SOH Renewal Project - Works Packages 1A, 1B & 1C

Construction Management Plan

Document details	
Title	Construction Management Plan
Client	Sydney Opera House Trust
Client reference no.	SOH-482
Laing O'Rourke contract no.	K20

Revisions

Revision	Date	Description	Prepared by	Approved by
1	14th November 2016	DRAFT: ECI Phase submission	David Gill	Ed Obiala & Ben Nicol
2	31st January 2017	DRAFT: ECI Phase Submission Entry Foyer 1C Detail	David Gill	Ed Obiala & Ben Nicol
3	24th February 2017	DRAFT: Update establishment plans	David Gill	Ed Obiala & Ben Nicol

Management reviews

Review date	Details	Reviewed by

Controlled:	YES	Copy no.:	Uncontrolled:	NO

Note: This plan is a near-final draft and will be reviewed subject to the advice that Laing O'Rourke is the preferred tenderer.

The plan will be further developed through the ECI period after detailed subcontractor involvement.

Terms and definitions

The following terms, abbreviations and definitions are used in this plan.

Abbreviation	Meaning
DA	development application
CC	Construction Certificate
SOH	Sydney Opera House
"The House"	Sydney Opera House
CMP	Construction Management Plan
LORAC	Laing O'Rourke Australia Construction
JST	Joan Sutherland Theatre
TMP	Theatre Machinery Package
SAVE	Safety Accessibility and Venue Enhancement
NOHSC	National Occupational Health and Safety Commission
CSC	City of Sydney Council
PCA	Principal Certifying Authority
PCAu	Property Council Australia
RMS	Roads and Maritime Services
TCP	Traffic Control Plan
CTMP	Construction Traffic Management Plan

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1. Introduction

This Construction Management Plan (CMP) forms part of the suite of project management plans developed for the Sydney Opera House Renewal Projects – Works Package 1A, 1B, &1C. It outlines the key management systems, procedures and controls that Laing O'Rourke will use to:

- Achieve all project objectives
- Deliver the Sydney Opera House Trust value for money
- Give certainty of delivering the project on schedule
- Provide innovative solutions that align with the overall project objectives
- Achieve exceptional and demonstrable outcomes in safety, whole of life, environment, sustainability and quality.

The CMP is a dynamic document and will be updated throughout delivery of the project, as required.

1.1.1 Scope of work

The Sydney Opera House is Australia's most significant building, performing arts centre, cultural precinct and meeting point. It is inscribed on the UNESCO World Heritage List as a masterpiece of human creative genius.

In 2013 the Sydney Opera House Trust commenced a ten year program of renewal to ensure that the Sydney Opera House will best utilise its buildings and precinct in order to enhance the performer and visitor experiences, mitigate any safety and operational risks, upgrade equipment, infrastructure and facilities, confirm regulatory compliance and ensure the best and most efficient use of spaces and technology.

Work Packages 1A, 1B and 1C form part of this renewal program and primarily concentrate on the Joan Sutherland Theatre and its surrounds.

1.1.2 Work Package 1A

Work Package 1A has the renewal of the overhead theatre machinery system as it primary focus. While this highly specialised component has already been let to Wagner Biro, the following works are required to support this Work Package:

- general builders work associated with the upgrade of the theatre machinery and the space reconciliation beneath the stage, including removal of hazardous material, demolition, removal of redundant services, temporary structural propping, adaption of existing structure and installation of new structure, alteration of existing services and installation of new services and making good finishes;
- supply and installation of new dimming equipment; and
- Supply, cabling and installation of new IT and communications system, including extension and upgrade of existing facilities.

Work Package 1A must be completed within the closure period that has been designated for the Joan Sutherland Theatre (26 May 2017 to 15 November 2017).

1.1.3 Work Package 1B

Work Package 1B is a more general Safety, Accessibility and Venue Enhancement (SAVE) program of works and covers the following:

- accessibility;
- control room upgrade;
- electro-acoustic upgrade;
- auditorium lighting replacement;
- assistive lighting systems;
- follow-spot room;
- seat refurbishment;
- surtitle infrastructure; and
- HVAC.

1.1.4 Work Package 1C

Work Package 1C deals with the creation of a new Ballet Rehearsal Room (BRR) and Function Centre as well as reconfiguring and upgrading the Main Level 1 Entry Foyers and the level 2 Southern Foyer (JST).

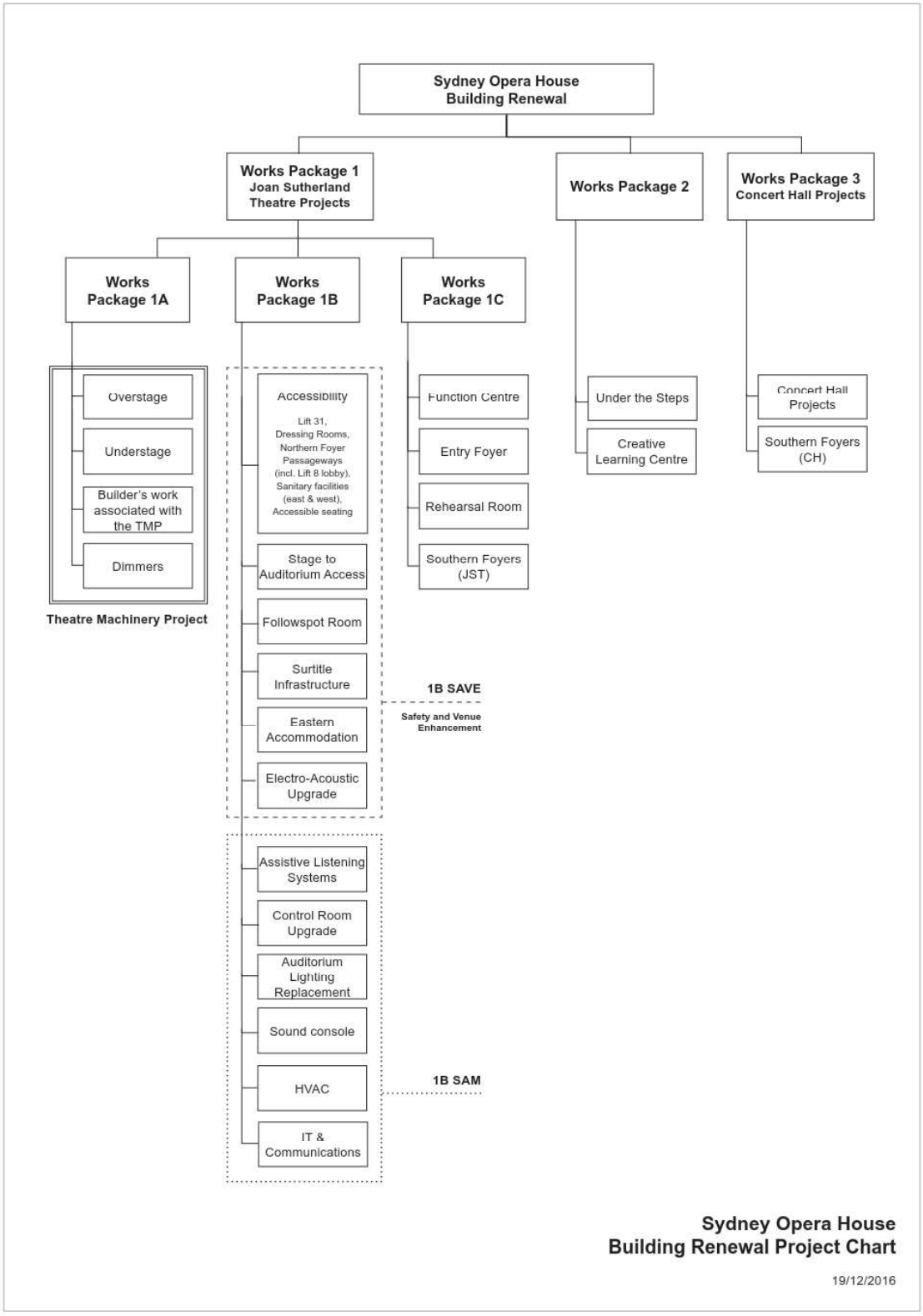


Figure 1- Work Package Breakdown

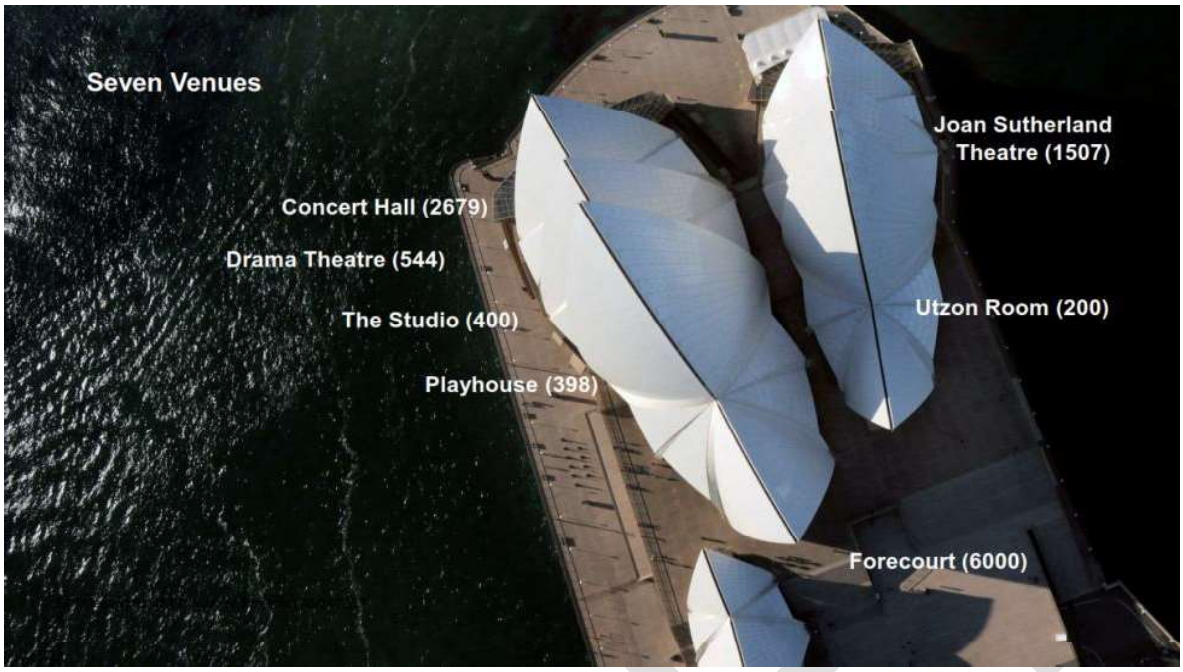


Figure 2- Numbers indicate seating capacity

1.1.5 Project objectives

The project objectives are to deliver the individual Works Packages:

- In a manner which is safe, economical and efficient to maintain over its operational life;
- In a manner which is suitable for the nominated use;
- In a manner which incorporates and reflects environmentally sustainable practices;
- In a manner which is energy efficient and which facilitates the achievement of ecologically sustainable practices;
- In a manner which maximises the objectives of, the ECI brief, the Package Element Specifications, the General Specifications and the Reference Documents;
- In accordance with the requirements of the Conservation Management Plan, in order to allow the works to be accomplished without the loss of the heritage significance of the Sydney Opera House and its relationship with the site;
- In accordance with design documentation that is fully developed and fit for purpose;
- In a manner that maximises scope for the available funds; and
- By the completion dates for each Works Package, and any separable portions within each Works Package.

1.1.6 Construction objectives

Our proven track record in delivering complex projects in busy operating environments and understanding of the difficulty that can be experienced in transitioning users assures the SOH Trust that Laing O'Rourke appreciates and understands the construction objectives for the delivery of the Project, in particular:

- Safety for all: Ensuring the safety of SOH, construction personnel and the public during the construction phase.
- Operation continuity: Maintaining the operational building with minimal disruptions alongside the new build.
- Access: Maintaining and coordinating access for SOH and construction personnel throughout the construction phase.
- Segregation: Maintaining construction site works and operational SOH areas separate.
- Minimum disruption: Mitigating all necessary and planned disruptions to SOH and key stakeholders.

1.1.7 Heritage Listings

- The Sydney Opera House is provided statutory heritage protection under the following listings:
- World Heritage List (UNESCO) - 28 June 2007. In 2007, the Sydney Opera House was inscribed on UNESCO's World Heritage List (WHL) for its Outstanding Universal Value and as a "masterpiece of human creative genius"
- National Heritage List (Australian Government) – 2005. The following is the Summary Statement of Significance of the National Heritage values of the Sydney Opera House:
- The Sydney Opera House, constructed between 1957 and 1973, is a masterpiece of modern architectural design, engineering and construction technology in Australia. It exhibits the creative genius of its designer, the Danish architect Jørn Utzon and the contributions to its successful completion by the engineering firm Ove Arup and Partners, the building contractors M.R. Hornibrook, and the architects Hall, Todd and Littlemore. It is an exceptional creative and technical achievement in the national history of building design and construction in Australia.
- Register of the National Estate (Australian Government).
- State Heritage Register (NSW Government) – 2003. The following is the Statement of Significance of the State Heritage values of the Sydney Opera House:
- The Sydney Opera House is of State significance as a twentieth century architectural masterpiece sited on a prominent peninsular in Sydney Harbour. In association with the Sydney Harbour Bridge it has become an internationally recognised symbol of Sydney and Australia, which is also widely admired by Local citizens. Designed for the NSW Government by renowned Danish architect Jørn Utzon between 1957 and 1966, and completed in 1973 by Hall, Todd and Littlemore, the building has exceptional aesthetic significance because of its quality as a monumental sculpture in the round, both day and night, and because of the appropriateness of its design to its picturesque setting. Its public spaces and promenades have a majestic quality, endowed by powerful structural forms and enhanced by vistas to the Harbour and the city. An icon of modern architecture, the Sydney Opera House uses the precise technology of the machine age to express organic form. It has scientific and technical significance for the ways in which its construction continually pushed engineering and building technologies to the limit. It also has significance for the extensive associations of the site with many famous people and important themes in Australian history. Abutting the site of the first settlement of Europeans in Australia at Sydney Cove, the Sydney Opera House stands on Bennelong Point, Aboriginal land which was named after a Wangal Aboriginal man and which is of significance in the history of the entanglements and interactions between Aboriginal and non-Aboriginal cultures in Australia. Other historic themes associated with the site include the arrival of the First Fleet in Sydney Cove, scientific investigation, Defence, picturesque planning, marine and urban transport and most recently, cultural showcasing. Since its official opening by the Queen in 1973, the Sydney Opera House has been the scene of many notable achievements in the performing arts and has associations with many nationally and internationally renowned artistic performers. The Sydney Opera House provides an outstanding Visual, cultural and tourist focal point for Sydney and Australia.
- State Environmental Planning Policy (Major Development) 2005 (NSW Government)
- State Regional Environmental Plan (Sydney Harbour Catchment) 2005 (NSW Government)
- Sydney Local Environmental Plan 2005 (City of Sydney Council)

2. Roles and Responsibilities

The key construction roles and responsibilities are outlined in the following table.

Role	Responsibility
Project Leader	• The project leader will assume ultimate responsibility for the project. • Project programme • OHS • Quality / Environmental • Construction activities
Commercial Manager	• The commercial manager will be responsible for the cost and financial aspects of the project, reporting to the Project Leader.
Construction Manager	• The Construction Manager will be responsible for the operation of the construction side of the works, in particular the day-to-day management of on-site progress, WH&S and client liaison.
Digital Engineering Lead	• The Digital Engineering Lead will be responsible for managing all the digital engineering activities, the DE model ensuring it provides a single source of project data across the design engineering, planning and delivery teams activities and aligns with specific requirements of the SOH BIM management team
Design Manager	• The Design Manager will be responsible for finalisation of shop drawings, temporary works designs, remaining approvals of samples and RFI's. Finalisation of AFC documentation for remaining works packages.
Services Manager	• The Services Manager will be responsible for ensuring buildability and commissioning requirements are understood, communicated and implemented by the delivery team and supply chain. The services manager will also work closely with SOH operations personnel and maintenance contractors to plan and implement procedures for smooth transition from commissioning through to completion.
Senior Project Engineer	• The Senior Project Engineer will oversee the engineering team providing technical coordination link between the construction and design. The senior project engineer will oversee the project/site engineers and coordinate between all of the packages of works.

Table 1: Roles and responsibilities

3. Construction Management

3.1.1 Location & Brief Description

Located on the peninsula of Bennelong Point, the Sydney Opera House is divided into two sectional halves, (i) the Concert Hall located of the western side and (ii) the Joan Sutherland Theatre (previously the Opera Theatre) located of the eastern side. The Opera House is a unique design and incorporates a number of innovative construction techniques. The superstructure of the Sydney Opera House is predominately precast concrete with internal steel reinforcement. Construction on the Sydney Opera House (SOH) commenced in 1959 and was completed in 1973.

The Sydney Opera House spans Levels -08' to Level +130'. The levels are determined according to height in feet relative to sea level.

The Sydney Opera House is a Landmark, skyline-dominating arts centre for opera, theatre, music and dance, plus guided tours.

The address is the northern end of Macquarie Street Bennelong Point Sydney NSW 2000.

Figure 3- Sydney Opera House Location (indicated in red box)

3.1.2 Existing Buildings & Neighbours

Across the harbour 750metres to the north is one of the city's most established and affluent neighbourhoods of Kirribilli which is part of North Sydney Council.

Across the Quay 500metres west is the overseas passenger terminal and "The Rocks".

To the south is 300metres is the toaster, Circular Quay, Government House, commercial office space, residential and hotels.

1.2km to the east across the harbour is Garden Island, Woolloomooloo Finger Wharf and Potts Point

RMS, Sydney Ferries and private companies operate within the harbour.

Figure 4- Map indicating location of Neighbours

3.1.3 Existing Utilities & Provider's

In the event that any service is required to be shut down, the direct contact for these is the Sydney Opera House Building Operations who are available on 02 9250 7979.

3.1.4 Power

Power to the SOH has recently been upgraded inclusive of a new 11kva substation and main switchboard.

The chamber substation is owned by Ausgrid and power reticulation is managed and operated by SOH.

The reticulation within the SOH precinct and is metered to all of the various tenants

The existing power supply capability is sufficient for the intended scope of works inclusive of temporary works to Packages 1A, B, C, stage 2 and 3. This detail has been advised through SOH and their consultant design teams.

3.1.5 Water

The incoming main is owned by Sydney water. The reticulation of water supply is managed and operated by SOH.

3.1.6 Sewer

The outgoing sewer main is owned by Sydney water. The discharge of sewer and trade waste is managed and operated by SOH.

The existing sewer system goes to a number of pumping stations.

3.1.7 Stormwater

The outgoing stormwater main is owned by Sydney water. The discharge of stormwater to the main is maintained by SOH.

The existing building rainwater system drains to a central GPT and then into Sydney Harbour.

3.1.8 Gas

The incoming main is owned by Jemena. The reticulation of gas supply is managed and operated by SOH.

The reticulation within the SOH precinct and is metered to all of the various tenants

3.1.9 Telecommunication Providers

Telecommunications reticulation is managed and operated by SOH.

Telecommunications the SOH comes into a central MDF where it is then distributed to the various users.

3.1.10 Geotechnical Conditions

Geotechnical specification and requirements have been detailed by AECOM.

A geotechnical report was prepared for the VAPS project and can be referred to.

Currently investigations are proposed for the lift 36 pit and the front of the steps area thrust block.

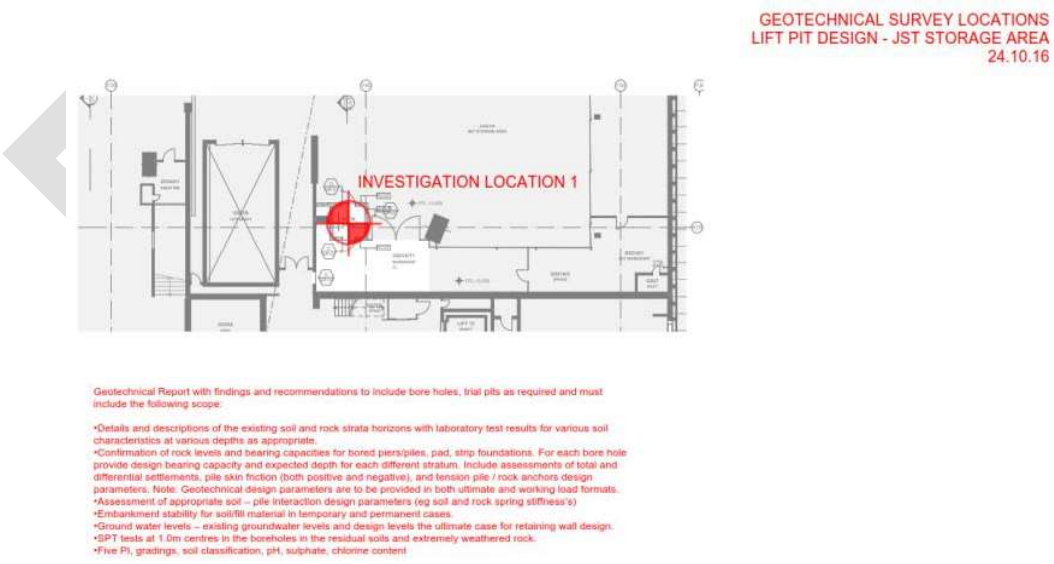


Figure 5- Example of Geotechnical Survey

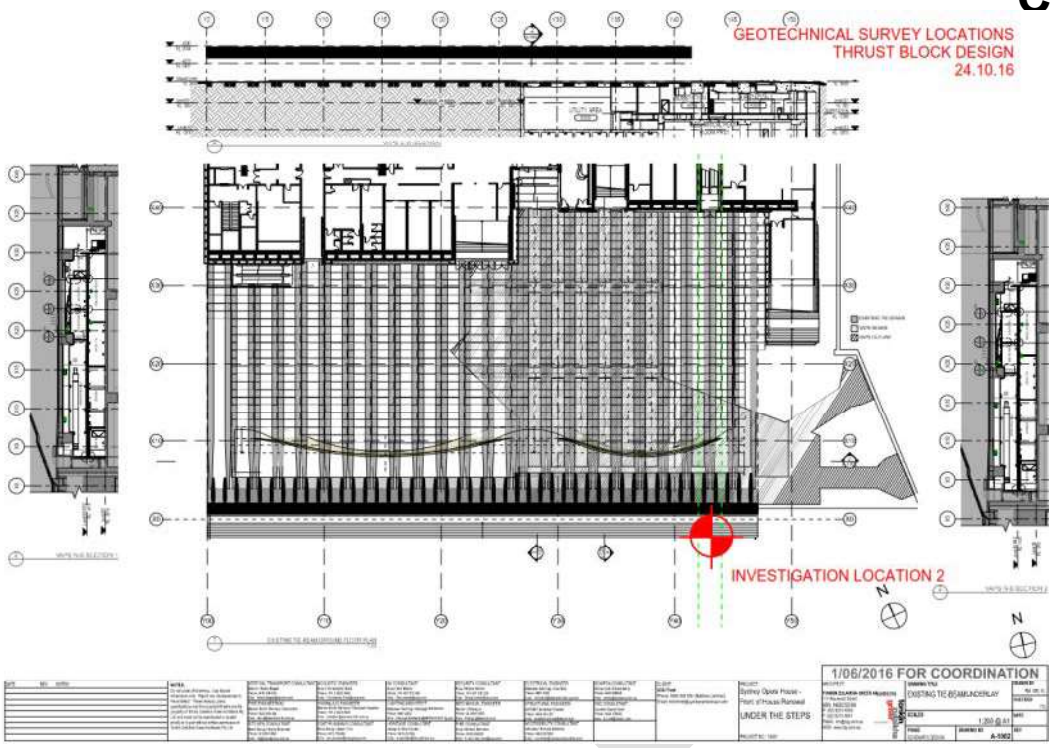


Figure 6- Geotechnical Survey Locations

3.1.11 Contamination and Hazardous Materials Risk Assessment

The Sydney Opera House (SOH) was constructed between 1959 and 1973 at a time when it was common for building materials & products to contain some asbestos, PCBs, lead and chromate paints.

SOH keeps a details register of Asbestos, PCB's, lead and chromate paint.

Hibbs & Associates Pty Ltd conducted a survey of the Sydney Opera House (SOH) to identify the typical locations where older fluorescent light fittings with the potential to contain PCB's exist and to identify the typical locations and applications in which lead or chromate based paints have been used. The site inspection was conducted between 27 July and 05 August 2015.

3.1.12 Survey Results

SUMMARY OF FINDINGS

The Register – Paint Systems and PCB's, was prepared at the request of Mr Dean Jakubowski, Contractors & Events Manager.

3.1.12.1 Lead and or Chromate Paint Systems

The survey included the inspection and analysis of representative paint systems used throughout the SOH.

The typical applications in which lead and / or chromate paint systems are present is summarised below.

Structural metal throughout including:

Metal flooring of Winch Grid (Joan Sutherland Theatre),Base support structure of winches and motors, Structural columns/beams, Hand rails and stair structures, Winches, Fly Motors, Motors

All paint systems were in a good and stable condition at the time of the survey.

During the initial survey it was identified that a number of base metal results (paint removed) had significant levels of lead and chromium. Upon reviewing the raw data, Hibbs & Associates revisited the site to confirm whether these results were reproducible. Similar results were obtained during the re-inspection; confirming the presence of a corrosion coating deposited directly onto the surface of the base metal, and therefore present under overlaid

paint systems. These coating are similar to what would be expected from dip tank or electroplated corrosion conversion coatings. The base metal plating or coatings are deposited directly onto clean metal surfaces to provide enhanced corrosion protection.

Therefore there are three possible scenarios for obtaining positive results for heavy metals:

Only the paint systems contain lead and or chromate, refer Table 1 on the following page for examples;

The paint system and base metal protective surface layer contains lead and or chromate, refer Table 2 on the following page for examples; or

There is no lead or chromate in the paint system, however there is either lead or chromate in the base metal corrosion surface layer, refer Table 3 for a list of locations.

It is important to differentiate the possible scenarios from a maintenance perspective. Should minor remedial paint works be required i.e. top coat peeling lead and or chromate paint requires only a light sanding for paint preparatory works, PPE and appropriate control measure are required to capture all paint debris and dust.

In areas that do not contain lead or chromate in the paint, but do have lead or chromate in the base metal corrosion protective surface layer, in this instance no additional controls other than what is normally used for painting preparatory (PPE requirements) works are necessary. However, should the preparatory works have the potential to be abraded i.e by grinding back to the base metal where the base metal corrosion protective surface layers are located, then additional controls above those normally used may be required.

For convenience, we have provided the following tables to assist in the interpretation of the analytical results.

Table 1 – Example of elevated levels of chromate and/or lead in paint only

Location	Item	Paint	Lead Result ppm or %	Chromate Result ppm or %	Base Metal Result lead	Base Metal Result lead chromate
JST winch grid	Winch pinspot Fly	Yellow coating	30.30%	6.28%	<746 ppm	<903 ppm

Due to the base metal result being less than the limit of reporting (LOR) i.e. <746, the surface coating contains both lead and chromate while there is no or negligible plating on the base metal.

Refer to the Register in Appendix 1 for the location of chromate and or lead paint systems identified at the SOH.

Table 2 - Example of elevated levels of chromate and/or lead in paint and base metal

Location	Item	Paint	Lead Result ppm or %	Chromate Result ppm or %	Base Metal Result lead	Base Metal Result lead chromate
Drama Theatre Mezzanine	Metal guard rail opposite stairs	Black coating	15.90%	5128 ppm	11.19%	4115 ppm

This indicates that the paint has lead and chromate present and the base metal has some type of coating or plating on it.

Refer to the Register in Appendix 1 for the location of chromate and or lead paint systems identified at the SOH.

Table 3 – List of areas with elevated levels of chromate and/or lead on base metal surface, present as a plating or corrosion conversion coating.

Level (feet, below & above sea level)	Room / Area	General Location - Walls, Ceiling or Structure	Sample Location	Results
Seventh Level +100	JST, Winch Grid	Structural columns	Vertical column adjacent Pinspot Fly 3 D68	Contains lead & chromium plating or coating
Seventh Level +100	JST, Winch Grid	Metal floor	Floor adjacent Backcloth Fly 10 D35	Contains lead & chromium plating or coating
Seventh Level +100	JST, Winch Grid	Structural columns	Diagonal column adjacent Blackcloth Fly 28 D45	Contains lead & chromium plating or coating
Seventh Level +100	JST Rear Follow Spot Area	Metal surfaces rear of Catwalk Area	Handrail at access to Moon Buggy area	Contains Lead plating or coating
First Level +30	Drama Theatre Mezzanine	Metal rails	Guard rail opposite stairs	Contains lead & chromium plating or coating
First Level +30	Drama Theatre Mezzanine	Scenery Batten/Curtain/Lighting Bars	Curtain Bar	Contains lead & chromium plating or coating
First Level +30	Drama Theatre Mezzanine	B14 Winch Room	Machine support structure	Contains Lead plating or coating
First Level +30	Drama Theatre Mezzanine	Stair railing and supports, east & west stairs (note, eastern stair top rail has no primer)	Hand railing vertical support, eastern stairs (not top hand rail)	Contains lead & chromium plating or coating

Level (feet, below & above sea level)	Room / Area	General Location - Walls, Ceiling or Structure	Sample Location	Results
Seventh Level +100	JST, Upper Winch Level Sheave Grid	Structural columns	Diagonal column adjacent winch	Contains Lead plating or coating
Eighth Level +115	Concert Hall, Crown Area	Cloud winch motor base	South No. 2	Contains Lead plating or coating
Eighth Level +115	Concert Hall, Crown Area	Metal throughout northern section	Base support below Winch 12, attached to structural Beam	Contains Lead plating or coating
Mezzanine Level +21	JST, Motor area below Stage	Structural columns	Middle level of Screw Lift area	Contains Lead plating or coating
Basement Level +01	JST basement area with workshop	Metal structures	Redundant JST stage revolve	Contains Lead plating or coating
Basement Level +01	JST basement area with workshop	Stair structures with circular railings	Basement level	Contains Lead plating or coating
First Level +30	JST, Mezzanine corridor south of stage off Gallery areas	Circular Railings	Top railing	Contains Lead plating or coating
Basement Level +01	Below boardwalk	Metal grill below northern stairs to access door	Metal grill below northern stairs to access door	Contains Chromium plating or coating
First Level + 30	Drama Theatre Winch Room	Motor	Panorama fly 4 B24	Contains lead & chromium plating or coating

Level (feet, below & above sea level)	Room / Area	General Location - Walls, Ceiling or Structure	Sample Location	Results
Basement Level +01	Plantroom 25	Sewage ejector pump, Pump motor	No 1B sewage ejector pump	Contains Lead plating or coating
Basement Level +01	Plantroom 24	Gas pipe	North side	Contains Lead plating or coating

The results analysed for the items listed in the table above indicates that the paint does not have lead and chromate present but the base metal has some type of coating or plating on it.

The items listed do not contain lead and or chromate paint as outlined in the Register included in Appendix 1.

The coating or plating on the base metal poses minimum risk whilst working however appropriate PPE should be worn if the base metal is being abraded or grinded.

3.1.12.2 Polychlorinated Biphenyls (PCB)

During the survey, a combination of plastic capacitors, metal cased capacitors and no capacitors were identified within light fittings examined. Fluorescent light fittings are located throughout the building as both single and twin tube fittings.

Metal cased capacitors were identified in the following locations:

- Concert Hall, Walkway above Plant Room 21 - Capacitor: Ducon 4µF ± 10, APF 240 8CR.
- Play House, Winch Grid, loose light fitting on electrical cabinet - Capacitor: Ducon 8 µF ± 10, APF 280 SCR.
- Joan Sutherland Theatre, Return air plenum above Plant Room 23, Section 1-3 - Capacitor: Ducon 4µF ± 10, APF 240 8CR.

No leaking PCB containing capacitors were identified during the inspection.

Although only three (3) metal cased capacitors were identified within the light fittings examined, metal cased capacitors are predicted to be in many locations throughout the SOH. Fluorescent light fittings across the site have been retrofitted as the need arises, leaving fluorescent light fittings with similar casings/fittings throughout the site.

As a result of retrofitting, a visual observation based on the age of the light fittings is not a reliable indicator as to whether the light fitting contains PCB's or not. However on disassembly of the light fitting, should the capacitor have a metal casing it is a reliable visual indicator that the light fitting may contain PCB and the capacitor is presumed to contain PCB until further investigation confirms otherwise.

3.1.12.3 Asbestos

Asbestos is a naturally occurring mineral fibre that withstands heat, erosion and decay, and has fire and water resistant properties. Asbestos is a known carcinogen and its manufacture has been banned since the late 1980s and supply banned in Australia since 2003. Asbestos becomes a hazard when microscopic fibre fragments become airborne and are inhaled. The Opera House was constructed at a time when it was common for building materials to contain some asbestos.

The Opera House has a comprehensive Asbestos Management Plan to ensure that asbestos is in good condition and undisturbed. The Opera House regularly obtains expert advice to ensure that our asbestos management is best practice and effective.

In summary,

- The Opera House maintains a comprehensive Asbestos Register detailing the location, type and condition of asbestos found at the Opera House.
- Prior to any building or maintenance project related works, an asbestos Risk Assessment must be completed
- Only appropriately qualified, trained and where appropriate licenced personnel shall work with asbestos material within the Opera House
- The Unexpected Finds procedure is followed when an unknown material is discovered that may contain asbestos

3.2 ECI Investigations (LORAC and consultants)

During the 2016/ 2017 ECI phase, various investigations were undertaken to better understand the existing fabric and scope of works required in the Building Renewal Project. The following surveys were undertaken by the consultants.

- Electrical Services – Ryan Wilkes
- HAZMAT – Hibbs & Associates
- Geotechnical – Douglas Partners
- Services Search(GPR) – Suresearch
- Mechanical - Engie
- Fire - Wormald
- BMS - Honeywell
- Traditional and cadastral survey – Cardno
- Various General Site Investigations – LORA

4. Site Management

- Enabling & Site Establishment Works will need to commence end of May 2017.
- Construction works will commence 23rd May 2017 after the closure of the JST.
- Programmed completion of the project is May 2018.

4.1.1 Contact Details

Contact details are provided for the project as follows:

Role	Name	Company	Number
Project Director	Ed Obiala	Laing O'Rourke	0409 389 914
Project Leader	Ben Nicol	Laing O'Rourke	0427 057 334
Construction Manager	David Gill	Laing O'Rourke	0414 494 962
24 Hour Emergency Contact:	David Gill	Laing O'Rourke	0414 494 962
Snr Project Engineer	Kevin Barry	Laing O'Rourke	0417 666 922
Demolition Subcontractor (24 Hour):	TBC	To be Appointed	TBC
(24 Hour):	TBC	To be Appointed	TBC

The above details are correct at the time of issue of this plan.

Additionally these contact details will be displayed on site in a manner which is clearly visible and legible from any public place adjoining the site. Should any changes to these details occur they will be reflected first on site displays, and then in any subsequent update of this document.

4.1.2 Site Establishment

The main site establishment compound, housing the site office and welfare facilities, will be situated on the northern broad walk where the current function centre marquee sits. LORAC cannot get possession of this area until the 8th June 2017 when Vivid and the Function Centre close.

The JST possession is currently 2 weeks prior to this date and early works in April 2017 is currently being planned therefore an initial enabling site establishment is required. Options currently being explored for the early works include 'under the steps', B4 loading dock and the cleavage area.

Hoardings delineating Works Packages 1A, B, C areas are detailed within this document and will be installed as per the delivery programme.

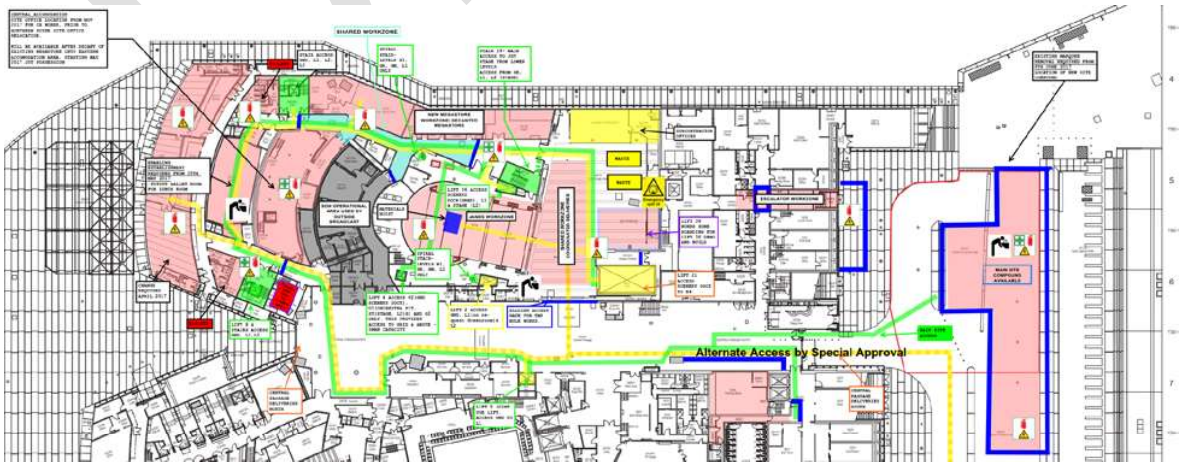


Figure 7- Ground Floor Site Establishment & Access Plan

4.1.3 Enabling & Site Establishment Works (existing Ballet Rehearsal Room) - May 2017

This involves the use of existing spaces within the JST and B4 loading dock. The ballet room will be fitted out for a lunch room, change room within the current function centre office and toilets as indicated below. Site access will be through the current Stage Entry and along Central Passage.

This will be a shared space between SOH staff and construction workforce for a short period.

The welfare facilities will cater for the trades starting the Theatre Machinery Package (TMP), Entry Foyer and the SAVE package. Trades include:

- Hoarding & sheds
- Wipedown and clearance certificates
- Demolition
- Temporary services
- Temporary protection and
- Hoists and scaffolding
- Estimated resources:
- 40 workforce over 2 shifts
- 24 staff based within the existing BRR site office

Establishment of the loading dock will take place May 2017. Bay 1 and the large corridor leading to lift 21 has been dedicated for the sole use of the JST Works Packages 1A, 1B and 1C. The projects logistics manager and forklift driver will be based in B4 to control all deliveries in conjunction with SOH dock staff and security.

The logistic manger and forklift driver will have a small site office on the dock and are able to utilise the existing toilets and kitchenette.

A hoarding needs to be constructed to stop dust entering the main dock area. Large waste bins will be kept within this area and lifted out onto the dock using the existing 5t Gantry crane

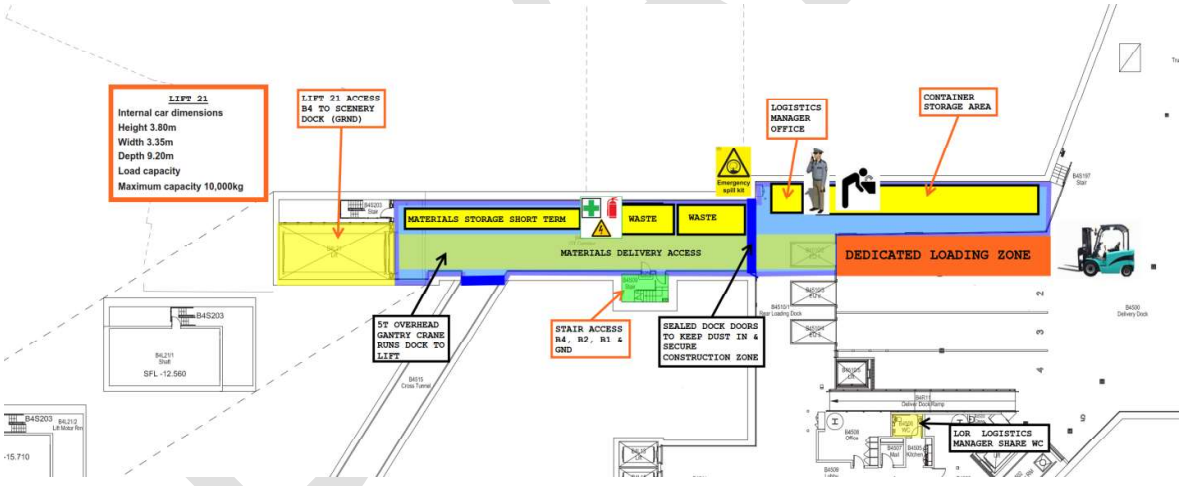


Figure 8- B4 loading dock site establishment and Access plan

4.1.4 Main Site Establishment Compound (northern broadwalk) - June 2017

Commencing on the 8th June 2017 an 'A' class hoarding will be erected around the main site establishment compound.

The compound is in full view of the harbour, public events and tourists. Special requirements such as colour and branding are to be agreed with SOH. All hoardings are to be 'coconut husk' colour.

All welfare facilities will be within this space inclusive of lunch, change, ablutions and first aid.

Estimated Resources:

- 180 workforce over 2 shifts

4.1.4.1 Site Offices and Amenities

The LORAC Main Site Establishment Welfare Compound located on the Ground Level Under the Steps area inclusive of:

- LORAC first-aid office
- Lunch and change sheds
- Male and female toilets, change rooms and showers
    - The LORAC site office will be locate on level 2 in the northern foyer. Access to the site office will be through the main compound up lift & stair 8 or 3.

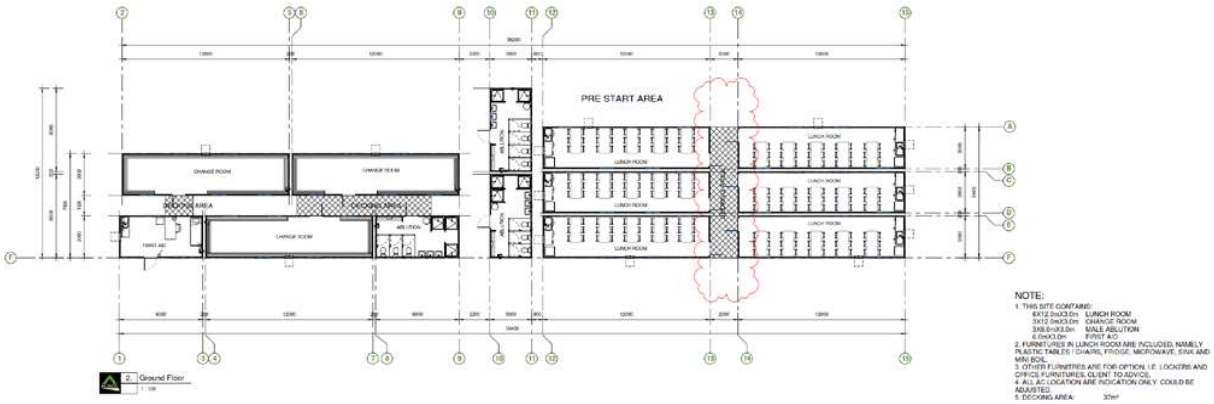


Figure 9- Proposed Under the Steps Main Site Compound with Lunch Rooms, Change Rooms, Ablutions, First Aid and Decking Area

4.1.4.2 Estimated Resources:

- 30 staff split over 2 shifts

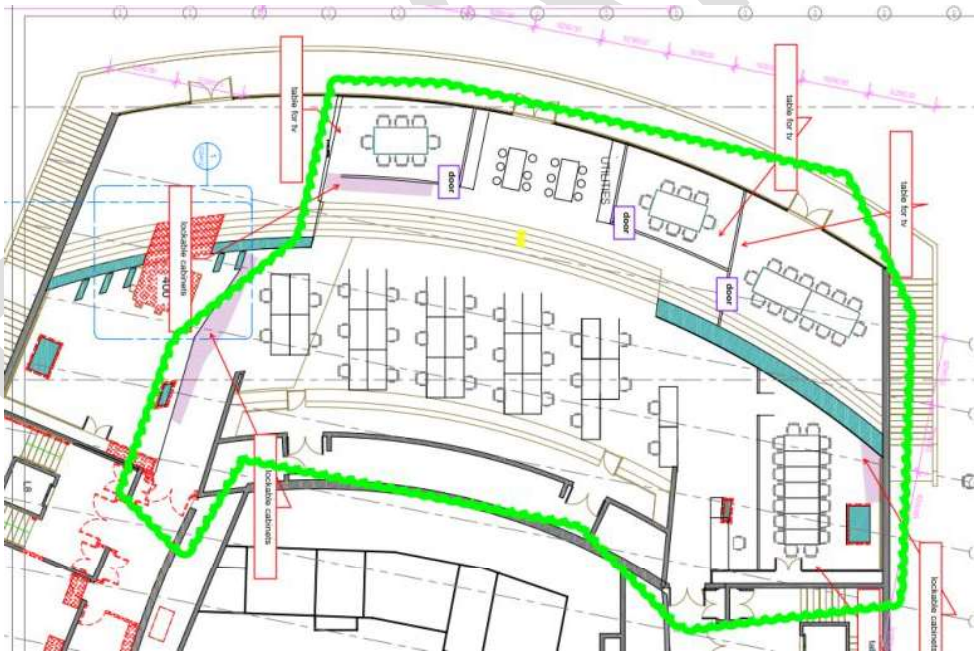


Figure 10- Laing O'Rourke Site Office Located Level 2 Northern Foyer

Figure 11- Location and size of main site compound

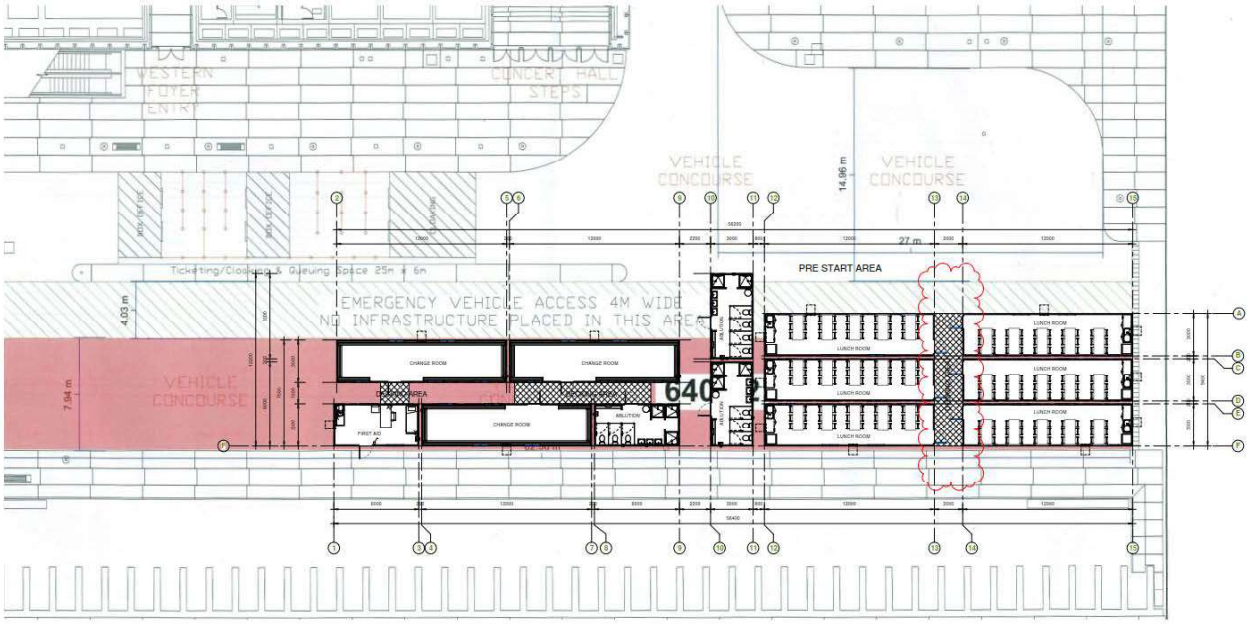


Figure 12- Main Compound Layout Ground Level Under the Steps

Existing amenities throughout the floors will be protected and utilised for the workforce

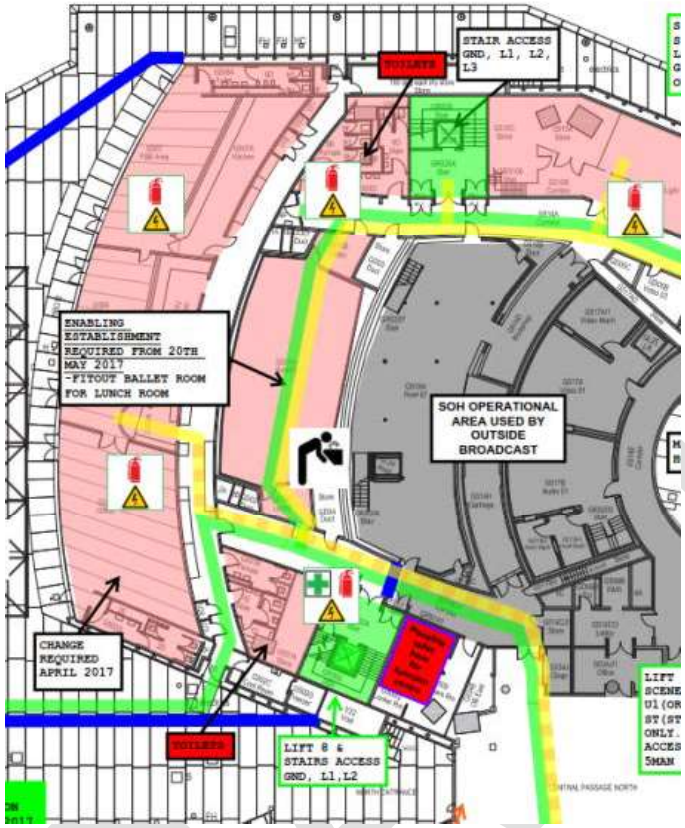


Figure 13- Existing Ground Floor toilets

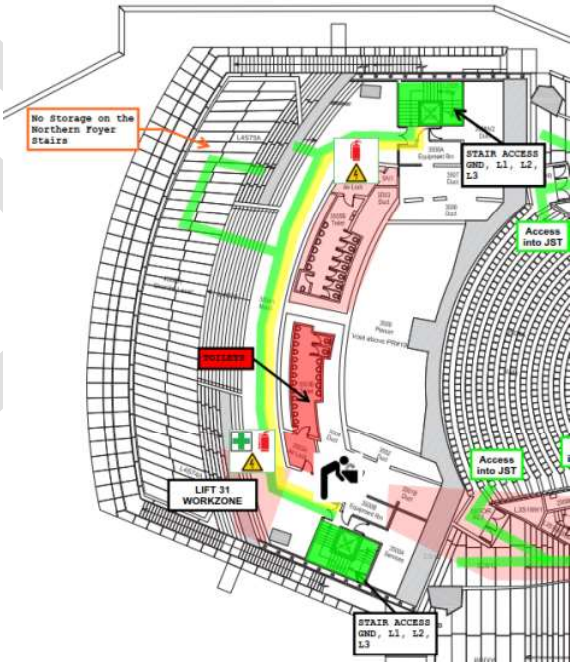


Figure 14- Existing Level 3 toilets

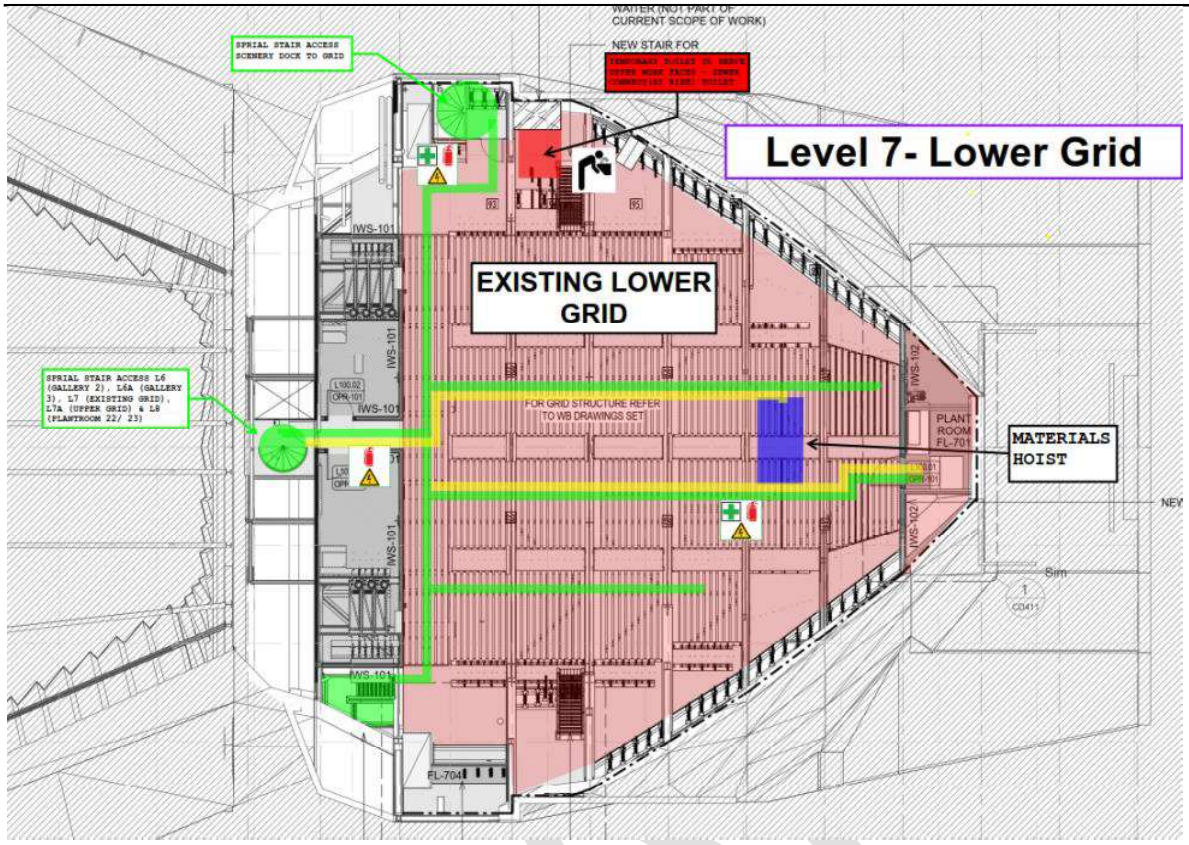


Figure 15- Grid Level 7 Temporary Hi Rise Toilet

4.1.5 Demobilisation – Start November 2017

Demobilisation will progressively occur from November 2017 through to May 2018.

Currently the plan is for the LORAC site office located in the Northern Foyer to demobilise and establish into the new planned Central Accommodation (currently in design).

If the Main Welfare Compound is required to be demobilised for the opening of the JST then another location will be required on site. Areas currently being considered are 'under the steps', B4 loading dock and the cleavage area.

4.1.6 Removal and Protection of the Works

All the finishes within and around the Sydney Opera House are World Heritage listed.

The Building & Heritage Committee (BHC) provides assistance to the Trust by overseeing and monitoring building, renewal, conservation and heritage matters at the Sydney Opera House.

A separate temporary protection package is has been scoped up and includes the following:

- Floor and wall precast
- Joinery
- Flooring
- Glazing
- FFE

4.1.6.1 General Protection

This section will outline the general protection to the existing finishes and structures of the site. Protection specific to various Work Packs will be outlined in each workpack's individual Section 5- Overall Construction Methodologies. This protection is required to preserve the largely heritage finishes and structure that is found omnipresent in all work areas. General Protection which will be present during for all stages of construction during JST closure is described as follows.

Protection of Level B4 Loading Dock Corridor Walls

- 1200mm high plywood along the length of the corridor

Figure 16- 1200mm high plywood protection to B4 Loading Dock Corridor

Protection of Lifts

Lifts which will be heavily used during construction will be protected with

- Heavy fabric or plywood hoarding to internal lift walls
- Plywood floor protection
- Plastic Adhesive Layer to lift doors
- Lift Frame Door Bumpers, either plywood or foam bumpers

Protection of Precast Concrete Panels

Protection of Precast Panels which fall into the designated LOR construction area will require AstroTurf or rubber matting protection. This includes the External Level 2 Southern Podium, Level 1 External Podium (only if utilised during crane lifting), Southern Foyers, Ground Floor Northern Broadwalk Site Compound Area, Internal Corridors around JST as well as panels within the cleavage.

- Astroturf or Rubber Matting

Protection of Brushbox Timber Walls

The external walls of JST Theatre Levels 2, 3 and 4 are clad with brishbox timber finish. These are heritage listed and will not be removed during construction.

- 1800mm high coreflute cladding

Construction on trolley way

To prevent general carelessness and bumping of loads into brushbox walls and glass panels, the construction of a 2400mm wide trolley way with edging to sit on top of rubber/ astroturf protection.

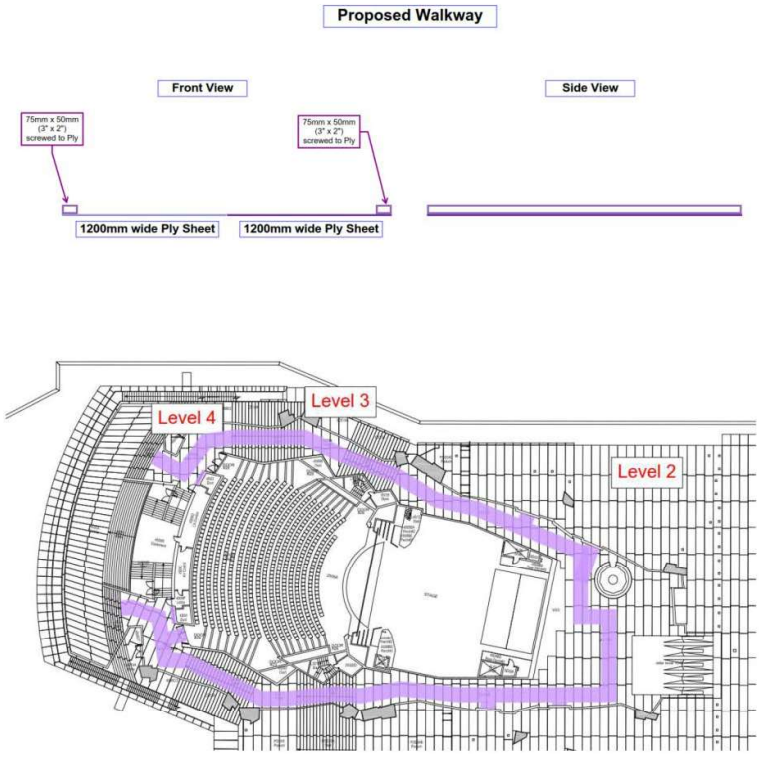


Figure 17- Proposed Trolleyway

Protection of Miscellaneous Signs and Doors

Protection of highly trafficked Doors and adjacent signs will have plywood boxing or coreflute cladding. Refer to TP021- Temporary Protection for full list of protection requirements.

Protection of Wobbly Panels

Existing Wobbly Panels within Level 1 Dressing Room Area which may be used as storage areas. As these panels are heritage, 1200mm high plywood backed against full height hoarding will be provided.

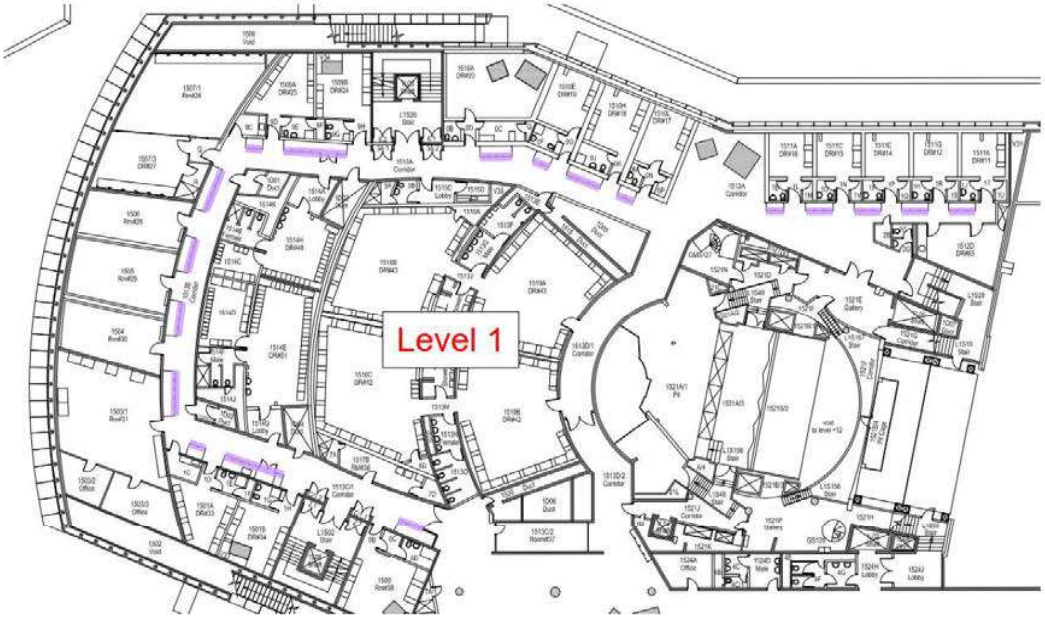


Figure 18- Level 1 Heritage Wobbly Panels to be protected

4.1.7 Hoardings

The site location is under the jurisdiction of the Sydney Opera House Trust and as such no hoarding or work zone fees will be attracted from the City of Sydney Council. The hoarding contractor will erect the following:

4.1.7.1 Ground Level

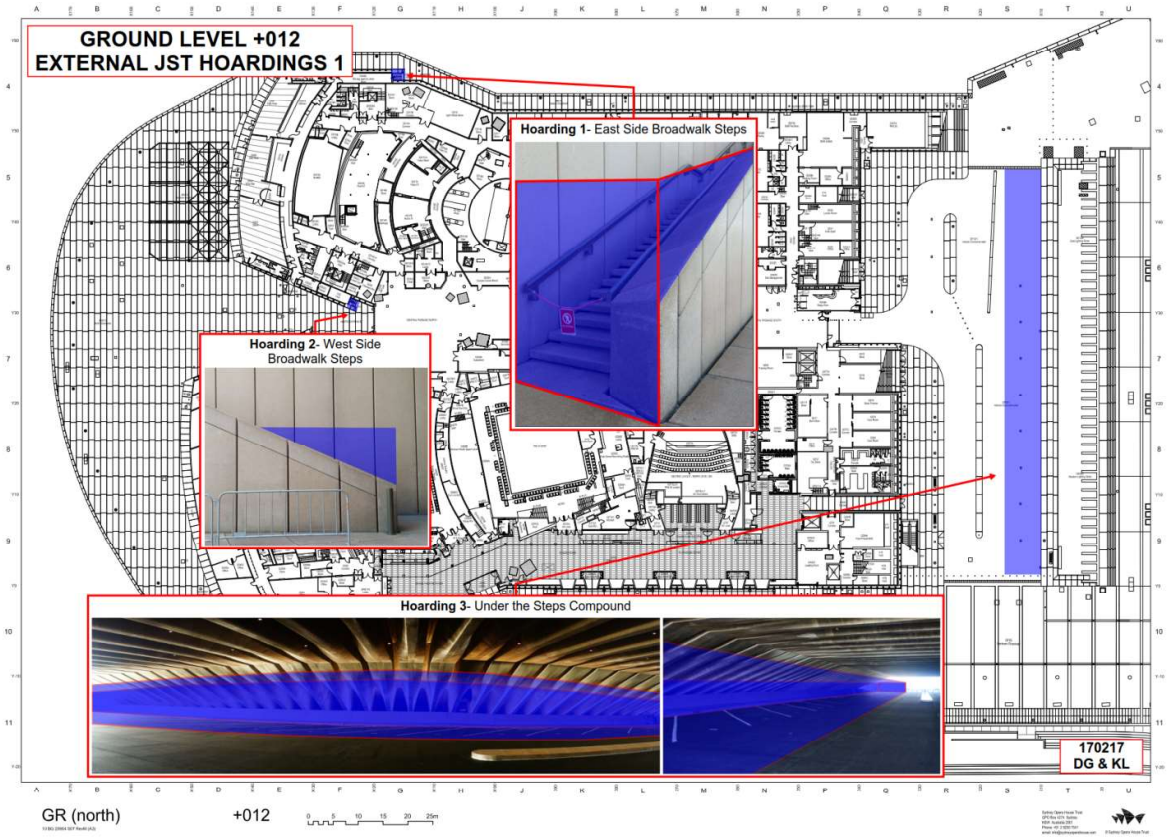


Figure 19- Ground Level Hoardings

Hoarding 1- East Side Broadwalk Steps

The Steps from Level 2.5 Northern Foyer leading to the Eastern Broadwalk will have an 'A' class hoarding installed at Ground Level; door access through this hoarding will be installed. This hoarding will serve to restrict access for the general public to LOR site whilst maintaining options for access/ egress and materials handling for the contractor.

Hoarding 2- West Side Broadwalk Steps

Similar to Hoarding 1, the steps from Level 2.5 Northern Foyer leading to the West Side Northern Broadwalk will have an 'A' class hoarding installed at Ground Level, door access through this hoarding will be installed. This hoarding will serve to restrict access for the general public to LOR site whilst maintaining options for access/ egress and materials handling for the contractor.

Hoarding 3- Under the Steps Compound

Under the Steps Compound will house the main site compound for the Stage 1A, 1B and 1C works. This hoarding will delineate LOR site compound and handling area from the general public. Hoarding will be of sufficient height to hide site sheds within. Access to the site compound will be provided through pedestrian gates and double truck gates in the hoarding.

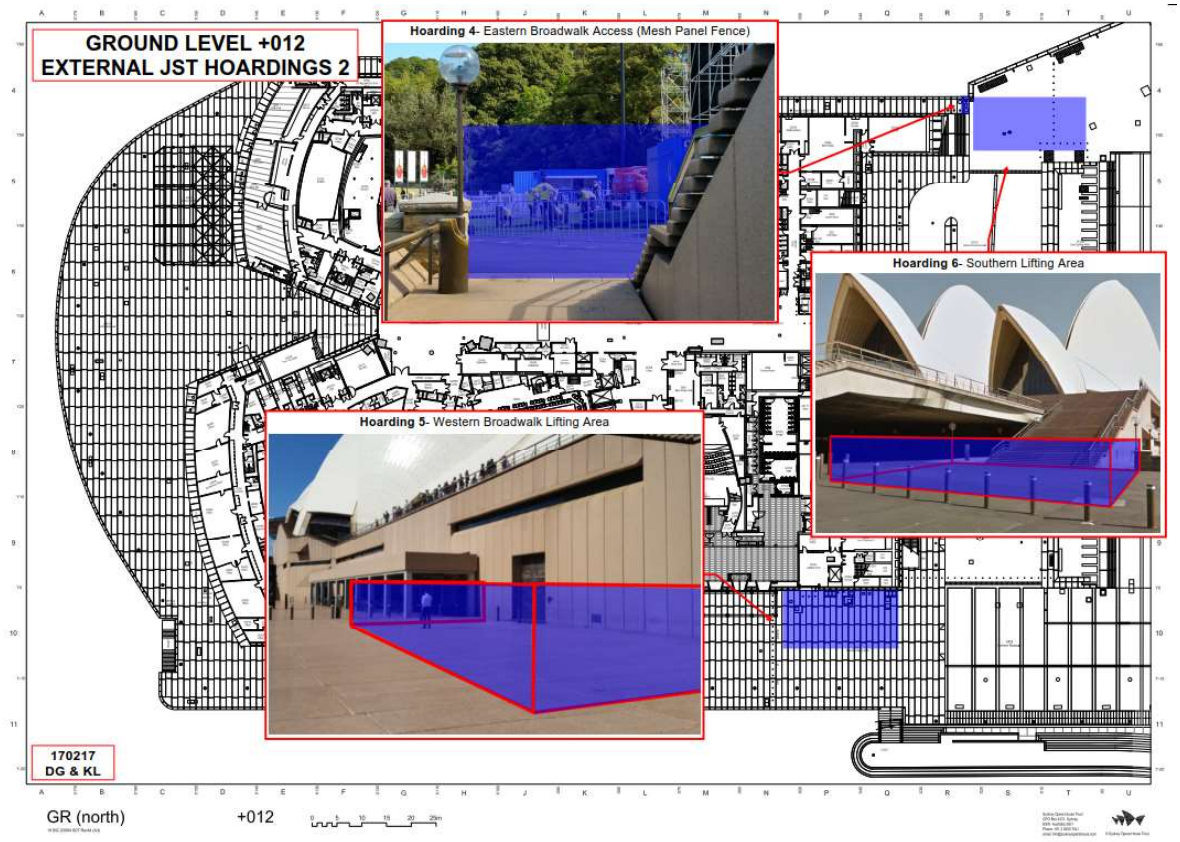


Figure 20- Ground Level Hoardings 2

Hoarding 4- Eastern Broadwalk Access (Mesh Panel Fence)

A hoarding at the South Eastern corner of the base of the stairs will be required during works on the Northern Broadwalk, Eastern Broadwalk and as required. This is to restrict pedestrian access from the Southern side and to stop pedestrians wandering down into live construction works on the South Eastern Broadwalk. Hoarding can be mesh panel fencing with concrete blocks to allow rapid setup and demobilisation.

Hoarding 5- Western Broadwalk Lifting Area

An area on the Western Broadwalk has been identified as a possible crane setup, counterweight slewing and lifting location for lifting of materials from Ground Level up to the Level 2 Top of Stairs area. As with Hoarding 4, this is envisioned to be a temporary area possession (only during craning of materials), and as such will require mesh panel fencing with concrete blocks to facilitate rapid setup and demobilisation.

Hoarding 6- Southern Lifting Area

Similar to Hoarding 5, an alternate area towards the South Eastern Area at the bottom of the Stairs has been identified as a possible crane setup, counterweight slewing and lifting location. This area will facilitate the lifting of materials from Ground Level up to the Level 2 Top of Stairs area. As with Hoarding 6, this is envisioned to be a temporary area possession (only during craning of materials), and as such will require mesh panel fencing with concrete blocks to facilitate rapid setup and demobilisation.

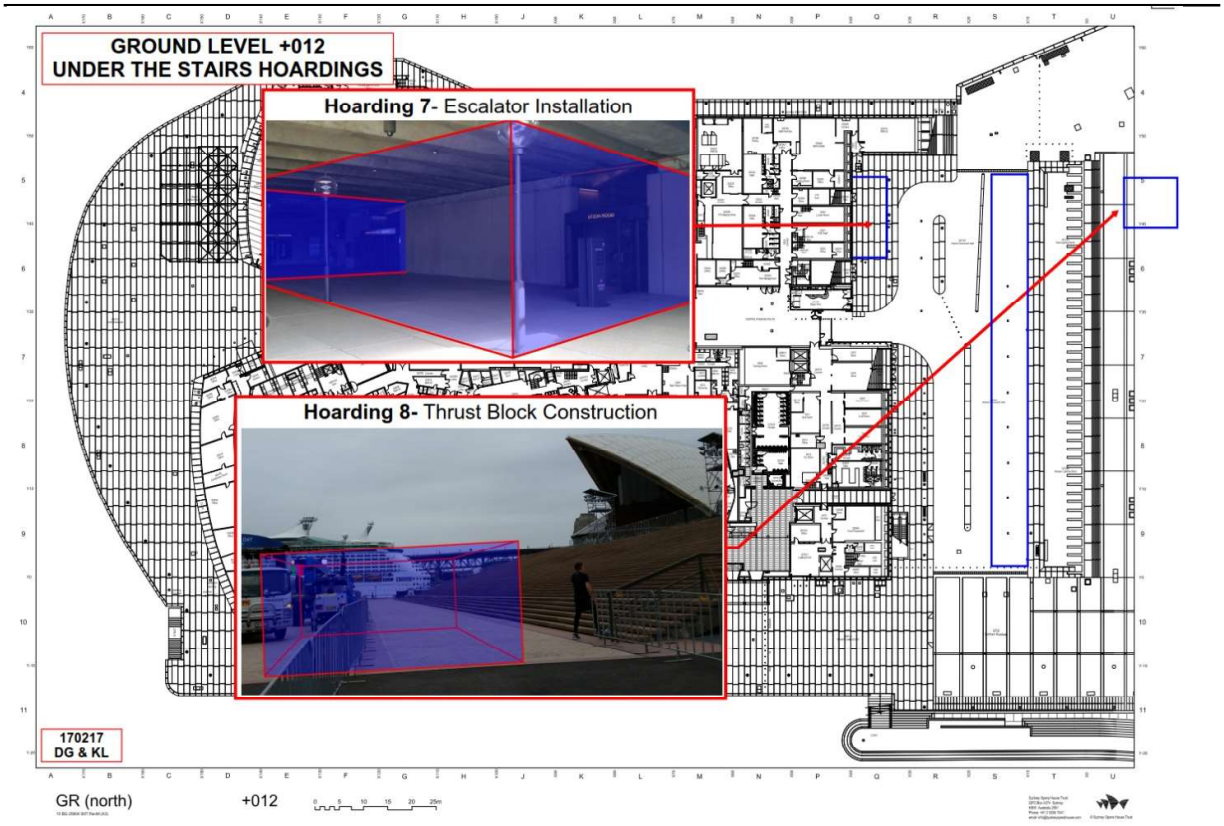


Figure 21- Ground Level Hoardings 3

Hoarding 7- Escalator Installation

Under the stairs in the area from adjacent to the JST Stairs to the Utzon Room Stairs, an 'A' class hoarding will be installed. This area will act as a handling area during the installation of the escalators. It will require a double door wide enough to allow handling of at least one escalator at the time as well as machinery required for the installation. These hoardings will also restrict public access to the construction area.

Hoarding 8- Thrust Block Construction

At the Southern end, beyond the foot of the stairs, an 'A' class hoarding will be set up to allow for the excavation and construction for the thrust block. It will require a double door wide enough to allow movement of excavator and concreting equipment.

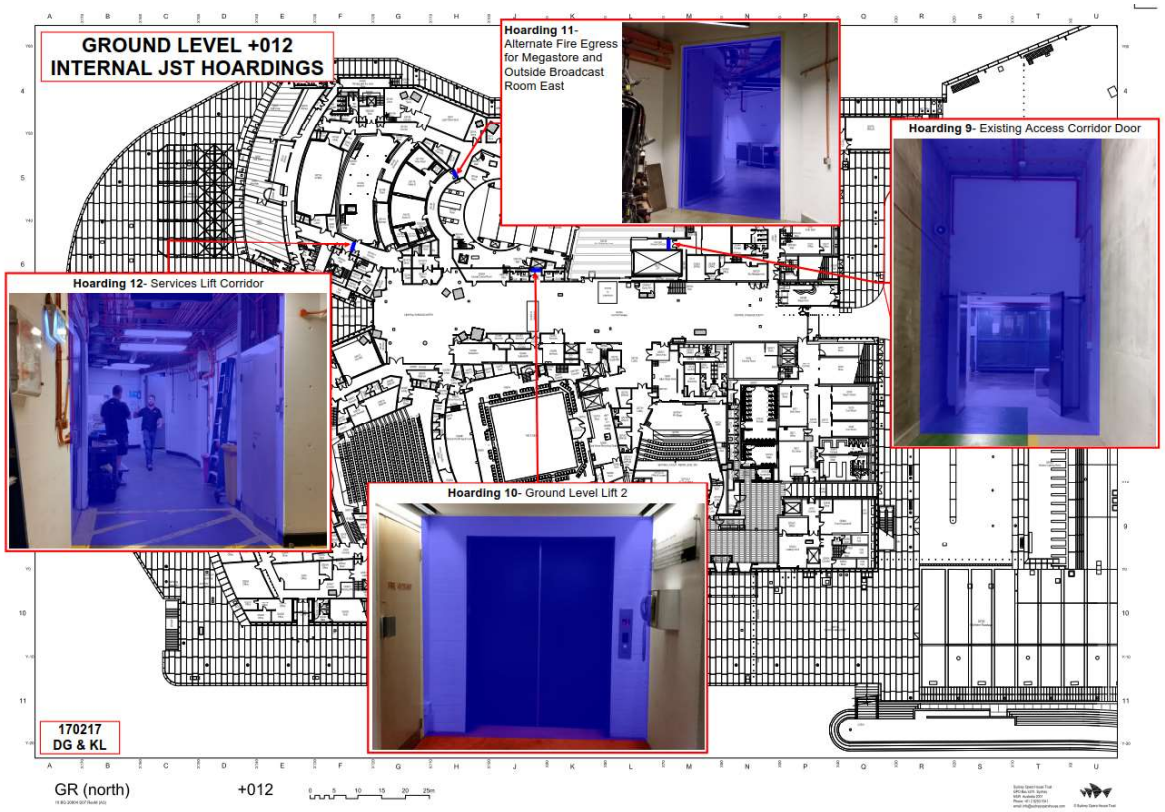


Figure 22- Ground Level Hoardings 4

Hoarding 9- Existing Access Corridor Door

Access corridor G521B/1 into JST Scenery Dock from the Southern Side will require an 'A' class hoarding to be installed. This hoarding will serve to restrict access by the public into the construction site from the public back of house areas which will be still operational. It will also serve to restrict access by workers to Lift 15, treasury corridor and through to the current Building Operations area which will be kept operational. A single door to open in the direction of the existing doors is required for emergency egress and access as required.

Hoarding 10- Lift 2 (Ground Floor)

Existing Ground Level Lift 2 Doors and part of Lobby G520F will be required to be hoarded off by 'A' class hoarding. Access to Lift 2 must be restricted as it location in Level 2 opens out into the JST construction works. Hence, public use of the lift must be restricted. Again, a double door, equivalent to the width of the lift doors will be required to maintain use of the lift if required during construction works. Hoarding line should still allow use of the two accessible toilets at the forefront of the Lift 2 lobby.

Hoarding 11- Alternate Fire Egress for Megastore and Outside Broadcast Room (East)

The Eastern Door of Corridor G514E will require an 'A' class hoarding to act as delineation between possessed JST construction area and operational public areas. This hoarding will allow Audio 01 and Video 01 G517 Rooms to remain operational during the works as well as the Outside Broadcast Studio and the Megastore. The hoarding will require a double door with panic bar to allow emergency fire egress from the Eastern door of the Megastore. This means that Megastore workers, who are existing from the Eastern door in the case of an emergency, will be required to traverse through a live construction site. It is therefore a requirement that Megastore workers will be required to undertake a general site induction prior to working in the Megastore during JST possession periods.

Hoarding 12- Services Lift Corridor

Corridor G514C/1 will require an 'A' class hoarding from the North of the Megastore Entry to South of the Lift 8 Lobby. This will serve to maintain access to the Megastore from the public areas while restricting Lift 8 access to within the construction site area. The hoarding will require a double door to allow access and materials handling if required.

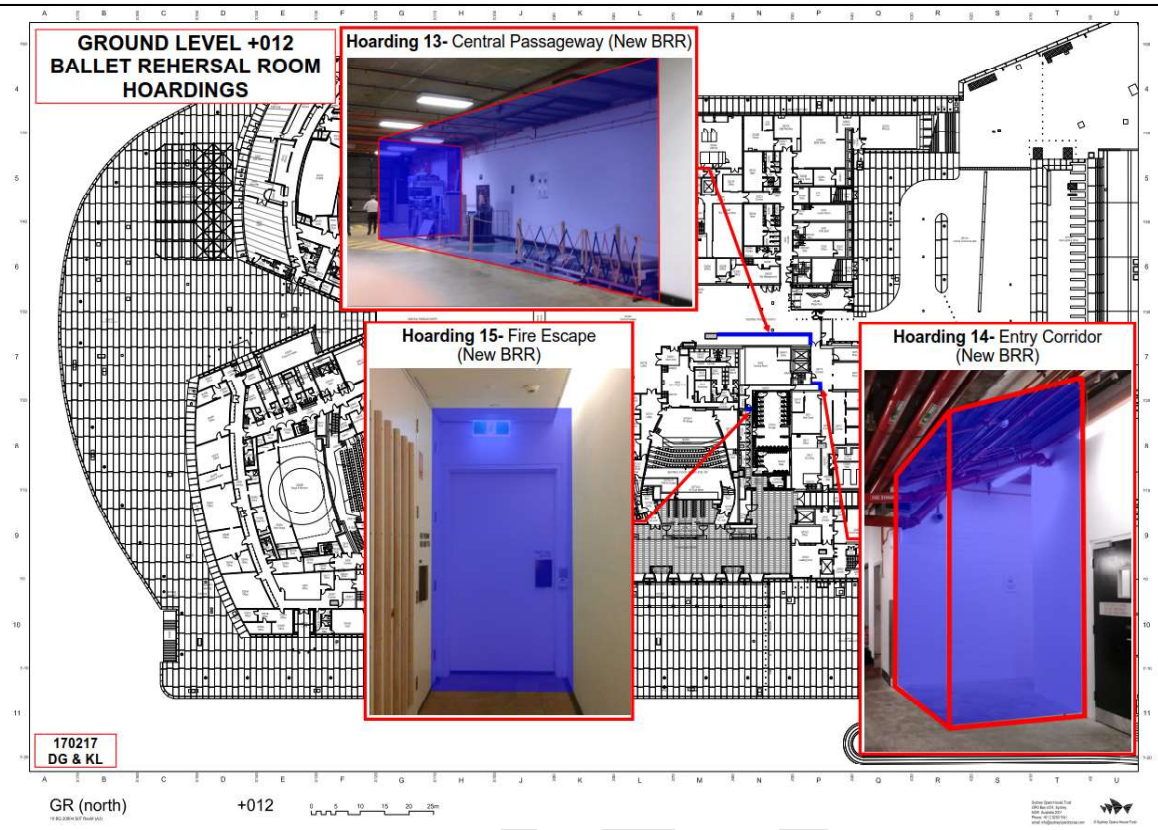


Figure 23- Ground Level Hoardings 5

Hoarding 13- Central Passageway (New BRR)

An 'A' class hoarding will be required to the east of the existing G606 training room (location of new ballet rehearsal room) adjacent to the central passageway. This will restrict access into construction zone from the central passageway and provide working space from the exterior of the rehearsal room to cut the door and window penetrations in. A double door will be required approximately at the location of the door penetration to allow easy materials handling for demolition and construction of the new ballet rehearsal room. Existing services above which will not be removed will be required to be protected and sealed against the hoarding.

Hoarding 14- Entry Corridor (New BRR)

Entry to Existing Entry Corridor G602/1 from Corridor G577A (adjacent to Lifts 13 and 18) will require a hoarding to restrict pedestrian access from operation public areas to the new ballet rehearsal room and surrounding works. It will also restrict access to GRS111 Stairs which can provide alternate access to other construction areas from lower levels. A double door will be required to allow easy materials handling for demolition and construction of the new ballet rehearsal room as well as the new slab in Corridor G602/1. As before, existing services which will not be removed will be sealed against the hoarding.

Hoarding 15- Fire Escape (New BRR)

Fire Door at the end of Corridor G703/1 (adjacent to the Female Playhouse Toilets) which leads into the G602/1 Entry Corridor will require an 'A' Class hoarding. The Fire Door currently provides access from the Playhouse to the Central Passageway and also acts as a fire escape door for the Playhouse. Sealing of the existing door and blacking out of the existing fire egress sign shall be sufficient to seal off pedestrian access to the New Ballet Rehearsal Room works from the Western Side. Block plans and fire egress routes will be adapted as required by consultants.

4.1.7.2 Level 1

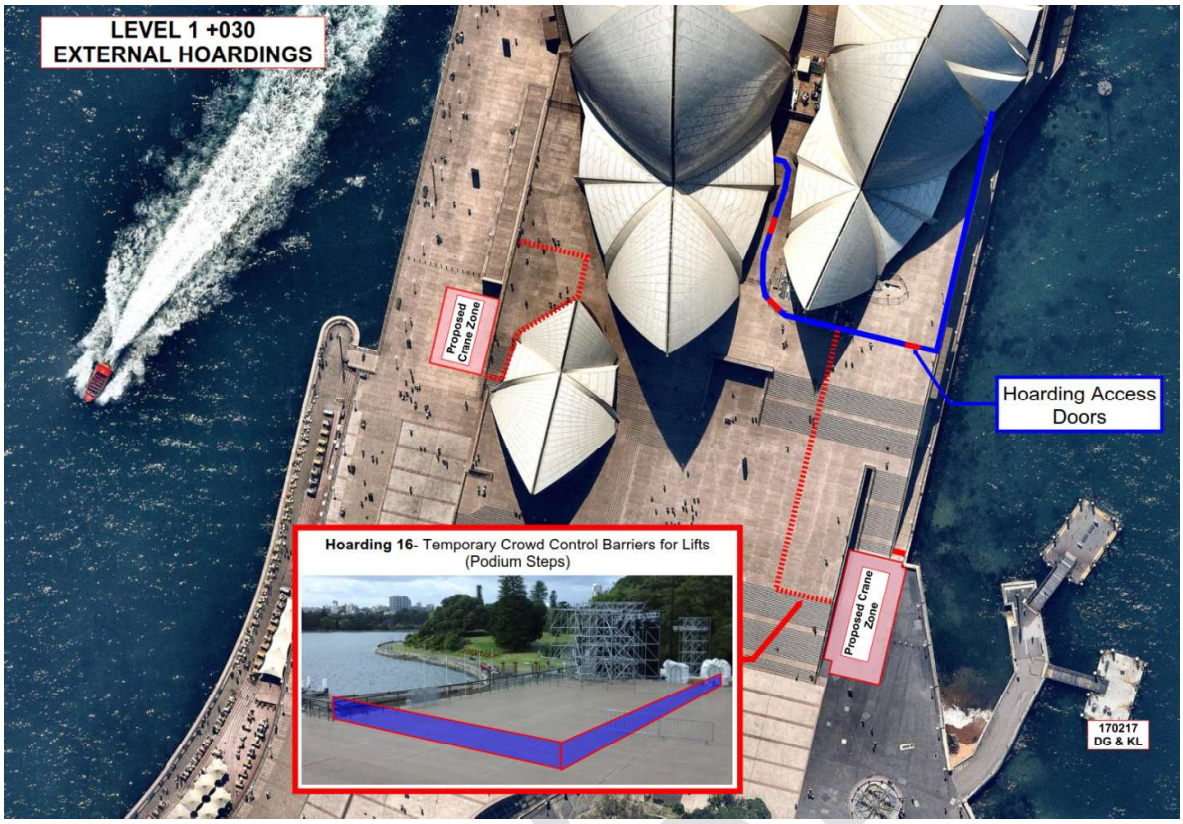


Figure 24- Level 1 Hoardings

Hoarding 16- Temporary Crowd Barriers for Lifts (Podium Steps)

During cranage on either the Eastern or Western Sides, protective areas will be required to be set up to ensure that no lifting above people's heads will occur. This protection has been allowed for in the form of temporary metal crowd control barriers, as are currently frequently used by SOH, to delineate areas externally. These will be mobilised as required.

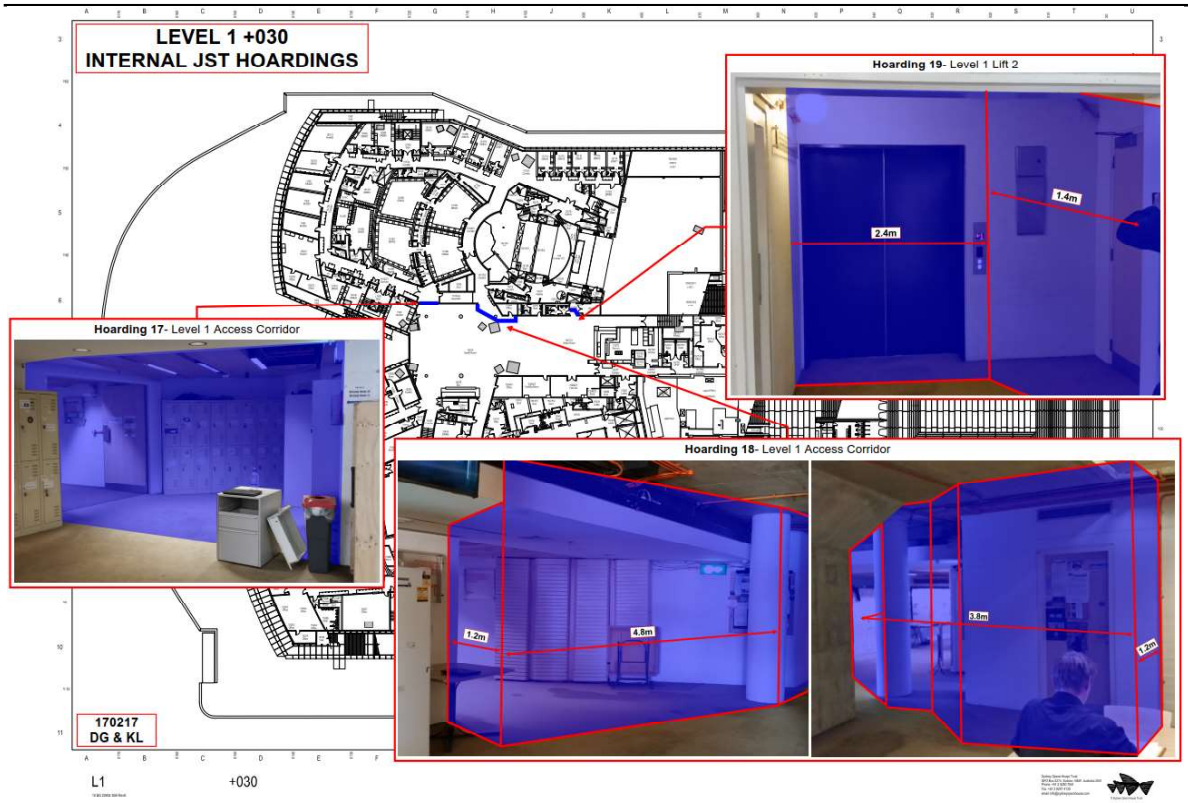


Figure 25- Level 1 Hoardings 2

Hoarding 17- 1513C/1 Access Corridor

Greenroom cafeteria and Lounge area will remain operational during construction works; servicing actors all support staff as well as various SOH operations staff. Located on level 1, roughly in the centreline of the Opera House it will be directly adjacent to any JST works to be undertaken. As such, public access to the construction site will be restricted. An 'A' class hoarding will be required at the entrance to corridor 1513/C from the Greenroom. A double door will be required for access as required as well as air grilles for smoke relief. Hoarding will be acoustically rated to minimise noise dispersion into a sensitive stakeholder area.

Hoarding 18- 1513D/2 Access Corridor

Specification and context similar to Hoarding 19, Pedestrian Access to 1513D/2 Access Corridor will be restricted through an 'A' class hoarding.

Hoarding 19- Lift 2 (Level 1)

Existing Level 1 Lift 2 Doors and part of Lobby 1524H will be required to be hoarded off by 'A' class hoarding. Access to Lift 2 must be restricted as it location in Level 2 opens out into the JST construction works. Hence, public use of the lift must be restricted. In addition, Stairs L1S50 lead up to JST Stage and access to these must also be restricted. Hoarding line should allow the lift and stairs to be accessed by construction workers but still allow the public to use the female toilets adjacent to Lift 2.

4.1.7.3 Level 2

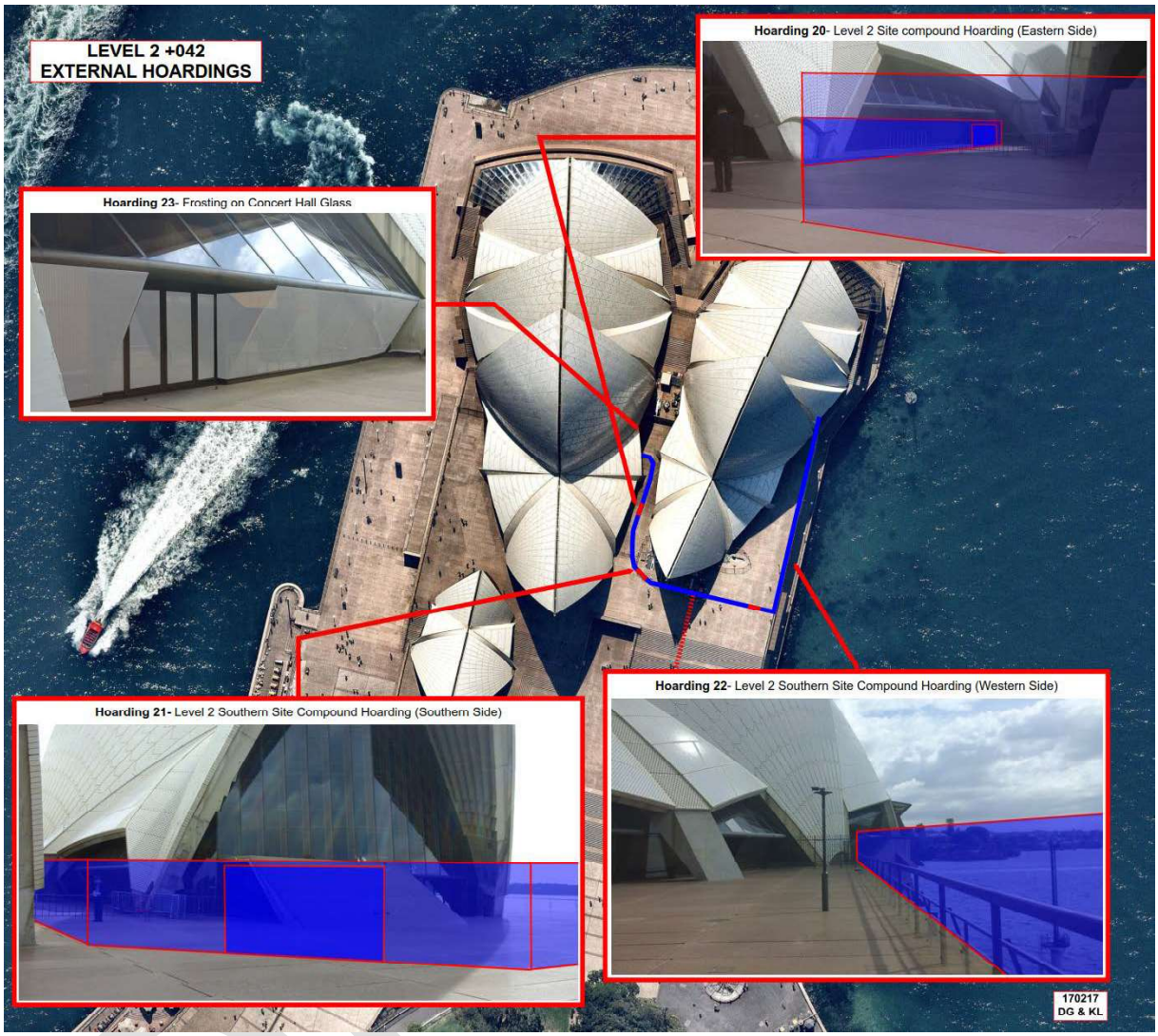


Figure 26- Level 2 Hoardings

Hoarding 20/ 21/ 22- Level 2 External Site Compound Hoardings

On the external Level 2 landing immediately south of the JST Sails, a site compound has been proposed to be set out. This area may act as a cranage landing area, handling area, storage area or even host site sheds. 'A' class hoardings will be erected to delineate the site from general public. Three double doors will be installed along the Western, South Western and Southern face of the hoarding to allow access as required. Due to the very public location, these hoardings will also provide privacy within the compound.

Hoarding 23- Frosting on Concert Hall Glass

Glass panels on the Western JST Corridor windows will require an adhesive 'frosting' hoarding. This will provide privacy to site from the operational eastern Concert Hall corridor during construction works. Frosting will be able to be removed as required. It is estimated a total of 3 to 4 glass panels are required to be frosted.

4.1.7.4 Entry Foyer- Level 1(All Stages)

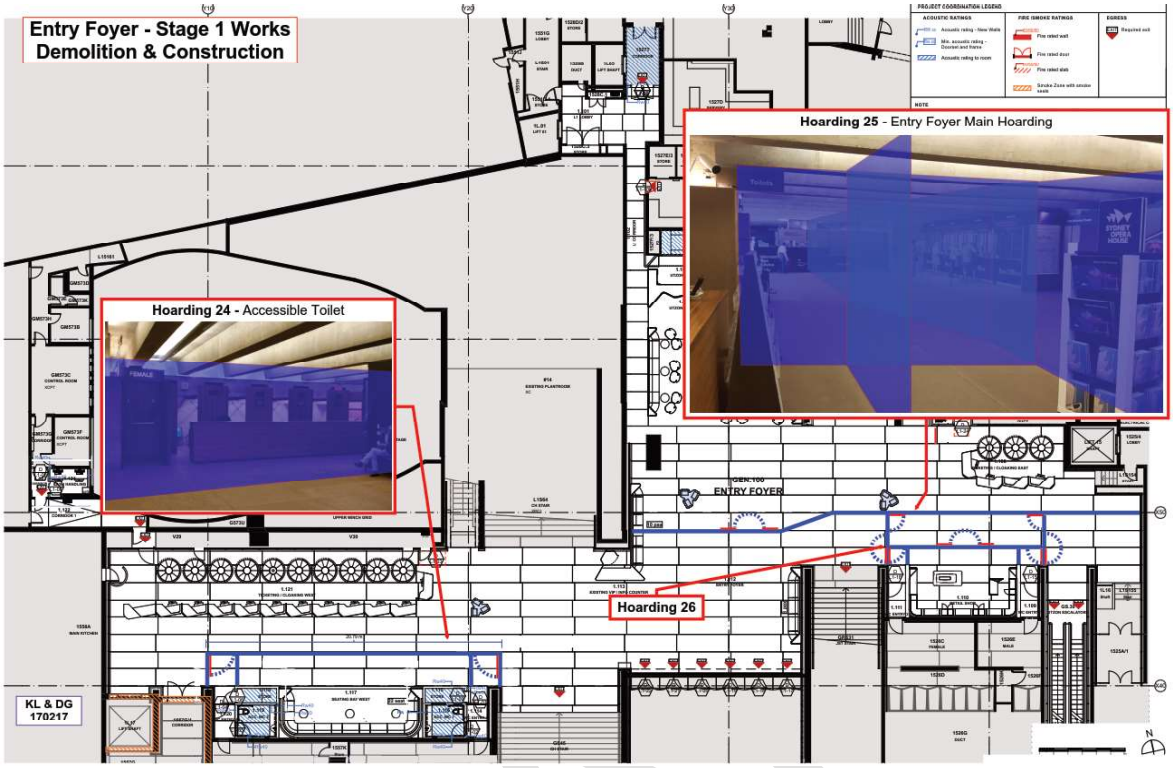


Figure 27- Entry Foyer Hoardings

Hoarding 24- Stage 1 Entry Foyer Accessible Toilets

On the Western Side of the Entry Foyer at existing 1557B Cloak Room, two accessible toilets will be constructed as part of Entry Foyer works. This will occur whilst the Entry Foyer is operational and open to the public. As such, 'A' class hoarding will be required to delineate and protect the public from construction works. Public Access through to the existing toilets will be retained, through the provision of throughput walkways and single doors as shown in the mark up above. This will allow access to existing facilities whilst simultaneously providing a delineated localised compound area.

Hoarding 25 and 26- Entry Foyer Main Hoardings

The Eastern side of Entry Foyer (1527P and 1526A) will be hoarded off as part of the Stage 2A works. This will provide site delineation, space and protection for the public from the Utzon Lounge works, new retail area and new cloaking area. The unique layout as shown in the figure above is to facilitate constraints in both restricting public access to localised construction works whilst maintain public throughput access to the Utzon Room. Double doors on the West and East sides will open to allow public access through and can be shut as required when work to the new lounge and cloaking area is required.

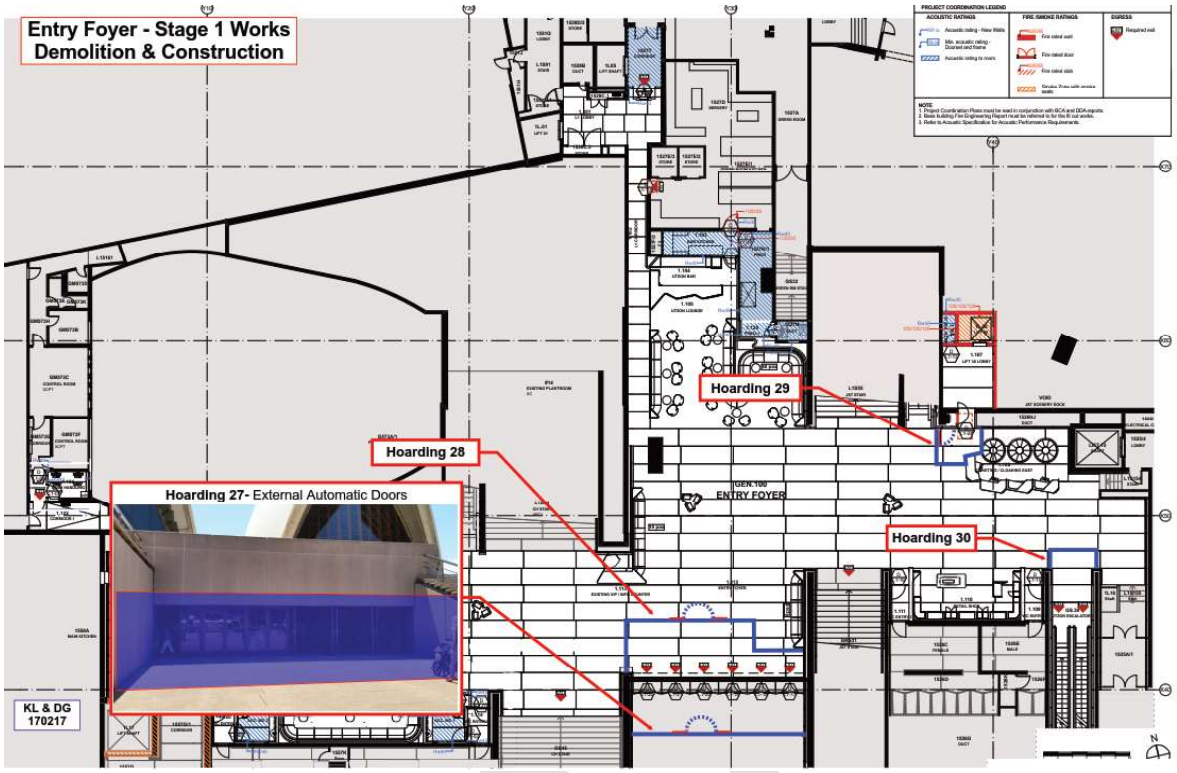


Figure 28- Entry Foyer Hoardings 2

Hoarding 27- External Automatic Doors

A hoarding is required to restrict public access from the Level 1 outside Podium into the Entry Foyer through the existing doors. This is due to work to convert the existing doors to automatic doors. The hoarding will be mesh panel fencing with concrete bases, which may be replaced by plywood hoarding if required. Access through this hoarding will be provided to allow access to the compound.

Hoarding 28

An internal hoarding to restrict public access from the Entry Foyer to the revolving door works as described in Hoarding 27 is required. As before, the hoarding will be mesh panel fencing with concrete bases, which may be replaced by plywood hoarding if required. Access through this hoarding will be provided to allow access to the compound.

Hoarding 29

Level 1 Lift 36 lobby which does not currently exist will be constructed (bondek slab construction) and as such access and protection to this works is required. The hoarding will be A class full height hoarding.

Hoarding 30

An 'A' class hoarding will be required to restrict general pedestrian access to the Utzon Stair escalator works. Hoarding will require a double door for access as required.

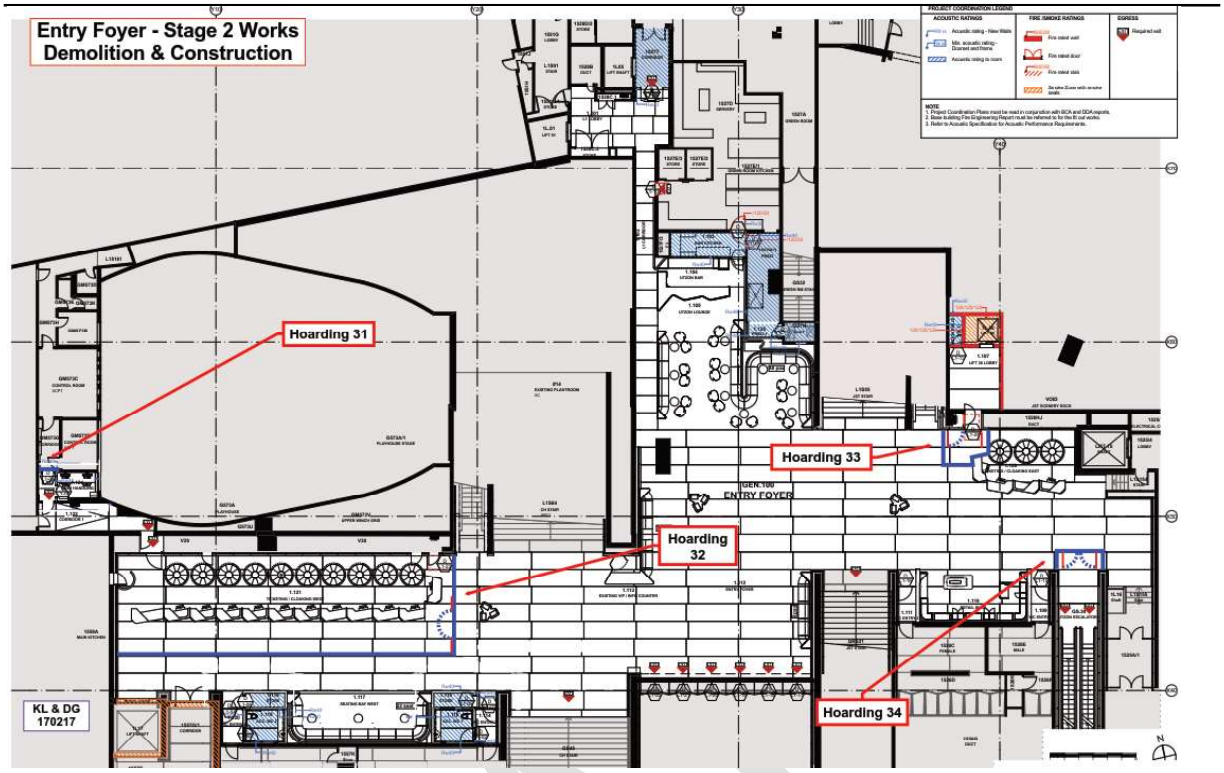


Figure 29- Entry Foyer Hoardings 3

Hoarding 31

Control Room GM573F will be refurbished into a cash handling room. In order to restrict SOH operations staff access from operational areas to the north of the construction site, an 'A' class hoarding to existing door between Control Room GM573C and GM573G will be required. It may be possible to seal off the existing door. This will also serve to restrict access into corridor V29 to seal off to access into the New Cloaking Construction Area. Appropriate protection to the heritage precast door and sufficient sealing to prevent dust travelling is required.

Hoarding 32

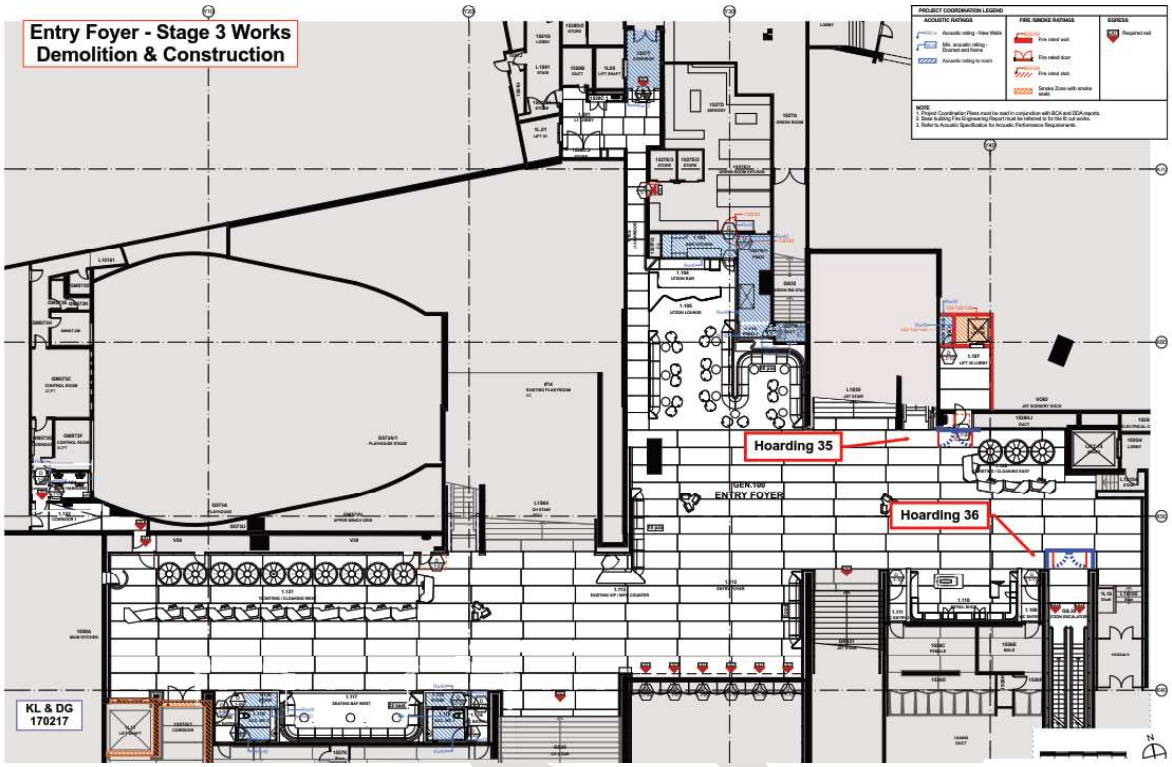
The new cloaking/ ticketing area will be refurbished from an existing lounge. This will occur whilst adjacent to a functional and public entry foyer. To delineate the construction works from general public area, the erection of an 'A' class hoarding is required. A double door will be installed to allow materials handling and access as required. The hoarding and door will be sealed to minimise the spread of dust into adjacent public area.

Hoarding 33

Refer hoarding 29, this is the designation given to the Stage 2 hoarding. Reconstruction may not be required.

Hoarding 34

Refer hoarding 30, this is the designation given to the Stage 2 hoarding. Reconstruction may not be required.



Hoarding 35

Modification to Hoarding 29 due to ongoing Level 1 Lift 36 lobby works whilst the rest of the Entry Foyer has been completed and opened to the public.

Hoarding 36

Refer hoarding 30, this is the designation given to the Stage 3 hoarding. Reconstruction may not be required.

4.1.7.5 Lift 36 Hoardings

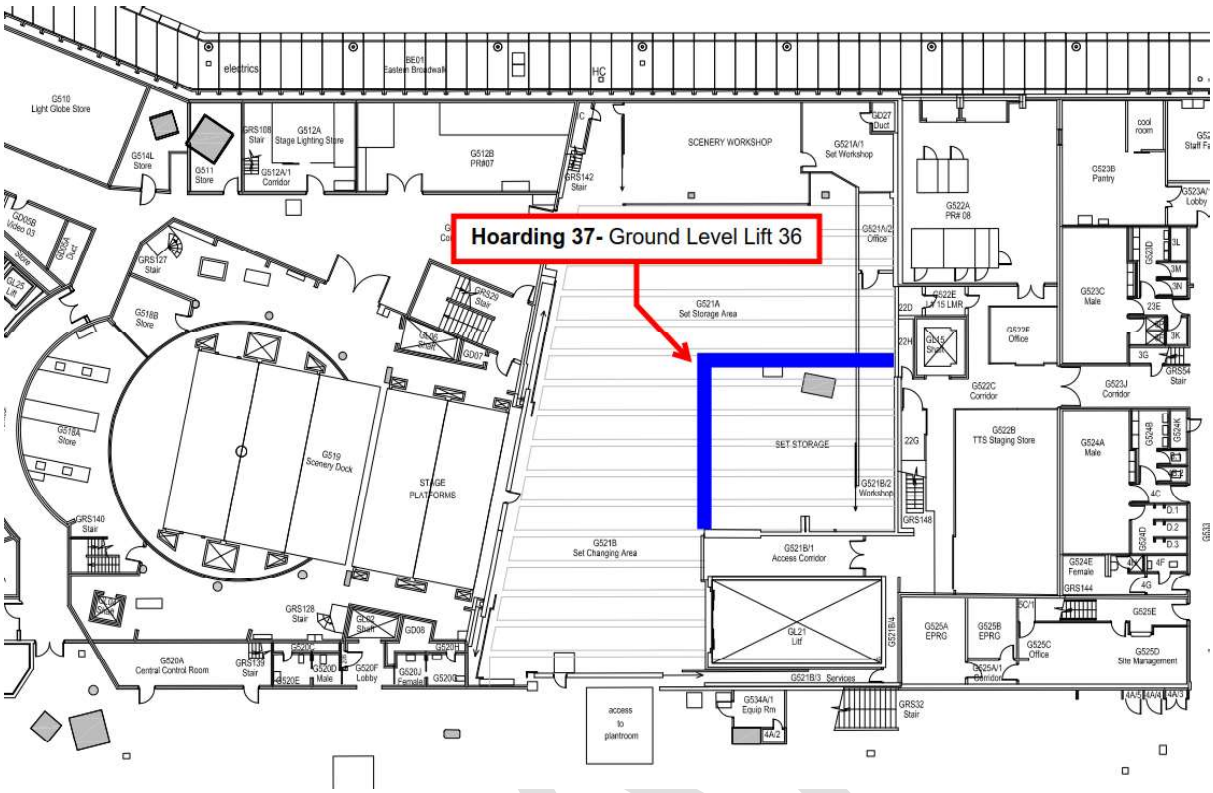


Figure 30- Lift 36 Hoardings

Hoarding 37- Ground Level Lift 36

For construction and excavation of Lift 36 pit, shaft and lift machinery, protection for the workers within the JST construction site from excavator, operating machinery and excavation will be achieved through the erection of an 'A' class hoarding. It is imagined that this will be mesh panel fencing with concrete bases during demolition but will require e neat cool room panel hoarding during final construction.

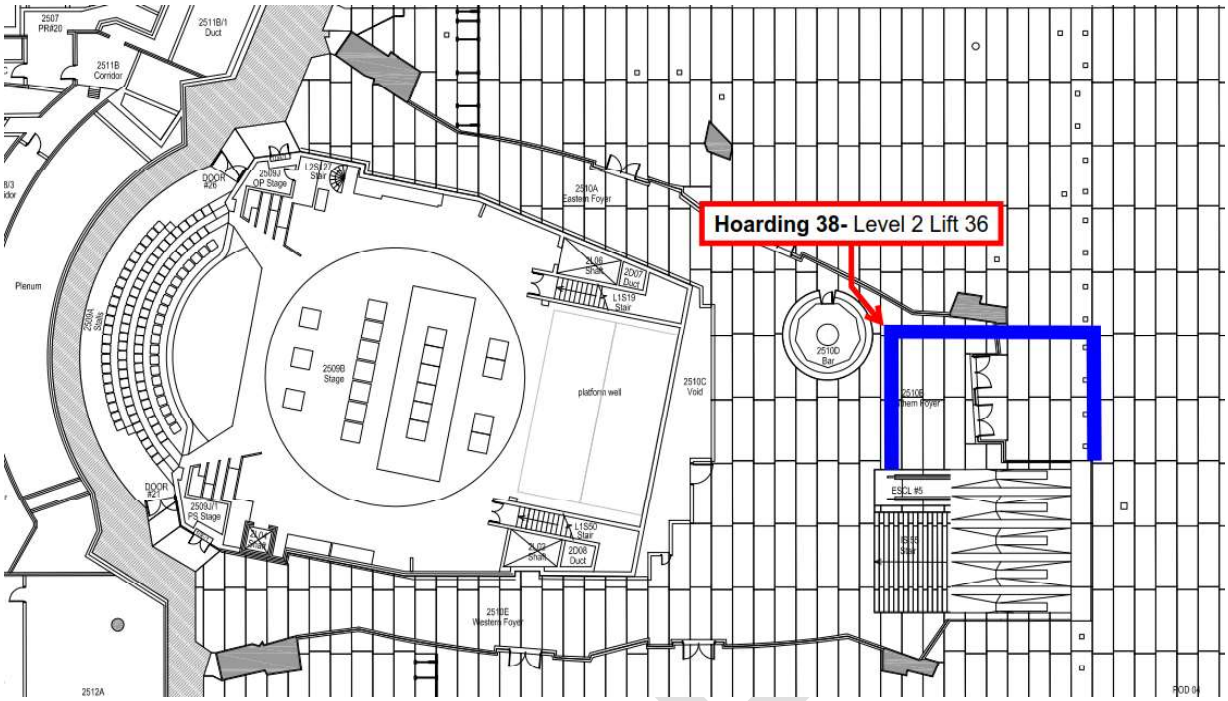


Figure 31- Lift 31 Hoardings 2

Hoarding 38- Level 2 Lift 36

For construction and excavation of Lift 36 pit, shaft and lift machinery, protection for the workers within the JST construction site from excavator, other operating machinery and excavation will be achieved through the erection of an 'A' class hoarding It is imagined that this will be mesh panel fencing with concrete bases during demolition but will require e neat cool room panel hoarding during final construction.