



ATTACHMENT D2

Responses to National and World Heritage Recommendations Raised in Heritage Council

Submission 20 February 2019

PART 2 – ASSESSMENT OF MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (NES) UNDER THE EPBC ACT 1999

Summary of Impacts

- 15.1 The proposed action will impact on Matters of NES in both a positive and negative way. The positive impacts arise from the provision of equitable access to the Concert Hall and surrounding Foyers of the SOH and upgrades which improve its use as a premier performance venue. These impacts strengthen some intangible values and therefore have a positive impact on some Matters of NES.
- 15.2 However, to achieve the positive impacts, the proposed action includes some detrimental impacts on values. There are visual, spatial and physical adverse impacts on some Matters of NES arising from the loss of original building fabric, some alterations to original building fabric and the introduction of new building fabric.
- 15.3 Where there are some positive and some negative impacts on values, it is important to consider all of the values. The Burra Charter article 5.1 states

'Conservation of a place should identify and take into consideration all aspects of cultural and natural significance without unwarranted emphasis on any one value at the expense of others'.

The Summary Assessment of Impacts included in Appendix A of the Sydney Opera House Concert Hall and Creative Learning Centre Renewal Projects Heritage Impact Statement (HIS), should be revised to assess against all of the identified heritage values.

SOH Response

The Summary Assessment of Impacts Tables have been revised in consultation with Heritage Council representatives and members of the Heritage Division and included at Attachment C.

- 15.4 The 2011 ICOMOS Guidance on Heritage Impact Assessments notes that the cumulative effect of separate impacts should also be considered. The cumulative impacts of the works to the Concert Hall and Creative Learning Centre need to be assessed as part of the overall SOH Building Renewal Program, including works nearing completion for the Joan Sutherland Theatre Accessibility and Additional Works and Front of House Works. Inspection of these works has also informed the assessment of the proposed action for the Concert Hall and Creative Learning Centre.

SOH Response

The Summary Assessment of Impacts Tables have been revised and are included at Attachment C.

- 15.5 Finally, in accordance with the Conservation Management Plan's Policy 20.14, these substantial changes to the SOH should be reported to the World Heritage Committee.

SOH Response

The SOH will provide a report to the World Heritage Committee (WHC), through the Department of the Environment and Energy (DEE), in line with periodic reporting obligations against the World Heritage Convention and DEE's quarterly reports to the WHC on 'controlled actions' under the EPBC Act. SOH will consult with DEE as to whether a further standalone report should be provided by SOH to the WHC in addition to the above reporting.

Four components of the action

15.6 The action and associated impacts on Matters of NES are discussed as four components as detailed in Part 1.

- Concert Hall Accessibility Works
- Concert Hall Acoustic Works
- Concert Hall Functional Works
- Creative Learning Centre

15.7 The aspects of the action with the greatest adverse impacts are the:

- provision of a passageway cut through the existing stairs of the Eastern Side Foyer of the Concert Hall
- provision of two lifts in the Northern Foyer
- Western Podium exhaust hood
- introduction of new acoustic treatments within the Concert Hall.

Mitigation measures and feasible alternatives to be investigated further

15.8 To ensure that the action does not have an unacceptable impact on Matters of NES, the proponent has nominated some mitigation measures in the HIS.

15.9 Some feasible alternatives to aspects of the action or areas where further investigation is required have been identified through the assessment process. Their likely impact on Matters of NES deserve further consideration to reduce negative impacts on values as far as possible. The key ones are summarised below.

Removal of original fabric

15.10 The action includes the removal of some original fabric. Removed fabric should be retained and reused where possible to retain the consistency of the design regime in accordance with the CMP.

SOH Response

As with previous works at SOH, all removed material is salvaged and reused wherever possible, unless it has been identified for archival storage – requiring it to be carefully stored for future interpretation or potential reinstatement. It is an important principle for new works at SOH that new materials and finishes match as closely as possible and various techniques and materials have been tried and tested in earlier works to achieve this. These will be implemented in the proposed Concert Hall and Creative Learning Centre projects.

New fabric

15.11 Any new fabric should be installed in a way which promotes flexibility and reversibility. This is particularly applicable for equipment being installed which may become redundant due to future technology. It should be capable of removal with minimal further impact on original

fabric. This should also include the option of reinstatement of original fabric and the uncluttered experience of the space in the future.

SOH Response

The SOH commits to complying with this recommendation.

Where appropriate, removed original fabric will always be reused in the first instance, stored for potential future reuse or reinstatement, and only disposed of when damaged or worn beyond repair. Some of the proposed new equipment will be able to be removed with minimal further impact on original fabric, for example the proposed over-stage reflectors, speakers and lighting.

A summary of reversibility of the proposed works is provided at Attachment B.

- 15.12 Given the requirement for cohesiveness of the whole experience, the CMP and the Utzon Design Principles recommend carefully matching the materials and finishes when introducing new fabric, as well as reusing original fabric whenever possible.

SOH Response

The SOH commits to complying with this recommendation to carefully match materials and finishes when introducing new fabric and reusing original fabric where possible. This includes, but is not limited to:

- *Concrete finishes (see response to 3.20 in Part 1 and the covering letter);*
- *Stair treads, where new treads need to be fabricated (see response to 3.19 in Part 1);*
- *New fixtures and fittings, such as cubicles and dressing room fitouts, where required;*
- *New architectural hardware, where required; and*
- *New seating where replacement is necessary.*

SOH will reuse original fabric wherever possible as part of the proposed works, and ensure that significant elements are stored for potential future reinstatement.

Other elements that are unable to be reused but have been identified by SOH's heritage consultant/architect as significant will be archived as part of the SOH collection and carefully stored for future interpretation e.g. select pieces of theatre machinery.

Promote understanding of changes

- 15.13 It is particularly important that the process of change at the SOH can be understood by the public. Both the HIS and Part 1 support that approach. It is therefore essential that the narrative of changes is available to the public. In some cases, it is necessary that original fittings and fabric of significance, made redundant by technology, can still be appreciated and contribute to that story of change.

SOH Response

The SOH commits to interpreting the process of change at the SOH and has developed a Renewal Interpretation Strategy (RIS) to support this storytelling. SOH proposes to update the RIS to ensure it adequately incorporates the Concert Hall and Creative Learning Centre works. The SOH is also developing a Heritage Action Plan, a requirement of the CMP4, which will include a commitment to developing an overarching interpretation strategy for the site that shares with the community the process of change at SOH. The SOH incorporates interpretation into many channels, onsite and online, including: tours (attended by over 500,000 local and international visitors each year); the SOH website; social media channels; onsite exhibitions; extensive exhibits on the SOH's Google Cultural Institute site; hoardings during construction works and broader creative and communications initiatives. Original fittings and fabrics of significance are stored and/or documented for archival purposes and SOH will continue to ensure that the community continues to understand and appreciate their place in the SOH's history and heritage significance.

- 15.14 Consistent with Condition 4 of the Commonwealth approval for the SOH Building Renewal Program - Safety, Accessibility and Venue Enhancements (EPBC 2016/7825), the five (5) year Heritage Interpretation Strategy for the interpretation of the architectural history of the SOH and its World and National Heritage values should be amended to include the Concert Hall works.

SOH Response

The Renewal Interpretation Strategy, 2017 (RIS) provides the framework for the interpretation of all Stage 1 Renewal Projects through the themes and audiences addressed in the document. As recommended, the SOH will revise the RIS to include the Concert Hall and Creative Learning Centre projects.

- 15.15 Updating of the Conservation Management Plan to reflect the significant changes to the spaces, forms, fabric and materials of the SOH provides one record of change. This provides an enduring record which complements the public story.

SOH Response

The SOH will update the CMP after the completion of the works, as recommended.

Avoiding visual clutter

- 15.16 The substantial amount of new acoustic and amplified equipment and elements will create visual clutter compared to the current arrangement. In the *Utzon Design Principles*, Utzon made several references to avoiding visual clutter, although not specifically addressing the Concert Hall. Inclusion in the automated settings for the Concert Hall of an 'at rest' setting which results in the new acoustic and amplified equipment being hidden as much as possible will allow appreciation of the Concert Hall in as original as possible state. It will provide increased opportunity for views to significant Peter Hall designed elements as close as possible to the original configuration.

SOH Response

As noted in the covering letter, and in response to sections 4.14, 4.29, 4.37 and 16.2.17, SOH agrees to develop an 'at rest' mode.

Renders of this configuration are included in Attachment E.

- *Drawing ARM-SK-9226 shows the view from seat position Row N Seat 25 in the Upper Circle.*

- *Drawing ARM-SK-9227 shows the view from seat position Row X Seat 25 in the Stalls.*
- *Drawing ARM-SK-9228 shows the view from Seat 10 in Box A.*
- *Drawing ARM-SK-9229 shows the view from seat position Row C Seat 40 in the Circle.*

Further review and research

- 15.17 There are some actions where further review may have the potential for change to reduce negative impacts. These have been outlined in Part 1, with many of them to be addressed as part of the Section 60 stage application under the Heritage Act 1977.

SOH Response

As discussed in the response to Part 1, the following components of the project have been deleted:

- *the relocation of Plantroom 17 (however the existing plant in the location will be replaced with smaller plant);*
- *the insertion of an exhaust hood in the Western podium façade;*
- *the insertion of Lift 29 in the Northern Foyer of the Concert Hall; and*
- *the demolition of two women's cubicles at Level 3 of the Concert Hall Northern Foyer.*

As discussed in the response to Part 1, the following components of the project will be subject to further design refinement and will be addressed as part of the Section 60 application under the Heritage Act 1977:

- *the use of bronze panelling in the Caves area;*
- *the final colour and design of the over-stage reflectors;*
- *the final detail design of the laminated brushbox panels;*
- *details of the construction methodology for the sidewall reflector panels;*
- *details of the construction methodology for the acoustic drape mechanisms;*
- *details of the final speaker system to be deployed;*
- *details of the penetrations in the Concert Hall ceiling; and*
- *final finishes to be used in the anteroom and orchestra assembly room.*

As discussed in the response to Part 1, the approach to concrete finishes will have the SOH work with its Heritage Architect and an experienced concrete expert to ensure that new finishes appropriately match the existing in form and finish.

Concrete finish benchmarks will be prepared and subject to the endorsement of the Heritage Architect, in consultation with the Design Advisory Panel (DAP), Conservation Council (CC) and Heritage Council delegate.

- 15.18 Further research is required to assess the significance of some elements potentially being impacted prior to approval of actions which impact on them. This assessment must be undertaken prior to the removal of any items to ensure appropriate action is taken in regard to recognition and recording of significant fabric and engineering solutions of the time. In addition, archival recording must be undertaken prior to removal, with the equipment in situ to record the full ensemble of parts.

SOH Response

As discussed in the response to Part 1, and similar to the approach taken with the Theatre Machinery Project in the Joan Sutherland Theatre the following approach will be taken with respect to significant elements: the SOH will undertake a significance assessment of the mechanical equipment and machinery by a qualified heritage expert/heritage architect prior to its removal, and where appropriate, significant pieces will be recorded, removed and accessioned into the collection and/or recorded to archives and deaccessioned. An archival recording of mechanical equipment and machinery will be undertaken prior to removal. This approach will specifically be taken with respect to theatre equipment (including the current over-stage acrylic reflectors and associated equipment), and air conditioning plant.

Conclusion

- 15.19 Subject to the recommendations within the HIS and Part 1, in general the action is considered to have an acceptable impact on Matters of NES.
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16.0 DISCUSSION OF THE IMPACTS ON MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE OF EACH OF THE FOUR COMPONENTS OF THE ACTION

16.1 Part of action: Concert Hall Accessibility Works

Relevant impacts of the action

- 16.1.1 The action and the relevant impacts of the action for the Concert Hall accessibility works are described in S 3.0 of Part 1.

Matters of NES affected by the action

- 16.1.2 World Heritage values – Authenticity (form and function) and integrity
- 16.1.3 National Heritage values – Criterion A (Events, Processes), Criterion E (Aesthetic characteristics), Criterion F (Creative or technical achievement), Criterion G (Social value), Criterion H (Significant people)

Nature and extent of likely impacts on:

(A) the World Heritage values of a World Heritage property

- 16.1.4 The impact is positive in terms of authenticity of function as the works enhance accessibility to public spaces, including the Concert Hall, provide accessible dressing rooms for performers and provide new accessible patron toilet facilities.
- 16.1.5 The negative impacts on authenticity of form and integrity associated with the new handrails, toilets and seating are minor.
- 16.1.6 The works with a substantial negative impact on values and authenticity of form and integrity are:
- the partial demolition of a section of stairs on the Concert Hall Eastern Side Foyer to create a passageway/accessible path of travel to the Caves in the Northern Foyer;
 - the new external exhaust hood on the Western Podium façade resulting from relocation of the plant room; and,
 - two new lifts in the Northern Foyers, including the cutting of the exceptionally significant cranked concrete beams.
- 16.1.7 The negative impacts involve the loss of original designed spaces, the loss of fabric and the introduction of new fabric.

SOH Response

Passageway/accessible path of travel to the Caves - The introduction of the passageway in the Concert Hall Eastern Side Foyer has been proposed as the most suitable means for providing equitable access to all areas of the Concert Hall. When combined with the lift(s) in the Northern Foyer, patrons with restricted access capabilities will be able to enjoy the majestic experience of the Northern Foyer along with additional seating options within the Hall itself.

External exhaust hood on the Western Podium - The SOH has revised the need to relocate Plant Room 17 resulting in the removal of the proposed new external hood on the Western Podium façade. This reduces the potential negative impact on the heritage values and authenticity of the Opera House.

Two new lifts in Northern Foyer - As discussed in the covering letter, the SOH has decided to remove Lift 29 (the lift in the Northern Foyer, on the western side) from the Project.

In relation to the cranked beams, the SOH is committed to retaining as much original fabric in situ as possible.

It should be noted that the demolition proposed does not include six cranked beams at Level 3. There are two sets of cranked beams at each end of the Northern Foyer. One set supports the stairs from Level 2A to Level 3 (Mural Level). Of this set, only two cranked beams are demolished for the construction of a lift. The second set of cranked beams supports the stairs from Level 3A to Level 4, of this set, six beams are demolished for the construction of a lift and the lift access at Level 3A.

The plans that appear to show full sweeps of concrete steps being demolished actually show the carpet being removed only across the full sweep of steps.

The extent of superstructure demolition is shown in the drawings included in Attachment E. 49-BR-ARM01-A0900 DETAIL DEMOLITION SUPERSTRUCTURE PLANS - LIFT 30 (included in Attachment E).

(B) the National Heritage values of a National Heritage place

- 16.1.8 The Concert Hall accessibility works will have a positive impact on the values of Events, Processes (Criterion A) and Social Value (Criterion G) as they strengthen public access to the SOH.
- 16.1.9 They will have a negative impact on the values of Aesthetic characteristics (Criterion E), Creative or technical achievement (Criterion F) and Significant people (Criterion H).
- 16.1.10 Impacts on the Aesthetic characteristics occur in the Eastern Side Foyer and Northern Foyer of the Concert Hall and will detrimentally change the strong aesthetic experienced while moving through these spaces. There is a visual and spatial impact on the flight of stairs in the Eastern Side Foyer from the introduction of the passageway. There is a visual and spatial impact on the outer ends of the broad sweep of steps and cranked concrete beams in the Northern Foyer from the proposed lifts.
- 16.1.11 Other impacts on Aesthetic characteristics and Creative or technical achievement relate to fabric and spaces in the same locations. This includes detrimental changes to eight of the reinforced radial cranked beams in the Northern Foyer (both sides) and the alterations to Peter Hall's external glazing which are both required to accommodate the lifts. Similarly there is an impact on the precast granite plank steps in the Eastern Side Foyer and the Northern Foyer where the existing expanse of stairs is cut for the passageway and entry to the lifts.

- 16.1.12 The introduction of the exhaust hood on the Western Podium façade impacts on the values of Aesthetic characteristics, Creative or technical achievement and Significant people. The solidity of the podium in one of the most highly visible areas is associated with Utzon's innovative design concept.

Conclusions on relevant impacts on Matters of NES

Description of feasible mitigation measures, changes to the action or procedures to prevent or minimise environmental impacts on each relevant Matter of NES proposed by the proponent

- 16.1.13 The proponent suggests that the location and design of the insertions of the passageway and the lifts minimise visual intrusion into the space and avoid interrupting the relationship of the foyer spaces with the harbour setting.
- 16.1.14 The proponent argues that the tangible impacts on fabric must be considered in relation to the substantial improvements in function and accessibility which are intangible values.
- 16.1.15 The proponent generally proposes matching the existing materials and finishes when new elements are introduced as a mitigating measure because it will reduce visual impacts. This is supported. However, it has been observed that there were some issues in achieving a matching appearance between new and existing concrete in the recent alterations to the Joan Sutherland Theatre Side Foyer passageway.

SOH Response

Similar to other Renewal projects, the SOH will work with the SOH Heritage Architect and an experienced concrete expert to ensure that new finishes appropriately match the existing in form and finish.

As per the discussion in the RtS cover letter, concrete finish benchmarks will be prepared and subject to the endorsement of the SOH's Heritage Architect, in consultation with the DAP, CC and NSW Heritage Council delegate.

Description of any feasible alternatives to the action or mitigating measures that have been identified through the assessment process, and their likely impact on Matters of NES

- 16.1.16 There are some actions which should be subject to further review as there is potential for change to reduce negative impacts. These are:
- the need for two lifts within the Northern Foyer (refer S 3.50)
 - the location and size of the new mechanical exhaust hooded external opening into the podium wall (refer S 3.26)
 - the method of installation of handrails, particularly the impacts on precast granite stair treads (refer S 3.33/4)
 - the extent of demolition within the Northern Foyer to ensure that as much original fabric is retained in situ as possible (S 3.51)
 - the proposed detail of the extension of the cranked beams to the new lift to ensure the design does not disrupt the aesthetic qualities of the distinctive line of crank points in the beams (S 3.53)

SOH Response

A review of some actions to examine the potential for changes to reduce negative impacts to National and World heritage values:

1. The need for two lifts within the Northern Foyer

As discussed in the SOH response to paragraph 3.50 and 16.1.7, the SOH has proposed to remove Lift 29 from the proposed works.

The proposed lift 30 has been designed to minimise and mitigate heritage impacts through detailed information relating to the materials, colours, design of handrails, wall cladding and construction methodology.

The HIS at Section 9.3 considers the impact of the accessibility components of the Concert Hall project on National Heritage values of the SOH, and it notes that:

“While acknowledging there will be some negative impacts to significant fabric and spaces arising from the Concert Hall Renewal project in regard to introduction of Lifts 29 and 30 and the consequent cutting of a number of the significant cranked beams in the Northern foyer, the cutting and diminished width of the stairs in the Eastern side foyer resulting from the new passageway at Level 2, and the acoustic upgrades within the Concert Hall auditorium, the overall impact of this project will be positive.

With these insertions, the experience of these spaces, their power and grandeur, will be available to people who may never have been able to access them before. This is completely in line with Utzon’s original concepts, and the identified National Values.

The improved functionality and accessibility of the Concert Hall and its foyers, will potentially enhance the reputation and ability of the Sydney Opera House to attract national and international visitors, patrons and performers.”

The HIS at Section 10.1 considers the impact of the Concert Hall project on the World Heritage values of the SOH, and it notes the following:

“Many components of the Concert Hall Renewal Project will greatly improve access to the Concert Hall side of the Opera House to a wider section of society, both performers and patrons – particularly those with reduced mobility, many of whom will never have experienced some of these spaces before. These accessibility upgrades, including the eastern passageway and Lifts 29 and 30, require some alterations to exceptionally significant spaces and will have a substantial impact on components of their fabric. However these impacts must be considered in relation to the substantial accessibility benefits offered by these changes for both performers and patrons. The carefully considered design, configuration and placement of these new facilities retains and respects Utzon’s intent and design regime for these spaces and will not adversely affect the OUV that underpins its World Heritage Listing.

Details throughout this project have been resolved to a consistent language and very high quality and comply with the Utzon Design Principles and the CMP 4th edition. This design development process has been reviewed by means of regular ‘design consistency’ workshops, attended by the SOH heritage architect and members of the Eminent Architects Panel and Conservation Council.

The Concert Hall renewal project will enhance the patron experience, performance and operational capability of the Sydney Opera House to continue to host and celebrate world standard performance art. In this respect, this proposal will help sustain the iconic international standing of this Opera House – a key part of its OUV.

In conclusion, it is considered the proposed works in this Concert Hall Renewal Project will be consistent with and respect Utzon’s vision for the place and Peter Hall’s highly significant contribution to its completion. The works substantially improve the functionality and accessibility of the foyer spaces and the Concert Hall itself. They will also substantially improve its acoustic performance, and together, improve its ability to ‘function as a world-class performing arts centre’.

The impacts of these works are significant but will be ultimately positive and not threaten or diminish the Outstanding Universal Value that enshrines Sydney Opera House on the World Heritage List."

Considering the above assessment, if the SOH only constructs Lift 30, then to the extent that there is any adverse impact on a matter of national environmental significance (MNES), then this impact would be lessened. It should be emphasised however, that the HIS assessment concludes that the proposed introduction of two lifts respects the National Heritage values of the SOH and does not diminish the Outstanding Universal Value that enshrines SOH on the World Heritage List.]

2. The location and size of the new mechanical exhaust hooded external opening into the podium wall

This action has been changed to reduce negative impacts on national heritage values.

As discussed in the SOH response to paragraph 3.26 and 16.1.7, the SOH has revised the need to relocate Plant Room 17 and the introduction of the new external exhaust hood on the Western Podium façade. This work is no longer proposed to be included in the scope of the project.

The SOH will undertake a significance assessment of the air conditioning equipment prior to its removal, and where appropriate, significant pieces will be removed and securely archived. An archival recording will also be prepared.

The air conditioning plant in Plantroom 17 is an Air Handling Unit, which comprises a fan, cooling coils, walls, pipework and controls. The walls are constructed of Cliplok and Rockwool. The cooling coils, pipework and controls have all been replaced in the last fifteen years. The fan is a Howden proprietary fan that is still commercially available, one of 55 similar units throughout the SOH.

Due to the constricted nature of the location, the A/C plant and equipment will need to be broken down as the equipment would not be able to be extracted intact. The materials will be sent for recycling.

Given the above, it is considered that this alternate design does not result in any impact on the National or World Heritage values of the SOH, and hence no adverse impact on a MNES.

3. The method of installation of handrails, particularly the impacts on precast granite stair treads

The HIS (Section 7.2.2.2, p.43) notes the following in regard to the installation of these handrails

"Additional handrails are proposed in the side foyers to assist those who find the stairs difficult. These are as visually minimal as possible and follow the suite of profiles and details developed for eventual application across the site. On the east side, this additional handrail is only required between Levels 3 and 4 as there will be handrails surrounding the new Level 2 passage. These additional handrails will have moderate visual impact, but are considered of great benefit for the comfort of patrons."

The method of installation will require suitable engineered fixings to ensure compliance with the National Construction Code. The proposal will have some limited impact on the fabric of the stair treads and the aesthetic values of the space but these are considered minimal and acceptable due to their sensitive and open design. Consistent with the discussion above regarding the accessibility impacts of the Northern Foyer lift, the introduction of these handrails will not adversely impact the National or World Heritage values of the SOH, and hence will not have an adverse impact on a MNES.

4. The extent of demolition within the Northern Foyer to ensure that as much original fabric is retained in situ as possible

The removal of Lift 29 significantly reduces the extent of demolition within the Northern Foyer. The demolition proposed to construct Lift 30 is considered to be the minimal amount of demolition necessary to allow for the construction of the lift. Where possible, original fabric will be retained or modified in preference to demolition or removal.

As discussed above, the construction of Lift 30 is respectful of the National Heritage values of the SOH, nor will it diminish the Outstanding Universal Value for which the SOH is enshrined on the World Heritage list.

5. The proposed detail of the extension of the cranked beams to the new lift to ensure the design does not disrupt the aesthetic qualities of the distinctive line of crank points in the beams

The relevant extract from the HIS is provided below. This should now be read in the knowledge that Lift 29 has been removed from scope, reducing the impact on the cranked beams and retaining in whole the aesthetic qualities of the distinctive line of crank points in the beams on the western side of the Northern Foyer:

"The fabric of the cranked concrete beams towards the east and west ends of the Northern Foyer will be adversely affected by the insertion of Lifts 29 and 30. However, the remaining large sweep of these exceptional finely finished beams across the space will remain uninterrupted and unaffected. These beams represent the engineering genius of Ove Arup & Partners and the skilled craftsmanship of the builders for Stage 1 – Civil & Civic. Hornibrook were the builders for stages 2 and 3.

The original configuration, materials, colour and finish of these beams will be respected in the proposed changes to these beams. The new or changed work will retain the original line of direction changes in the beams, with new configurations stepping back from these." (Section 7.1)

"Lifts 29 and 30 do cut through a number of the original radial cranked beams – total of 2 on Level 2-3 and 6 on Level 3A-4 for each lift. The splayed cut through the granite stairs for the landing on Level 3A results in the cutting of additional beams (included in the above figures) but does provide a better visual result in that there is less interruption and reduction to the broad sweep of stairs at each end. The beams between the lift and the outer wall have to be modified anyway to carry the loads from the lift shaft area. The crease line in the beams is retained on the underside to minimise visual impacts and retain the sense of the full extent of the structure. Insertion of these lifts result in very high but acceptable impacts given the substantial benefits to accessibility and patron amenity." (Section 7.2.3.2)

As discussed above, the construction of Lift 30 is respectful of the National Heritage values of the SOH, and will not diminish the Outstanding Universal Value for which the SOH is enshrined on the World Heritage list.

16.1.17 There are some elements which require further research to assess their significance. A good understanding of their significance is needed prior to decision-making about actions which may impact on them. These are:

- Mechanical equipment and machinery while it is in situ (refer S 3.27)
- the number of Peter Hall public toilet facilities, including the value of their fixtures and finishes, so that there is a better understanding of the impact of the potential loss of some amenities (S 3.61 and S 3.69)

SOH Response

Mechanical equipment and machinery while it is in situ

The proposed modifications to Concert Hall existing equipment and machinery will not adversely impact on the National or World Heritage values of the SOH.

The CMP4 is the principal management plan by which the SOH upholds and protects the State, National and World Heritage values of the place. CMP4 includes Policy 13.2 Machinery and equipment.

The HIS has assessed compliance with CMP4, and specifically Policy 13.2 at Section 7.2.2.7 (NB. The HIS incorrectly referenced this policy as 12.2, the correct number is 13.2):

“Much of the existing machinery and equipment associated with the Concert Hall dates from the original installation in the early 1970s. With technological advancements, including the change to digital systems, and changes to operational safety standards, this equipment is approaching the end of its life and requires replacement. If it is not replaced, safety and other compliance issues will remain and the efficient operation and management of the Concert Hall as a venue will be hindered. In order to continue its use and strengthen its reputation as the major auditorium in Australia’s pre-eminent performing arts centre, (key aspects of its significance), this machinery and equipment needs to be replaced and updated.

A full heritage assessment of existing machinery and equipment in the Concert Hall will be undertaken, and any significant pieces identified. The process outlined in this policy was carried out for the recent Theatre Machinery Project in the Joan Sutherland Theatre where the machinery was fully documented before decommissioning and selected significant pieces removed and archived as part of the Opera House collection. It is proposed this same process will be employed for the Concert Hall Renewal Project.”

As noted in the response to section 5.35 above, the SOH commits to undertaking the full heritage assessment, archival recording, and archiving of relevant significant items.

With respect to the existing air conditioning plant in Plantroom 17, as noted above, the air conditioning plant in Plantroom 17 is an Air Handling Unit, which comprises a fan, cooling coils, walls, pipework and controls. The walls are constructed of Cliplok and Rockwool. The cooling coils, pipework and controls have all been replaced in the last fifteen years. The fan is a Howden proprietary fan that is still commercially available, one of 55 similar units throughout the SOH.

Due to the constricted nature of the location, the air conditioning plant and equipment will need to be broken down as the equipment would not be able to be extracted intact. The materials will be sent for recycling.

SOH does not consider that the proposed modifications to mechanical equipment and machinery will have adverse impacts on the National or World Heritage values of the SOH.

The number of Peter Hall public toilet facilities, including the value of their fixtures and finishes, so that there is a better understanding of the impact of the potential loss of some amenities

The only original Peter Hall toilets in front-of-house areas are in the Northern Foyers of the JST and Concert Hall. The only ones to have been altered are the JST women’s toilets. All others are as completed in 1972-73. With the removal of the need to relocate the air conditioning plant from Plantroom 17, there is no longer a need to demolish any of the Peter Hall public toilet facilities on Level 3 of the Northern Foyer.

- 16.1.18 The action includes the introduction of bronze panelling on one wall of the new passageway and on the southern wall in the ‘Caves’ area. This treatment introduces a new design aesthetic which will detract from the aesthetic values. A panelling treatment consistent with existing panelling used within the SOH is required to ensure the existing ‘natural’ visually recessive palette of materials and colours is retained and respected (refer to S 3.17 and S 3.55).

SOH Response

With respect to the use of bronze panelling in the passageway, this design element has been considered further by the DAP on two occasions, on 11 April 2018 and 3 June 2019. The DAP has recommended that the eastern wall of the passageway should remain as bronze panels, but subject to some design refinements as compared to the DA submission.

The advice of the DAP from the meeting on 11 April 2019, was as follows:

"The Panel generally supported the approach to bronze cladding as proposed by the architects with the following recommended refinements:

- Reducing the depth of the folds within the bronze cladding panels in the eastern passage and consequently reducing the extent of the black recessive elements between panels.*
- Investigation of the quality of the southern concrete wall within the 'cave' area with a view to deleting the bronze cladding in this location and revealing the concrete.*
- Reposition the junction between the carpet and granite paving at the southern end of the passage to align with the termination of the curtain if there is sufficient depth in the slab.*

"If these refinements are adopted the Panel is prepared to support an amended submission to the Heritage Council in response to their comments.

"The Panel also requested that the scope of works include removal of carpet from columns in the northern foyer."

After receiving this advice, ARM Architects revised the panelling in the passageway in accordance with the DAP's proposal. The position of the junction between the carpet and precast granite pavers in the passageway was also revised. Further investigation of the condition of the southern wall of the Caves has been undertaken, however more work is required to resolve the preferred finish for this wall.

ARM presented its revised designs for the passageway to the DAP at a meeting on 3 June 2019. The Heritage Council was represented at this meeting by Mr Bruce Pettman.

The rationale for the use of bronze panelling in the passageway is predicated on the following key issues:

- The passageway is a "new" unique space within the SOH, with no analogous locations;*
- The passageway is external to the Concert Hall, and the use of brushbox in this space is not supported because of this;*
- The passageway is a created space, with only some pre-existing walls, and therefore new walls need to be constructed; and*
- The appropriate treatment for the walls below the stair treads in the cut through the stairs, is bronze panels, similar to those used near the lift in the JST Northern Foyer, and therefore it is appropriate to continue the bronze panelling into the passageway itself.*

The DAP supported this rationale and confirmed at the meeting on 3 June 2019 that the bronze panelling in the passageway was the appropriate finish.

The changes to the bronze panelling that have been confirmed by the DAP, are shown in the following drawings included in Attachment E:

- The original proposal for the raked bronze panelling, looking northwards, is shown in ARM-SK-9230;*
- The revised proposal for the raked bronze panelling, looking northwards, is shown in ARM-SK-9231;*
- The revised proposal, looking south, is shown in ARM-SK-9232; and*
- The detail of the revised proposal for the rake of the bronze panelling, are shown in ARM-SK-9234, ARM-SK-9235, and ARM-SK-9236.*

As discussed above, ARM Architects also revised the position of the junction between the granite precast paving and the carpet in the passageway, in accordance with the DAP's prior guidance. The original proposal for the junction is shown in ARM-SK-9237, with the revised proposal shown in ARM-SK-9238 and ARM-SK-9239.

The south wall of the Caves is currently formed by a plywood wall, covered in carpet, sitting on a concrete plinth. The plywood wall conceals the following services and equipment: an air-conditioning duct and diffusers, up lighting of the beams, and a fire hydrant pipeline and hose reel. Further investigation of the condition of the concrete wall behind the carpet covered plywood will be undertaken to determine the appropriate final finish for this wall.

At the DAP meeting on 3 June 2019, ARM Architects presented to the DAP some findings of the review of the conditions of the south wall of the Caves. The DAP has supported the further investigation of the condition of the concrete wall and the required services in this area.

The SOH will continue to review the use of bronze panelling in the Caves area. This review process will be undertaken in consultation with ARM Architects, the SOH Heritage Architect, the DAP, and the CC. The SOH will be pleased to work with the Heritage Council, as part of this process, to achieve the best outcome for this component of the project.

The final finishes for both the passageway and the south wall of the Caves will be defined in the Section 60 application for the works.

16.2 Part of action: Concert Hall Acoustic Works

Relevant impacts of the action

- 16.2.1 The action and the relevant impacts of the action for enhancement of the Concert Hall acoustics are described in S 4.0 of Part 1.

Matters of NES affected by the action

- 16.2.2 World Heritage values – Authenticity (form and function) and integrity
- 16.2.3 National Heritage values – Criterion A (Events, Processes), Criterion F (Creative or technical achievement), Criterion G (Social value)

Nature and extent of likely impacts on:

(A) the World Heritage values of a World Heritage property

- 16.2.4 The impact is positive in terms of authenticity of function as the works enhance the acoustic experience of the Concert Hall as a performance venue.
- 16.2.5 The negative impacts on authenticity of form and integrity associated with new acoustic upgrades are substantial.
- 16.2.6 The key substantial negative impact on values and authenticity of form and integrity are:
- permanent visual and physical impacts on the Peter Hall interiors which contribute to the 'role of the building as an architectural monument'
 - the visual impact of clutter within the Concert Hall, some of which is permanent and some which is temporary during specific performances.
- 16.2.7 The negative impacts involve tangible values, including the loss of original designed views, the loss of original fabric and the introduction of new fabric, as well as intangible values with the introduction of additional clutter detracting from the visual experience of some performances.

SOH Response

The CMP4 Statement of Significance relevantly states:

*"The Sydney Opera House is a masterpiece of 20th century architecture **and** a world renowned performing arts centre." (emphasis added)*

The SOH Heritage Architect has noted, "Neither of these can be considered in isolation and each must support and strengthen the other.

"Peter Hall's 1973 Concert Hall interior included elements that Peter Hall was not happy about but were required for acoustic reasons – the acrylic 'cloud' acoustic reflectors, and the saw-tooth profile box and circle fronts. These are to be replaced with more refined and considered elements that have been designed with the assistance of the latest technology while still retaining and respecting Hall's design vision and regime for this space. This is what Utzon refers to as 'fine-tuning the instrument'. This instrument is not just for looking at – like a museum exhibit in a glass case, it is an instrument that is to be played – to house, present and celebrate performance.

An addendum to the Heritage Impact Statement has been prepared, and this is provided with this RtS as Attachment H. In this addendum, the Heritage Architect has addressed how these conclusions are drawn.

(B) the National Heritage values of a National Heritage place

- 16.2.8 The Concert Hall acoustic works will have a positive impact on the values of Events, Processes (Criterion A) and Social Value (Criterion G) as they strengthen the public experience of acoustic performance at the Concert Hall.
- 16.2.9 They will have a substantial negative impact on the value of Creative or technical achievement (Criterion F).
- 16.2.10 Detrimental impacts on the value of Creative or technical achievement occur in the Peter Hall designed Concert Hall interior in terms of changes to fabric, spaces and visual experience. These include the removal of the existing over-stage reflectors and addition of new reflectors, the addition of new profiled timber panelling to box fronts and stage surrounds and their reorientation, and the provision of new operable acoustic drapes. In addition to the physical impacts, significant views to the organ and pipes ensemble, the folded and domed ceiling forms and the timber finishes are detrimentally impacted by the acoustic works.

SOH Response

With respect to NHL Criterion F, the HIS includes the following:

"9.2.4 NHL Criterion F – Creative or technical achievement

"The place has outstanding heritage value to the nation because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period.

"Relevant key values from National Heritage values:

- "In every aspect it is a structure at the leading edge of endeavour.*
- "The 'hybrid' interior spaces of the Sydney Opera House reflect the creative genius of both Utzon and Todd, Hall and Littlemore, who completed the building and interior finishes after Utzon's departure. The major public spaces with outside views, for example were designed by Utzon (and completed by Peter Hall) to be finished in natural materials, textures and colours similar to those on the exterior of the building in order to bring the outside inside (Kerr 2003, 69)."*
- "the creation of sensory experiences to bring pleasure to the building's users, particularly the experience of approaching, mounting the grand staircase to the podium, passing through the low ribbed box office, up to the foyers flanking the auditoria with their harbour views, and the climax of the performance itself. 'Both ideas were...reinforced by Utzon's application of counterpointing techniques using light and dark tones, soft and hard textures and richly treated warm and cool interior colours."*

- *“The interior spaces designed by Peter Hall, including the major auditoria known as the Concert Hall and Opera Theatre, and the minor performance spaces, performers’ and staff areas, and rehearsal rooms, known collectively as ‘Wobbly Land’ because of the distinctive ‘U’ shaped timber panelling, demonstrate the distinctive design solutions that made the Opera House a functioning performing arts centre in the 1970s, and reflect the prevailing aesthetic values, building standards, and financial constraints of the day.”*

“Concert Hall Renewal Project – Comment

“The Concert Hall renewal project will generally retain and respect these values.

“The acoustic upgrades to the Concert Hall auditorium will have high impacts on a limited amount of significant fabric and on key views towards the grand organ and adjacent areas of the faceted ceiling. There will be some impact on the character of the original Hall interior, however this is considered acceptable given the potentially high positive impact in the overall acoustic performance and functionality of the Concert Hall. The acoustic interventions on the sidewalls have been specifically designed to be retractable so as to be hidden from view when not in use. Generally, the proposed interventions reference Hall’s palette of materials and colours of white birch, brush box, and his signature magenta colour for the Concert Hall. The curved shape and profile of the suspended ‘petal’ over-stage reflectors have been resolved to provide optimal acoustic performance while retaining partial views to the Grand Organ, and can be rotated or flown upwards depending on the acoustic needs of the performance type.

“Due to the solid nature and extent of the over-stage reflectors, it will not be possible to light the stage from the circular ‘crown’ as is done presently. This will be achieved by suspended lighting arrays between the acoustic reflectors and via suspended lighting trusses over the stalls.

“Visual impacts from these new elements are acknowledged as not insubstantial, but the mock-ups and acoustic testing have confirmed that improvements in the acoustic performance of the Concert Hall will be considerable. The proposed acoustic design has also been through a rigorous peer review process that supported the proposed changes. The visual impacts are therefore considered necessary if this venue is to maintain its status as a world class performance venue.

“In order to minimise visual clutter, the set-up for each performance should deploy the minimum technical and acoustic equipment and be flown out or removed when not in use. This includes suspended speaker clusters and lighting. This is an ongoing housekeeping and management issue for the Opera House and the performing companies who use the Concert Hall. Policy 8.4 in the CMP addresses this issue.

“While there are many parts to the proposed interventions in the Concert Hall, they have all been designed with the aim of respecting the technical and aesthetic excellence of Peter Hall’s original design. It is our assessment that when these works are completed, this will be achieved.”

The HIS has summarised its assessment of the heritage impact on National Heritage values at Section 9.3.1, and relevantly states:

"The proposed functional and acoustic upgrades within the Concert Hall auditorium will result in some adverse impacts on the significant character and fabric of the Concert Hall auditorium. However Peter Hall's design aesthetic and choice of materials will be respected by these changes. These impacts are acknowledged as not insubstantial, but the mock-ups and acoustic testing, as well as the peer review process, have confirmed that improvements in the acoustic performance of the Concert Hall will be considerable. These impacts are therefore considered necessary if this venue is to maintain its status as a world-class performance venue.

"Our conclusion is that the accessibility, functional and acoustic related works in the Concert Hall and its foyers will strengthen the core function of the Opera House as a performing arts centre and have a positive impact on its National Heritage values."

The HIS also provides a summary assessment of impact on National Heritage values according to the National Heritage significant impact criteria at Section 9.4. It states:

"The Significant impact criteria for a National Heritage place, as stated in the Significant Impact Guidelines are as follows:

"An action is likely to have a significant impact on the National Heritage values of a National Heritage place if there is a real chance or possibility that it will cause:

- one or more of the National Heritage values to be lost*
- one or more of the National Heritage values to be degraded or damaged, or*
- one or more of the National Heritage values to be notably altered, modified, obscured or diminished.*

"Comment

"The above assessment concludes that none of the National Heritage values of the Sydney Opera House will be lost, degraded or damaged through either the Concert Hall Renewal or Creative Learning Centre projects. For the Creative Learning Centre project, none of the National Heritage values will be altered, modified, obscured or diminished. For the Concert Hall project, some significant fabric and spaces that contribute to these National Heritage values, will be altered, modified, and in the instance of the Grand Organ, partially obscured by the proposal.

'However, it is important not to consider the 'significant impacts' of the proposed action (Concert Hall renewal project) in isolation. The changes proposed will substantially improve access and amenities for patrons and performers, and potentially enhance the ability of the Sydney Opera House to attract patrons and national and internationally recognised performers with its improved functionality and acoustic performance, thus retaining its status as Australia's pre-eminent performing arts centre, and respecting its National Heritage values.'

The HIS summary conclusion of the impact on National Heritage values according to the National Heritage Significant Impact Criteria at Section 9.4.1 states:

"Works proposed in the Concert Hall Renewal project are substantial and will have some adverse impacts on fabric of the eastern side foyer, northern foyer, and the Concert Hall itself and also on views within these spaces. However, the creative and technical achievements of its principal designers, Jørn Utzon, Ove Arup and Peter Hall will be respected and not diminished by these works.

"The impacts on fabric and spaces in the Concert Hall project are assessed as having a 'significant (adverse) impact' on some of the National Heritage values of the Opera House.

"The proposed changes in the Creative Learning Centre project will be permanent but none will have a 'significant impact' on the National Heritage values of the Opera House.

"It is important to note the changes proposed in both of these projects will substantially improve access and amenities for patrons and performers, and potentially enhance and strengthen the ability of the Sydney Opera House to attract patrons and national and internationally recognised performers with its improved functionality and acoustic performance, thus retaining its status as Australia's pre-eminent performing arts centre, and respecting its National Heritage values."

Conclusions on relevant impacts on Matters of NES

Description of feasible mitigation measures, changes to the action or procedures to prevent or minimise environmental impacts on each relevant Matter of NES proposed by the proponent

- 16.2.11 The proponent suggests that the location and design of some of the new features and equipment should be subject to further review, including some full scale prototypes to be tested.
- 16.2.12 The proponent argues that the tangible impacts on fabric and visuals must be considered in relation to the substantial improvements in acoustic experience which positively impact intangible values.
- 16.2.13 The proponent proposes detailed methods of protecting some of the characteristics of existing materials and finishes when new elements are introduced.

SOH Response

The SOH has proposed the following in regard to the acoustic upgrades.

Over-stage Reflectors

The over-stage reflectors were part of a full scale mock-up trial in November 2016. This is described in the HIS and the Appendix to the HIS. The proposed configuration has been determined to be a component of a total solution to improve the acoustic performance of the Concert Hall. The HIS relevantly notes:

- While the proposed arrangement of reflectors is denser and less transparent than the existing arrangement, the proposed 'petals' retain partial views to the grand organ, the focal point of the Concert Hall, although much of the space between the reflectors will be occupied by suspended over-stage lighting arrays, required because of the solidity of the reflectors.*
- These reflectors were mocked up for acoustic and visual tests and proved that the acoustic benefits were substantial, for both performers and audience. The mock-ups also suggested a high gloss or matte finish should be avoided, and a colour based on magenta should be further explored and refined.*
- The reflector shape and use of magenta is supported for two reasons. Firstly, it visually separates these suspended elements from the radiating geometry of the plywood ceiling, avoiding visual confusion and respecting Hall's design, and secondly, it strengthens the sense of 'celebration' of the performance space as intended by both Utzon and Hall, using Hall's original colour palette.*
- These suspended over-stage reflectors will be the most highly visible components of the acoustic upgrade. High visual impacts however positive acoustic impact.*
- The replacement of the existing acrylic acoustic 'clouds' and their replacement with a new array of petal shaped solid reflectors is supported provided they meet the following conditions:*

- before manufacture of the final reflectors, the final colour and finish is prototyped in situ in the Concert Hall and approved by the CC, DAP, and heritage architect; and
- an original acrylic cloud reflector in good condition is identified and archived as part of the Opera House's collection.

Sidewall Reflectors

The sidewall reflectors were mocked up and formed part of the trial in November 2016. They have also been determined to be a component of a total solution to improve the acoustic performance of the Concert Hall. The HIS relevantly notes:

- These projecting operable reflector panels are considered to have a high visual and fabric impact but are acceptable provided they meet the following conditions:
 - the existing white birch panels are retained and reinstated in their original locations, and not replaced with new as these are book and end-matched from a single log with panels above;
 - cuts across an original sheet junction are avoided wherever possible, and where this is not possible, the sheet junction is retained in its existing location;
 - there is minimal visual interruption of existing white birch plywood, and preferably, the cut out section to accommodate the reflector is used as the face of the new flap to ensure it matches;
 - flaps are fully retracted and the original plywood surface finish flush with the existing plywood when these reflector flaps are not required.

Laminated Brush Box Panels

A full scale prototype of the laminated brush box panel has been installed on Box C. This prototype has demonstrated that the proposed acoustically diffusive pattern is not an overwhelming feature in the Concert Hall. The prototype has demonstrated that the method of construction can be improved to ensure the best aesthetic outcome when the final panels are constructed.

The diffusive surfaces also form a key component of the total acoustic solution. The HIS notes the following in regard to the laminated brush box panels:

- It is important to note that all the original 'sawtooth' profile box fronts were replaced with flat panels in the same material in late 2011 as part of an earlier attempt to improve acoustic performance. Their replacement with new profiled panels of matching material will have little impact on original fabric. The original panels were archived as part of the Opera House collection of salvaged original fitout.
- The proposed works affect much of the original 1973 wall fabric, however the new panelling respects the original material of the auditorium by continued use of glue-laminated brush box – high impact on fabric but with overall positive acoustic benefits.

Acoustic Drapes

The proposed acoustic drapes are only deployed for amplified concerts, usually contemporary music. The current practice is to manually erect black drapes in key locations to reduce reverberation. The current practice does not generally compliment the architecture of the Concert Hall, and the proposal to use drapes that grade from black near the stage, to a magenta that matches the seats will see a significant aesthetic improvement when the Hall is used for amplified performances.

With respect to the banners to be suspended from the ceiling crown and sidewalls, the HIS notes:

- *The automated drapes from the crown require substantial modification of three of the plain concentric white birch plywood rings in the centre of Hall's exceptionally significant design of this space. In each of these rings, a number of short drapes will be deployed from opening hatches in the existing plywood. The drapes themselves will fold like Roman blinds, into an arrangement of short 'containers' between the existing plywood lining and the steel structure that supports it, and will not be visible unless deployed.*
- *The retractable 'drawer' units high on the side walls over the stage, deploying absorption drapes, will complement the absorption capacity of the drapes from the crown.*
- *The amplified performance type typically requires a more 'theatrical' approach to the presentation of the stage, and views to the grand organ are not considered important for this performance type. Their visual impact, when deployed, will be high, but this is considered appropriate and acceptable. The proposed graded magenta colour of the drapes are an extension of this dramatic effect and is supported.*
- *For amplified performance, the 'petal' reflector panels can be tilted and raised to reduce their visual impact in the space and allow deployment of the acoustic drapes from the crown. In their tilted and raised position, they will also reflect sound towards the arrangement of drapes.*
- *It is highly likely that full plywood rings may need to be taken down and modified on a bench to ensure the works are executed properly and without unnecessary damage. Site investigations suggest that individual rings are not physically joined to adjacent panels, but separated by a flexible plastic jointing strip. In this regard, and before commencement of works on any part of the plywood ceiling, it is recommended the process and methodology for cutting out, constructing, and operating these new panels, be tested via a full size operational prototype that includes a full size drape.*
- *Modifications to these plywood ring panels are considered to have a high impact on original fabric but are acceptable provided they meet the following conditions:*
 - *the location and configuration of the drapes respects the geometry of the interior;*
 - *all drapes are fully retractable and the machinery / hardware for their automation / deployment is fully concealed from the auditorium;*
 - *the substantial modifications to the ceiling crown to accommodate the drapes and their machinery is as least intrusive as possible, so that when retracted, the crown looks as close as possible to the original configuration;*
 - *the existing white birch ring is retained and not replaced as these ring elements are matched from a single log with other ceiling panels;*
 - *there is minimal loss of existing white birch plywood, and preferably, the cut out section to accommodate each acoustic drape unit is used as the lower face of its access panel to ensure it matches; and*
 - *drapes and access panels are fully retracted and sit flush with the existing plywood when acoustic drapes are not required.*

With respect to the automated acoustic absorption drapes to be deployed to the stage surround, box fronts, and rear wall of the stalls; and automated acoustic absorption drapes rising from concealed hatches in the floor along side and perimeter walls, the HIS notes:

- *The automated acoustic absorption drapes rising from the floor along side and perimeter walls, will allow wall and ceiling details to remain unaffected. A mock-up of this mechanism should be trialled to ensure all technical issues are resolved.*

- *The automated drapes on the box fronts, stage surround, and rear wall of the stalls should also be tested with a full-sized mock-up.*

Generally in respect to the acoustic absorption drapes, the HIS notes:

- *While the acoustic drapes throughout the auditorium will have high impacts on the significant fabric and character of the Hall interior they are generally considered acceptable provided they meet the following conditions:*
 - *the location and configuration of the drapes respects the geometry of the interior;*
 - *the cloth material used for the drapes and banners is to be plain, without pattern, and the colour based on the signature magenta of the seat upholstery, grading towards black, closest to the stage, as indicated on the renders provided in the application;*
 - *the indirect lighting of wall and ceiling panels around the perimeter of the hall is retained and not impacted by the drapes, regardless of their deployment;*
 - *all drapes are fully retractable and the machinery / hardware for their automation / deployment is fully concealed;*
 - *covers and hatches over acoustic drape units should finish flush with the surrounding brush box when not required.*

Description of any feasible alternatives to the action or mitigating measures that have been identified through the assessment process, and their likely impact on Matters of NES

16.2.14 There are some actions which should be subject to further review as there is potential for change to reduce negative impacts (some overlap with those suggested by the proponent). These are actions which impact on the following existing and proposed elements of the Concert Hall:

- over-stage reflectors (refer to S 4.10)
- side wall reflectors (refer to S 4.13)
- laminated brush box panels (refer to S 4.21, 4.23)
- tapered bronze guard-rails (refer to S 4.22)
- 1973 box fronts (refer to S 4.23, 4.24)
- white birch ceiling crown (refer to S 4.28)
- new acoustic drapes (refer to S 4.30)
- new lighting arrays (refer to S. 4.35)
- ceiling penetrations for new lighting and speaker arrays (refer to S 4.36)

SOH Response

Over-stage reflectors (refer to S 4.10), side wall reflectors (refer to S 4.13), and new lighting arrays (refer to S. 4.35).

As discussed above, the over-stage reflectors, side wall reflectors, and new lighting arrays form key components of the acoustic upgrade. The HIS discusses the impacts of these insertions as follows:

The acoustic upgrades to the Concert Hall auditorium will have high impacts on a limited amount of significant fabric and on key views towards the grand organ and adjacent areas of the faceted ceiling. There will be some impact on the character of the original Hall interior, however this is considered acceptable given the potentially high positive impact in the overall acoustic

performance and functionality of the Concert Hall. The acoustic interventions on the sidewalls have been specifically designed to be retractable so as to be hidden from view when not in use.

Generally, the proposed interventions reference Hall's palette of materials and colours of white birch, brush box, and his signature magenta colour for the Concert Hall. The curved shape and profile of the suspended 'petal' over-stage reflectors have been resolved to provide optimal acoustic performance while retaining partial views to the Grand Organ, and can be rotated or flown upwards depending on the acoustic needs of the performance type.

Due to the solid nature and extent of the over-stage reflectors, it will not be possible to light the stage from the circular 'crown' as is done presently. This will be achieved by suspended lighting arrays between the acoustic reflectors and via suspended lighting trusses over the stalls.

Visual impacts from these new elements are acknowledged as not insubstantial, but the mock-ups and acoustic testing have confirmed that improvements in the acoustic performance of the Concert Hall will be considerable. The proposed acoustic design has also been through a rigorous peer review process that supported the proposed changes. The visual impacts are therefore considered necessary if this venue is to maintain its status as a world class performance venue.

In order to minimise visual clutter, the set-up for each performance should deploy the minimum technical and acoustic equipment and be flown out or removed when not in use. This includes suspended speaker clusters and lighting. This is an ongoing housekeeping and management issue for the Opera House and the performing companies who use the Concert Hall. Policy 8.4 in the CMP addresses this issue.

As noted in the covering letter, SOH agrees to develop an 'at rest' mode. Renders of this configuration are included in Attachment E.

- Drawing ARM-SK-9226 shows the view from seat position Row N Seat 25 in the Upper Circle.
- Drawing ARM-SK-9227 shows the view from seat position Row X Seat 25 in the Stalls.
- Drawing ARM-SK-9228 shows the view from Seat 10 in Box A.
- Drawing ARM-SK-9229 shows the view from seat position Row C Seat 40 in the Circle.

Laminated brush box panels (refer to S 4.21, 4.23)

The laminated brush box panels also form key components of the proposed acoustic upgrade. The HIS notes the following in regard to the laminated brush box panels:

- It is important to note that all the original 'sawtooth' profile box fronts were replaced with flat panels in the same material in late 2011 as part of an earlier attempt to improve acoustic performance. Their replacement with new profiled panels of matching material will have little impact on original fabric. The original panels were archived as part of the Opera House collection of salvaged original fitout.
- The proposed works affect much of the original 1973 wall fabric, however the new panelling respects the original material of the auditorium by continued use of glue-laminated brush box – high impact on fabric but with overall positive acoustic benefits.

Tapered bronze guard-rails (refer to S 4.22)

The original tapered bronze guard-rails surrounding the boxes and the front of the circle will be retained, however the rails at the rear of Boxes A, B, C, U, V, and W, will be replaced with new compliant sections as accessible seating is installed at the rear of these boxes, and this requires the replacement of the existing rear walls with segmented removable walls to allow direct wheelchair access to the seat positions.

1973 box fronts (refer to S 4.23, 4.24)

As discussed in Part 1, the existing box fronts and side walls of the stage surround are not original material and were installed in 2011. This installation of new fabric in 2011 is described in Section 5.2.3 of the HIS (P16):

Following acoustic analyses and tests by Kirkegaard Associates, commencing in 2007, the 'saw-tooth' fronts to the boxes were replaced with flat panels in matching brush box in 2011/12 ...

The original 1970s saw-tooth panels were photographed, removed, tagged, wrapped and stored when this replacement occurred. The original concrete support walls were exposed and new steel sub-frames added to carry the replacement flat panels. The tapered bronze handrails at the top of each box front were retained.

White birch ceiling crown (refer to S 4.28)

As discussed in Part 1, the SOH is committed to complying with the condition relating to the modification to the ceiling crown as detailed in Section 7.2.2.2 of the HIS:

- Modifications to these plywood ring panels are considered to have a high impact on original fabric but are acceptable provided they meet the following conditions:
 - the location and configuration of the drapes respects the geometry of the interior;
 - all drapes are fully retractable and the machinery / hardware for their automation / deployment is fully concealed from the auditorium;
 - the substantial modifications to the ceiling crown to accommodate the drapes and their machinery is as least intrusive as possible, so that when retracted, the crown looks as close as possible to the original configuration;
 - the existing white birch ring is retained and not replaced as these ring elements are matched from a single log with other ceiling panels;
 - there is minimal loss of existing white birch plywood, and preferably, the cut out section to accommodate each acoustic drape unit is used as the lower face of its access panel to ensure it matches; and
 - drapes and access panels are fully retracted and sit flush with the existing plywood when acoustic drapes are not required.

New acoustic drapes (refer to S 4.30)

With regard to the acoustic drapes the HIS at Section 7.2.2.2 finds, "While the acoustic drapes throughout the auditorium will have high impacts on the significant fabric and character of the Hall interior they are generally considered acceptable provided they meet the following conditions:

- the location and configuration of the drapes respects the geometry of the interior;
- the cloth material used for the drapes and banners is to be plain, without pattern, and the colour based on the signature magenta of the seat upholstery, grading towards black, closest to the stage, as indicated on the renders provided in the application;
- the indirect lighting of wall and ceiling panels around the perimeter of the hall is retained and not impacted by the drapes, regardless of their deployment;
- all drapes are fully retractable and the machinery / hardware for their automation / deployment is fully concealed;
- covers and hatches over acoustic drape units should finish flush with the surrounding brush box when not required.

Ceiling penetrations for new lighting and speaker arrays (refer to S 4.36)

There are more than 500 penetrations currently in the CH ceiling:

- 170 existing penetrations will be patched
- 12 penetrations will be reused by new equipment
- 300 new penetrations will be created – in 3 sizes – 60mm dia, 150mm dia and 180mm dia

The new theatre machinery and penetration design is such that will bob weights will no longer be left hanging in the space when winches are not in use. This will remove significant visual clutter from the existing upper volume.

Further revision of the speaker system has negated the need for five speaker arrays across the stage front. There will be only left, centre and right speakers deployed to the front of the stage. When not required, the central speaker array will be raised as high as practicable. This is illustrated in the Concert Hall 'At Rest' images included in Attachment E. Removing the central speaker array is impractical for operational reasons. Speaker technology is constantly improving and this installation will allow these improvements with potentially less visual impact on the space and no adverse impacts on the fabric.

16.2.15 There are some elements which require further research to assess their significance. A good understanding of their significance is needed prior to decision-making about actions which may impact on them. These are:

- Concert Hall acoustic-related equipment and machinery while it is in situ (refer S 5.23)

SOH Response

The SOH is committed to undertaking a significance assessment and follow its recommendations on CH equipment and machinery, while in situ, as per the responses at 3.27, 3.69, 5.35, 15.18, 16.1.6, and 16.1.7. All machinery and equipment will be recorded in situ for archival purposes.

The proposed modifications to Concert Hall existing equipment and machinery will not adversely impact on the National or World Heritage values of the SOH.

The CMP4 is the principal management plan by which the SOH upholds and protects the State, National and World Heritage values of the place. CMP4 includes Policy 13.2 Machinery and equipment.

The HIS has assessed compliance with CMP4, and specifically Policy 13.2 at Section 7.2.2.7:

"Much of the existing machinery and equipment associated with the Concert Hall dates from the original installation in the early 1970s. With technological advancements, including the change to digital systems, and changes to operational safety standards, this equipment is approaching the end of its life and requires replacement. If it is not replaced, safety and other compliance issues will remain and the efficient operation and management of the Concert Hall as a venue will be hindered. In order to continue its use and strengthen its reputation as the major auditorium in Australia's pre-eminent performing arts centre, (key aspects of its significance), this machinery and equipment needs to be replaced and updated.

A full heritage assessment of existing machinery and equipment in the Concert Hall will be undertaken, and any significant pieces identified. The process outlined in this policy was carried out for the recent Theatre Machinery Project in the Joan Sutherland Theatre where the machinery was fully documented before decommissioning and selected significant pieces removed and archived as part of the Opera House collection. It is proposed this same process will be employed for the Concert Hall Renewal Project."

As noted in the response to section 5.35 above, the SOH commits to undertaking the full heritage assessment, archival recording, and archiving of relevant significant items.

- 16.2.16 The loss of the original acrylic cloud reflectors has a negative impact. A mitigating measure is that the original reflectors are retained and used in a way that contributes to the story of change at the SOH for the public. (refer to S 4.12)

SOH Response

As discussed at 16.2.7, Peter Hall's 1973 Concert Hall interior included elements that Hall was not happy about but were required for acoustic reasons including the acrylic 'cloud' acoustic reflectors. These are to be replaced with more refined and considered elements that have been designed with the assistance of the latest technology while still retaining and respecting Hall's design vision and regime for this space. This is what Utzon refers to as 'fine-tuning the instrument'. The SOH Heritage Architect has prepared an addendum to the HIS, and this has been included here as Attachment H.

The SOH will select one original cloud reflector, along with the matching winch and ancillary equipment, and archive this in the SOH collection as per the recommended condition in the HIS.

The full set of reflectors is unable to be retained as there is no appropriate location where the full set of reflectors could be made publicly accessible at the SOH. There are 18 original cloud reflectors, along with 3 additional central, downstage reflectors that were installed in 2014/15. The reflectors are made of Perspex, with an outside diameter of 1735mm, an internal diameter of ~1100mm, and a depth of 190mm. The reflectors have an approximate mass of 66 kilograms.

The SOH will commit to developing a strategy in regard to the future interpretation of the reflectors and this will form a component of the revised Renewal Interpretation Strategy (noting that a revision of this strategy is also a recommendation of the Heritage Council).

- 16.2.17 The substantial amount of new acoustic and amplified equipment and elements will create visual clutter compared to the current arrangement. A mitigation measure is that the automated settings for the Concert Hall include an 'at rest' setting which results in the new acoustic and amplified equipment being hidden as much as possible to allow appreciation of the Concert Hall in as original as possible state. The details of this setting mode and when it will be available are to be developed. (refer to S 4.14) This will allow increased opportunity for views to significant Peter Hall designed elements as close as possible to the original configuration

SOH Response

As discussed in the covering letter, the SOH proposes that a policy governing the implementation of the 'at rest' mode when the venue is not being used for performances is included in its future revision of the CMP.

16.3 Part of action: Concert Hall Functional Works

Relevant impacts of the action

- 16.3.1 The action and the relevant impacts of the action for Concert Hall functional works are described in S5.0 of Part 1.

Matters of NES affected by the action

- 16.3.2 World Heritage values – Authenticity (form and function) and integrity
- 16.3.3 National Heritage values – Criterion A (Events, Processes), Criterion E (Aesthetic characteristics), Criterion F (Creative or technical achievement), Criterion G (Social value), Criterion H (Significant people)

Nature and extent of likely impacts on:

(A) the World Heritage values of a World Heritage property

- 16.3.4 The impact is positive in terms of authenticity of function as the works enhance the comfort of audience and performers appreciating the Concert Hall as a performance venue. Improved functionality of the stage and back stage is also positive in terms of authenticity of function.
- 16.3.5 There are minor negative impacts on authenticity of form and integrity associated with changes to the stage levels and automation, provision of a new technical equipment zone above the stage ceiling, as well as seat refurbishment.
- 16.3.6 The key substantial negative impact on values and authenticity of form and integrity are:
- the increase in the size of stage wings which narrows the side foyer spaces,
 - the extensive speaker and lighting arrays with resultant ceiling penetrations and visual impacts,
 - the upgrades to the existing air conditioner system, including the increase in the number of ceiling diffusers and closing up of canon port openings, and
 - the visual impact of clutter within the Concert Hall, some of which is permanent and some of which is only during specific performances.
- 16.3.7 The negative impacts involve tangible values, including impacts on original designed views, the loss of original fabric and the introduction of new fabric, as well as intangible values with the impact of clutter detracting from the visual experience of some performances.

SOH Response

The increase in the size of stage wings

The reconfiguration of the side foyers is specifically driven by the introduction of the arena risers on the stage, rather than the increase in backstage area. The introduction of the arena risers is a key component of the acoustic upgrades to the Concert Hall, specifically to improve orchestral performances. Once the arena risers are deployed, additional doors from the stage wings must be included downstage (towards the audience) to provide access to the stage. To achieve this outcome the side foyers must be reconfigured.

The proposed configuration to increase the backstage area of the Concert Hall for the arena risers retains and respects the geometry of Peter Hall's auditorium and foyer walls. The changes to the foyers are minimal and will not be at all obvious to visitors and patrons. The main exit path widths in the side foyers are respected and barely narrowed.

The SOH considers this reconfiguration to be the minimal solution to the stage access issue when the arena risers are deployed, and the proposed design respects the design aesthetics of the side foyers. It has only a minimal impact on the plan area of the side foyers, and only in areas with a lowered ceiling height created by bulkheads above. It does not have any impact on normal paths of access through the foyers. As much original fabric as possible will be reused in the new configuration.

Additional plans which detail the extent of demolition, and relocated and new fabric are included in Attachment E. Drawing ARM-9240 details the new work with the removed structure shown in red for the East Side Foyer, and drawing ARM-9241 details the new work with the removed structure shown in red for the West Side Foyer.

Additional renders, which provide a different perspective from those included in the EIS package, are also included in Attachment E. The view of the existing East Side Foyer is shown in ARM R-05, with the proposed configuration shown in ARM R-06. The view of the existing West Side Foyer is shown in ARM R-07, with the proposed configuration shown in ARM R-08.

The extensive speaker and lighting arrays with resultant ceiling penetrations and visual impacts

Further revision of the speaker system has negated the need for five speaker arrays across the stage front. There will be only left, centre and right speakers deployed to the front of the stage. When not required, the central speaker array will be raised as high as practicable. This is illustrated in the Concert Hall 'At Rest' images included in Attachment E. Removing the central speaker array is impractical for operational reasons. Speaker technology is constantly improving and this installation will allow these improvements with potentially less visual impact on the space and no adverse impacts on the fabric.

The lighting arrays proposed have been extensively reviewed by the DAP, with the conclusion reached that the short lighting bars in a black finish were the most appropriate design.

The current design has removed the need for forestage lighting bars.

The upgrades to the existing air conditioner system

The HIS describes these works in Section 7.2.2.2, as follows:

- The 'cannon-port' openings require modification to accommodate the upgraded air delivery system and address acoustic leakage. It is proposed to infill the existing rectangular openings with matching white birch veneered ply, with a discrete shadow line to delineate the extent of the original opening. Where they are to accommodate new air diffusers, these should be closely fitted within the patched area. A full size mock-up should be assembled and approved first, before these particular works commence.
- Additional air diffusers are required forward of the existing rectangular ones on the ceiling soffits over the boxes and sides of the auditorium. These should have minimal impact as long as the existing plywood is retained and the order and proportion of existing registers and the ceiling geometry is retained and respected with the new work. As these new registers are close to the radius junction with the vertical ceiling panels, they should be as discrete as possible so as not to visually weaken the panels.
- These new registers are proposed to have white birch surrounds and should therefore sit 'quietly' in their new location. Their setout, as proposed, respects the geometry of the auditorium. Refer to images below.
- Potentially negative impacts from the revised 'cannon-port' openings and new air delivery registers are acceptable provided that:
 - the 'cannon-port' infill panels are closely fitted with a fine shadow line to delineate the extent of the original opening, and match the adjacent white birch as closely as possible;
 - the new air delivery registers in the soffits over the boxes should respect the geometry of the ceiling, plywood panels and adjacent registers, have white birch surrounds with narrow slot registers, and visually sit 'quietly' in their location.

The visual impact of clutter within the Concert Hall

The Concert Hall is an extremely busy venue. There are very few times when the venue isn't being used in some way including, hosting events, setting or striking for an event, rehearsals, maintenance, and retaining the setting for the hall between multiple shows. The Sydney Opera House itself is open 363 days per year, and the Concert Hall offers venue hirers 3 sessions of bookings per day, a total of 1,089 per annum. Typically, the number of actual bookings per annum exceeds 1,000. Given the requirements for setting up, striking, and rehearsals for these shows there is little, if any, "dark time" in the venue. Even on occasions when the venue is not being used for a performance but is booked by a hirer (e.g. between a run of shows), it is standard for the hirer to require the venue to remain 'set' in the required configuration for the next performance, to ensure that acoustic and technical consistency and integrity remains from performance to performance.

Apart from patrons coming to performances, the only other members of the public visiting the Concert Hall will be tour groups. Hosting tour groups within the Concert Hall is dependent on the agreement of the venue hirer, noting that activities to support performances (e.g. instrument tuning and rehearsals) will always take precedence. On many occasions, tours will be able to observe set up or striking of the Concert Hall, giving visitors a look behind the scenes and adding to the experience.

The SOH manages the use of the space in the most respectful way possible and most recently, in line with CMP4. The new enhancements that are being installed will give SOH greater flexibility to showcase the Concert Hall in many different ways. When operational requirements allow, the Concert Hall will be left in a state that is in line with the CMP4 and showcases the hall in the most presentable way possible.

The “basic configuration” to which the Concert Hall can be re-configured for the presentation of the Hall on the rare occasions when the venue is not required for performance or being reset for a different performance is as shown in the renders included in Attachment E. Typically, tour groups visiting the Concert Hall (being the only other members of the public permitted to visit the venue apart from patrons) will be taken to the upper stalls or circle. The SOH has prepared a series of renders that display the Concert Hall with the minimum acoustic interventions in place, these have been termed Concert Hall ‘At Rest’ Images, these are included in Attachment E.

The new theatre machinery and penetration design is such that bob weights will no longer be left hanging in the space when winches are not in use. This will remove significant visual clutter from the existing upper volume.

(B) The National Heritage values of a National Heritage place

- 16.3.8 The Concert Hall functional works will have a positive impact on the values of Events, Processes (Criterion A) and Social Value (Criterion G) as they enhance public comfort during performances at the SOH. They also have a positive impact on the value of Events, Processes (Criterion A) because they assist with staging of performances.
- 16.3.9 They will have a negative impact on the values of Aesthetic characteristics (Criterion E), Creative or technical achievement (Criterion F) and Significant people (Criterion H).
- 16.3.10 Impacts on the Aesthetic characteristics occur in the side foyers of the Concert Hall due to the narrowing of the space which will detrimentally change the strong aesthetic response experienced while moving through these foyers. There is a visual and spatial impact from the loss of the stepped configuration. Other impacts on Aesthetic characteristics relate to fabric on the panelled timber walls and spaces in the side foyers. This is also an impact on Significant people as the side foyers were designed by Utzon.
- 16.3.11 There is an impact on the Creative or technical achievement relating to the interior of the Concert Hall from the updates to the speakers and lighting arrays. These impacts relate to fabric, views and spaces. There is also an impact on the Creative or technical achievement from the upgrades to the existing air conditioning system within the Concert Hall in terms of fabric.

SOH Response

Side foyers

The proposed introduction of the automated stepped stage platforms requires the circulation space within the side wings (prompt and opposite prompt) to be extended downstage and doors to the stage relocated. This requirement, in conjunction with the new accessible theatre entries, require modifications to the public entry to the front stalls and associated brush box panelling in the side foyers. The changed configuration respects Hall’s geometry and set out of the auditorium entries and side foyers and follows existing detailing and materials. Overall, the works will result in moderate

visual impacts as the overall width of the foyer is reduced, however the quality and character of the space and the 'natural' palette of materials and colours is retained and respected.

The HIS has concluded at Section 9.3.1:

"While acknowledging there will be some negative impacts to significant fabric and spaces arising from the Concert Hall Renewal project in regard to introduction of Lifts 29 and 30 and the consequent cutting of a number of the significant cranked beams in the Northern foyer, the cutting and diminished width of the stairs in the Eastern side foyer resulting from the new passageway at Level 2, and the acoustic upgrades within the Concert Hall auditorium, the overall impact of this project will be positive.

"With these insertions, the experience of these spaces, their power and grandeur, will be available to people who may never have been able to access them before. This is completely in line with Utzon's original concepts, and the identified National Values.

"The improved functionality and accessibility of the Concert Hall and its foyers, will potentially enhance the reputation and ability of the Sydney Opera House to attract national and international visitors, patrons and performers.

"The proposed functional and acoustic upgrades within the Concert Hall auditorium will result in some adverse impacts on the significant character and fabric of the Concert Hall auditorium. However Peter Hall's design aesthetic and choice of materials will be respected by these changes. These impacts are acknowledged as not insubstantial, but the mock-ups and acoustic testing, as well as the peer review process, have confirmed that improvements in the acoustic performance of the Concert Hall will be considerable. These impacts are therefore considered necessary if this venue is to maintain its status as a world-class performance venue".

"Our conclusion is that the accessibility, functional and acoustic related works in the Concert Hall and its foyers will strengthen the core function of the Opera House as a performing arts centre and have a positive impact on its National Heritage values."

Section 9.2.4 of the HIS discusses the impact of the project on NHL Criterion F – Creative or technical achievement:

The Concert Hall renewal project will generally retain and respect these values.

Speakers and lighting arrays

The acoustic upgrades to the Concert Hall auditorium will have high impacts on a limited amount of significant fabric and on key views towards the grand organ and adjacent areas of the faceted ceiling. There will be some impact on the character of the original Hall interior, however this is considered acceptable given the potentially high positive impact in the overall acoustic performance and functionality of the Concert Hall. The acoustic interventions on the sidewalls have been specifically designed to be retractable so as to be hidden from view when not in use. Generally, the proposed interventions reference Hall's palette of materials and colours of white birch, brush box, and his signature magenta colour for the Concert Hall. The curved shape and profile of the suspended 'petal' over-stage reflectors have been resolved to provide optimal acoustic performance while retaining partial views to the Grand Organ, and can be rotated or flown upwards depending on the acoustic needs of the performance type.

Due to the solid nature and extent of the over-stage reflectors, it will not be possible to light the stage from the circular 'crown' as is done presently. This will be achieved by suspended lighting arrays between the acoustic reflectors and via suspended lighting trusses over the stalls.

Visual impacts from these new elements are acknowledged as not insubstantial, but the mock-ups and acoustic testing have confirmed that improvements in the acoustic performance of the Concert Hall will be considerable. The proposed acoustic design has also been through a rigorous peer review process that supported the proposed changes. The visual impacts are therefore considered necessary if this venue is to maintain its status as a world class performance venue.

In order to minimise visual clutter, the set-up for each performance should deploy the minimum technical and acoustic equipment and be flown out or removed when not in use. This includes suspended speaker clusters and lighting. This is an ongoing housekeeping and management issue for the Opera House and the performing companies who use the Concert Hall. Policy 8.4 in the CMP addresses this issue. Air conditioning system

The proposed upgrade of the air-conditioning system for the Concert Hall involves replacement of the existing air delivery system in the 'cannon-port' openings with a more efficient diffuser system in approximately the same or similar locations. Acoustic considerations also require openings such as these to be blocked wherever possible. It is proposed to infill the openings with matching plywood and fit new diffusers within the patched area to minimise impact on the original fabric. Works should be detailed and executed to ensure this is achieved and discordant patches are avoided.

Additional air diffusers are required in the Concert Hall in the lower horizontal sections of the ceiling over the boxes. This will improve patron comfort and more evenly distribute the air supply. The proposed design utilises longer and finer diffusers and should be visually recessive, sitting comfortably with the configuration of existing diffusers.

While there are many parts to the proposed interventions in the Concert Hall, they have all been designed with the aim of respecting the technical and aesthetic excellence of Peter Hall's original design. It is SOH's assessment that when these works are completed, this will be achieved.

Conclusions on relevant impacts on Matters of NES

Description of feasible mitigation measures, changes to the action or procedures to prevent or minimise environmental impacts on each relevant Matter of NES proposed by the proponent

- 16.3.12 The proponent suggests that the location and design of some of the new features and equipment should be subject to further review, including some full-scale prototypes to be tested.

SOH Response

The following components of the proposed projects have or will be prototyped and tested prior to final design and construction methodology:

- *Diffusive panels treatment to box fronts, stage surround, and perimeter wall – prototyped in November 2018, with lessons learnt to be incorporated into future manufacture and installation*
- *Over-stage acoustic reflectors – already extensively prototyped with some further refinements to be further tested*
- *Sidewall reflector – in situ construction method*
- *Acoustic drapes – prototyping ongoing*

These prototypes are to be tested prior to final construction of the proposed modifications. Other than these components, SOH proposes to construct the project as described in the EIS and HIS.

- 16.3.13 The proponent argues that the tangible impacts on fabric and visuals must be considered in relation to the substantial improvements in the functional performance which positively impact intangible values.

SOH Response

The Statement of Significance in CMP4, encapsulates the essential tension in managing the dual characteristics for which the SOH is listed at World, National and State Heritage lists:

*The Sydney Opera House is **a masterpiece of 20th century architecture AND a world-renowned performing arts centre**. It is universally valued for its unparalleled design, form and response to its setting; and its exceptional engineering achievements and technological innovations. It is an internationally recognised landmark, an architectural icon, a symbol of Sydney and Australia, and holds a unique place in the Australian psyche as a focus for national celebrations and events. (emphasis added)*

Neither of these aspects can be considered in isolation, and each must support and strengthen the other.

With respect to the impact of the proposed works on the National Heritage values of the SOH, the HIS concludes that:

- Works proposed in the Concert Hall Renewal project are substantial and will have some adverse impacts on fabric of the eastern side foyer, northern foyer, and the Concert Hall itself and also on views within these spaces. However, the creative and technical achievements of its principal designers, Jørn Utzon, Ove Arup and Peter Hall will be respected and not diminished by these works.*
- The impacts on fabric and spaces in the Concert Hall project are assessed as having a 'significant (adverse) impact' on some of the National Heritage values of the Opera House.*
- The proposed changes in the Creative Learning Centre project will be permanent but none will have a 'significant impact' on the National Heritage values of the Opera House.*
- It is important to note the changes proposed in both of these projects will substantially improve access and amenities for patrons and performers, and potentially enhance and strengthen the ability of the Sydney Opera House to attract patrons and national and internationally recognised performers with its improved functionality and acoustic performance, thus retaining its status as Australia's pre-eminent performing arts centre, and respecting its National Heritage values." (HIS Section 9.4.1)*

it is concluded that the works proposed in the Concert Hall Renewal and Creative Learning Centre projects, are substantial and will have negative impacts on some fabric and spaces, but will have no significant (adverse) impact on the Outstanding Universal Value that enshrines Sydney Opera House on the World Heritage List, either in the short or long term." (HIS Section 10.3)

16.3.14 The proponent proposes detailed methods of protecting some of the characteristics of existing materials and finishes when new elements are introduced.

SOH Response

All building fabric that remains in situ during the construction project will be protected from damage and impacts of construction. The protection will remain in place until all construction works are completed and the upgraded Concert Hall and Creative Learning Centre are opened to use.

Specific works will protect the Grand Organ during the construction, including barriers to prevent dust ingress and atmospheric control to maintain humidity.

Description of any feasible alternatives to the action or mitigating measures that have been identified through the assessment process, and their likely impact on Matters of NES

16.3.15 There are some actions which should be subject to further review as there is potential for change to reduce negative impacts (some overlap with those suggested by the proponent). These are:

- reconfiguration of side foyers (refer to S 5.15)
- demolition within the anteroom and orchestra assembly room (refer to S 5.16)
- strengthening of the steel structure above the plywood Concert Hall ceiling (refer to 5.24)
- infilling of the cannon-ports and diffusers (refer to S 5.34)
- introduction of air delivery registers in the soffits over the boxes (refer to S 5.34)

SOH Response

With respect to the impact of the Concert Hall Renewal Project on National Heritage values of the place, the HIS has concluded that the accessibility, functional and acoustic related works in the Concert Hall and its foyers will strengthen the core function of the Opera House as a performing arts centre and have a positive impact on its National Heritage Values.

Similarly, with respect to the World Heritage values of the SOH, the HIS (Section 10.1) has concluded that:

- *Many components of the Concert Hall Renewal Project will greatly improve access to the Concert Hall side of the Opera House to a wider section of society, both performers and patrons – particularly those with reduced mobility, many of whom will never have experienced some of these spaces before. These accessibility upgrades, including the eastern passageway and Lifts 29 and 30, require some alterations to exceptionally significant spaces and will have a substantial impact on components of their fabric. However these impacts must be considered in relation to the substantial accessibility benefits offered by these changes for both performers and patrons. The carefully considered design, configuration and placement of these new facilities retains and respects Utzon's intent and design regime for these spaces and will not adversely affect the OUV that underpins its World Heritage Listing.*
- *The proposed acoustic enhancements and modifications, stage and theatre machinery upgrades will also have a substantial impact on affected spaces and their fabric, particularly the exceptionally significant Concert Hall. The design and configuration of these proposed changes and upgrades retains and respects Peter Hall's design intent and design regime for this space and is consistent with retaining and enhancing its primary use. The functional benefits will be substantial and the impacts will not adversely affect the OUV that underpin its World Heritage Listing*
- *Details throughout this project have been resolved to a consistent language and very high quality and comply with the Utzon Design Principles and the CMP 4th edition. This design development process has been reviewed by means of regular 'design consistency' workshops, attended by the SOH heritage architect and members of the Eminent Architects Panel and Conservation Council.*

- *The Concert Hall renewal project will enhance the patron experience, performance and operational capability of the Sydney Opera House to continue to host and celebrate world standard performance art. In this respect, this proposal will help sustain the iconic international standing of this Opera House – a key part of its OUV.*
- *In conclusion, it is considered the proposed works in this Concert Hall Renewal Project will be consistent with and respect Utzon's vision for the place and Peter Hall's highly significant contribution to its completion. The works substantially improve the functionality and accessibility of the foyer spaces and the Concert Hall itself. They will also substantially improve its acoustic performance, and together, improve its ability to 'function as a world-class performing arts centre'.*
- *The impacts of these works are significant but will be ultimately positive and not threaten or diminish the Outstanding Universal Value that enshrines Sydney Opera House on the World Heritage List.*

Reconfiguration of side foyers

As noted in the HIS at 7.2.2.2, "the proposed introduction of the of the automated stepped stage platforms requires the circulation space within the side wings (prompt and opposite prompt) to be extended downstage and doors to the stage relocated. This requirement, in conjunction with the new accessible theatre entries, require modifications to the public entry to the front stalls and associated brush box panelling in the side foyers. The changed configuration respects Hall's geometry and set out of the auditorium entries and side foyers and follows existing detailing and materials. Overall the works will result in moderate visual impacts as the overall width of the foyer is reduced, however the quality and character of space and the 'natural' palette of materials and colours is retained and respected."

As noted in the response to S5.15 above, the SOH considers this reconfiguration to be the minimal solution to the stage access issue, and the proposed design respects the design aesthetics of the side foyers. As much original fabric as possible will be reused in the new configuration. The loss of area to side foyers is approximately 19sqm each side. The Southern and side foyers at Level 2 total in the order of 900sqm.

Demolition within the anteroom and orchestra assembly room

The proposed demolition within the anteroom and orchestra assembly room is required to achieve the level access from backstage to stage, and is undertaken at the same time that the stage is lowered. This reconfiguration will improve sightlines for audience members, add to the acoustic performance of the Concert Hall, and improves work health and safety outcomes for performers and production staff. The removal of the limited amount of brushbox panelling in the anteroom is considered necessary as the current panelling is subject to significant damage from road cases and other production equipment. The brushbox panelling in a back-of-house space is not consistent with the Peter Hall design regime for back-of-house spaces, and is inconsistent with CMP4 Policy 10.1 Hall design regime for back-of-house. Design consistency is considered as an Opportunity for Change in CMP4 – "Retain and where possible strengthen consistency of Hall's design regime in existing and new work in back-of-house spaces."

The proposed works will not have a significant impact on a MNES, as they will not significantly impact the National or World Heritage values of the SOH.

Strengthening of the steel structure above the plywood Concert Hall ceiling

The strengthening of the steel structure has been discussed in the response to S5.24. The HIS has identified this work in Section 7.2.2.2, and makes the following observations:

- *Structure could be modified if required but should not negatively impact on, and should improve where possible, views upwards from foyers.*

- Substantially retained but with minor modifications and strengthening to accommodate revised loadings and access. Views upwards from foyers not affected. Minimal impact.
- The strengthening of the steel structure will not have a significant impact on a MNES, as this will not impact the National or World Heritage values of the SOH.

Infilling of the cannon-ports and diffusers and introduction of air delivery registers in the soffits over the boxes

The HIS describes these works in Section 7.2.2.2, as follows:

- *The ‘cannon-port’ openings require modification to accommodate the upgraded air delivery system and address acoustic leakage. It is proposed to infill the existing rectangular openings with matching white birch veneered ply, with a discrete shadow line to delineate the extent of the original opening. Where they are to accommodate new air diffusers, these should be closely fitted within the patched area. A full size mock-up should be assembled and approved first, before these particular works commence.*
- *Additional air diffusers are required forward of the existing rectangular ones on the ceiling soffits over the boxes and sides of the auditorium. These should have minimal impact as long as the existing plywood is retained and the order and proportion of existing registers and the ceiling geometry is retained and respected with the new work. As these new registers are close to the radius junction with the vertical ceiling panels, they should be as discrete as possible so as not to visually weaken the panels.*
- *These new registers are proposed to have white birch surrounds and should therefore sit ‘quietly’ in their new location. Their setout, as proposed, respects the geometry of the auditorium. Refer to images below.*
- *Potentially negative impacts from the revised ‘cannon-port’ openings and new air delivery registers are acceptable provided that:*
 - *the ‘cannon-port’ infill panels are closely fitted with a fine shadow line to delineate the extent of the original opening, and match the adjacent white birch as closely as possible;*
 - *the new air delivery registers in the soffits over the boxes should respect the geometry of the ceiling, plywood panels and adjacent registers, have white birch surrounds with narrow slot registers, and visually sit ‘quietly’ in their location.*

These works will not have a significant impact on a MNES, as these works will not impact on the National or World Heritage values of the SOH.

16.3.16 There are some elements which require further research to assess their significance. A good understanding of their significance is needed prior to decision-making about actions which may impact on them. These are:

- Concert Hall existing equipment and machinery while it is in situ (refer to S 5.35)

SOH Response

The proposed modifications to Concert Hall existing equipment and machinery will not adversely impact on the National or World Heritage values of the SOH.

The CMP4 is the principal management plan by which the SOH upholds and protects the State, National and World Heritage values of the place. CMP4 includes Policy 13.2 Machinery and equipment.

The HIS has assessed compliance with CMP4, and specifically Policy 13.2 at Section 7.2.2.7:

"Much of the existing machinery and equipment associated with the Concert Hall dates from the original installation in the early 1970s. With technological advancements, including the change to digital systems, and changes to operational safety standards, this equipment is approaching the end of its life and requires replacement. If it is not replaced, safety and other compliance issues will remain and the efficient operation and management of the Concert Hall as a venue will be hindered. In order to continue its use and strengthen its reputation as the major auditorium in Australia's pre-eminent performing arts centre, (key aspects of its significance), this machinery and equipment needs to be replaced and updated.

A full heritage assessment of existing machinery and equipment in the Concert Hall will be undertaken, and any significant pieces identified. The process outlined in this policy was carried out for the recent Theatre Machinery Project in the Joan Sutherland Theatre where the machinery was fully documented before decommissioning and selected significant pieces removed and archived as part of the Opera House collection. It is proposed this same process will be employed for the Concert Hall Renewal Project."

As noted in the response to section 5.35 above, SOH commits to undertaking the full heritage assessment, archival recording, and archiving of relevant significant items.

16.4 Part of action: Creative Learning Centre Works

Relevant impacts of the action:

- 16.4.1 The action and the relevant impacts of the action for the Creative Learning Centre works are described in S 6.0 of Part 1.

Matters of NES affected by the action

- 16.4.2 World Heritage values – Authenticity (form and function) and integrity
- 16.4.3 National Heritage values – Criterion A (Events, Processes), Criterion E (Aesthetic characteristics), Criterion F (Creative or technical achievement), Criterion G (Social value), Criterion H (Significant people)

Nature and extent of likely impacts on:

(A) the World Heritage values of a World Heritage property

- 16.4.4 The impact is positive in terms of authenticity of function as the works enhance the ability of the SOH to engage with and promote the performing arts to younger generations.
- 16.4.5 The negative impacts on authenticity of form and integrity associated with the removal of internal walls and partitions to create larger spaces and construction of a new WC and other facilities are minor.
- 16.4.6 The works with a substantial negative impact on values and authenticity of form and integrity are:
- the modification of the recessed entry from the Western Broadwalk, and
 - the cutting of a large opening in the main curved concrete wall and another in minor north south wall to connect spaces.
- 16.4.7 The negative impacts involve the loss of original designed spaces, the loss of fabric and the introduction of new fabric.

(B) the National Heritage values of a National Heritage place

- 16.4.8 The Creative Learning Centre works will have a positive impact on the values of Events, Processes (Criterion A) and Social Value (Criterion G) as they enhance the ability of the SOH to engage with and promote the performing arts to younger generations.
- 16.4.9 They will have a negative impact on the values of Aesthetic characteristics (Criterion E), Creative or technical achievement (Criterion F) and Significant people (Criterion H).
- 16.4.10 Impacts on the Aesthetic characteristics occur in the modification of the recessed entry from the Western Broadwalk due to the reduction of the deep shadow on the existing entry. There is a visual and spatial impact from the loss of the deep alcove. Other impacts on Aesthetic characteristics are due to the proposed opening in the curved concrete wall. Both of these also impact on Significant people as they are features that were designed by Utzon.
- 16.4.11 There is an impact on the Creative or technical achievement relating to both the recessed entry and the opening in the curved wall in terms of fabric, views and spaces. There is also an impact on the Creative or Technical achievement from the removal of the existing fit out designed by Peter Hall, including wall and ceiling white birch plywood 'wobbly' panels and reuse of the 'wobbly' panels in the same space.

Conclusions on relevant impacts on Matters of NES

Description of feasible mitigation measures, changes to the action or procedures to prevent or minimise environmental impacts on each relevant Matter of NES proposed by the proponent

- 16.4.12 The proponent argues that the tangible impacts on fabric and visuals must be considered in relation to the substantial benefits of engaging with younger generations which positively impact intangible values.
- 16.4.13 The proponent proposes that reuse of some existing fabric, such as the 'wobbly' panels is a mitigating measure.

Description of any feasible alternatives to the action that have been identified through the assessment process, and their likely impact on Matters of NES

- 16.4.14 There are some actions which should be subject to further review as there is potential for change to reduce negative impacts. These are:
- the proposed relocation of the western entry doors (refer to S 6.11)
 - the proposed opening within the curved concrete wall and the strengthening it requires (refer to 6.12 and 6.13)

SOH Response

The HIS has assessed the impact on MNES of the introduction of the Creative Learning Centre at Section 9.0.

With respect to the impacts on National Heritage Values, the HIS concludes:

"The proposed works to accommodate the Creative Learning Centre will have negligible impact on the external architecture and setting of the Opera House and no adverse impact on its National Heritage values.

Proposed alterations to form the spaces for the Creative Learning Centre affect some original structure within the Podium but not the unique folded and cranked beams or the ribbed shell roof structure.

The Creative Learning Centre project will retain and respect the design regimes of both Utzon and Hall and provide a unique facility that closely relates to the Western Foyers and other spaces within the Podium. This facility will enhance the ability of the Opera House to engage with and promote the performing arts to younger generations, both locally and nationally. This will strengthen its association with the performing arts and wider community.” (HIS Section 9.3.2)

The HIS has assessed the impact on National Heritage Values according to the National Heritage significant impact criteria at Section 9.4.1:

“The proposed changes in the Creative Learning Centre project will be permanent but none will have a ‘significant impact’ on the National Heritage values of the Opera House.”

Relocation of the Western Entry Doors

The configuration of the entry to the Creative Learning Centre from the Western Broadwalk has been designed to provide internal access to the amenities, from both the Primary Learning Space and the Secondary Learning Spaces, without a patron needing to go through the other learning space. Secondly, the configuration has been designed to cater for the use of the small lobby created for a camera location when the Creative Learning Centre is being used for the creation of digital content. Lastly, the small lobby created provides an alternative entry to the Creative Learning Centre when an event is underway in the Western Foyer.

It should be noted that there is a door in a similar position on the Eastern Broadwalk, and this door is set back only 1.52m from the podium façade. The proposed door to the Creative Learning Centre is set back 1.95m from the podium façade.

Additional renders of this entry to the Creative Learning Centre have been prepared and are included here in Attachment E.

The Proposed Opening within the Curved Concrete Wall and its Strengthening

The size of the proposed opening in the curved concrete wall is necessary to provide the usable space required for the Primary Learning Space. The render in the EIS package did not accurately display the size of the proposed opening. New renders have been prepared which more accurately show the size of the proposed opening, these have also been included in Appendix D.

The Sydney Opera House believes that the size of the opening is appropriate, and that sufficient area of the original wall remains to provide evidence and understanding of the wall and spatial arrangement of the space.