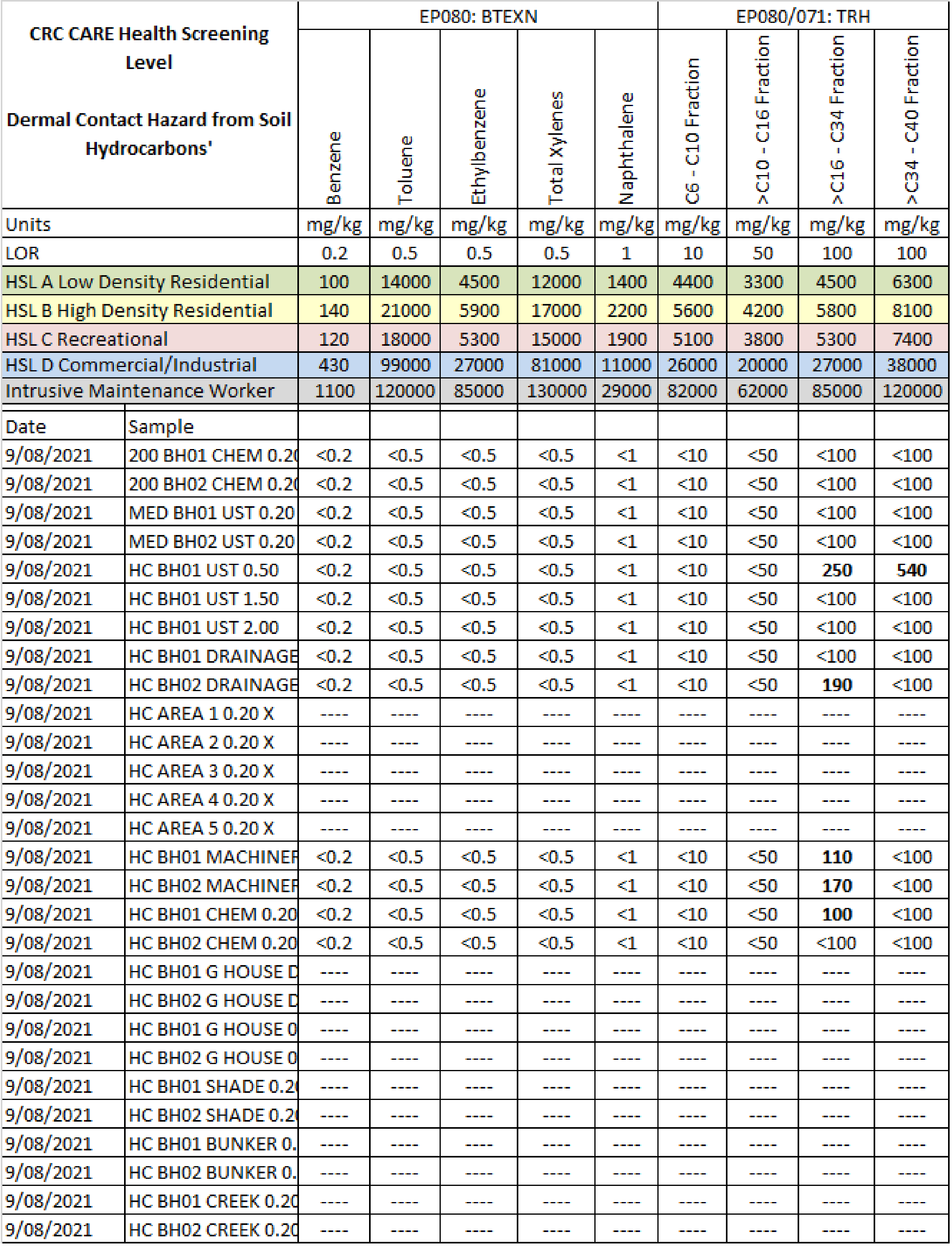
Table 33 Soil Analytical Results Compared Against CRC CARE Guidelines for Dermal Contact – Precinct 2&3



CRC CARE Health Screening Level **Dermal Contact Hazard from Soil Hydrocarbons'**		EP080: BTEXN					EP080/071: TRH			
		Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		0.2	0.5	0.5	0.5	1	10	50	100	100
HSL A Low Density Residential		100	14000	4500	12000	1400	4400	3300	4500	6300
HSL B High Density Residential		140	21000	5900	17000	2200	5600	4200	5800	8100
HSL C Recreational		120	18000	5300	15000	1900	5100	3800	5300	7400
HSL D Commercial/Industrial		430	99000	27000	81000	11000	26000	20000	27000	38000
Intrusive Maintenance Worker		1100	120000	85000	130000	29000	82000	62000	85000	120000
Date	Sample									
8/09/2021	Glass Houses 1 X	<0.2	<0.5	<0.5	<0.5	<1	<10	**60**	**500**	**120**
8/09/2021	Glass Houses 2 X	<0.2	<0.5	<0.5	<0.5	<1	<10	**50**	**430**	**110**
8/09/2021	Glass Houses 3 X	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**320**	<100
8/09/2021	Animal Family 1 X	<0.2	<0.5	<0.5	<0.5	<1	<10	**410**	**1080**	**330**
8/09/2021	Animal Family 2 X	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
8/09/2021	Chem Store 1 X	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
8/09/2021	Chem Store 2 X	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**220**	<100
8/09/2021	Chem UST 0.5	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
8/09/2021	Chem UST 2.5	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**100**	<100

Table 34 for Precinct 3 shows no guideline exceedances and therefore no risk identified.

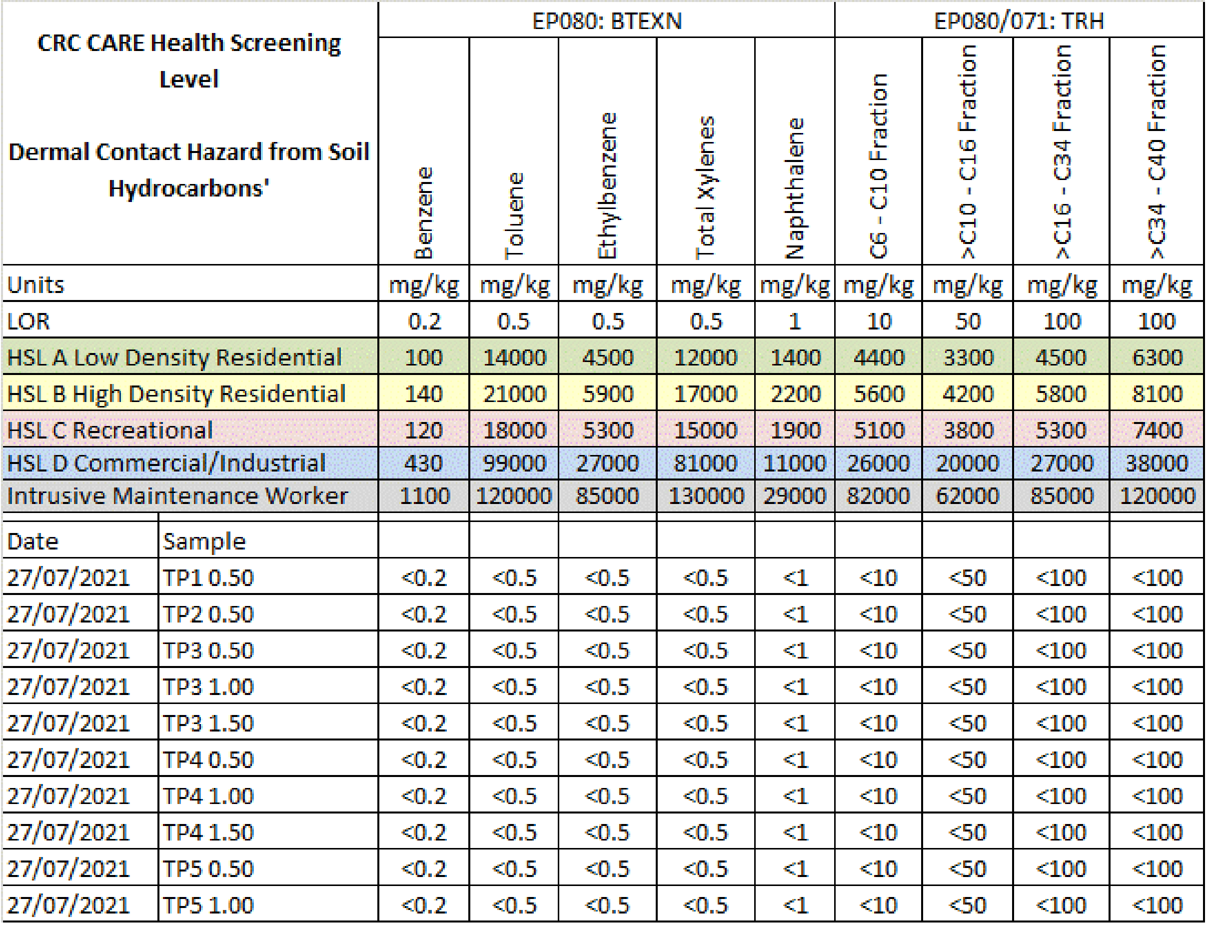
Table 34 Soil Analytical Results Compared Against CRC CARE Guidelines for Dermal Contact -Precinct 3



CRC CARE Health Screening Level Dermal Contact Hazard from Soil Hydrocarbons'		EP080: BTEXN					EP080/071: TRH			
		Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		0.2	0.5	0.5	0.5	1	10	50	100	100
HSL A Low Density Residential		100	14000	4500	12000	1400	4400	3300	4500	6300
HSL B High Density Residential		140	21000	5900	17000	2200	5600	4200	5800	8100
HSL C Recreational		120	18000	5300	15000	1900	5100	3800	5300	7400
HSL D Commercial/Industrial		430	99000	27000	81000	11000	26000	20000	27000	38000
Intrusive Maintenance Worker		1100	120000	85000	130000	29000	82000	62000	85000	120000
Date	Sample									
9/08/2021	200 BH01 CHEM 0.2	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
9/08/2021	200 BH02 CHEM 0.2	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
9/08/2021	MED BH01 UST 0.20	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
9/08/2021	MED BH02 UST 0.20	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
9/08/2021	HC BH01 UST 0.50	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**250**	**540**
9/08/2021	HC BH01 UST 1.50	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
9/08/2021	HC BH01 UST 2.00	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
9/08/2021	HC BH01 DRAINAGE	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
9/08/2021	HC BH02 DRAINAGE	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**190**	<100
9/08/2021	HC AREA 1 0.20 X	----	----	----	----	----	----	----	----	----
9/08/2021	HC AREA 2 0.20 X	----	----	----	----	----	----	----	----	----
9/08/2021	HC AREA 3 0.20 X	----	----	----	----	----	----	----	----	----
9/08/2021	HC AREA 4 0.20 X	----	----	----	----	----	----	----	----	----
9/08/2021	HC AREA 5 0.20 X	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 MACHINE	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**110**	<100
9/08/2021	HC BH02 MACHINE	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**170**	<100
9/08/2021	HC BH01 CHEM 0.20	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**100**	<100
9/08/2021	HC BH02 CHEM 0.20	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
9/08/2021	HC BH01 G HOUSE D	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 G HOUSE D	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 G HOUSE 0	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 G HOUSE 0	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 SHADE 0.2	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 SHADE 0.2	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 BUNKER 0.	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 BUNKER 0.	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 CREEK 0.2	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 CREEK 0.2	----	----	----	----	----	----	----	----	----

Table 35 for Precinct 5 shows no guideline exceedances and therefore no risk identified.

Table 35 Soil Analytical Results Compared Against CRC CARE Guidelines for Dermal Contact – Precinct 5



CRC CARE Health Screening Level Dermal Contact Hazard from Soil Hydrocarbons'		EP080: BTEXN					EP080/071: TRH			
		Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		0.2	0.5	0.5	0.5	1	10	50	100	100
HSL A Low Density Residential		100	14000	4500	12000	1400	4400	3300	4500	6300
HSL B High Density Residential		140	21000	5900	17000	2200	5600	4200	5800	8100
HSL C Recreational		120	18000	5300	15000	1900	5100	3800	5300	7400
HSL D Commercial/Industrial		430	99000	27000	81000	11000	26000	20000	27000	38000
Intrusive Maintenance Worker		1100	120000	85000	130000	29000	82000	62000	85000	120000
Date	Sample									
27/07/2021	TP1 0.50	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
27/07/2021	TP2 0.50	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
27/07/2021	TP3 0.50	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
27/07/2021	TP3 1.00	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
27/07/2021	TP3 1.50	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
27/07/2021	TP4 0.50	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
27/07/2021	TP4 1.00	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
27/07/2021	TP4 1.50	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
27/07/2021	TP5 0.50	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
27/07/2021	TP5 1.00	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100

9.2.2 Dust Inhalation & Soil Ingestion

Combined dust inhalation and soil ingestion risk is assessed through the application of NEPM (2013) Health Investigation Levels (HILs) for exposure to soil contaminants.

Laboratory analytical results for soil samples are presented in Appendix 8. Soil analytical results are compared against the HILs presented in Table 36 to Table 42. Concentrations which exceeded laboratory LOR would be highlighted in bold except for metals, and HIL exceedances would be highlighted with a coloured cell indicating the highest HIL land used class which is exceeded.

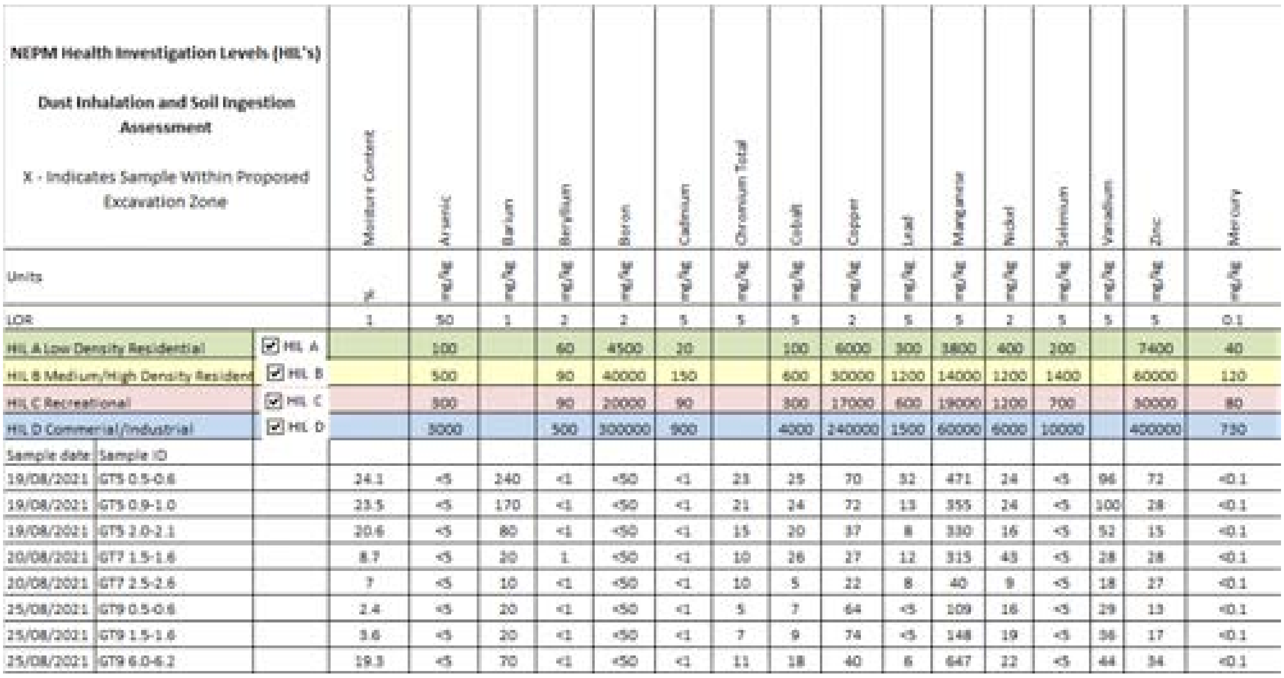
There was a single exceedance of the HIL guidelines (residential and recreational) for dust inhalation and soil ingestion in shallow soils/fill in Precinct 1 (GT2 1.1m) for Benzo(a)pyrene. The SWMP and/or CMP for any earthworks in this area of the Site will require adequate dust suppression measures.

Table 36 Soil Analytical Results Compared Against NEPM (2013) Health Investigation Limit Guidelines – Precinct 1

NEPM Health Investigation Levels (HIL's) **Dust Inhalation and Soil Ingestion Assessment** X - Indicates Sample Within Proposed Excavation Zone			Moisture Content	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Mercury	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	PAHs	Benzo(a)pyrene TEQ (WHO)
Units			%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			1	50	1	2	2	5	5	5	2	5	5	2	5	5	5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
HIL A Low Density Residential		☑ HIL A		100		60	4500	20		100	6000	300	3800	400	200		7400	40																	300	3
HIL B Medium/High Density Resident		☑ HIL B		500		90	40000	150		600	30000	1200	14000	1200	1400		60000	120																	400	4
HIL C Recreational		☑ HIL C		300		90	20000	90		300	17000	600	19000	1200	700		30000	80																	300	3
HIL D Commerial/Industrial		☑ HIL D		3000		500	300000	900		4000	240000	1500	60000	6000	10000		400000	730																	4000	40
HIDE ROW		D		3000		500	300000	900		4000	240000	1500	60000	6000	10000			730																	4000	40
Sample date:	Sample ID																																			
11/08/2021	GT1 0.5-0.6m		19	<5	90	<1	<50	<1	12	40	42	6	744	42	<5	260	30	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
11/08/2021	GT1 1.0-1.1m		19.1	<5	20	<1	<50	<1	18	10	31	<5	115	14	<5	104	23	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
11/08/2021	GT1 2.0-2.1m		28.2	<5	40	1	<50	<1	18	15	95	10	258	18	<5	122	79	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
11/08/2021	GT1 3.0-3.1m		35.8	<5	20	<1	<50	<1	21	12	45	13	229	18	<5	49	48	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
11/08/2021	GT1 4.0-4.1m		36.1	<5	40	<1	<50	<1	22	43	82	16	519	26	<5	83	46	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/08/2021	GT2 0.5-0.6m		8.5	<5	140	<1	<50	<1	10	20	28	14	118	14	<5	193	13	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/08/2021	GT2 1.0-1.1m		19	<5	150	<1	<50	<1	16	22	67	86	290	23	<5	86	112	<0.1	<0.5	<0.5	<0.5	<0.5	3.6	1.0	8.3	9.4	4.6	5.1	5.2	4.7	6.2	3.2	1.3	4.1	**57**	**9.4**
17/08/2021	GT2 2.0-2.1m		17.9	<5	70	<1	<50	<1	10	15	27	6	138	13	<5	132	14	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/08/2021	GT2 3.0-3.1m		33.2	<5	60	<1	<50	<1	16	36	37	12	548	15	<5	49	38	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/08/2021	GT2 4.0-4.1m		38	<5	100	1	<50	<1	13	38	134	13	649	48	<5	214	93	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
17/08/2021	GT2 5.0-5.1m		25.4	<5	10	<1	<50	<1	15	14	34	7	252	22	<5	185	70	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
18/08/2021	GT3 0.5-0.6m		24.9	<5	110	<1	<50	<1	37	16	49	20	369	21	<5	159	46	<0.1	<0.5	<0.5	<0.5	<0.5	1.4	<0.5	3.0	3.6	1.8	2.0	1.4	1.5	1.8	0.7	<0.5	1.0	**18**	**2.4**
18/08/2021	GT3 1.0-1.1m		20.4	<5	70	<1	<50	<1	16	9	31	36	135	11	<5	109	57	<0.1	<0.5	<0.5	<0.5	<0.5	1.0	<0.5	2.3	2.7	1.3	1.6	1.2	1.2	1.3	<0.5	<0.5	0.7	**13**	**1.7**
18/08/2021	GT3 2.0-2.1m		24.9	<5	120	<1	<50	<1	19	34	41	6	271	28	<5	135	22	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
18/08/2021	GT3 3.0-3.1m		23.9	<5	20	<1	<50	<1	12	26	79	8	415	28	<5	230	24	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
18/08/2021	GT3 5.0-5.1m		32.9	<5	10	<1	<50	<1	18	16	64	12	58	22	<5	56	56	0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
19/08/2021	Precinct 1 bank X		16	<5	80	<1	<50	<1	11	17	32	45	317	11	<5	67	92	<0.1																		
19/08/2021	Precinct 1 rugby X		16.7	<5	80	<1	<50	<1	11	14	28	226	212	12	<5	64	69	<0.1																		

Table 37 for Precinct 2 shows no guideline exceedances and therefore no risk identified.

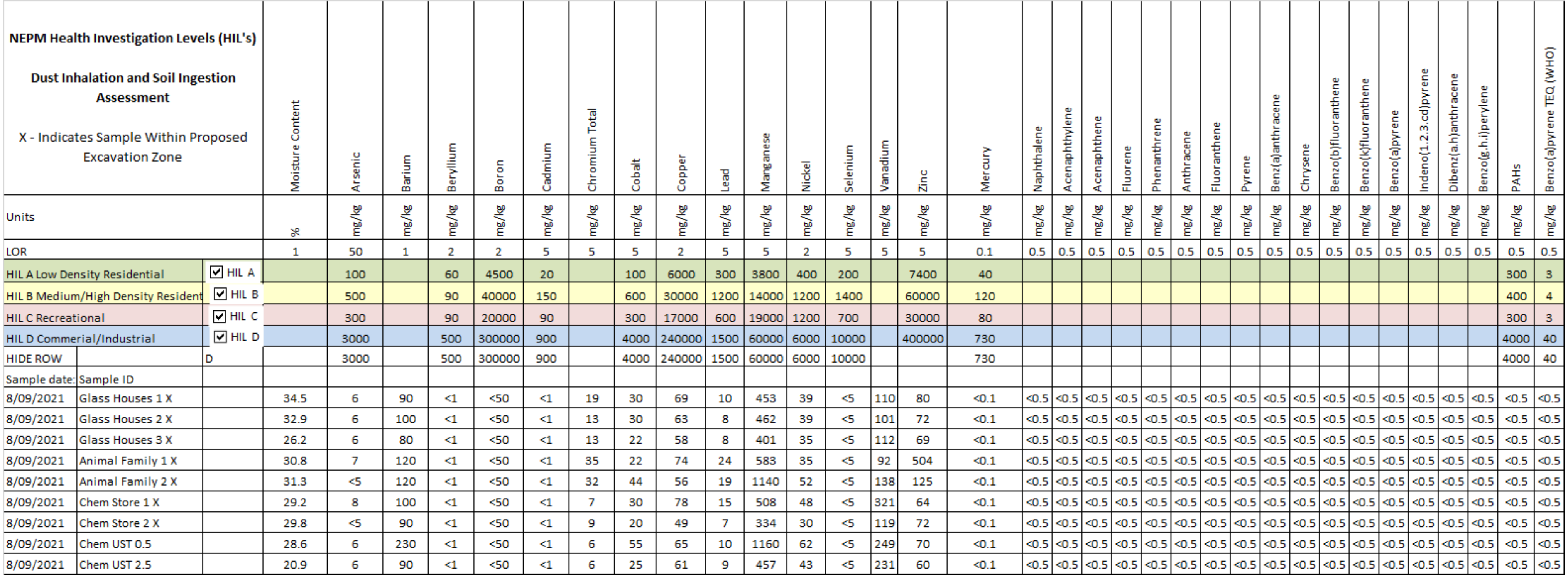
Table 37 Soil Analytical Results Compared Against NEPM (2013) Health Investigation Limit Guidelines – Precinct 2



NEPM Health Investigation Levels (HIL's) Dust Inhalation and Soil Ingestion Assessment X - Indicates Sample Within Proposed Excavation Zone			Moisture Content	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Mercury
Units			%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			1	50	1	2	2	5	5	5	2	5	5	2	5	5	5	0.1
HIL A Low Density Residential		☑ HIL A		100		60	4500	20		100	6000	300	3800	400	200		7400	40
HIL B Medium/High Density Resident		☑ HIL B		500		90	40000	150		600	30000	1200	14000	1200	1400		60000	120
HIL C Recreational		☑ HIL C		300		90	20000	90		300	17000	600	19000	1200	700		30000	80
HIL D Commerial/Industrial		☑ HIL D		3000		500	300000	900		4000	240000	1500	60000	6000	10000		400000	730
Sample date	Sample ID																	
19/08/2021	GT5 0.5-0.6		24.1	<5	240	<1	<50	<1	23	25	70	32	471	24	<5	96	72	<0.1
19/08/2021	GT5 0.9-1.0		23.5	<5	170	<1	<50	<1	21	24	72	13	355	24	<5	100	28	<0.1
19/08/2021	GT5 2.0-2.1		20.6	<5	80	<1	<50	<1	15	20	37	8	330	16	<5	52	15	<0.1
20/08/2021	GT7 1.5-1.6		8.7	<5	20	1	<50	<1	10	26	27	12	315	43	<5	28	28	<0.1
20/08/2021	GT7 2.5-2.6		7	<5	10	<1	<50	<1	10	5	22	8	40	9	<5	18	27	<0.1
25/08/2021	GT9 0.5-0.6		2.4	<5	20	<1	<50	<1	5	7	64	<5	109	16	<5	29	13	<0.1
25/08/2021	GT9 1.5-1.6		3.6	<5	20	<1	<50	<1	7	9	74	<5	148	19	<5	36	17	<0.1
25/08/2021	GT9 6.0-6.2		19.3	<5	70	<1	<50	<1	11	18	40	6	647	22	<5	44	34	<0.1

Table 38 for Precinct 2&3 shows no guideline exceedances and therefore no risk identified.

Table 38 Soil Analytical Results Compared Against NEPM (2013) Health Investigation Limit Guidelines – Precinct 2&3



NEPM Health Investigation Levels (HIL's) **Dust Inhalation and Soil Ingestion Assessment** X - Indicates Sample Within Proposed Excavation Zone			Moisture Content	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Mercury	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	PAHs	Benzo(a)pyrene TEQ (WHO)
Units			%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			1	50	1	2	2	5	5	5	2	5	5	2	5	5	5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
HIL A Low Density Residential		☑ HIL A		100		60	4500	20		100	6000	300	3800	400	200		7400	40																	300	3
HIL B Medium/High Density Resident		☑ HIL B		500		90	40000	150		600	30000	1200	14000	1200	1400		60000	120																	400	4
HIL C Recreational		☑ HIL C		300		90	20000	90		300	17000	600	19000	1200	700		30000	80																	300	3
HIL D Commerial/Industrial		☑ HIL D		3000		500	300000	900		4000	240000	1500	60000	6000	10000		400000	730																	4000	40
HIDE ROW		D		3000		500	300000	900		4000	240000	1500	60000	6000	10000			730																	4000	40
Sample date:	Sample ID																																			
8/09/2021	Glass Houses 1 X		34.5	6	90	<1	<50	<1	19	30	69	10	453	39	<5	110	80	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
8/09/2021	Glass Houses 2 X		32.9	6	100	<1	<50	<1	13	30	63	8	462	39	<5	101	72	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
8/09/2021	Glass Houses 3 X		26.2	6	80	<1	<50	<1	13	22	58	8	401	35	<5	112	69	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
8/09/2021	Animal Family 1 X		30.8	7	120	<1	<50	<1	35	22	74	24	583	35	<5	92	504	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
8/09/2021	Animal Family 2 X		31.3	<5	120	<1	<50	<1	32	44	56	19	1140	52	<5	138	125	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
8/09/2021	Chem Store 1 X		29.2	8	100	<1	<50	<1	7	30	78	15	508	48	<5	321	64	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
8/09/2021	Chem Store 2 X		29.8	<5	90	<1	<50	<1	9	20	49	7	334	30	<5	119	72	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
8/09/2021	Chem UST 0.5		28.6	6	230	<1	<50	<1	6	55	65	10	1160	62	<5	249	70	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
8/09/2021	Chem UST 2.5		20.9	6	90	<1	<50	<1	6	25	61	9	457	43	<5	231	60	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

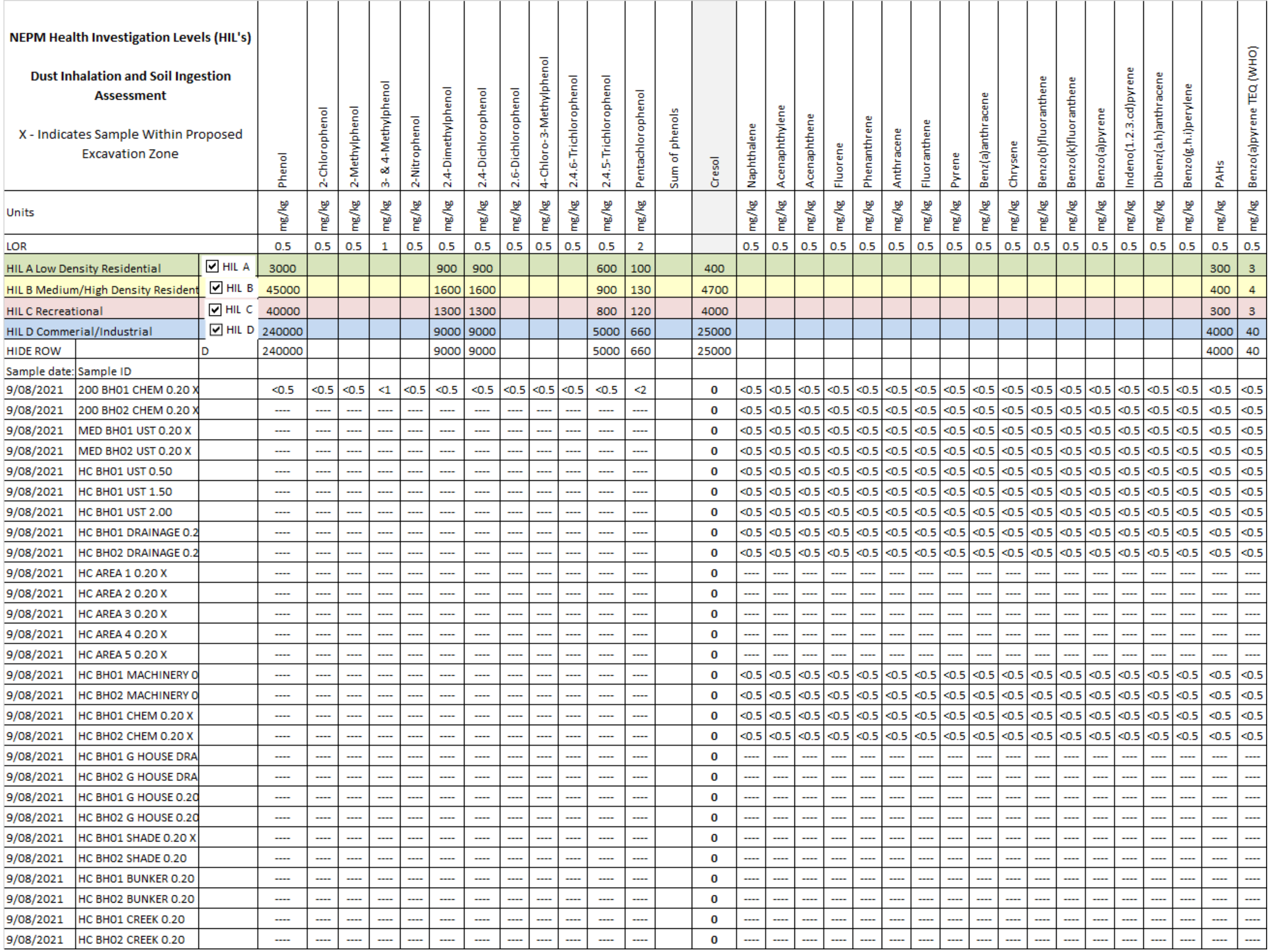
Table 39 for Precinct 2&3 for pesticides shows no guideline exceedances and therefore no risk identified.

Table 39 Soil Analytical Results Compared Against NEPM (2013) Health Investigation Limit Guidelines – Precinct 2&3 pesticides

NEPM Health Investigation Levels (HIL's) Dust Inhalation and Soil Ingestion Assessment X - Indicates Sample Within Proposed Excavation Zone			alpha-BHC	Hexachlorobenzene (HCB)	beta-BHC	gamma-BHC	delta-BHC	Heptachlor	Sum of Aldrin + Dieldrin	Heptachlor epoxide	trans-Chlordane	alpha-Endosulfan	cis-Chlordane	Dieldrin	4.4`-DDE	Endrin	beta-Endosulfan	4.4`-DDD	Endrin aldehyde	Endosulfan (sum)	4.4`-DDT	Endrin ketone	Methoxychlor	Chlordane	DDE DDD DDT	Dichlorvos	Demeton-S-methyl	Monocrotophos	Dimethoate	Diazinon	Chlorpyrifos-methyl	Parathion-methyl	Malathion	Fenthion	Chlorpyrifos	Parathion	Pirimphos-ethyl	Chlorfenvinphos	Bromophos-ethyl	Fenamiphos	Prothiofos	Ethion	Carbophenothion	Azinphos Methyl
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.2	0.05	0.2	0.05	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
HIL A Low Density Residential		☑ HIL A		10				6	6			270		6		10	270			270			300	50	240										160									
HIL B Medium/High Density Resident		☑ HIL B		15				10	10			400		10		20	400			400			500	90	600										340									
HIL C Recreational		☑ HIL C		10				10	10			340		10		20	340			340			400	70	400										250									
HIL D Commerial/Industrial		☑ HIL D		80				50	45			2000		45		100	2000			2000			2500	530	3600										2000									
HIDE ROW		D		80				50	45			2000		45		100	2000			2000			2500	530	3600										2000									
Sample date:	Sample ID																																											
8/09/2021	Glass Houses 1 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
8/09/2021	Glass Houses 2 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
8/09/2021	Glass Houses 3 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
8/09/2021	Animal Family 1 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
8/09/2021	Animal Family 2 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
8/09/2021	Chem Store 1 X		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
8/09/2021	Chem Store 2 X		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
8/09/2021	Chem UST 0.5		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
8/09/2021	Chem UST 2.5		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Table 40 for Precinct 3 shows no guideline exceedances and therefore no risk identified.

Table 40 Soil Analytical Results Compared Against NEPM (2013) Health Investigation Limit Guidelines – Precinct 3



NEPM Health Investigation Levels (HIL's) **Dust Inhalation and Soil Ingestion Assessment** X - Indicates Sample Within Proposed Excavation Zone			Phenol	2-Chlorophenol	2-Methylphenol	3- & 4-Methylphenol	2-Nitrophenol	2.4-Dimethylphenol	2.4-Dichlorophenol	2.6-Dichlorophenol	4-Chloro-3-Methylphenol	2.4.6-Trichlorophenol	2.4.5-Trichlorophenol	Pentachlorophenol	Sum of phenols	Cresol	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	PAHs	Benzo(a)pyrene TEQ (WHO)
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
HIL A Low Density Residential		☑ HIL A	3000					900	900				600	100		400																	300	3
HIL B Medium/High Density Resident		☑ HIL B	45000					1600	1600				900	130		4700																	400	4
HIL C Recreational		☑ HIL C	40000					1300	1300				800	120		4000																	300	3
HIL D Commerial/Industrial		☑ HIL D	240000					9000	9000				5000	660		25000																	4000	40
HIDE ROW		D	240000					9000	9000				5000	660		25000																	4000	40
Sample date:	Sample ID																																	
9/08/2021	200 BH01 CHEM 0.20 X		<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	200 BH02 CHEM 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	MED BH01 UST 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	MED BH02 UST 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	HC BH01 UST 0.50		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	HC BH01 UST 1.50		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	HC BH01 UST 2.00		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	HC BH01 DRAINAGE 0.2		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	HC BH02 DRAINAGE 0.2		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	HC AREA 1 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC AREA 2 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC AREA 3 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC AREA 4 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC AREA 5 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 MACHINERY 0		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	HC BH02 MACHINERY 0		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	HC BH01 CHEM 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	HC BH02 CHEM 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9/08/2021	HC BH01 G HOUSE DRA		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 G HOUSE DRA		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 G HOUSE 0.20		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 G HOUSE 0.20		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 SHADE 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 SHADE 0.20		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 BUNKER 0.20		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 BUNKER 0.20		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 CREEK 0.20		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 CREEK 0.20		----	----	----	----	----	----	----	----	----	----	----	----		0	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Table 41 for Precinct 3 for pesticides shows no guideline exceedances and therefore no risk identified.

Table 41 Soil Analytical Results Compared Against NEPM (2013) Health Investigation Limit Guidelines – Precinct 3 pesticides

NEPM Health Investigation Levels (HIL's) **Dust Inhalation and Soil Ingestion Assessment** X - Indicates Sample Within Proposed Excavation Zone			alpha-BHC	Hexachlorobenzene (HCB)	beta-BHC	gamma-BHC	delta-BHC	Heptachlor	Sum of Aldrin + Dieldrin	Heptachlor epoxide	trans-Chlordane	alpha-Endosulfan	cis-Chlordane	Dieldrin	4.4`-DDE	Endrin	beta-Endosulfan	4.4`-DDD	Endrin aldehyde	Endosulfan (sum)	4.4`-DDT	Endrin ketone	Methoxychlor	Chlordane	DDE DDD DDT	Dichlorvos	Demeton-S-methyl	Monocrotophos	Dimethoate	Diazinon	Chlorpyrifos-methyl	Parathion-methyl	Malathion	Fenthion	Chlorpyrifos	Parathion	Pirimphos-ethyl	Chlorfenvinphos	Bromophos-ethyl	Fenamiphos	Prothiofos	Ethion	Carbophenothion	Azinphos Methyl
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.2	0.05	0.2	0.05	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
HIL A Low Density Residential		☑ HIL A		10				6	6			270		6		10	270			270			300	50	240										160									
HIL B Medium/High Density Resident		☑ HIL B		15				10	10			400		10		20	400			400			500	90	600										340									
HIL C Recreational		☑ HIL C		10				10	10			340		10		20	340			340			400	70	400										250									
HIL D Commerial/Industrial		☑ HIL D		80				50	45			2000		45		100	2000			2000			2500	530	3600										2000									
HIDE ROW		D		80				50	45			2000		45		100	2000			2000			2500	530	3600										2000									
Sample date:	Sample ID																																											
9/08/2021	200 BH01 CHEM 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	200 BH02 CHEM 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	MED BH01 UST 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	MED BH02 UST 0.20 X		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 UST 0.50		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 UST 1.50		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 UST 2.00		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 DRAINAGE 0.2		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH02 DRAINAGE 0.2		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC AREA 1 0.20 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC AREA 2 0.20 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC AREA 3 0.20 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC AREA 4 0.20 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC AREA 5 0.20 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH01 MACHINERY 0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH02 MACHINERY 0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH01 CHEM 0.20 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH02 CHEM 0.20 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH01 G HOUSE DRA		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH02 G HOUSE DRA		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH01 G HOUSE 0.20		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH02 G HOUSE 0.20		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH01 SHADE 0.20 X		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH02 SHADE 0.20		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
9/08/2021	HC BH01 BUNKER 0.20		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 BUNKER 0.20		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH01 CREEK 0.20		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9/08/2021	HC BH02 CREEK 0.20		----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Table 42 for Precinct 5 shows no guideline exceedances and therefore no risk identified.

Table 42 Soil Analytical Results Compared Against NEPM (2013) Health Investigation Limit Guidelines – Precinct 5

Bold - Indicates LOR Exceedance in Non Metalic Compounds			EA055: Moisture Content															Total Recoverable Mercury by FIMS	EP075(SIM)B: Polynuclear Aromatic Hydrocarbons																	
NEPM Health Investigation Levels (HIL's) **Dust Inhalation and Soil Ingestion Assessment** X - Indicates Sample Within Proposed Excavation Zone			Moisture Content	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Mercury	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	PAHs	Benzo(a)pyrene TEQ (WHO)
Units			%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			1	50	1	2	2	5	5	5	2	5	5	2	5	5	5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
HIL A Low Density Residential		☑ HIL A		100		60	4500	20		100	6000	300	3800	400	200		7400	40																	300	3
HIL B Medium/High Density Resident		☑ HIL B		500		90	40000	150		600	30000	1200	14000	1200	1400		60000	120																	400	4
HIL C Recreational		☑ HIL C		300		90	20000	90		300	17000	600	19000	1200	700		30000	80																	300	3
HIL D Commerial/Industrial		☑ HIL D		3000		500	300000	900		4000	240000	1500	60000	6000	10000		400000	730																	4000	40
HIDE ROW		D		3000		500	300000	900		4000	240000	1500	60000	6000	10000			730																	4000	40
Sample date:	Sample ID																																			
27/07/2021	TP1 0.50		15	<5	90	<1	<50	<1	46	15	19	6	514	28	<5	97	35	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
27/07/2021	TP2 0.50		19.6	<5	70	<1	<50	<1	35	9	14	23	400	10	<5	176	45	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
27/07/2021	TP3 0.50		13.2	<5	120	1	<50	1	72	19	33	13	518	21	<5	376	33	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
27/07/2021	TP3 1.00		10.5	<5	60	<1	<50	<1	64	11	17	10	384	13	<5	332	19	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
27/07/2021	TP3 1.50		10.5	<5	30	<1	<50	<1	62	9	13	11	402	8	<5	342	14	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
27/07/2021	TP4 0.50		18.6	<5	50	<1	<50	<5	82	14	25	16	428	19	<5	417	36	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
27/07/2021	TP4 1.00		15.9	<5	70	<1	<50	<1	42	21	39	10	414	22	<5	194	34	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
27/07/2021	TP4 1.50		17.9	<5	70	<1	<50	2	67	21	30	19	733	18	<5	286	41	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
27/07/2021	TP5 0.50		15.4	<5	40	<1	<50	<1	37	8	18	8	109	11	<5	195	24	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
27/07/2021	TP5 1.00		17.5	<5	30	<1	<50	<1	52	10	27	6	98	17	<5	248	15	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

10 INDOOR INHABITANT PVI ASSESSMENT – HSL's

This PVI assessment has been conducted in accordance with relevant CRC CARE Technical Documentation and NEPM 2013 guidelines presented in references section of this report. The HSL assessment approach is generally the first (Tier 1) investigation phase adopted for assessing PVI risk at petroleum hydrocarbon (PHC) impacted Sites. HSL guidelines have been applied for samples collected from the Site to account for risks that may be associated with volatile hydrocarbon vapour intrusion into confined spaces where there may be an inhalation risk through longer term exposure. This does not constitute a full vapour risk assessment but provides additional information from which to further quantify any risk.

A detailed investigation (Tier 2 to 3) is recommended over an HSL assessment where an acute risk has been identified at the Site (CRC CARE 2013) because of:

- Migrating product on surface soils beneath buildings;
- Strong PHC odours;
- Flammable risk in confined spaces; and/or
- Health complaints from occupants.

Based on the Site visits, none of the above conditions have been identified at the Site. If the outcome of this Tier 1 assessment reveals HSL exceedances for hydrocarbon vapour intrusion, a more detailed (Tier 2) assessment will be required to further evaluate the human health risk.

PVI risk is initially interpreted through the development of HSL threshold limits from the following classifications:

- The geology and or hydrogeology of the investigation point; and
- Land use sensitivity:

The resulting HSL threshold limits are compared with laboratory analytical results.

10.1 Selected Media for Assessing PVI Risk

Table 43 presents a summary of the preferred HSL approach to assessing PVI risk. In this case soil and groundwater has been assessed at selected locations on Site.

Table 43 Preferred Methods for Determining Site PVI Risk

Media Analysed	Method	Limitations	Order of Preference
Soil Gas	Concentrations of a soil gas through a soil vapor probe	This approach provides the most reliable data in interpreting PVI risk, although direct modelling should be applied if concentrations exceed HSL threshold limits.	Primary
Groundwater	Concentrations of PHC in groundwater through deployment of monitoring wells	More robust and reliable that soil in determining onSite and in particular, offSite risks. Determining PVI risk based on groundwater is inherently conservative when interpreting vapour risk to account for not readily discernible preferential pathways. Reference may be drawn to alternative assessment approaches: 1) Application of Site-specific conditions to the CRC CARE model for assessing PVI risk 2) Soil gas interpretation for areas where a PVI risk is identified from groundwater analysis.	Secondary
Soil	Concentrations of PHC in soil	Concentrations in soil may be subject variability due to soil moisture, organic content and oxygen ingress all which create significant bias in threshold values. Reliance is place on utilizing groundwater analysis over soil. Soil results provide localised information.	Tertiary

10.2 Land Use Class

For surrounding properties, the potential PVI risk is characterized through application of CRC CARE HSL's for each individual property based on their existing land use (NEPM 2013; Friebel & Nadebaum 2010). The CRC CARE guidelines have been referenced to ensure that the correct land use and density category has been adopted for surrounding land use to ensure health risks are consistent with the HSL models. Aspects considered include the:

- Sensitivity of the existing or potential land use;
- Percentage of paved area for defining potential vapour migration risk;
- Type of basement garage which may influence the confinement of PHC vapors;
- Presence of a slab or cavity for discerning vapour intrusion risk.

If hydrocarbon impacted soil is discerned at the Site, consideration is given to downgradient receptors. Where applicable, land use class therefore considers:

- Downgradient receptors where onSite HSL exceedances have been identified in soil; and
- Variations in land use for different parts of the proposed development.

The following land use classes are applied:

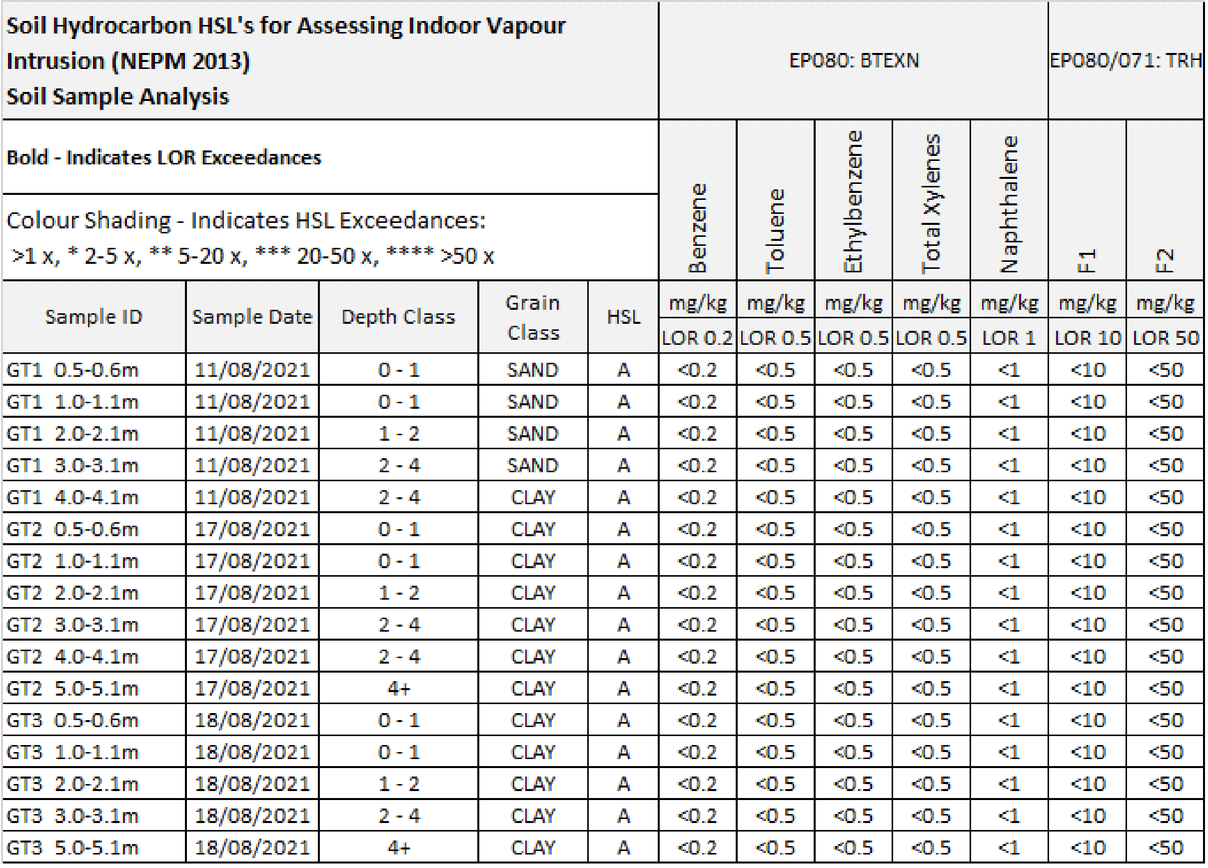
- *HSL A for Residential Land use (the most sensitive possible use)*

10.3 Findings

Laboratory analytical results for soil samples are presented in Appendix 8. Table 44 to Table 47 present the soil results against a potential indoor vapour risk. Concentrations which exceeded laboratory LOR would be highlighted in bold. HSL exceedances would be highlighted with a coloured cell.

Table 44 for Precinct 1 shows no indoor vapour risk identified.

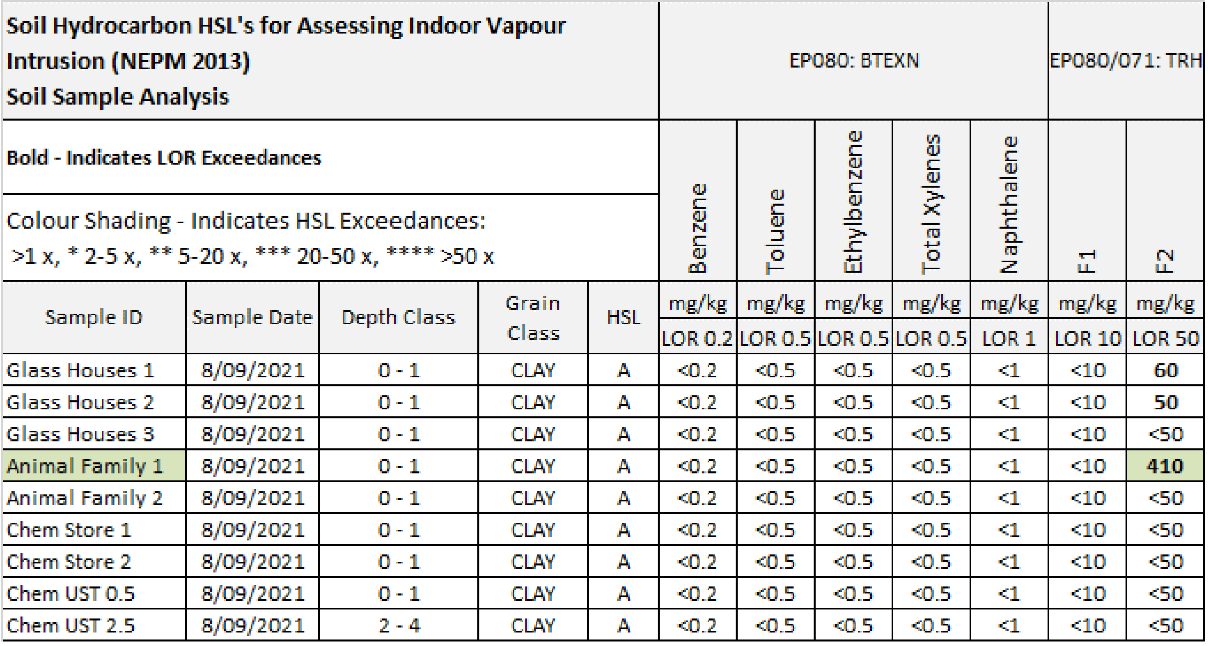
Table 44 Soil Analytical Results Compared Against HSL A - Precinct 1



Soil Hydrocarbon HSL's for Assessing Indoor Vapour Intrusion (NEPM 2013) Soil Sample Analysis					EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances Colour Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x					Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	F1	F2
Sample ID	Sample Date	Depth Class	Grain Class	HSL	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
					LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
GT1 0.5-0.6m	11/08/2021	0 - 1	SAND	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT1 1.0-1.1m	11/08/2021	0 - 1	SAND	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT1 2.0-2.1m	11/08/2021	1 - 2	SAND	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT1 3.0-3.1m	11/08/2021	2 - 4	SAND	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT1 4.0-4.1m	11/08/2021	2 - 4	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 0.5-0.6m	17/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 1.0-1.1m	17/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 2.0-2.1m	17/08/2021	1 - 2	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 3.0-3.1m	17/08/2021	2 - 4	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 4.0-4.1m	17/08/2021	2 - 4	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 5.0-5.1m	17/08/2021	4+	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT3 0.5-0.6m	18/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT3 1.0-1.1m	18/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT3 2.0-2.1m	18/08/2021	1 - 2	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT3 3.0-3.1m	18/08/2021	2 - 4	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT3 5.0-5.1m	18/08/2021	4+	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50

Table 45 for Precinct 2& 3 shows a potential indoor vapour risk identified in one shallow sample from the storage area under the old animal facility building. Any sensitive land use in this area involving building demolition and new construction would require further assessment.

Table 45 Soil Analytical Results Compared Against HSL A - Precinct 2&3



Soil Hydrocarbon HSL's for Assessing Indoor Vapour Intrusion (NEPM 2013)
Soil Sample Analysis

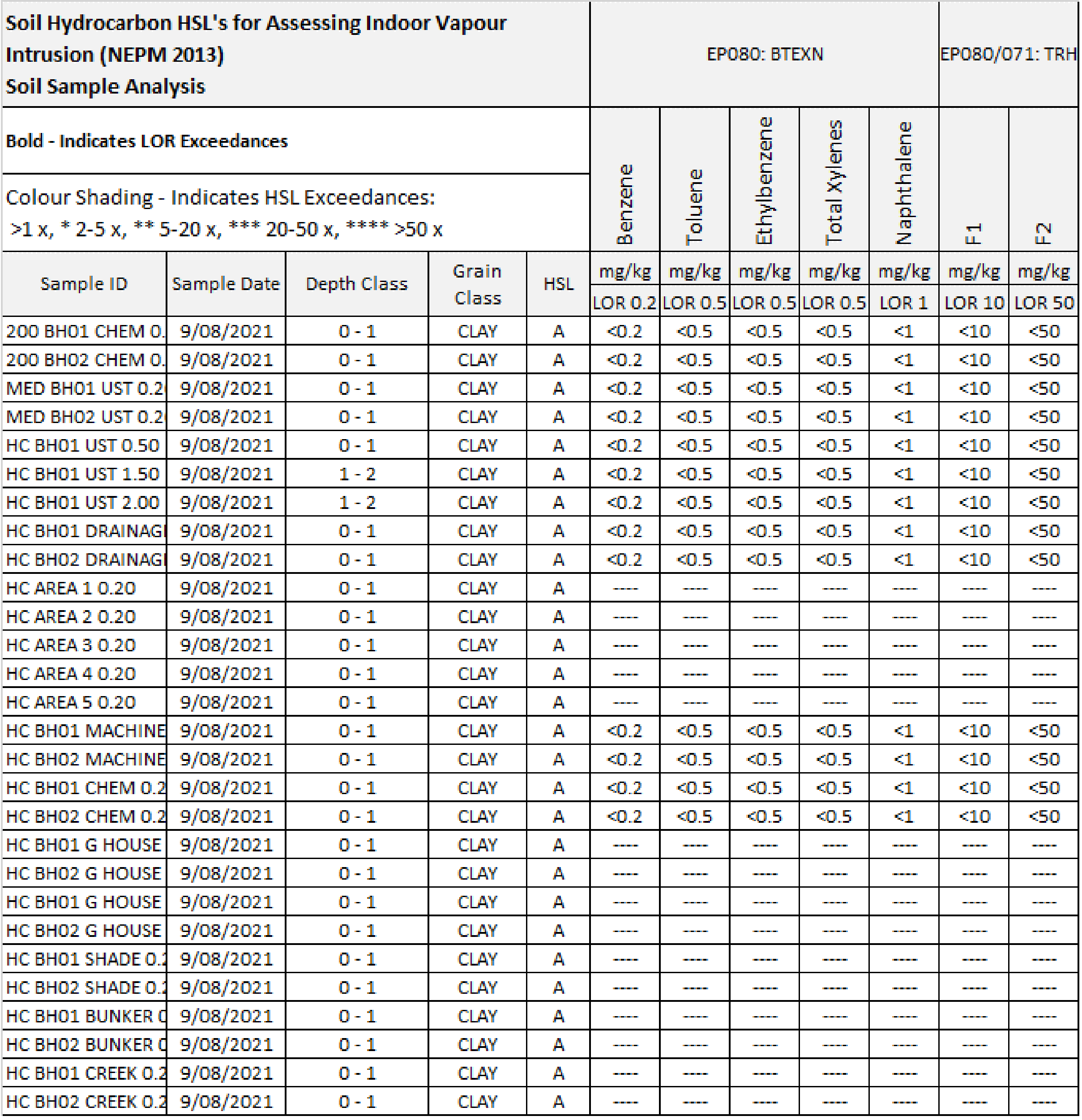
Bold - Indicates LOR Exceedances

Colour Shading - Indicates HSL Exceedances:
>1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x

					EP080: BTEXN					EP080/071: TRH	
					Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	F1	F2
Sample ID	Sample Date	Depth Class	Grain Class	HSL	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
					LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
Glass Houses 1	8/09/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	**60**
Glass Houses 2	8/09/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	**50**
Glass Houses 3	8/09/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
Animal Family 1	8/09/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	**410**
Animal Family 2	8/09/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
Chem Store 1	8/09/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
Chem Store 2	8/09/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
Chem UST 0.5	8/09/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
Chem UST 2.5	8/09/2021	2 - 4	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50

Table 46 for Precinct 3 shows no indoor vapour risk identified.

Table 46 Soil Analytical Results Compared Against HSL A - Precinct 3



Soil Hydrocarbon HSL's for Assessing Indoor Vapour Intrusion (NEPM 2013) **Soil Sample Analysis**					EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances Colour Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x					Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	F1	F2
Sample ID	Sample Date	Depth Class	Grain Class	HSL	mg/kg LOR 0.2	mg/kg LOR 0.5	mg/kg LOR 0.5	mg/kg LOR 0.5	mg/kg LOR 1	mg/kg LOR 10	mg/kg LOR 50
200 BH01 CHEM 0.	9/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
200 BH02 CHEM 0.	9/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
MED BH01 UST 0.2	9/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
MED BH02 UST 0.2	9/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 UST 0.50	9/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 UST 1.50	9/08/2021	1 - 2	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 UST 2.00	9/08/2021	1 - 2	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 DRAINAG	9/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH02 DRAINAG	9/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC AREA 1 0.20	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC AREA 2 0.20	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC AREA 3 0.20	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC AREA 4 0.20	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC AREA 5 0.20	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC BH01 MACHINE	9/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH02 MACHINE	9/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 CHEM 0.2	9/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH02 CHEM 0.2	9/08/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 G HOUSE	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC BH02 G HOUSE	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC BH01 G HOUSE	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC BH02 G HOUSE	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC BH01 SHADE 0.	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC BH02 SHADE 0.	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC BH01 BUNKER	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC BH02 BUNKER	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC BH01 CREEK 0.2	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----
HC BH02 CREEK 0.2	9/08/2021	0 - 1	CLAY	A	----	----	----	----	----	----	----

Table 47 for Precinct 5 shows no indoor vapour risk identified.

Table 47 Soil Analytical Results Compared Against HSL A - Precinct 5

Soil Hydrocarbon HSL's for Assessing Indoor Vapour Intrusion (NEPM 2013) Soil Sample Analysis					EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances Colour Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x					Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	F1	F2
Sample ID	Sample Date	Depth Class	Grain Class	HSL	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
					LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
TP1 0.50	27/07/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP2 0.50	27/07/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP3 0.50	27/07/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP3 1.00	27/07/2021	1 - 2	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP3 1.50	27/07/2021	1 - 2	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP4 0.50	27/07/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP4 1.00	27/07/2021	1 - 2	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP4 1.50	27/07/2021	1 - 2	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP5 0.50	27/07/2021	0 - 1	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP5 1.00	27/07/2021	1 - 2	CLAY	A	<0.2	<0.5	<0.5	<0.5	<1	<10	<50

11 TRENCH WORKER PVI ASSESSMENT – HSL's

11.1 Classification

The following Health Screening Assessment is based on hydrocarbon vapour intrusion risk to subsurface excavation workers within excavations. This is assessed through analysis of vapors from soil and soil vapours. Groundwater is generally not used to assess risk as threshold limits for all depth and grain classes are non-limiting. Land use classes are not applicable when assessing vapour intrusion into trenches.

Soil and soil vapour HSL's for assessing hydrocarbon risk to maintenance workers are based on CRC CARE Technical Report 10 guidelines (Friebel & Nadebaum 2011) and the following variables:

- Dominant grain size class of material at the soil sample depth or based on the dominant grain class of the backfill material based on US Agriculture Soil Classification System (SCS) and partitioning into either sand, silt or clay; and
- Classifying soil according to depth ranges: 0 to 2 m; 2 to 4 m; 4 to 8 m; and greater than 8 m;

11.2 Findings

Laboratory analytical results for soil samples are presented in Appendix 8 and summarised in Table 48. Concentrations which exceeded laboratory LOR would be highlighted in bold, and HSL exceedances highlighted with a coloured cell indicating the highest HSL land used class which is exceeded.

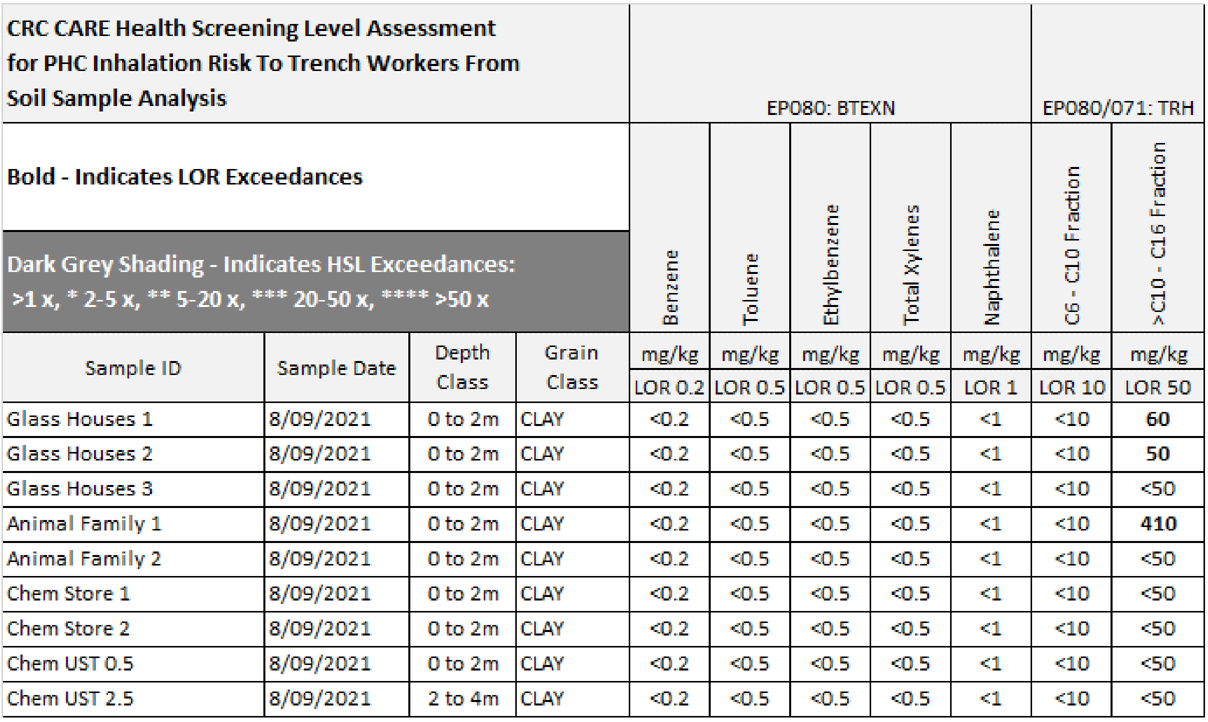
Table 48 results for Precinct 1 show no exceedance of the CRC CARE HSL guidelines for Assessing PVI Risk to Trench Workers and no soil vapour risk was identified.

Table 48 Summary of Soil Analytical Results Compared against HSL's for Assessing PVI Risk to Trench Workers – Precinct 1

CRC CARE Health Screening Level Assessment for PHC Inhalation Risk To Trench Workers From Soil Sample Analysis				EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances Dark Grey Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x				Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction
Sample ID	Sample Date	Depth Class	Grain Class	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
GT1 0.5-0.6m	11/08/2021	0 to 2m	SAND	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT1 1.0-1.1m	11/08/2021	0 to 2m	SAND	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT1 2.0-2.1m	11/08/2021	0 to 2m	SAND	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT1 3.0-3.1m	11/08/2021	2 to 4m	SAND	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT1 4.0-4.1m	11/08/2021	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 0.5-0.6m	17/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 1.0-1.1m	17/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 2.0-2.1m	17/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 3.0-3.1m	17/08/2021	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 4.0-4.1m	17/08/2021	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT2 5.0-5.1m	17/08/2021	4 to 8m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT3 0.5-0.6m	18/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT3 1.0-1.1m	18/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT3 2.0-2.1m	18/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT3 3.0-3.1m	18/08/2021	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
GT3 5.0-5.1m	18/08/2021	4 to 8m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50

Table 49 results for Precinct 2&3 show no exceedance of the CRC CARE HSL guidelines for Assessing PVI Risk to Trench Workers and no soil vapour risk was identified.

Table 49 Summary of Soil Analytical Results Compared against HSL's for Assessing PVI Risk to Trench Workers – Precinct 2&3



CRC CARE Health Screening Level Assessment for PHC Inhalation Risk To Trench Workers From Soil Sample Analysis

Bold - Indicates LOR Exceedances

Dark Grey Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, * 20-50 x, **** >50 x**

				EP080: BTEXN					EP080/071: TRH	
				Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction
Sample ID	Sample Date	Depth Class	Grain Class	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
Glass Houses 1	8/09/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	**60**
Glass Houses 2	8/09/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	**50**
Glass Houses 3	8/09/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
Animal Family 1	8/09/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	**410**
Animal Family 2	8/09/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
Chem Store 1	8/09/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
Chem Store 2	8/09/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
Chem UST 0.5	8/09/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
Chem UST 2.5	8/09/2021	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50

Table 50 results for Precinct 3 show no exceedance of the CRC CARE HSL guidelines for Assessing PVI Risk to Trench Workers and no soil vapour risk was identified.

Table 50 Summary of Soil Analytical Results Compared against HSL's for Assessing PVI Risk to Trench Workers – Precinct 3

CRC CARE Health Screening Level Assessment for PHC Inhalation Risk To Trench Workers From Soil Sample Analysis				EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances										
Dark Grey Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x				Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction
Sample ID	Sample Date	Depth Class	Grain Class	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
200 BH01 CHEM 0.20	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
200 BH02 CHEM 0.20	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
MED BH01 UST 0.20	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
MED BH02 UST 0.20	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 UST 0.50	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 UST 1.50	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 UST 2.00	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 DRAINAGE 0.20	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH02 DRAINAGE 0.20	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC AREA 1 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC AREA 2 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC AREA 3 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC AREA 4 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC AREA 5 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC BH01 MACHINERY 0.20	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH02 MACHINERY 0.20	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 CHEM 0.20	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH02 CHEM 0.20	9/08/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
HC BH01 G HOUSE DRAINAG	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC BH02 G HOUSE DRAINAG	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC BH01 G HOUSE 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC BH02 G HOUSE 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC BH01 SHADE 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC BH02 SHADE 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC BH01 BUNKER 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC BH02 BUNKER 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC BH01 CREEK 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----
HC BH02 CREEK 0.20	9/08/2021	0 to 2m	CLAY	----	----	----	----	----	----	----

Table 51 results for Precinct 5 show no exceedance of the CRC CARE HSL guidelines for Assessing PVI Risk to Trench Workers and no soil vapour risk was identified.

Table 51 Summary of Soil Analytical Results Compared against HSL's for Assessing PVI Risk to Trench Workers – Precinct 5

CRC CARE Health Screening Level Assessment for PHC Inhalation Risk To Trench Workers From Soil Sample Analysis				EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances Dark Grey Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x				Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction
Sample ID	Sample Date	Depth Class	Grain Class	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
TP1 0.50	27/07/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP2 0.50	27/07/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP3 0.50	27/07/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP3 1.00	27/07/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP3 1.50	27/07/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP4 0.50	27/07/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP4 1.00	27/07/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP4 1.50	27/07/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP5 0.50	27/07/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
TP5 1.00	27/07/2021	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50

12 GROUNDWATER ASSESSMENT

12.1 HSL’s for Assessing Petroleum Vapour Intrusion

Health Screening Levels (HSLs) for vapour intrusion are provided in Table 1A(4) of Schedule B1 of the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended April 2013 (NEPC, 2013) (the NEPM).

The NEPM groundwater HSLs provide an initial screening assessment for potential health risks via vapour intrusion to users of land overlying petroleum hydrocarbon impacted groundwater. This investigation concerns the following:

- As the proposed future use of the Site includes residential, NEPM HSL A screening criteria for residential use have been adopted;

Screening Level guidelines for assessing petroleum vapour intrusion from groundwater into shallow trenches (less than 1 m BGS) are non-limiting given that the derived groundwater HSL exceeds the water solubility limit (Friebel, E & Nadebaum, P., 2011).

The following classes have been applied to the Site to derive an appropriate screening Level for assessing petroleum vapour intrusion risk from groundwater:

- SAND grain size - confirmed by a particle size distribution analysis of the main geological strata encountered at the Site; and
- A groundwater depth class of 4 to 8 m bgs.
- For the potential development, residential A land use class.

12.2 Groundwater Results

Groundwater was sampled from three monitoring wells. Groundwater analytical results are compared against selected water quality screening Levels and are presented in Tables 52 to Table 57; and the laboratory certificates are presented in Appendix 8. Screening for hydrocarbon vapour intrusion risk as outlined in section 12.1 was completed to the most sensitive possible use class of residential A. Groundwater results were also assessed against NEPM 95% trigger guidelines for both fresh and marine waters.

Table 52 presents the groundwater results against a potential indoor vapour risk for residential building occupation. No hydrocarbons were detected in any samples, so no risk was identified.

Table 52 Groundwater Analytical Results Compared Against HSL A

NEPM (ASC) 2013 Schedule B1 **Groundwater HSL's for Assessing Vapour Intrusion Risk**						Benzene	Toluene	Ethylbenzene	Xylene	Naphthalene	F1	F2
Units						µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR						1	2	2	2	5	20	100
Water Sample ID	Date	Groundwater Depth Class (m)	Grain Class	HSL								
MW2	9/9/21	<2	CLAY	A	Limit	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
					Result	<1	<2	<2	<2	<5	<20	<100
MW3	9/9/21	2 - 4	CLAY	A	Limit	5000	NL	NL	NL	NL	NL	NL
					Result	<1	<2	<2	<2	<5	<20	<100
MW1	13/9/21	<2	CLAY	A	Limit	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
					Result	<1	<2	<2	<2	<5	<20	<100

Table 53 presents the groundwater results against selected fresh water (95% trigger) water quality guidelines for TRH, BTEXN and lead. No hydrocarbons or lead was detected in any samples, so no risk was identified.

Table 53 Groundwater analytical results compared against selected fresh water (95% trigger) water quality guidelines (TRH, BTEXN & Pb)

Fresh Water (95% Trigger) ANZG (2018)		Benzene	Toluene	Ethyl-benzene	Xylene			BTEX	Napthalene	TRH Carbon Chain Fractions							Dilsolved Lead
					M, P	O	Total	Total		6 - 10	F1	>10 - 16	>16 - 34	>34 - 40	>10 - 40	F2	
UNITS		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
LOR		1	2	2	2	2	2	1	5	20	20	100	100	100	100	100	0.001
Investigation Limit		950	180	80	275	350			16								0.0034
Date Collected	**Water Sample ID**																
9/09/2021	MW2	<1	<2	<2	<2	<2	<2	<1	<5	<20	<20	<100	<100	<100	<100	<100	<0.001
9/09/2021	MW3	<1	<2	<2	<2	<2	<2	<1	<5	<20	<20	<100	<100	<100	<100	<100	<0.001
13/09/2021	MW1	<1	<2	<2	<2	<2	<2	<1	<5	<20	<20	<100	<100	<100	<100	<100	<0.001

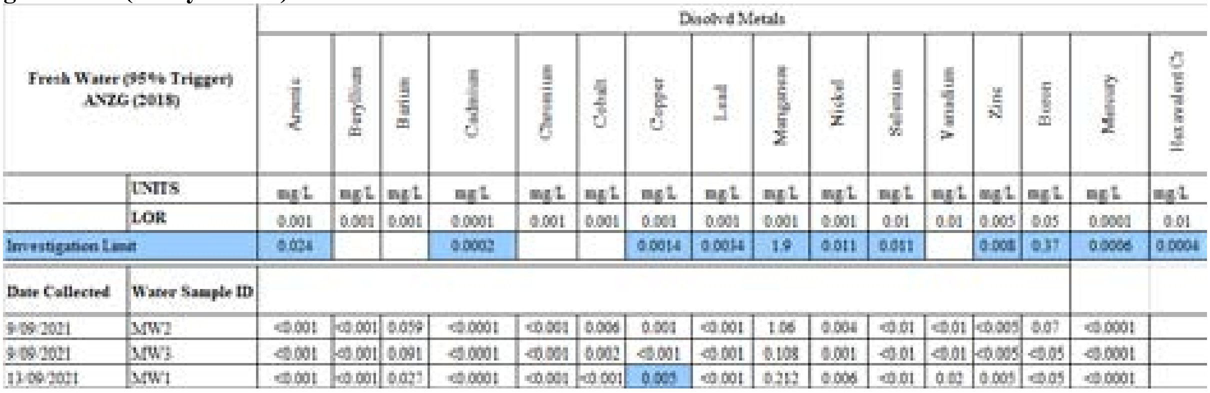
Table 54 presents the groundwater results against selected fresh water (95% trigger) water quality guidelines for PAH. Benzo(a)pyrene was detected in MW2 in Precinct 1 where soil impacted with Benzo(a)pyrene was also detected. Any groundwater extraction or dewatering in this area will require appropriate management and disposal.

Table 54 Groundwater analytical results compared against selected fresh water (95% trigger) water quality guidelines (PAH)

Fresh Water (95% Trigger) ANZG (2018)		Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	PAH Sum	Benzo(a)pyrene TEQ (WHO)
UNITS		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR		1	1	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	0.5	0.5
Investigation Limit		16				2	0.4	1.4						0.2					
Date Collected	**Water Sample ID**																		
9/09/2021	MW2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	0.7	<1.0	<1.0	<1.0	1.8	0.7
9/09/2021	MW3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<0.5	<0.5
13/09/2021	MW1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<0.5	<0.5

Table 55 presents the groundwater results against selected fresh water (95% trigger) water quality guidelines for heavy metals. Copper was detected in MW1 in Precinct 1 Any groundwater extraction or dewatering in this area will require appropriate management and disposal. The source of the copper is not confirmed as soil impact was not detected, however there may be undetected soil impacted with copper from ammunition casings discarded in the ground from the former rifle range.

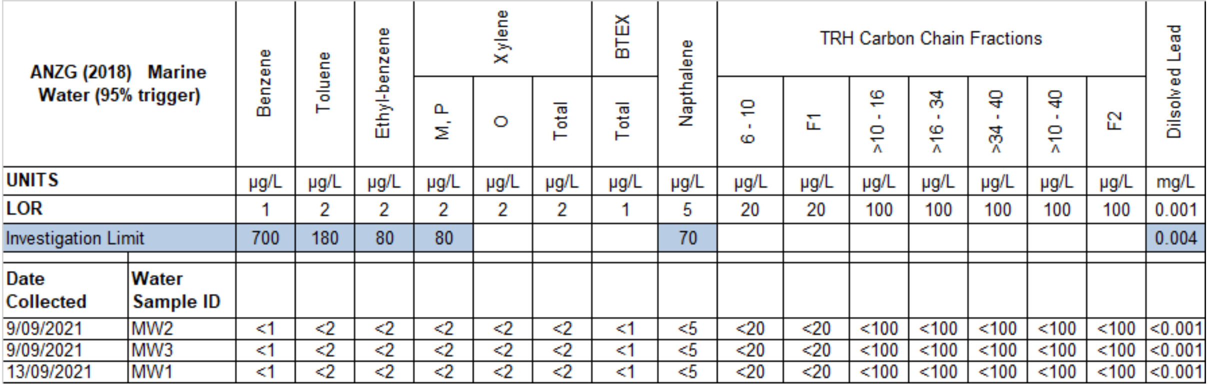
Table 55 Groundwater analytical results compared against selected fresh water (95% trigger) water quality guidelines (heavy metals)



Fresh Water (95% Trigger) ANZG (2018)		Dissolved Metals															
		Arsenic	Beryllium	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Boron	Mercury	Hexavalent Cr
	UNITS	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	LOR	0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.01	0.005	0.05	0.0001	0.01
Investigation Limit		0.024			0.0002			0.0014	0.0034	1.9	0.011	0.011		0.008	0.37	0.0006	0.0004
Date Collected	Water Sample ID																
9/09/2021	MW2	<0.001	<0.001	0.059	<0.0001	<0.001	0.006	0.001	<0.001	1.06	0.004	<0.01	<0.01	<0.005	0.07	<0.0001	
9/09/2021	MW3	<0.001	<0.001	0.091	<0.0001	<0.001	0.002	<0.001	<0.001	0.108	0.001	<0.01	<0.01	<0.005	<0.05	<0.0001	
13/09/2021	MW1	<0.001	<0.001	0.027	<0.0001	<0.001	<0.001	0.005	<0.001	0.212	0.006	<0.01	0.02	0.005	<0.05	<0.0001	

Table 56 presents the groundwater results against selected marine water (95% trigger) water quality guidelines for TRH, BTEXN and lead. No hydrocarbons or lead was detected in any samples, so no risk was identified.

Table 56 Groundwater analytical results compared against selected Marine water (95% trigger) water quality guidelines (TRH, BTEXN & Pb)



ANZG (2018) Marine Water (95% trigger)		Benzene	Toluene	Ethyl-benzene	Xylene			BTEX	Napthalene	TRH Carbon Chain Fractions							Dilsolved Lead
					M, P	O	Total	Total		6 - 10	F1	>10 - 16	>16 - 34	>34 - 40	>10 - 40	F2	
UNITS		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
LOR		1	2	2	2	2	2	1	5	20	20	100	100	100	100	100	0.001
Investigation Limit		700	180	80	80				70								0.004
Date Collected	Water Sample ID																
9/09/2021	MW2	<1	<2	<2	<2	<2	<2	<1	<5	<20	<20	<100	<100	<100	<100	<100	<0.001
9/09/2021	MW3	<1	<2	<2	<2	<2	<2	<1	<5	<20	<20	<100	<100	<100	<100	<100	<0.001
13/09/2021	MW1	<1	<2	<2	<2	<2	<2	<1	<5	<20	<20	<100	<100	<100	<100	<100	<0.001

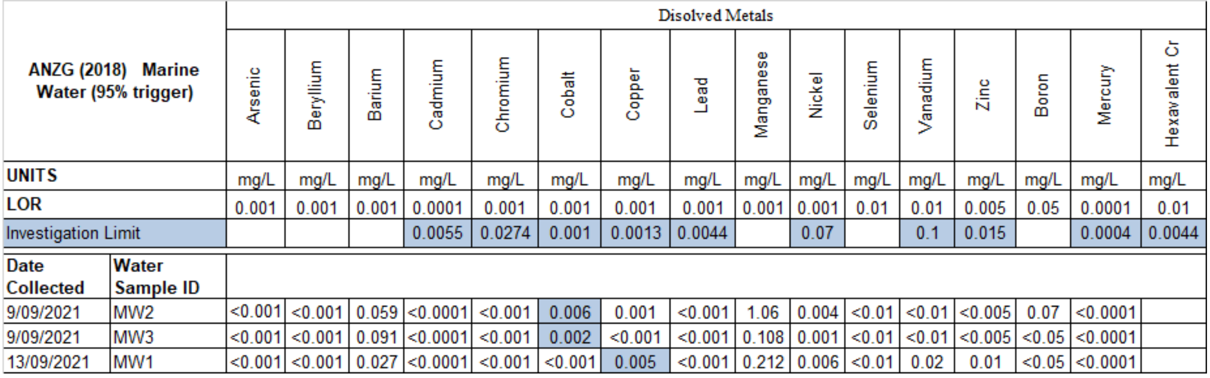
Table 57 presents the groundwater results against selected fresh water (95% trigger) water quality guidelines for PAH. Benzo(a)pyrene was detected in MW2 in Precinct 1 where soil impacted with Benzo(a)pyrene was also detected. Any groundwater extraction or dewatering in this area will require appropriate management and disposal.

Table 57 Groundwater analytical results compared against selected marine water (95% trigger) water quality guidelines (PAH)

ANZG (2018) Marine Water (95% trigger)		Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	Sum of polycyclic aromatic hydrocarbons	Benzo(a)pyrene TEQ (WHO)
UNITS		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR		1	1	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	0.5	0.5
Investigation Limit		70				2	0.4	1.4						0.2					
Date Collected	Water Sample ID																		
9/09/2021	MW2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	0.7	<1.0	<1.0	<1.0	1.8	0.7
9/09/2021	MW3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<0.5	<0.5
13/09/2021	MW1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<0.5	<0.5

Table 58 presents the groundwater results against selected marine water (95% trigger) water quality guidelines for heavy metals. Copper was detected in MW1 in Precinct 1. Any groundwater extraction or dewatering in this area will require appropriate management and disposal. The source of the copper is not confirmed as soil impact was not detected, however there may be undetected soil impacted with copper from ammunition casings discarded in the ground from the former rifle range. Cobalt was detected in MW2 in Precinct 1, and MW3 in Precinct 4, the source of the cobalt is unknown but may be attributed to weathering of sedimentary boulders within the tertiary aged sediments.

Table 58 Groundwater analytical results compared against selected marine (95% trigger) water quality guidelines (heavy metals)



ANZG (2018) Marine Water (95% trigger)		Disolved Metals															
		Arsenic	Beryllium	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Boron	Mercury	Hexavalent Cr
UNITS		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR		0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.01	0.005	0.05	0.0001	0.01
Investigation Limit					0.0055	0.0274	0.001	0.0013	0.0044		0.07		0.1	0.015		0.0004	0.0044
Date Collected	Water Sample ID																
9/09/2021	MW2	<0.001	<0.001	0.059	<0.0001	<0.001	0.006	0.001	<0.001	1.06	0.004	<0.01	<0.01	<0.005	0.07	<0.0001	
9/09/2021	MW3	<0.001	<0.001	0.091	<0.0001	<0.001	0.002	<0.001	<0.001	0.108	0.001	<0.01	<0.01	<0.005	<0.05	<0.0001	
13/09/2021	MW1	<0.001	<0.001	0.027	<0.0001	<0.001	<0.001	0.005	<0.001	0.212	0.006	<0.01	0.02	0.01	<0.05	<0.0001	

13 SOIL DISPOSAL ASSESSSMENT

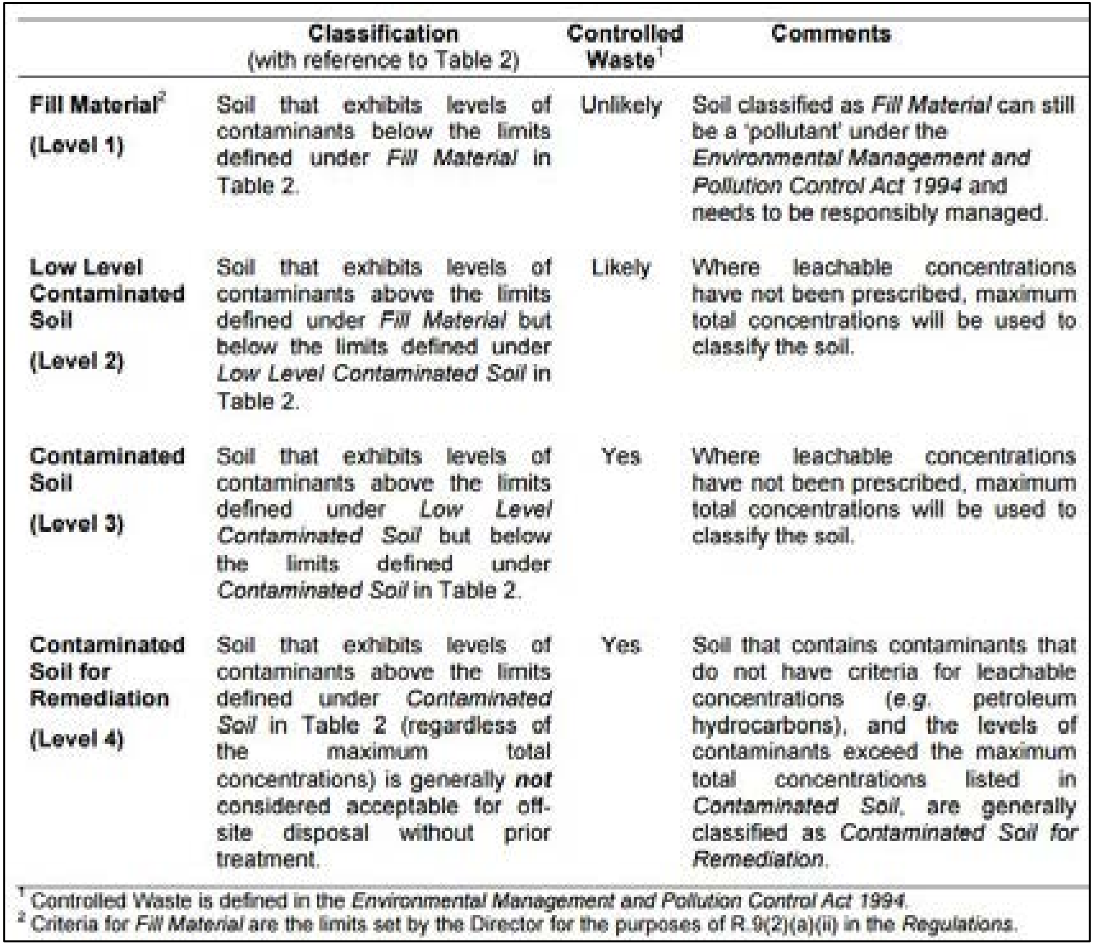
13.1 Guidelines

Soil which is excavated from the Site for landfill disposal is to be assessed against Information Bulletin 105 (IB105) for Classification and Management of Contaminated Soil for Disposal. The EPA uses 4 categories to classify contaminated soil as per Table 59:

- (Level 1) Fill Material;
- (Level 2) Low Level Contaminated Soil;
- (Level 3) Contaminated Soil; and
- (Level 4) Contaminated Soil.

Fixed numerical values are presented for soil concentrations and leachable fraction concentrations.

Table 59 Summary of IB105 Classification Guidelines



	Classification (with reference to Table 2)	Controlled Waste[1]	Comments
Fill Material[2] **(Level 1)**	Soil that exhibits levels of contaminants below the limits defined under *Fill Material* in Table 2.	Unlikely	Soil classified as *Fill Material* can still be a 'pollutant' under the *Environmental Management and Pollution Control Act 1994* and needs to be responsibly managed.
Low Level Contaminated Soil **(Level 2)**	Soil that exhibits levels of contaminants above the limits defined under *Fill Material* but below the limits defined under *Low Level Contaminated Soil* in Table 2.	Likely	Where leachable concentrations have not been prescribed, maximum total concentrations will be used to classify the soil.
Contaminated Soil **(Level 3)**	Soil that exhibits levels of contaminants above the limits defined under *Low Level Contaminated Soil* but below the limits defined under *Contaminated Soil* in Table 2.	Yes	Where leachable concentrations have not been prescribed, maximum total concentrations will be used to classify the soil.
Contaminated Soil for Remediation **(Level 4)**	Soil that exhibits levels of contaminants above the limits defined under *Contaminated Soil* in Table 2 (regardless of the maximum total concentrations) is generally ***not*** considered acceptable for off-site disposal without prior treatment.	Yes	Soil that contains contaminants that do not have criteria for leachable concentrations (e.g. petroleum hydrocarbons), and the levels of contaminants exceed the maximum total concentrations listed in *Contaminated Soil*, are generally classified as *Contaminated Soil for Remediation*.

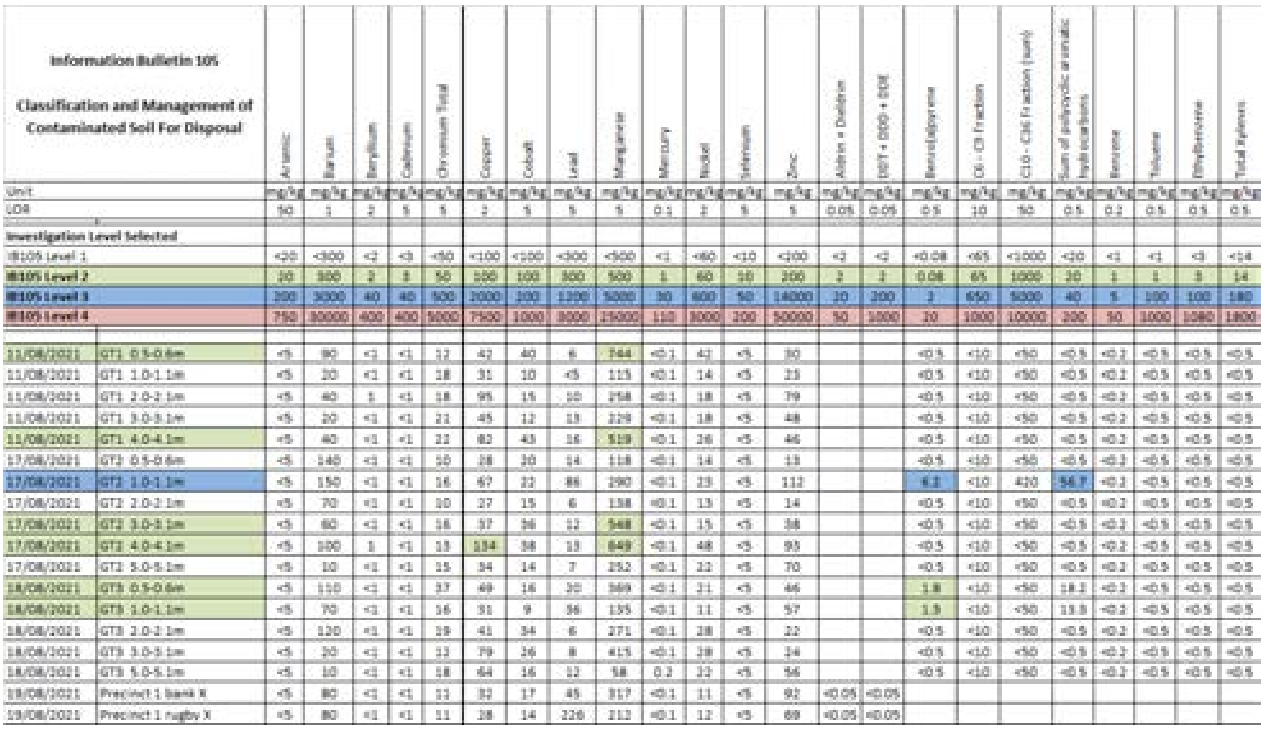
[1] Controlled Waste is defined in the *Environmental Management and Pollution Control Act 1994*.
[2] Criteria for *Fill Material* are the limits set by the Director for the purposes of R.9(2)(a)(ii) in the *Regulations*.

13.2 Findings

The soil samples have been compared against IB105 guidelines for soil disposal for a range of the samples across the Site. Tables are presented for each set of results, generally collated in each individual Precinct as found in Table 60 to Table 63.

The results in Table 60 for Precinct 1 show several samples classified as Level 2 and Level 3 contaminated soil for manganese, copper, and Benzo(a)pyrene. It is likely Benzo(a)pyrene is present in the filled areas of Precinct 1m and is possibly widespread in the vicinity of the lower field areas of the rugby oval and surrounds. Manganese is found to be widespread in Tasmania, and is generally naturally occurring. Further detailed sampling and testing including leachate testing is recommended for any future development in Precinct 1.

Table 60 Soil Analytical Results Compared Against IB105 Investigation Limits for soil Disposal – Precinct 1



Information Bulletin 105 Classification and Management of Contaminated Soil For Disposal		Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Copper	Cobalt	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Aldrin + Dieldrin	DDT + DDD + DDE	Benzo(a)pyrene	C6 - C9 Fraction	C10 - C36 Fraction (sum)	Sum of polycyclic aromatic hydrocarbons	Benzene	Toluene	Ethylbenzene	Total Xylenes
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		50	1	2	5	5	2	5	5	5	0.1	2	5	5	0.05	0.05	0.5	10	50	0.5	0.2	0.5	0.5	0.5
Investigation Level Selected																								
IB105 Level 1		<20	<300	<2	<3	<50	<100	<100	<300	<500	<1	<60	<10	<200	<2	<2	<0.08	<65	<1000	<20	<1	<1	<3	<14
IB105 Level 2		20	300	2	3	50	100	100	300	500	1	60	10	200	2	2	0.08	65	1000	20	1	1	3	14
IB105 Level 3		200	3000	40	40	500	2000	200	1200	5000	30	600	50	14000	20	200	2	650	5000	40	5	100	100	180
IB105 Level 4		750	30000	400	400	5000	7500	1000	3000	25000	110	3000	200	50000	50	1000	20	1000	10000	200	50	1000	1080	1800
11/08/2021	GT1 0.5-0.6m	<5	90	<1	<1	12	42	40	6	744	<0.1	42	<5	30			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
11/08/2021	GT1 1.0-1.1m	<5	20	<1	<1	18	31	10	<5	115	<0.1	14	<5	23			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
11/08/2021	GT1 2.0-2.1m	<5	40	1	<1	18	95	15	10	258	<0.1	18	<5	79			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
11/08/2021	GT1 3.0-3.1m	<5	20	<1	<1	21	45	12	13	229	<0.1	18	<5	48			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
11/08/2021	GT1 4.0-4.1m	<5	40	<1	<1	22	82	43	16	519	<0.1	26	<5	46			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
17/08/2021	GT2 0.5-0.6m	<5	140	<1	<1	10	28	20	14	118	<0.1	14	<5	13			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
17/08/2021	GT2 1.0-1.1m	<5	150	<1	<1	16	67	22	86	290	<0.1	23	<5	112			6.2	<10	420	56.7	<0.2	<0.5	<0.5	<0.5
17/08/2021	GT2 2.0-2.1m	<5	70	<1	<1	10	27	15	6	138	<0.1	13	<5	14			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
17/08/2021	GT2 3.0-3.1m	<5	60	<1	<1	16	37	36	12	548	<0.1	15	<5	38			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
17/08/2021	GT2 4.0-4.1m	<5	100	1	<1	13	134	38	13	849	<0.1	48	<5	93			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
17/08/2021	GT2 5.0-5.1m	<5	10	<1	<1	15	34	14	7	252	<0.1	22	<5	70			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
18/08/2021	GT3 0.5-0.6m	<5	110	<1	<1	37	49	16	20	369	<0.1	21	<5	46			1.8	<10	<50	18.2	<0.2	<0.5	<0.5	<0.5
18/08/2021	GT3 1.0-1.1m	<5	70	<1	<1	16	31	9	36	135	<0.1	11	<5	57			1.3	<10	<50	13.3	<0.2	<0.5	<0.5	<0.5
18/08/2021	GT3 2.0-2.1m	<5	120	<1	<1	19	41	34	6	271	<0.1	28	<5	22			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
18/08/2021	GT3 3.0-3.1m	<5	20	<1	<1	12	79	26	8	415	<0.1	28	<5	24			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
18/08/2021	GT3 5.0-5.1m	<5	10	<1	<1	18	64	16	12	58	0.2	22	<5	56			<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
19/08/2021	Precinct 1 bank X	<5	80	<1	<1	11	32	17	45	317	<0.1	11	<5	92	<0.05	<0.05								
19/08/2021	Precinct 1 rugby X	<5	80	<1	<1	11	28	14	226	212	<0.1	12	<5	69	<0.05	<0.05								

The results in Table 61 for Precinct 2 indicate little soil impact, with only a single sample at depth classified as Level 2 contaminated soil for manganese. Manganese is found to widespread in Tasmania, and generally naturally occurring.

Table 61 Soil Analytical Results Compared Against IB105 Investigation Limits for soil Disposal – Precinct 2

Information Bulletin 105 **Classification and Management of Contaminated Soil For Disposal**		Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Copper	Cobalt	Lead	Manganese	Mercury	Nickel	Selenium	Zinc
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		50	1	2	5	5	2	5	5	5	0.1	2	5	5
Investigation Level Selected														
IB105 Level 1		<20	<300	<2	<3	<50	<100	<100	<300	<500	<1	<60	<10	<200
IB105 Level 2		20	300	2	3	50	100	100	300	500	1	60	10	200
IB105 Level 3		200	3000	40	40	500	2000	200	1200	5000	30	600	50	14000
IB105 Level 4		750	30000	400	400	5000	7500	1000	3000	25000	110	3000	200	50000
19/08/2021	GT5 0.5-0.6	<5	240	<1	<1	23	70	25	32	471	<0.1	24	<5	72
19/08/2021	GT5 0.9-1.0	<5	170	<1	<1	21	72	24	13	355	<0.1	24	<5	28
19/08/2021	GT5 2.0-2.1	<5	80	<1	<1	15	37	20	8	330	<0.1	16	<5	15
20/08/2021	GT7 1.5-1.6	<5	20	1	<1	10	27	26	12	315	<0.1	43	<5	28
20/08/2021	GT7 2.5-2.6	<5	10	<1	<1	10	22	5	8	40	<0.1	9	<5	27
25/08/2021	GT9 0.5-0.6	<5	20	<1	<1	5	64	7	<5	109	<0.1	16	<5	13
25/08/2021	GT9 1.5-1.6	<5	20	<1	<1	7	74	9	<5	148	<0.1	19	<5	17
25/08/2021	GT9 6.0-6.2	<5	70	<1	<1	11	40	18	6	647	<0.1	22	<5	34

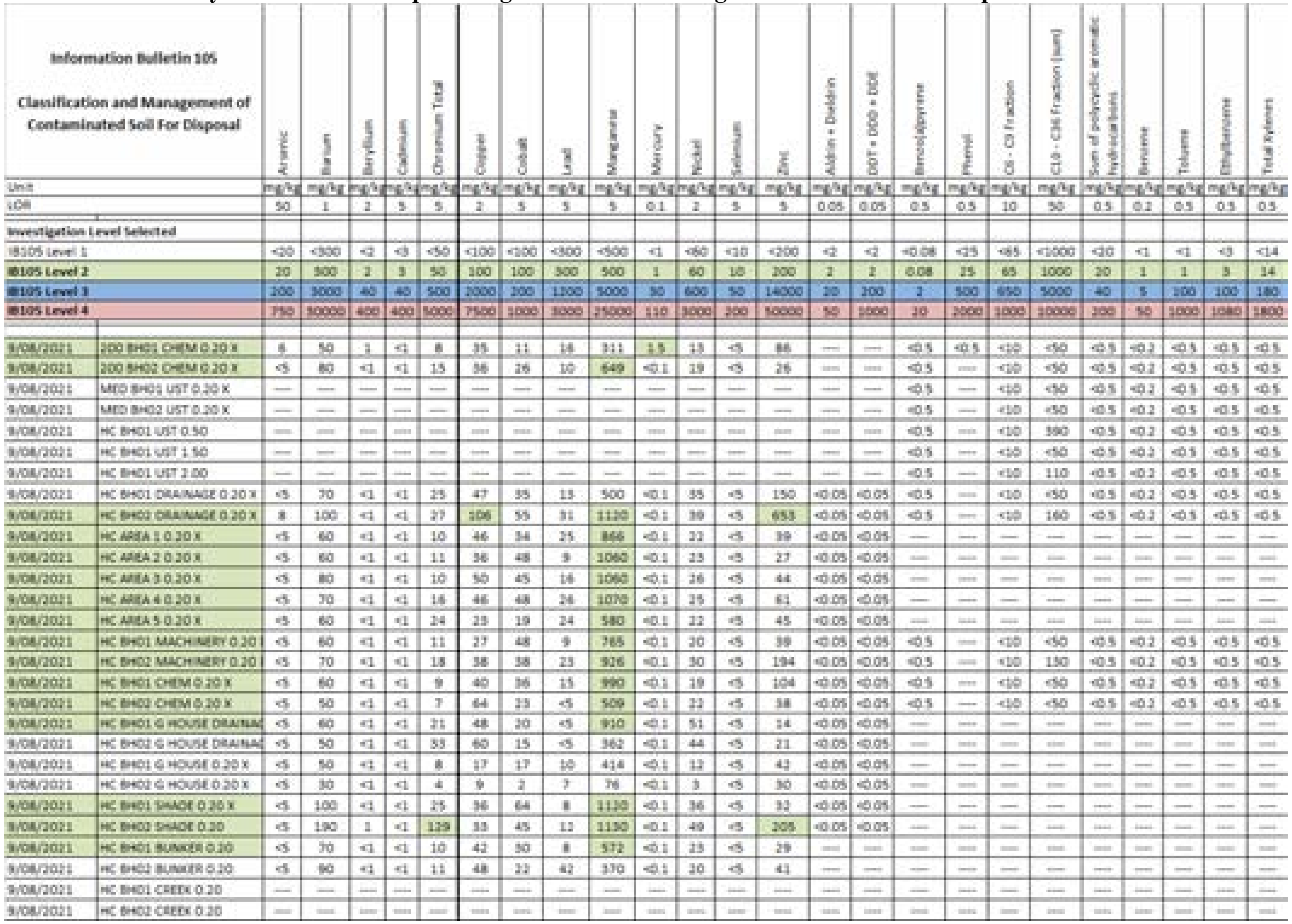
The results in Table 62 for Precinct 2&3 indicate soil impact, with multiple samples classified as Level 2 contaminated soil for manganese. However, manganese is found to widespread in Tasmania, and generally naturally occurring. A single sample under the former animal's facility also had an exceedance for zinc, and F2 hydrocarbons. Any soil excavation in this area will require additional sampling, testing and management.

Table 62 Soil Analytical Results Compared Against IB105 Investigation Limits for soil Disposal – Precinct 2&3

Information Bulletin 105 **Classification and Management of Contaminated Soil For Disposal**		Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Copper	Cobalt	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Aldrin + Dieldrin	DDT + DDD + DDE	Benzo(a)pyrene	Phenol	C6 - C9 Fraction	C10 - C36 Fraction (sum)	Sum of polycyclic aromatic hydrocarbons	Benzene	Toluene	Ethylbenzene	Total Xylenes
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		50	1	2	5	5	2	5	5	5	0.1	2	5	5	0.05	0.05	0.5	0.5	10	50	0.5	0.2	0.5	0.5	0.5
Investigation Level Selected																									
IB105 Level 1		<20	<300	<2	<3	<50	<100	<100	<300	<500	<1	<60	<10	<200	<2	<2	<0.08	<25	<65	<1000	<20	<1	<1	<3	<14
IB105 Level 2		20	300	2	3	50	100	100	300	500	1	60	10	200	2	2	0.08	25	65	1000	20	1	1	3	14
IB105 Level 3		200	3000	40	40	500	2000	200	1200	5000	30	600	50	14000	20	200	2	500	650	5000	40	5	100	100	180
IB105 Level 4		750	30000	400	400	5000	7500	1000	3000	25000	110	3000	200	50000	50	1000	20	2000	1000	10000	200	50	1000	1080	1800
8/09/2021	Glass Houses 1 X	6	90	<1	<1	19	69	30	10	453	<0.1	39	<5	80	<0.05	<0.05	<0.5	----	<10	620	<0.5	<0.2	<0.5	<0.5	<0.5
8/09/2021	Glass Houses 2 X	6	100	<1	<1	13	63	30	8	462	<0.1	39	<5	72	<0.05	<0.05	<0.5	----	<10	530	<0.5	<0.2	<0.5	<0.5	<0.5
8/09/2021	Glass Houses 3 X	6	80	<1	<1	13	58	22	8	401	<0.1	35	<5	69	<0.05	<0.05	<0.5	----	<10	390	<0.5	<0.2	<0.5	<0.5	<0.5
8/09/2021	Animal Family 1 X	7	120	<1	<1	35	74	22	24	583	<0.1	35	<5	504	<0.05	<0.05	<0.5	----	<10	1770	<0.5	<0.2	<0.5	<0.5	<0.5
8/09/2021	Animal Family 2 X	<5	120	<1	<1	32	56	44	19	1140	<0.1	52	<5	125	<0.05	<0.05	<0.5	----	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
8/09/2021	Chem Store 1 X	8	100	<1	<1	7	78	30	15	508	<0.1	48	<5	64	----	----	<0.5	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
8/09/2021	Chem Store 2 X	<5	90	<1	<1	9	49	20	7	334	<0.1	30	<5	72	----	----	<0.5	<0.5	<10	250	<0.5	<0.2	<0.5	<0.5	<0.5
8/09/2021	Chem UST 0.5	6	230	<1	<1	6	65	55	10	1160	<0.1	62	<5	70	----	----	<0.5	----	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
8/09/2021	Chem UST 2.5	6	90	<1	<1	6	61	25	9	457	<0.1	43	<5	60	----	----	<0.5	----	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5

The results in Table 63 for Precinct 3 indicate soil impact, with multiple samples classified as Level 2 contaminated soil for manganese. However, manganese is found to widespread in Tasmania, and generally naturally occurring. A small number of samples also had an exceedance for chromium, copper, zinc, and mercury. Any soil excavation in this area will require additional sampling, testing and management.

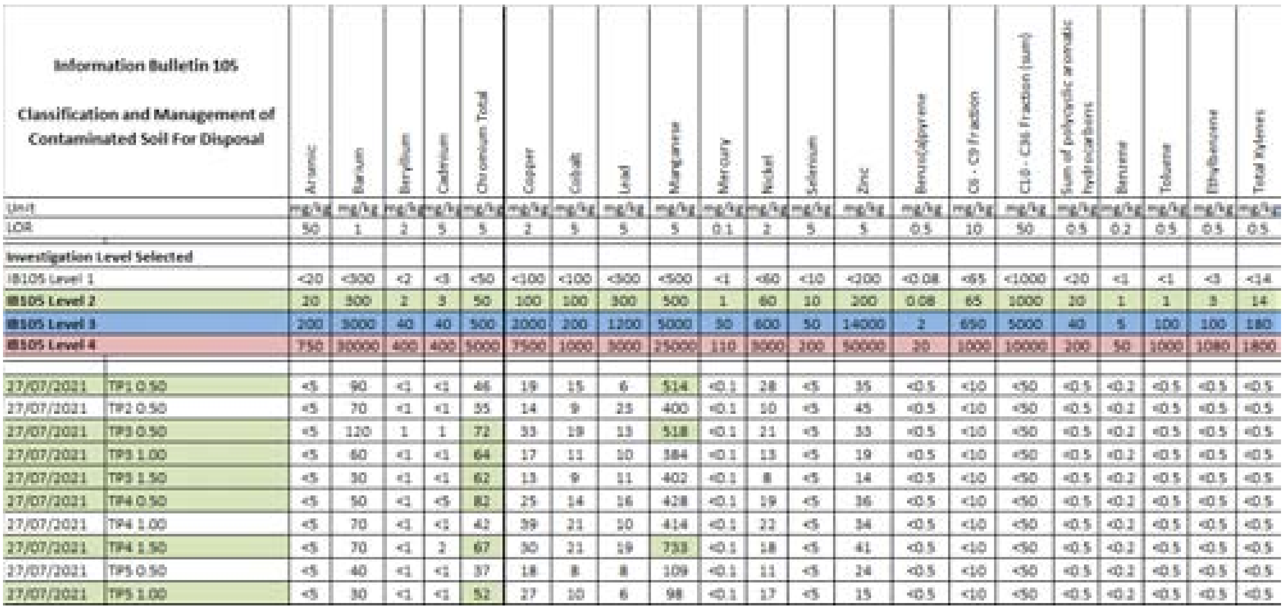
Table 63 Soil Analytical Results Compared Against IB105 Investigation Limits for soil Disposal – Precinct 3



Information Bulletin 105 Classification and Management of Contaminated Soil For Disposal		Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Copper	Cobalt	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Aldrin + Dieldrin	DDT + DDD + DDE	Benzo(a)pyrene	Phenol	C6 - C9 Fraction	C10 - C36 Fraction (sum)	Sum of polycyclic aromatic hydrocarbons	Benzene	Toluene	Ethylbenzene	Total Xylenes
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		50	1	2	5	5	2	5	5	5	0.1	2	5	5	0.05	0.05	0.5	0.5	10	50	0.5	0.2	0.5	0.5	0.5
Investigation Level Selected																									
IB105 Level 1		<20	<300	<2	<3	<50	<100	<100	<300	<500	<1	<60	<10	<200	<2	<2	<0.08	<25	<65	<1000	<20	<1	<1	<3	<14
IB105 Level 2		20	300	2	3	50	100	100	300	500	1	60	10	200	2	2	0.08	25	65	1000	20	1	1	3	14
IB105 Level 3		200	3000	40	40	500	2000	200	1200	5000	30	600	50	14000	20	200	2	500	650	5000	40	5	100	100	180
IB105 Level 4		750	30000	400	400	5000	7500	1000	3000	25000	110	3000	200	50000	50	1000	20	2000	1000	10000	200	50	1000	1080	1800
9/08/2021	200 BH01 CHEM 0.20 X	6	50	1	<1	8	35	11	16	311	1.5	13	<5	86	—	—	<0.5	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	200 BH02 CHEM 0.20 X	<5	80	<1	<1	15	36	26	10	649	<0.1	19	<5	26	—	—	<0.5	—	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	MED BH01 UST 0.20 X	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<0.5	—	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	MED BH02 UST 0.20 X	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<0.5	—	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	HC BH01 UST 0.50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<0.5	—	<10	390	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	HC BH01 UST 1.50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<0.5	—	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	HC BH01 UST 2.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<0.5	—	<10	110	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	HC BH01 DRAINAGE 0.20 X	<5	70	<1	<1	25	47	35	13	500	<0.1	35	<5	150	<0.05	<0.05	<0.5	—	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	HC BH02 DRAINAGE 0.20 X	8	100	<1	<1	27	106	55	31	1120	<0.1	39	<5	653	<0.05	<0.05	<0.5	—	<10	160	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	HC AREA 1 0.20 X	<5	60	<1	<1	10	46	34	25	866	<0.1	22	<5	39	<0.05	<0.05	—	—	—	—	—	—	—	—	—
9/08/2021	HC AREA 2 0.20 X	<5	60	<1	<1	11	36	48	9	1060	<0.1	23	<5	27	<0.05	<0.05	—	—	—	—	—	—	—	—	—
9/08/2021	HC AREA 3 0.20 X	<5	80	<1	<1	10	50	45	16	1060	<0.1	26	<5	44	<0.05	<0.05	—	—	—	—	—	—	—	—	—
9/08/2021	HC AREA 4 0.20 X	<5	70	<1	<1	16	46	48	26	1070	<0.1	25	<5	61	<0.05	<0.05	—	—	—	—	—	—	—	—	—
9/08/2021	HC AREA 5 0.20 X	<5	60	<1	<1	24	23	19	24	580	<0.1	22	<5	45	<0.05	<0.05	—	—	—	—	—	—	—	—	—
9/08/2021	HC BH01 MACHINERY 0.20	<5	60	<1	<1	11	27	48	9	765	<0.1	20	<5	39	<0.05	<0.05	<0.5	—	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	HC BH02 MACHINERY 0.20	<5	70	<1	<1	18	38	38	23	926	<0.1	30	<5	194	<0.05	<0.05	<0.5	—	<10	130	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	HC BH01 CHEM 0.20 X	<5	60	<1	<1	9	40	36	15	990	<0.1	19	<5	104	<0.05	<0.05	<0.5	—	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	HC BH02 CHEM 0.20 X	<5	50	<1	<1	7	64	23	<5	509	<0.1	22	<5	38	<0.05	<0.05	<0.5	—	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
9/08/2021	HC BH01 G HOUSE DRAINAG	<5	60	<1	<1	21	48	20	<5	910	<0.1	51	<5	14	<0.05	<0.05	—	—	—	—	—	—	—	—	—
9/08/2021	HC BH02 G HOUSE DRAINAG	<5	50	<1	<1	33	60	15	<5	362	<0.1	44	<5	21	<0.05	<0.05	—	—	—	—	—	—	—	—	—
9/08/2021	HC BH01 G HOUSE 0.20 X	<5	50	<1	<1	8	17	17	10	414	<0.1	12	<5	42	<0.05	<0.05	—	—	—	—	—	—	—	—	—
9/08/2021	HC BH02 G HOUSE 0.20 X	<5	30	<1	<1	4	9	2	7	76	<0.1	3	<5	30	<0.05	<0.05	—	—	—	—	—	—	—	—	—
9/08/2021	HC BH01 SHADE 0.20 X	<5	100	<1	<1	25	36	64	8	1120	<0.1	36	<5	32	<0.05	<0.05	—	—	—	—	—	—	—	—	—
9/08/2021	HC BH02 SHADE 0.20	<5	190	1	<1	129	33	45	12	1130	<0.1	49	<5	205	<0.05	<0.05	—	—	—	—	—	—	—	—	—
9/08/2021	HC BH01 BUNKER 0.20	<5	70	<1	<1	10	42	30	8	572	<0.1	23	<5	29	—	—	—	—	—	—	—	—	—	—	—
9/08/2021	HC BH02 BUNKER 0.20	<5	90	<1	<1	11	48	22	42	370	<0.1	20	<5	41	—	—	—	—	—	—	—	—	—	—	—
9/08/2021	HC BH01 CREEK 0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9/08/2021	HC BH02 CREEK 0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

The results in Table 64 for Precinct 5 soil impact, with all samples classified as Level 2 contaminated soil for manganese and/or chromium. Manganese is found to widespread in Tasmania, and generally naturally occurring. Chromium has also been found to be naturally occurring in sedimentary rocks in Tasmania, and the chromium present may be a result of weathering of the Permian rock fill on the Site that was excavated for the highway cutting of the nearby southern outlet. Further investigation into the origin of the rock materials and the chromium is recommended prior to any detailed design works or budget estimates. Study of surrounding soils and sediments in undeveloped areas is recommended to establish a baseline concentration for reference.

Table 64 Soil Analytical Results Compared Against IB105 Investigation Limits for soil Disposal – Precinct 5



Information Bulletin 105 Classification and Management of Contaminated Soil For Disposal		Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Copper	Cobalt	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Benzo(a)pyrene	C6 - C9 Fraction	C10 - C36 Fraction (sum)	Sum of polycyclic aromatic hydrocarbons	Benzene	Toluene	Ethylbenzene	Total Xylenes
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		50	1	2	5	5	2	5	5	5	0.1	2	5	5	0.5	10	50	0.5	0.2	0.5	0.5	0.5
Investigation Level Selected																						
IB105 Level 1		<20	<300	<2	<3	<50	<100	<100	<300	<500	<1	<60	<10	<200	<0.08	<65	<1000	<20	<1	<1	<3	<14
IB105 Level 2		20	300	2	3	50	100	100	300	500	1	60	10	200	0.08	65	1000	20	1	1	3	14
IB105 Level 3		200	3000	40	40	500	2000	200	1200	5000	30	600	50	14000	2	650	5000	40	5	100	100	180
IB105 Level 4		750	30000	400	400	5000	7500	1000	3000	25000	110	3000	200	50000	20	1000	10000	200	50	1000	1080	1800
27/07/2021	TP1 0.50	<5	90	<1	<1	46	19	15	6	514	<0.1	28	<5	35	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
27/07/2021	TP2 0.50	<5	70	<1	<1	35	14	9	23	400	<0.1	10	<5	45	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
27/07/2021	TP3 0.50	<5	120	1	1	72	33	19	13	518	<0.1	21	<5	33	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
27/07/2021	TP3 1.00	<5	60	<1	<1	64	17	11	10	384	<0.1	13	<5	19	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
27/07/2021	TP3 1.50	<5	30	<1	<1	62	13	9	11	402	<0.1	8	<5	14	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
27/07/2021	TP4 0.50	<5	50	<1	<5	82	25	14	16	428	<0.1	19	<5	36	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
27/07/2021	TP4 1.00	<5	70	<1	<1	42	39	21	10	414	<0.1	22	<5	34	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
27/07/2021	TP4 1.50	<5	70	<1	2	67	30	21	19	733	<0.1	18	<5	41	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
27/07/2021	TP5 0.50	<5	40	<1	<1	37	18	8	8	109	<0.1	11	<5	24	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5
27/07/2021	TP5 1.00	<5	30	<1	<1	52	27	10	6	98	<0.1	17	<5	15	<0.5	<10	<50	<0.5	<0.2	<0.5	<0.5	<0.5

14 CONCEPTUAL SITE MODEL

14.1 Potential & Identified Contamination Sources

The identified source of contamination impacting the investigation area is predominantly uncontrolled fill in Precinct 1, and localised surface spills in Precinct 3.

There may be other unknown potential sources of onSite or offSite impact (outside of the sampling areas) which GES are unaware of and therefore have not been investigated within this assessment.

Contaminates of potential concern associated with these potential sources have already been identified in a previous section.

14.1.1 Identified Primary Sources

Identified primary sources of contamination is historical Site fill in the lower areas of the Site on the former rifle range/creek areas in Precinct 1. Localised surface spills of oils and heavy metals from rusting metal material is present in limited areas in Precinct 2 & 3.

14.1.2 Identified Secondary Sources

Secondary source is contamination which may sources from a primary source (soil, groundwater, surface water and vapour). Secondary sources are typically spatially separated from the primary source, and may have a direct pathway linkage impacting or affecting receptors of interest.

The groundwater contaminated in Precinct 1 is the secondary source of contamination.

14.2 Potential Receptors

The following presents a summary of all potential receptors considered in the assessment.

14.2.1 Potential Future OnSite Receptors

Potential future onSite receptors are presented in Table 65.

Table 65 Summary of Potential Future OnSite Receptors

Medium	Specific OnSite Receptor	Impact Identified
Soil Impact	Future Construction and Trench workers – construction phase	Yes
	Future onSite Site users – Commercial Workers and recreational users of the Site plus possible residents	Yes
	Future trench workers – ongoing maintenance	Potential
Groundwater Impact	Future Construction and Trench workers – construction phase	No
	Future onSite Site users – Commercial Workers and recreational users of the Site	No
	Future trench workers – ongoing maintenance	No

14.2.2 Identified Human Receptors

Soil results for benzo(a)pyrene exceeded human contact guidelines in Precinct 1, a single result for hydrocarbons in soil exceeded human heath guidelines for indoor vapour for residential use in Precinct 3.

There were no human health exceedances from the groundwater results.

14.2.3 Identified Ecological Receptors

Groundwater results exceeded ecological guidelines for both freshwater and Marine water guideline. Note the contaminated groundwater is currently not utilised or accessed and there are no ecological receptors identified on Site however there is a plausible risk.

There were limited ecological exceedances in soil in Precinct 1 for benzo(a)pyrene and for hydrocarbons in Precinct 3, this only has potential to impact receptors if disturbed.

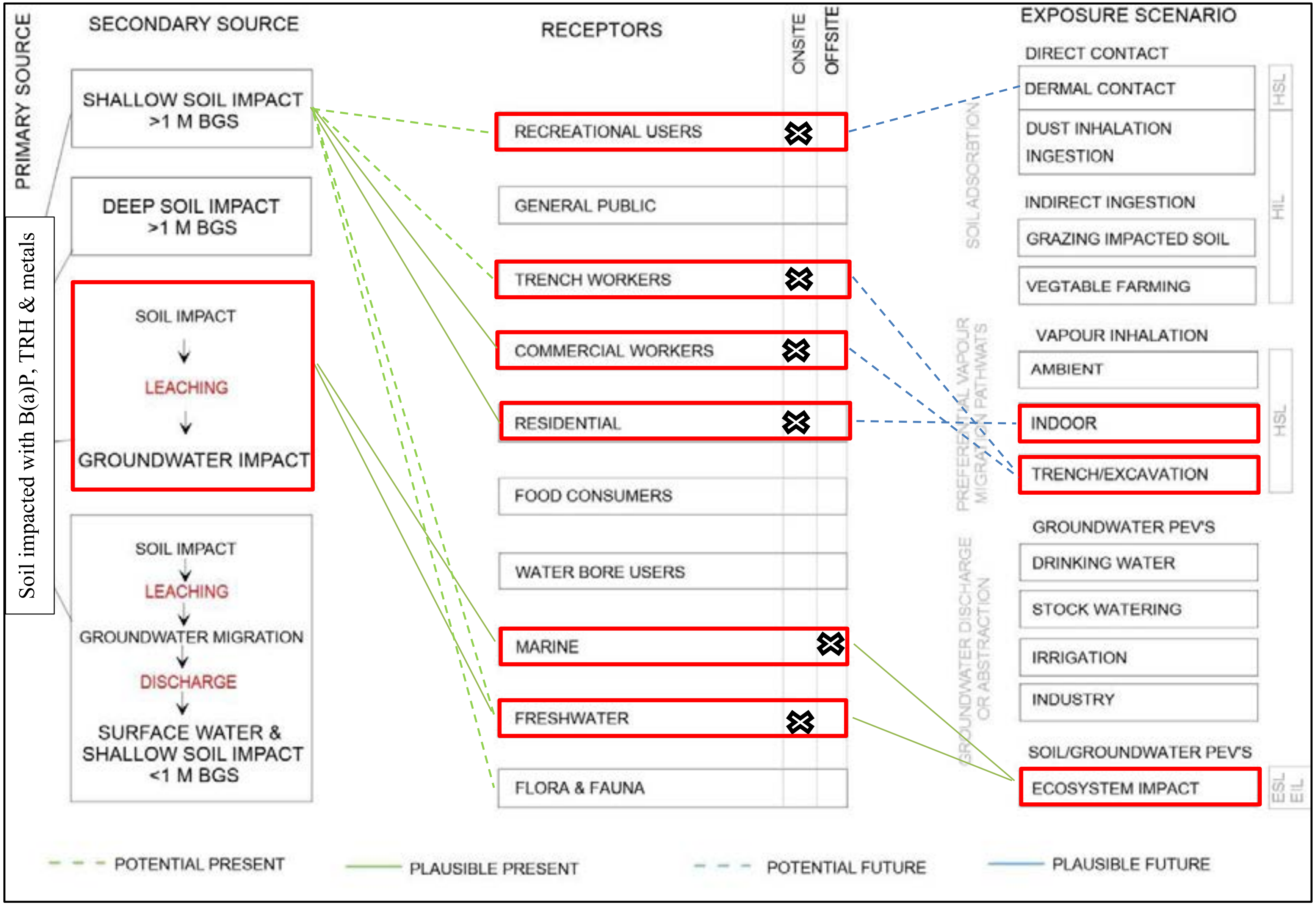


Figure 16 Conceptual Site Model Identifying Contamination Source, Receptors and Transport Mechanisms/Exposure Routes

15 CONCLUSIONS

15.1 Desktop Assessment

The following key information was gathered during the PSI (GES 2019):

- The Site is zoned *Particular Purpose and Environmental Management* under the Hobart City Council *Interim Planning Scheme 2015* and is owned by UTAS.
- The geology of the Site is underlaid with Quaternary and Tertiary aged deposits on the lower elevations of the Site with significant fill deposits present in the current sports fields. The upper slopes of the Site are dominated by Jurassic dolerite with associated shallow clay soils. Extensive fill deposits are present under the sprots fields at Olinda Grove comprising of rock material excavated for construction of the nearby highway.
- There are a total of 2 registered bores located within 500m of the investigation area according to the MRT. One bore has been either capped or abandoned, and the second not in use for many years. Therefore, the possibility of residents accessing groundwater has been ruled out.
- Groundwater is inferred to be travelling in a easterly direction. The closest ecological receptor is the River Derwent; approximately 100m from the Site.
- The Site walkover confirmed that the Site is free from any commercial or industrial activities that involve significant sources of contamination such as bulk fuel storage and dispensing, manufacturing, automotive repairs & maintenance, or other industrial processes.
- Dangerous good were stored on the Site in a limited number of storage facilities around the Site, and fuel had been historically stored in a number of underground tanks on Site, all of which have long been decommissioned.
- Historical records showed the Site formerly hosted a rifle range with that was decommissioned prior to construction of Churchill Avenue and much of the nearby civil and residential infrastructure. Records indicate significant bulk earthworks took place after decommissioning of the Site, but there is some potential for residential heavy metal contamination from the range.
- It was concluded that there is likely to be localised contamination across the Site, but the Site has not hosted historical industrial activities and is unlikely to have extensive soil or groundwater contamination.

15.2 Soil Assessment

From the soil assessment the following is concluded:

- <u>Environment:</u> There was Benzo(a)pyrene and heavy metals detected in a small number of samples in Precinct 1,3 & 5. There were a small number guideline exceedances and a possible risk to ecological receptors identified in the shallow soil assessment.
- <u>Human Health:</u> There were no human health guideline exceedances for dermal contact compared with CRC CARE 2011 HSL guideline limits, no human health guideline exceedances compared with NEPM 2013 HIL guideline limits for dust inhalation or ingestion.
- <u>Human Health:</u> There was a single human health guideline exceedance for shallow soil impacted with hydrocarbons in Precinct 3 for residential indoor vapour intrusion compared with CRC CARE HSL guideline limits
- <u>Human Health:</u> There were a small number of human health guideline exceedances for shallow soil impacted with Benzo(a)pyrene in Precinct 1 when compared with NEPM 2013 HIL guideline limits for dust inhalation or ingestion.
- <u>Excavated Soil Management:</u> In terms of *IB105*, a small number of soil samples tested from Precinct 1, 3 & 5, are Level 2 and Level 3 Material, and classified as low Level contaminated soil. It must be noted some of the heavy metal contaminants identified (manganese & chromium) are known to be naturally occurring in the local area such that further background profiling and assessment is recommended prior to any bulk earthworks.

15.3 Groundwater Assessment

From the groundwater assessment, it is concluded that:

- Environment: There were Fresh Water and Marine Water guideline exceedances for Benzo(a)pyrene and copper in Precinct 1. A potential risk to the environment has been identified if groundwater is not managed during deep excavations or any dewatering/recovery operations.
- Human Health – There we were no human health guideline exceedances in the groundwater

16 RECOMMENDATIONS

GES recommends the following:

16.1 Soil Contamination

Soil impacted with contaminants in concentrations exceeding the applicable health and environmental guidelines was identified in small number of samples on the Site. The results indicate that soil contamination is likely to be localised to the identified areas of concern on the Site.

Further investigations must be undertaken in the areas of potential concern prior to any detailed design and planning for construction. The current information and any future investigation results must be evaluated to prepare the following management measures:

- Specific Soil and Water Management Plans (SWMP) will be required for the various Precincts and/or building areas to control the movement and erosion of soil from the Site that could impact ecological receptors.
- Specific Construction Environmental Management Plans (CEMP) will be required for the various Precincts and/or building areas to ensure health and safety values are maintained.
- Specific assessment of materials identified as potentially contaminated soil according to EPA IB105 must be undertaken with refence to local background Levels and possible reuse on Site.

16.2 Groundwater Contamination

Limited groundwater contamination was identified. To minimise the risk to future Site commercial workers during possible redevelopment, plus future trench works and ecological receptors, the following mitigation measures should be put in place as a minimum:

- Current groundwater monitoring bores should be maintained and standing water Levels and contaminant concentrations monitored prior to any detailed design and development on the Site.
- Any deep excavation and dewatering works as part of future redevelopment in Precinct 1 must have a specific groundwater management plan including disposal approvals.

16.3 Suitability of the Site for Site Redevelopment

The current Environmental Site Assessment has identified localised soil contamination over a limited area of the Site. The assessment has also identified contaminated groundwater is underlying the lower areas of the Site. Provided the recommendations and protection measures are implemented from this report including but not limited to further specific investigations and implementation of management plans then GES is satisfied that future redevelopment on the Site will not adversely impact on human health or the environment.

REFERENCES

ANZECC, 2000. *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*. Australian and New Zealand Environment and Conservation Council and National Health and Medical Research Council.

AS/NZS 1726:1993. Geotechnical Site Investigations. Standards Australia, 1993.

AS 4482:2005 Guide to the investigation and sampling of Sites with potentially contaminated soil – Part 1: Non-volatile and semi-volatile compounds, Standards Australia, 2005.

CRC CARE 2017b, Risk-based Management and Remediation guidance for benzo(a)pyrene. Technical Report no. 39, CRC for Contamination Assessment and Remediation of the Environment, Newcastle, Australia.

Davis, GB, Merrick, NP & McLaughlan, RG 2006, Protocols and techniques for characterising Sites with subsurface petroleum hydrocarbons – a review, Technical Report no. 2, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

Davis, GB, Patterson, BM & Trefry, MG 2009a, Biodegradation of petroleum hydrocarbon vapours, Technical Report no. 12, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

EPA Tasmania, 2018. Information Bulletin (IB)105. *Classification and Management of Contaminated Soil for Disposal.* Version 3. Environmental Protection Authority Tasmania.

Freeze, R.A., and Cherry, J.A., 1979, Groundwater: Englewood Cliffs, NJ, Prentice-Hall, 604 p.

Friebel, E & Nadebaum, 2011a, 'Health screening Levels for petroleum hydrocarbons in soil and groundwater. Part 1: Technical development document', CRC for Contamination Assessment and Remediation of the Environment, CRC CARE Technical Report no. 10, Adelaide.

Friebel, E & Nadebaum, 2011b, 'Health screening Levels for petroleum hydrocarbons in soil and groundwater. Part 2: Application document', CRC for Contamination Assessment and Remediation of the Environment, CRC CARE Technical Report no. 10, Adelaide.

LIST (2019). Land Information System Tasmania Online Database. Department of Primary Industries, Parks, Water and Environment. 2019. https://www.thelist.tas.gov.au/app/content/home

NEPC, 1999. Guideline on Data Collection, Sample Design and Reporting Schedule B (2), National Environmental Protection Measure (Assessment of Site Contamination), National Environment Protection Council, 1999. Measures as amended, taking into account amendments up to National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)

NEPM, 1999.Guideline on Investigation Levels for Soil and Groundwater, Schedule B (1), National Environment Protection (Assessment of Site Contamination) Measure, National Environment Protection Council, 1999. Measures as amended, taking into account amendments up to National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1).

LIMITATIONS STATEMENT

This *Preliminary Environmental Site Assessment* Report has been prepared in accordance with the scope of services between Geo-Environmental Solutions Pty. Ltd. (GES) and ClarkeHopkinsClarke Architects on behalf of UTAS Properties Pty Ltd ('the Client'). To the best of GES's knowledge, the information presented herein represents the Client's requirements at the time of printing of the Report. However, the passage of time, manifestation of latent conditions or impacts of future events may result in findings differing from that described in this Report. In preparing this Report, GES has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations referenced herein. Except as otherwise stated in this Report, GES has not verified the accuracy or completeness of such data, surveys, analyses, designs, plans and other information.

The scope of this study does not allow for the review of every possible soil and groundwater contaminant over the whole area of the Site. The conclusions described within this report are based on the information collected during the desktop investigation.

This report does not purport to provide legal advice. Readers of the report should engage professional legal practitioners for this purpose as required.

No responsibility is accepted for use of any part of this report in any other context or for any other purpose by third party

Appendix 1 GES Staff

Geo-Environmental Solutions (GES) is a specialist geotechnical and environmental consultancy providing advice on all aspects of soils, geology, hydrology, and soil and groundwater contamination across a diverse range of industries.

Geo Environmental Solutions Pty Ltd:

- ACN – 115 004 834
- ABN – 24 115 004 834

GES STAFF - ENGAGED IN SITE INVESTIGATION WORKS

Dr John Paul Cumming B.Agr.Sc (Hons) Phd CPSS GAICD

- Principle Author and Principle Environmental Consultant
- PhD in Environmental Soil Chemistry from the University of Tasmania in 2007
- 18 years' experience in environmental contamination assessment and Site remediation.

Mr Mark Downie B.Agr.Sc

- Soil Scientist with 15 years' professional experience.
- 8 years' experience in contamination assessment and reporting of soils and groundwater.

Mr Aaron Plummer (Cert. IV)

- Soil Technician
- 10 years' experience in hydrocarbon and heavy metal contamination sampling of soils and groundwater

GES STAFF – CONTAMINATED SITES EXPERIENCE

Mr David Lee B.Sc

- Geologist with 3 years' experience in Site assessments for land-use, landslide, coastal hazards and foundation construction, including contaminated Site assessments.
- 2 years' experience undertaking geotechnical assessment and design in underground hard rock mining.

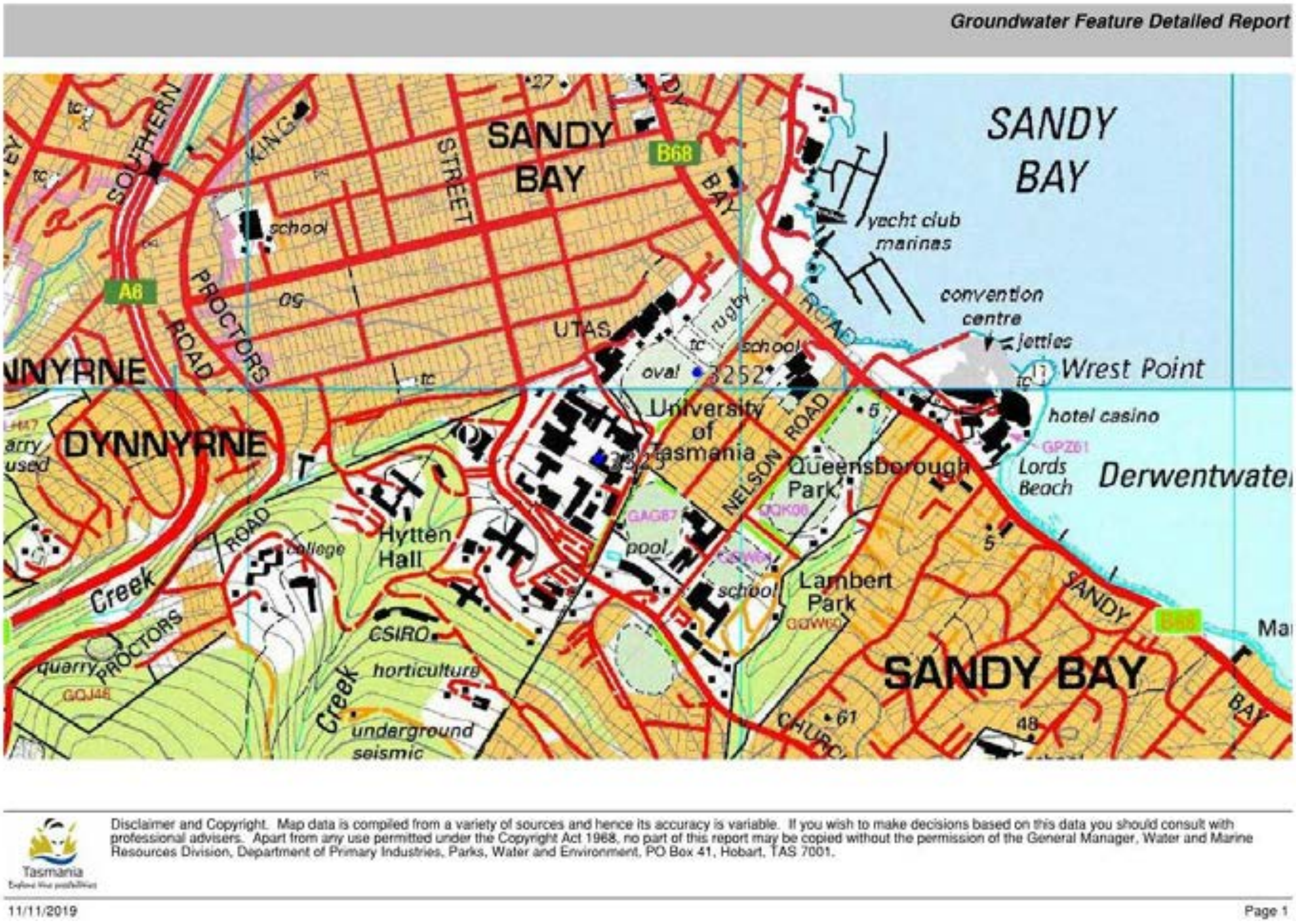
Dr Sam Rees B.Agr.Sc (Phd)

- Soil & Environmental Scientist
- 6 years' experience in hydrocarbon and heavy metal contamination assessment and reporting of soils

Mr Grant McDonald (Adv. cert. hort.)

- Soil Technician
- 10 years' experience in hydrocarbon and heavy metal contamination sampling of soils and groundwater.

Appendix 2 Groundwater Bore report DPIPWE



Groundwater Feature Detailed Report

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Tasmania

11/11/2019

Page 1

Groundwater Feature Detailed Report

Identification

Feature id: 3252 **Feature type:** Bore

Location

Locality: Sandy Bay

Easting: 526914 **Datum:** GDA94

Northing: 5250033 **Accuracy:** 50

Ground level (m ASL):

Construction

Date drilled: 18/08/1987

Drilling company: Gerald Spaulding Drillers Pty Ltd

Depth (metres): 48.80

Initial yield (L/sec): 4.54

Initial EC (µS/cm):

Bore diameters

From (m)	To (m)	Diameter (mm)	Drilling technique
0.0	48.8	203.00	Air Percussion (Rotary air - R)

Casings

From (m)	To (m)	Inside diameter (mm)	Outside diameter (mm)	Material
0.0	42.7		152.00	unplasticised polyvinylchloride uPVC

Screens

From (m)	To (m)	Inlet type
NA		

Seals

From (m)	To (m)	Material type
NA		

Geological / Hydrogeological Information

Lithological Log

From (m)	To (m)	Lithological description
0.0	0.6	dolerite fill
0.6	9.2	yellow clay
9.2	18.3	decomposed basalt (clay)
18.3	24.4	broken basalt
24.4	48.8	decomposed basalt

Depth to water struck

Date	From (m)	To (m)	Cumulative yield
18/08/1987	24.4	36.6	4.54

Main aquifer geology: Tertiary Basalt

Final TDS (mg/L):

11/11/2019 Page 2

Standing Water Levels

Standing water levels

Date	SWL (metres)
NA	

Current status

Last recorded statuses

Type	Value	Date recorded
function	functioning	18/08/1987

Groundwater Feature Detailed Report

Identification **Feature id:** 3325 **Feature type:** Bore

Location

Locality: Sandy Bay
Easting: 526714 **Datum:** GDA94
Northing: 5249858 **Accuracy:** 50
Ground level (m ASL):

Construction

Date drilled: 01/01/1967
Drilling company: Unknown duplicate
Depth (metres):
Initial yield (L/sec):
Initial EC (µS/cm):

Bore diameters

From (m)	To (m)	Diameter (mm)	Drilling technique
			Unknown

Casings

From (m)	To (m)	Inside diameter (mm)	Outside diameter (mm)	Material
NA				

Screens

From (m)	To (m)	Inlet type
NA		

Seals

From (m)	To (m)	Material type
NA		

Geological / Hydrogeological Information

Lithological Log

From (m)	To (m)	Lithological description
NA		

Depth to water struck

Date	From (m)	To (m)	Cumulative yield
NA			

Main aquifer geology: Tertiary Sediments
Final TDS (mg/L): 2463

Standing Water Levels

Standing water levels

Date	SWL (metres)
NA	

11/11/2019 Page 4

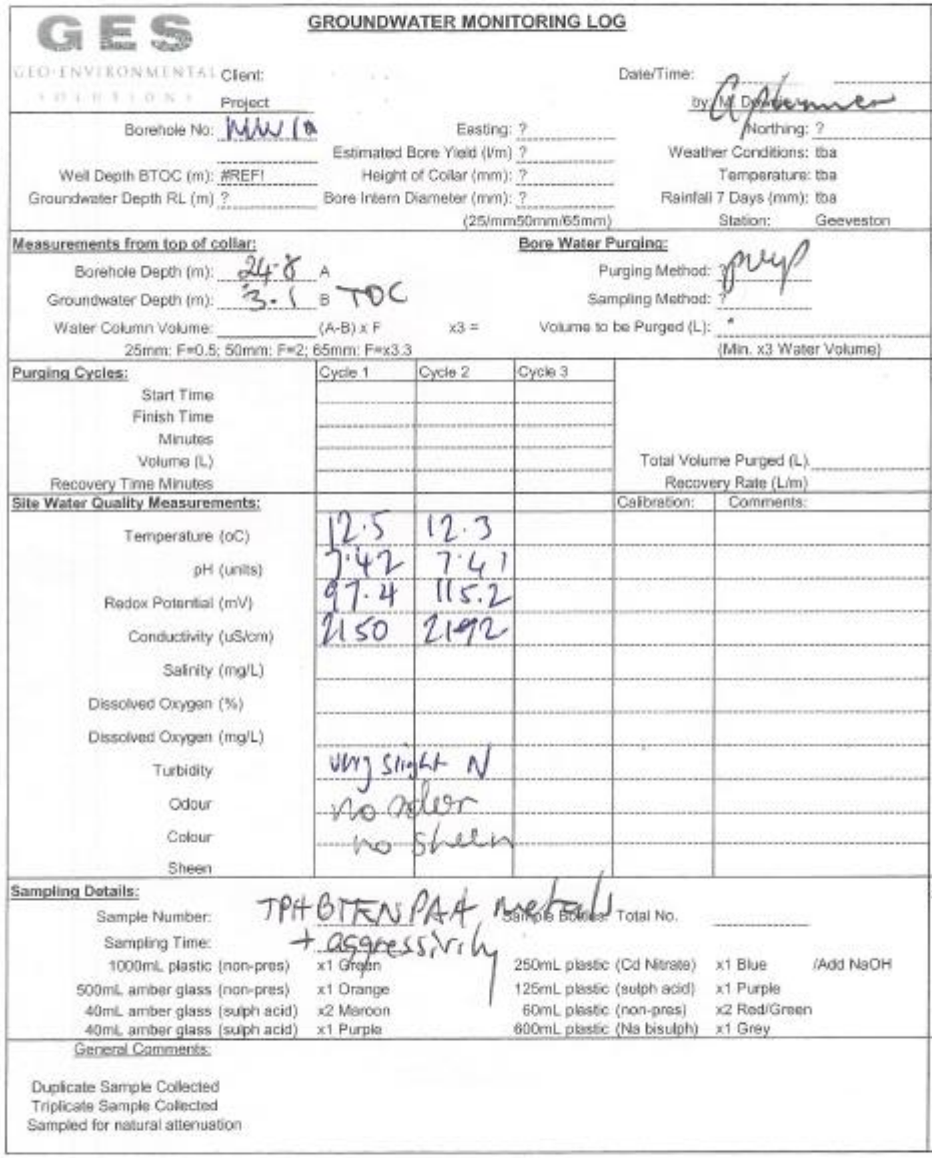
Groundwater Feature
Detailed Report

Current status

Last recorded statuses

Type	Value	Date recorded
function	Unknown	01/11/1996

Appendix 3 Field Notes from current sampling



GEO-ENVIRONMENTAL SOLUTIONS

GROUNDWATER MONITORING LOG

Client:
Project
Date/Time:
by: M D

Borehole No: MW1a
Easting: ?
Northing: ?
Estimated Bore Yield (l/m) ?
Weather Conditions: tba
Well Depth BTOC (m): #REF!
Height of Collar (mm): ?
Temperature: tba
Groundwater Depth RL (m) ?
Bore Intern Diameter (mm): ?
(25/mm50mm/65mm)
Rainfall 7 Days (mm): tba
Station: Geeveston

Measurements from top of collar:

Borehole Depth (m): 24.8 A
Groundwater Depth (m): 3.1 B TOC
Water Column Volume: (A-B) x F x3 =
25mm: F=0.5; 50mm: F=2; 65mm: F=x3.3

Bore Water Purging:

Purging Method: pump
Sampling Method: ?
Volume to be Purged (L):
(Min. x3 Water Volume)

Purging Cycles:	Cycle 1	Cycle 2	Cycle 3
Start Time			
Finish Time			
Minutes			
Volume (L)			
Recovery Time Minutes			

Total Volume Purged (L)
Recovery Rate (L/m)

Site Water Quality Measurements:				Calibration:	Comments:
Temperature (oC)	12.5	12.3			
pH (units)	7.42	7.41			
Redox Potential (mV)	97.4	115.2			
Conductivity (uS/cm)	2150	2192			
Salinity (mg/L)					
Dissolved Oxygen (%)					
Dissolved Oxygen (mg/L)					
Turbidity	very slight N				
Odour	no odor				
Colour	no sheen				
Sheen					

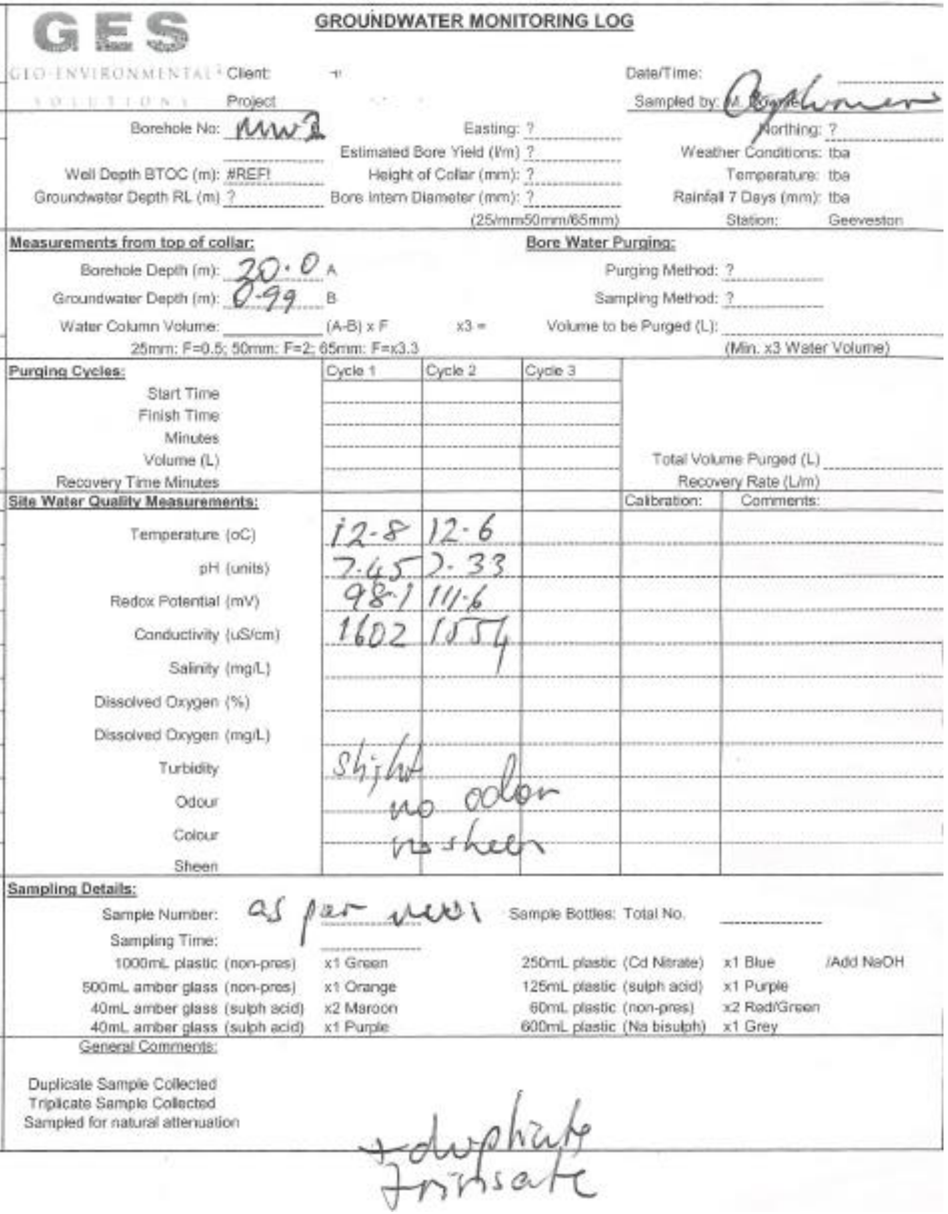
Sampling Details:

Sample Number: TPH BTEN PAH metals + aggressivity
Sample Bottles: Total No.
Sampling Time:

1000mL plastic (non-pres)	x1 Green	250mL plastic (Cd Nitrate)	x1 Blue /Add NaOH
500mL amber glass (non-pres)	x1 Orange	125mL plastic (sulph acid)	x1 Purple
40mL amber glass (sulph acid)	x2 Maroon	60mL plastic (non-pres)	x2 Red/Green
40mL amber glass (sulph acid)	x1 Purple	600mL plastic (Na bisulph)	x1 Grey

General Comments:

Duplicate Sample Collected
Triplicate Sample Collected
Sampled for natural attenuation



GEO-ENVIRONMENTAL SOLUTIONS

GROUNDWATER MONITORING LOG

Client:
Project
Date/Time:
Sampled by: M [illegible]

Borehole No: MW2
Easting: ?
Northing: ?
Estimated Bore Yield (l/m) ?
Weather Conditions: tba
Well Depth BTOC (m): #REF!
Height of Collar (mm): ?
Temperature: tba
Groundwater Depth RL (m) ?
Bore Intern Diameter (mm): ?
(25/mm50mm/65mm)
Rainfall 7 Days (mm): tba
Station: Geeveston

Measurements from top of collar:

Borehole Depth (m): 20.0 A
Groundwater Depth (m): 0.99 B
Water Column Volume: (A-B) x F x3 =
25mm: F=0.5; 50mm: F=2; 65mm: F=x3.3

Bore Water Purging:

Purging Method: ?
Sampling Method: ?
Volume to be Purged (L):
(Min. x3 Water Volume)

Purging Cycles:	Cycle 1	Cycle 2	Cycle 3
Start Time			
Finish Time			
Minutes			
Volume (L)			
Recovery Time Minutes			

Total Volume Purged (L)
Recovery Rate (L/m)

Site Water Quality Measurements:				Calibration:	Comments:
Temperature (oC)	12.8	12.6			
pH (units)	7.45	7.33			
Redox Potential (mV)	98.1	111.6			
Conductivity (uS/cm)	1602	1554			
Salinity (mg/L)					
Dissolved Oxygen (%)					
Dissolved Oxygen (mg/L)					
Turbidity	slight				
Odour	no odor				
Colour	no sheen				
Sheen					

Sampling Details:

Sample Number: as per MW1
Sample Bottles: Total No.
Sampling Time:

1000mL plastic (non-pres)	x1 Green	250mL plastic (Cd Nitrate)	x1 Blue /Add NaOH
500mL amber glass (non-pres)	x1 Orange	125mL plastic (sulph acid)	x1 Purple
40mL amber glass (sulph acid)	x2 Maroon	60mL plastic (non-pres)	x2 Red/Green
40mL amber glass (sulph acid)	x1 Purple	600mL plastic (Na bisulph)	x1 Grey

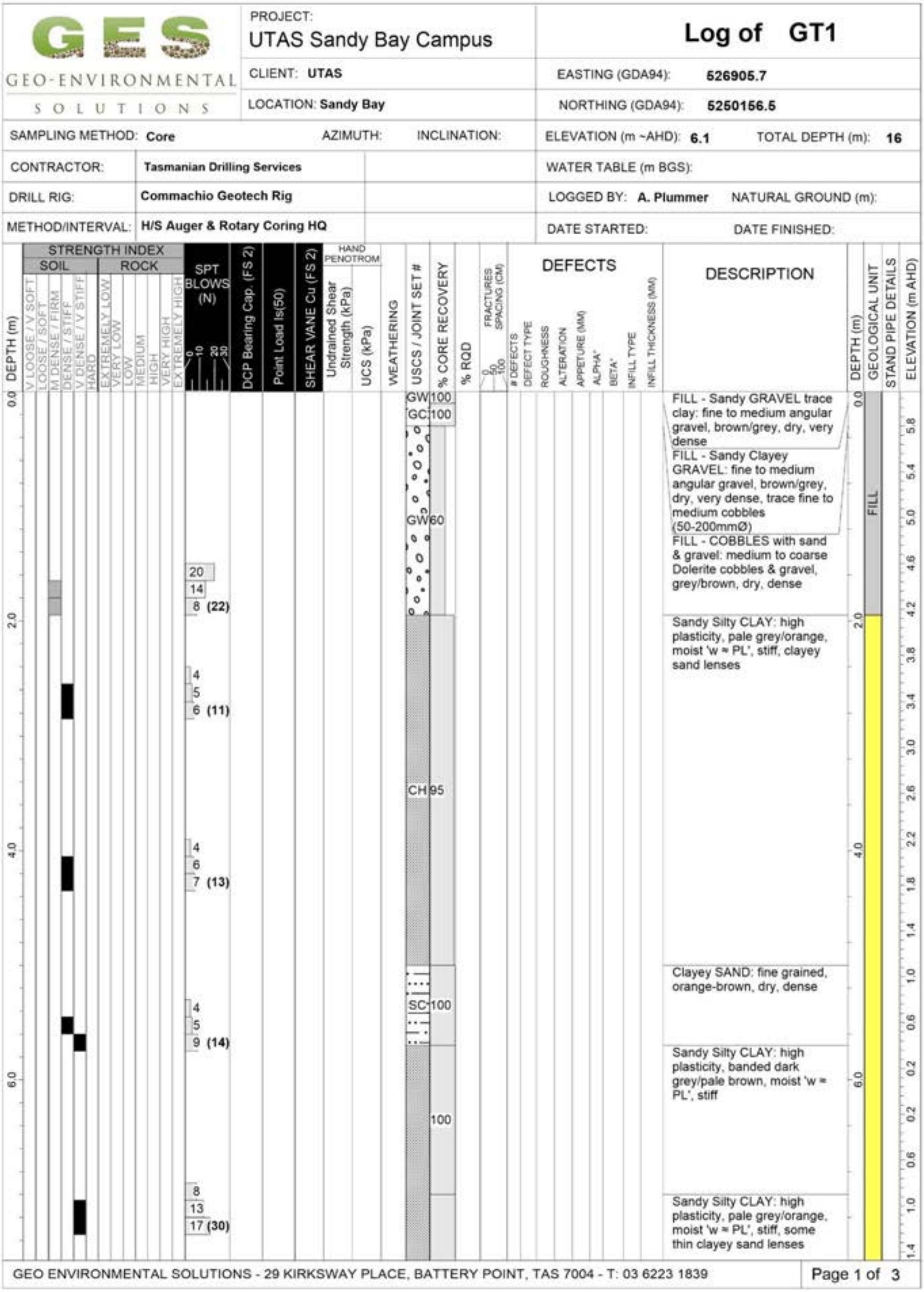
General Comments:

Duplicate Sample Collected
Triplicate Sample Collected
Sampled for natural attenuation

+ duplicate
Triplicate

Appendix 4 Bore logs

Appendix 4 Soil Bore Logs



PROJECT: UTAS Sandy Bay Campus

Log of GT1

CLIENT: **UTAS**

LOCATION: **Sandy Bay**

EASTING (GDA94): **526905.7**

NORTHING (GDA94): **5250156.5**

SAMPLING METHOD: **Core**

AZIMUTH:

INCLINATION:

ELEVATION (m ~AHD): **6.1**

TOTAL DEPTH (m): **16**

CONTRACTOR: **Tasmanian Drilling Services**

WATER TABLE (m BGS):

DRILL RIG: **Commachio Geotech Rig**

LOGGED BY: **A. Plummer**

NATURAL GROUND (m):

METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**

DATE STARTED:

DATE FINISHED:

SPT BLOWS (N)	USCS / JOINT SET #	% CORE RECOVERY	DESCRIPTION
	GW	100	FILL - Sandy GRAVEL trace clay: fine to medium angular gravel, brown/grey, dry, very dense
	GC	100	FILL - Sandy Clayey GRAVEL: fine to medium angular gravel, brown/grey, dry, very dense, trace fine to medium cobbles (50-200mmØ)
20 14 8 (22)	GW	60	FILL - COBBLES with sand & gravel: medium to coarse Dolerite cobbles & gravel, grey/brown, dry, dense
4 5 6 (11) 4 6 7 (13)	CH	95	Sandy Silty CLAY: high plasticity, pale grey/orange, moist 'w ≈ PL', stiff, clayey sand lenses
4 5 9 (14)	SC	100	Clayey SAND: fine grained, orange-brown, dry, dense
		100	Sandy Silty CLAY: high plasticity, banded dark grey/pale brown, moist 'w ≈ PL', stiff
8 13 17 (30)			Sandy Silty CLAY: high plasticity, pale grey/orange, moist 'w ≈ PL', stiff, some thin clayey sand lenses

GEO ENVIRONMENTAL SOLUTIONS - 29 KIRKSWAY PLACE, BATTERY POINT, TAS 7004 - T: 03 6223 1839

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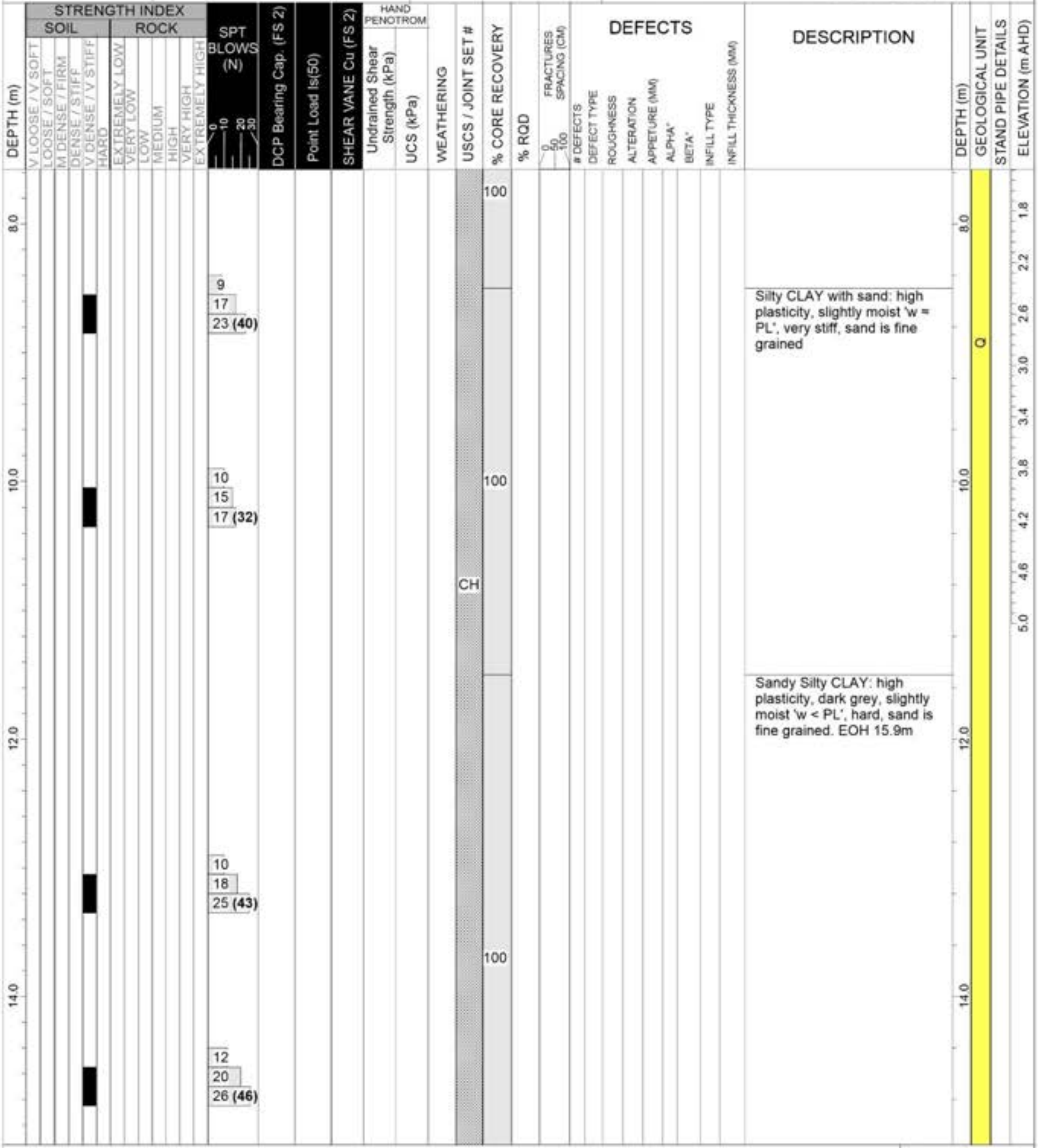
GES
GEO-ENVIRONMENTAL
SOLUTIONS

PROJECT:
UTAS Sandy Bay Campus

Log of GT1

CLIENT: **UTAS**
EASTING (GDA94): **526905.7**
LOCATION: **Sandy Bay**
NORTHING (GDA94): **5250156.5**
SAMPLING METHOD: **Core** AZIMUTH: INCLINATION:
ELEVATION (m ~AHD): **6.1** TOTAL DEPTH (m): **16**
CONTRACTOR: **Tasmanian Drilling Services**
WATER TABLE (m BGS):
DRILL RIG: **Commachio Geotech Rig**
LOGGED BY: **A. Plummer** NATURAL GROUND (m):
METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**
DATE STARTED: DATE FINISHED:

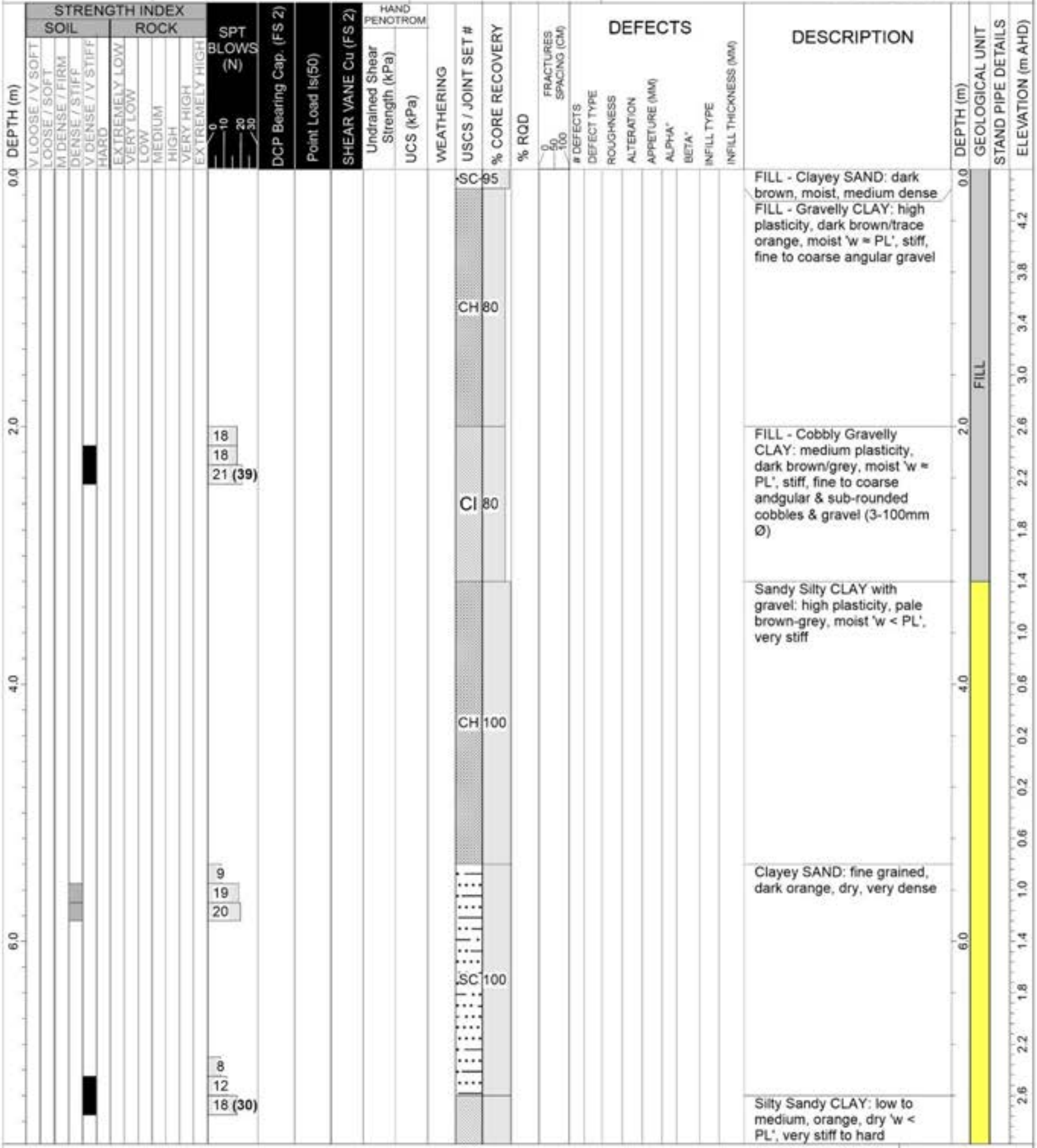


Silty CLAY with sand: high plasticity, slightly moist 'w = PL', very stiff, sand is fine grained

Sandy Silty CLAY: high plasticity, dark grey, slightly moist 'w < PL', hard, sand is fine grained. EOH 15.9m

GES
GEO-ENVIRONMENTAL
SOLUTIONS

PROJECT: UTAS Sandy Bay Campus		**Log of GT2**	
CLIENT: **UTAS**		EASTING (GDA94):	**527028.1**
LOCATION: **Sandy Bay**		NORTHING (GDA94):	**5250198.3**
SAMPLING METHOD: **Core**	AZIMUTH: INCLINATION:	ELEVATION (m ~AHD): **4.6**	TOTAL DEPTH (m): **24.9**
CONTRACTOR:	**Tasmanian Drilling Services**	WATER TABLE (m BGS):	
DRILL RIG:	**Commachio Geotech Rig**	LOGGED BY: **A. Plummer**	NATURAL GROUND (m):
METHOD/INTERVAL:	**H/S Auger & Rotary Coring HQ**	DATE STARTED:	DATE FINISHED:



FILL - Clayey SAND: dark brown, moist, medium dense

FILL - Gravelly CLAY: high plasticity, dark brown/trace orange, moist 'w ≈ PL', stiff, fine to coarse angular gravel

FILL - Cobbly Gravelly CLAY: medium plasticity, dark brown/grey, moist 'w ≈ PL', stiff, fine to coarse andgular & sub-rounded cobbles & gravel (3-100mm Ø)

Sandy Silty CLAY with gravel: high plasticity, pale brown-grey, moist 'w < PL', very stiff

Clayey SAND: fine grained, dark orange, dry, very dense

Silty Sandy CLAY: low to medium, orange, dry 'w < PL', very stiff to hard

GES
GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of GT2

CLIENT: **UTAS**

LOCATION: **Sandy Bay**

EASTING (GDA94): **527028.1**

NORTHING (GDA94): **5250198.3**

SAMPLING METHOD: **Core**

AZIMUTH:

INCLINATION:

ELEVATION (m ~AHD): **4.6**

TOTAL DEPTH (m): **24.9**

CONTRACTOR: **Tasmanian Drilling Services**

WATER TABLE (m BGS):

DRILL RIG: **Commachio Geotech Rig**

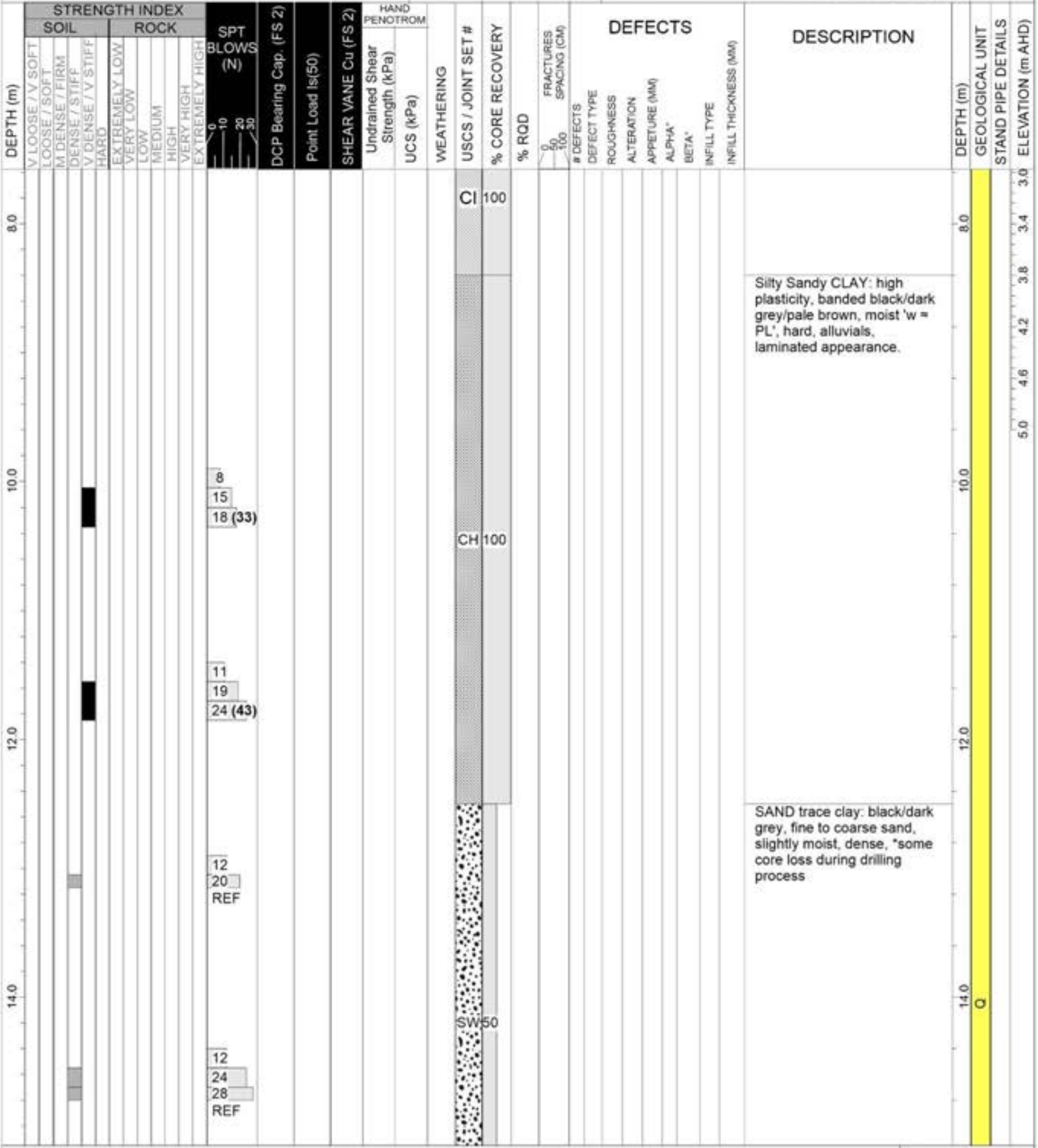
LOGGED BY: **A. Plummer**

NATURAL GROUND (m):

METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**

DATE STARTED:

DATE FINISHED:



Silty Sandy CLAY: high plasticity, banded black/dark grey/pale brown, moist 'w = PL', hard, alluvials, laminated appearance.

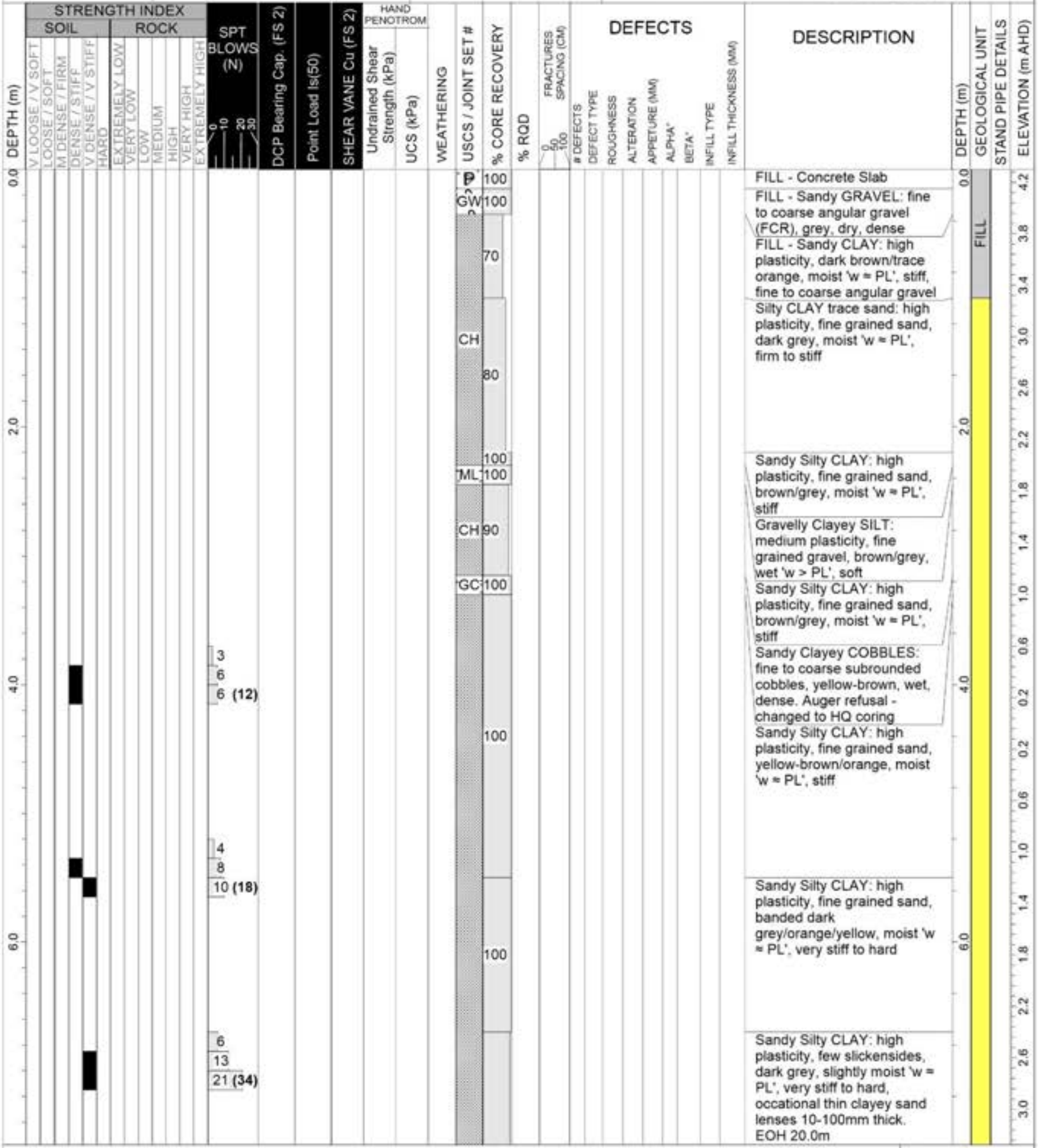
SAND trace clay: black/dark grey, fine to coarse sand, slightly moist, dense, *some core loss during drilling process

GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of GT3

CLIENT: **UTAS**
LOCATION: **Sandy Bay**
EASTING (GDA94): **526931.4**
NORTHING (GDA94): **5250269.6**
SAMPLING METHOD: **Core**
AZIMUTH:
INCLINATION:
ELEVATION (m ~AHD): **4.3**
TOTAL DEPTH (m): **20**
CONTRACTOR: **Tasmanian Drilling Services**
WATER TABLE (m BGS):
DRILL RIG: **Commachio Geotech Rig**
LOGGED BY: **A. Plummer**
NATURAL GROUND (m):
METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**
DATE STARTED:
DATE FINISHED:



FILL - Concrete Slab

FILL - Sandy GRAVEL: fine to coarse angular gravel (FCR), grey, dry, dense

FILL - Sandy CLAY: high plasticity, dark brown/trace orange, moist 'w ≈ PL', stiff, fine to coarse angular gravel

Silty CLAY trace sand: high plasticity, fine grained sand, dark grey, moist 'w ≈ PL', firm to stiff

Sandy Silty CLAY: high plasticity, fine grained sand, brown/grey, moist 'w ≈ PL', stiff

Gravelly Clayey SILT: medium plasticity, fine grained gravel, brown/grey, wet 'w > PL', soft

Sandy Silty CLAY: high plasticity, fine grained sand, brown/grey, moist 'w ≈ PL', stiff

Sandy Clayey COBBLES: fine to coarse subrounded cobbles, yellow-brown, wet, dense. Auger refusal - changed to HQ coring

Sandy Silty CLAY: high plasticity, fine grained sand, yellow-brown/orange, moist 'w ≈ PL', stiff

Sandy Silty CLAY: high plasticity, fine grained sand, banded dark grey/orange/yellow, moist 'w ≈ PL', very stiff to hard

Sandy Silty CLAY: high plasticity, few slickensides, dark grey, slightly moist 'w = PL', very stiff to hard, occational thin clayey sand lenses 10-100mm thick. EOH 20.0m

GES
GEO-ENVIRONMENTAL
SOLUTIONS

PROJECT:
UTAS Sandy Bay Campus

Log of GT3

CLIENT: **UTAS**

EASTING (GDA94): **526931.4**

LOCATION: **Sandy Bay**

NORTHING (GDA94): **5250269.6**

SAMPLING METHOD: **Core**
AZIMUTH:
INCLINATION:

ELEVATION (m ~AHD): **4.3**
TOTAL DEPTH (m): **20**

CONTRACTOR: **Tasmanian Drilling Services**

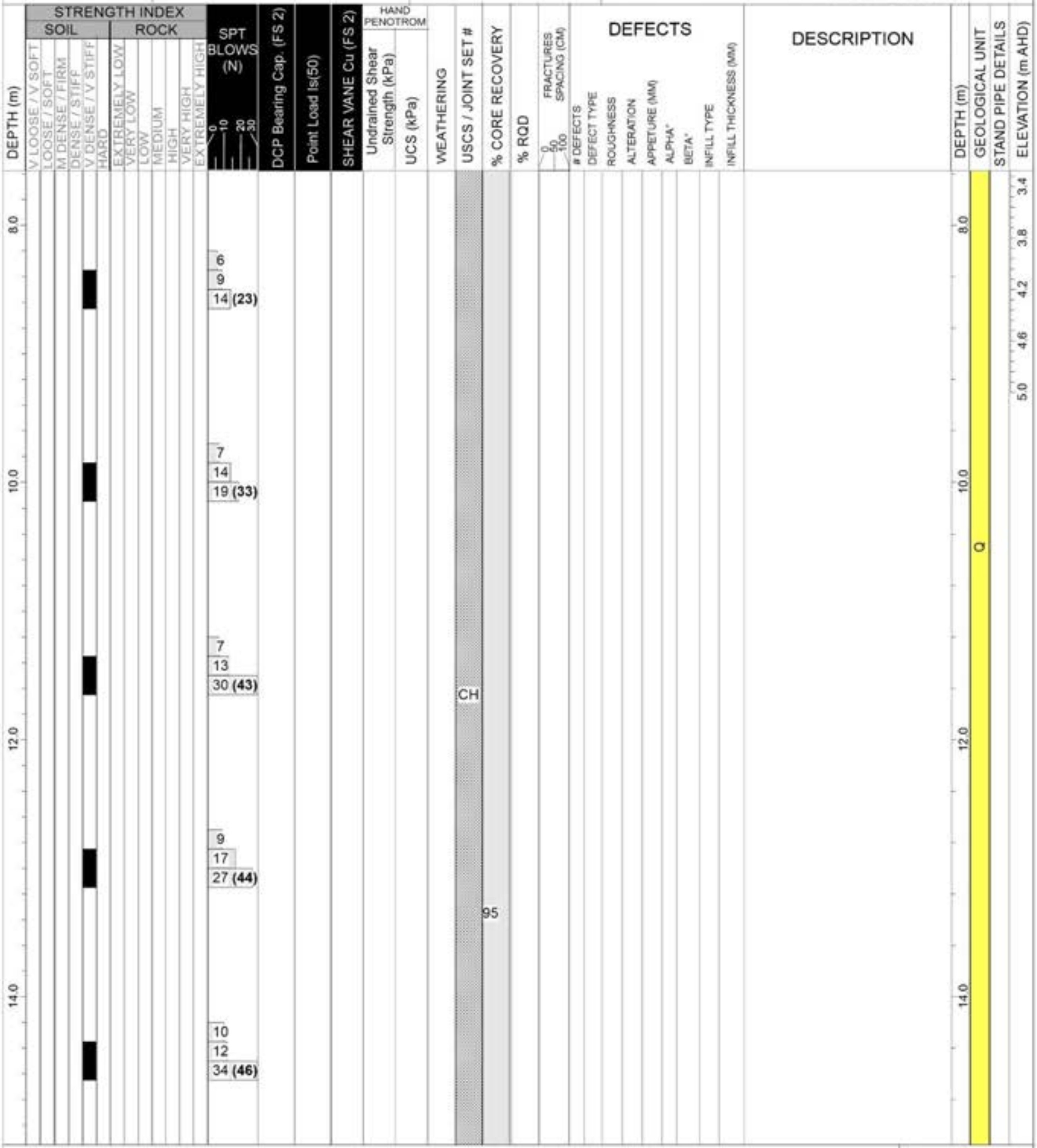
WATER TABLE (m BGS):

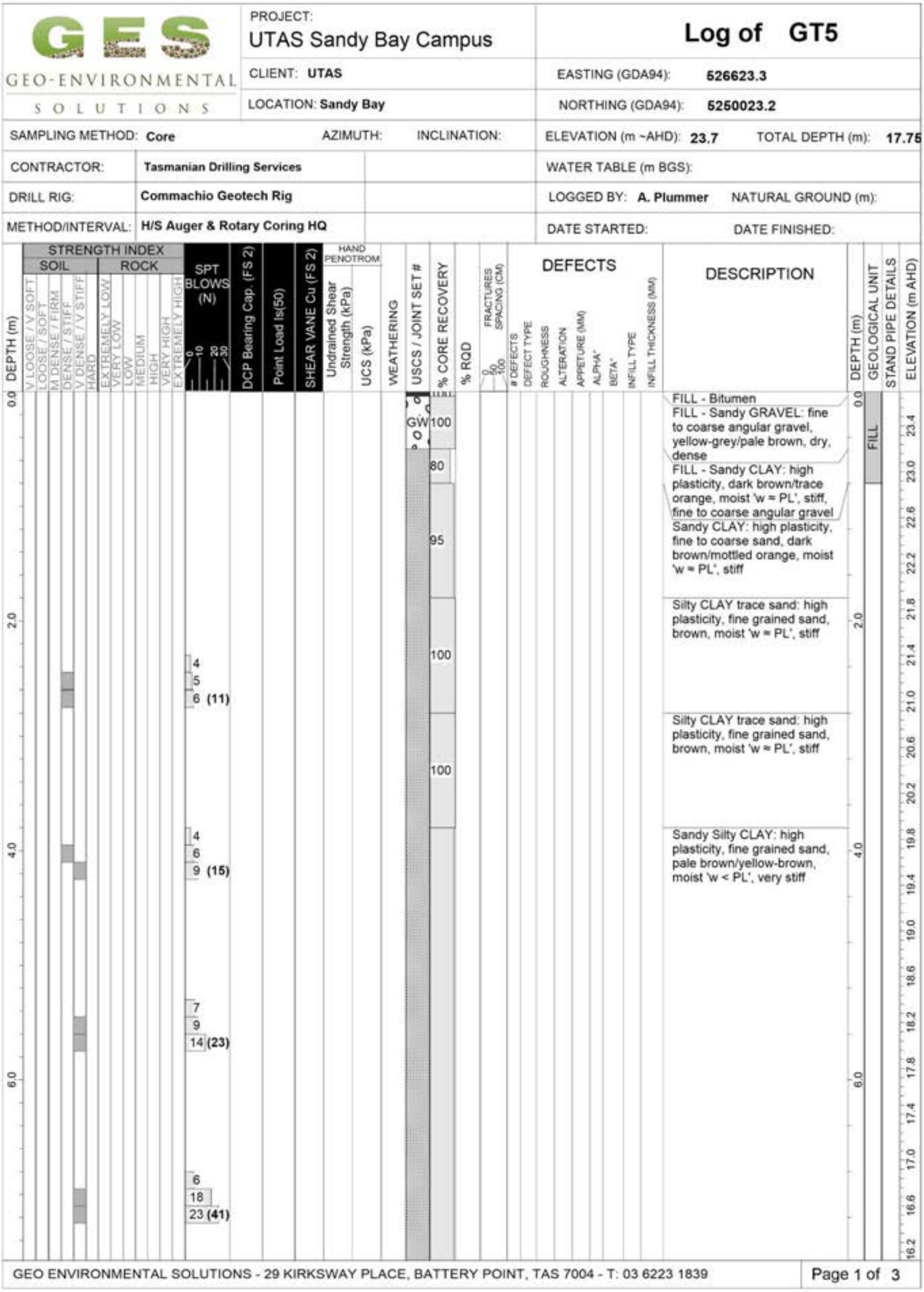
DRILL RIG: **Commachio Geotech Rig**

LOGGED BY: **A. Plummer**
NATURAL GROUND (m):

METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**

DATE STARTED:
DATE FINISHED:





GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of GT5

CLIENT: **UTAS**

LOCATION: **Sandy Bay**

EASTING (GDA94): **526623.3**

NORTHING (GDA94): **5250023.2**

SAMPLING METHOD: **Core**

AZIMUTH:

INCLINATION:

ELEVATION (m ~AHD): **23.7**

TOTAL DEPTH (m): **17.75**

CONTRACTOR: **Tasmanian Drilling Services**

WATER TABLE (m BGS):

DRILL RIG: **Commachio Geotech Rig**

LOGGED BY: **A. Plummer**

NATURAL GROUND (m):

METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**

DATE STARTED:

DATE FINISHED:

SPT BLOWS (N):

4
5
6 **(11)**

4
6
9 **(15)**

7
9
14 **(23)**

6
18
23 **(41)**

% CORE RECOVERY: 100, 80, 95, 100, 100

DESCRIPTION:

FILL - Bitumen

FILL - Sandy GRAVEL: fine to coarse angular gravel, yellow-grey/pale brown, dry, dense

FILL - Sandy CLAY: high plasticity, dark brown/trace orange, moist 'w ≈ PL', stiff, fine to coarse angular gravel

Sandy CLAY: high plasticity, fine to coarse sand, dark brown/mottled orange, moist 'w ≈ PL', stiff

Silty CLAY trace sand: high plasticity, fine grained sand, brown, moist 'w ≈ PL', stiff

Silty CLAY trace sand: high plasticity, fine grained sand, brown, moist 'w ≈ PL', stiff

Sandy Silty CLAY: high plasticity, fine grained sand, pale brown/yellow-brown, moist 'w < PL', very stiff

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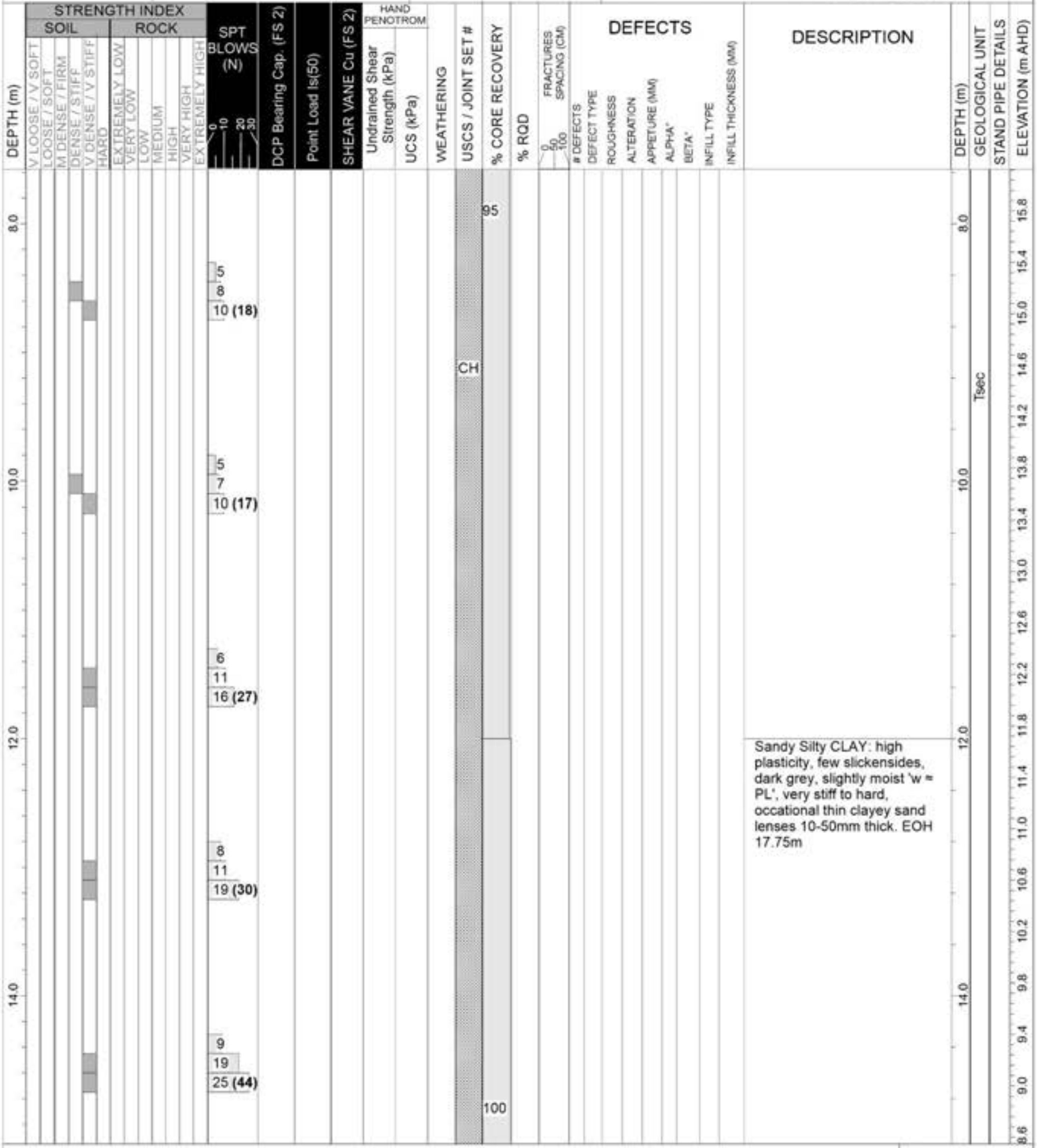
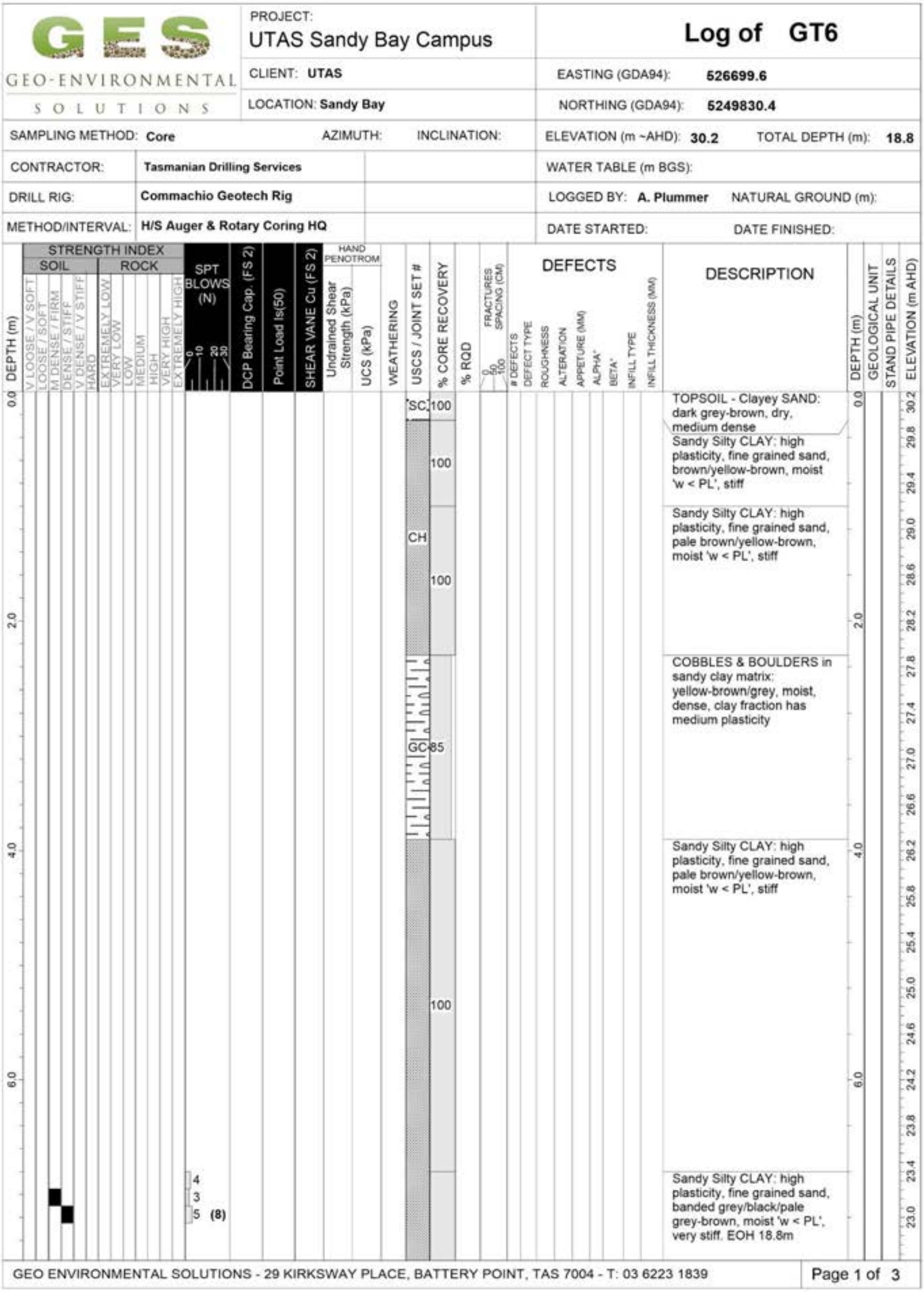
GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus		**Log of GT5**
CLIENT: **UTAS**		EASTING (GDA94): **526623.3**
LOCATION: **Sandy Bay**		NORTHING (GDA94): **5250023.2**
SAMPLING METHOD: **Core**	AZIMUTH: INCLINATION:	ELEVATION (m ~AHD): **23.7** TOTAL DEPTH (m): **17.75**
CONTRACTOR: **Tasmanian Drilling Services**		WATER TABLE (m BGS):
DRILL RIG: **Commachio Geotech Rig**		LOGGED BY: **A. Plummer** NATURAL GROUND (m):
METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**		DATE STARTED: DATE FINISHED:



Sandy Silty CLAY: high plasticity, few slickensides, dark grey, slightly moist 'w ≈ PL', very stiff to hard, occational thin clayey sand lenses 10-50mm thick. EOH 17.75m



GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of GT6

CLIENT: **UTAS**

EASTING (GDA94): **526699.6**

LOCATION: **Sandy Bay**

NORTHING (GDA94): **5249830.4**

SAMPLING METHOD: **Core** AZIMUTH: INCLINATION:

ELEVATION (m ~AHD): **30.2** TOTAL DEPTH (m): **18.8**

CONTRACTOR: **Tasmanian Drilling Services**

WATER TABLE (m BGS):

DRILL RIG: **Commachio Geotech Rig**

LOGGED BY: **A. Plummer** NATURAL GROUND (m):

METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**

DATE STARTED: DATE FINISHED:

DEPTH (m)	STRENGTH INDEX (SOIL / ROCK)	SPT BLOWS (N)	USCS / JOINT SET #	% CORE RECOVERY	DESCRIPTION	DEPTH (m)	ELEVATION (m AHD)
0.0			SC	100	TOPSOIL - Clayey SAND: dark grey-brown, dry, medium dense	0.0	30.2
				100	Sandy Silty CLAY: high plasticity, fine grained sand, brown/yellow-brown, moist 'w < PL', stiff		29.8
			CH	100	Sandy Silty CLAY: high plasticity, fine grained sand, pale brown/yellow-brown, moist 'w < PL', stiff		29.4
2.0			GC	85	COBBLES & BOULDERS in sandy clay matrix: yellow-brown/grey, moist, dense, clay fraction has medium plasticity	2.0	28.2
4.0				100	Sandy Silty CLAY: high plasticity, fine grained sand, pale brown/yellow-brown, moist 'w < PL', stiff	4.0	26.2
6.0	M DENSE / FIRM DENSE / STIFF	4 3 5 (8)			Sandy Silty CLAY: high plasticity, fine grained sand, banded grey/black/pale grey-brown, moist 'w < PL', very stiff. EOH 18.8m	6.0	23.4

GEO ENVIRONMENTAL SOLUTIONS - 29 KIRKSWAY PLACE, BATTERY POINT, TAS 7004 - T: 03 6223 1839

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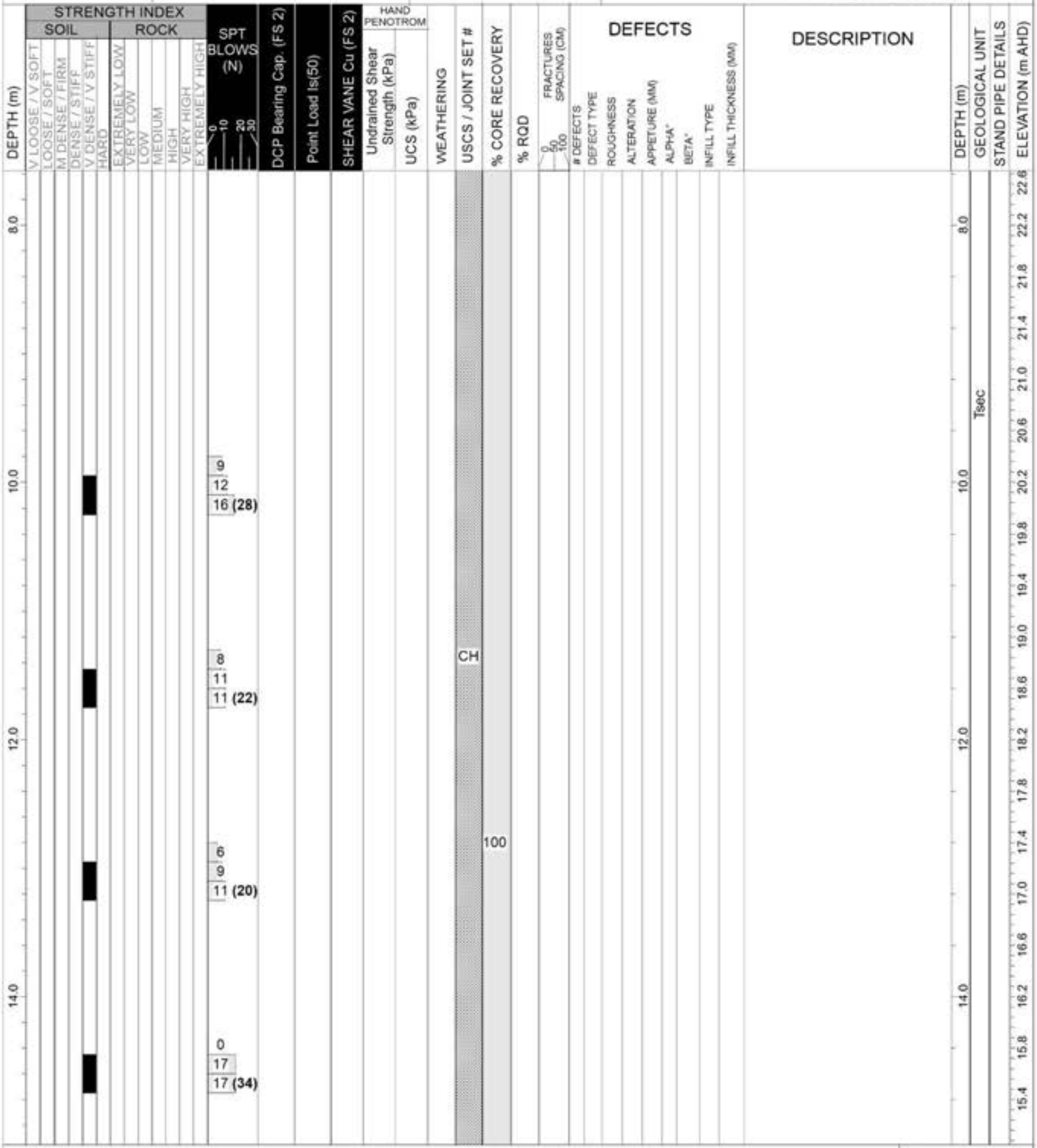
GEO-ENVIRONMENTAL
SOLUTIONS

PROJECT:
UTAS Sandy Bay Campus

Log of GT6

CLIENT: **UTAS**
LOCATION: **Sandy Bay**
EASTING (GDA94): **526699.6**
NORTHING (GDA94): **5249830.4**
SAMPLING METHOD: **Core**
AZIMUTH:
INCLINATION:
ELEVATION (m ~AHD): **30.2**
TOTAL DEPTH (m): **18.8**
CONTRACTOR: **Tasmanian Drilling Services**
WATER TABLE (m BGS):
DRILL RIG: **Commachio Geotech Rig**
LOGGED BY: **A. Plummer**
NATURAL GROUND (m):
METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**
DATE STARTED:
DATE FINISHED:



GEO ENVIRONMENTAL SOLUTIONS - 29 KIRKSWAY PLACE, BATTERY POINT, TAS 7004 - T: 03 6223 1839

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GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of GT7

CLIENT: **UTAS**

LOCATION: **Sandy Bay**

EASTING (GDA94): **526569.7**

NORTHING (GDA94): **5249869.4**

SAMPLING METHOD: **Core**

AZIMUTH:

INCLINATION:

ELEVATION (m ~AHD): **30.5**

TOTAL DEPTH (m): **20.4**

CONTRACTOR: **Tasmanian Drilling Services**

WATER TABLE (m BGS):

DRILL RIG: **Commachio Geotech Rig**

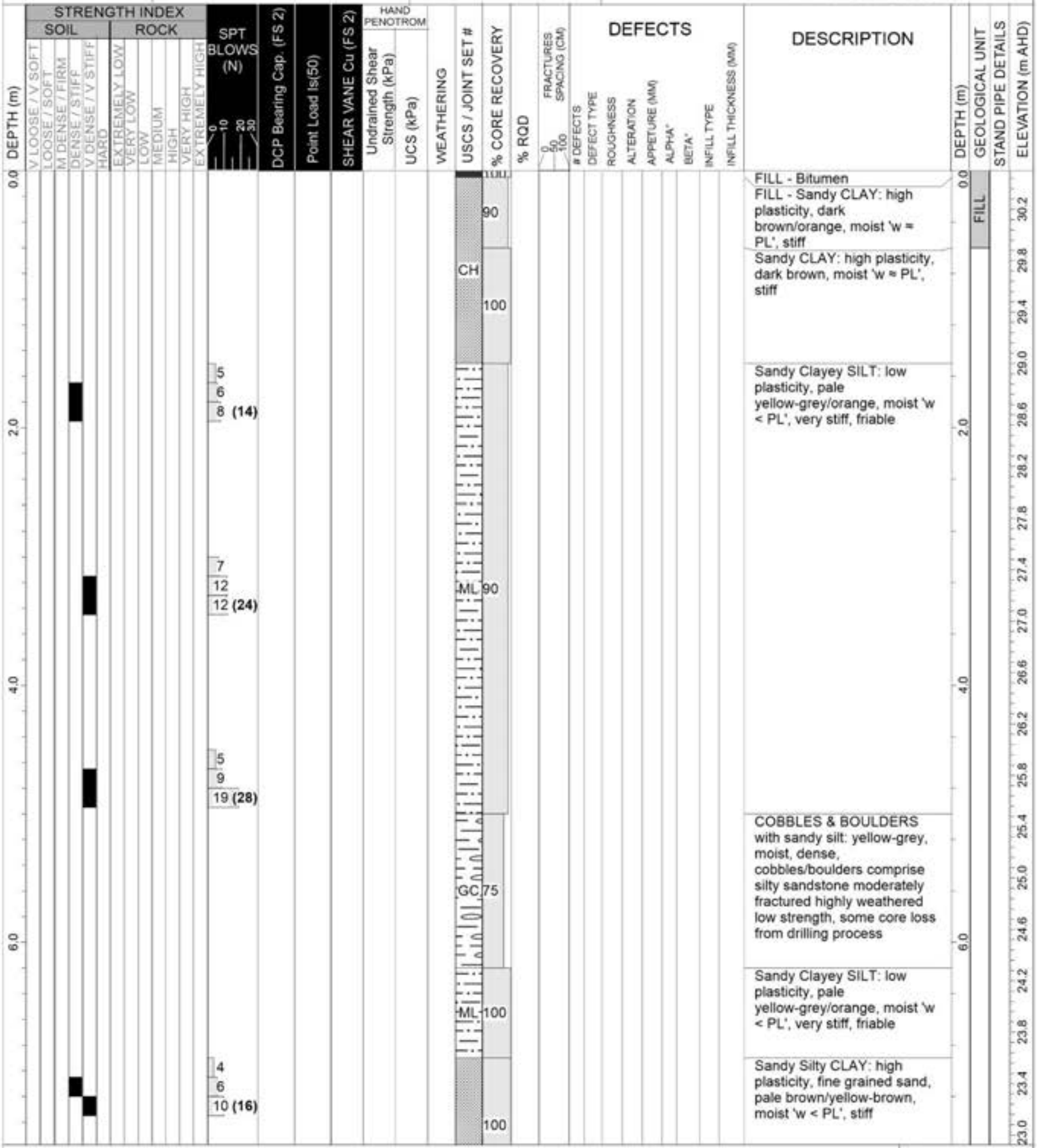
LOGGED BY: **A. Plummer**

NATURAL GROUND (m):

METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**

DATE STARTED:

DATE FINISHED:



FILL - Bitumen

FILL - Sandy CLAY: high plasticity, dark brown/orange, moist 'w ≈ PL', stiff

Sandy CLAY: high plasticity, dark brown, moist 'w ≈ PL', stiff

Sandy Clayey SILT: low plasticity, pale yellow-grey/orange, moist 'w < PL', very stiff, friable

COBBLES & BOULDERS with sandy silt: yellow-grey, moist, dense, cobbles/boulders comprise silty sandstone moderately fractured highly weathered low strength, some core loss from drilling process

Sandy Clayey SILT: low plasticity, pale yellow-grey/orange, moist 'w < PL', very stiff, friable

Sandy Silty CLAY: high plasticity, fine grained sand, pale brown/yellow-brown, moist 'w < PL', stiff

GES
GEO-ENVIRONMENTAL
SOLUTIONS

PROJECT: UTAS Sandy Bay Campus		**Log of GT7**
CLIENT: **UTAS**		EASTING (GDA94): **526569.7**
LOCATION: **Sandy Bay**		NORTHING (GDA94): **5249869.4**
SAMPLING METHOD: **Core**	AZIMUTH: INCLINATION:	ELEVATION (m ~AHD): **30.5** TOTAL DEPTH (m): **20.4**
CONTRACTOR: **Tasmanian Drilling Services**		WATER TABLE (m BGS):
DRILL RIG: **Commachio Geotech Rig**		LOGGED BY: **A. Plummer** NATURAL GROUND (m):
METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**		DATE STARTED: DATE FINISHED:

DEPTH (m)	STRENGTH INDEX – SOIL: V LOOSE / V SOFT, LOOSE / SOFT, M DENSE / FIRM, DENSE / STIFF, V DENSE / V STIFF, HARD	STRENGTH INDEX – ROCK: EXTREMELY LOW, VERY LOW, LOW, MEDIUM, HIGH, VERY HIGH, EXTREMELY HIGH	SPT BLOWS (N)	DCP Bearing Cap. (FS 2)	Point Load Is(50)	SHEAR VANE Cu (FS 2)	HAND PENOTROM Undrained Shear Strength (kPa)	UCS (kPa)	WEATHERING	USCS / JOINT SET #	% CORE RECOVERY	% RQD	FRACTURES SPACING (CM)	DEFECTS: # DEFECTS, DEFECT TYPE, ROUGHNESS, ALTERATION, APPETURE (MM), ALPHA°, BETA°, INFILL TYPE, INFILL THICKNESS (MM)	DESCRIPTION	DEPTH (m)	GEOLOGICAL UNIT	STAND PIPE DETAILS	ELEVATION (m AHD)
8.0															Sandy Silty CLAY: high plasticity, fine grained sand, banded grey/black/pale grey-brown, moist 'w < PL', very stiff. EOH 20.4m	8.0			22.6
	DENSE / STIFF		3 6 6 **(12)**																22.2 21.8 21.4 21.0
10.0	DENSE / STIFF V DENSE / V STIFF		5 8 10 **(18)**													10.0	Tsec		20.6 20.2 19.8 19.4 19.0
12.0	V DENSE / V STIFF		9 16 19 **(35)**													12.0			18.6 18.2 17.8
	V DENSE / V STIFF		9 15 19 **(34)**							CH									17.4 17.0
14.0											100					14.0			16.6 16.2
	V DENSE / V STIFF		7 14 20 **(34)**																15.8 15.4

GES
GEO-ENVIRONMENTAL SOLUTIONS

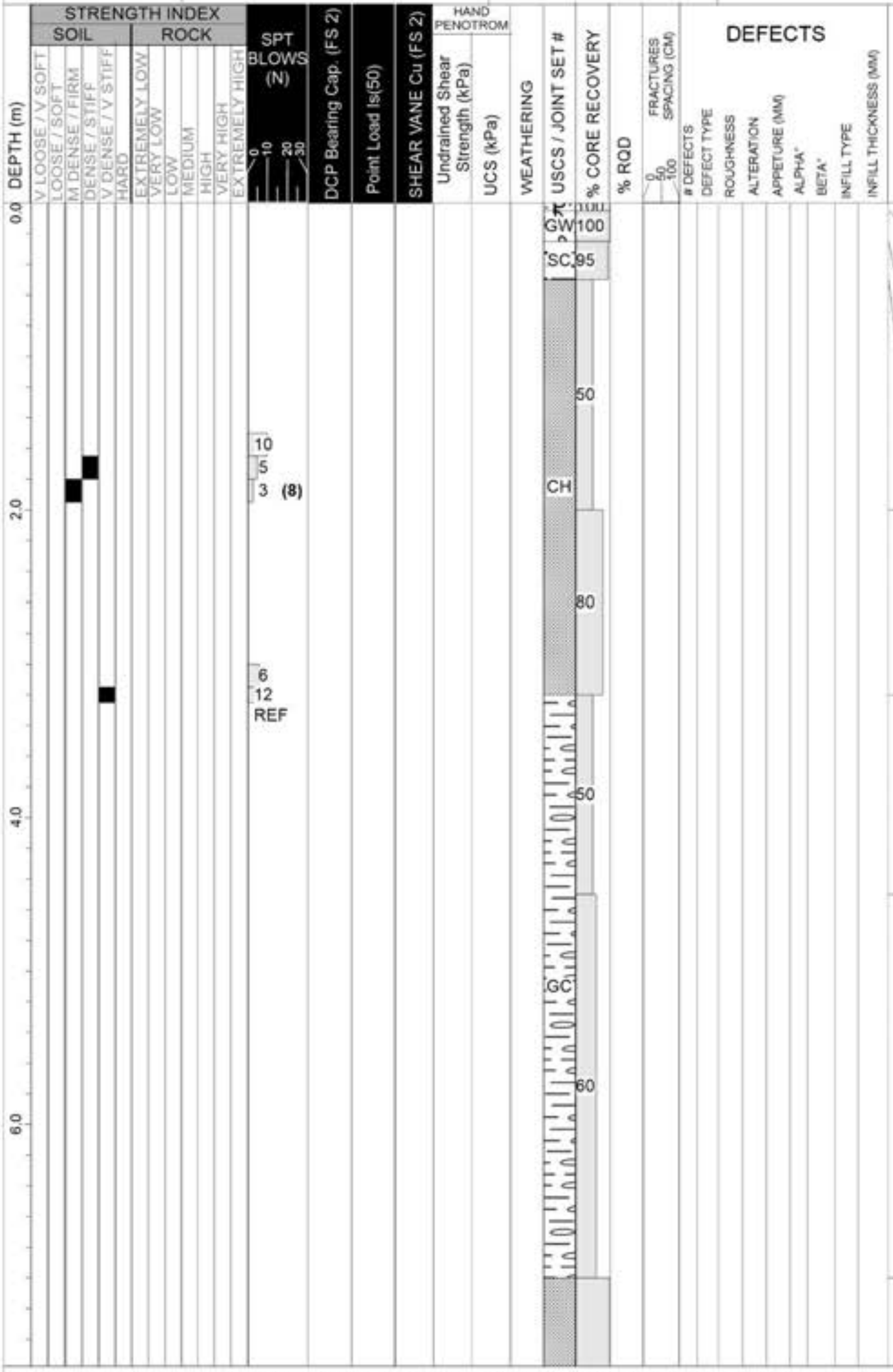
PROJECT: UTAS Sandy Bay Campus

Log of GT8

CLIENT: **UTAS**
EASTING (GDA94): **526448.3**
LOCATION: **Sandy Bay**
NORTHING (GDA94): **5249914.6**

SAMPLING METHOD: **Core**
AZIMUTH:
INCLINATION:
ELEVATION (m ~AHD): **31.7**
TOTAL DEPTH (m): **20.45**

CONTRACTOR: **Tasmanian Drilling Services**
WATER TABLE (m BGS):
DRILL RIG: **Commachio Geotech Rig**
LOGGED BY: **A. Plummer**
NATURAL GROUND (m):
METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**
DATE STARTED:
DATE FINISHED:



DESCRIPTION

FILL - Pavers

FILL - Sandy GRAVEL: fine to coarse angular gravel (FCR), grey/brown, dry, dense

FILL - Silty Clayey SAND: fine to medium grained, brown/grey/orange, dry, very dense

FILL - Sandy CLAY with gravel: high plasticity, dark brown/trace orange, moist 'w = PL', stiff, fine to coarse angular gravel

Sandy CLAY: high plasticity, fine to coarse sand, dark brown/mottled orange, moist 'w = PL', stiff

COBBLES & BOULDERS in sandy clay matrix: yellow-brown/grey, moist, dense, clay fraction has medium plasticity, cobbles/boulders comprise Dolerite moderately fractured highly weathered medium strength, some core loss from drilling process

COBBLES & BOULDERS with sandy silt: yellow-grey, moist, dense, cobbles/boulders comprise silty sandstone moderately fractured highly weathered low strength, some core loss from drilling process

Sandy Silty CLAY trace gravel: high plasticity, fine grained sand/fine to medium subrounded mudstone/sandstone gravel

GES
GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of GT8

CLIENT: **UTAS**
LOCATION: **Sandy Bay**
EASTING (GDA94): **526448.3**
NORTHING (GDA94): **5249914.6**

SAMPLING METHOD: **Core**
AZIMUTH:
INCLINATION:
ELEVATION (m ~AHD): **31.7**
TOTAL DEPTH (m): **20.45**

CONTRACTOR: **Tasmanian Drilling Services**
WATER TABLE (m BGS):

DRILL RIG: **Commachio Geotech Rig**
LOGGED BY: **A. Plummer**
NATURAL GROUND (m):

METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**
DATE STARTED:
DATE FINISHED:

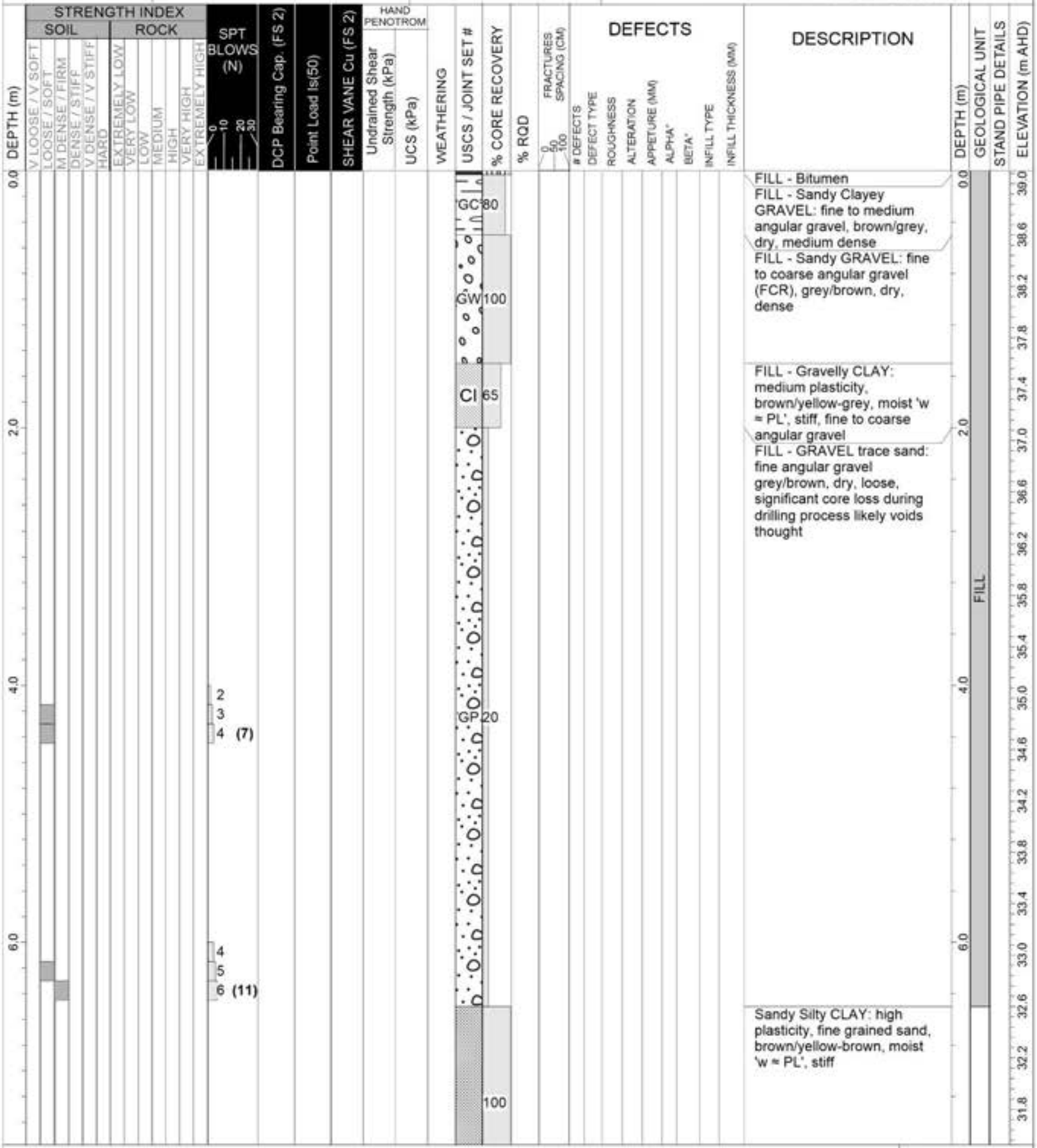
DEPTH (m)	STRENGTH INDEX – SOIL: V LOOSE / V SOFT, LOOSE / SOFT, M DENSE / FIRM, DENSE / STIFF, V DENSE / V STIFF, HARD; ROCK: EXTREMELY LOW, VERY LOW, LOW, MEDIUM, HIGH, VERY HIGH, EXTREMELY HIGH	SPT BLOWS (N) 0 10 20 30	DCP Bearing Cap. (FS 2)	Point Load Is(50)	SHEAR VANE Cu (FS 2)	HAND PENOTROM Undrained Shear Strength (kPa)	UCS (kPa)	WEATHERING	USCS / JOINT SET #	% CORE RECOVERY	% RQD	FRACTURES SPACING (CM) 0 50 100	DEFECTS: # DEFECTS, DEFECT TYPE, ROUGHNESS, ALTERATION, APPETURE (MM), ALPHA°, BETA°, INFILL TYPE, INFILL THICKNESS (MM)	DESCRIPTION	DEPTH (m)	GEOLOGICAL UNIT	STAND PIPE DETAILS	ELEVATION (m AHD)
8.0	V DENSE / V STIFF	10 17 24							CH	100				pale brown/yellow-brown, moist 'w < PL', stiff	8.0			23.8 23.4 23.0 22.6
									CL	100				Gravelly Sandy CLAY: low plasticity, grey, slightly moist 'w ≈ PL', very stiff				22.2
10.0	V DENSE / V STIFF	9 17 21 (38)												Sandy Silty CLAY: high plasticity, fine grained sand, banded grey/black/pale grey-brown, moist 'w < PL', very stiff, laminated appearence	10.0	Tsec		21.8 21.4 21.0 20.6 20.2
12.0									CH	85					12.0			19.8 19.4 19.0
	V DENSE / V STIFF	8 15 20 (35)																18.6 18.2
14.0															14.0			17.8 17.4
	V DENSE / V STIFF	16 10 REF												Gravelly Sandy CLAY with cobbles: medium plasticity, dark grey/grey, moist 'w < PL', very stiff, likely old alluvials, fine to coarse				17.0 16.6

GES
GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of GT9

CLIENT: **UTAS**		EASTING (GDA94): **526711.6**	
LOCATION: **Sandy Bay**		NORTHING (GDA94): **5249698.2**	
SAMPLING METHOD: **Core**	AZIMUTH: INCLINATION:	ELEVATION (m ~AHD): **39.1**	TOTAL DEPTH (m): **26.3**
CONTRACTOR:	**Tasmanian Drilling Services**	WATER TABLE (m BGS):	
DRILL RIG:	**Commachio Geotech Rig**	LOGGED BY: **A. Plummer**	NATURAL GROUND (m):
METHOD/INTERVAL:	**H/S Auger & Rotary Coring HQ**	DATE STARTED:	DATE FINISHED:



FILL - Bitumen

FILL - Sandy Clayey GRAVEL: fine to medium angular gravel, brown/grey, dry, medium dense

FILL - Sandy GRAVEL: fine to coarse angular gravel (FCR), grey/brown, dry, dense

FILL - Gravelly CLAY: medium plasticity, brown/yellow-grey, moist 'w ≈ PL', stiff, fine to coarse angular gravel

FILL - GRAVEL trace sand: fine angular gravel grey/brown, dry, loose, significant core loss during drilling process likely voids thought

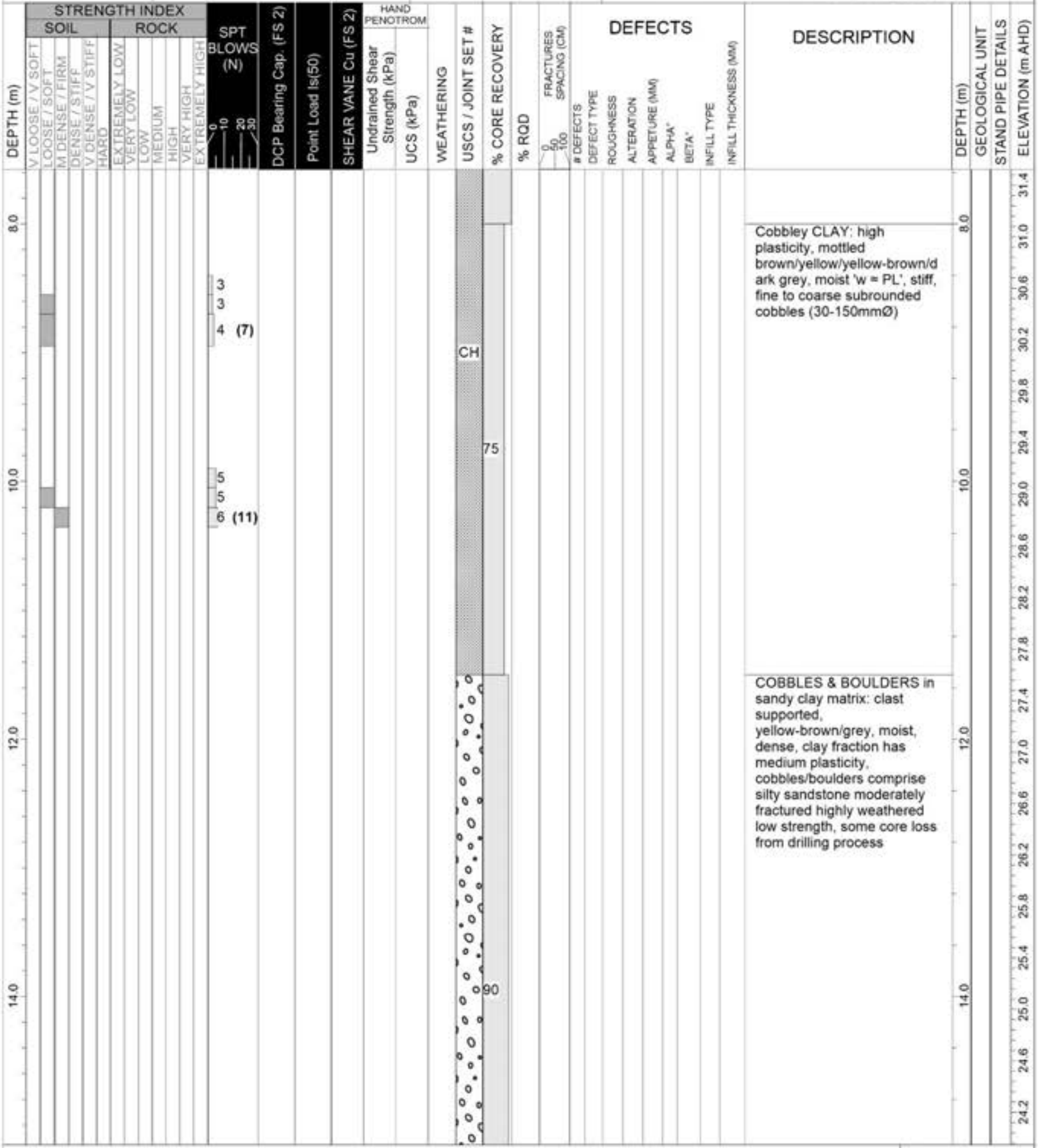
Sandy Silty CLAY: high plasticity, fine grained sand, brown/yellow-brown, moist 'w ≈ PL', stiff

GES
GEO-ENVIRONMENTAL
SOLUTIONS

PROJECT:
UTAS Sandy Bay Campus

Log of GT9

CLIENT: **UTAS**		EASTING (GDA94):	**526711.6**
LOCATION: **Sandy Bay**		NORTHING (GDA94):	**5249698.2**
SAMPLING METHOD: **Core**	AZIMUTH: INCLINATION:	ELEVATION (m ~AHD): **39.1**	TOTAL DEPTH (m): **26.3**
CONTRACTOR:	**Tasmanian Drilling Services**	WATER TABLE (m BGS):	
DRILL RIG:	**Commachio Geotech Rig**	LOGGED BY: **A. Plummer**	NATURAL GROUND (m):
METHOD/INTERVAL:	**H/S Auger & Rotary Coring HQ**	DATE STARTED:	DATE FINISHED:



Cobbley CLAY: high plasticity, mottled brown/yellow/yellow-brown/dark grey, moist 'w ≈ PL', stiff, fine to coarse subrounded cobbles (30-150mmØ)

COBBLES & BOULDERS in sandy clay matrix: clast supported, yellow-brown/grey, moist, dense, clay fraction has medium plasticity, cobbles/boulders comprise silty sandstone moderately fractured highly weathered low strength, some core loss from drilling process

GES
GEO-ENVIRONMENTAL SOLUTIONS

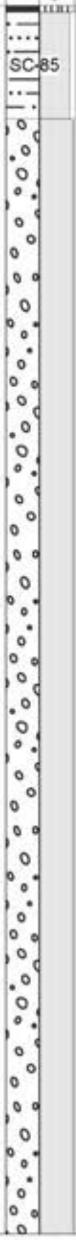
PROJECT: UTAS Sandy Bay Campus

Log of GT11

CLIENT: **UTAS**
LOCATION: **Sandy Bay**
EASTING (GDA94): **526369.4**
NORTHING (GDA94): **5249847.9**
SAMPLING METHOD: **Core**
AZIMUTH:
INCLINATION:
ELEVATION (m ~AHD): **49.8**
TOTAL DEPTH (m): **18.9**
CONTRACTOR: **Tasmanian Drilling Services**
WATER TABLE (m BGS):
DRILL RIG: **Commachio Geotech Rig**
LOGGED BY: **A. Plummer**
NATURAL GROUND (m):
METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**
DATE STARTED:
DATE FINISHED:

DEPTH (m)	SPT BLOWS (N)	USCS / JOINT SET #	% CORE RECOVERY	DESCRIPTION	GEOLOGICAL UNIT	ELEVATION (m AHD)
0.0				FILL - Bitumen	FILL	49.8
		SC	85	FILL - Gravelly Clayey SAND: yellow/grey, dry, medium dense		49.4
				COBBLES & BOULDERS in silty gravel matrix: clast supported, yellow-brown/grey, moist, dense, clay fraction has medium plasticity, cobbles/boulders comprise silty sandstone moderately fractured highly weathered low strength, some core loss from drilling process		49.0
						48.6
						48.2
2.0						47.8
	15 REF					47.4
						47.0
						46.6
						46.2
4.0						45.8
						45.4
						45.0
						44.6
						44.2
6.0						43.8
						43.4
						43.0
	20 REF					42.6

Column headings: DEPTH (m); STRENGTH INDEX: SOIL (V LOOSE / V SOFT, LOOSE / SOFT, M DENSE / FIRM, DENSE / STIFF, V DENSE / V STIFF, HARD), ROCK (EXTREMELY LOW, VERY LOW, LOW, MEDIUM, HIGH, VERY HIGH, EXTREMELY HIGH); SPT BLOWS (N) 0 10 20 30; DCP Bearing Cap. (FS 2); Point Load Is(50); SHEAR VANE Cu (FS 2); HAND PENOTROM: Undrained Shear Strength (kPa), UCS (kPa); WEATHERING; USCS / JOINT SET #; % CORE RECOVERY; % RQD; FRACTURES SPACING (CM) 0 50 100; DEFECTS: # DEFECTS, DEFECT TYPE, ROUGHNESS, ALTERATION, APPETURE (MM), ALPHA°, BETA°, INFILL TYPE, INFILL THICKNESS (MM); DESCRIPTION; DEPTH (m); GEOLOGICAL UNIT; STAND PIPE DETAILS; ELEVATION (m AHD)



GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of GT11

CLIENT: **UTAS**

LOCATION: **Sandy Bay**

EASTING (GDA94): **526369.4**

NORTHING (GDA94): **5249847.9**

SAMPLING METHOD: **Core**

AZIMUTH:

INCLINATION:

ELEVATION (m ~AHD): **49.8**

TOTAL DEPTH (m): **18.9**

CONTRACTOR: **Tasmanian Drilling Services**

WATER TABLE (m BGS):

DRILL RIG: **Commachio Geotech Rig**

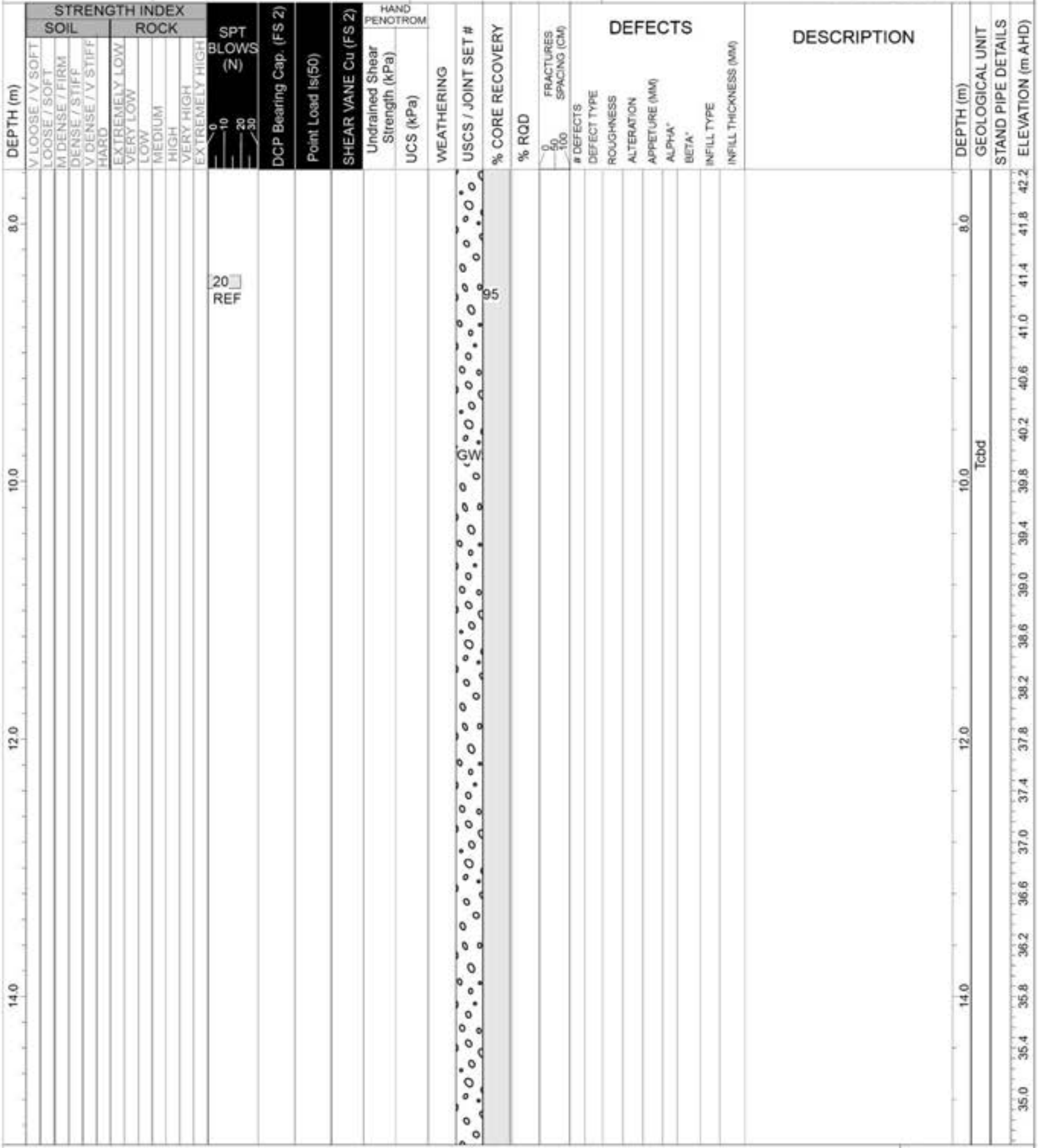
LOGGED BY: **A. Plummer**

NATURAL GROUND (m):

METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**

DATE STARTED:

DATE FINISHED:

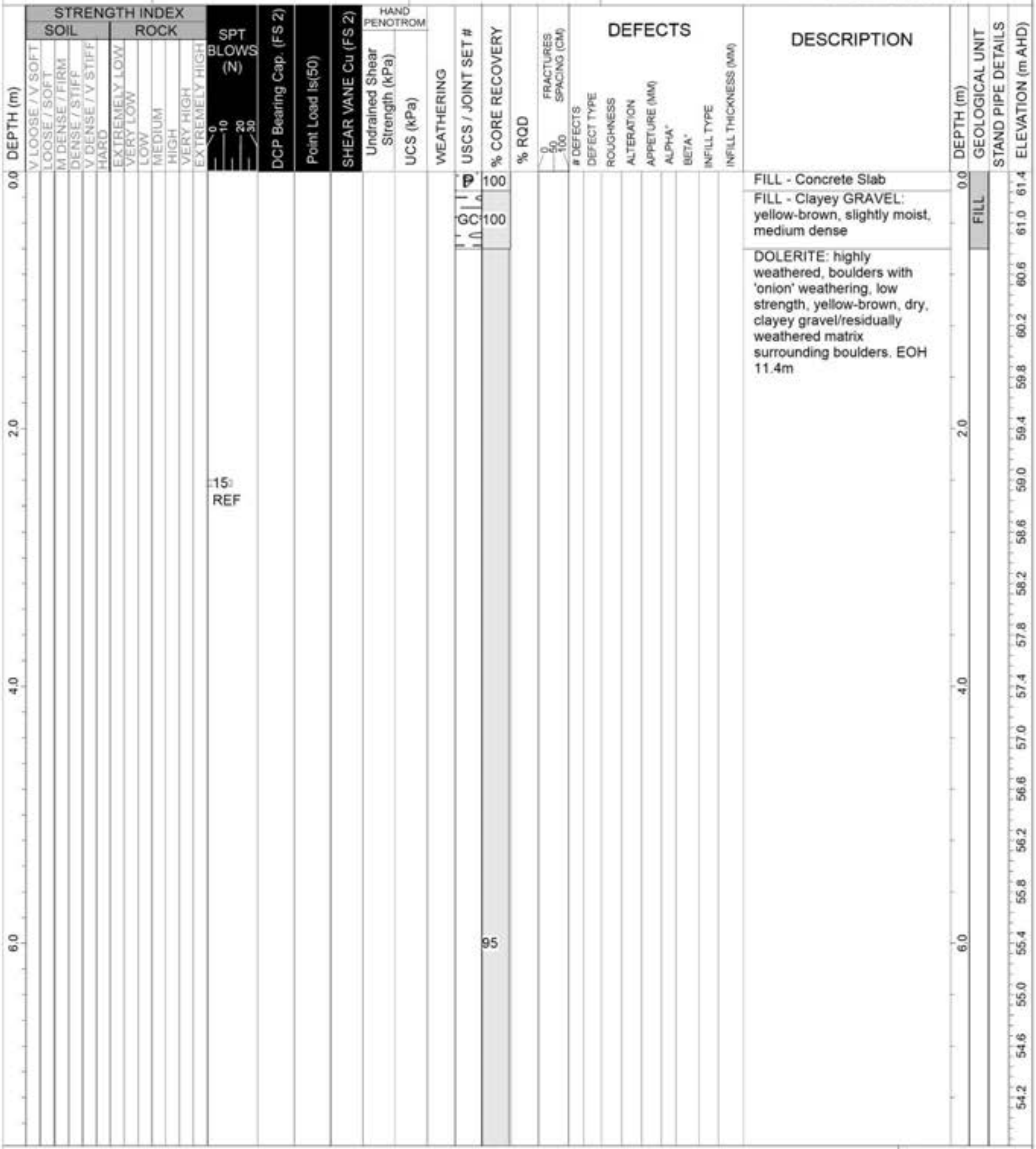


GES
GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of GT12

CLIENT: **UTAS**
LOCATION: **Sandy Bay**
EASTING (GDA94): **526414.6**
NORTHING (GDA94): **5249646.1**
SAMPLING METHOD: **Core**
AZIMUTH:
INCLINATION:
ELEVATION (m ~AHD): **61.4**
TOTAL DEPTH (m): **11.4**
CONTRACTOR: **Tasmanian Drilling Services**
WATER TABLE (m BGS):
DRILL RIG: **Commachio Geotech Rig**
LOGGED BY: **A. Plummer**
NATURAL GROUND (m):
METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**
DATE STARTED:
DATE FINISHED:

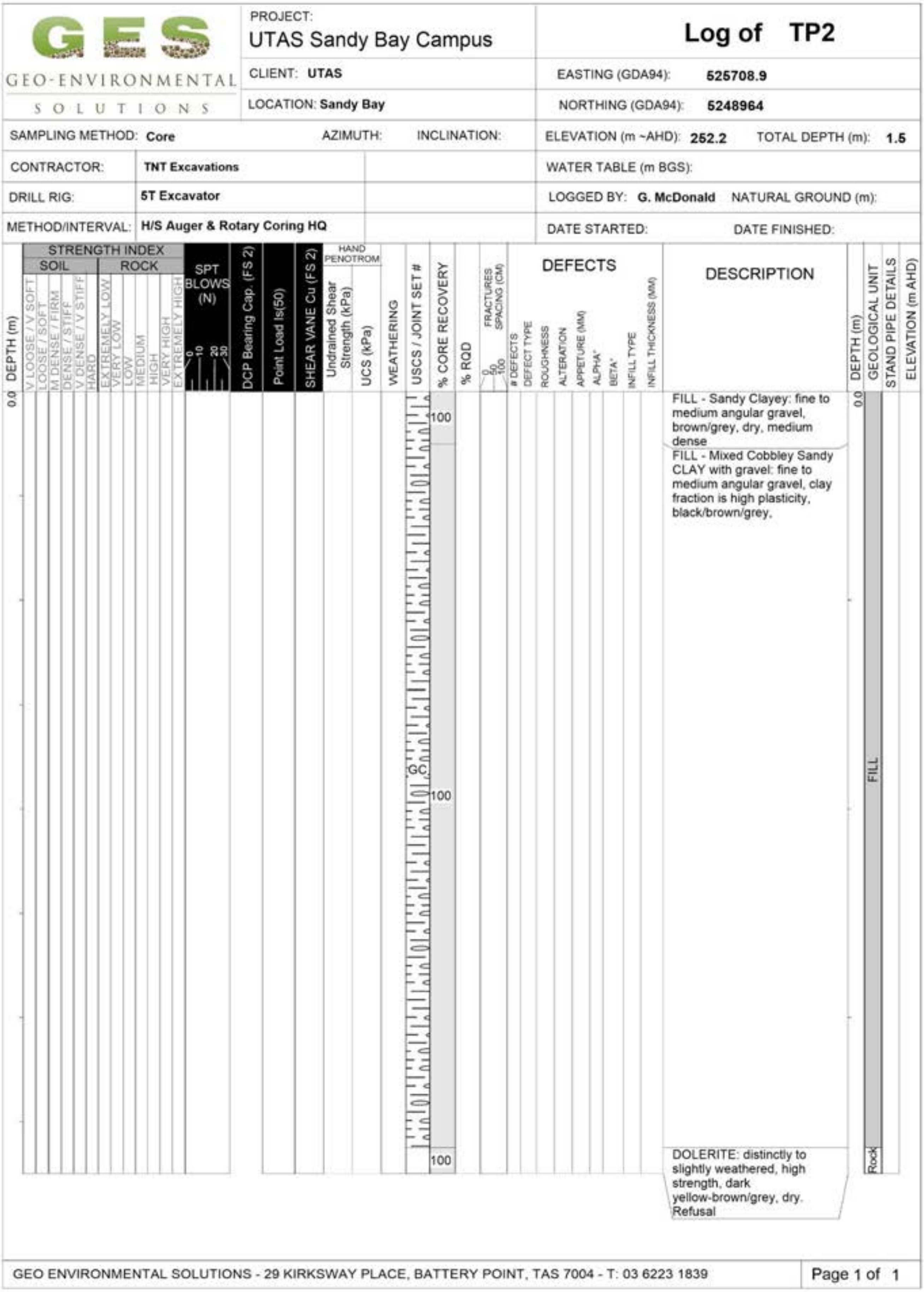


DEPTH (m)	SPT BLOWS (N)	USCS / JOINT SET #	% CORE RECOVERY	DESCRIPTION	GEOLOGICAL UNIT
0.0		P	100	FILL - Concrete Slab	FILL
		GC	100	FILL - Clayey GRAVEL: yellow-brown, slightly moist, medium dense	
				DOLERITE: highly weathered, boulders with 'onion' weathering, low strength, yellow-brown, dry, clayey gravel/residually weathered matrix surrounding boulders. EOH 11.4m	
2.0	15 REF				
4.0					
6.0			95		

GES
GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus		**Log of TP1**	
CLIENT: **UTAS**		EASTING (GDA94):	**525669.3**
LOCATION: **Sandy Bay**		NORTHING (GDA94):	**5248998.9**
SAMPLING METHOD: **Core**	AZIMUTH: INCLINATION:	ELEVATION (m ~AHD): **252.3**	TOTAL DEPTH (m): **1.5**
CONTRACTOR:	**TNT Excavations**	WATER TABLE (m BGS):	
DRILL RIG:	**5T Excavator**	LOGGED BY: **G. McDonald**	NATURAL GROUND (m):
METHOD/INTERVAL:	**H/S Auger & Rotary Coring HQ**	DATE STARTED:	DATE FINISHED:

DEPTH (m)	STRENGTH INDEX SOIL: V LOOSE / V SOFT, LOOSE / SOFT, M DENSE / FIRM, DENSE / STIFF, V DENSE / V STIFF, HARD	STRENGTH INDEX ROCK: EXTREMELY LOW, VERY LOW, LOW, MEDIUM, HIGH, VERY HIGH, EXTREMELY HIGH	SPT BLOWS (N) 0 10 20 30	DCP Bearing Cap. (FS 2)	Point Load Is(50)	SHEAR VANE Cu (FS 2)	HAND PENOTROM Undrained Shear Strength (kPa)	UCS (kPa)	WEATHERING	USCS / JOINT SET #	% CORE RECOVERY	% RQD	FRACTURES SPACING (CM) 0 50 100	DEFECTS: # DEFECTS, DEFECT TYPE, ROUGHNESS, ALTERATION, APPETURE (MM), ALPHA°, BETA°, INFILL TYPE, INFILL THICKNESS (MM)	DESCRIPTION	DEPTH (m)	GEOLOGICAL UNIT	STAND PIPE DETAILS	ELEVATION (m AHD)
0.0											100				FILL - Sandy Clayey: fine to medium angular gravel, brown/grey, dry, medium dense	0.0			
															FILL - Mixed Cobbley Sandy CLAY with gravel: fine to medium angular gravel, clay fraction is high plasticity, black/brown/grey, dry, stiff, trace fine to medium cobbles (50-500mmØ), uncontrolled				
										GC	100						FILL		
											100				DOLERITE: distinctly to slightly weathered, high strength, dark yellow-brown/grey, dry. Refusal		Rock		



GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of TP2

CLIENT: **UTAS**

LOCATION: **Sandy Bay**

EASTING (GDA94): **525708.9**

NORTHING (GDA94): **5248964**

SAMPLING METHOD: **Core** AZIMUTH: INCLINATION:

ELEVATION (m ~AHD): **252.2** TOTAL DEPTH (m): **1.5**

CONTRACTOR: **TNT Excavations**

WATER TABLE (m BGS):

DRILL RIG: **5T Excavator**

LOGGED BY: **G. McDonald** NATURAL GROUND (m):

METHOD/INTERVAL: **H/S Auger & Rotary Coring HQ**

DATE STARTED: DATE FINISHED:

DEPTH (m) | STRENGTH INDEX – SOIL: V LOOSE / V SOFT, LOOSE / SOFT, M DENSE / FIRM, DENSE / STIFF, V DENSE / V STIFF, HARD | ROCK: EXTREMELY LOW, VERY LOW, LOW, MEDIUM, HIGH, VERY HIGH, EXTREMELY HIGH | SPT BLOWS (N) 0 10 20 30 | DCP Bearing Cap. (FS 2) | Point Load Is(50) | SHEAR VANE Cu (FS 2) | HAND PENOTROM Undrained Shear Strength (kPa) | UCS (kPa) | WEATHERING | USCS / JOINT SET # | % CORE RECOVERY | % RQD | FRACTURES SPACING (CM) 0 50 100 | DEFECTS: # DEFECTS, DEFECT TYPE, ROUGHNESS, ALTERATION, APPETURE (MM), ALPHA°, BETA°, INFILL TYPE, INFILL THICKNESS (MM) | DESCRIPTION | DEPTH (m) | GEOLOGICAL UNIT | STAND PIPE DETAILS | ELEVATION (m AHD)

0.0

USCS / JOINT SET #: GC

% CORE RECOVERY: 100, 100, 100

FILL - Sandy Clayey: fine to medium angular gravel, brown/grey, dry, medium dense

FILL - Mixed Cobbley Sandy CLAY with gravel: fine to medium angular gravel, clay fraction is high plasticity, black/brown/grey,

DOLERITE: distinctly to slightly weathered, high strength, dark yellow-brown/grey, dry. Refusal

GEOLOGICAL UNIT: FILL, Rock

GEO ENVIRONMENTAL SOLUTIONS - 29 KIRKSWAY PLACE, BATTERY POINT, TAS 7004 - T: 03 6223 1839

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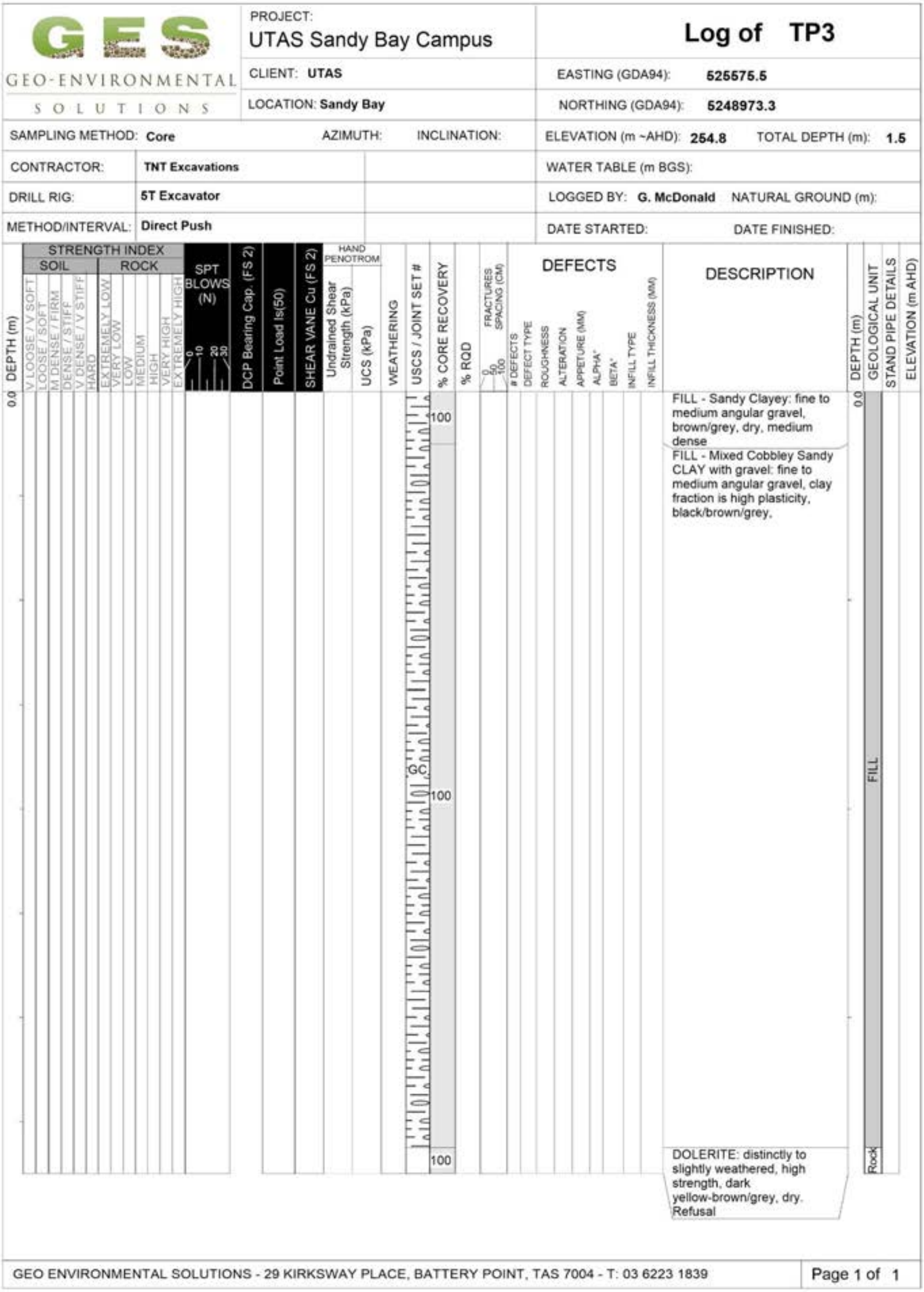

GES
GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of TP3

CLIENT: **UTAS**

EASTING (GDA94): **525575.5**

LOCATION: **Sandy Bay**

NORTHING (GDA94): **5248973.3**

SAMPLING METHOD: **Core**

AZIMUTH:

INCLINATION:

ELEVATION (m ~AHD): **254.8**

TOTAL DEPTH (m): **1.5**

CONTRACTOR: **TNT Excavations**

WATER TABLE (m BGS):

DRILL RIG: **5T Excavator**

LOGGED BY: **G. McDonald**

NATURAL GROUND (m):

METHOD/INTERVAL: **Direct Push**

DATE STARTED:

DATE FINISHED:

DEPTH (m)	STRENGTH INDEX – SOIL: V LOOSE / V SOFT, LOOSE / SOFT, M DENSE / FIRM, DENSE / STIFF, V DENSE / V STIFF, HARD	STRENGTH INDEX – ROCK: EXTREMELY LOW, VERY LOW, LOW, MEDIUM, HIGH, VERY HIGH, EXTREMELY HIGH	SPT BLOWS (N) 0 10 20 30	DCP Bearing Cap. (FS 2)	Point Load Is(50)	SHEAR VANE Cu (FS 2)	HAND PENOTROM Undrained Shear Strength (kPa)	UCS (kPa)	WEATHERING	USCS / JOINT SET #	% CORE RECOVERY	% RQD	FRACTURES SPACING (CM) 0 50 100	DEFECTS: # DEFECTS, DEFECT TYPE, ROUGHNESS, ALTERATION, APPETURE (MM), ALPHA°, BETA°, INFILL TYPE, INFILL THICKNESS (MM)	DESCRIPTION	DEPTH (m)	GEOLOGICAL UNIT	STAND PIPE DETAILS	ELEVATION (m AHD)
0.0											100				FILL - Sandy Clayey: fine to medium angular gravel, brown/grey, dry, medium dense	0.0			
										GC	100				FILL - Mixed Cobbley Sandy CLAY with gravel: fine to medium angular gravel, clay fraction is high plasticity, black/brown/grey,		FILL		
											100				DOLERITE: distinctly to slightly weathered, high strength, dark yellow-brown/grey, dry. Refusal		Rock		

GEO ENVIRONMENTAL SOLUTIONS - 29 KIRKSWAY PLACE, BATTERY POINT, TAS 7004 - T: 03 6223 1839

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GES
GEO-ENVIRONMENTAL
SOLUTIONS

PROJECT: UTAS Sandy Bay Campus		**Log of TP4**	
CLIENT: **UTAS**		EASTING (GDA94):	**525715.2**
LOCATION: **Sandy Bay**		NORTHING (GDA94):	**5248862.3**
SAMPLING METHOD: **Core**	AZIMUTH: INCLINATION:	ELEVATION (m ~AHD): **255.5**	TOTAL DEPTH (m): **1.5**
CONTRACTOR:	**TNT Excavations**	WATER TABLE (m BGS):	
DRILL RIG:	**5T Excavator**	LOGGED BY: **G. McDonald**	NATURAL GROUND (m):
METHOD/INTERVAL:	**Direct Push**	DATE STARTED:	DATE FINISHED:

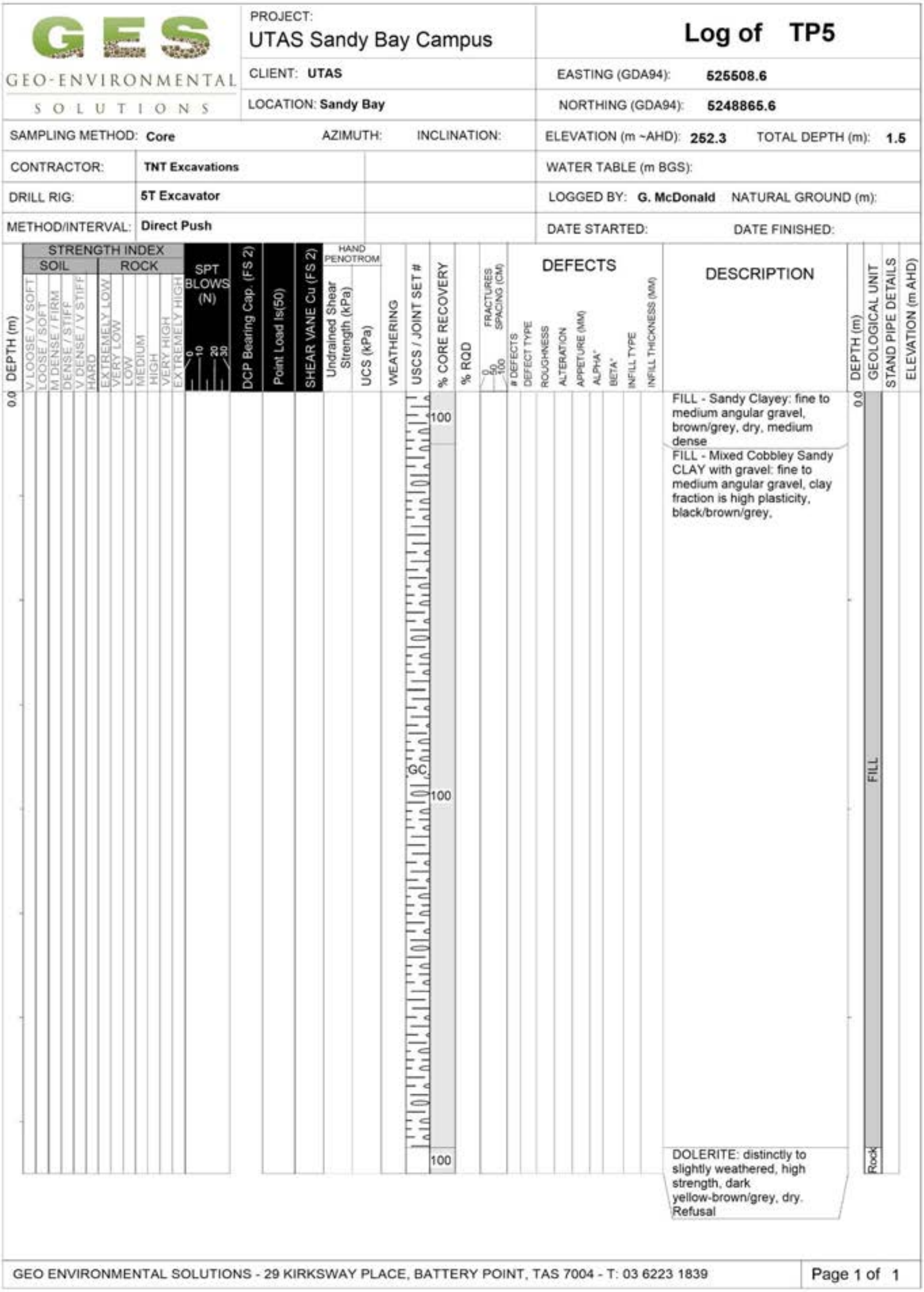
DEPTH (m)	STRENGTH INDEX SOIL / ROCK	SPT BLOWS (N)	DCP Bearing Cap. (FS 2)	Point Load Is(50)	SHEAR VANE Cu (FS 2)	HAND PENOTROM Undrained Shear Strength (kPa)	UCS (kPa)	WEATHERING	USCS / JOINT SET #	% CORE RECOVERY	% RQD	FRACTURES SPACING (CM)	DEFECTS	DESCRIPTION	DEPTH (m)	GEOLOGICAL UNIT	STAND PIPE DETAILS	ELEVATION (m AHD)
0.0										100				FILL - Sandy Clayey: fine to medium angular gravel, brown/grey, dry, medium dense	0.0	FILL		
									GC	100				FILL - Mixed Cobbley Sandy CLAY with gravel: fine to medium angular gravel, clay fraction is high plasticity, black/brown/grey,				
										100				DOLERITE: distinctly to slightly weathered, high strength, dark yellow-brown/grey, dry. Refusal		Rock		

STRENGTH INDEX — SOIL: V LOOSE / V SOFT, LOOSE / SOFT, M DENSE / FIRM, DENSE / STIFF, V DENSE / V STIFF, HARD; ROCK: EXTREMELY LOW, VERY LOW, LOW, MEDIUM, HIGH, VERY HIGH, EXTREMELY HIGH

SPT BLOWS (N): 0, 10, 20, 30

FRACTURES SPACING (CM): 0, 50, 100

DEFECTS: # DEFECTS, DEFECT TYPE, ROUGHNESS, ALTERATION, APPETURE (MM), ALPHA°, BETA°, INFILL TYPE, INFILL THICKNESS (MM)



GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: UTAS Sandy Bay Campus

Log of TP5

CLIENT: **UTAS**

LOCATION: **Sandy Bay**

EASTING (GDA94): **525508.6**

NORTHING (GDA94): **5248865.6**

SAMPLING METHOD: **Core**

AZIMUTH:

INCLINATION:

ELEVATION (m ~AHD): **252.3**

TOTAL DEPTH (m): **1.5**

CONTRACTOR: **TNT Excavations**

WATER TABLE (m BGS):

DRILL RIG: **5T Excavator**

LOGGED BY: **G. McDonald**

NATURAL GROUND (m):

METHOD/INTERVAL: **Direct Push**

DATE STARTED:

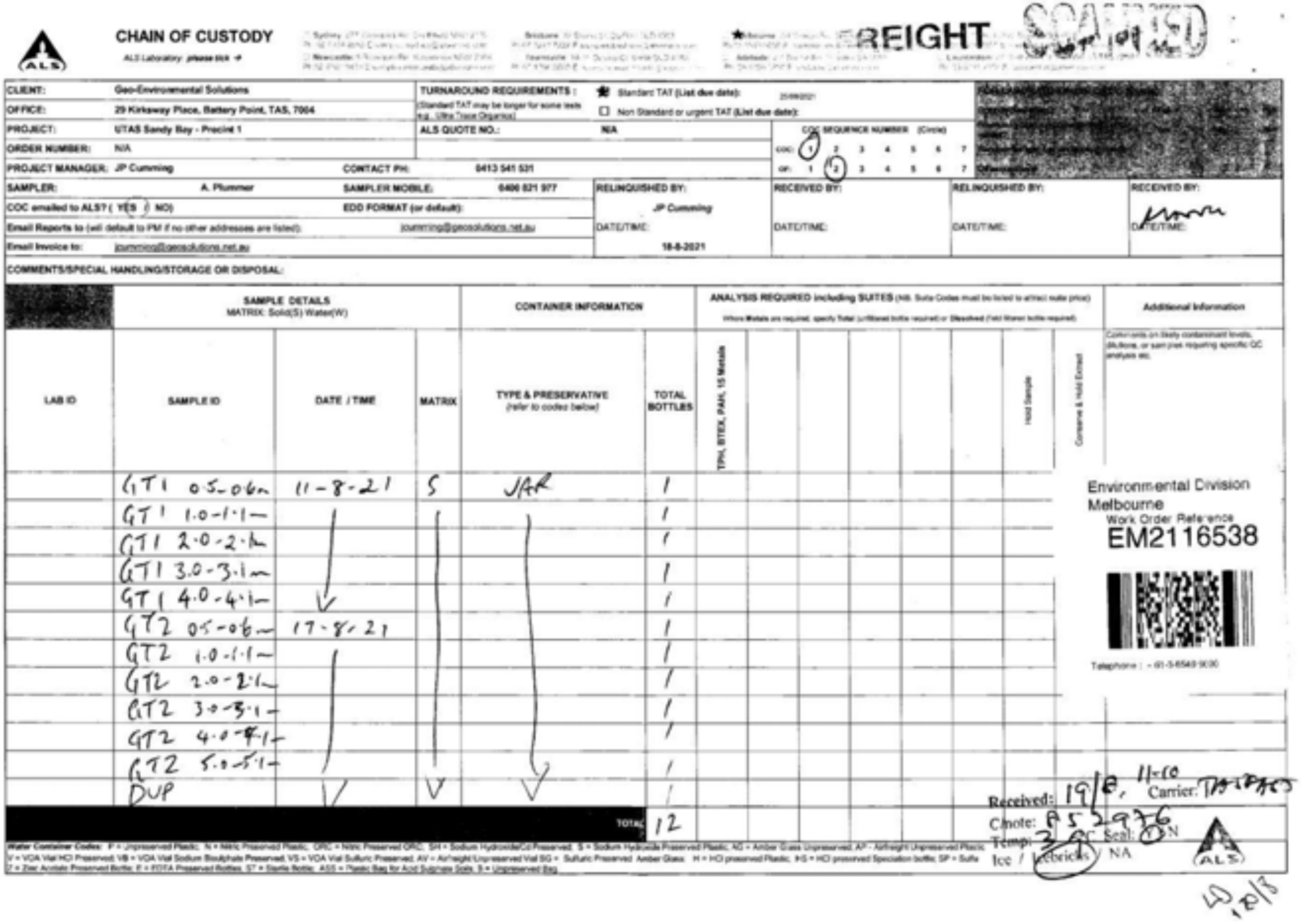
DATE FINISHED:

DEPTH (m)	STRENGTH INDEX: SOIL (V LOOSE / V SOFT, LOOSE / SOFT, M DENSE / FIRM, DENSE / STIFF, V DENSE / V STIFF, HARD); ROCK (EXTREMELY LOW, VERY LOW, LOW, MEDIUM, HIGH, VERY HIGH, EXTREMELY HIGH)	SPT BLOWS (N) 0 10 20 30	DCP Bearing Cap. (FS 2)	Point Load Is(50)	SHEAR VANE Cu (FS 2)	HAND PENOTROM: Undrained Shear Strength (kPa)	UCS (kPa)	WEATHERING	USCS / JOINT SET #	% CORE RECOVERY	% RQD	FRACTURES SPACING (CM) 0 50 100	DEFECTS: # DEFECTS, DEFECT TYPE, ROUGHNESS, ALTERATION, APPETURE (MM), ALPHA°, BETA°, INFILL TYPE, INFILL THICKNESS (MM)	DESCRIPTION	DEPTH (m)	GEOLOGICAL UNIT	STAND PIPE DETAILS	ELEVATION (m AHD)
0.0										100				FILL - Sandy Clayey: fine to medium angular gravel, brown/grey, dry, medium dense	0.0	FILL		
									GC	100				FILL - Mixed Cobbley Sandy CLAY with gravel: fine to medium angular gravel, clay fraction is high plasticity, black/brown/grey,				
										100				DOLERITE: distinctly to slightly weathered, high strength, dark yellow-brown/grey, dry. Refusal		Rock		

GEO ENVIRONMENTAL SOLUTIONS - 29 KIRKSWAY PLACE, BATTERY POINT, TAS 7004 - T: 03 6223 1839

Page 1 of 1

Appendix 5 Chain of Custody and Sample Receipt Notification



CHAIN OF CUSTODY

ALS Laboratory: please tick →

★ Melbourne

FREIGHT

SCANNED

CLIENT:	Geo-Environmental Solutions	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	★ Standard TAT (List due date): 25/08/2021 ☐ Non Standard or urgent TAT (List due date):
OFFICE:	29 Kirksway Place, Battery Point, TAS, 7004		
PROJECT:	UTAS Sandy Bay - Precinct 1	**ALS QUOTE NO.:**	N/A
ORDER NUMBER:	N/A		
PROJECT MANAGER:	JP Cumming	**CONTACT PH:**	0413 541 531
SAMPLER:	A. Plummer	**SAMPLER MOBILE:**	0400 821 977
COC emailed to ALS? ([✓ YES] **/ NO)**		**EDD FORMAT (or default):**	
Email Reports to (will default to PM if no other addresses are listed):			jcumming@geosolutions.net.au
Email Invoice to:	jcumming@geosolutions.net.au		

COC SEQUENCE NUMBER (Circle)

COC: [✓ 1] 2 3 4 5 6 7

OF: 1 [✓ 2] 3 4 5 6 7

RELINQUISHED BY:	**RECEIVED BY:**	**RELINQUISHED BY:**	**RECEIVED BY:**
JP Cumming			
DATE/TIME: 18-8-2021	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			**CONTAINER INFORMATION**		**ANALYSIS REQUIRED including SUITES** (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								**Additional Information**
LAB ID	**SAMPLE ID**	**DATE / TIME**	**MATRIX**	**TYPE & PRESERVATIVE** (refer to codes below)	**TOTAL BOTTLES**	TPH, BTEX, PAH, 15 Metals						Hold Sample	Conserve & Hold Extract	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	GT1 0.5-0.6m	11-8-21	S	JAR	1									
	GT1 1.0-1.1m				1									
	GT1 2.0-2.1m				1									
	GT1 3.0-3.1m				1									
	GT1 4.0-4.1m				1									
	GT2 05-06m	17-8-21			1									
	GT2 1.0-1.1m				1									
	GT2 2.0-2.1m				1									
	GT2 3.0-3.1m				1									
	GT2 4.0-4.1m				1									
	GT2 5.0-5.1m				1									
	DUP				1									
				TOTAL	12									

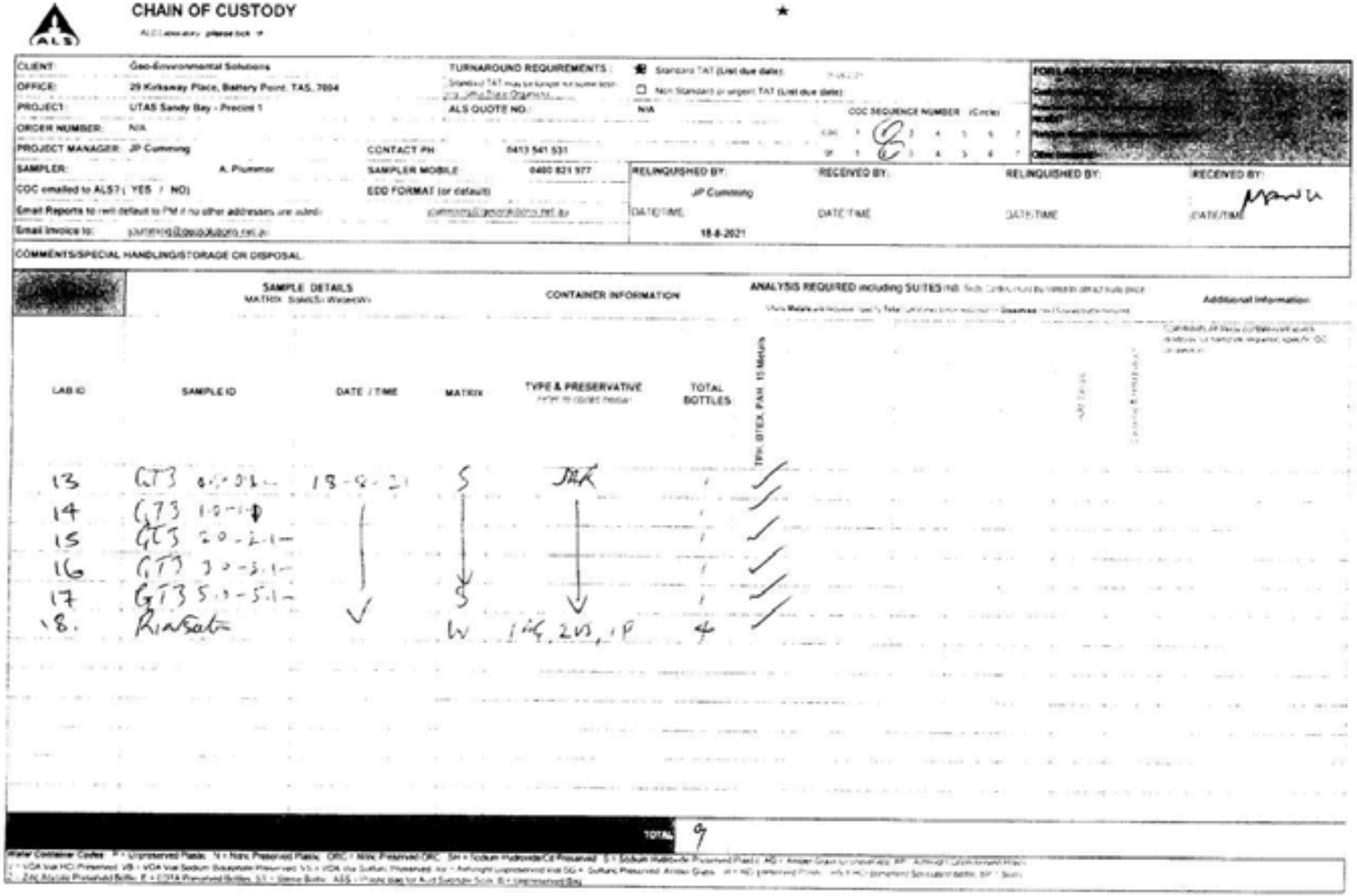
Environmental Division
Melbourne
Work Order Reference
EM2116538

Telephone : +61-3-8549 9600

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfu Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

Received: 19/8, 11:10 Carrier: [illegible]
Cnote: A52976
Temp: 3.4 °C Seal: [✓ Y] / N
Ice / [✓ Icebricks] / NA

LD 18/8



CHAIN OF CUSTODY

ALS Laboratory: please tick ✓

CLIENT:	Geo-Environmental Solutions	TURNAROUND REQUIREMENTS:	★ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	29 Kirksway Place, Battery Point, TAS, 7004		
PROJECT:	UTAS Sandy Bay - Precinct 1	ALS QUOTE NO.:	N/A
ORDER NUMBER:	N/A	COC SEQUENCE NUMBER (Circle)	COC: 1 [✓ 2] 3 4 5 6 7 OF: 1 [✓ 2] 3 4 5 6 7
PROJECT MANAGER:	JP Cumming	CONTACT PH:	0413 541 531
SAMPLER:	A. Plummer	SAMPLER MOBILE:	0400 821 977
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to (will default to PM if no other addresses are listed):			
Email Invoice to:			

[redacted]

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
JP Cumming			Manu
DATE/TIME: 18-8-2021	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

[redacted]

SAMPLE DETAILS
MATRIX: Solid(S) Water(W)

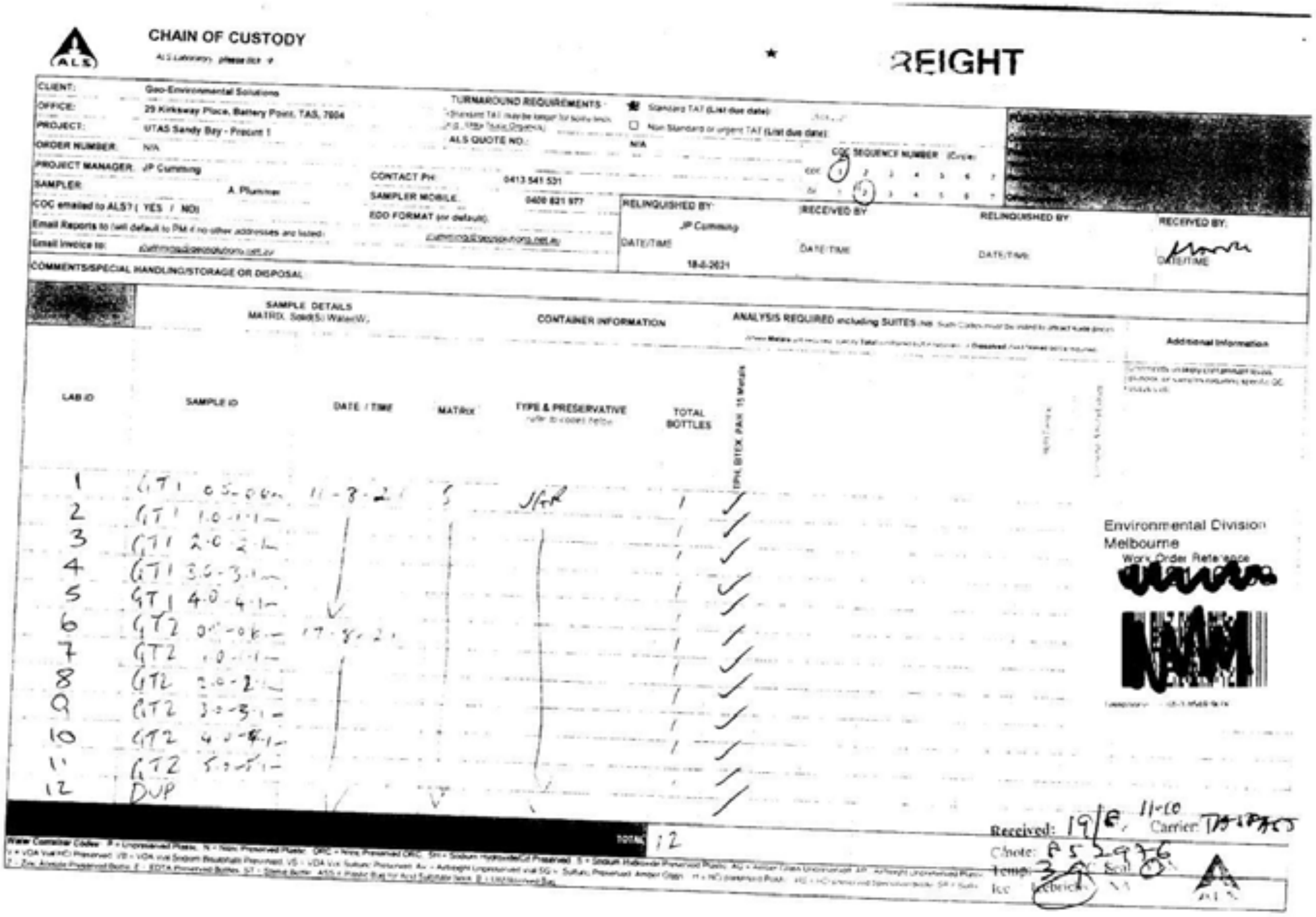
CONTAINER INFORMATION

ANALYSIS REQUIRED including SUITES

Additional Information

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE	TOTAL BOTTLES	TPH, BTEX, PAH, 15 Metals
13	GT3 0.0-0.1-	18-8-21	S	JAR	1	✓
14	GT3 1.0-1.1	↓	↓	↓	1	✓
15	GT3 2.0-2.1-				1	✓
16	GT3 3.0-3.1-				1	✓
17	GT3 5.0-5.1-	✓	S		1	✓
18.	Rinsate		W	1AG, 2VS, 1P	4	✓
					TOTAL 9	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag



REIGHT

CHAIN OF CUSTODY

ALS Laboratory: please tick ✓

CLIENT: Geo-Environmental Solutions
OFFICE: 29 Kirksway Place, Battery Point, TAS, 7004
PROJECT: UTAS Sandy Bay - Precinct 1
ORDER NUMBER: N/A
PROJECT MANAGER: JP Cumming
CONTACT PH: 0413 541 531
SAMPLER: A. Plummer
SAMPLER MOBILE: 0400 821 977
COC emailed to ALS? (YES / NO)
EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed): jcumming@geosolutions.net.au
Email Invoice to: jcumming@geosolutions.net.au

TURNAROUND REQUIREMENTS: ★ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):
ALS QUOTE NO.: N/A

COC SEQUENCE NUMBER (Circle)
COC: [✓ 1] 2 3 4 5 6 7
OF: 1 [✓ 2] 3 4 5 6 7

[redacted]

RELINQUISHED BY: JP Cumming
DATE/TIME: 18-8-2021
RECEIVED BY:
DATE/TIME:
RELINQUISHED BY:
DATE/TIME:
RECEIVED BY:
DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

[redacted]

SAMPLE DETAILS
MATRIX: Solid(S) Water(W)

CONTAINER INFORMATION

ANALYSIS REQUIRED including SUITES

Additional Information

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	TPH, BTEX, PAH, 15 Metals
1	GT1 0.5-0.6m	11-8-21	S	Jar	1	✓
2	GT1 1.0-1.1m				1	✓
3	GT1 2.0-2.1m				1	✓
4	GT1 3.0-3.1m				1	✓
5	GT1 4.0-4.1m				1	✓
6	GT2 0.5-0.6m	17-8-21			1	✓
7	GT2 1.0-1.1m				1	✓
8	GT2 2.0-2.1m				1	✓
9	GT2 3.0-3.1m				1	✓
10	GT2 4.0-4.1m				1	✓
11	GT2 5.0-5.1m				1	✓
12	DUP					✓
				TOTAL	12	

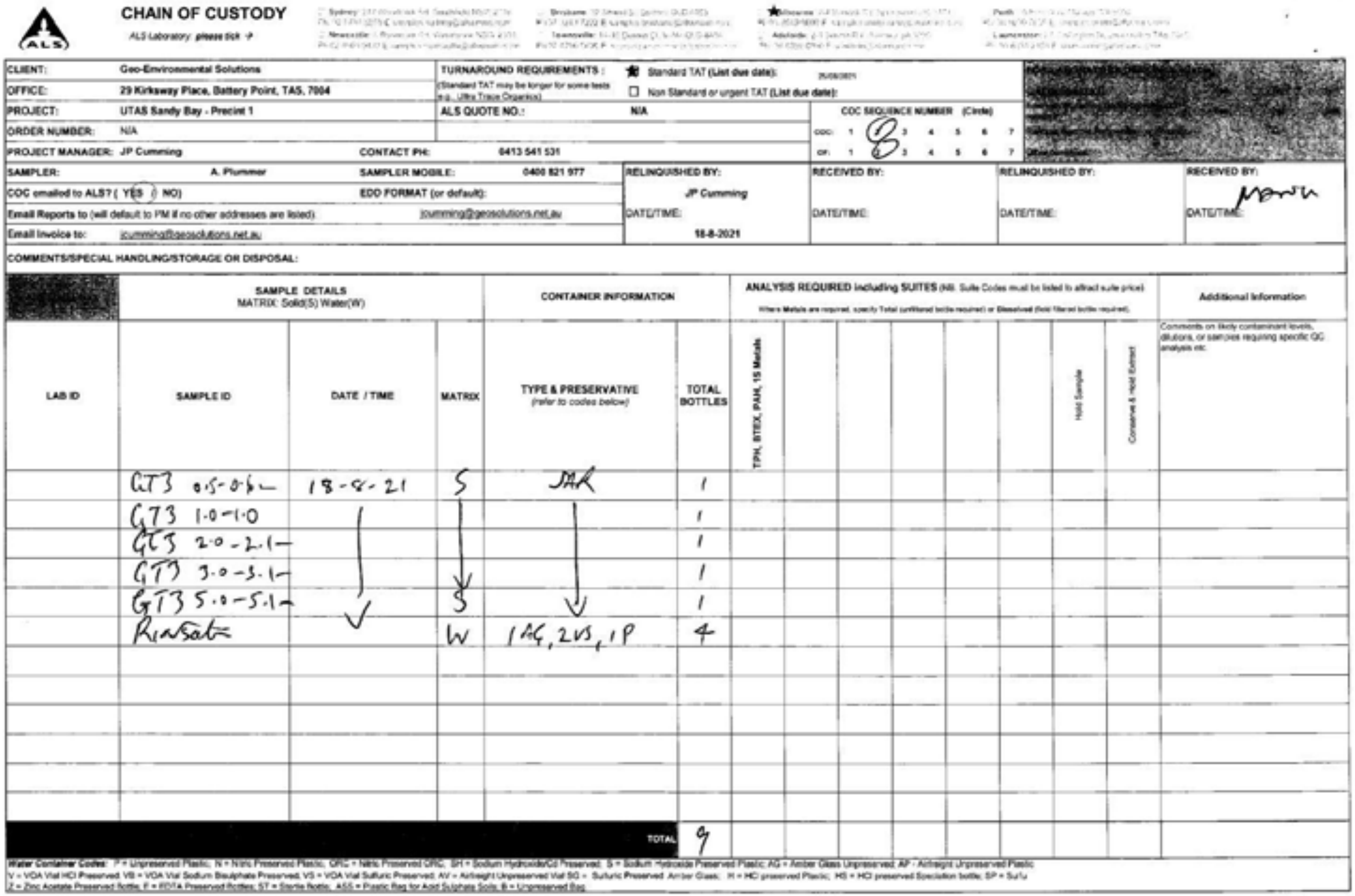
Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

Environmental Division
Melbourne
Work Order Reference
[redacted]

[redacted]

Received: 19/8 11:10 Carrier: TAS FREIGHT
Cnote: 852976
Temp: 3.4°C Seal: [✓ Y] N
Ice [✓ Icebricks] NA

ALS



CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: Geo-Environmental Solutions
OFFICE: 29 Kirksway Place, Battery Point, TAS, 7004
PROJECT: UTAS Sandy Bay - Precint 1
ORDER NUMBER: N/A
PROJECT MANAGER: JP Cumming
CONTACT PH: 0413 541 531
SAMPLER: A. Plummer
SAMPLER MOBILE: 0400 821 977
COC emailed to ALS? ([✓ YES] / NO)
EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed): jcumming@geosolutions.net.au
Email Invoice to: jcumming@geosolutions.net.au

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)
★ Standard TAT (List due date): 25/08/2021
☐ Non Standard or urgent TAT (List due date):
ALS QUOTE NO.: N/A

COC SEQUENCE NUMBER (Circle)
COC: 1 [✓ 2] 3 4 5 6 7
OF: 1 [✓ 2] 3 4 5 6 7

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
JP Cumming DATE/TIME: 18-8-2021	DATE/TIME:	DATE/TIME:	Marsh DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	TPH, BTEX, PAH, 15 Metals						Hold Sample	Conserve & Hold Extract	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	GT3 0.5-0.6	18-8-21	S	JAR	1									
	GT3 1.0-1.0				1									
	GT3 2.0-2.1				1									
	GT3 3.0-3.1				1									
	GT3 5.0-5.1		S		1									
	Rinsate		W	1AG, 2VS, 1P	4									
					TOTAL	9								

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfu
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2116538**

Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: DR JOHN PAUL CUMMING	Contact	: Peter Ravlic
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: jcumming@geosolutions.net.au	E-mail	: peter.ravlic@alsglobal.com
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9645
Facsimile	: +61 03 6223 4539	Facsimile	: +61-3-8549 9626
Project	: UTAS Sandy Bay - Precinct 1	Page	: 1 of 3
Order number	: ----	Quote number	: EB2017GEOENVSOL0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: A. Plummer		

Dates

Date Samples Received	: 19-Aug-2021 11:10	Issue Date	: 20-Aug-2021
Client Requested Due Date	: 27-Aug-2021	Scheduled Reporting Date	: **27-Aug-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 3.9°C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 18 / 18

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

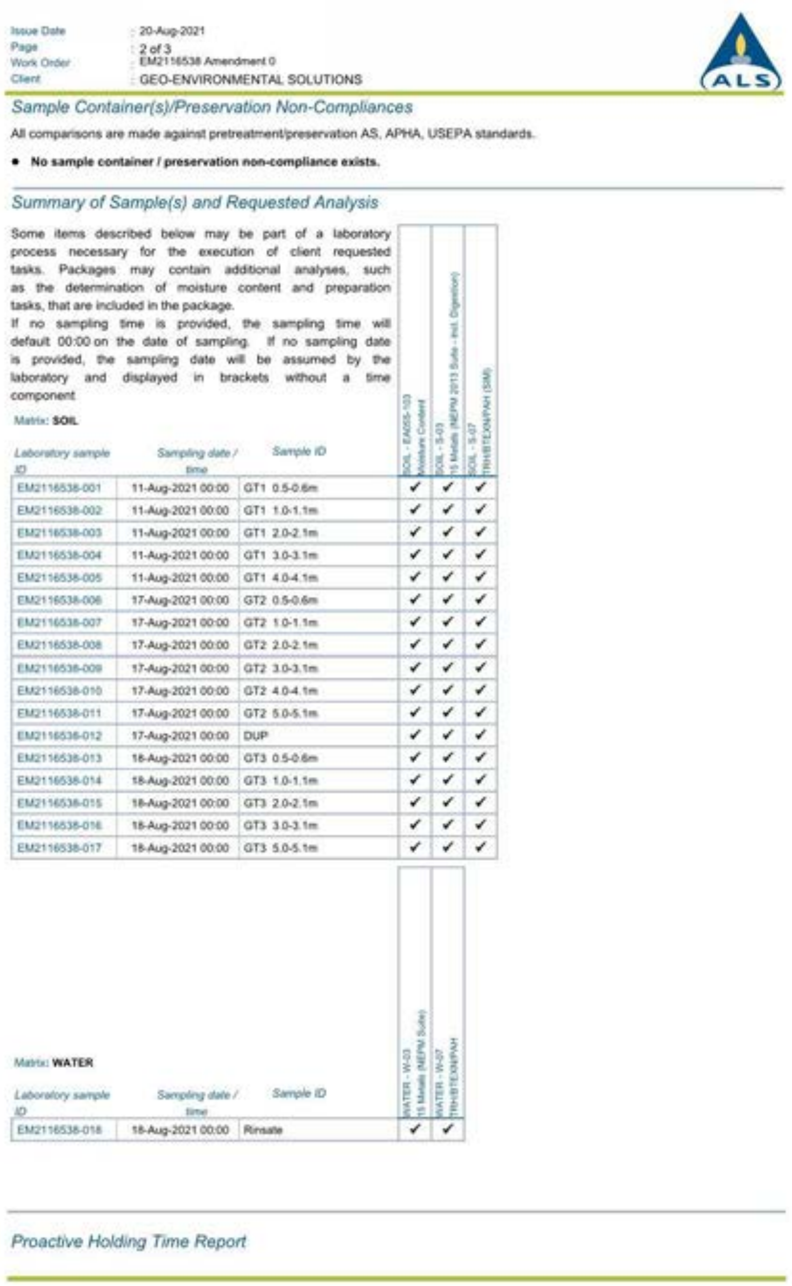
RIGHT SOLUTIONS | RIGHT PARTNER

Issue Date	: 20-Aug-2021
Page	: 3 of 3
Work Order	: EM2116538 Amendment 0
Client	: GEO-ENVIRONMENTAL SOLUTIONS

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

All Invoices		
- A4 - AU Tax Invoice (INV)	Email	smcintosh@geosolutions.net.au
JOHN PAUL CUMMING		
- *AU Certificate of Analysis - NATA (COA)	Email	jcumming@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jcumming@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jcumming@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jcumming@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	jcumming@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	jcumming@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	jcumming@geosolutions.net.au
- EDI Format - ESDAT (ESDAT)	Email	jcumming@geosolutions.net.au



Issue Date : 20-Aug-2021
Page : 2 of 3
Work Order : EM2116538 Amendment 0
Client : GEO-ENVIRONMENTAL SOLUTIONS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

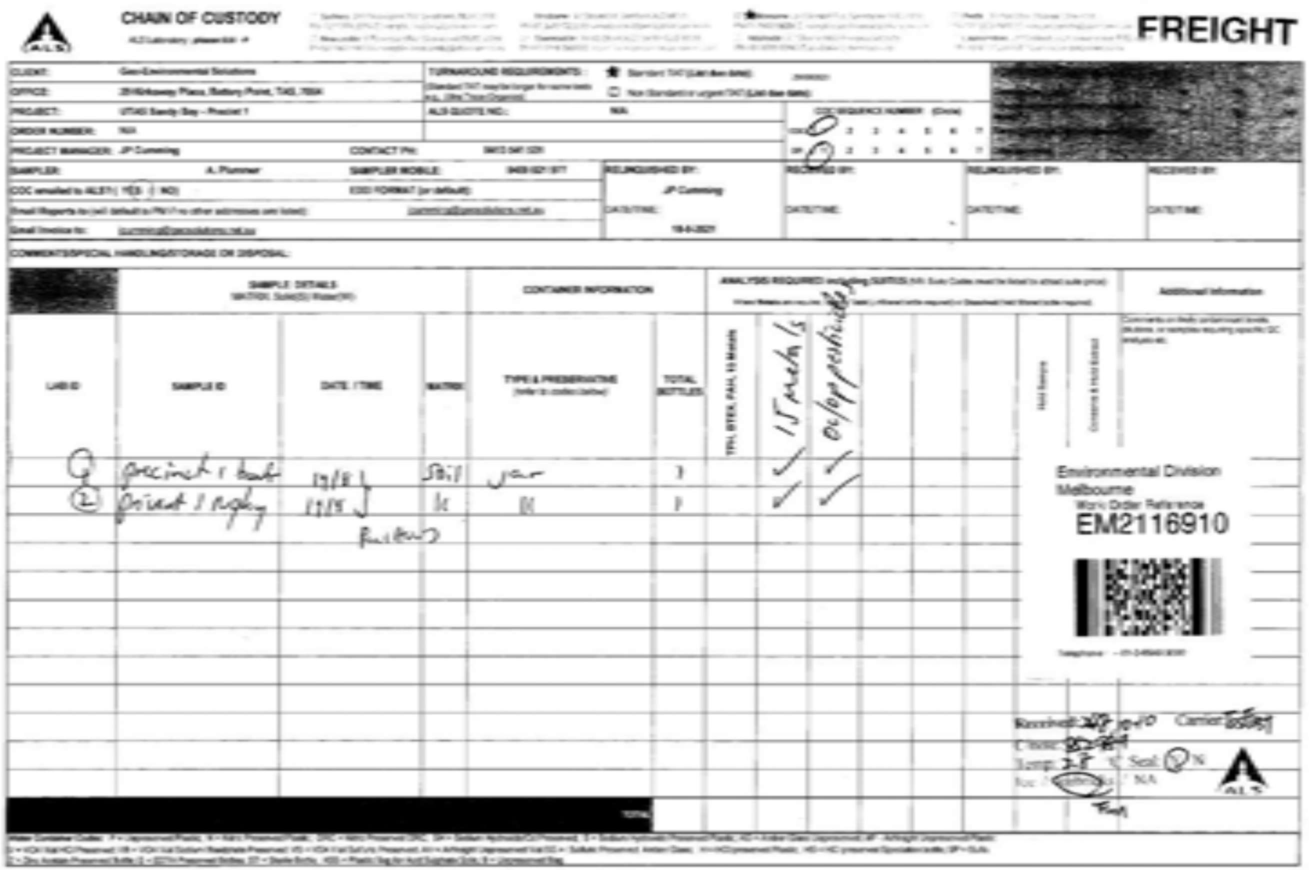
Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EA055-103 Moisture Content	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)	SOIL - S-07 TRH/BTEXN/PAH (SIM)
EM2116538-001	11-Aug-2021 00:00	GT1 0.5-0.6m	✓	✓	✓
EM2116538-002	11-Aug-2021 00:00	GT1 1.0-1.1m	✓	✓	✓
EM2116538-003	11-Aug-2021 00:00	GT1 2.0-2.1m	✓	✓	✓
EM2116538-004	11-Aug-2021 00:00	GT1 3.0-3.1m	✓	✓	✓
EM2116538-005	11-Aug-2021 00:00	GT1 4.0-4.1m	✓	✓	✓
EM2116538-006	17-Aug-2021 00:00	GT2 0.5-0.6m	✓	✓	✓
EM2116538-007	17-Aug-2021 00:00	GT2 1.0-1.1m	✓	✓	✓
EM2116538-008	17-Aug-2021 00:00	GT2 2.0-2.1m	✓	✓	✓
EM2116538-009	17-Aug-2021 00:00	GT2 3.0-3.1m	✓	✓	✓
EM2116538-010	17-Aug-2021 00:00	GT2 4.0-4.1m	✓	✓	✓
EM2116538-011	17-Aug-2021 00:00	GT2 5.0-5.1m	✓	✓	✓
EM2116538-012	17-Aug-2021 00:00	DUP	✓	✓	✓
EM2116538-013	18-Aug-2021 00:00	GT3 0.5-0.6m	✓	✓	✓
EM2116538-014	18-Aug-2021 00:00	GT3 1.0-1.1m	✓	✓	✓
EM2116538-015	18-Aug-2021 00:00	GT3 2.0-2.1m	✓	✓	✓
EM2116538-016	18-Aug-2021 00:00	GT3 3.0-3.1m	✓	✓	✓
EM2116538-017	18-Aug-2021 00:00	GT3 5.0-5.1m	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - W-03 15 Metals (NEPM Suite)	WATER - W-07 TRH/BTEXN/PAH
EM2116538-018	18-Aug-2021 00:00	Rinsate	✓	✓

Proactive Holding Time Report



CHAIN OF CUSTODY

FREIGHT

CLIENT:	Geo-Environmental Solutions	TURNAROUND REQUIREMENTS:	★ Standard TAT
OFFICE:	29 Kirksway Place, Battery Point, TAS, 7004		☐ Non Standard or urgent TAT
PROJECT:	UTAS Sandy Bay – Precinct 1	ALS QUOTE NO.:	N/A
ORDER NUMBER:	N/A		
PROJECT MANAGER: JP Cumming	CONTACT PH:		
SAMPLER:	A. Plummer	SAMPLER MOBILE:	

[redacted]

RELINQUISHED BY: JP Cumming

DATE/TIME: 19-8-2021

RECEIVED BY:

DATE/TIME:

RELINQUISHED BY:

DATE/TIME:

RECEIVED BY:

DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE	TOTAL BOTTLES	TRH, BTEX, PAH, 15 Metals	15 metals	OC/OP pesticides
①	precinct 1 bed	19/8	Soil	jar	1		✓	✓
②	precinct 1 rugby	19/8	"	"	1		✓	✓
		Rubbish						

Environmental Division
Melbourne
Work Order Reference
EM2116910

Received: 20/8 1040 Carrier:
Temp: 3.8 °C Seal: Y/N

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2116910**

Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: DR JOHN PAUL CUMMING	Contact	: Peter Ravlic
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: jcumming@geosolutions.net.au	E-mail	: peter.ravlic@alsglobal.com
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9645
Facsimile	: +61 03 6223 4539	Facsimile	: +61-3-8549 9626
Project	: UTAS Sandy Bay - Precinct 1	Page	: 1 of 2
Order number	: ----	Quote number	: EB2017GEOENVSOL0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: AP		

Dates

Date Samples Received	: 26-Aug-2021 10:10	Issue Date	: 26-Aug-2021
Client Requested Due Date	: 02-Sep-2021	Scheduled Reporting Date	: **02-Sep-2021**

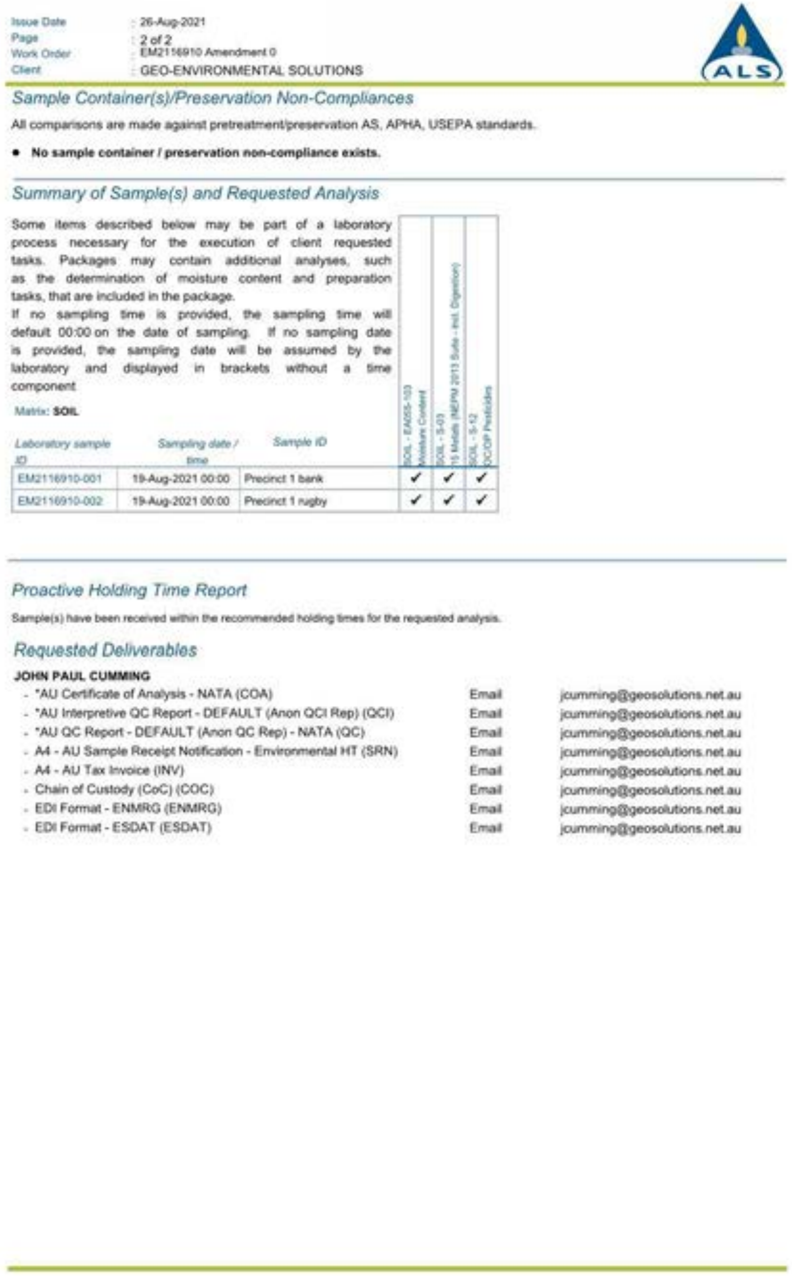
Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 2.8°C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 2 / 2

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

RIGHT SOLUTIONS | RIGHT PARTNER



Issue Date : 26-Aug-2021
Page : 2 of 2
Work Order : EM2116910 Amendment 0
Client : GEO-ENVIRONMENTAL SOLUTIONS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	SOIL - EA055-103 Moisture Content	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)	SOIL - S-12 OC/OP Pesticides
EM2116910-001	19-Aug-2021 00:00	Precinct 1 bank	✓	✓	✓
EM2116910-002	19-Aug-2021 00:00	Precinct 1 rugby	✓	✓	✓

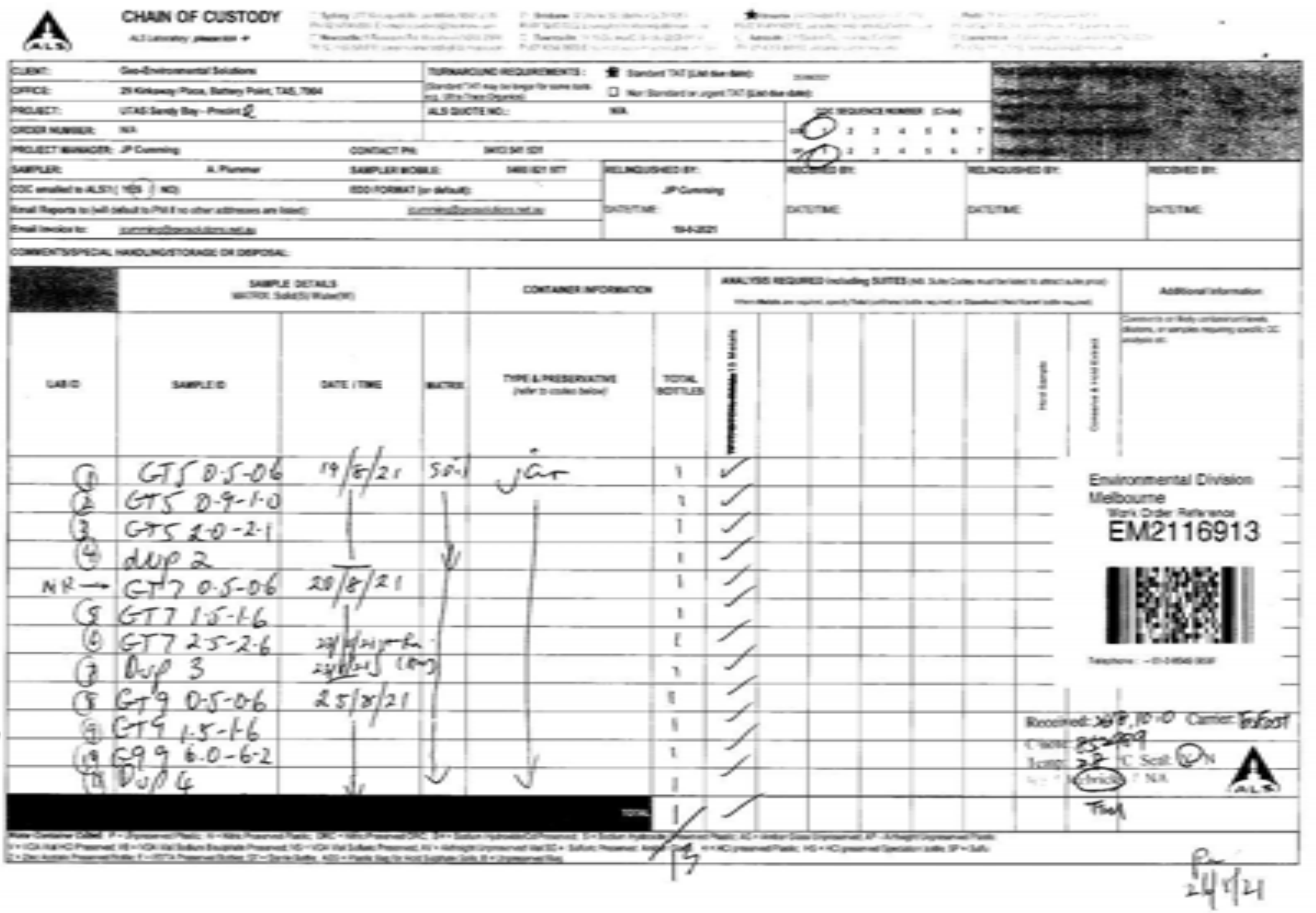
Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

JOHN PAUL CUMMING

- *AU Certificate of Analysis - NATA (COA)	Email	jcumming@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jcumming@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jcumming@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jcumming@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	jcumming@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	jcumming@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	jcumming@geosolutions.net.au
- EDI Format - ESDAT (ESDAT)	Email	jcumming@geosolutions.net.au



CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: Geo-Environmental Solutions
OFFICE: 29 Kirksway Place, Battery Point, TAS, 7004
PROJECT: UTAS Sandy Bay - Precinct 2
ORDER NUMBER: N/A
PROJECT MANAGER: JP Cumming CONTACT PH:
SAMPLER: A. Plummer SAMPLER MOBILE:
COC emailed to ALS? ([✓ YES] / NO) EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed):
Email Invoice to:
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: ☒ Standard TAT (List due date) ☐ Non Standard or urgent TAT (List due date)
ALS QUOTE NO.: N/A

RELINQUISHED BY: JP Cumming
DATE/TIME: 19-8-2021
RECEIVED BY:
DATE/TIME:
RELINQUISHED BY:
DATE/TIME:
RECEIVED BY:
DATE/TIME:

[redacted]

SAMPLE DETAILS MATRIX: Solid(S) Water(W)
CONTAINER INFORMATION
ANALYSIS REQUIRED including SUITES
Additional Information

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	10 Metals	Hold Sample
①	GT5 0.5-0.6	19/8/21	Soil	jar	1	✓	
②	GT5 0.9-1.0				1	✓	
③	GT5 2.0-2.1				1	✓	
④	dup 2				1	✓	
NR →	GT7 0.5-0.6	20/8/21			1	✓	
⑤	GT7 1.5-1.6				1	✓	
⑥	GT7 2.5-2.6	23/8/21			1	✓	
⑦	Dup 3	23/8/21			1	✓	
⑧	GT9 0.5-0.6	25/8/21			1	✓	
⑨	GT9 1.5-1.6				1	✓	
⑩	GT9 6.0-6.2				1	✓	
⑪	Dup 4				1	✓	
				TOTAL	1	✓	

Environmental Division
Melbourne
Work Order Reference
EM2116913

Received: 10:10 Carrier: TasFast
Temp: °C Seal: Y/N

24/8/21

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2116913**

Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: DR JOHN PAUL CUMMING	Contact	: Peter Ravlic
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: jcumming@geosolutions.net.au	E-mail	: peter.ravlic@alsglobal.com
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9645
Facsimile	: +61 03 6223 4539	Facsimile	: +61-3-8549 9626
Project	: UTAS Sandy Bay - Precint 2	Page	: 1 of 3
Order number	: ----	Quote number	: EB2017GEOENVSOL0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: AP		

Dates

Date Samples Received	: 26-Aug-2021 10:10	Issue Date	: 26-Aug-2021
Client Requested Due Date	: 02-Sep-2021	Scheduled Reporting Date	: **02-Sep-2021**

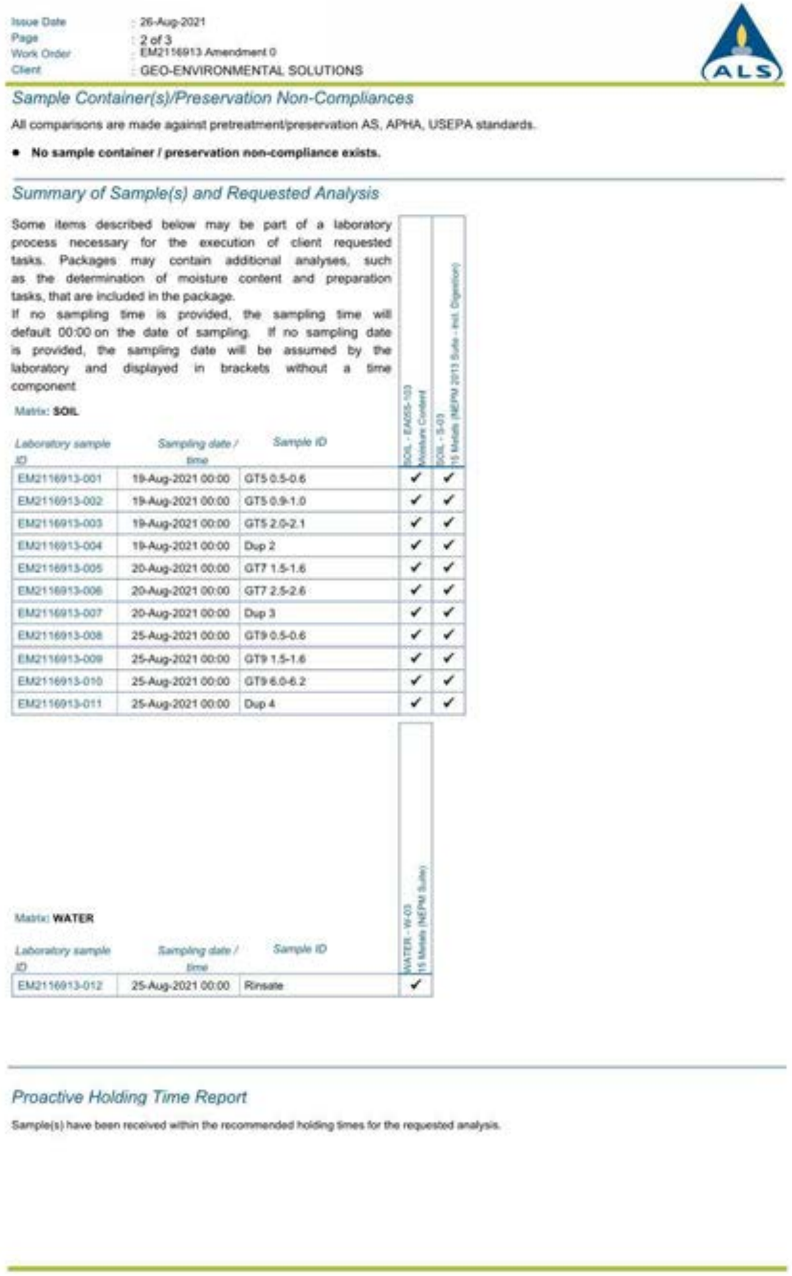
Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 2.8°C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 12 / 12

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Sampling date discrepancy has been noted on the COC. Please advise if these need to be amended. COC date will be reported.**
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Sample GT7 0.5-0.6 was not received.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

RIGHT SOLUTIONS | RIGHT PARTNER



Issue Date : 26-Aug-2021
Page : 2 of 3
Work Order : EM2116913 Amendment 0
Client : GEO-ENVIRONMENTAL SOLUTIONS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EA055-103 Moisture Content	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)
EM2116913-001	19-Aug-2021 00:00	GT5 0.5-0.6	✓	✓
EM2116913-002	19-Aug-2021 00:00	GT5 0.9-1.0	✓	✓
EM2116913-003	19-Aug-2021 00:00	GT5 2.0-2.1	✓	✓
EM2116913-004	19-Aug-2021 00:00	Dup 2	✓	✓
EM2116913-005	20-Aug-2021 00:00	GT7 1.5-1.6	✓	✓
EM2116913-006	20-Aug-2021 00:00	GT7 2.5-2.6	✓	✓
EM2116913-007	20-Aug-2021 00:00	Dup 3	✓	✓
EM2116913-008	25-Aug-2021 00:00	GT9 0.5-0.6	✓	✓
EM2116913-009	25-Aug-2021 00:00	GT9 1.5-1.6	✓	✓
EM2116913-010	25-Aug-2021 00:00	GT9 6.0-6.2	✓	✓
EM2116913-011	25-Aug-2021 00:00	Dup 4	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - W-03 15 Metals (NEPM Suite)
EM2116913-012	25-Aug-2021 00:00	Rinsate	✓

Proactive Holding Time Report

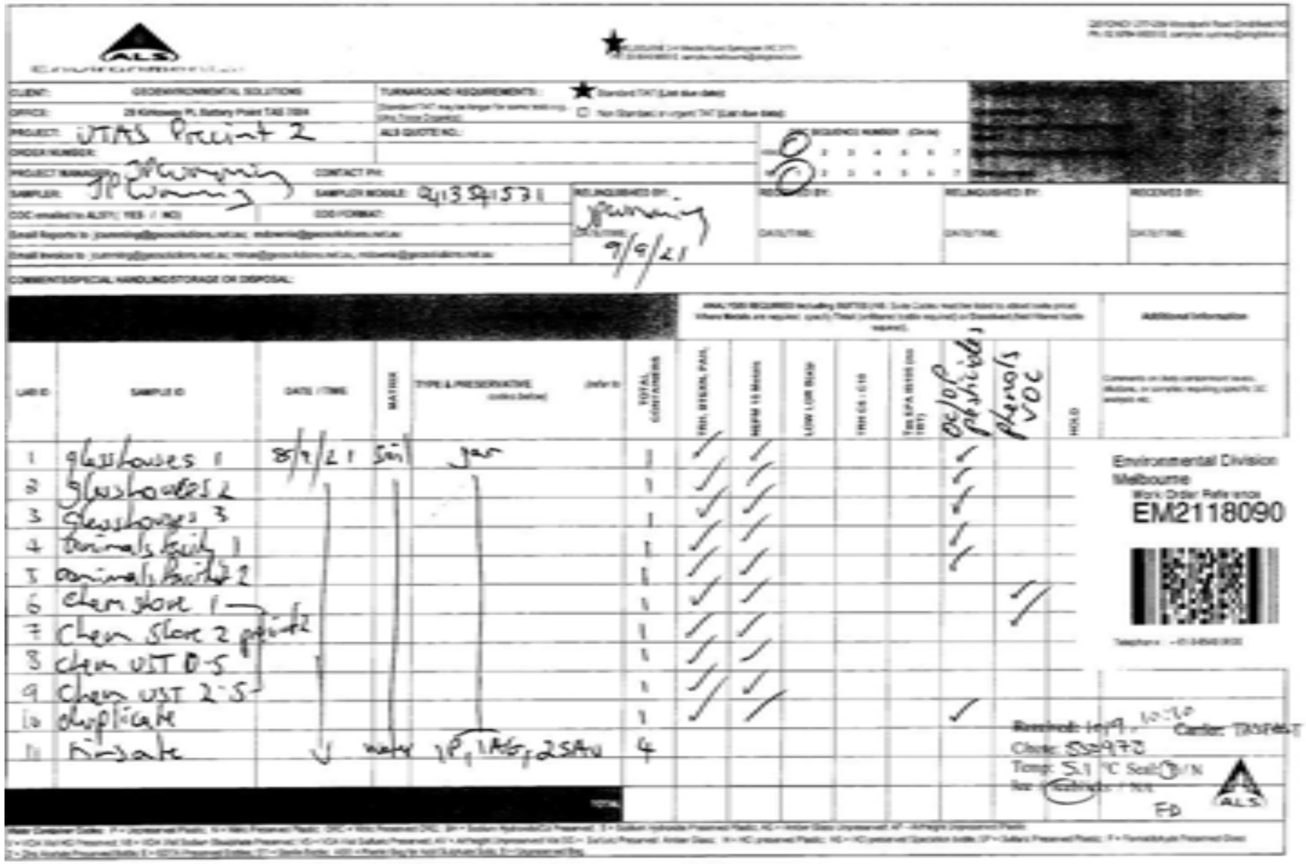
Sample(s) have been received within the recommended holding times for the requested analysis.

Issue Date : 26-Aug-2021
Page : 3 of 3
Work Order : EM2116913 Amendment 0
Client : GEO-ENVIRONMENTAL SOLUTIONS

Requested Deliverables

JOHN PAUL CUMMING

- *AU Certificate of Analysis - NATA (COA)	Email	jcumming@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jcumming@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jcumming@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jcumming@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	jcumming@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	jcumming@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	jcumming@geosolutions.net.au
- EDI Format - ESDAT (ESDAT)	Email	jcumming@geosolutions.net.au



CLIENT: GEOENVIRONMENTAL SOLUTIONS

OFFICE: 29 Kirksway Pl, Battery Point TAS 7004

PROJECT: UTAS Precinct 2

ORDER NUMBER:

PROJECT MANAGER: JP Cumming

CONTACT PH:

SAMPLER: JP Cumming

SAMPLER MOBILE: 0413541531

COC emailed to ALS? (YES / NO)

EDD FORMAT:

Email Reports to: jcumming@geosolutions.net.au; [illegible]

Email Invoice to: [illegible]

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS: ★ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

[redacted]

RELINQUISHED BY: JCumming DATE/TIME: 9/9/21

RECEIVED BY: DATE/TIME:

RELINQUISHED BY: DATE/TIME:

RECEIVED BY: DATE/TIME:

[redacted]

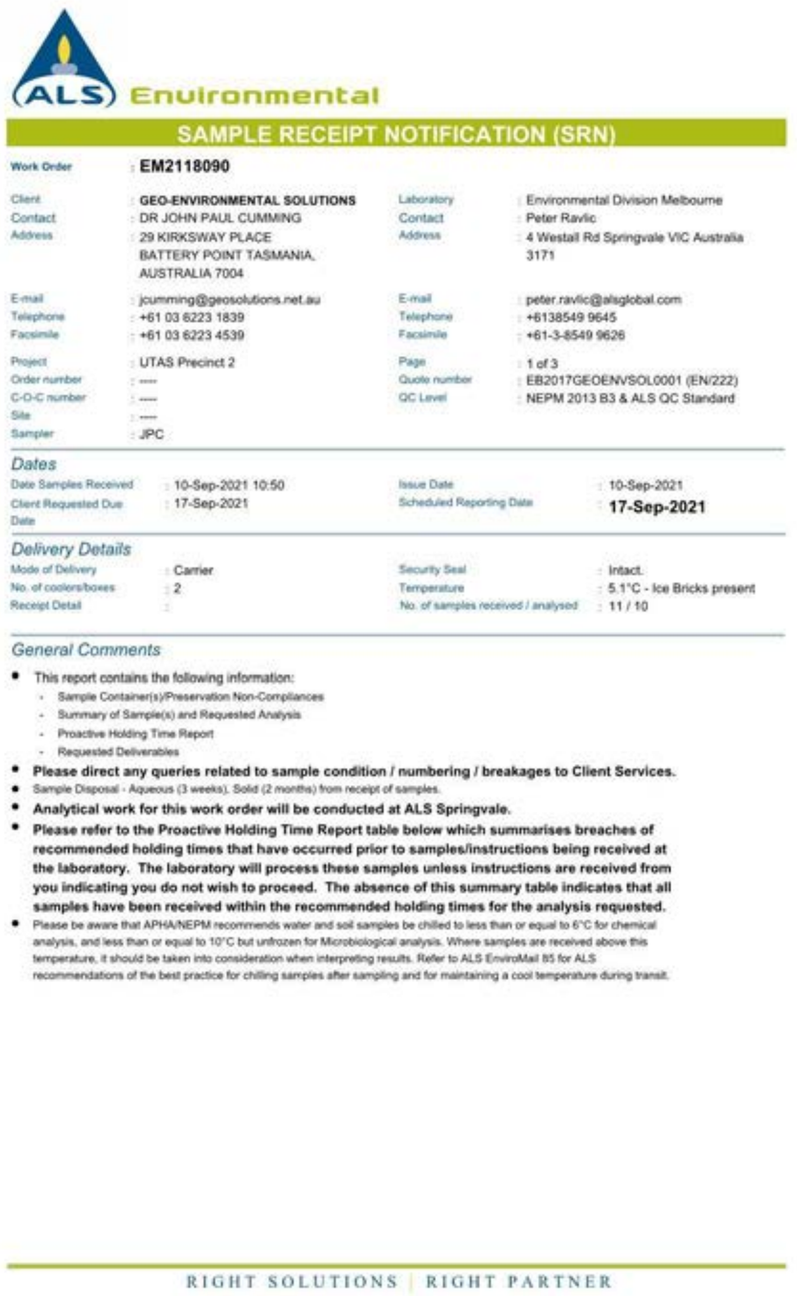
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE	TOTAL CONTAINERS	TRH, BTEXN, PAH	NEPM 15 Metals	LOW LVR Risk	TRH C6 - C10	[illegible]	OC/OP pesticides,	phenols VOC	HOLD
1	glasshouses 1	8/9/21	Soil	jar	1	✓	✓				✓		
2	glasshouses 2				1	✓	✓				✓		
3	glasshouses 3				1	✓	✓				✓		
4	animals facility 1				1	✓	✓				✓		
5	animals facility 2				1	✓	✓				✓		
6	chem store 1				1	✓	✓					✓	
7	chem store 2 paint				1	✓	✓					✓	
8	chem UST 0.5				1	✓	✓						
9	chem UST 2.5				1	✓	✓						
10	duplicate				1	✓	✓				✓		
11	Rinsate		water	1P, 1AG, 2SAV	4								

TOTAL

Environmental Division
Melbourne
Work Order Reference
EM2118090

Telephone: [illegible]

Received: 10/9 10:30 Carrier: TASFAST
Chete: 552973
Temp: 5.1 °C Seal: Y/N
Ice: Icebricks / NA
FD



ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2118090**

Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: DR JOHN PAUL CUMMING	Contact	: Peter Ravlic
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: jcumming@geosolutions.net.au	E-mail	: peter.ravlic@alsglobal.com
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9645
Facsimile	: +61 03 6223 4539	Facsimile	: +61-3-8549 9626
Project	: UTAS Precinct 2	Page	: 1 of 3
Order number	: ----	Quote number	: EB2017GEOENVSOL0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: JPC		

Dates

Date Samples Received	: 10-Sep-2021 10:50	Issue Date	: 10-Sep-2021
Client Requested Due Date	: 17-Sep-2021	Scheduled Reporting Date	: **17-Sep-2021**

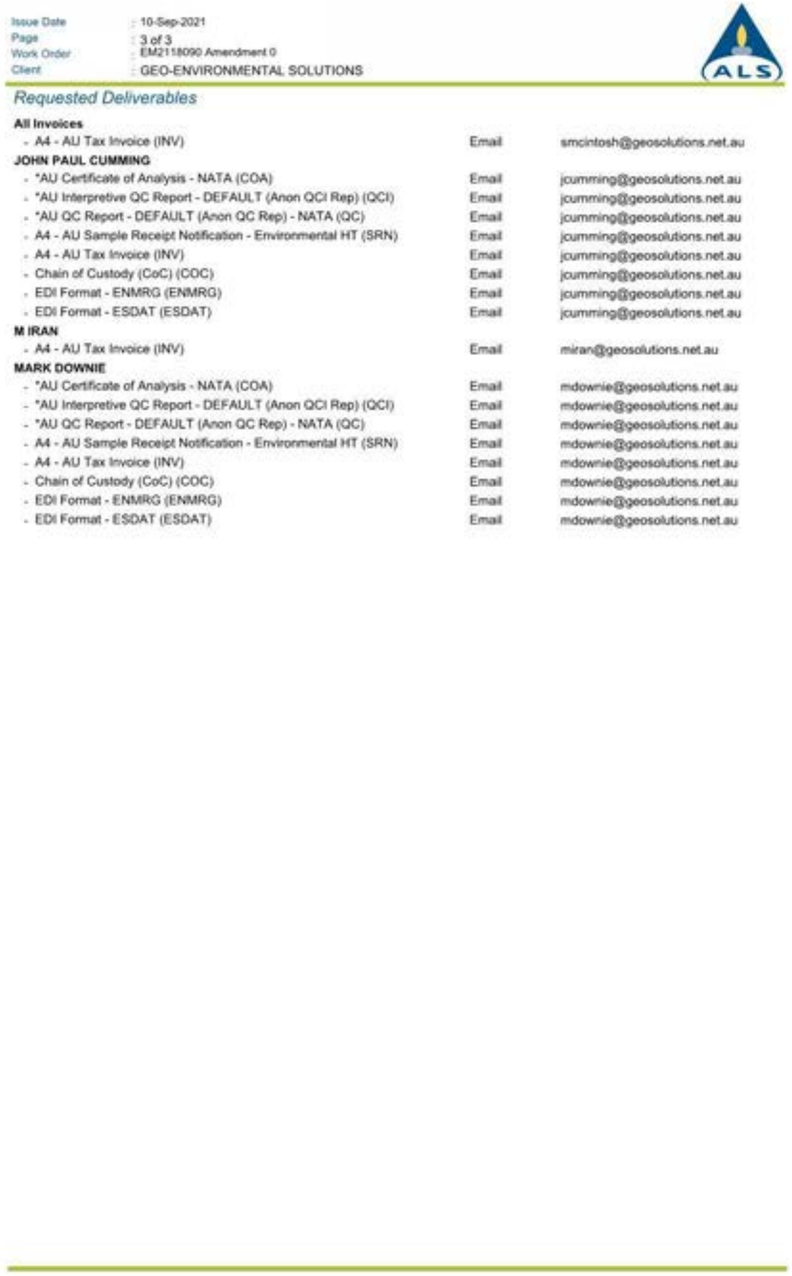
Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 2	Temperature	: 5.1°C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 11 / 10

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

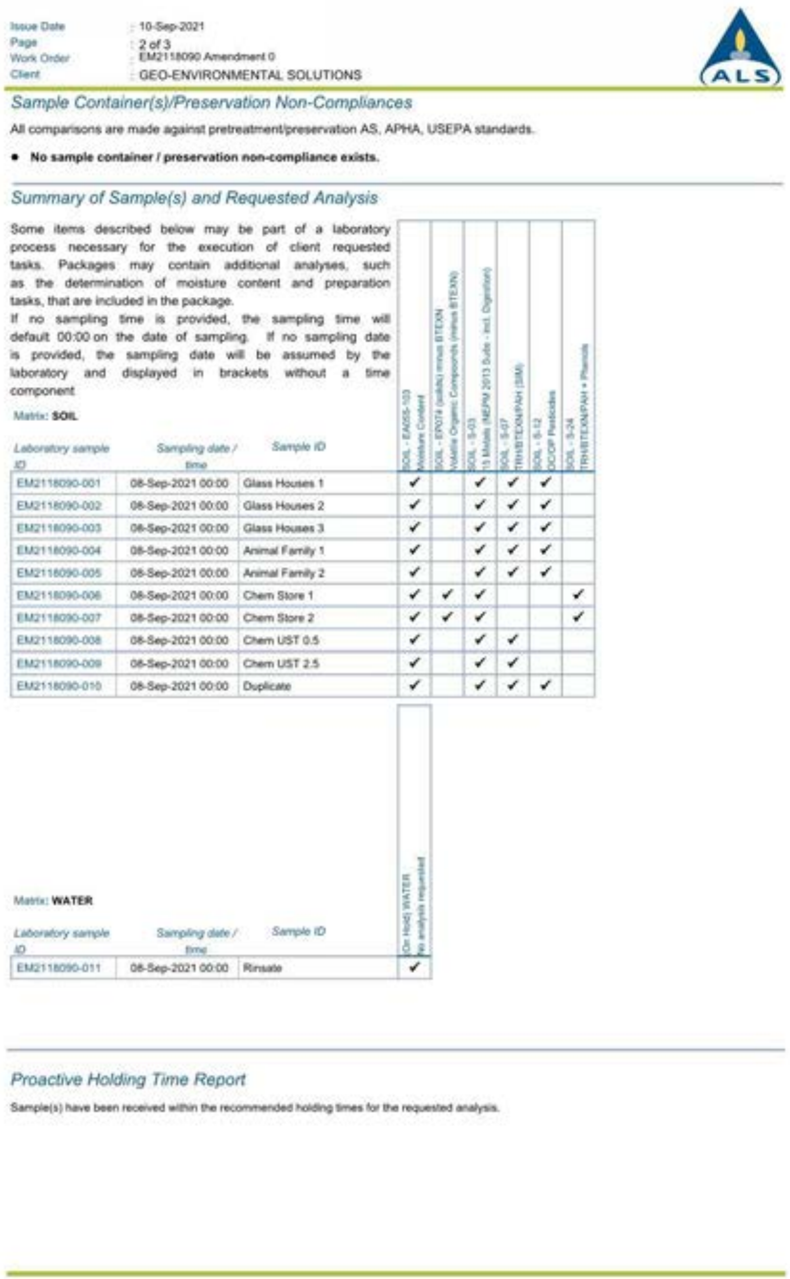
RIGHT SOLUTIONS | RIGHT PARTNER



Issue Date : 10-Sep-2021
Page : 3 of 3
Work Order : EM2118090 Amendment 0
Client : GEO-ENVIRONMENTAL SOLUTIONS

Requested Deliverables

All Invoices		
- A4 - AU Tax Invoice (INV)	Email	smcintosh@geosolutions.net.au
JOHN PAUL CUMMING		
- *AU Certificate of Analysis - NATA (COA)	Email	jcumming@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jcumming@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jcumming@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jcumming@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	jcumming@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	jcumming@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	jcumming@geosolutions.net.au
- EDI Format - ESDAT (ESDAT)	Email	jcumming@geosolutions.net.au
M IRAN		
- A4 - AU Tax Invoice (INV)	Email	miran@geosolutions.net.au
MARK DOWNIE		
- *AU Certificate of Analysis - NATA (COA)	Email	mdownie@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	mdownie@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	mdownie@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	mdownie@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	mdownie@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	mdownie@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	mdownie@geosolutions.net.au
- EDI Format - ESDAT (ESDAT)	Email	mdownie@geosolutions.net.au



Issue Date : 10-Sep-2021
Page : 2 of 3
Work Order : EM2118090 Amendment 0
Client : GEO-ENVIRONMENTAL SOLUTIONS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

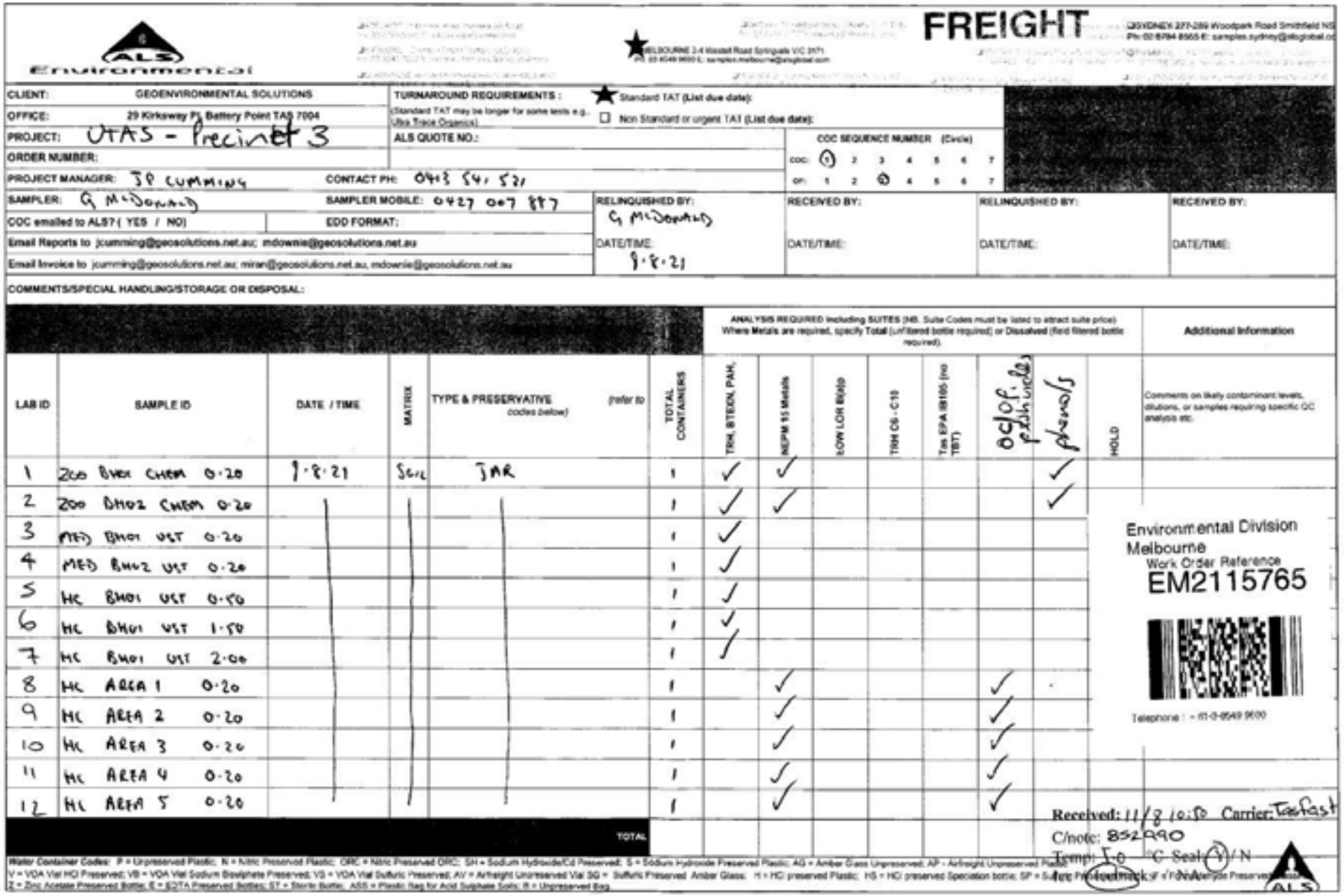
Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EA055-103 Moisture Content	SOIL - EP074 (solids) minus BTEXN Volatile Organic Compounds (minus BTEXN)	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)	SOIL - S-07 TRH/BTEXN/PAH (SIM)	SOIL - S-12 OC/OP Pesticides	SOIL - S-24 TRH/BTEXN/PAH + Phenols
EM2118090-001	08-Sep-2021 00:00	Glass Houses 1	✓		✓	✓	✓	
EM2118090-002	08-Sep-2021 00:00	Glass Houses 2	✓		✓	✓	✓	
EM2118090-003	08-Sep-2021 00:00	Glass Houses 3	✓		✓	✓	✓	
EM2118090-004	08-Sep-2021 00:00	Animal Family 1	✓		✓	✓	✓	
EM2118090-005	08-Sep-2021 00:00	Animal Family 2	✓		✓	✓	✓	
EM2118090-006	08-Sep-2021 00:00	Chem Store 1	✓	✓	✓			✓
EM2118090-007	08-Sep-2021 00:00	Chem Store 2	✓	✓	✓			✓
EM2118090-008	08-Sep-2021 00:00	Chem UST 0.5	✓		✓	✓		
EM2118090-009	08-Sep-2021 00:00	Chem UST 2.5	✓		✓	✓		
EM2118090-010	08-Sep-2021 00:00	Duplicate	✓		✓	✓	✓	

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	(On Hold) WATER No analysis requested
EM2118090-011	08-Sep-2021 00:00	Rinsate	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.



ALS Environmental

★ MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

FREIGHT

SYDNEY 277-289 Woodpark Road Smithfield NS
Ph: 02 8784 8555 E: samples.sydney@alsglobal.co

[redacted]

CLIENT: GEOENVIRONMENTAL SOLUTIONS

OFFICE: 29 Kirksway Pl, Battery Point TAS 7004

PROJECT: UTAS - Precinct 3

ORDER NUMBER:

PROJECT MANAGER: JP CUMMING

CONTACT PH: 0413 541 521

SAMPLER: G McDonald

SAMPLER MOBILE: 0427 007 887

COC emailed to ALS? (YES / NO)

EDD FORMAT:

Email Reports to jcumming@geosolutions.net.au; mdownie@geosolutions.net.au

Email Invoice to jcumming@geosolutions.net.au; miran@geosolutions.net.au, mdownie@geosolutions.net.au

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

★ Standard TAT (List due date):

☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC: [✓ 1] 2 3 4 5 6 7

OF: 1 2 [✓ 3] 4 5 6 7

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
G McDonald			
DATE/TIME: 9·8·21	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

[redacted]

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

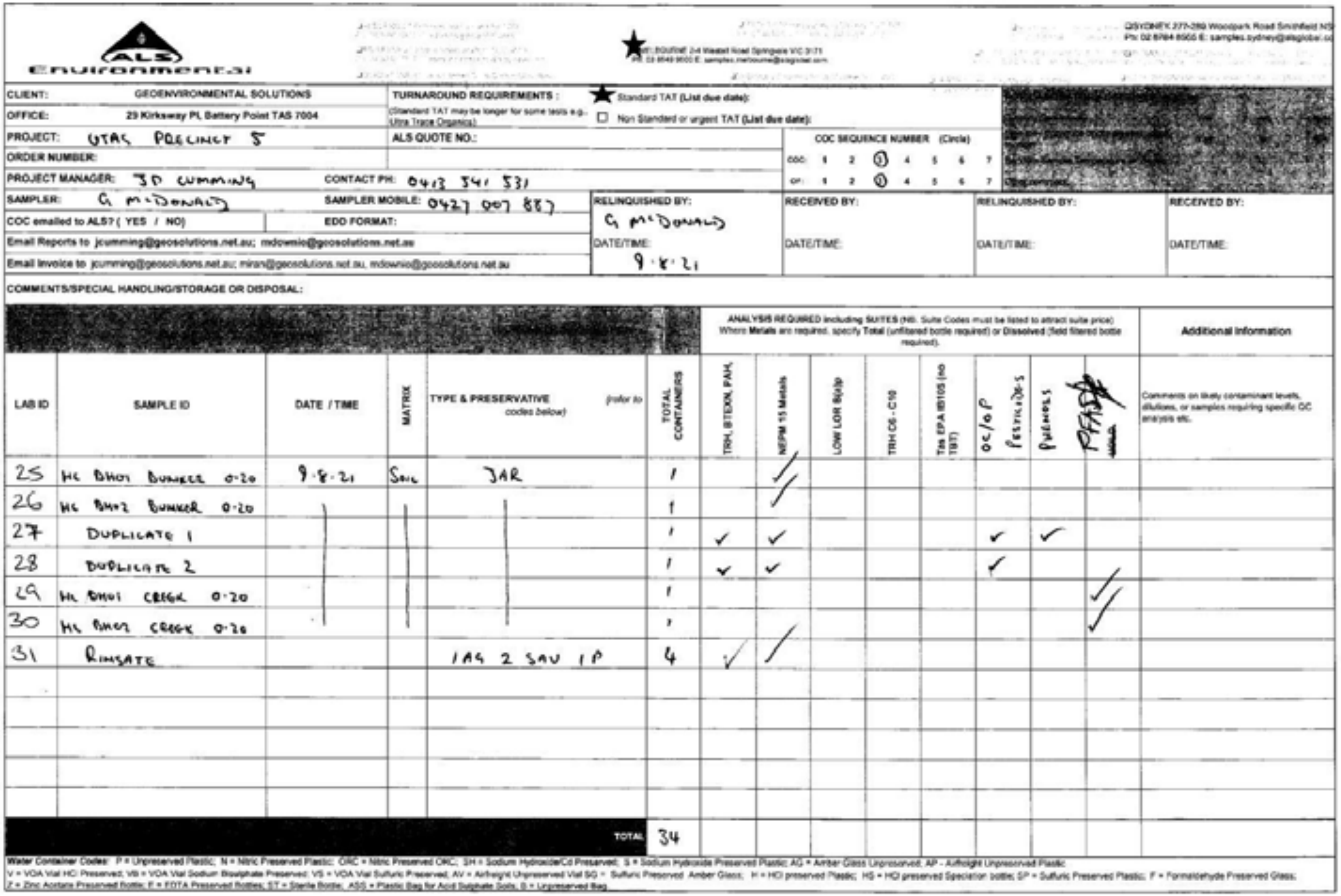
Additional Information

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	TRH, BTEXN, PAH,	NEPM 15 Metals	SOW LOR B(a)p	TRH C6 - C10	Tas EPA IB105 (no TBT)	oc/op. pesticides	phenols	HOLD	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	200 BH01 CHEM 0·20	9·8·21	Soil	JAR	1	✓	✓					✓		
2	200 BH02 CHEM 0·20				1	✓	✓					✓		
3	MED BH01 UST 0·20				1	✓								
4	MED BH02 UST 0·20				1	✓								
5	HC BH01 UST 0·50				1	✓								
6	HC BH01 UST 1·50				1	✓								
7	HC BH01 UST 2·00				1	✓								
8	HC AREA 1 0·20				1		✓				✓			
9	HC AREA 2 0·20				1		✓				✓			
10	HC AREA 3 0·20				1		✓				✓			
11	HC AREA 4 0·20				1		✓				✓			
12	HC AREA 5 0·20				1		✓				✓			
				TOTAL										

Environmental Division
Melbourne
Work Order Reference
EM2115765
Telephone : + 61-3-8549 9600

Received: 11/8 10:50 Carrier: Tasfast
C/note: 852990
Temp: 1.0 °C Seal: [✓ Y] / N
Free Ice / [✓ Icebrick] / None

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag



ALS Environmental

MELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NS
Ph: 02 8784 8555 E: samples.sydney@alsglobal.co

CLIENT:	GEOENVIRONMENTAL SOLUTIONS
OFFICE:	29 Kirksway PL Battery Point TAS 7004
PROJECT:	UTAS PRECINCT 5
ORDER NUMBER:	
PROJECT MANAGER:	JD CUMMING
CONTACT PH:	0413 541 531
SAMPLER:	G McDONALD
SAMPLER MOBILE:	0427 007 887
COC emailed to ALS? (YES / NO)	
EDD FORMAT:	

Email Reports to jcumming@geosolutions.net.au; mdownie@geosolutions.net.au

Email Invoice to jcumming@geosolutions.net.au; miran@geosolutions.net.au, mdownie@geosolutions.net.au

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)

★ Standard TAT (List due date):

☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC: 1 2 [✓ 3] 4 5 6 7

OF: 1 2 [✓ 3] 4 5 6 7

[redacted]

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
G McDONALD			
DATE/TIME: 9·8·21	DATE/TIME:	DATE/TIME:	DATE/TIME:

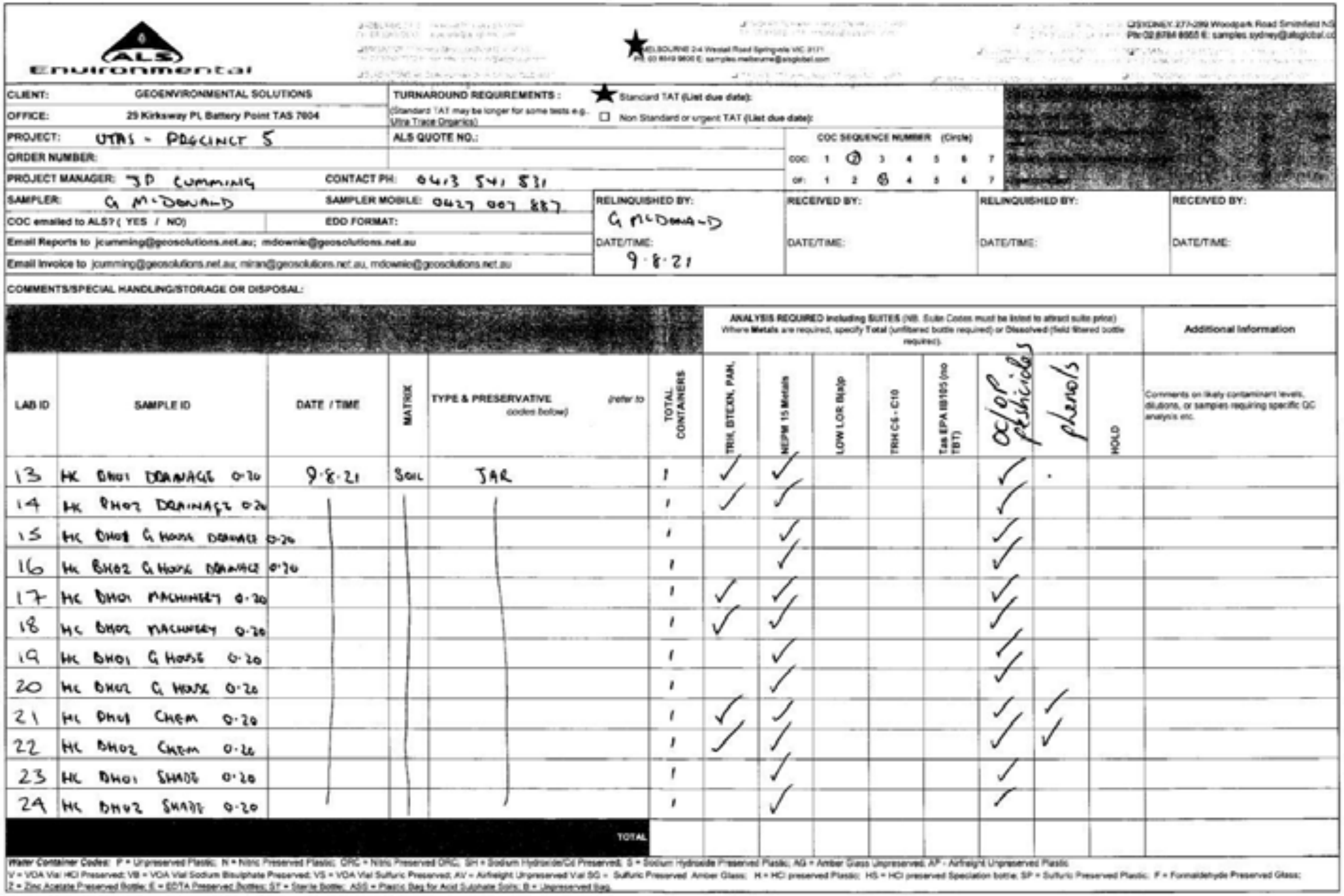
COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

[redacted]

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	TRH, BTEXN, PAH,	NEPM 15 Metals	LOW LOR 8p/p	TRH C6 - C10	Tas EPA IB105 (no TBT)	OC/OP PESTICIDES	PHENOLS	PFAS	Additional Information Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
25	HC BHO1 BUNKER 0-20	9·8·21	SOIL	JAR	1		✓							
26	HC BHO2 BUNKER 0-20				1		✓							
27	DUPLICATE 1				1	✓	✓				✓	✓		
28	DUPLICATE 2				1	✓	✓				✓			
29	HC BHO1 CREEK 0-20				1								✓	
30	HC BHO2 CREEK 0-20				1								✓	
31	RINSATE			1AG 2 SAV 1P	4	✓	✓							
					TOTAL 34									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag



ALS Environmental

★MELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

☐SYDNEY 277-289 Woodpark Road Smithfield NS
Ph: 02 8784 8555 E: samples.sydney@alsglobal.c

[redacted]

CLIENT: GEOENVIRONMENTAL SOLUTIONS
OFFICE: 29 Kirksway PL Battery Point TAS 7004
PROJECT: UTAS - PRECINCT 5
ORDER NUMBER:
PROJECT MANAGER: JP CUMMING
CONTACT PH: 0413 541 531
SAMPLER: G McDONALD
SAMPLER MOBILE: 0427 007 887
COC emailed to ALS? (YES / NO)
EDD FORMAT:
Email Reports to jcumming@geosolutions.net.au; mdownie@geosolutions.net.au
Email Invoice to jcumming@geosolutions.net.au; miran@geosolutions.net.au, mdownie@geosolutions.net.au

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
★ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):
ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)
COC: 1 (2) 3 4 5 6 7
OF: 1 2 (3) 4 5 6 7

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
G McDONALD			
DATE/TIME: 9·8·21	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

[redacted]

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	TRH, BTEXN, PAH,	NEPM 15 Metals	LOW LOR B(a)p	TRH C6 - C10	Tas EPA IB105 (no TBT)	OC/OP pesticides	phenols	HOLD	Additional Information Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	HK BH01 DRAINAGE 0·20	9·8·21	SOIL	JAR	1	✓	✓				✓			
14	HK BH02 DRAINAGE 0·20				1	✓	✓				✓			
15	HK BH01 G HOUSE DRAINAGE 0-20				1		✓				✓			
16	HK BH02 G HOUSE DRAINAGE 0·20				1		✓				✓			
17	HC BH01 MACHINERY 0·20				1	✓	✓				✓			
18	HC BH02 MACHINERY 0·20				1	✓	✓				✓			
19	HK BH01 G HOUSE 0·20				1		✓				✓			
20	HC BH02 G HOUSE 0·20				1		✓				✓			
21	HC BH01 CHEM 0·20				1	✓	✓				✓	✓		
22	HC BH02 CHEM 0·20				1	✓	✓				✓	✓		
23	HC BH01 SHADE 0·20				1		✓				✓			
24	HC BH02 SHADE 0·20				1		✓				✓			
				TOTAL										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2115765**

Client : **GEO-ENVIRONMENTAL SOLUTIONS**
Contact : DR JOHN PAUL CUMMING
Address : 29 KIRKSWAY PLACE
BATTERY POINT TASMANIA,
AUSTRALIA 7004

E-mail : jcumming@geosolutions.net.au
Telephone : +61 03 6223 1839
Facsimile : +61 03 6223 4539

Project : UTAS - Precinct 3
Order number : ----
C-O-C number : ----
Site : ----
Sampler : G MCDONALD

Laboratory : Environmental Division Melbourne
Contact : Peter Ravlic
Address : 4 Westall Rd Springvale VIC Australia
3171

E-mail : peter.ravlic@alsglobal.com
Telephone : +6138549 9645
Facsimile : +61-3-8549 9626

Page : 1 of 4
Quote number : EB2017GEOENVSOL0001 (EN/222)
QC Level : NEPM 2013 B3 & ALS QC Standard

Dates

Date Samples Received : 11-Aug-2021 10:50
Client Requested Due Date : 18-Aug-2021
Issue Date : 11-Aug-2021
Scheduled Reporting Date : **18-Aug-2021**

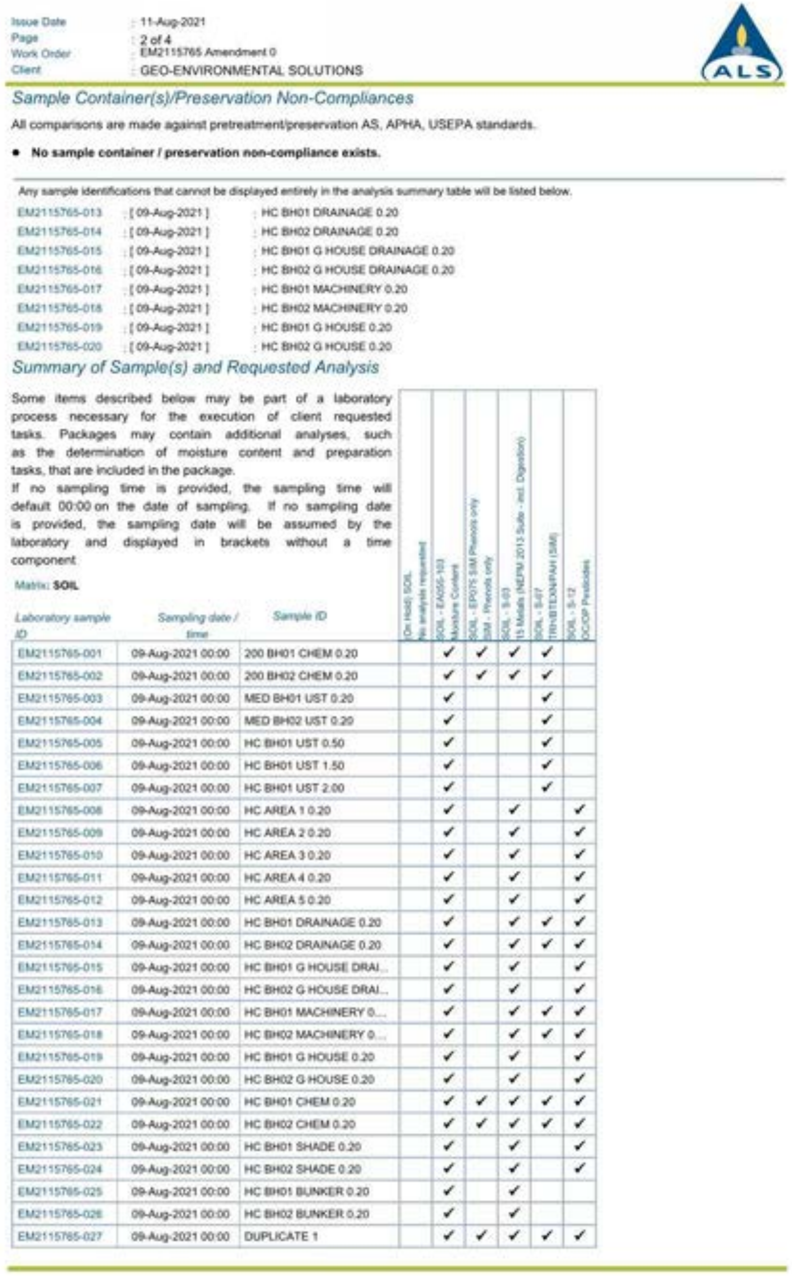
Delivery Details

Mode of Delivery : Carrier
No. of coolers/boxes : 1
Receipt Detail :
Security Seal : Intact.
Temperature : 5.0°C - Ice Bricks present
No. of samples received / analysed : 31 / 29

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **PFAS analysis omitted from samples 029 and 030 due to bottle non compliance.**
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

RIGHT SOLUTIONS | RIGHT PARTNER



Issue Date : 11-Aug-2021
Page : 2 of 4
Work Order : EM2115765 Amendment 0
Client : GEO-ENVIRONMENTAL SOLUTIONS

ALS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EM2115765-013	: [09-Aug-2021]	: HC BH01 DRAINAGE 0.20
EM2115765-014	: [09-Aug-2021]	: HC BH02 DRAINAGE 0.20
EM2115765-015	: [09-Aug-2021]	: HC BH01 G HOUSE DRAINAGE 0.20
EM2115765-016	: [09-Aug-2021]	: HC BH02 G HOUSE DRAINAGE 0.20
EM2115765-017	: [09-Aug-2021]	: HC BH01 MACHINERY 0.20
EM2115765-018	: [09-Aug-2021]	: HC BH02 MACHINERY 0.20
EM2115765-019	: [09-Aug-2021]	: HC BH01 G HOUSE 0.20
EM2115765-020	: [09-Aug-2021]	: HC BH02 G HOUSE 0.20

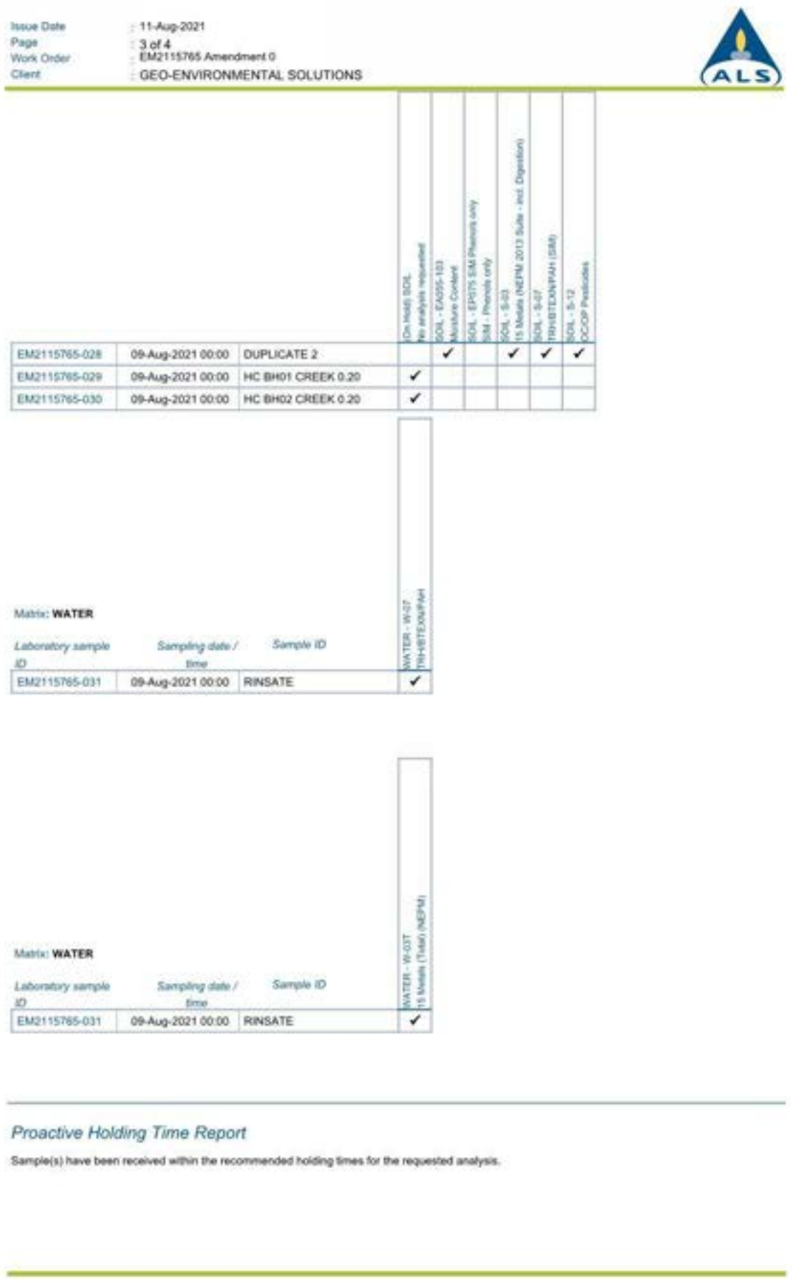
Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EP075 SIM Phenols only SIM - Phenols only	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)	SOIL - S-07 TRH/BTEXN/PAH (SIM)	SOIL - S-12 OC/OP Pesticides
EM2115765-001	09-Aug-2021 00:00	200 BH01 CHEM 0.20		✓	✓	✓	✓	
EM2115765-002	09-Aug-2021 00:00	200 BH02 CHEM 0.20		✓	✓	✓	✓	
EM2115765-003	09-Aug-2021 00:00	MED BH01 UST 0.20		✓			✓	
EM2115765-004	09-Aug-2021 00:00	MED BH02 UST 0.20		✓			✓	
EM2115765-005	09-Aug-2021 00:00	HC BH01 UST 0.50		✓			✓	
EM2115765-006	09-Aug-2021 00:00	HC BH01 UST 1.50		✓			✓	
EM2115765-007	09-Aug-2021 00:00	HC BH01 UST 2.00		✓			✓	
EM2115765-008	09-Aug-2021 00:00	HC AREA 1 0.20		✓		✓		✓
EM2115765-009	09-Aug-2021 00:00	HC AREA 2 0.20		✓		✓		✓
EM2115765-010	09-Aug-2021 00:00	HC AREA 3 0.20		✓		✓		✓
EM2115765-011	09-Aug-2021 00:00	HC AREA 4 0.20		✓		✓		✓
EM2115765-012	09-Aug-2021 00:00	HC AREA 5 0.20		✓		✓		✓
EM2115765-013	09-Aug-2021 00:00	HC BH01 DRAINAGE 0.20		✓		✓	✓	✓
EM2115765-014	09-Aug-2021 00:00	HC BH02 DRAINAGE 0.20		✓		✓	✓	✓
EM2115765-015	09-Aug-2021 00:00	HC BH01 G HOUSE DRAI...		✓		✓		✓
EM2115765-016	09-Aug-2021 00:00	HC BH02 G HOUSE DRAI...		✓		✓		✓
EM2115765-017	09-Aug-2021 00:00	HC BH01 MACHINERY 0....		✓		✓	✓	✓
EM2115765-018	09-Aug-2021 00:00	HC BH02 MACHINERY 0....		✓		✓	✓	✓
EM2115765-019	09-Aug-2021 00:00	HC BH01 G HOUSE 0.20		✓		✓		✓
EM2115765-020	09-Aug-2021 00:00	HC BH02 G HOUSE 0.20		✓		✓		✓
EM2115765-021	09-Aug-2021 00:00	HC BH01 CHEM 0.20		✓	✓	✓	✓	✓
EM2115765-022	09-Aug-2021 00:00	HC BH02 CHEM 0.20		✓	✓	✓	✓	✓
EM2115765-023	09-Aug-2021 00:00	HC BH01 SHADE 0.20		✓		✓		✓
EM2115765-024	09-Aug-2021 00:00	HC BH02 SHADE 0.20		✓		✓		✓
EM2115765-025	09-Aug-2021 00:00	HC BH01 BUNKER 0.20		✓		✓		
EM2115765-026	09-Aug-2021 00:00	HC BH02 BUNKER 0.20		✓		✓		
EM2115765-027	09-Aug-2021 00:00	DUPLICATE 1		✓	✓	✓	✓	✓



Issue Date : 11-Aug-2021
Page : 3 of 4
Work Order : EM2115765 Amendment 0
Client : GEO-ENVIRONMENTAL SOLUTIONS

			(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EP075 SIM Phenols only SIM - Phenols only	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)	SOIL - S-07 TRH/BTEXN/PAH (SIM)	SOIL - S-12 OC/OP Pesticides
EM2115765-028	09-Aug-2021 00:00	DUPLICATE 2		✓		✓	✓	✓
EM2115765-029	09-Aug-2021 00:00	HC BH01 CREEK 0.20	✓					
EM2115765-030	09-Aug-2021 00:00	HC BH02 CREEK 0.20	✓					

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - W-07 TRH/BTEXN/PAH
EM2115765-031	09-Aug-2021 00:00	RINSATE	✓

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - W-03T 15 Metals (Total) (NEPM)
EM2115765-031	09-Aug-2021 00:00	RINSATE	✓

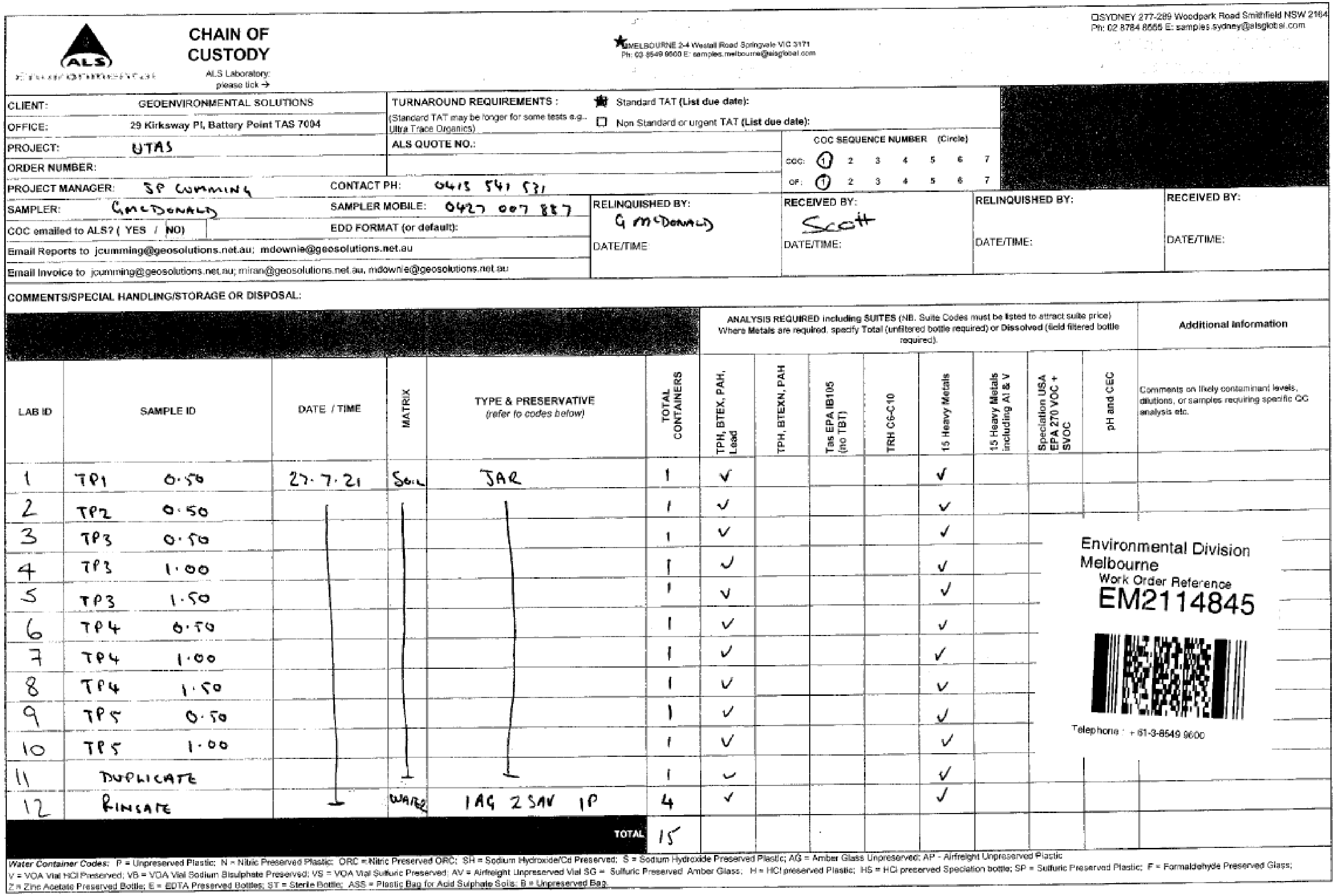
Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Issue Date : 11-Aug-2021
Page : 4 of 4
Work Order : EM2115765 Amendment 0
Client : GEO-ENVIRONMENTAL SOLUTIONS

Requested Deliverables

JOHN PAUL CUMMING		
- *AU Certificate of Analysis - NATA (COA)	Email	jcumming@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jcumming@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jcumming@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jcumming@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	jcumming@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	jcumming@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	jcumming@geosolutions.net.au
- EDI Format - ESDAT (ESDAT)	Email	jcumming@geosolutions.net.au
M IRAN		
- A4 - AU Tax Invoice (INV)	Email	miran@geosolutions.net.au
MARK DOWNIE		
- *AU Certificate of Analysis - NATA (COA)	Email	mdownie@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	mdownie@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	mdownie@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	mdownie@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	mdownie@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	mdownie@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	mdownie@geosolutions.net.au
- EDI Format - ESDAT (ESDAT)	Email	mdownie@geosolutions.net.au



CHAIN OF CUSTODY

ALS Laboratory: please tick →

★MELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164
Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

CLIENT: GEOENVIRONMENTAL SOLUTIONS

OFFICE: 29 Kirksway Pl, Battery Point TAS 7004

PROJECT: UTAS

ORDER NUMBER:

PROJECT MANAGER: SP CUMMING

CONTACT PH: 0413 541 531

SAMPLER: G MCDONALD

SAMPLER MOBILE: 0427 007 887

COC emailed to ALS? (YES / [✓ NO])

EDD FORMAT (or default):

Email Reports to jcumming@geosolutions.net.au; mdownie@geosolutions.net.au

Email Invoice to jcumming@geosolutions.net.au; miran@geosolutions.net.au, mdownie@geosolutions.net.au

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)

★ Standard TAT (List due date):

☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC: [✓ 1] 2 3 4 5 6 7

OF: [✓ 1] 2 3 4 5 6 7

RELINQUISHED BY: G McDONALD
DATE/TIME:

RECEIVED BY: Scott
DATE/TIME:

RELINQUISHED BY:
DATE/TIME:

RECEIVED BY:
DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	TPH, BTEX, PAH, Lead	TPH, BTEXN, PAH	Tas EPA IB105 (no TBT)	TRH C6-C10	15 Heavy Metals	15 Heavy Metals including Al & V	Speciation USA EPA 270 VOC + SVOC	pH and CEC	Additional Information: Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	TP1 0.50	27.7.21	SOIL	JAR	1	✓				✓				
2	TP2 0.50				1	✓				✓				
3	TP3 0.50				1	✓				✓				
4	TP3 1.00				1	✓				✓				
5	TP3 1.50				1	✓				✓				
6	TP4 0.50				1	✓				✓				
7	TP4 1.00				1	✓				✓				
8	TP4 1.50				1	✓				✓				
9	TP5 0.50				1	✓				✓				
10	TP5 1.00				1	✓				✓				
11	DUPLICATE				1	✓				✓				
12	RINSATE		WATER	1AG 2SAV 1P	4	✓				✓				
				TOTAL	15									

Environmental Division
Melbourne
Work Order Reference
EM2114845

Telephone : + 61-3-8549 9600

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM2114845**

Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: DR JOHN PAUL CUMMING	Contact	: Peter Ravlic
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: jcumming@geosolutions.net.au	E-mail	: peter.ravlic@alsglobal.com
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9645
Facsimile	: +61 03 6223 4539	Facsimile	: +61-3-8549 9626
Project	: UTAS	Page	: 1 of 3
Order number	: ----	Quote number	: EB2017GEOENVSOL0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: G MCDONALD		

Dates

Date Samples Received	: 30-Jul-2021 10:50	Issue Date	: 30-Jul-2021
Client Requested Due Date	: 06-Aug-2021	Scheduled Reporting Date	: **06-Aug-2021**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 6.2°C - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 12 / 12

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

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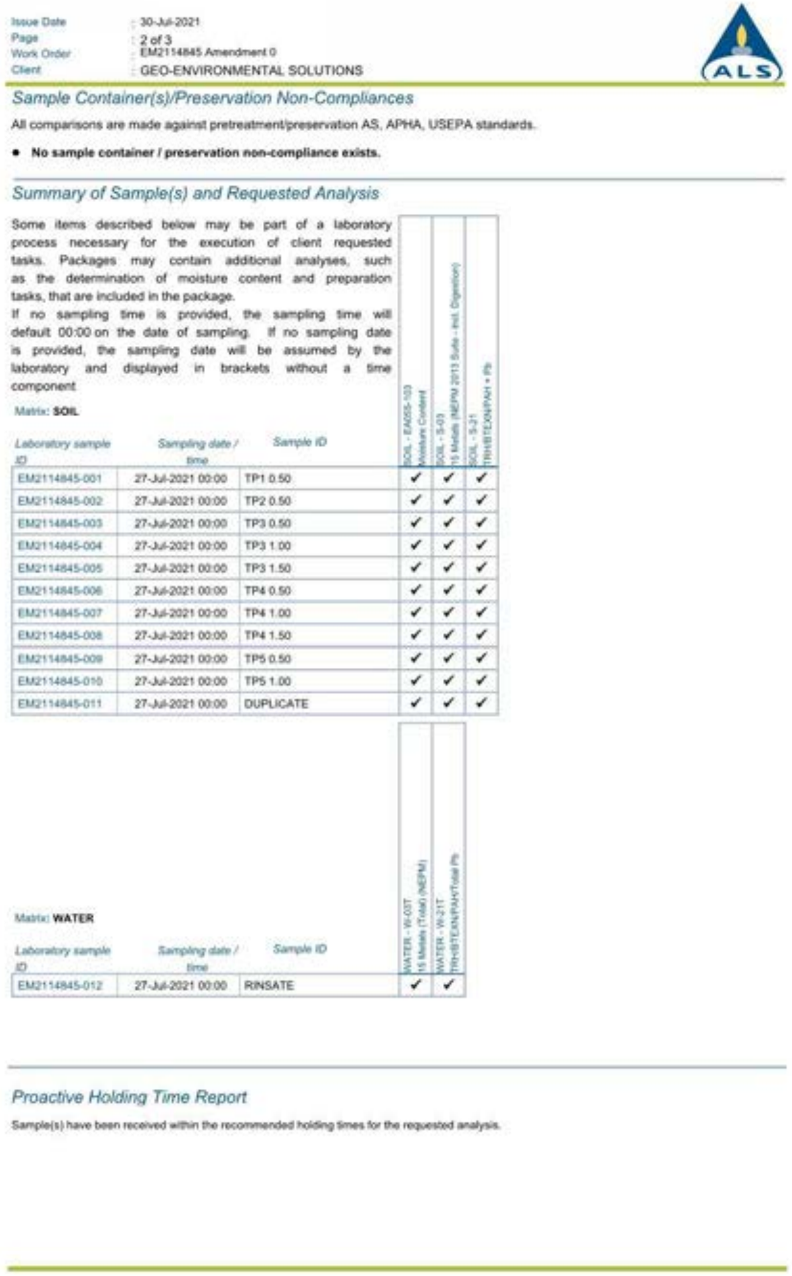

Issue Date : 30-Jul-2021
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Work Order : EM2114845 Amendment 0
Client : GEO-ENVIRONMENTAL SOLUTIONS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EA055-103 Moisture Content	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)	SOIL - S-21 TRH/BTEXN/PAH + Pb
EM2114845-001	27-Jul-2021 00:00	TP1 0.50	✓	✓	✓
EM2114845-002	27-Jul-2021 00:00	TP2 0.50	✓	✓	✓
EM2114845-003	27-Jul-2021 00:00	TP3 0.50	✓	✓	✓
EM2114845-004	27-Jul-2021 00:00	TP3 1.00	✓	✓	✓
EM2114845-005	27-Jul-2021 00:00	TP3 1.50	✓	✓	✓
EM2114845-006	27-Jul-2021 00:00	TP4 0.50	✓	✓	✓
EM2114845-007	27-Jul-2021 00:00	TP4 1.00	✓	✓	✓
EM2114845-008	27-Jul-2021 00:00	TP4 1.50	✓	✓	✓
EM2114845-009	27-Jul-2021 00:00	TP5 0.50	✓	✓	✓
EM2114845-010	27-Jul-2021 00:00	TP5 1.00	✓	✓	✓
EM2114845-011	27-Jul-2021 00:00	DUPLICATE	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - W-03T 15 Metals (Total) (NEPM)	WATER - W-21T TRH/BTEXN/PAH/Total Pb
EM2114845-012	27-Jul-2021 00:00	RINSATE	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Issue Date : 30-Jul-2021
Page : 3 of 3
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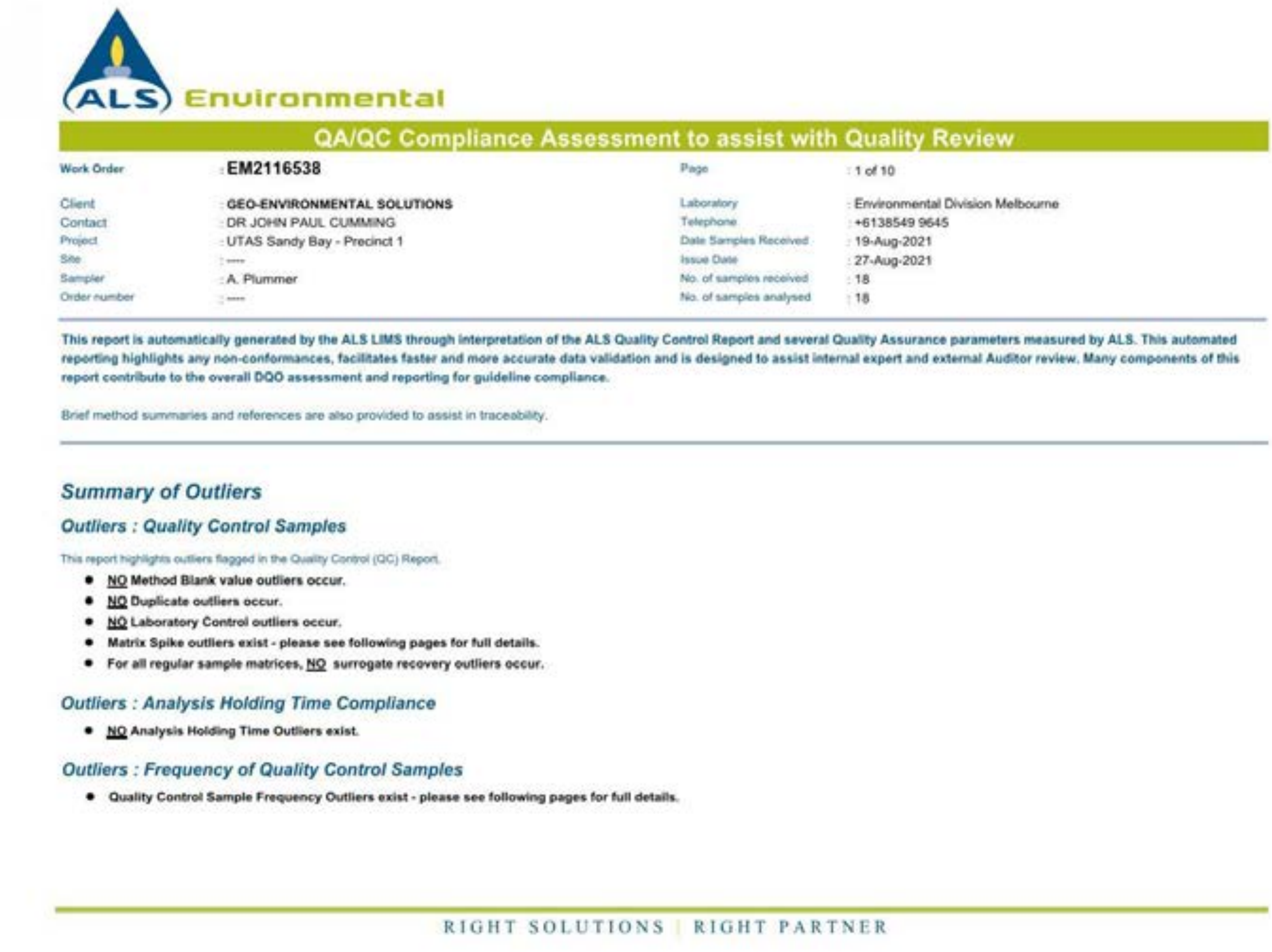
Requested Deliverables

JOHN PAUL CUMMING		
- *AU Certificate of Analysis - NATA (COA)	Email	jcumming@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jcumming@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jcumming@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jcumming@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	jcumming@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	jcumming@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	jcumming@geosolutions.net.au
- EDI Format - ESDAT (ESDAT)	Email	jcumming@geosolutions.net.au
M IRAN		
- A4 - AU Tax Invoice (INV)	Email	miran@geosolutions.net.au
MARK DOWNIE		
- *AU Certificate of Analysis - NATA (COA)	Email	mdownie@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	mdownie@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	mdownie@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	mdownie@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	mdownie@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	mdownie@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	mdownie@geosolutions.net.au
- EDI Format - ESDAT (ESDAT)	Email	mdownie@geosolutions.net.au

Appendix 6 Laboratory QA and QC Reports



ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2116538**	Page	: 1 of 10
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: DR JOHN PAUL CUMMING	Telephone	: +6138549 9645
Project	: UTAS Sandy Bay - Precinct 1	Date Samples Received	: 19-Aug-2021
Site	: ----	Issue Date	: 27-Aug-2021
Sampler	: A. Plummer	No. of samples received	: 18
Order number	: ----	No. of samples analysed	: 18

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

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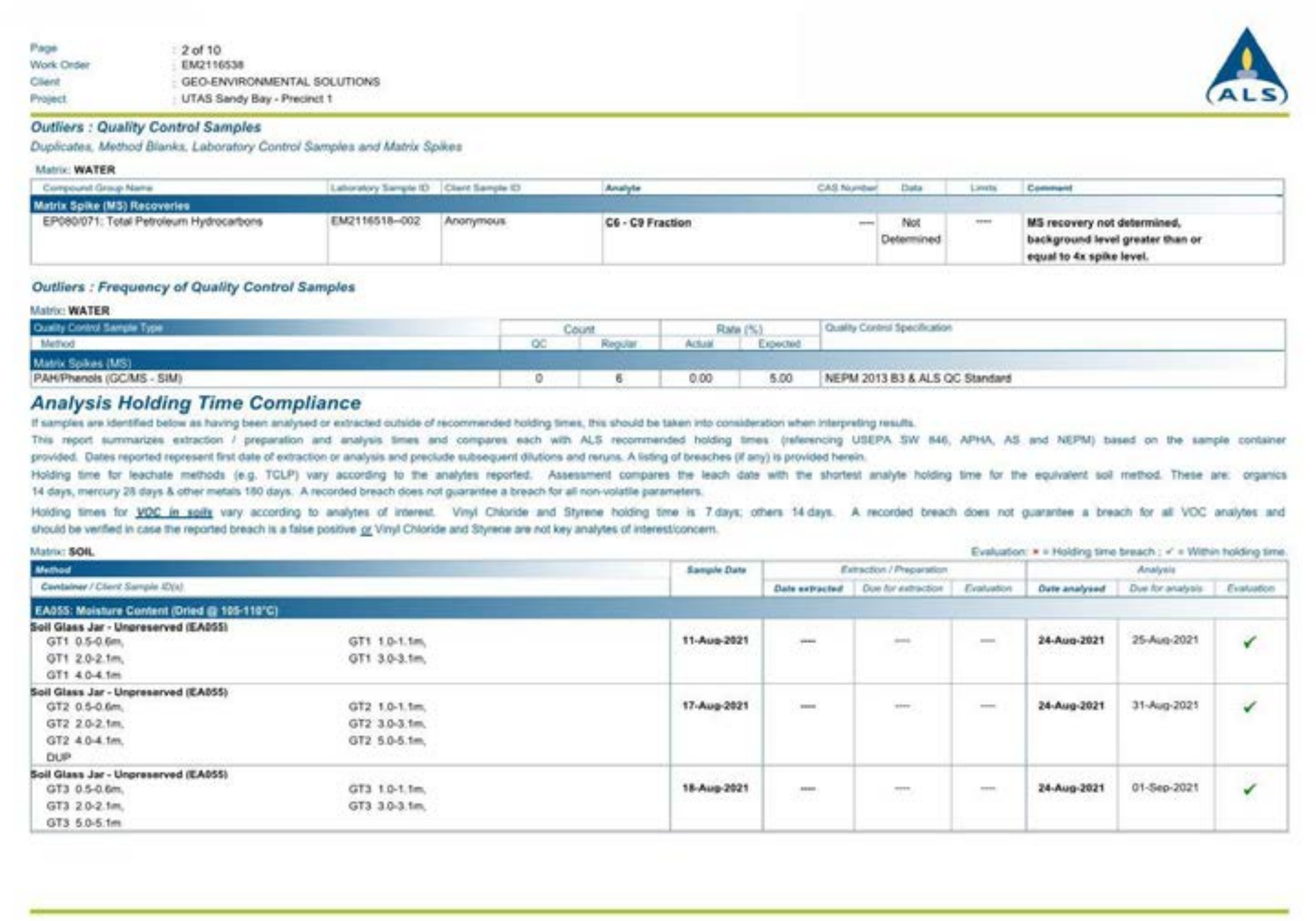

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Work Order : EM2116538
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precinct 1

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP080/071: Total Petroleum Hydrocarbons	EM2116518--002	Anonymous	**C6 - C9 Fraction**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	6	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055) GT1 0.5-0.6m, GT1 2.0-2.1m, GT1 4.0-4.1m	GT1 1.0-1.1m, GT1 3.0-3.1m,	**11-Aug-2021**	----	----	----	**24-Aug-2021**	25-Aug-2021	✓
Soil Glass Jar - Unpreserved (EA055) GT2 0.5-0.6m, GT2 2.0-2.1m, GT2 4.0-4.1m, DUP	GT2 1.0-1.1m, GT2 3.0-3.1m, GT2 5.0-5.1m,	**17-Aug-2021**	----	----	----	**24-Aug-2021**	31-Aug-2021	✓
Soil Glass Jar - Unpreserved (EA055) GT3 0.5-0.6m, GT3 2.0-2.1m, GT3 5.0-5.1m	GT3 1.0-1.1m, GT3 3.0-3.1m,	**18-Aug-2021**	----	----	----	**24-Aug-2021**	01-Sep-2021	✓

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Work Order : EM2116538
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precinct 1

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	**Sample Date**	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) GT1 0.5-0.6m, GT1 1.0-1.1m, GT1 2.0-2.1m, GT1 3.0-3.1m, GT1 4.0-4.1m	**11-Aug-2021**	**26-Aug-2021**	07-Feb-2022	✓	**26-Aug-2021**	07-Feb-2022	✓
Soil Glass Jar - Unpreserved (EG005T) GT2 0.5-0.6m, GT2 1.0-1.1m, GT2 2.0-2.1m, GT2 3.0-3.1m, GT2 4.0-4.1m, GT2 5.0-5.1m, DUP	**17-Aug-2021**	**26-Aug-2021**	13-Feb-2022	✓	**26-Aug-2021**	13-Feb-2022	✓
Soil Glass Jar - Unpreserved (EG005T) GT3 0.5-0.6m, GT3 1.0-1.1m, GT3 2.0-2.1m, GT3 3.0-3.1m, GT3 5.0-5.1m	**18-Aug-2021**	**26-Aug-2021**	14-Feb-2022	✓	**26-Aug-2021**	14-Feb-2022	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) GT1 0.5-0.6m, GT1 1.0-1.1m, GT1 2.0-2.1m, GT1 3.0-3.1m, GT1 4.0-4.1m	**11-Aug-2021**	**26-Aug-2021**	08-Sep-2021	✓	**26-Aug-2021**	08-Sep-2021	✓
Soil Glass Jar - Unpreserved (EG035T) GT2 0.5-0.6m, GT2 1.0-1.1m, GT2 2.0-2.1m, GT2 3.0-3.1m, GT2 4.0-4.1m, GT2 5.0-5.1m, DUP	**17-Aug-2021**	**26-Aug-2021**	14-Sep-2021	✓	**26-Aug-2021**	14-Sep-2021	✓
Soil Glass Jar - Unpreserved (EG035T) GT3 0.5-0.6m, GT3 1.0-1.1m, GT3 2.0-2.1m, GT3 3.0-3.1m, GT3 5.0-5.1m	**18-Aug-2021**	**26-Aug-2021**	15-Sep-2021	✓	**26-Aug-2021**	15-Sep-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM)) GT1 0.5-0.6m, GT1 1.0-1.1m, GT1 2.0-2.1m, GT1 3.0-3.1m, GT1 4.0-4.1m	**11-Aug-2021**	**25-Aug-2021**	25-Aug-2021	✓	**25-Aug-2021**	04-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP075(SIM)) GT2 0.5-0.6m, GT2 1.0-1.1m, GT2 2.0-2.1m, GT2 3.0-3.1m, GT2 4.0-4.1m, GT2 5.0-5.1m, DUP	**17-Aug-2021**	**25-Aug-2021**	31-Aug-2021	✓	**26-Aug-2021**	04-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP075(SIM)) GT3 0.5-0.6m, GT3 1.0-1.1m, GT3 2.0-2.1m, GT3 3.0-3.1m, GT3 5.0-5.1m	**18-Aug-2021**	**25-Aug-2021**	01-Sep-2021	✓	**26-Aug-2021**	04-Oct-2021	✓

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Work Order : EM2116538
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precinct 1

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	**Sample Date**	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		**Date extracted**	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080) GT1 0.5-0.6m, GT1 1.0-1.1m, GT1 2.0-2.1m, GT1 3.0-3.1m, GT1 4.0-4.1m	**11-Aug-2021**	**24-Aug-2021**	25-Aug-2021	✓	**24-Aug-2021**	25-Aug-2021	✓
Soil Glass Jar - Unpreserved (EP071) GT1 0.5-0.6m, GT1 1.0-1.1m, GT1 2.0-2.1m, GT1 3.0-3.1m, GT1 4.0-4.1m	**11-Aug-2021**	**25-Aug-2021**	25-Aug-2021	✓	**25-Aug-2021**	04-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP080) GT2 0.5-0.6m, GT2 1.0-1.1m, GT2 2.0-2.1m, GT2 3.0-3.1m, GT2 4.0-4.1m, GT2 5.0-5.1m, DUP	**17-Aug-2021**	**24-Aug-2021**	31-Aug-2021	✓	**24-Aug-2021**	31-Aug-2021	✓
Soil Glass Jar - Unpreserved (EP071) GT2 0.5-0.6m, GT2 1.0-1.1m, GT2 2.0-2.1m, GT2 3.0-3.1m, GT2 4.0-4.1m, GT2 5.0-5.1m, DUP	**17-Aug-2021**	**25-Aug-2021**	31-Aug-2021	✓	**26-Aug-2021**	04-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP080) GT3 0.5-0.6m, GT3 1.0-1.1m, GT3 2.0-2.1m, GT3 3.0-3.1m, GT3 5.0-5.1m	**18-Aug-2021**	**24-Aug-2021**	01-Sep-2021	✓	**24-Aug-2021**	01-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP071) GT3 0.5-0.6m, GT3 1.0-1.1m, GT3 2.0-2.1m, GT3 3.0-3.1m, GT3 5.0-5.1m	**18-Aug-2021**	**25-Aug-2021**	01-Sep-2021	✓	**26-Aug-2021**	04-Oct-2021	✓

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Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precinct 1

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method *Container / Client Sample ID(s)*	**Sample Date**	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	**Date analysed**	*Due for analysis*	*Evaluation*
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080) GT1 0.5-0.6m, GT1 1.0-1.1m, GT1 2.0-2.1m, GT1 3.0-3.1m, GT1 4.0-4.1m	**11-Aug-2021**	**24-Aug-2021**	25-Aug-2021	✓	**24-Aug-2021**	25-Aug-2021	✓
Soil Glass Jar - Unpreserved (EP071) GT1 0.5-0.6m, GT1 1.0-1.1m, GT1 2.0-2.1m, GT1 3.0-3.1m, GT1 4.0-4.1m	**11-Aug-2021**	**25-Aug-2021**	25-Aug-2021	✓	**25-Aug-2021**	04-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP080) GT2 0.5-0.6m, GT2 1.0-1.1m, GT2 2.0-2.1m, GT2 3.0-3.1m, GT2 4.0-4.1m, GT2 5.0-5.1m, DUP	**17-Aug-2021**	**24-Aug-2021**	31-Aug-2021	✓	**24-Aug-2021**	31-Aug-2021	✓
Soil Glass Jar - Unpreserved (EP071) GT2 0.5-0.6m, GT2 1.0-1.1m, GT2 2.0-2.1m, GT2 3.0-3.1m, GT2 4.0-4.1m, GT2 5.0-5.1m, DUP	**17-Aug-2021**	**25-Aug-2021**	31-Aug-2021	✓	**26-Aug-2021**	04-Oct-2021	✓
Soil Glass Jar - Unpreserved (EP080) GT3 0.5-0.6m, GT3 1.0-1.1m, GT3 2.0-2.1m, GT3 3.0-3.1m, GT3 5.0-5.1m	**18-Aug-2021**	**24-Aug-2021**	01-Sep-2021	✓	**24-Aug-2021**	01-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP071) GT3 0.5-0.6m, GT3 1.0-1.1m, GT3 2.0-2.1m, GT3 3.0-3.1m, GT3 5.0-5.1m	**18-Aug-2021**	**25-Aug-2021**	01-Sep-2021	✓	**26-Aug-2021**	04-Oct-2021	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080) GT1 0.5-0.6m, GT1 1.0-1.1m, GT1 2.0-2.1m, GT1 3.0-3.1m, GT1 4.0-4.1m	**11-Aug-2021**	**24-Aug-2021**	25-Aug-2021	✓	**24-Aug-2021**	25-Aug-2021	✓
Soil Glass Jar - Unpreserved (EP080) GT2 0.5-0.6m, GT2 1.0-1.1m, GT2 2.0-2.1m, GT2 3.0-3.1m, GT2 4.0-4.1m, GT2 5.0-5.1m, DUP	**17-Aug-2021**	**24-Aug-2021**	31-Aug-2021	✓	**24-Aug-2021**	31-Aug-2021	✓
Soil Glass Jar - Unpreserved (EP080) GT3 0.5-0.6m, GT3 1.0-1.1m, GT3 2.0-2.1m, GT3 3.0-3.1m, GT3 5.0-5.1m	**18-Aug-2021**	**24-Aug-2021**	01-Sep-2021	✓	**24-Aug-2021**	01-Sep-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

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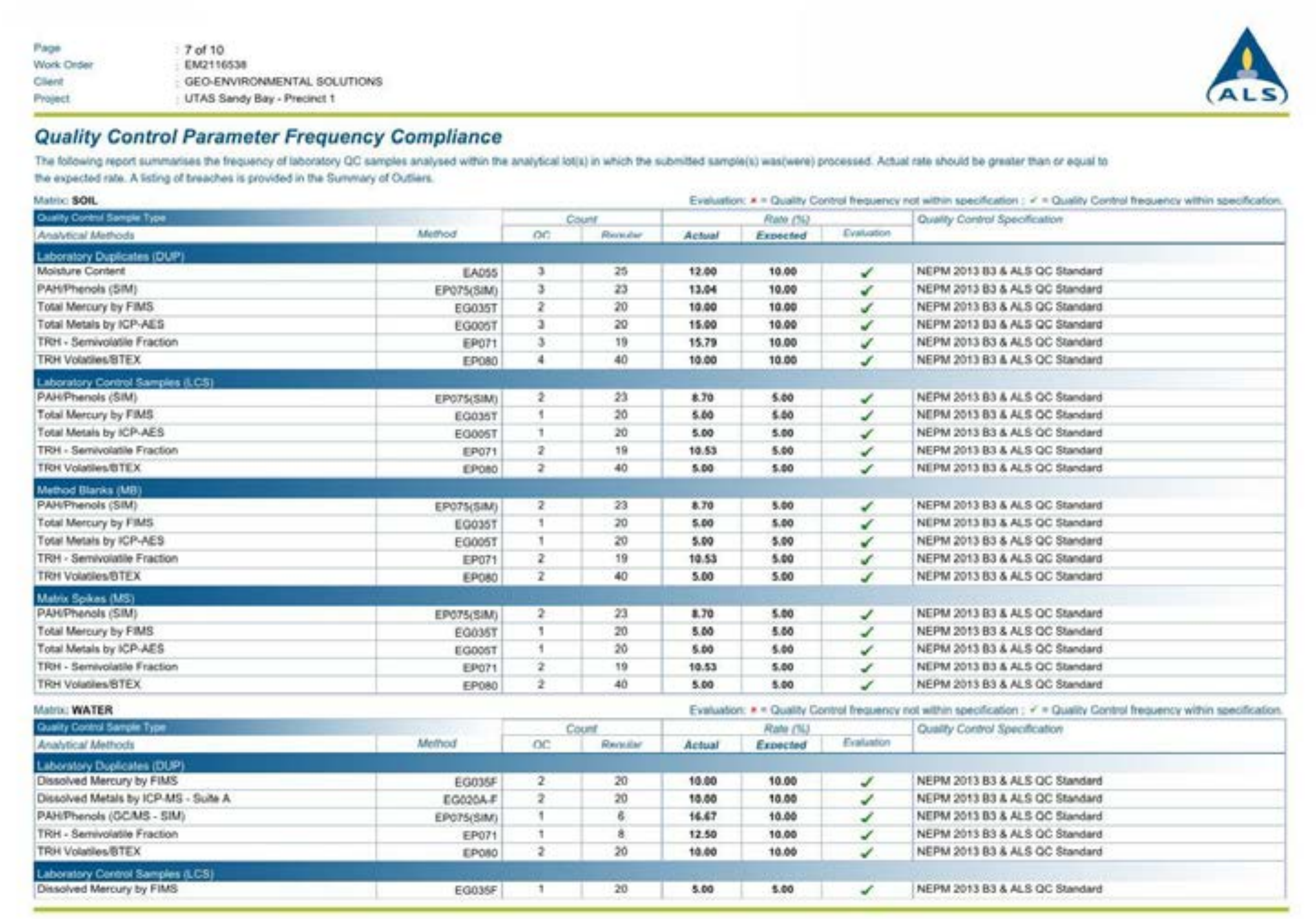
Work Order : EM2116538
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precinct 1

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	**Sample Date**	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		**Date extracted**	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F) Rinsate	**18-Aug-2021**	----	----	----	**25-Aug-2021**	14-Feb-2022	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F) Rinsate	**18-Aug-2021**	----	----	----	**25-Aug-2021**	15-Sep-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM)) Rinsate	**18-Aug-2021**	**23-Aug-2021**	25-Aug-2021	✓	**24-Aug-2021**	02-Oct-2021	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071) Rinsate	**18-Aug-2021**	**23-Aug-2021**	25-Aug-2021	✓	**24-Aug-2021**	02-Oct-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) Rinsate	**18-Aug-2021**	**21-Aug-2021**	01-Sep-2021	✓	**21-Aug-2021**	01-Sep-2021	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071) Rinsate	**18-Aug-2021**	**23-Aug-2021**	25-Aug-2021	✓	**24-Aug-2021**	02-Oct-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) Rinsate	**18-Aug-2021**	**21-Aug-2021**	01-Sep-2021	✓	**21-Aug-2021**	01-Sep-2021	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) Rinsate	**18-Aug-2021**	**21-Aug-2021**	01-Sep-2021	✓	**21-Aug-2021**	01-Sep-2021	✓



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Work Order : EM2116538
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precinct 1

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	3	25	**12.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	3	23	**13.04**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	3	20	**15.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	3	19	**15.79**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	2	23	**8.70**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	19	**10.53**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	2	23	**8.70**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	19	**10.53**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	2	23	**8.70**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	19	**10.53**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

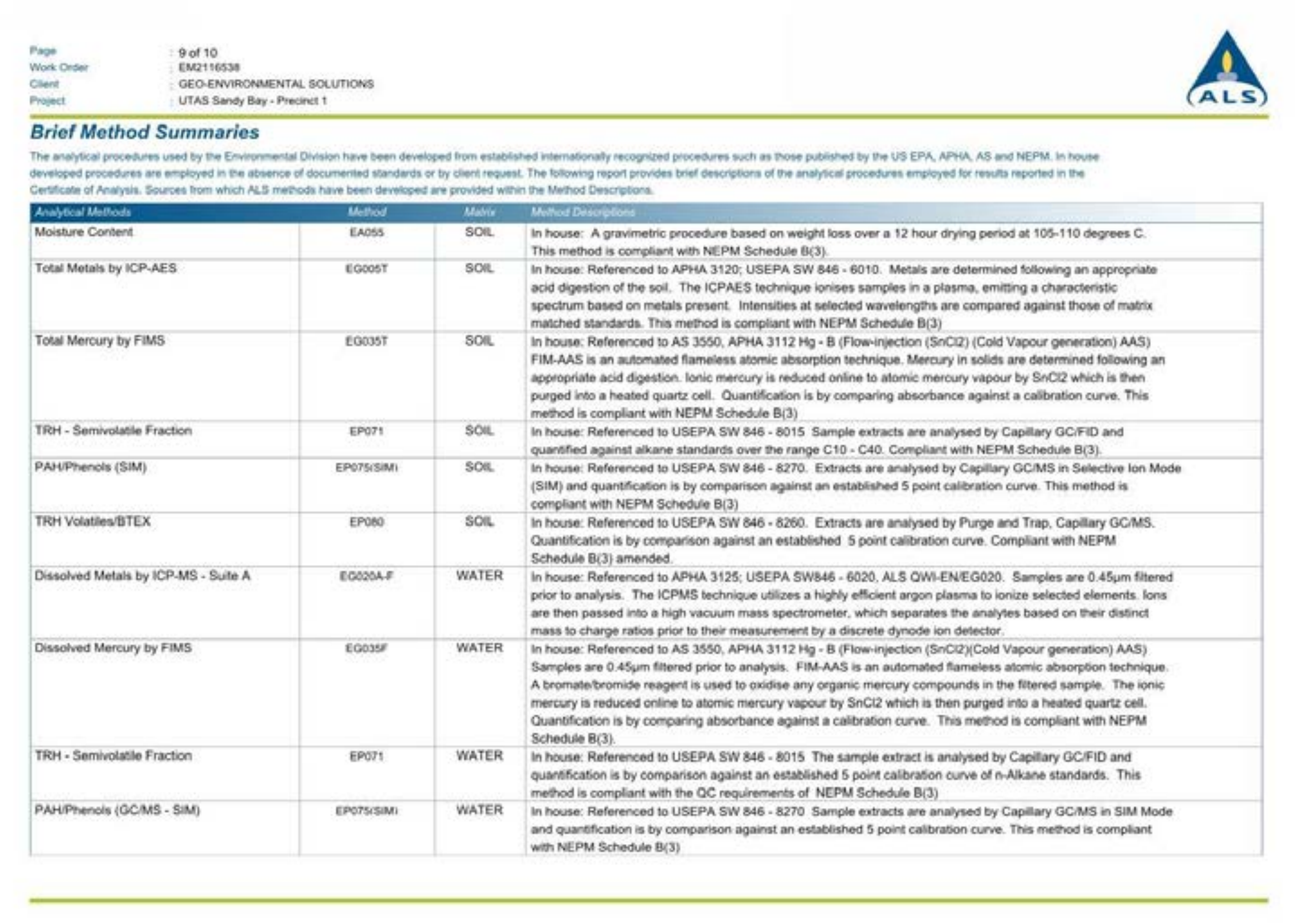
Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Dissolved Mercury by FIMS	EG035F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Page	: 8 of 10
Work Order	: EM2116538
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: UTAS Sandy Bay - Precinct 1

Matrix: **WATER**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	6	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard



Page : 9 of 10
Work Order : EM2116538
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precinct 1

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)

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Work Order : EM2116538
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precinct 1

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM2116910**	Page	: 1 of 4
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: DR JOHN PAUL CUMMING	Telephone	: +6138549 9645
Project	: UTAS Sandy Bay - Precinct 1	Date Samples Received	: 26-Aug-2021
Site	: ----	Issue Date	: 01-Sep-2021
Sampler	: AP	No. of samples received	: 2
Order number	: ----	No. of samples analysed	: 2

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

RIGHT SOLUTIONS | RIGHT PARTNER

Page : 2 of 4
Work Order : EM2116910
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precinct 1

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

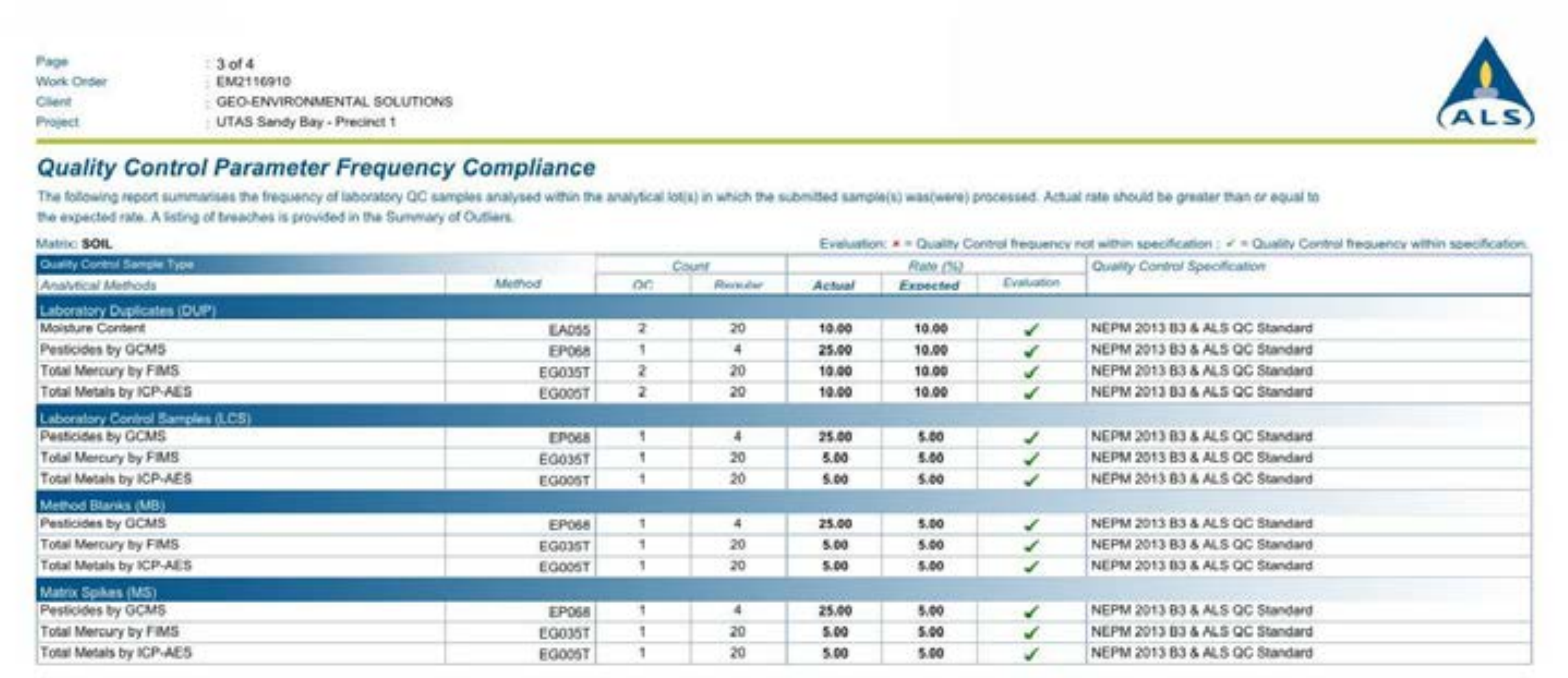
Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055) Precinct 1 bank, Precinct 1 rugby	**19-Aug-2021**	----	----	----	**27-Aug-2021**	02-Sep-2021	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) Precinct 1 bank, Precinct 1 rugby	**19-Aug-2021**	**30-Aug-2021**	15-Feb-2022	✓	**30-Aug-2021**	15-Feb-2022	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) Precinct 1 bank, Precinct 1 rugby	**19-Aug-2021**	**30-Aug-2021**	16-Sep-2021	✓	**31-Aug-2021**	16-Sep-2021	✓
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068) Precinct 1 bank, Precinct 1 rugby	**19-Aug-2021**	**30-Aug-2021**	02-Sep-2021	✓	**31-Aug-2021**	09-Oct-2021	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068) Precinct 1 bank, Precinct 1 rugby	**19-Aug-2021**	**30-Aug-2021**	02-Sep-2021	✓	**31-Aug-2021**	09-Oct-2021	✓



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Work Order : EM2116910
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precinct 1

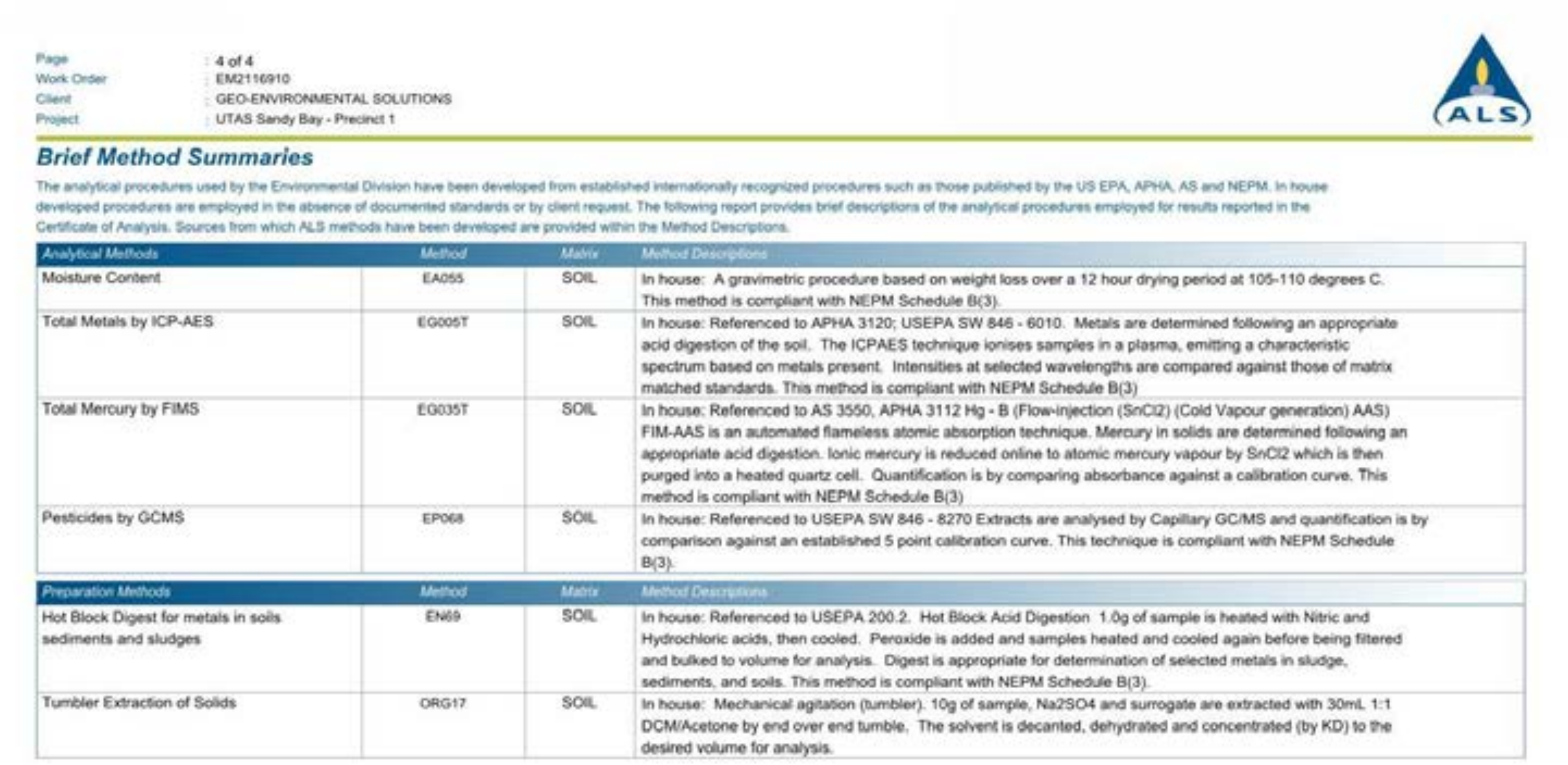
Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Pesticides by GCMS	EP068	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Pesticides by GCMS	EP068	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Pesticides by GCMS	EP068	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard



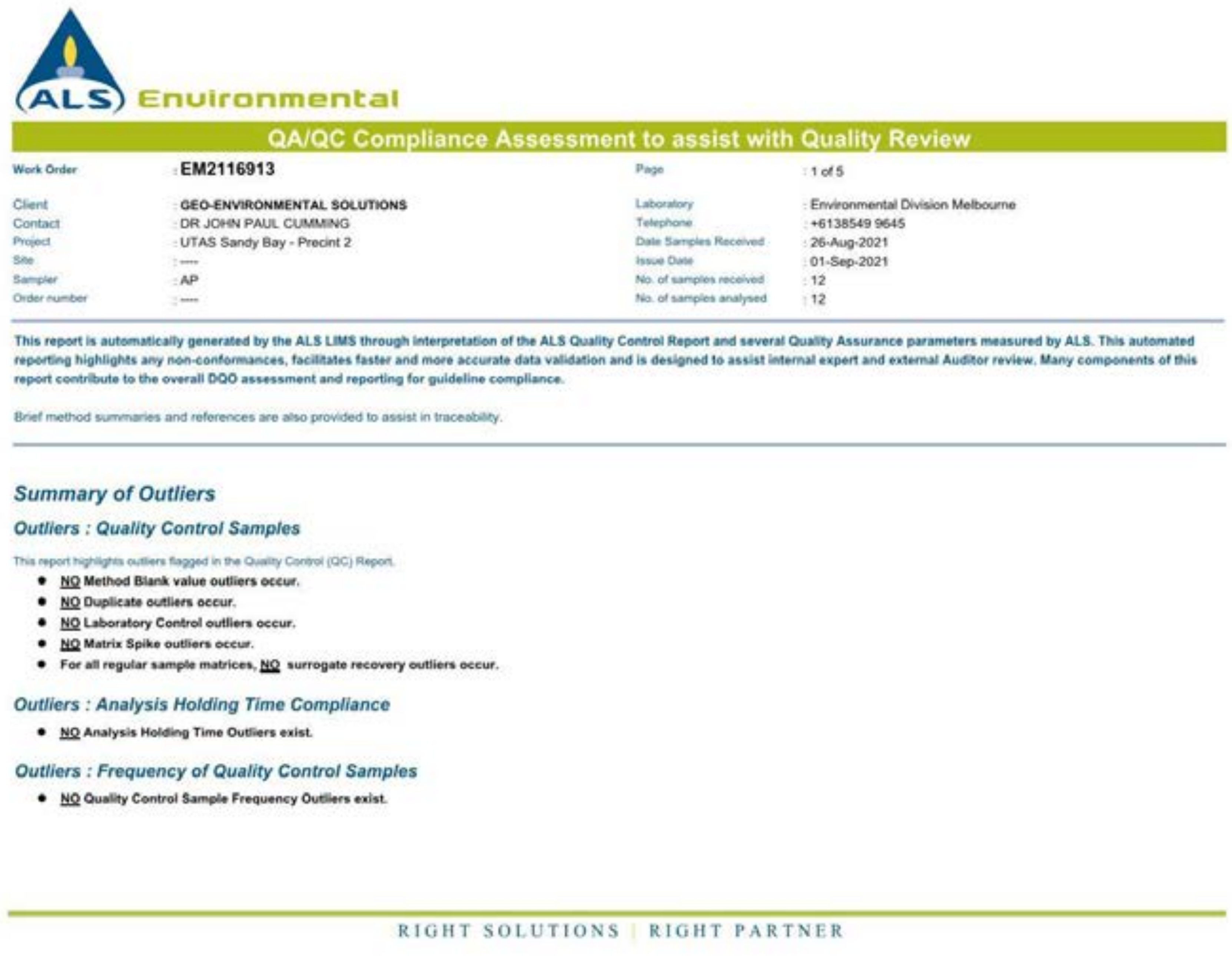
Page	: 4 of 4
Work Order	: EM2116910
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: UTAS Sandy Bay - Precinct 1

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Pesticides by GCMS	EP068	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM Schedule B(3).

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.



ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EM2116913	Page	: 1 of 5
Client	: GEO-ENVIRONMENTAL SOLUTIONS	Laboratory	: Environmental Division Melbourne
Contact	: DR JOHN PAUL CUMMING	Telephone	: +6138549 9645
Project	: UTAS Sandy Bay - Precint 2	Date Samples Received	: 26-Aug-2021
Site	: ----	Issue Date	: 01-Sep-2021
Sampler	: AP	No. of samples received	: 12
Order number	: ----	No. of samples analysed	: 12

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

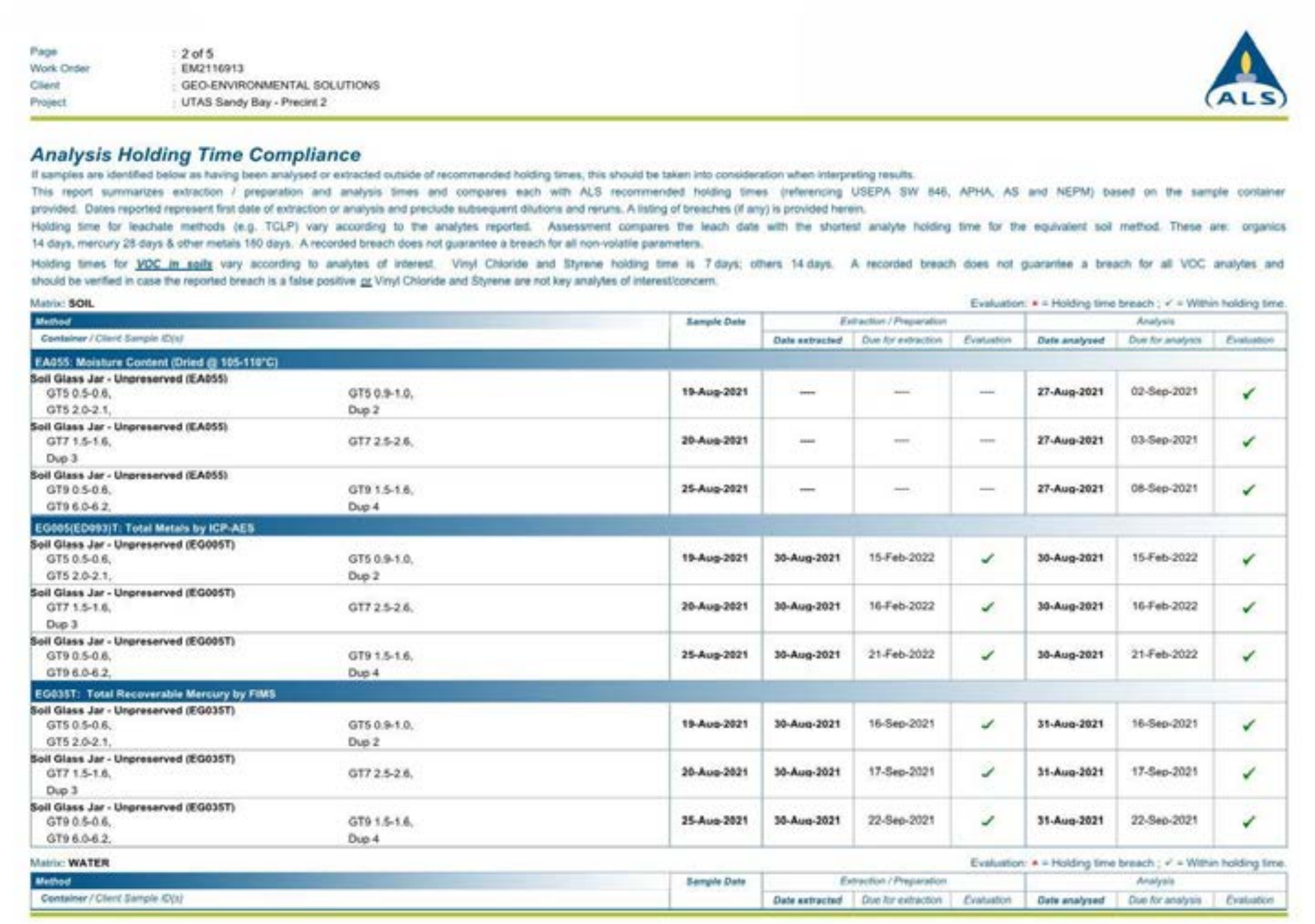
Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

RIGHT SOLUTIONS | RIGHT PARTNER



Page : 2 of 5
Work Order : EM2116913
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precinct 2

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method **Container** / Client Sample ID(s)	**Sample Date**	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055) GT5 0.5-0.6, GT5 0.9-1.0, GT5 2.0-2.1, Dup 2	**19-Aug-2021**	----	----	----	**27-Aug-2021**	02-Sep-2021	✓
Soil Glass Jar - Unpreserved (EA055) GT7 1.5-1.6, GT7 2.5-2.6, Dup 3	**20-Aug-2021**	----	----	----	**27-Aug-2021**	03-Sep-2021	✓
Soil Glass Jar - Unpreserved (EA055) GT9 0.5-0.6, GT9 1.5-1.6, GT9 6.0-6.2, Dup 4	**25-Aug-2021**	----	----	----	**27-Aug-2021**	08-Sep-2021	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) GT5 0.5-0.6, GT5 0.9-1.0, GT5 2.0-2.1, Dup 2	**19-Aug-2021**	**30-Aug-2021**	15-Feb-2022	✓	**30-Aug-2021**	15-Feb-2022	✓
Soil Glass Jar - Unpreserved (EG005T) GT7 1.5-1.6, GT7 2.5-2.6, Dup 3	**20-Aug-2021**	**30-Aug-2021**	16-Feb-2022	✓	**30-Aug-2021**	16-Feb-2022	✓
Soil Glass Jar - Unpreserved (EG005T) GT9 0.5-0.6, GT9 1.5-1.6, GT9 6.0-6.2, Dup 4	**25-Aug-2021**	**30-Aug-2021**	21-Feb-2022	✓	**30-Aug-2021**	21-Feb-2022	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) GT5 0.5-0.6, GT5 0.9-1.0, GT5 2.0-2.1, Dup 2	**19-Aug-2021**	**30-Aug-2021**	16-Sep-2021	✓	**31-Aug-2021**	16-Sep-2021	✓
Soil Glass Jar - Unpreserved (EG035T) GT7 1.5-1.6, GT7 2.5-2.6, Dup 3	**20-Aug-2021**	**30-Aug-2021**	17-Sep-2021	✓	**31-Aug-2021**	17-Sep-2021	✓
Soil Glass Jar - Unpreserved (EG035T) GT9 0.5-0.6, GT9 1.5-1.6, GT9 6.0-6.2, Dup 4	**25-Aug-2021**	**30-Aug-2021**	22-Sep-2021	✓	**31-Aug-2021**	22-Sep-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method **Container** / Client Sample ID(s)	**Sample Date**	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation

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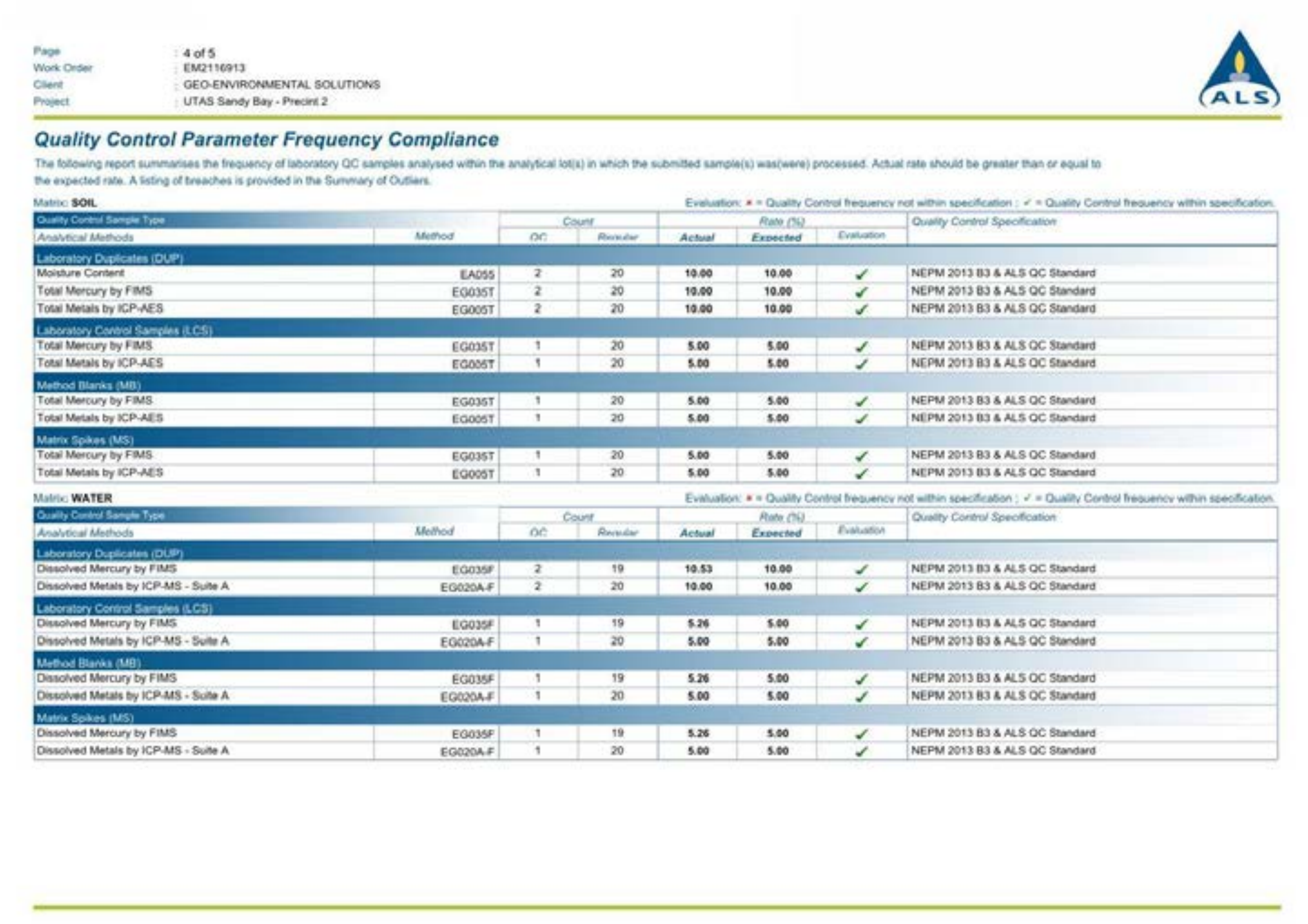
Work Order : EM2116913
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precint 2

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	**Sample Date**	*Extraction / Preparation*			*Analysis*		
Container / *Client Sample ID(s)*		**Date extracted**	*Due for extraction*	*Evaluation*	**Date analysed**	*Due for analysis*	*Evaluation*
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
Rinsate	**25-Aug-2021**	----	----	----	**31-Aug-2021**	21-Feb-2022	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
Rinsate	**25-Aug-2021**	----	----	----	**31-Aug-2021**	22-Sep-2021	✓



Page	: 4 of 5
Work Order	: EM2116913
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: UTAS Sandy Bay - Precint 2

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

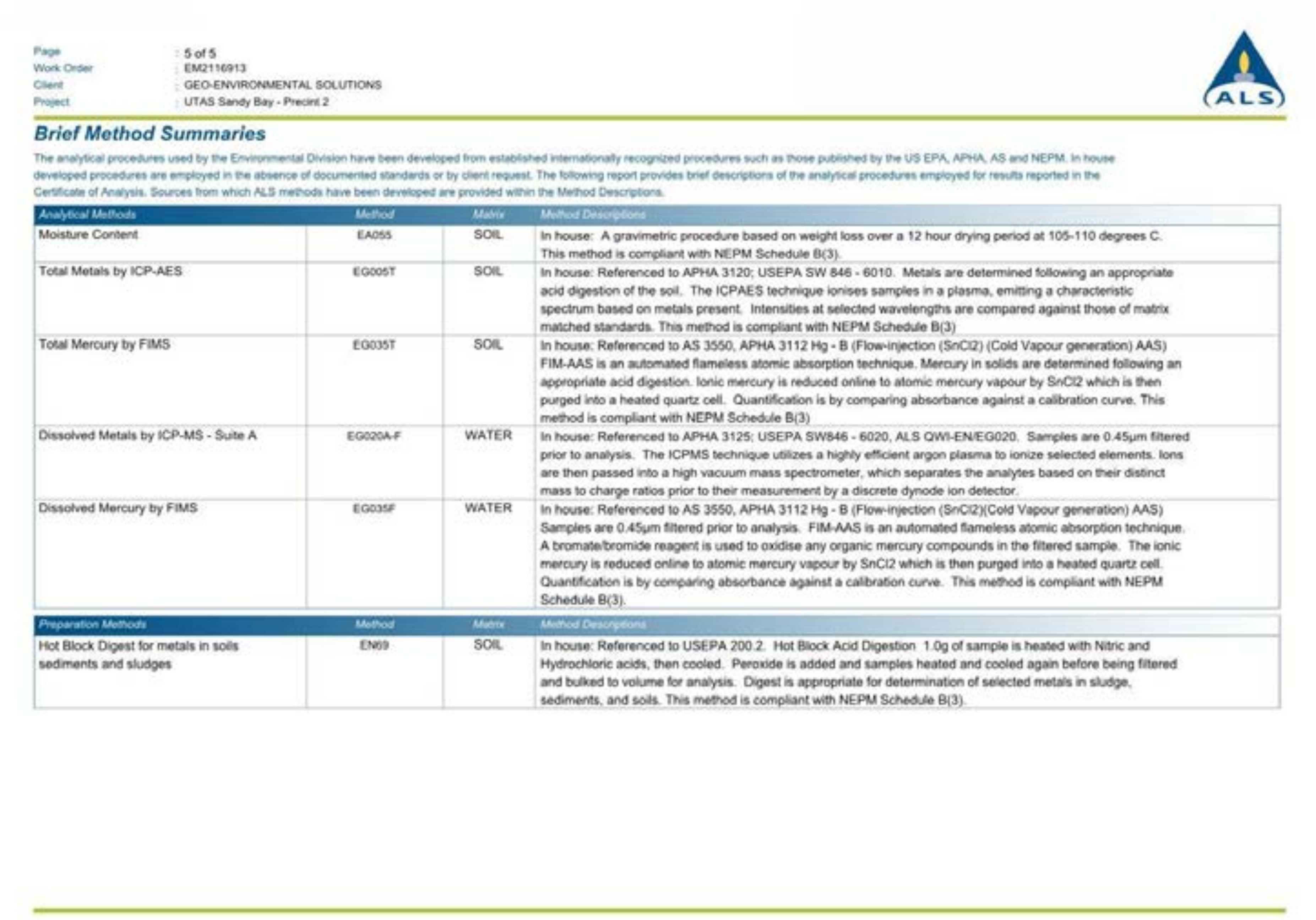
Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Dissolved Mercury by FIMS	EG035F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Mercury by FIMS	EG035F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard



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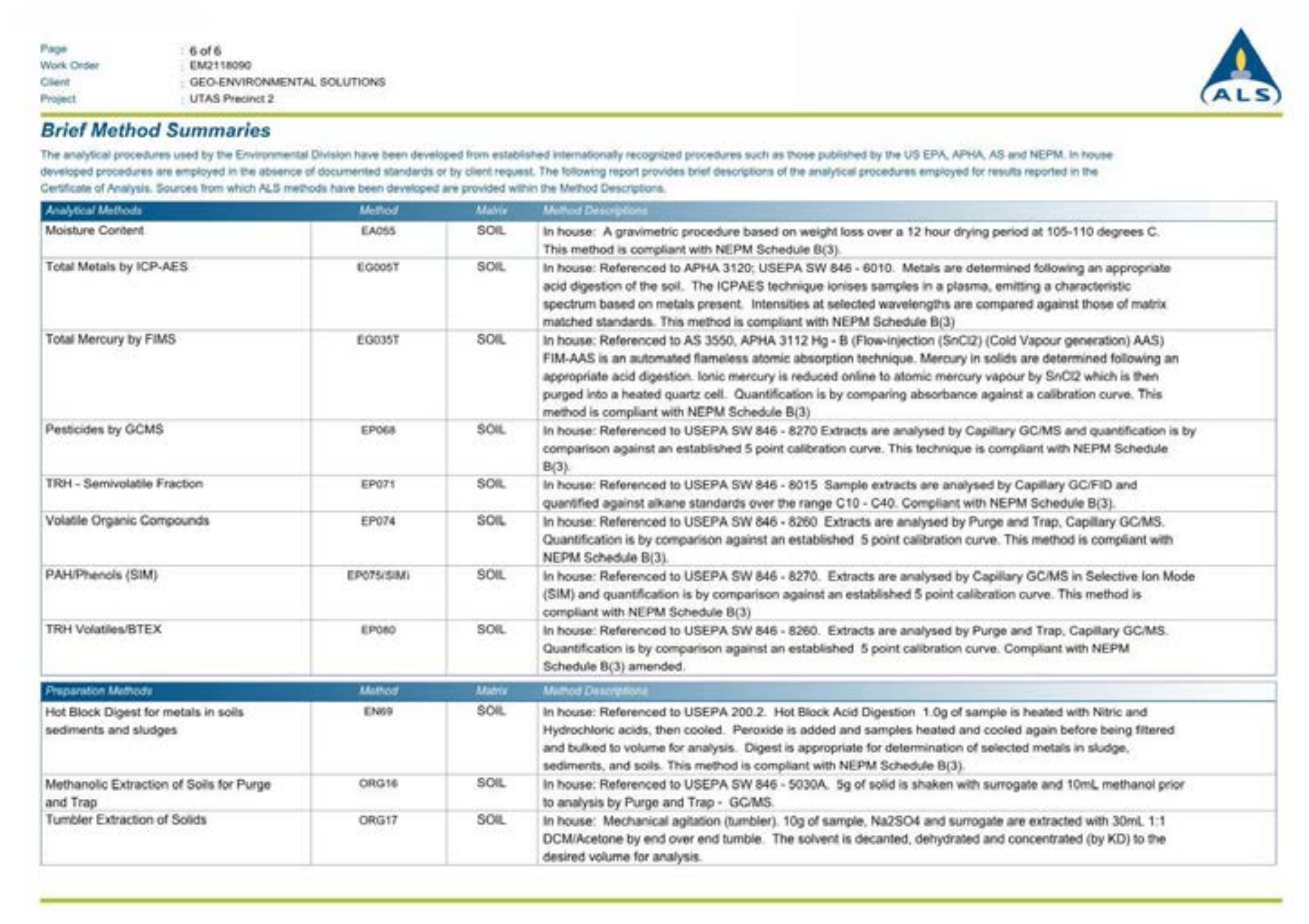
Work Order : EM2116913
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Sandy Bay - Precint 2

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).



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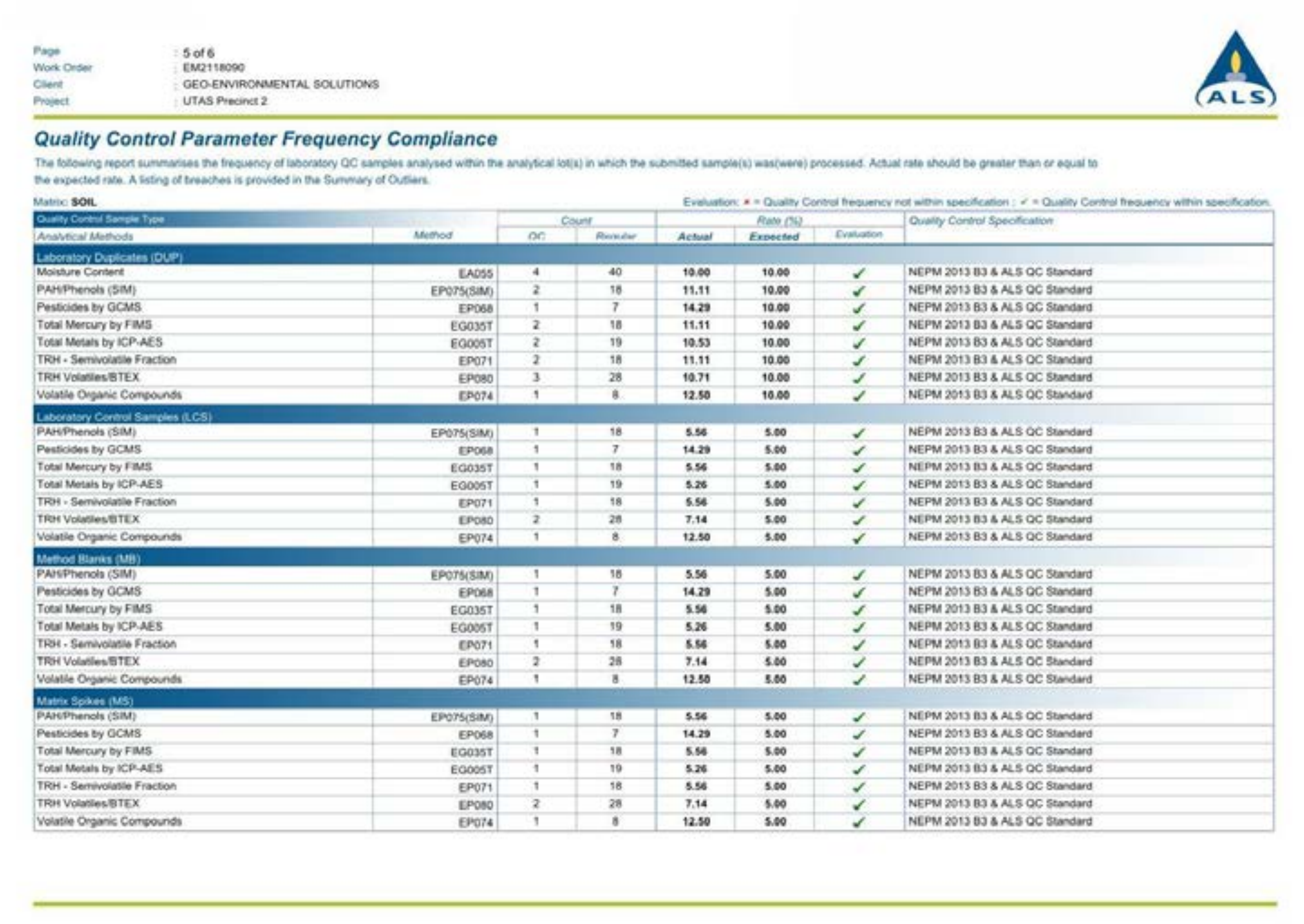
Work Order : EM2118090
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Precinct 2

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Pesticides by GCMS	EP068	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
Volatile Organic Compounds	EP074	SOIL	In house: Referenced to USEPA SW 846 - 8260 Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3).
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.



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Work Order : EM2118090
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Precinct 2

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type Analytical Methods	Method	Count QC	 Regular	Rate (%) Actual	 Expected	 Evaluation	Quality Control Specification
Laboratory Duplicates (DUP)							
Moisture Content	EA055	4	40	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	3	28	10.71	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	28	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	28	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	28	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard

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Work Order	: EM2118090
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: UTAS Precinct 2

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method **Container** / Client Sample ID(s)	**Sample Date**	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**11-Sep-2021**	22-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP071) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem Store 1, Chem Store 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**11-Sep-2021**	22-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP071) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem Store 1, Chem Store 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**11-Sep-2021**	22-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP080) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	22-Sep-2021	✓

Page : 3 of 6
Work Order : EM2118090
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Precinct 2

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	**Sample Date**	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		**Date extracted**	*Due for extraction*	*Evaluation*	**Date analysed**	*Due for analysis*	*Evaluation*
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓
EP074A: Monocyclic Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074B: Oxygenated Compounds							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074C: Sulfonated Compounds							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074D: Fumigants							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074E: Halogenated Aliphatic Compounds							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074F: Halogenated Aromatic Compounds							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074G: Trihalomethanes							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP075(SIM)A: Phenolic Compounds							
Soil Glass Jar - Unpreserved (EP075(SIM)) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM)) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem Store 1, Chem Store 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓

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Work Order	: EM2118090
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: UTAS Precinct 2

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EP080/071: Total Petroleum Hydrocarbons	EM2117977--001	Anonymous	**C10 - C36 Fraction (sum)**	----	31.9 %	0% - 20%	**RPD exceeds LOR based limits**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2	EM2117977--001	Anonymous	**>C10 - C40 Fraction (sum)**	----	33.2 %	0% - 20%	**RPD exceeds LOR based limits**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2	EM2118090--003	Glass Houses 3	**>C10 - C40 Fraction (sum)**	----	51.2 %	0% - 50%	**RPD exceeds LOR based limits**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	**Sample Date**	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		**Date extracted**	*Due for extraction*	*Evaluation*	**Date analysed**	*Due for analysis*	*Evaluation*
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem Store 1, Chem Store 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	----	----	----	**13-Sep-2021**	22-Sep-2021	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem Store 1, Chem Store 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**13-Sep-2021**	07-Mar-2022	✓	**13-Sep-2021**	07-Mar-2022	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem Store 1, Chem Store 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**13-Sep-2021**	06-Oct-2021	✓	**13-Sep-2021**	06-Oct-2021	✓

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EM2118090	Page	: 1 of 6
Client	: GEO-ENVIRONMENTAL SOLUTIONS	Laboratory	: Environmental Division Melbourne
Contact	: DR JOHN PAUL CUMMING	Telephone	: +6138549 9645
Project	: UTAS Precinct 2	Date Samples Received	: 10-Sep-2021
Site	: ----	Issue Date	: 15-Sep-2021
Sampler	: JPC	No. of samples received	: 11
Order number	: ----	No. of samples analysed	: 10

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **Duplicate outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

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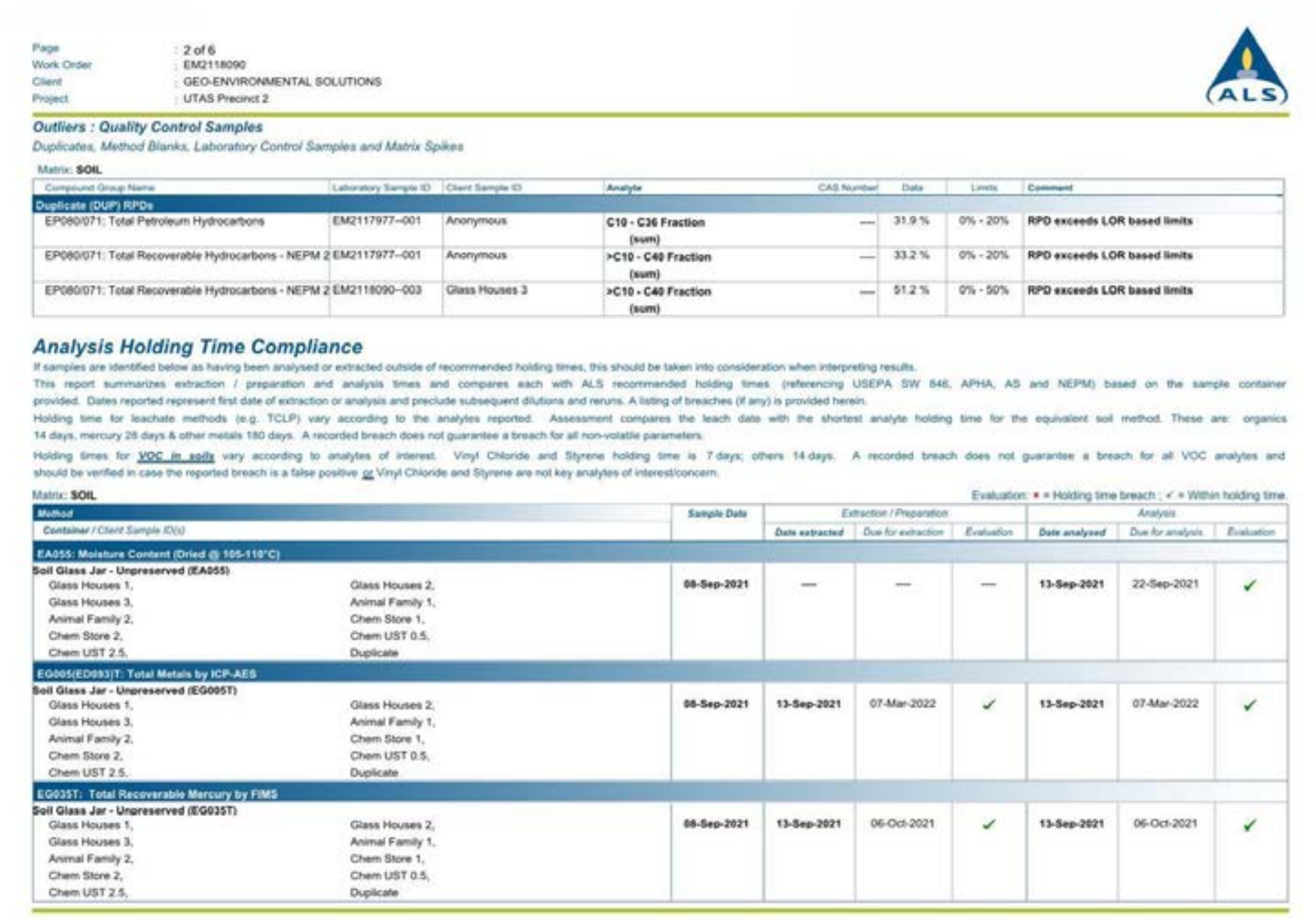

Page : 2 of 6
Work Order : EM2118090
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Precinct 2

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EP080/071: Total Petroleum Hydrocarbons	EM2117977--001	Anonymous	**C10 - C36 Fraction (sum)**	----	31.9 %	0% - 20%	**RPD exceeds LOR based limits**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2	EM2117977--001	Anonymous	**>C10 - C40 Fraction (sum)**	----	33.2 %	0% - 20%	**RPD exceeds LOR based limits**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2	EM2118090--003	Glass Houses 3	**>C10 - C40 Fraction (sum)**	----	51.2 %	0% - 50%	**RPD exceeds LOR based limits**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method		**Sample Date**	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)			**Date extracted**	*Due for extraction*	*Evaluation*	**Date analysed**	*Due for analysis*	*Evaluation*
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
Glass Houses 1, Glass Houses 3, Animal Family 2, Chem Store 2, Chem UST 2.5,	Glass Houses 2, Animal Family 1, Chem Store 1, Chem UST 0.5, Duplicate	**08-Sep-2021**	----	----	----	**13-Sep-2021**	22-Sep-2021	✓
EG005(ED093)T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved (EG005T)								
Glass Houses 1, Glass Houses 3, Animal Family 2, Chem Store 2, Chem UST 2.5,	Glass Houses 2, Animal Family 1, Chem Store 1, Chem UST 0.5, Duplicate	**08-Sep-2021**	**13-Sep-2021**	07-Mar-2022	✓	**13-Sep-2021**	07-Mar-2022	✓
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035T)								
Glass Houses 1, Glass Houses 3, Animal Family 2, Chem Store 2, Chem UST 2.5,	Glass Houses 2, Animal Family 1, Chem Store 1, Chem UST 0.5, Duplicate	**08-Sep-2021**	**13-Sep-2021**	06-Oct-2021	✓	**13-Sep-2021**	06-Oct-2021	✓

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Work Order : EM2118090
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Precinct 2

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

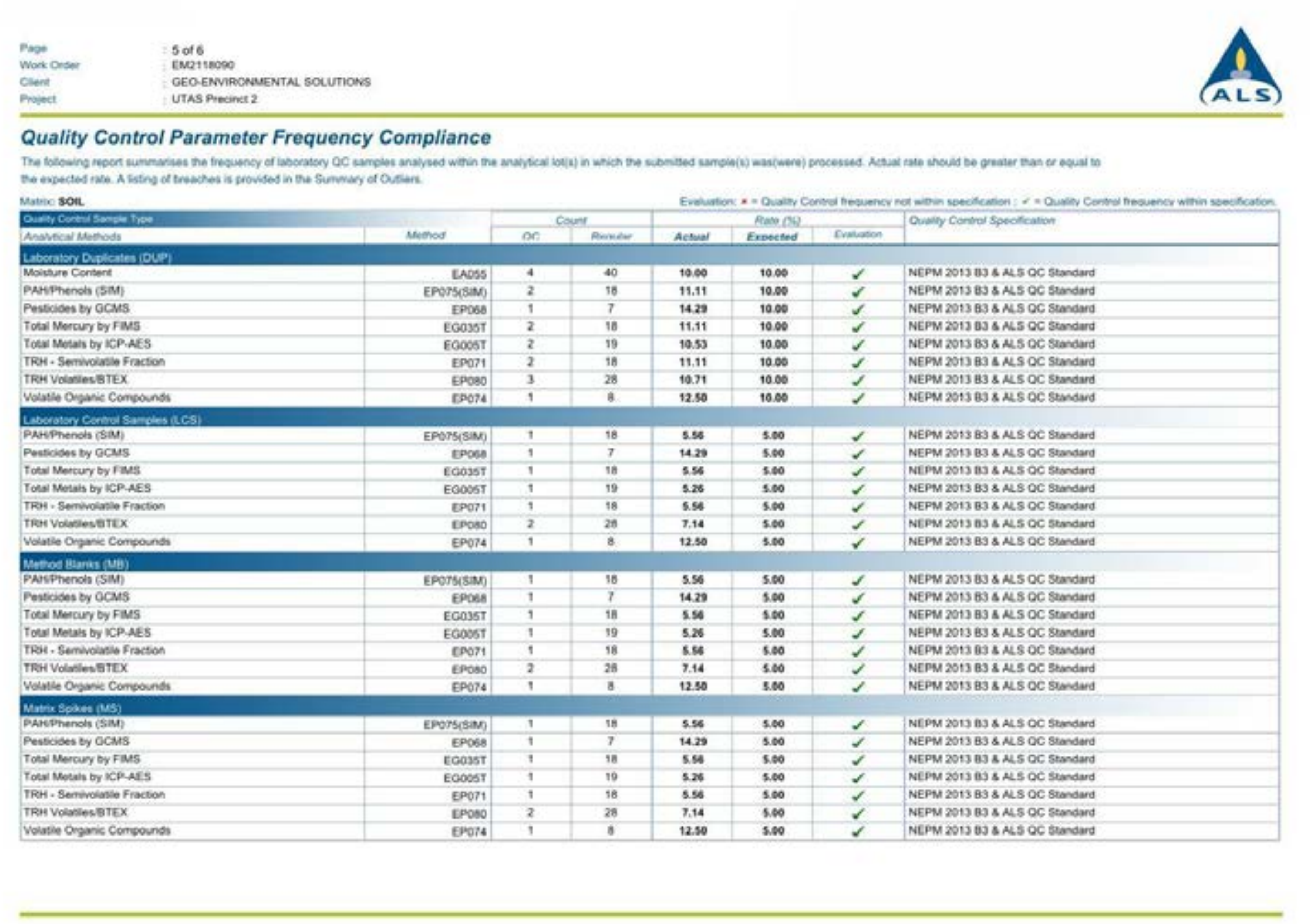
Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓
EP074A: Monocyclic Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074B: Oxygenated Compounds							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074C: Sulfonated Compounds							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074D: Fumigants							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074E: Halogenated Aliphatic Compounds							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074F: Halogenated Aromatic Compounds							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP074G: Trihalomethanes							
Soil Glass Jar - Unpreserved (EP074) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	15-Sep-2021	✓	**13-Sep-2021**	15-Sep-2021	✓
EP075(SIM)A: Phenolic Compounds							
Soil Glass Jar - Unpreserved (EP075(SIM)) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM)) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem Store 1, Chem Store 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓

Page : 4 of 6
Work Order : EM2118090
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Precinct 2

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**11-Sep-2021**	22-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP071) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem Store 1, Chem Store 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**11-Sep-2021**	22-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP071) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem Store 1, Chem Store 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	21-Oct-2021	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080) Glass Houses 1, Glass Houses 2, Glass Houses 3, Animal Family 1, Animal Family 2, Chem UST 0.5, Chem UST 2.5, Duplicate	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**11-Sep-2021**	22-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP080) Chem Store 1, Chem Store 2	**08-Sep-2021**	**11-Sep-2021**	22-Sep-2021	✓	**13-Sep-2021**	22-Sep-2021	✓



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Work Order	: EM2118090
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: UTAS Precinct 2

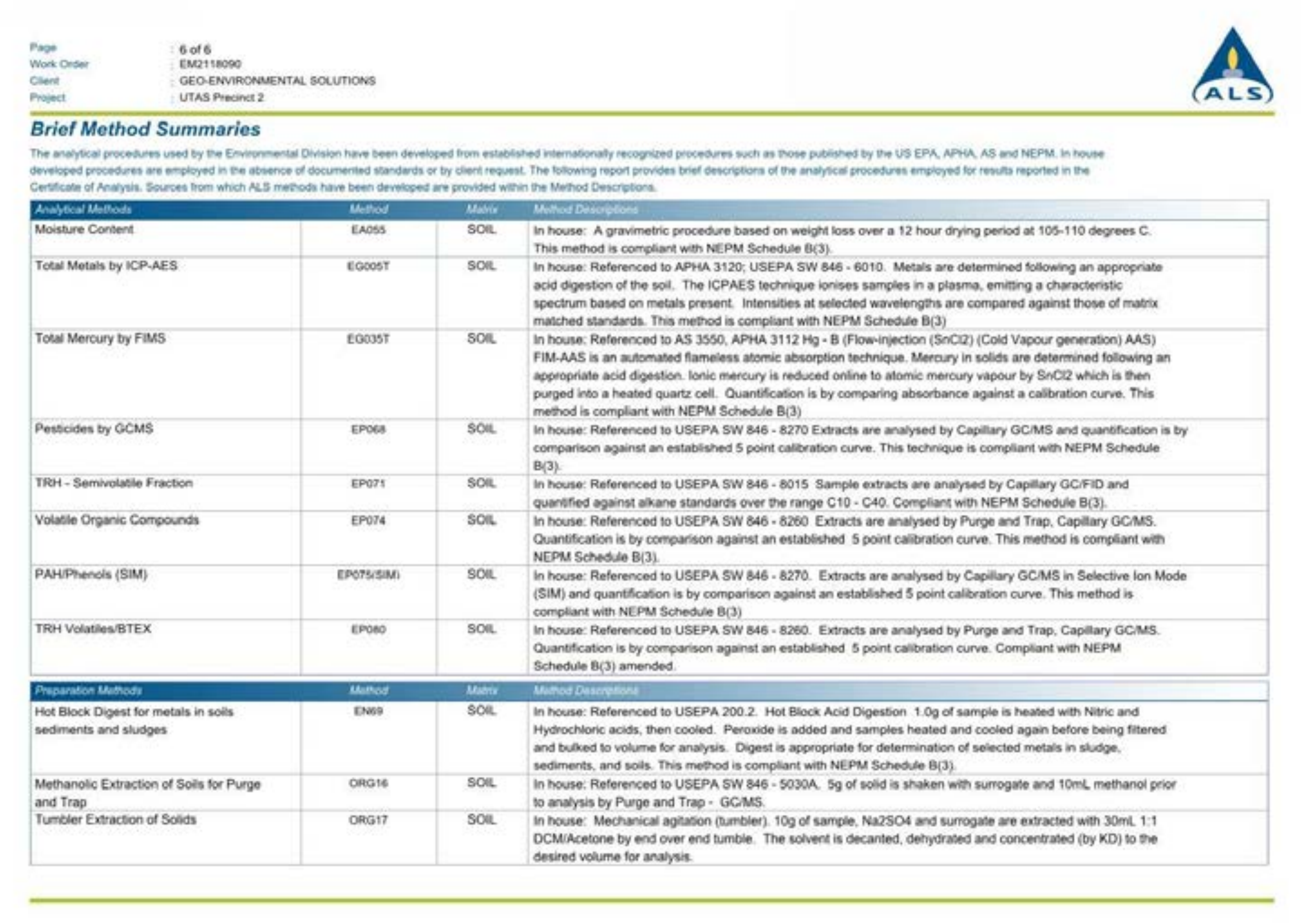
Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	3	28	**10.71**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	28	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	28	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	28	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Volatile Organic Compounds	EP074	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard



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Work Order : EM2118090
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS Precinct 2

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Pesticides by GCMS	EP068	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
Volatile Organic Compounds	EP074	SOIL	In house: Referenced to USEPA SW 846 - 8260 Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3).
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order : **EM2115765**
Page : 1 of 11

Client : **GEO-ENVIRONMENTAL SOLUTIONS**
Contact : DR JOHN PAUL CUMMING
Project : UTAS - Precinct 3
Site : ----
Sampler : G MCDONALD
Order number : ----

Laboratory : Environmental Division Melbourne
Telephone : +6138549 9645
Date Samples Received : 11-Aug-2021
Issue Date : 18-Aug-2021
No. of samples received : 31
No. of samples analysed : 31

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

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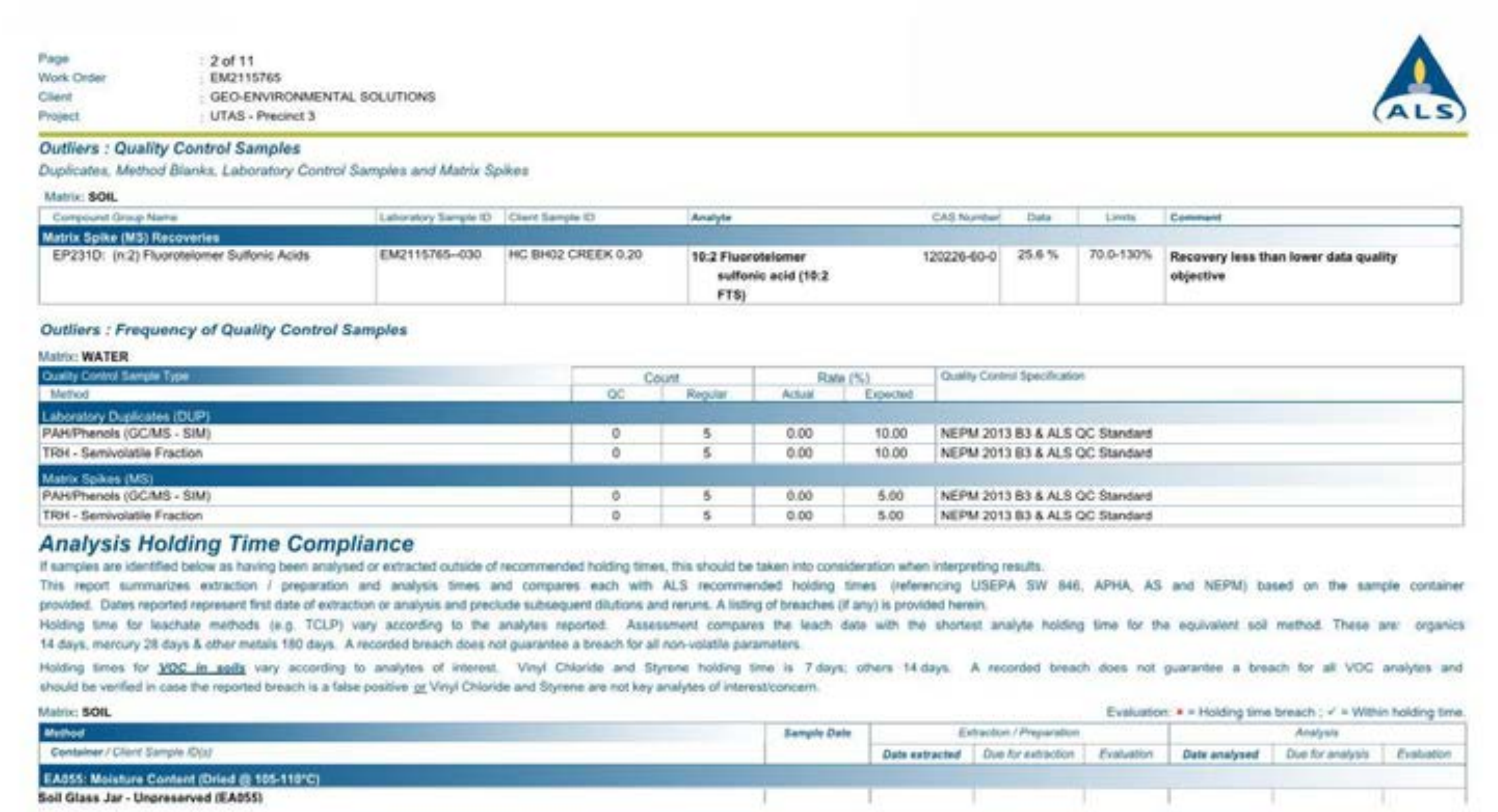

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Work Order : EM2115765
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS - Precinct 3

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	**Analyte**	CAS Number	Data	Limits	**Comment**
Matrix Spike (MS) Recoveries							
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EM2115765--030	HC BH02 CREEK 0.20	**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	25.6 %	70.0-130%	**Recovery less than lower data quality objective**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	5	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	5	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	5	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	5	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

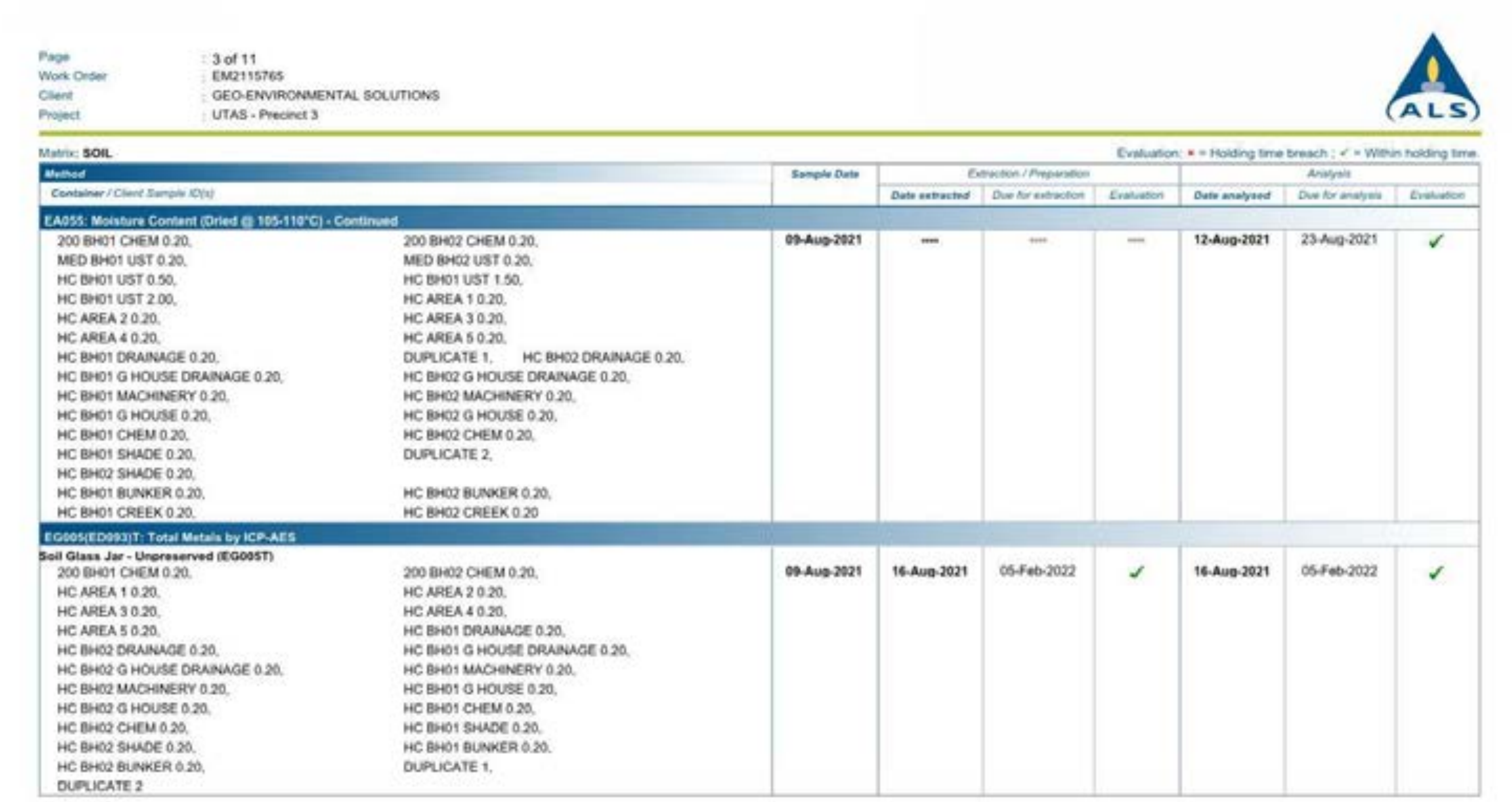
Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✓ = Within holding time.

Method	***Sample Date***	*Extraction / Preparation*			*Analysis*		
Container / *Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							



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Work Order : EM2115765
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS - Precinct 3

Matrix: **SOIL**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method **Container** / Client Sample ID(s)	**Sample Date**	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C) - Continued							
200 BH01 CHEM 0.20, MED BH01 UST 0.20, HC BH01 UST 0.50, HC BH01 UST 2.00, HC AREA 2 0.20, HC AREA 4 0.20, HC BH01 DRAINAGE 0.20, HC BH01 G HOUSE DRAINAGE 0.20, HC BH01 MACHINERY 0.20, HC BH01 G HOUSE 0.20, HC BH01 CHEM 0.20, HC BH01 SHADE 0.20, HC BH02 SHADE 0.20, HC BH01 BUNKER 0.20, HC BH01 CREEK 0.20, 200 BH02 CHEM 0.20, MED BH02 UST 0.20, HC BH01 UST 1.50, HC AREA 1 0.20, HC AREA 3 0.20, HC AREA 5 0.20, DUPLICATE 1, HC BH02 DRAINAGE 0.20, HC BH02 G HOUSE DRAINAGE 0.20, HC BH02 MACHINERY 0.20, HC BH02 G HOUSE 0.20, HC BH02 CHEM 0.20, DUPLICATE 2, HC BH02 BUNKER 0.20, HC BH02 CREEK 0.20	**09-Aug-2021**	----	----	----	**12-Aug-2021**	23-Aug-2021	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T) 200 BH01 CHEM 0.20, HC AREA 1 0.20, HC AREA 3 0.20, HC AREA 5 0.20, HC BH02 DRAINAGE 0.20, HC BH02 G HOUSE DRAINAGE 0.20, HC BH02 MACHINERY 0.20, HC BH02 G HOUSE 0.20, HC BH02 CHEM 0.20, HC BH02 SHADE 0.20, HC BH02 BUNKER 0.20, DUPLICATE 2 200 BH02 CHEM 0.20, HC AREA 2 0.20, HC AREA 4 0.20, HC BH01 DRAINAGE 0.20, HC BH01 G HOUSE DRAINAGE 0.20, HC BH01 MACHINERY 0.20, HC BH01 G HOUSE 0.20, HC BH01 CHEM 0.20, HC BH01 SHADE 0.20, HC BH01 BUNKER 0.20, DUPLICATE 1,	**09-Aug-2021**	**16-Aug-2021**	05-Feb-2022	✓	**16-Aug-2021**	05-Feb-2022	✓

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Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	**Sample Date**	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		**Date extracted**	*Due for extraction*	*Evaluation*	**Date analysed**	*Due for analysis*	*Evaluation*
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) 200 BH01 CHEM 0.20, 200 BH02 CHEM 0.20, HC AREA 1 0.20, HC AREA 2 0.20, HC AREA 3 0.20, HC AREA 4 0.20, HC AREA 5 0.20, HC BH01 DRAINAGE 0.20, HC BH02 DRAINAGE 0.20, HC BH01 G HOUSE DRAINAGE 0.20, HC BH02 G HOUSE DRAINAGE 0.20, HC BH01 MACHINERY 0.20, HC BH02 MACHINERY 0.20, HC BH01 G HOUSE 0.20, HC BH02 G HOUSE 0.20, HC BH01 CHEM 0.20, HC BH02 CHEM 0.20, HC BH01 SHADE 0.20, HC BH02 SHADE 0.20, HC BH01 BUNKER 0.20, HC BH02 BUNKER 0.20, DUPLICATE 1, DUPLICATE 2	**09-Aug-2021**	**16-Aug-2021**	06-Sep-2021	✓	**17-Aug-2021**	06-Sep-2021	✓
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068) HC AREA 1 0.20, HC AREA 2 0.20, HC AREA 3 0.20, HC AREA 4 0.20, HC AREA 5 0.20, HC BH01 DRAINAGE 0.20, HC BH02 DRAINAGE 0.20, HC BH01 G HOUSE DRAINAGE 0.20, HC BH02 G HOUSE DRAINAGE 0.20, HC BH01 MACHINERY 0.20, HC BH02 MACHINERY 0.20, DUPLICATE 1, HC BH01 G HOUSE 0.20, HC BH02 G HOUSE 0.20, HC BH01 CHEM 0.20, HC BH02 CHEM 0.20, HC BH01 SHADE 0.20, HC BH02 SHADE 0.20, DUPLICATE 2	**09-Aug-2021**	**14-Aug-2021**	23-Aug-2021	✓	**16-Aug-2021**	23-Sep-2021	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068) HC AREA 1 0.20, HC AREA 2 0.20, HC AREA 3 0.20, HC AREA 4 0.20, HC AREA 5 0.20, HC BH01 DRAINAGE 0.20, HC BH02 DRAINAGE 0.20, HC BH01 G HOUSE DRAINAGE 0.20, HC BH02 G HOUSE DRAINAGE 0.20, HC BH01 MACHINERY 0.20, HC BH02 MACHINERY 0.20, DUPLICATE 1, HC BH01 G HOUSE 0.20, HC BH02 G HOUSE 0.20, HC BH01 CHEM 0.20, HC BH02 CHEM 0.20, HC BH01 SHADE 0.20, HC BH02 SHADE 0.20, DUPLICATE 2	**09-Aug-2021**	**14-Aug-2021**	23-Aug-2021	✓	**16-Aug-2021**	23-Sep-2021	✓
EP075(SIM)A: Phenolic Compounds							
Soil Glass Jar - Unpreserved (EP075(SIM)) 200 BH01 CHEM 0.20	**09-Aug-2021**	**14-Aug-2021**	23-Aug-2021	✓	**16-Aug-2021**	23-Sep-2021	✓

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Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	**Sample Date**	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		**Date extracted**	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM)) 200 BH01 CHEM 0.20, 200 BH02 CHEM 0.20, MED BH01 UST 0.20, MED BH02 UST 0.20, HC BH01 UST 0.50, HC BH01 UST 1.50, HC BH01 UST 2.00, HC BH01 DRAINAGE 0.20, HC BH02 DRAINAGE 0.20, HC BH01 MACHINERY 0.20, HC BH02 MACHINERY 0.20, HC BH01 CHEM 0.20, HC BH02 CHEM 0.20, DUPLICATE 1, DUPLICATE 2	**09-Aug-2021**	**14-Aug-2021**	23-Aug-2021	✓	**16-Aug-2021**	23-Sep-2021	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080) 200 BH01 CHEM 0.20, 200 BH02 CHEM 0.20, MED BH01 UST 0.20, MED BH02 UST 0.20, HC BH01 UST 0.50, HC BH01 UST 1.50, HC BH01 UST 2.00, HC BH01 DRAINAGE 0.20, HC BH02 DRAINAGE 0.20, HC BH01 MACHINERY 0.20, HC BH02 MACHINERY 0.20, HC BH01 CHEM 0.20, HC BH02 CHEM 0.20, DUPLICATE 1, DUPLICATE 2	**09-Aug-2021**	**13-Aug-2021**	23-Aug-2021	✓	**13-Aug-2021**	23-Aug-2021	✓
Soil Glass Jar - Unpreserved (EP071) 200 BH01 CHEM 0.20, 200 BH02 CHEM 0.20, MED BH01 UST 0.20, MED BH02 UST 0.20, HC BH01 UST 0.50, HC BH01 UST 1.50, HC BH01 UST 2.00, HC BH01 DRAINAGE 0.20, HC BH02 DRAINAGE 0.20, HC BH01 MACHINERY 0.20, HC BH02 MACHINERY 0.20, HC BH01 CHEM 0.20, HC BH02 CHEM 0.20, DUPLICATE 1, DUPLICATE 2	**09-Aug-2021**	**14-Aug-2021**	23-Aug-2021	✓	**16-Aug-2021**	23-Sep-2021	✓

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Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	**Sample Date**	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		**Date extracted**	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080) 200 BH01 CHEM 0.20, 200 BH02 CHEM 0.20, MED BH01 UST 0.20, MED BH02 UST 0.20, HC BH01 UST 0.50, HC BH01 UST 1.50, HC BH01 UST 2.00, HC BH01 DRAINAGE 0.20, HC BH02 DRAINAGE 0.20, HC BH01 MACHINERY 0.20, HC BH02 MACHINERY 0.20, HC BH01 CHEM 0.20, HC BH02 CHEM 0.20, DUPLICATE 1, DUPLICATE 2	**09-Aug-2021**	**13-Aug-2021**	23-Aug-2021	✓	**13-Aug-2021**	23-Aug-2021	✓
Soil Glass Jar - Unpreserved (EP071) 200 BH01 CHEM 0.20, 200 BH02 CHEM 0.20, MED BH01 UST 0.20, MED BH02 UST 0.20, HC BH01 UST 0.50, HC BH01 UST 1.50, HC BH01 UST 2.00, HC BH01 DRAINAGE 0.20, HC BH02 DRAINAGE 0.20, HC BH01 MACHINERY 0.20, HC BH02 MACHINERY 0.20, HC BH01 CHEM 0.20, HC BH02 CHEM 0.20, DUPLICATE 1, DUPLICATE 2	**09-Aug-2021**	**14-Aug-2021**	23-Aug-2021	✓	**16-Aug-2021**	23-Sep-2021	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080) 200 BH01 CHEM 0.20, 200 BH02 CHEM 0.20, MED BH01 UST 0.20, MED BH02 UST 0.20, HC BH01 UST 0.50, HC BH01 UST 1.50, HC BH01 UST 2.00, HC BH01 DRAINAGE 0.20, HC BH02 DRAINAGE 0.20, HC BH01 MACHINERY 0.20, HC BH02 MACHINERY 0.20, HC BH01 CHEM 0.20, HC BH02 CHEM 0.20, DUPLICATE 1, DUPLICATE 2	**09-Aug-2021**	**13-Aug-2021**	23-Aug-2021	✓	**13-Aug-2021**	23-Aug-2021	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
Soil Glass Jar - Unpreserved (EP231X) HC BH01 CREEK 0.20, HC BH02 CREEK 0.20	**09-Aug-2021**	**17-Aug-2021**	05-Feb-2022	✓	**17-Aug-2021**	26-Sep-2021	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
Soil Glass Jar - Unpreserved (EP231X) HC BH01 CREEK 0.20, HC BH02 CREEK 0.20	**09-Aug-2021**	**17-Aug-2021**	05-Feb-2022	✓	**17-Aug-2021**	26-Sep-2021	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
Soil Glass Jar - Unpreserved (EP231X) HC BH01 CREEK 0.20, HC BH02 CREEK 0.20	**09-Aug-2021**	**17-Aug-2021**	05-Feb-2022	✓	**17-Aug-2021**	26-Sep-2021	✓
EP231P: PFAS Sums							
Soil Glass Jar - Unpreserved (EP231X) HC BH01 CREEK 0.20, HC BH02 CREEK 0.20	**09-Aug-2021**	**17-Aug-2021**	05-Feb-2022	✓	**17-Aug-2021**	26-Sep-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

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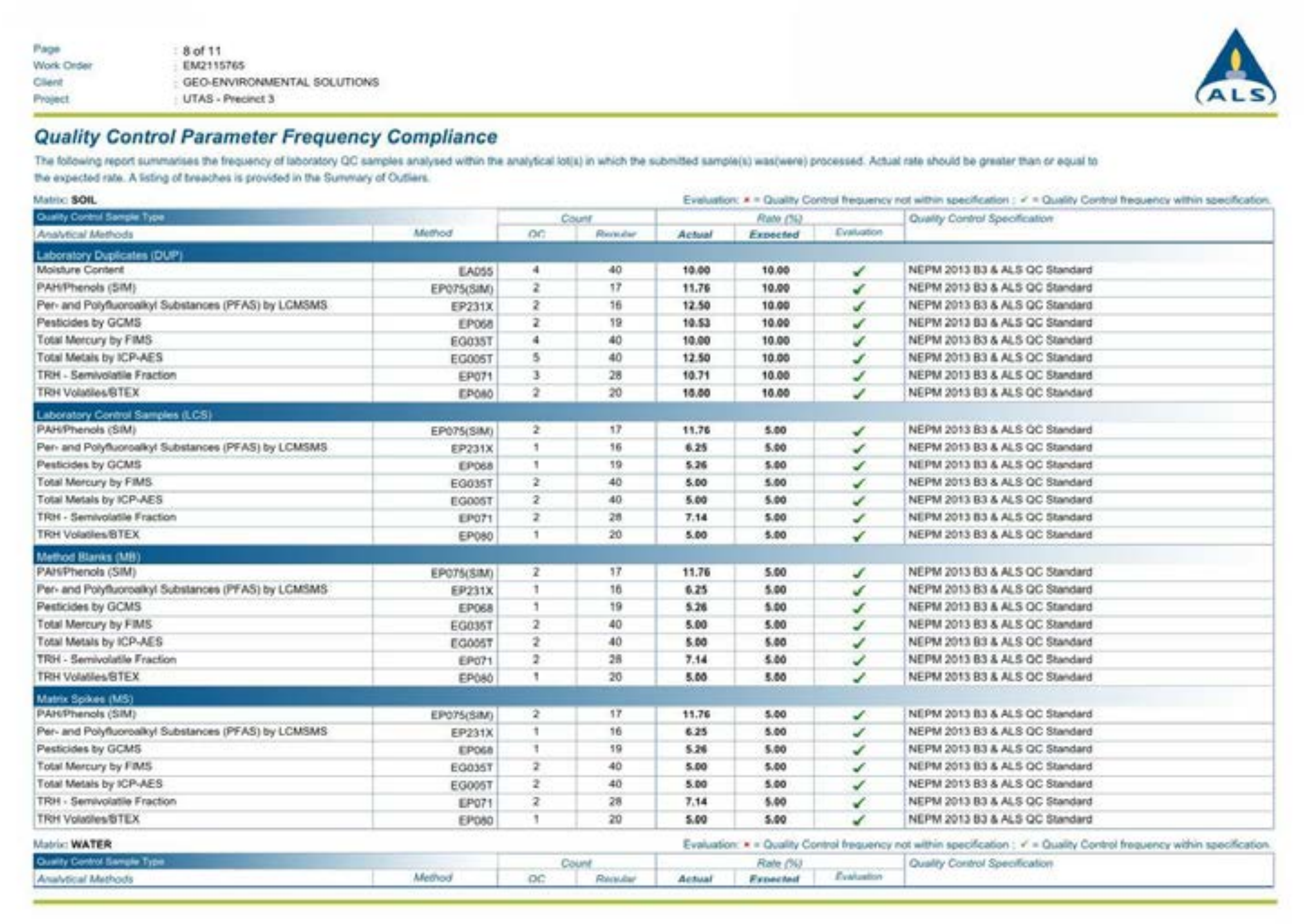
Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	**Sample Date**	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		**Date extracted**	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) RINSATE	**09-Aug-2021**	**17-Aug-2021**	05-Feb-2022	✓	**17-Aug-2021**	05-Feb-2022	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) RINSATE	**09-Aug-2021**	----	----	----	**13-Aug-2021**	06-Sep-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM)) RINSATE	**09-Aug-2021**	**11-Aug-2021**	16-Aug-2021	✓	**11-Aug-2021**	20-Sep-2021	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071) RINSATE	**09-Aug-2021**	**11-Aug-2021**	16-Aug-2021	✓	**11-Aug-2021**	20-Sep-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) RINSATE	**09-Aug-2021**	**11-Aug-2021**	23-Aug-2021	✓	**11-Aug-2021**	23-Aug-2021	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071) RINSATE	**09-Aug-2021**	**11-Aug-2021**	16-Aug-2021	✓	**11-Aug-2021**	20-Sep-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) RINSATE	**09-Aug-2021**	**11-Aug-2021**	23-Aug-2021	✓	**11-Aug-2021**	23-Aug-2021	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) RINSATE	**09-Aug-2021**	**11-Aug-2021**	23-Aug-2021	✓	**11-Aug-2021**	23-Aug-2021	✓



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Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

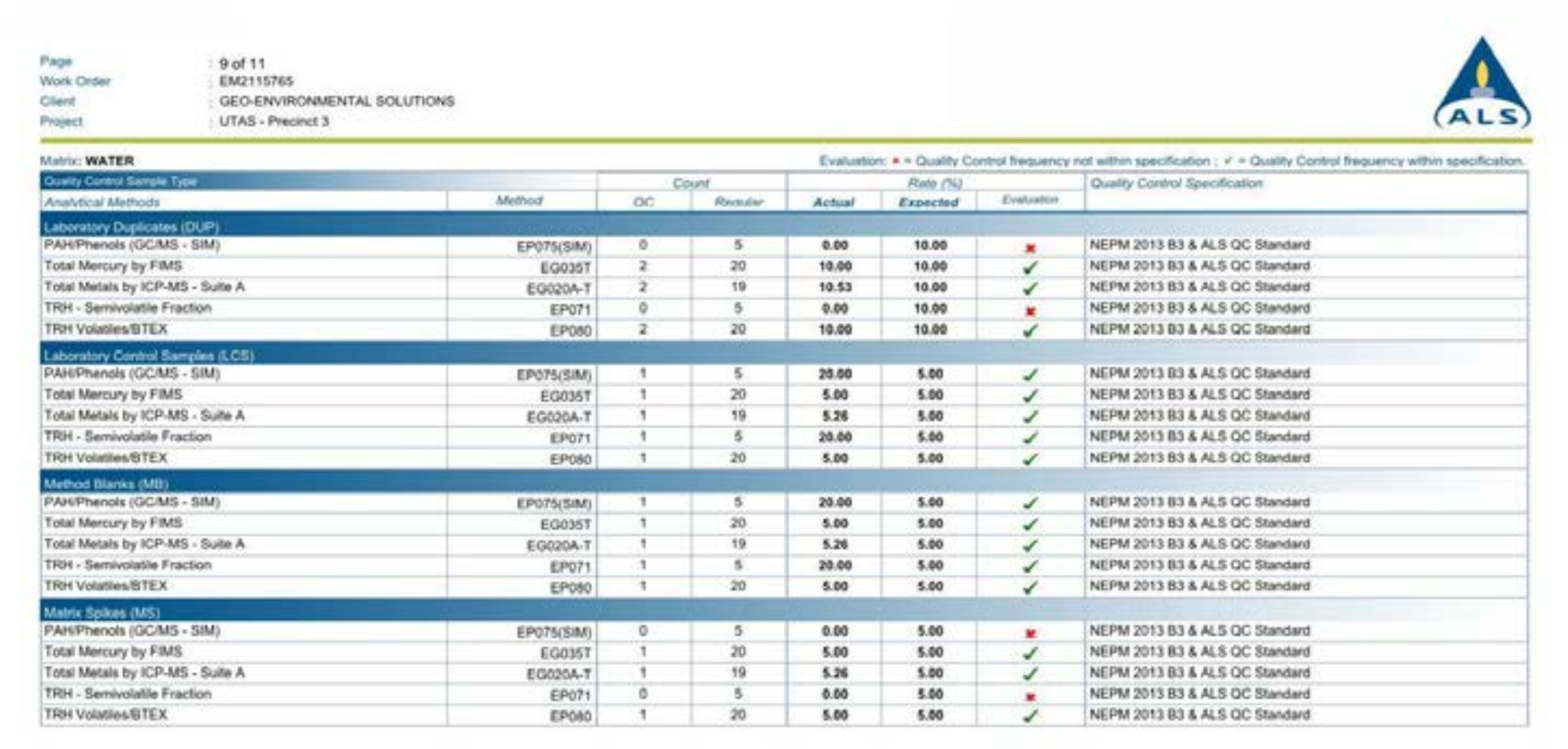
Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	5	40	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	3	28	**10.71**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	2	17	**11.76**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	28	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	2	17	**11.76**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	28	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	2	17	**11.76**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Pesticides by GCMS	EP068	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	28	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	



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Matrix: **WATER**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	5	**0.00**	**10.00**	✗	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	5	**0.00**	**10.00**	✗	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	5	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	5	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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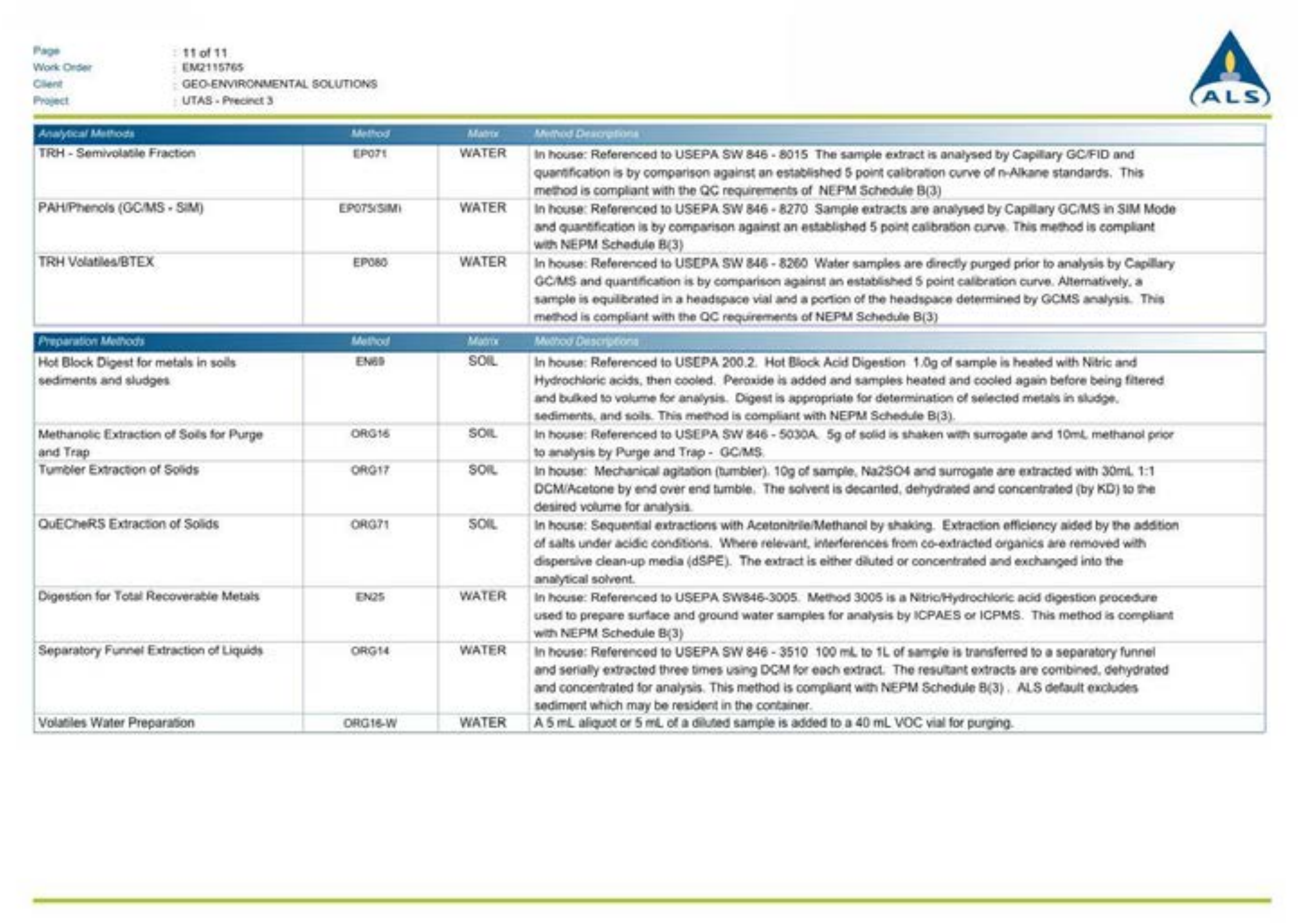
Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
Pesticides by GCMS	EP068	SOIL	In house: Referenced to USEPA SW 846 - 8270 Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).



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Analytical Methods	Method	Matrix	Method Descriptions
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
QuECheRS Extraction of Solids	ORG71	SOIL	In house: Sequential extractions with Acetonitrile/Methanol by shaking. Extraction efficiency aided by the addition of salts under acidic conditions. Where relevant, interferences from co-extracted organics are removed with dispersive clean-up media (dSPE). The extract is either diluted or concentrated and exchanged into the analytical solvent.
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order : **EM2114845**

Client : **GEO-ENVIRONMENTAL SOLUTIONS**
Contact : DR JOHN PAUL CUMMING
Project : UTAS
Site : ----
Sampler : G MCDONALD
Order number : ----

Page : 1 of 9

Laboratory : Environmental Division Melbourne
Telephone : +6138549 9645
Date Samples Received : 30-Jul-2021
Issue Date : 04-Aug-2021
No. of samples received : 12
No. of samples analysed : 12

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

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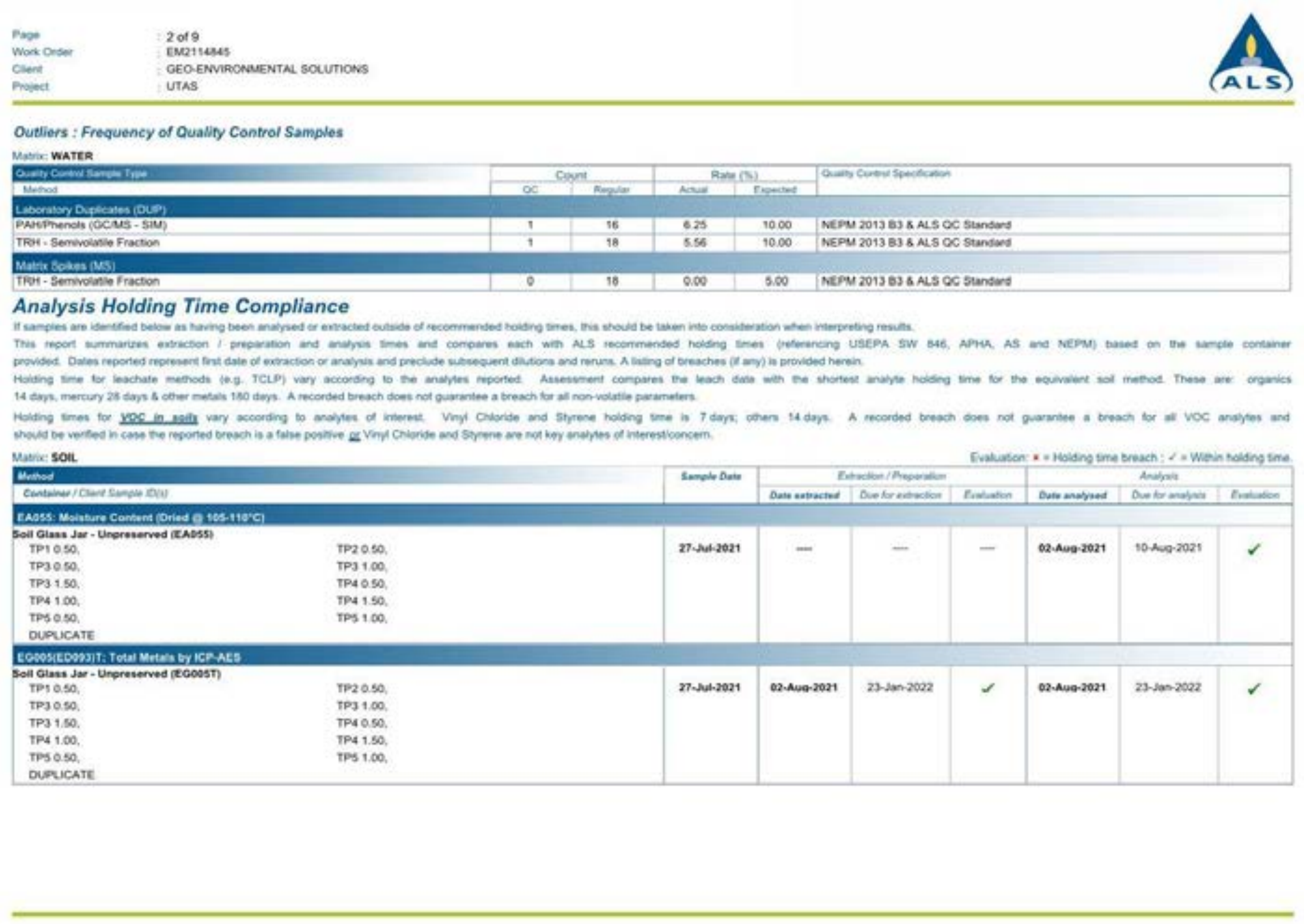

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Work Order : EM2114845
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	1	16	6.25	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	1	18	5.56	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
TRH - Semivolatile Fraction	0	18	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
TP1 0.50, TP3 0.50, TP3 1.50, TP4 1.00, TP5 0.50, DUPLICATE	TP2 0.50, TP3 1.00, TP4 0.50, TP4 1.50, TP5 1.00,	27-Jul-2021	----	----	----	02-Aug-2021	10-Aug-2021	✓
EG005(ED093)T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved (EG005T)								
TP1 0.50, TP3 0.50, TP3 1.50, TP4 1.00, TP5 0.50, DUPLICATE	TP2 0.50, TP3 1.00, TP4 0.50, TP4 1.50, TP5 1.00,	27-Jul-2021	02-Aug-2021	23-Jan-2022	✓	02-Aug-2021	23-Jan-2022	✓

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Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method **Container** / Client Sample ID(s)	**Sample Date**	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T) TP1 0.50, TP2 0.50, TP3 0.50, TP3 1.00, TP3 1.50, TP4 0.50, TP4 1.00, TP4 1.50, TP5 0.50, TP5 1.00, DUPLICATE	**27-Jul-2021**	**02-Aug-2021**	24-Aug-2021	✓	**02-Aug-2021**	24-Aug-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM)) TP1 0.50, TP2 0.50, TP3 0.50, TP3 1.00, TP3 1.50, TP4 0.50, TP4 1.00, TP4 1.50, TP5 0.50, TP5 1.00, DUPLICATE	**27-Jul-2021**	**02-Aug-2021**	10-Aug-2021	✓	**02-Aug-2021**	11-Sep-2021	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP071) TP1 0.50, TP2 0.50, TP3 0.50, TP3 1.00, TP3 1.50, TP4 0.50, TP4 1.00, TP4 1.50, TP5 0.50, TP5 1.00, DUPLICATE	**27-Jul-2021**	**02-Aug-2021**	10-Aug-2021	✓	**02-Aug-2021**	11-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP080) TP1 0.50, TP2 0.50, TP3 0.50, TP3 1.00, TP3 1.50, TP4 0.50, TP4 1.00, TP4 1.50, TP5 0.50, TP5 1.00, DUPLICATE	**27-Jul-2021**	**31-Jul-2021**	10-Aug-2021	✓	**31-Jul-2021**	10-Aug-2021	✓

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Work Order : EM2114845
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method *Container / Client Sample ID(s)*	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP071) TP1 0.50, TP2 0.50, TP3 0.50, TP3 1.00, TP3 1.50, TP4 0.50, TP4 1.00, TP4 1.50, TP5 0.50, TP5 1.00, DUPLICATE	**27-Jul-2021**	**02-Aug-2021**	10-Aug-2021	✓	**02-Aug-2021**	11-Sep-2021	✓
Soil Glass Jar - Unpreserved (EP080) TP1 0.50, TP2 0.50, TP3 0.50, TP3 1.00, TP3 1.50, TP4 0.50, TP4 1.00, TP4 1.50, TP5 0.50, TP5 1.00, DUPLICATE	**27-Jul-2021**	**31-Jul-2021**	10-Aug-2021	✓	**31-Jul-2021**	10-Aug-2021	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080) TP1 0.50, TP2 0.50, TP3 0.50, TP3 1.00, TP3 1.50, TP4 0.50, TP4 1.00, TP4 1.50, TP5 0.50, TP5 1.00, DUPLICATE	**27-Jul-2021**	**31-Jul-2021**	10-Aug-2021	✓	**31-Jul-2021**	10-Aug-2021	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method *Container / Client Sample ID(s)*	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) RINSATE	**27-Jul-2021**	**03-Aug-2021**	23-Jan-2022	✓	**03-Aug-2021**	23-Jan-2022	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) RINSATE	**27-Jul-2021**	**----**	----	----	**02-Aug-2021**	24-Aug-2021	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM)) RINSATE	**27-Jul-2021**	**02-Aug-2021**	03-Aug-2021	✓	**02-Aug-2021**	11-Sep-2021	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071) RINSATE	**27-Jul-2021**	**02-Aug-2021**	03-Aug-2021	✓	**02-Aug-2021**	11-Sep-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) RINSATE	**27-Jul-2021**	**30-Jul-2021**	10-Aug-2021	✓	**31-Jul-2021**	10-Aug-2021	✓

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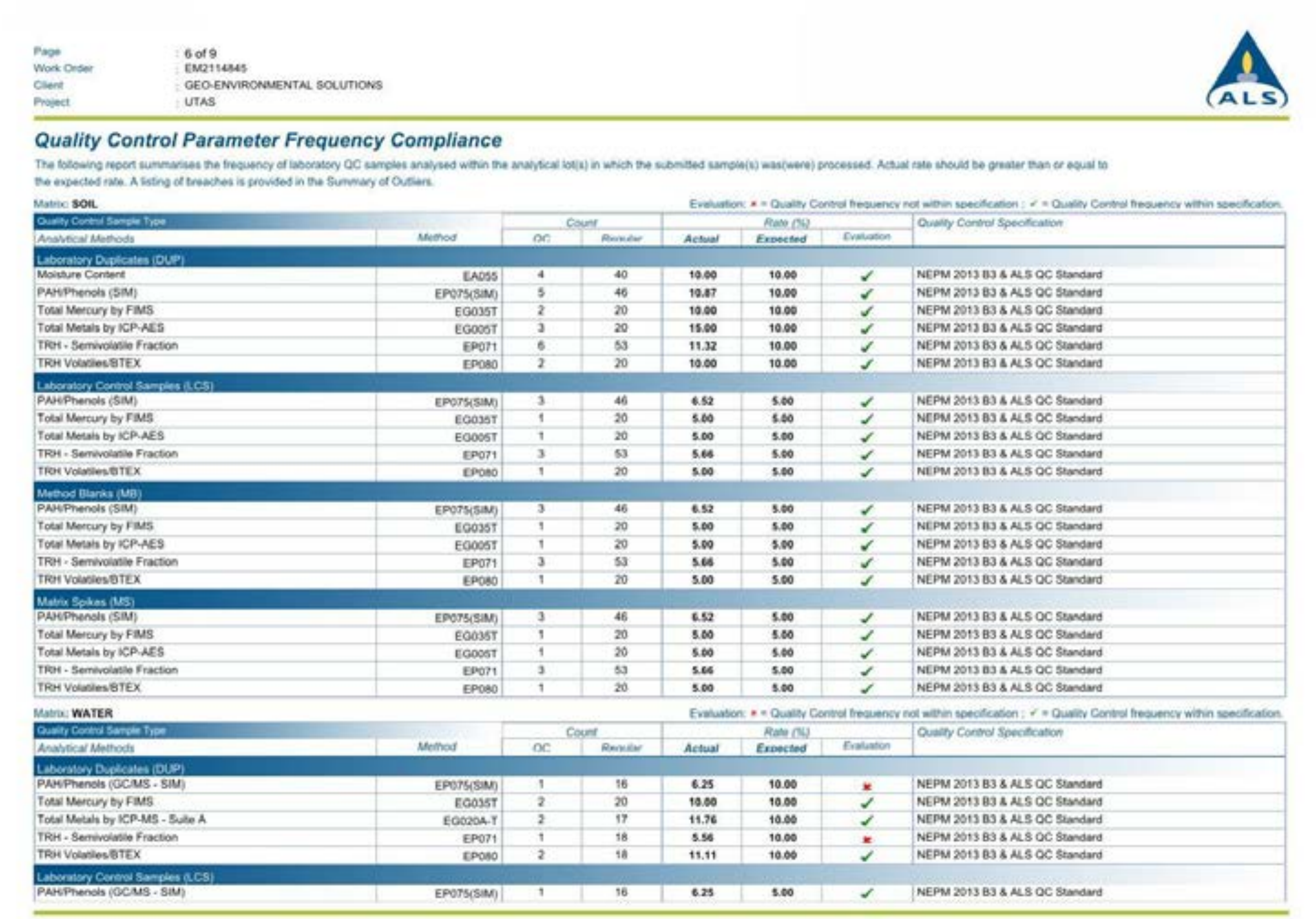
Work Order : EM2114845
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS

Matrix: **WATER**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method	**Sample Date**	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		**Date extracted**	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071) RINSATE	**27-Jul-2021**	**02-Aug-2021**	03-Aug-2021	✓	**02-Aug-2021**	11-Sep-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080) RINSATE	**27-Jul-2021**	**30-Jul-2021**	10-Aug-2021	✓	**31-Jul-2021**	10-Aug-2021	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) RINSATE	**27-Jul-2021**	**30-Jul-2021**	10-Aug-2021	✓	**31-Jul-2021**	10-Aug-2021	✓



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Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	5	46	**10.87**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	3	20	**15.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	6	53	**11.32**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	3	46	**6.52**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	3	53	**5.66**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	3	46	**6.52**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	3	53	**5.66**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	3	46	**6.52**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	3	53	**5.66**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	16	**6.25**	**10.00**	✗	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	**5.56**	**10.00**	✗	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

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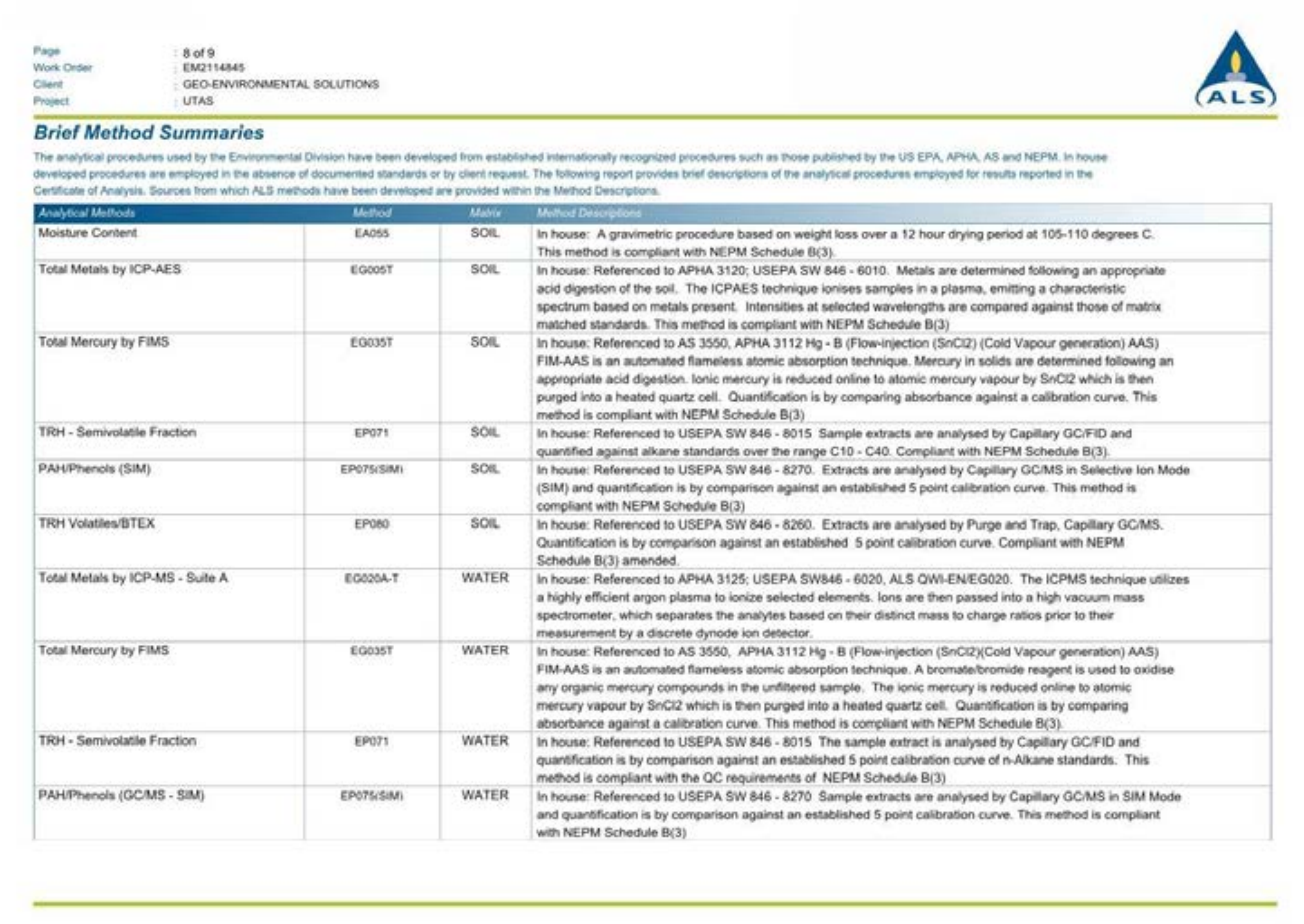
Work Order : EM2114845
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS

Matrix: **WATER**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Reqular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	18	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard



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Work Order	: EM2114845
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: UTAS

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)

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Work Order : EM2114845
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : UTAS

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.

Appendix 7 QA and QC Results for Duplicate and blank samples

Duplicate Comparison	Sample	Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Zinc	Mercury	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b+j)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a,h)anthracene	Benzo(g.h.i)perylene	Sum of polycyclic aromatic hyd	Benzo(a)pyrene TEQ (WHO)	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Sum of BTEX	Total Xylenes	Naphthalene	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	C6 - C10 Fraction	F1	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	>C10 - C40 Fraction (sum)	F2	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		50	1	2	5	5	5	2	5	5	2	5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.5	0.5	0.5	0.5	0.2	0.5	1	10	50	100	100	50	10	10	50	100	100	50	50	0.5	0.5
17/08/2021	DUP	<5	150	<1	<1	9	25	25	8	133	14	11	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	<100	<100	<50	<10	<10	<50	<100	<100	<50	<50	0.6	1.2
17/08/2021	GT1 0.5-0.6m	<5	140	<1	<1	10	20	28	14	118	14	13	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	<100	<100	<50	<10	<10	<50	<100	<100	<50	<50	0.6	1.2
Relative Percentage Difference (RPD) %		NA	6.9	NA	NA	10.5	22.2	11.3	54.5	12.0	0.0	16.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0	0.0
RPD Compliance Limit %		NA	15	NA	NA	NA	50	50	50	30	50	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	50
Method Detection Limit (MDL)		NA	>100	NA	NA	NA	100	40	100	500	40	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10
MDL Class		NONE	HIGH	NONE	NONE	NONE	LOW	LOW	LOW	MED	LOW	LOW	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	LOW
RPD Compliance With MDL?	54/56 (96%)	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Quality Control Blanks		Arsenic	Beryllium	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Boron	Mercury	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Total Xylenes	Sum of BTEX	Naphthalene	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	C6 - C10 Fraction	C6 - C10 Fraction minus BTEX (F1)	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	>C10 - C40 Fraction (sum)	>C10 - C16 Fraction minus Naphthalene (F2)	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b+j)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a,h)anthracene	Benzo(g.h.i)perylene	Sum of polycyclic aromatic hydrocarbons	Benzo(a)pyrene TEQ (zero)
Unit		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR		0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.01	0.005	0.05	0.0001	1	2	2	2	2	2	1	5	20	50	100	50	50	20	20	100	100	100	100	100	1	1	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	0.5	0.5
Date	Sample																																																					
27/07/2021	RINSATE	<0.001	<0.001	0.002	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.005	<0.05	<0.0001	<1	<2	<2	<2	<2	<2	<1	<5	<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<0.5	<0.5

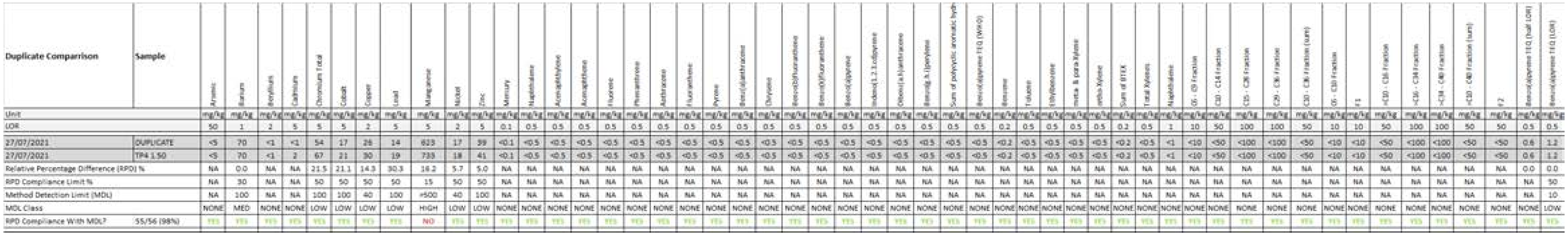
Duplicate Comparison	**Sample**	Moisture Content (dried @ 103°)	Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Zinc	Mercury
Unit		%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		1	50	1	2	5	5	5	2	5	5	2	5	0.1
19/08/2021	Dup 2	19.4	<5	180	<1	<1	17	19	62	26	398	20	105	<0.1
19/08/2021	GT5 0.5-0.6	24.1	<5	240	<1	<1	23	25	70	32	471	24	72	<0.1
Relative Percentage Difference (RPD) %		21.6	NA	28.6	NA	NA	30.0	27.3	12.1	20.7	16.8	18.2	37.3	NA
RPD Compliance Limit %			NA	15	NA	NA	50	50	30	50	30	50	50	NA
Method Detection Limit (MDL)		100	NA	>100	NA	NA	100	100	200	100	500	40	100	NA
MDL Class		MED	NONE	HIGH	NONE	NONE	LOW	LOW	MED	LOW	MED	LOW	LOW	NONE
RPD Compliance With MDL?	15/16 (94%)	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
20/08/2021	Dup 3	14	<5	<10	<1	<1	10	7	29	13	47	12	28	<0.1
20/08/2021	GT7 2.5-2.6	7	<5	10	<1	<1	10	5	22	8	40	9	27	<0.1
Relative Percentage Difference (RPD) %		66.7	NA	NA	NA	NA	0.0	33.3	27.5	47.6	16.1	28.6	3.6	NA
RPD Compliance Limit %			NA	NA	NA	NA	50	NA	50	50	50	50	50	NA
Method Detection Limit (MDL)		20	NA	NA	NA	NA	100	NA	40	100	100	40	100	NA
MDL Class		LOW	NONE	NONE	NONE	NONE	LOW	NONE	LOW	LOW	LOW	LOW	LOW	NONE
RPD Compliance With MDL?	15/16 (94%)	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
25/08/2021	Dup 4	3.1	<5	20	<1	<1	6	9	72	<5	134	17	17	<0.1
25/08/2021	GT9 0.5-0.6	2.4	<5	20	<1	<1	5	7	64	<5	109	16	13	<0.1
Relative Percentage Difference (RPD) %		25.5	NA	0.0	NA	NA	18.2	25.0	11.8	NA	20.6	6.1	26.7	NA
RPD Compliance Limit %			NA	30	NA	NA	NA	NA	30	NA	30	50	50	NA
Method Detection Limit (MDL)		20	NA	100	NA	NA	NA	NA	200	NA	500	40	100	NA
MDL Class		LOW	NONE	MED	NONE	NONE	NONE	NONE	MED	NONE	MED	LOW	LOW	NONE
RPD Compliance With MDL?	16/16 (100%)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Quality Control Blanks		Arsenic	Beryllium	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Boron	Mercury
Unit		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR		0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.01	0.005	0.05	0.0001
Date	Sample															
25/08/2021	Rinsate	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.005	<0.05	<0.0001

Duplicate Comparrison	**Sample**	Moisture Content (dried @ 103°	Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Vanadium	Zinc	Mercury	alpha-BHC	Hexachlorobenzene (HCB)	beta-BHC	gamma-BHC	delta-BHC	Heptachlor	Aldrin	Heptachlor epoxide	trans-Chlordane	alpha-Endosulfan	cis-Chlordane	Dieldrin	4.4`-DDE	Endrin	beta-Endosulfan	4.4`-DDD	Endrin aldehyde	Endosulfan sulfate	4.4`-DDT	Endrin ketone	Methoxychlor
Unit		%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		1	50	1	2	5	5	5	2	5	5	2	5	5	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.2	0.05	0.2
8/09/2021	Duplicate	34.6	7	90	<1	<1	18	31	62	8	459	40	101	73	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2
8/09/2021	Glass Houses 1	34.5	6	90	<1	<1	19	30	69	10	453	39	110	80	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2
Relative Percentage Difference (RPD) %		0.3	15.4	0.0	NA	NA	5.4	3.3	10.7	22.2	1.3	2.5	8.5	9.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD Compliance Limit %			NA	30	NA	NA	50	50	30	NA	30	50	30	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Method Detection Limit (MDL)		100	NA	100	NA	NA	100	100	200	NA	500	40	500	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MDL Class		MED	NONE	MED	NONE	NONE	LOW	LOW	MED	NONE	MED	LOW	MED	LOW	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
RPD Compliance With MDL?	103/104 (99%)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Duplicate Comparrison	**Sample**	Dichlorvos	Demeton-S-methyl	Monocrotophos	Dimethoate	Diazinon	Chlorpyrifos-methyl	Parathion-methyl	Malathion	Fenthion	Chlorpyrifos	Parathion	Pirimphos-ethyl	Chlorfenvinphos	Bromophos-ethyl	Fenamiphos	Prothiofos	Ethion	Carbophenothion	Azinphos Methyl	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	Sum of polycyclic aromatic hydr	Benzo(a)pyrene TEQ (WHO)
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		0.05	0.05	0.2	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
8/09/2021	Duplicate	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
8/09/2021	Glass Houses 1	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Relative Percentage Difference (RPD) %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD Compliance Limit %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Method Detection Limit (MDL)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MDL Class		NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
RPD Compliance With MDL?	103/104 (99%)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Duplicate Comparrison	**Sample**	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Sum of BTEX	Total Xylenes	Naphthalene	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	C6 - C10 Fraction	F1	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	>C10 - C40 Fraction (sum)	F2	PFOS	PFOA	6:2 Fluorotelomer sulfonate (6:2	8:2 Fluorotelomer sulfonate	Selenium	Boron	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)	Total Chlordane (sum)	Endosulfan (sum)	Sum of DDD + DDE + DDT	Sum of Aldrin + Dieldrin
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		0.2	0.5	0.5	0.5	0.5	0.2	0.5	1	10	50	100	100	50	10	10	50	100	100	50	50	0.05	0.2	0.05	0.05	5	2	0.5	0.5	0.05	0.05	0.05	0.05
8/09/2021	Duplicate	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	300	140	440	<10	<10	<50	360	<100	360	<50	<0.05	<0.2	<0.05	<0.05	<5	<50	0.6	1.2	<0.05	<0.05	<0.05	<0.05
8/09/2021	Glass Houses 1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	440	180	620	<10	<10	60	500	120	680	60	<0.05	<0.2	<0.05	<0.05	<5	<50	0.6	1.2	<0.05	<0.05	<0.05	<0.05
Relative Percentage Difference (RPD) %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	37.8	25.0	34.0	NA	NA	NA	32.6	NA	61.5	NA	NA	NA	NA	NA	NA	NA	0.0	0.0	NA	NA	NA	NA
RPD Compliance Limit %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	50	NA	50	NA	NA	NA	50	NA	50	NA	NA	NA	NA	NA	NA	NA	NA	50	NA	NA	NA	NA
Method Detection Limit (MDL)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2000	NA	1000	NA	NA	NA	2000	NA	1000	NA	NA	NA	NA	NA	NA	NA	NA	10	NA	NA	NA	NA
MDL Class		NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	LOW	NONE	LOW	NONE	NONE	NONE	LOW	NONE	LOW	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	LOW	NONE	NONE	NONE	NONE
RPD Compliance With MDL?	103/104 (99%)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES



Duplicate Comparrison	**Sample**	Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Zinc	Mercury	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	Sum of polycyclic aromatic hydr	Benzo(a)pyrene TEQ (WHO)	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Sum of BTEX	Total Xylenes	Naphthalene	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	C6 - C10 Fraction	F1	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	>C10 - C40 Fraction (sum)	F2	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		50	1	2	5	5	5	2	5	5	2	5	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.5	0.5	0.5	0.5	0.2	0.5	1	10	50	100	100	50	10	10	50	100	100	50	50	0.5	0.5
27/07/2021	DUPLICATE	<5	70	<1	<1	54	17	26	14	623	17	39	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	<100	<100	<50	<10	<10	<50	<100	<100	<50	<50	0.6	1.2
27/07/2021	TP4 1.50	<5	70	<1	2	67	21	30	19	733	18	41	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	<100	<100	<50	<10	<10	<50	<100	<100	<50	<50	0.6	1.2
Relative Percentage Difference (RPD) %		NA	0.0	NA	NA	21.5	21.1	14.3	30.3	16.2	5.7	5.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0	0.0
RPD Compliance Limit %		NA	30	NA	NA	50	50	50	50	15	50	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	50
Method Detection Limit (MDL)		NA	100	NA	NA	100	100	40	100	>500	40	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10
MDL Class		NONE	MED	NONE	NONE	LOW	LOW	LOW	LOW	HIGH	LOW	LOW	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	LOW
RPD Compliance With MDL?	55/56 (98%)	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Quality Control Blanks		Arsenic	Beryllium	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Boron	Mercury	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Total Xylenes	Sum of BTEX	Naphthalene	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	C6 - C10 Fraction	C6 - C10 Fraction minus BTEX (F1)	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	>C10 - C40 Fraction (sum)	>C10 - C16 Fraction minus Naphthalene (F2)	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b+j)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	Sum of polycyclic aromatic hydrocarbons	Benzo(a)pyrene TEQ (zero)
Unit		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR		0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.01	0.005	0.05	0.0001	1	2	2	2	2	2	1	5	20	50	100	50	50	20	20	100	100	100	100	100	1	1	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	0.5	0.5
Date	Sample																																																					
27/07/2021	RINSATE	<0.001	<0.001	0.002	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.005	<0.05	<0.0001	<1	<2	<2	<2	<2	<2	<1	<5	<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<0.5	<0.5