THE STAR

MODIFICATION 13 PLANNING SUBMISSION

MECHANICAL SERVICES

PREPARED BY

wsp

TABLE OF CONTENTS

Date	Revision No.	No. of Pages	Issue/Description of Amendment	Prepared By	Reviewed By	Approved By	Signature
14.11.16	A	23	Skeletal Report Issue	William Willis	John Verrell	John Verrell	
16.01.17	B	34	Draft Report Issue	William Willis	John Verrell	John Verrell	
28.02.17	C	34	Final Report Issue	William Willis	John Verrell	John Verrell	
17.03.17	D	34	Revised Final Report Issue	William Willis	John Verrell	John Verrell	
28.02.17	E	36	Revised Final Report	William Willis	John Verrell	John Verrell	
24.03.17	F	35	Revised Final Report	William Willis	John Verrell	John Verrell	
	G	34	Revised Final Report	William Willis	John Verrell	John Verrell	
14.08.17	H	35	Revised Final Report	William Willis	John Verrell	John Verrell	
21.09.17	J	35	Revised Final Report	William Willis	John Verrell	John Verrell	
4.12.17	K	35	Revised Final Report	William Willis	John Verrell	John Verrell	
31.01.18	L	36	Revised Final Report	Giancarlo Oradini	John Verrell	John Verrell	

1 EXECUTIVE SUMMARY

SEGL has commenced a five-year redevelopment journey to create a landmark, exemplar integrated resort. This proposed redevelopment will occur through the lodgement of two s75W modification applications to the original Major Project Approval (MP08_0098) with the Department of Planning and Environment (the Department).

Modification 14 which was approved in October 2017 proposes works and improvements across the site including improvements to access and circulation to and within the site and to generally improve the functioning, circulation and amenity of The Star. The proposed works will deliver an expansion of the Sovereign Resort and ancillary works, provide additional pre-function space to the Multi Use Events Facility, improve the arrival experience on Pirrama Road and a number of associated internal upgrade works. These works will also include the upgrade of the central cooling water system including harbour heat rejection. These works seek to enhance the attractiveness and functioning of The Star complex.

Modification 13, proposes the development of a new Ritz-Carlton Hotel and Residential Tower in the northern portion of the site with associated podium treatment, as well as other transport, retail, food and beverage improvements across the site. It is Modification 13 that is the subject of this report.

This Mechanical Report has been prepared by WSP for SEGL and outlines the proposed mechanical servicing strategies associated with the Modification 13 proposal.

The mechanical services will be designed to best practice principles to ensure that environmental impacts of the development are limited.

The cooling for the development will be provided by the main site central chilled water plant which will be upgraded in Modification 14, allowing the Modification 13 development to make use of the energy efficiency improvements planned for the existing site infrastructure, maximizing operational efficiencies and ensuring that extensive new dedicated thermal plant for Modification 13 is not required. HVAC energy consumption will be reduced through use of a wide range of air-side energy efficiency measures such as high efficiency air handling plant, occupancy-based outside air control and energy recovery.

All air discharges from mechanical plant will be designed to exceed statutory-minimum separation distances and include specialist chemical treatment of exhaust air where necessary to mitigate risk of negative environmental impact or nuisance (e.g. electrostatic and UV filtration on commercial kitchen exhaust discharges).

The HVAC systems will be designed to provide excellent indoor air quality, to protect the health and comfort of occupants; outside air will be provided with high efficiency filtration and delivered at quantities significantly above statutory minimums. CO2 monitoring will also be provided where appropriate to ensure a high quality indoor environment is obtained without compromising energy efficiency.

THE STAR

MODIFICATION 13
PROPOSED WORKS

2 MODIFICATION 13 PROPOSED WORKS

Modification 13 includes the following proposed works:

NEW RITZ CARLTON HOTEL AND RESIDENTIAL TOWER

New Ritz Carlton Hotel and residential tower includes:

- Demolition of part of the existing building in the northern portion of the site, including part of the Pirrama Road façade and part of the Jones Bay Road façade.
- Construction of a new Tower, 237.0 metres AHD (approximate, 234 metres from Pirrama Road);
- Residential uses across 35 levels, comprising:
  - A residential vehicular drop off lobby on Level B2
  - A residential lobby on Level 00 to be accessed from Jones Bay Road;
  - Residential communal space on Level 07 to be accessed via Level 08; and
  - 204 residential apartments located from Levels 05 to 06 and from Levels 08 to 38, featuring one-bedroom, two-bedroom and three-bedroom unit types (Note – no Level 13)
- Hotel uses across 31 levels, comprising:
  - A hotel arrival lobby on Level B2 to be accessed from the new Ritz-Carlton porte-cochere along Pirrama Road;
  - A hotel Sky Lobby for guest check-in on Level 39 and 40, featuring a restaurant, bar and lounge;
  - 220 hotel rooms located from Level 42 to 58 and from Level 60 to 61
  - A hotel spa and gym on Level 07
  - A VIP link to the Sovereign Room on Level 04 and 04 Mezzanine
  - A Ritz-Carlton Club lounge and terrace on Level 59
  - Hotel staff end-of-trip facilities on Level B3
  - Hotel staff arrival point on Level 00
  - Hotel back-of-house and plant on Level B2, 02, 03, 05, 41 and 42
- A Neighbourhood Centre consisting of the following proposed uses including street level cafe, library, learning / innovation hub, multipurpose function centre, practice rooms (functional use to be finalised in conjunction with a neighbourhood panel)
- A new car-parking stacker system below the new porte-cochere of the Ritz-Carlton Hotel, with a total capacity of 221 spaces, to serve the new hotel and apartments
- Vertical transport associated with the tower and podium; and
- A new drop-off / pick up area (short-term parking) on Jones Bay Road for the proposed apartments.

LEVEL 07

- A 'Ribbon' at Level 07 connecting the new Hotel and Residential Tower to the existing building along Pirrama Road, comprising:
  - Two pools and associated pool decks (one for the new Hotel, one for The Star); and
  - Two food and beverage premises with associated store rooms and facilities;
- Lift access from the Level 05 Terrace to Level 07;
- Residential communal open space associated with the new residential apartments, comprising pool and landscaped terrace at the base of the Tower adjacent to Jones Bay Road;
- Gym and associated change rooms and facilities for the residents;
- Gym and associated change rooms and facilities for hotel guests; and
- Landscaping treatments.

LEVEL 05 SKY TERRACE

- Three food and beverage outlets with external areas;
- Completion of the Vertical Transportation drum to connect with Level 05 Sky Terrace;
- Designated event spaces on the Terrace; and
- Landscaping treatment.

LEVEL 05 ASTRAL HOTEL POOL AND SPA RECREATIONAL FACILITY UPGRADE

- New pool deck, pool, spa, gym and amenities upgrade for Astral Hotel and Residences.

TOWER TO SOVEREIGN LINK BY ESCALATOR AND LIFT

- Link from the Tower (across Level 04 and Level 04 Mezzanine) to the Sovereign Resort and MUEF at Level 03, connected via Lift G4, Lift VIP 1 and escalators.
- Extension of the lift service to stop at Level 00, 01 and 05 in addition to Level 3, 4 and 4M.

LEVEL 03 SOVEREIGN COLUMN FAÇADE TREATMENT ALONG PIRRAMA ROAD

- New glazed detail to enclose exposed Level 03 Sovereign columns along the Pirrama Road façade.

VARIOUS RECONFIGURATION WORKS AROUND VERTICAL DRUM LEVEL 00 TO L5

- Revolving door at L00 main entrance landing Pirrama Road end
- Sliding door at L00 landing at stairs from Light Rail
- Reconfiguring of existing L1 and 2 void edge
- New escalators from L2 to L3 due to revised landing at Level 3
- Infill of L2 atrium void to main entrance at Pirrama Road

FAÇADE INTEGRATION WORKS

- Upgrades to the Pirrama Road and Jones Bay Road façades to integrate the new Ritz Carlton Hotel and Residential Tower with the existing building.

INFRASTRUCTURE UPGRADES

- A new plant room located within the podium over Levels 03, 04, 05 and 06 of the proposed Hotel and Residential Tower;
- Relocation of the current Level 03 cooling towers (adjacent to the MUEF) to the Level 09 plant room above the Level 06 plantroom adjacent to the Astral Hotel;
- New capstone microturbine units and associated flues in the proposed plant room at Level 03 between the Darling Hotel and the Astral Residence Tower;
- New capstone microturbine units and associated flues in the new Level 03 plant room at the base of the Tower;
- Relocation of the existing main switch-room to the new plant room on Level 02, south of the demolition cut line;
- Relocation of the existing data recovery centre to the new plant room on Level B1 of the Darling Hotel;
- Relocation of diesel generator flues to the side of the new Level 09 plantroom, adjacent to Astral Hotel.

LEVEL B02 TRANSPORT INTERCHANGE

- Upgrades to the Event Centre Loading Dock;
- Entry into Basement car stacker for the Tower apartments and Ritz-Carlton Hotel;
- New commuter bike parking and hire bike system;
- Upgrade of finishes to light rail station surrounds (but not within Light Rail corridor) and removal of existing wall barrier to the Pirrama Road frontage;
- Upgraded taxi-rank arrangements;
- Designated Star coach parking along Service Road in front of Light Rail station; and
- Realignment of kerbs and line-marking.
- *Note – no works within the Light Rail corridor*.

TRANSPORT IMPROVEMENTS – OTHER LOCATIONS

- Reconfiguration of existing median strips on Jones Bay Road and addition of new median strip on Pyrmont

Street, with associated line-marking to enable a new right-hand turning lane into the Astral Hotel Porte-Cochere;
- New Pyrmont Street carpark entry and exit, associated line marking, changes to internal circulation, and reconstruction of the pedestrian footpath along Pyrmont Street; and
- Relocation of existing feeder taxi-rank from Jones Bay Road to the Level B2 transport interchange.

SITE WIDE LANDSCAPE AND PUBLIC DOMAIN UPGRADES

- Upgrades to street frontages along Pirrama Road (for the Hotel Porte Cochere) and Jones Bay Road (for the residential entry);
- Upgrades to street frontage to Pyrmont Street, due to new car parking entry; and
- Upgrade to the entry forecourt of SELS building at the corner of Jones Bay Road and Pyrmont Street. (Note: no works within SELS building is proposed).

LEVEL 00-RESTAURANT STREET

- Creation of a new destination Restaurant Street by:
  - Incorporating existing Balla & Black Food and Beverage premises on Level 00; and
  - Converting existing retail shops into new Food and Beverage tenancies.

PIRRAMA ROAD AND JONES BAY ROAD FOOD AND BEVERAGE

- A revised food and beverage tenancy at the existing Pizzaperta outlet along Pirrama Road;
- A new food & beverage tenancy at the Marquee street entry; and
- A small café outlet adjacent to the residential lift lobby at Jones Bay Road.
- A new food & beverage tenancy accessed off existing walkway from Jones Bay Road.

FOOD AND BEVERAGE – OTHER LOCATIONS

- Reconfiguration of Harvest Buffet, including new escalators from Level 00 Food Court to Level 01; and
- Refurbishment of Bistro 88 into the interim Century tenancy. (Note: The Century tenancy post-construction is proposed to be at the Jones Bay end of L00 – Restaurant Street).

DARLING HOTEL CORNERS

- Upgrade of the corner plaza at the Union/Edward Street property entry to accommodate:
  - A new Food and Beverage premises on Level 01 and 02;
  - A new entry foyer leading to the Food Court;
  - A relocated awning enclosure at street level;
- Upgrade of the corner plaza at the Union/Pyrmont Street property entry to accommodate:
  - A new awning enclosure for the existing café;
  - A new revolving door at entry to Darling Hotel
  - Eight (8) luxury display cases at Darling Hotel car park entry; and
  - Two car display areas at Darling Hotel car park entry.

SITE-WIDE ACOUSTIC STRATEGY

- A site-wide acoustic monitoring strategy applied to assess impact of potential noise generating sources in Mod13

SITE-WIDE LIGHTING STRATEGY

- A site-wide lighting strategy integrating and improving the existing lighting across the precinct, with new lighting for the proposed Tower, Podium and Ribbon, including:
  - Internal lighting of Hotel and Residential spaces;
  - Illuminated highlights at the Sky Lobby and Club Lounge levels;
  - Integrated lighting on the eastern and western vertical façade slots and angled roof profile;
  - Podium external illumination from awnings, and under retail and lobby colonnades;
  - Landscape lighting on Level 07 open terraces and pool decks;

- Feature lighting accentuating the wing-like profile of the Ribbon and vertical element;
- Internal and external lighting to Food and Beverage outlet at Union/Edward Street corner;
- Façade LED lighting to the heritage SELS Building

SPECIAL LIGHTING EVENTS

- Approval for fifty three (53) Special Lighting Event nights per year. for the use of permanent installation of moving projector lights on the rooftop of the Astral Hotel

SIGNAGE UPGRADES

- Consolidation of existing signage approvals and new signage, including:
  - Approved signs;
  - Wayfinding signs;
  - Business identification (including Food and Beverage outlets); and
  - Signage on the Tower and Podium.

STORMWATER UPGRADES

- Stormwater upgrade works, including increased pit inlets and pipe capacities at the low points along Pyrmont Street and Edward Street.

THE STAR

INTRODUCTION AND BACKGROUND

3 INTRODUCTION AND BACKGROUND

3.1 GENERAL

This Mechanical Report has been prepared by WSP for The Star Entertainment Group Limited (SEGL) and outlines the proposed mechanical servicing strategies associated with the Modification 13 proposal, including (but not limited to):

- Relevant Standards and Codes;
- Scope of the Mechanical Services;
- Environmental Impact and Mitigation Strategies;
- Design Parameters to be used as a Basis for the Design; and
- Preliminary Plant Massing and Spatial Requirements.

3.2 SCOPE OF MECHANICAL SERVICES

The following services form part of the mechanical scope of works for this project:

- Central thermal plant for the proposed tower (boilers, pumps, heat exchangers, interface with site wide systems etc);
- Air conditioning systems;
- Heating distribution;
- Cooling distribution;
- Thermal insulation;
- Ventilation and exhaust systems;
- Stairwell pressurisation systems;
- Smoke management and exhaust systems;
- Building management system;
- Energy monitoring; and
- Automatic controls and motor control centres, including associated mechanical power wiring.

3.3 AUTHORITIES AND REGULATIONS

The Mechanical Ventilation and Air Conditioning systems for the Modification 13 building works at The Star, will be in accordance with normal engineering practice and meet the requirements of the Building Code of Australia, relevant Australian Standards, Conditions of Consent and Fire Engineering Reports.

The following standards will be applicable throughout the project:

- National Construction Code Building Code of Australia 2016;
- NSW Statutory Regulations;
- Relevant Australian Standards including but not limited to AS 1668.1, AS 1668.2, AS 3666, AS 4254, AS 1432, AS 3000, AS 3008, AS 1170, AS 1677 etc.; and
- The requirements of the NSW Work Cover Authority.

Specifically, the standards referenced below are in relation to the gazetted BCA at the time of the project initiation. (BCA 2016).

Mechanical Services System	BCA Requirement	Australian Standard	Fire Engineering Report
General	NCC 2016		
Energy Efficiency	NCC 2016 Section J		
Smoke Hazard	NCC 2016 Part E2	AS/NZS 1668.1 – 2015	
Smoke Hazard Management Systems	NCC 2016 Clause E2.2	AS/NZS 1668.1 - 2015, AS 1668.2 - 2012	FER associated to the subproject works.
Mechanical Air Handling Systems	NCC 2016 Clause E2.2	AS/NZS 1668.1 – 2015, AS 1668.2 - 2012	
Fire Dampers	NCC 2016 Clause C3.15	AS/NZS 1668.1 – 1998/Amdt 1 - 2002	
Mechanical Ventilation Systems	& NCC 2016 Clauses F4.5, F4.11, F4.12	AS1668.2 – 2012	
Cooling Towers	NCC 2016 Clause F4.5	AS 3666.1 – 2011	

3.4 DEFINITIONS

Unless the context otherwise requires, the following definitions apply:

AS Australian Standard

BCA Building Council of Australia

BMS Building Management System

DA Development Approval

ESD Environmental Sustainable Development

HVAC Heating, Ventilation and Air Conditioning

NCC National Construction Code of Australia

NLA Net Lettable Area

AHU Air Handling Unit

FCU Fan Coil Unit

THE STAR

MECHANICAL SERVICES SCOPE

4 MECHANICAL SERVICES SCOPE

4.1 GENERAL

4.1.1 Air Discharges

All air discharges from the new development will be designed to meet or exceed the requirements of AS1668.1:2015, AS1668.2: 2012 and AS3666.1: 2011.

Particular consideration has been given to the proposed position of the relocated cooling towers, new commercial kitchen exhaust, smoke exhaust and discharges. New capstone gas generators and existing diesel generators have also been considered, all of these have been reviewed in the Air Quality report issued by WSP. The locations are designed to ensure that minimum separation distances to boundaries, natural ventilation devices and air intakes are exceeded, wind effects considered, and kitchen odour treatment included (where deemed to be required), to minimise risk of nuisance to users of The Star, neighbouring properties, and the general public.

Refer to the following sections “Relocation of Cooling Towers” and “Restaurant Servicing Strategy” for further description of the work in these areas.

4.1.2 Indoor Air Quality

Buildings with good indoor environmental quality protect the health and comfort of building occupants. High-quality indoor environments can also enhance productivity and improve the building’s value. We are aiming for a 5-star Greenstar rating for the proposed tower component, refer to the ESD report for detail.

Where mechanical ventilation systems are employed it is possible, through the use of high efficiency filters, to remove a large percentage of airborne particulates from the incoming air stream. This will help promote occupants’ comfort, well-being, and productivity by improving indoor air quality. It is intended that high efficiency filtration will be applied to all central air handling units to ensure high quality of indoor air is achieved throughout the project.

It is proposed to utilise CO_2 sensors for monitoring of indoor air quality in large spaces with variable occupancy, providing the ability to optimize both energy efficiency and indoor air quality, through modulation of the outside air quantities.

4.1.3 Energy Efficiency

This project aims to achieve best practice energy efficiency for the mechanical services, in order to limit the project’s environmental impact and reduce ongoing operating costs. It is intended that the following energy efficiency enhancements will be included within the Modification 13 scope (but not limited to):

- Integration with the main site chilled water system, allowing the benefits of large-scale high efficiency plant to be extended to the new tower and ribbon, including the proposed infrastructure efficiency upgrades that are to be completed outside the scope of the Modification 13 works;
- Dedicated high efficiency condensing boilers for heating hot water in the tower;
- Variable volume secondary pipework reticulation to reduce pumping energy, with Pressure Independent Control Valves (PICV) to minimize pressure fluctuations and ensure efficient operation;
- Premium efficiency Air Handling Units (AHU’s) incorporating variable air volume control (VAV), economy cycle arrangements and/or CO2 outside control where appropriate and deemed to be of justifiable benefit;
- EC / DC fan coil units (FCU’s) to reduce electrical energy consumption compared to conventional FCU’s as well as providing improved demand-controllability and commissionability;
- Energy recovery systems to enable pre-conditioning of outdoor air supplies via transfer of energy with exhaust / relief air streams;
- Hotel guestroom ventilation systems integrated with the guestroom control system (for outside air) and lighting control (for bathroom exhaust) to shut off airflow when guestrooms are unoccupied;
- Extensive Building Automation System (BAS) with ability to monitor, control and optimise plant operation; and

- Extensive thermal energy metering system to enable apportioning of chilled and heating water usage as well as assisting with plant optimization and fault diagnosis.

4.2 CENTRAL PLANT

4.2.1 Integration with Site Chilled Water Infrastructure

The Star is currently developing a comprehensive master-plan to meet the future needs of the site. A key aspect of the master plan are major improvements to the existing cooling infrastructure, which is deemed to currently operate beneath its potential capacity and efficiency, to meet the future site requirements. This includes streamlining the secondary network, consolidation of chiller plant and uprating the sea water rejection system.

The Star currently employs an expansive water-cooled chiller system which serves the cooling needs of the site throughout the year. This system rejects this heat to the neighbouring harbour via sea water heat exchangers.

To maximize efficiencies associated with a consolidated central plant strategy, the proposed Hotel Tower and Ribbon will be served with chilled water from this site central thermal plant, interfaced via new energy transfer stations in the lower plant level, and independently metered for monitoring and billing. Energy transfer stations will also be located on the mid-tower plant level to avoid excessive static pressures in the pipework system.

The seawater heat rejection plant upgrades outlined within the Modification 14 works and proposed chilled water system efficiency improvements have been coordinated to ensure sufficient capacity is included to meet the additional loads associated with the Modification 13 works, ensuring efficiencies are optimized and limiting environmental impact. As a result, no additional heat rejection plant is proposed under the Modification 13 scope, and the additional chilled water plant capacity will be provided as a bolt-on capacity increase within the main site plant room only.

Each energy transfer station will consist of a minimum of two plate heat exchangers to decouple the two systems, sized at a minimum of 60% load each (to be agreed), and circulating pumps, in an N+1 arrangement, to distribute the chilled water to the cooling coils.

Thermal energy metering will provided to ensure that chilled water consumption can be apportioned to the various parties involved in an accurate and efficient manner, for cost apportioning purposes as well as assisting to identify any system inefficiencies.

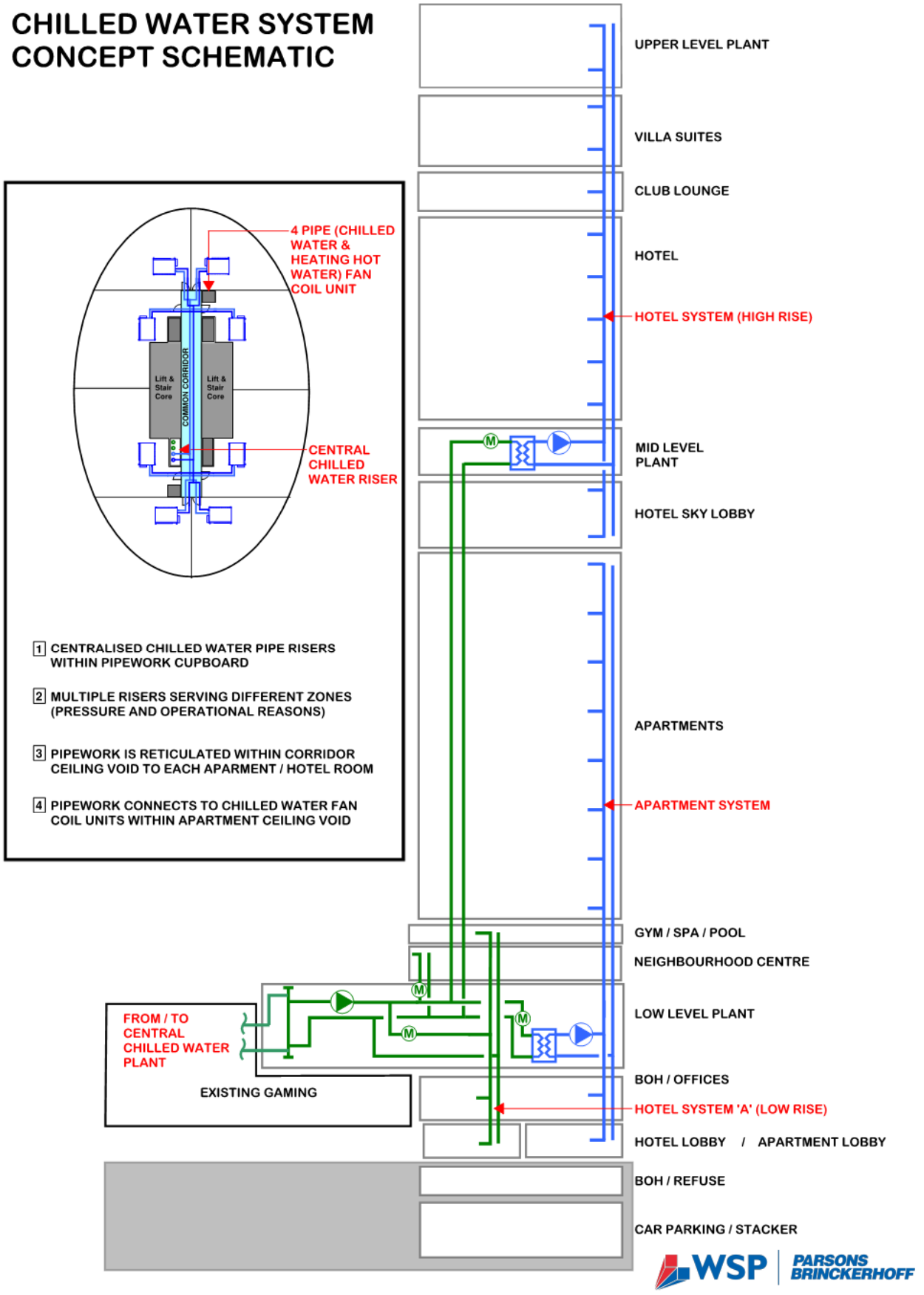

FIGURE 1: CONCEPT CHILLED WATER SCHEMATIC

4.2.2 Relocation of Cooling Towers

There are currently two forced-draft cooling towers located on the northern end of the Level 3 'Green Roof.' The cooling towers were installed to provide an alternative base-load heat rejection pathway whilst the main sea water heat rejection is taken offline for annual maintenance. Whist this was the main intended purpose for the cooling towers, it is also evident that the cooling towers have been programmed to provide supplemental heat rejection capacity when the sea water system has reached peak capacity, however it is expected that the supplemental operation will be required less frequently due to the seawater heat rejection upgrades included under the Modification 14 scope.

The proposed Ribbon structure is planned to occupy the same space in which the cooling towers currently reside. As a result, it is proposed to relocate the cooling towers and associated plant to accommodate this future development.

After a review of a number of potential locations it was deemed that locating cooling towers over the roof of the existing Multi Use Entertainment Facility (MUEF) plant room is most suitable for the following reasons:

- Compliant installation achievable (vertical discharge with satisfactory separation distances);
- Negligible change to existing scenario in terms of proximity to adjacent property boundaries;
- No impact to the floor areas of proposed site extensions;
- Ability to conduct demolition and construction without major dependence on other works; and
- Low architectural impact with integration into the existing plant building.

The preferred arrangement sees the construction of a flat, grated deck constructed over the existing MUEF plant room roof. Cooling towers are then mounted on this deck, discharging vertically. The construction of a new deck allows the existing roof below (and associated plant hung below) to remain unmodified, allowing the plant to remain operational with minimal to no downtime.

Currently there are a number of exhaust discharges located on the plant room roof. The grated deck above would allow for these discharges to escape through, located at a sufficient height to not impede the flow. The discharges would potentially be required to be translated slightly so that the underside of the cooling towers would not have significant effects on the flow.

It is proposed that the cooling tower extension (sides and roof) will be visually screened with louvres or similar to allow airflow to pass through but limiting the visual impact of the plant space, and providing consistent architectural representation with the existing plant area.

Assessments of noise and air quality affects are covered in the Acoustic and Air Quality reports issued by WSP.

It is anticipated that the most appropriate time to undertake the works would be on shoulder season, when the cooling towers will not be called upon to provide peak top up, nor cover for the seawater heat rejection maintenance.

4.3 EXISTING MECHANICAL SERVICES WITHIN PROJECT BOUNDARY

Given the close interaction between the existing site and new Tower and Ribbon extensions, it is inevitable that there will be existing mechanical plant serving areas to remain operational that will be affected by the works. A full study of the impacted systems will be undertaken during the services detailed design stage, with strategies developed to minimize impact on The Star operations, however, based on a review of the development, it is not likely that this would have any material impact on the design of the development nor potential environmental impacts. The following mechanical

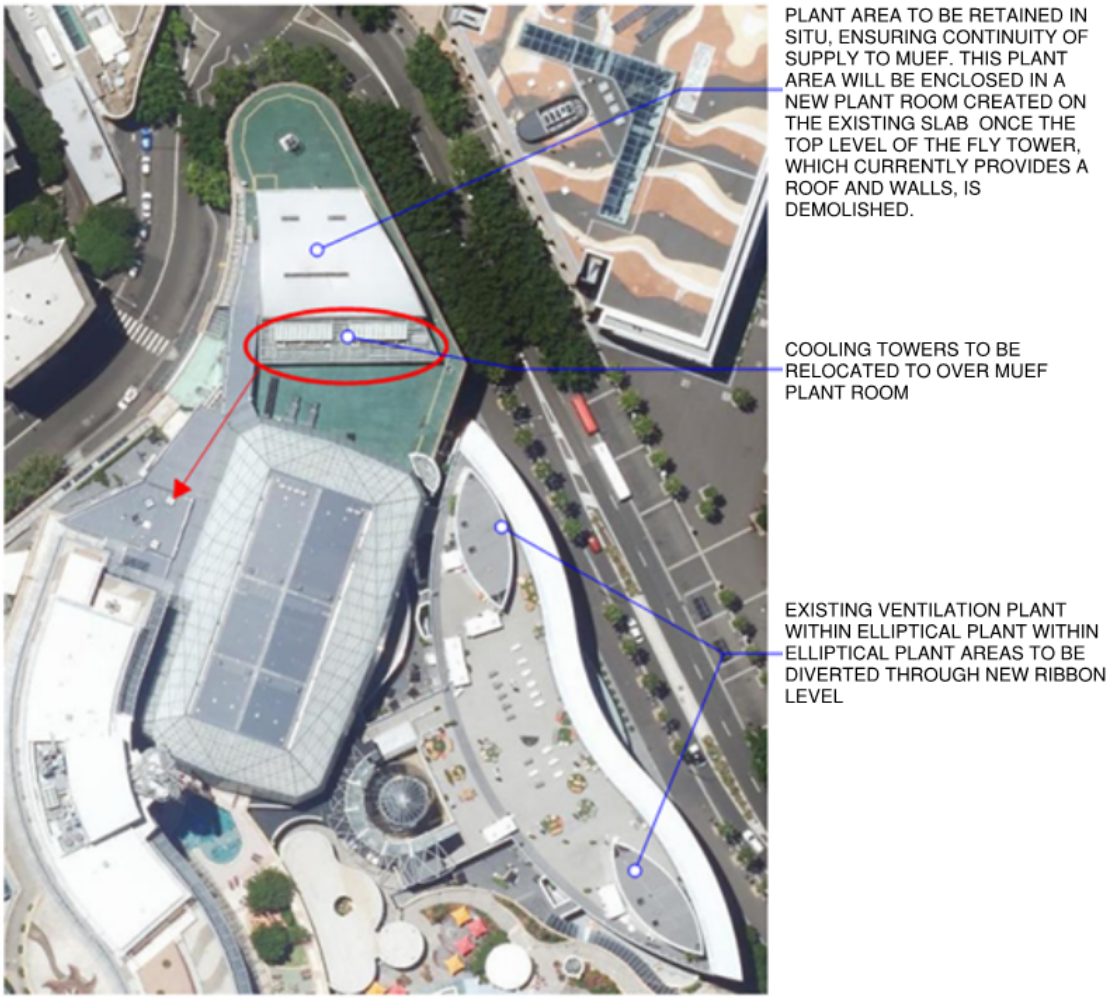

FIGURE 2: MAJOR MECHANICAL PLANT TO BE DIVERTED/RELOCATED TO ENABLE MODIFICATION 13 WORKS

equipment is known at this stage to require relocation or alteration in order to enable the Modification 13 works:

- Exhaust plant (smoke, toilet, kitchen exhaust) located within the 2no. elliptical plant rooms at existing roof level (i.e. below the proposed location for the new Ribbon structure).

These exhaust systems will be extended through the new Ribbon, with risers adjacent to the new stair cores, and vertical discharge above the new Ribbon roof level – refer to latest architectural documentation.

It is proposed to provide additional treatment (filtration, chemical treatment and the like) to commercial kitchen exhausts, where required, to minimise risk of nuisance odours to users of the Ribbon roof deck and beyond.

These works will also encompass the additional exhaust requirements of the new F&B on level 5 and 7.

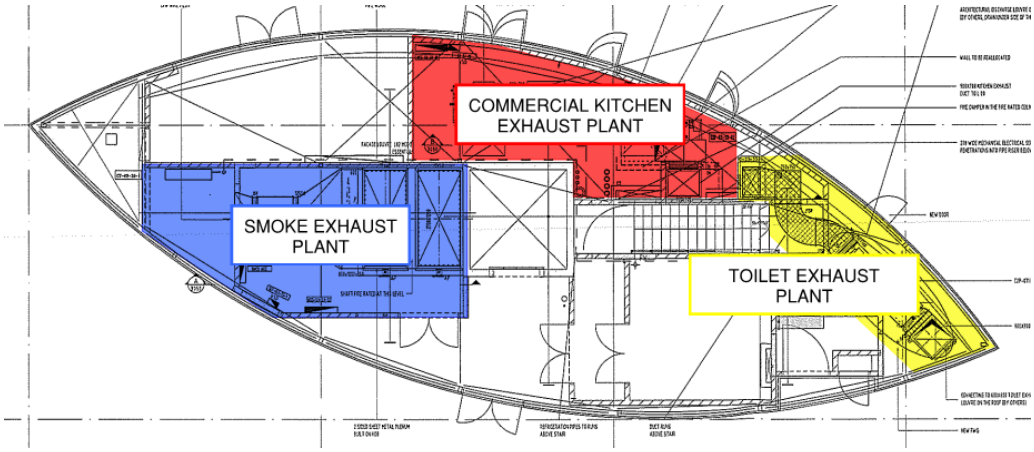

FIGURE 3: EXISTING VENTILATION PLANT WITHIN ELLIPTICAL PLANT ROOMS AT LEVEL 3 ROOF

- Multi-Use Entertainment Facility (MUEF) back up chiller and associated plant located in the existing flytower plant area.

It is intended to retain this plant area in situ, ensuring continuity of supply to the MUEF. This plant area will be enclosed in a new plant room created on the existing slab once the top level of the fly tower, which currently provides a roof and walls, is demolished.

FIGURE 4: EXISTING MUEF CHILLER PLANT WITHIN FLYTOWER PLANTROOM

- Ventilation and exhaust plant located on the existing green roof area adjacent MUEF.

Proposal: Incorporate within new Level 03-05 plant room (i.e. over the existing green roof).

- Chilled and heating water pipework reticulation throughout the northern end of the site.

Proposal: Pipework to be traced and cut back to most suitable location outside of the project boundary, or diverted where necessary to maintain operation.

4.4 PROPOSED MECHANICAL SERVICING CONCEPT

4.4.1 Restaurant and F&B

This project includes a number of restaurant tenancies which are being created, modified or refurbished. These include:

- New Hotel Sky Lobby Restaurant and Club Lounge;
- New Level 5 Roof Terrace Restaurants;
- New Level 00 Restaurant/s near New Hotel Tower; and
- Level 00 "Restaurant Street" new and refurbished restaurants.
- New Darling Union and Edward Streets food and beverage.

Whilst the services scope for each restaurant tenancy is not yet defined, the following mechanical works are anticipated:

Space cooling and heating shall be via fan coil units, or air handling units as appropriate for the scale of the restaurant. Where AHUs are used for larger spaces, they shall be provided with variable speed drives and economy cycles, where required. Full access will be provided to CHW & HHW valves and FCU filter media. Each tenancy will be provided with thermal energy metering for apportioning energy costs.

Supply air ductwork within the restaurant space will be installed by the tenant to suit their ceiling configuration.

The new restaurants will incorporate commercial cooking facilities which will require commercial exhaust plant. The following table outlines the preliminary proposed strategy for treating the objectionable discharge. Note that the final combination of filtration/treatment selected for each kitchen discharge will be dependent on cooking type, intensity and location.

Unconditioned make up air for the kitchen hoods shall be provided either directly to the hoods, or adjacent, such that extraction of conditioned air is minimized.

Commercial Kitchen Facility Location	**Proposed Exhaust Discharge Location**	**Relevant Standard or Additional Treatment**
Club Lounge (Upper Hotel Tower)	Exhaust vertically discharged above the Tower Roof Level	Designed in accordance with AS1668.1:2015, AS1668.2: 2012 and AS3666.1: 2011. No additional treatment proposed due to low-risk nature of discharge location (i.e. substantially above any nearby buildings or sensitive receivers).
Sky Lobby Restaurant and Servery (Mid Hotel Tower)	Exhaust vertically discharged above the Tower Roof Level Or Horizontally at L41	Designed in accordance with AS1668.1:2015, AS1668.2: 2012 and AS3666.1: 2011 No additional treatment proposed due to low-risk nature of discharge location (i.e. substantially above any nearby buildings or sensitive receivers).When discharged at roof level Inclusion of a combination of electrostatic filters, water washing and/or ultraviolet treatment to minimize odour/pollutant discharge when discharge at L41
Level 5 Sky Terrace Restaurants	Exhaust horizontally discharged at Level 6	Designed in accordance with AS1668.1:2015, AS1668.2: 2012 and AS3666.1: 2011 Inclusion of a combination of electrostatic filters, water washing and/or ultraviolet treatment to minimize odour/pollutant discharge.
Level 7 F&B	Exhaust horizontally discharged at Level 6	Designed in accordance with AS1668.1:2015, AS1668.2: 2012 and AS3666.1: 2011 Inclusion of a combination of electrostatic filters, water washing and/or ultraviolet treatment to minimize odour/pollutant discharge.

Commercial Kitchen Facility Location	Proposed Exhaust Discharge Location	Relevant Standard or Additional Treatment
Residential Entrance Level Restaurant (Level 00)	Exhaust horizontally discharged at Level 6 with plant located at level 3/5	Designed in accordance with AS1668.1:2015, AS1668.2: 2012 and AS3666.1: 2011 Inclusion of a combination of electrostatic filters, water washing and/or ultraviolet treatment to minimize odour/pollutant discharge.
New Restaurant Street Level 00	Exhaust horizontally discharged at Level 6 with plant located at level 3/5	Designed in accordance with AS1668.1:2015, AS1668.2: 2012 and AS3666.1: 2011 Inclusion of a combination of electrostatic filters, water washing and/or ultraviolet treatment to minimize odour/pollutant discharge.
New Darling Union and Edward Streets food and beverage.	Exhaust vertically discharged above the existing roof level	Designed in accordance with AS1668.1:2015, AS1668.2: 2012 and AS3666.1: 2011 Inclusion of a combination of electrostatic filters, water washing and/or ultraviolet treatment to minimize odour/pollutant discharge.
Existing Level 00 F&B and Level 02 Nightclub	Exhaust horizontally discharged at Level 6	Designed in accordance with AS1668.1:2015, AS1668.2: 2012 and AS3666.1: 2011 Inclusion of a combination of electrostatic filters, water washing and/or ultraviolet treatment to minimize odour/pollutant discharge.
Level 05 Bistro adjacent to Astral Residencies	Exhaust vertically above new roof	Designed in accordance with AS1668.1:2015, AS1668.2: 2012 and AS3666.1: 2011 Inclusion of a combination of electrostatic filters, water washing and/or ultraviolet treatment to minimize odour/pollutant discharge.

- Discharge locations will be designed to ensure appropriate physical separation to boundaries, air intakes or natural ventilation openings, in excess of the minimum requirements stipulated in AS1668.2:2012.
- Particular consideration will be given to exhaust discharges at Level 5 Roof Terrace and Ribbon Roof Level, and their proximity to the relocated cooling towers, with separation distances to be in excess of the minimum requirements in AS3666.1:2011 and located to minimise risk of exhaust air being drawn into cooling towers.

4.4.2 Smoke Management, Stair Pressurisation and 'Push-Pull' System

Stair pressurisation systems and smoke exhaust systems shall be specified where required as per AS1668.1:2015.

Preliminary Fire Engineering advice has indicated potential to utilise a 'push-pull' system in lieu of a traditional stair-pressurisation system for the main tower stairs, offering spatial and operational benefits.

This is a Fire Engineered solution and will thus be designed according to the Fire Engineer's recommendations, however the principle is as follows:

Two smoke exhaust risers are required, located generally at each end of the corridor such that air moving between the two risers will pass across the front of the entrance door to the stair (from non-smoke-affected end to smoke-affected-end), thus preventing smoke from entering the stair.

Each riser shaft will be fitted with a smoke exhaust fan at the top of the riser. The corridor itself will then be zoned into north and south portions, and which fan operates will be determined by the location of the zone which the actuated smoke detector sits within. The fan within the shaft closest to the detector will then run to exhaust smoke, and the fan within the other shaft will remain idle to allow fresh air to pass down through it.

The operation of this system has been diagrammatically shown in the figure below (refer WSP Fire Engineering Design Note).

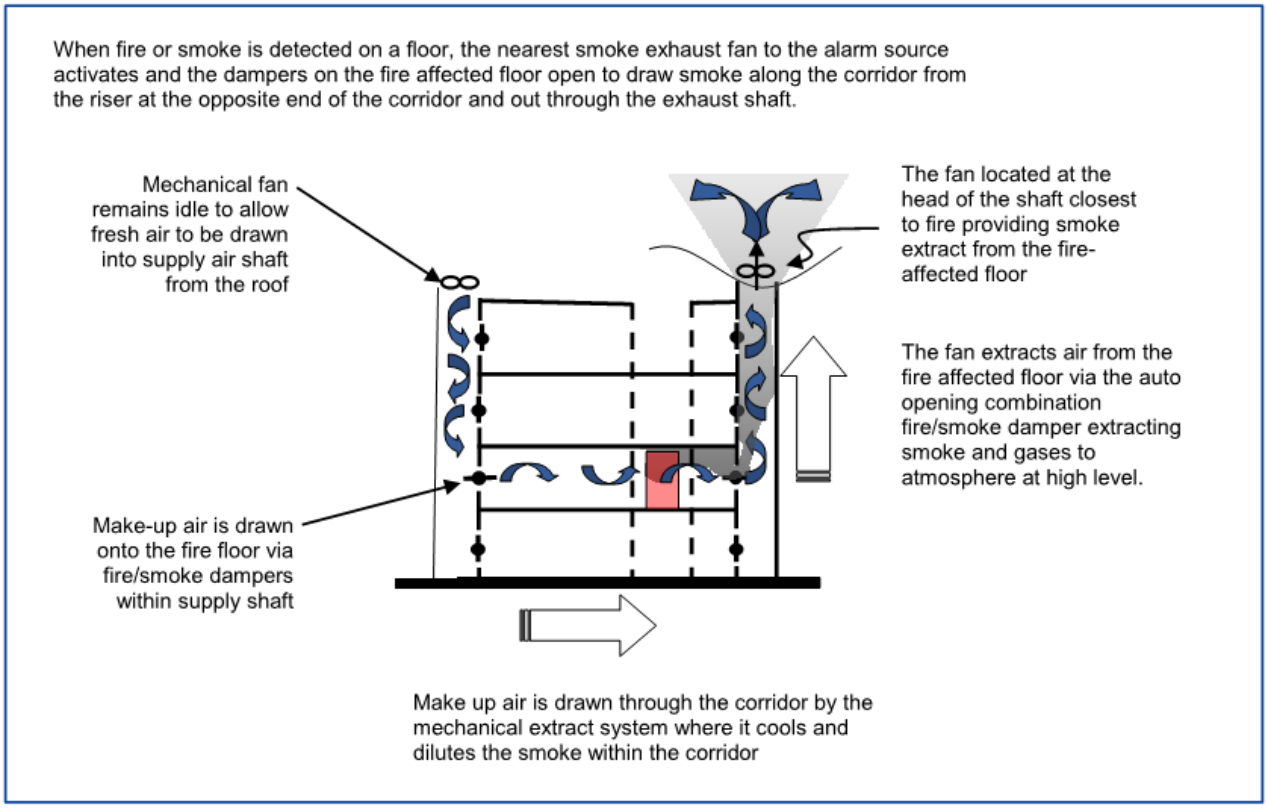

FIGURE 5: PUSH-PULL TOWER SMOKE MANAGEMENT PRINCIPLES

There is potential to further improve the building yield by utilising the 'push-pull' shafts (which would otherwise be sitting idle during normal operation) for mechanical ventilation purposes. It is anticipated that the risers would be used to provide conditioned ventilation air to the corridors and make-up air for the residential apartment levels, reducing the overall riser footprint required.

Air handling units to precondition the outside air would be located at mid and lower plant areas, which could also be used to provide make up air during smoke exhaust mode, should the resistance in the shaft be too great to operate successfully using natural make up from roof level alone.

On floors where higher smoke exhaust flow rates may be required (e.g. Hotel Sky Lobby), there would be potential to operate both shafts in exhaust mode and provide make up air through other means (e.g. using the AHU serving the space, openable façade louvres etc).

For the podium levels it is proposed to either introduce a lobby to the stair in order for the push-pull system to extend to these levels from the upper portion of the Tower, or alternatively, for a secondary separation door to be provided within the stair and air pressurisation to be introduced to serve these lower levels.

Extended Eat Street western arcade extension, BOH, Community Centre, Hotel Foyer will have dedicated smoke exhaust systems with fans located in the new level 3/5 plantroom built above the Green Roof area.

The addition of newly created retail spaces near Union St has potential implications on the Fire Engineering strategy for these parts of the site. Preliminary discussions with the Fire Engineer suggest that additional smoke exhaust systems may be required in order to protect people exiting through the area via the existing fire exits. It is anticipated that the smoke exhaust will be taken from high points within the open mall areas (near corners of Union and Edwards Streets, and Union and Pyrmont Streets) and transferred to discharge at roof level.

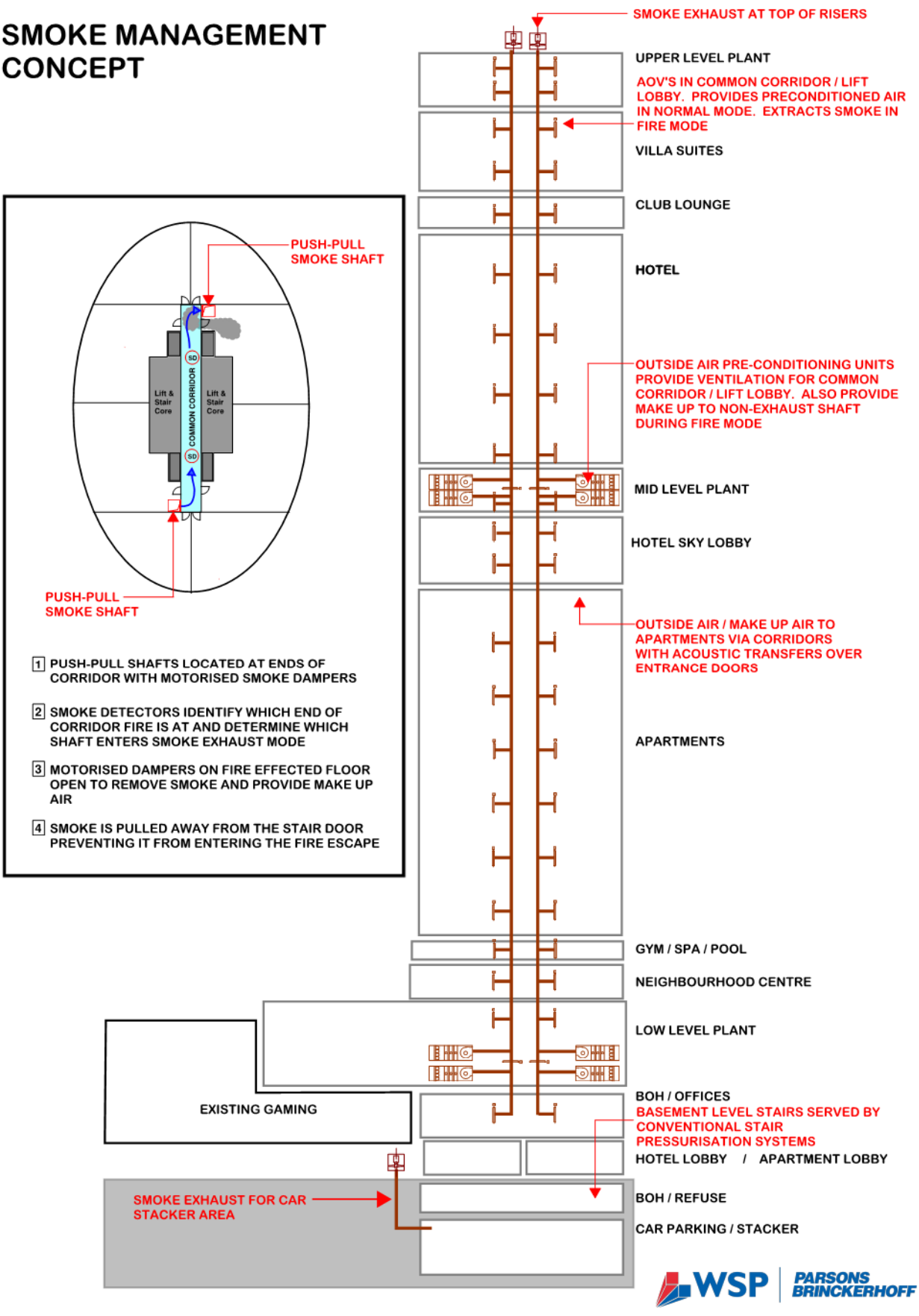

FIGURE 6: OVERALL SMOKE MANAGEMENT CONCEPT

4.4.3 Typical Hotel Floor

All hotel guestrooms and suites will be conditioned via 4-pipe fan coil unit systems supported from the underside of the soffit, generally positioned near to the entrance doors. The fan coil units will include removable and washable filter media, integral discharge grille and condensate drip trays. The unit locations will be coordinated with the partitioning to allow the condensate to be routed by gravity and terminate over a tundish. It is proposed to utiise FCU's with ECDC fans to provide greater energy efficiency and air flow flexibility.

FIGURE 7: TYPICAL CHILLED WATER FCU

Full access shall be provided to CHW & HHW valves and FCU filter media. Controls for each FCU will be integrated with the hotel management system – detailed requirements to be confirmed and developed.

Each on floor CHW & HHW connection shall be complete with a differential pressure control valve to maintain the flow rate to each fan coil unit independent of fluctuations in system pressure. This shall eliminate the need for balancing valves in the riser shafts.

Each guestroom bathroom will be mechanically ventilated by centralised exhaust system. The system will operate continuously. Bathroom doors will be undercut to allow air make-up for the exhaust systems.

The rooms shall be provided with outside air mechanically, via vertical risers connected to centralised air handling units located on plant levels.

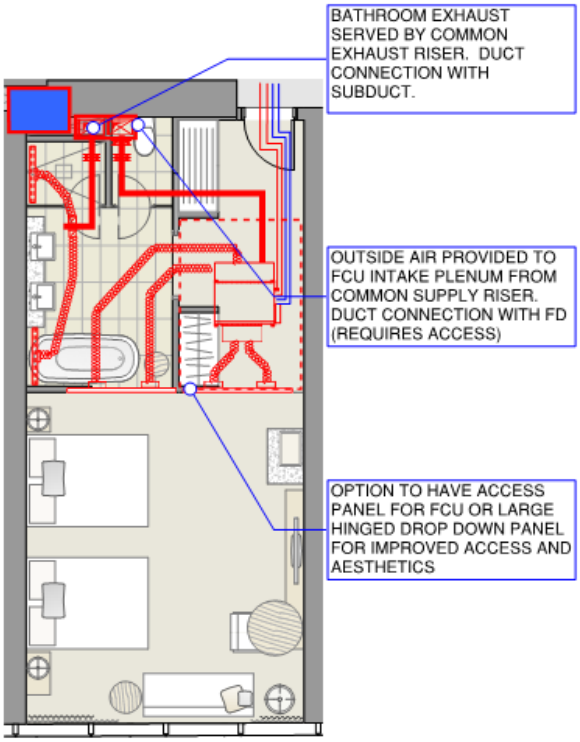

FIGURE 8: EXAMPLE HOTEL GUESTROOM ARRANGEMENT

The common lift lobby shall be mechanically ventilated with conditioned outside air from centralised air handling units located on plant levels. Subject to Ritz-Carlton requirements, the common corridors may be provided with 4-pipe fan coil units to more accurately maintain temperature in these corridors, if required.

4.4.4 Typical Apartment Floor

All living and bedroom areas will be conditioned via 4-pipe fan coil unit systems supported from the underside of the soffit. The fan coil unit(s) will include removable and washable filter media, integral discharge grille and condensate drip tray. The unit location will be coordinated with the partitioning to allow the condensate to be routed by gravity and terminate over a tundish.

Full access shall be provided to CHW & HHW valves and FCU filter media.

Each apartment will include hard wired wall mounted controller complete with on/off, temperature adjustment and fan speed adjustment.

Each on floor CHW & HHW connection shall be complete with a differential pressure control valve to maintain the flow rate to each fan coil unit independent of fluctuations in system pressure. This shall eliminate the need for balancing valves in the riser shafts.

Each apartment shall include mechanical toilet, laundry and kitchen rangehood exhaust ducted to the facade. Toilet and laundry areas shall be served by a common booster fan. Kitchen rangehoods will be complete with exhaust fans (by others). Should specified rangehood have insufficient static pressure to achieve discharge location then booster fans will be provided, interlocked with rangehood operation.

Toilet/laundry exhaust fans shall operate on activation of an independent manual on-off switch located within each of the respective areas. The switch shall be mounted in common panel with light switch. All exhaust fans shall be complete with non-return dampers within exhaust ductwork. Access panels shall be provided to all fan locations. Apartment bathroom doors and laundry cupboards will be undercut to allow air make-up for the exhaust systems.

The apartments shall be designed for outside air compliance via natural ventilation under the requirements of the NCC and ADG through a combination of ducted façade louvers and trickle vents in the spandrel which will both include appropriate acoustic treatment.

The common lift lobby shall be mechanically ventilated with outside air, which will also act to provide make-up for the apartment exhaust systems and to slightly pressurise the lift lobby to assist with minimising cooking odour transfer between apartments.. The outside air will be centrally pre-conditioned to assist with comfort levels in the lift lobby.

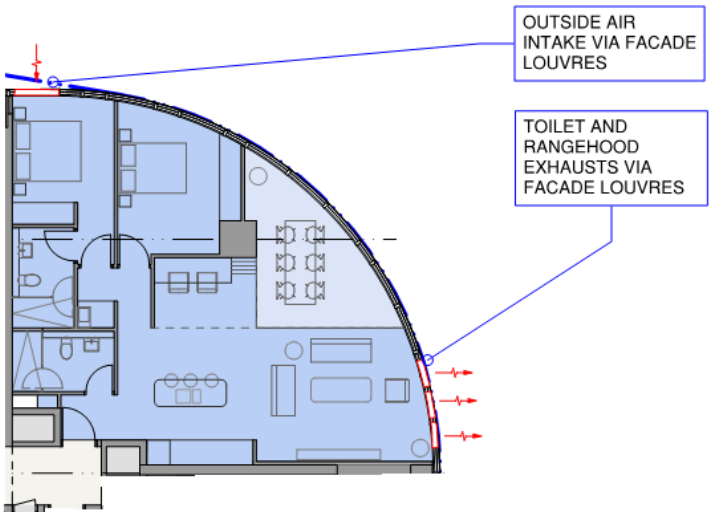

FIGURE 9: EXAMPLE APARTMENT ARRANGEMENT

4.4.5 Small Retail Spaces

This project includes a number of small retail tenancies which are being created, modified or refurbished. These include:

- New Darling Union and Edward Streets food and beverage.

Whilst the services scope for each retail space is not yet defined, the following mechanical works are anticipated:

Each retail space will be conditioned via a 4-pipe fan coil unit system supported from the underside of the soffit. The fan coil unit(s) will include removable and washable filter media, integral discharge grille and condensate drip tray. The unit location will be coordinated with partitions to allow the condensate to be routed by gravity and terminate over a tundish.

Full access shall be provided to CHW & HHW valves and FCU filter media.

Chilled water and heating water pipework will be extended from existing locations to serve each of the new retail tenancies. Energy metering will be provided, where appropriate, to allow energy costs to be apportioned.

Where required, new outside air systems will be provided to serve the retail tenancies. Outside air will be taken from the façade or other nearby appropriate location, filtered, and delivered to the space via the FCU's.

Supply air ductwork downstream of the FCU's will be installed by the tenant to suit their ceiling configuration.

4.4.6 Neighbourhood Centre

Air-conditioning to the Neighbourhood Centre spaces shall be supplied by the central cooling and heating plant, with thermal energy meters for apportioning energy consumption.

The spaces will be conditioned via fan coil units, or dedicated air handling units, deemed most appropriate during the design stage. The zoning strategy of the will be designed to suit the expected loads and operation of the spaces.

If AHU's are selected, they will be located in the Tower Level 3/5 (Podium) plant area, ducted via risers to serve the different Neighbourhood Centre floors. The AHU's will be VAV type and each floor will be provided with VAV boxes to allow for appropriate zone control of different façade orientations. AHU's will also be provided with economy cycles, and CO_2 control of outside air will be considered to improve energy efficiency, given the likelihood of variable occupancy in the space.

A metered tenant chilled water loop and dedicated outside air riser will ensure the Neighbourhood Centre can effectively and efficiently service any enclosed spaces they require (enclosed offices, meeting rooms and the like).

Provisions for tenant general exhaust, smoke exhaust and toilet exhaust will also be provided, with the fans located in the level 3/5 plantroom built on above the Green Roof.

4.4.7 Miscellaneous Air Conditioning

Air-conditioning to the general areas (BOH, Offices, Entrance Lobbies, etc) shall be supplied by the central cooling and heating plant.

Space cooling and heating shall be via fan coil units, or air handling units as appropriate for the scale and use of the space. The zoning strategy of the will be designed to suit the expected loads, orientation and operation of the spaces once defined.

Where AHUs are used for larger spaces, they shall be provided with variable speed drives and economy cycles, where appropriate. CO_2 monitoring will be considered, to enable outside air quantities to be adjusted based on demand, where variable occupancy is anticipated.

Insulated chilled and heating pipework shall be reticulated from the central plant to the air conditioning units via ceiling voids, served from the metered supplies appropriate for the operator of each space. Where FCU's are used, pre-conditioned outside air from central air handling plant will be provided.

Provisions for general exhaust, smoke exhaust and toilet exhaust will also be provided as required, with the fans located in the level 3/5 plantroom built on above the Green Roof.

4.4.8 Basement Car Park and Loading Dock

Car parking areas located within the basement shall be served by supply and exhaust ventilation systems as per AS1668.2: 2012.

It is currently proposed to utilise a proprietary car stacker system for the new basement parking. The ventilation requirements and services routing will be developed in conjunction with the architect and car stacker provider during the design phase.

Given the bespoke nature of the car stacker arrangement the smoke exhaust requirements will also be developed in conjunction with the Fire Engineer.

It is currently intended to discharge the car stacker ventilation exhaust air at podium level to avoid routing large ductwork through the building.

The existing Loading Dock adjacent Jones Bay Road, and below the new Hotel Tower will be undergoing alteration as part of the Modification 13 works. The ventilation strategy for the Loading Dock will remain as existing, with local modification and/or supplementation as required to serve the new arrangement and meet the requirements of AS1668.2: 2012. Modification to the exhaust discharge is not anticipated.

4.4.9 Miscellaneous Exhaust Systems

Mechanical ventilation systems will be provided to back of house areas as required, e.g.

- Waste storage room;
- Storage rooms;
- Plant and switch rooms; and
- Grease arrestor rooms.

The garbage chute will be exhausted via the top of the chute to eliminate odours entering the lobbies and apartments.

THE STAR

CONCLUSION

5 CONCLUSION

The mechanical services will be designed to best practice principles to ensure that environmental impacts of the development are limited.

The cooling for the development will be provided by the main site central chilled water plant, allowing the Modification 13 development to make use of the energy efficiency improvements planned for the existing site infrastructure, maximizing operational efficiencies and ensuring that extensive new dedicated thermal plant for Modification 13 is not required. Energy consumption for the development will be further minimized through use of a wide range of air-side energy efficiency measures such as high efficiency air handling plant, occupancy-based outside air control and energy recovery.

All air discharges from mechanical plant will be designed to exceed statutory-minimum separation distances and include specialist chemical treatment of exhaust air where necessary to mitigate risk of negative environmental impact or nuisance (e.g. electrostatic and UV filtration on commercial kitchen exhaust discharges).

The HVAC systems will be designed to provide excellent indoor air quality, to protect the health and comfort of occupants; outside air will be provided with high efficiency filtration and delivered at quantities significantly above statutory minimums. CO_2 monitoring will also be provided where appropriate to ensure a high quality indoor environment is obtained without compromising energy efficiency.

THE STAR

DESIGN CRITERIA

6 DESIGN CRITERIA

The design criteria presented herein will form the basis for the design of the works.

6.1 GENERAL

Item	Design Criteria
External Design Criteria	Cooling plant capacity to be based on the following; (Sydney R.O. Data, AIRAH DA09) **Summer** 32.8ºC DB, 22.6ºC WB (Full Solar Load) **Winter** 7.2ºC DB (No Solar Load)
Infiltration	**Perimeter Zones** 0.5 ACH **Foyers & Lobbies** 1.0 ACH within 4m of an opening
Thermal Envelope	The residential envelope is to be based on advice from the BASIX consultant and Client ESD Commitments Statement. The hotel, retail and commercial building envelope is to be based on advice from the Section J consultant.
People Load	General - 70 W/person sensible - 60 W/person latent Exercise Areas - 150 W/person sensible - 270 W/person latent
Zoning	The project areas will be zoned according to thermal load profile, these “thermal zones” or functional areas are defined by air-conditioning spaces facing different perimeter orientations or incorporating different internal load profiles.
Acoustic Criteria	The acoustic criteria and effect on the mechanical plant design will be developed in detail with the acoustic consultant during the design stage.

6.2 INTERNAL DESIGN CRITERIA – SERVICED APARTMENTS

Cooling plant capacity to be based on the following:

Item	Summer	Winter	Occupancy	Equipment	Lighting
Residential Serviced Apartments (air conditioned areas only)	22.5ºC DB	21ºC DB	1 Bed : 2 Ppl. 2 Bed : 4 Ppl. 3 Bed : 6 Ppl.	800W Living 600W Bedroom (sensible)	5 W/m^2
Main Serviced Apartment Entrance	22.5ºC DB	21ºC DB	3.5 m^2/person	15 W/m^2 (sensible)	8 W/m^2
Other Areas (TBC)					

- Tolerance is typically +/- 1.5 ºC DB at point of control.
- Humidity is not controlled. It is anticipated to generally be in the range of 40-60% RH by virtue of the cooling coil performance.
- *Residential lift lobbies will be provided with tempered outside air only.

Ventilation plant capacity to be based on the following:

Item	Design Criteria
Apartment Outside Air Provisions	Natural ventilation via operable windows to NCC requirements. Make up air for apartment bathroom/rangehood exhaust to be provided mechanically via acoustic transfers from Lift Lobby Corridors, or via the façade louvres – subject to design development.
Apartment Exhaust Provisions	Unless otherwise stated, the following spaces will be mechanically ventilated: **Residential Laundry** 40L/s **Residential Bathroom** 50L/s (in excess of AS 1668.2:2012 requirements to assist steam removal) **Residential Rangehood** TBC – Subject to Rangehood Spec.
Main Serviced Apartment Entrance	Mechanically ventilated with 10* l/s/person outside air as per AS1668.2:2012 requirements *Potential 50% or 100% increase required, if relevant Greenstar credits are targeted
Residential Lift Lobbies	Mechanically ventilated with 1* l/s/m^2 pre-conditioned outside air as per AS1668.2 or as required for diversified apartment bathroom/rangehood make-up. Largest value to apply. *Potential 50% or 100% increase required, if relevant Greenstar credits are targeted
Basement Carparking	Mechanically ventilated to AS1668.2:2012 requirements and as required to achieve Fire Engineering Alternative Solution requirements.
Garbage Room Exhaust	Mechanically ventilated with 10 AC/Hr (5 l/s/m^2 min.)
Other Areas (TBC)	

6.3 INTERNAL DESIGN CRITERIA – HOTEL & RIBBON

Note that the following is based on the requirements of Australian Standards, however the greater value of the Australian Standards and ASHRAE standards may be used, subject to Ritz-Carlton preference.

Cooling plant capacity to be based on the following:

Item	Summer	Winter	Occupancy	Equipment	Lighting
Guest Rooms, Suites & Villas	22.5ºC DB	21ºC DB	Studio: : 2 People 1 Bed : 2 People 2 Bed : 4 People 3 Bed : 6 People	TBC	5 W/m^2
Hotel Corridors / Lift Lobbies	22.5ºC DB	21ºC DB	Nil	5 W/m^2 (sensible)	8 W/m^2
Main Hotel Entrance Lobby	22.5ºC DB	21ºC DB	3.5 m^2/person	5 W/m^2 (sensible)	15 W/m^2
Sky Lobby / Club Lounge	22.5ºC DB	21ºC DB	1.5 m^2/person or number of seats	15 W/person (sensible) 5 W/person (latent)	18 W/m^2
Hotel Offices and Administrative Areas	22.5ºC DB	21ºC DB	10 m^2/person or number of seats	15 W/m^2 (sensible)	9 W/m^2
Restaurant, Banquet, Function Rooms	22.5ºC DB	21ºC DB	1.5 m^2/person or number of seats	15 W/person (sensible) 5 W/person (latent)	18 W/m^2
Kitchens – Commercial F+B	27ºC DB	21ºC DB	3.5 m^2/person	TBC	8 W/m^2
Hotel Gym	22.5ºC DB	21ºC DB	5 m^2/person	TBC	8 W/m^2
Other Areas (TBC)					

- Tolerance is typically +/- 1.5 ºC DB at point of control.
- Humidity is not controlled. It is anticipated to generally be in the range of 40-60% RH by virtue of the cooling coil performance.

Ventilation plant capacity to be based on the following:

Item	Design Criteria
Guestroom, Suites and Villas Outside Air Provisions	Mechanically ventilated with 10* l/s/person outside air as per AS1668.2:2012 requirements, or as required for make-up air to the bathrooms. The greatest value shall apply. *Potential 50% or 100% increase required, if relevant Green Star credits are targeted.
Guestroom, Suites and Villas Exhaust Provisions	Unless otherwise stated, the following spaces will be mechanically ventilated: **Hotel Bathroom/Ensuite** 50L/s (in excess of AS 1668.2:2012 requirements to assist steam removal)
Hotel Corridors / Lift Lobbies	Mechanically ventilated with 1* l/s/m^2 pre-conditioned outside air as per AS1668.2 *Potential 50% or 100% increase required, if relevant Greenstar credits are targeted
Main Hotel Entrance Lobby / Sky Lobby / Club Lounge	Mechanically ventilated with 10* l/s/person outside air as per AS1668.2:2012 requirements *Potential 50% or 100% increase required, if relevant Greenstar credits are targeted
Hotel Offices and Administrative Areas	Mechanically ventilated with 10* l/s/person outside air as per AS1668.2:2012 requirements *Potential 50% or 100% increase required, if relevant Greenstar credits are targeted
Restaurant, Banquet, Function Rooms	Mechanically ventilated with 10* l/s/person outside air as per AS1668.2:2012 requirements *Potential 50% or 100% increase required, if relevant Greenstar credits are targeted
Kitchens – Commercial F+B	Mechanical exhaust ventilation at 5 l/s/m^2 as per AS1668.2:2012 requirements Mechanical exhaust for commercial kitchen hoods (capacity allowance to be agreed).
Hotel Gym	Mechanically ventilated with 10 l/s/person outside air as per AS1668.2:2012 requirements
Public Area Toilet Exhaust	Mechanically ventilated with 10 l/s/ m^2 exhaust air as per AS1668.2:2012 requirements
Garbage Room Exhaust	Mechanically ventilated with 10 AC/Hr (5 l/s/m^2 min.)
Other Areas (TBC)	

6.4 INTERNAL DESIGN CRITERIA – THE STAR RETAIL SPACES

Cooling plant capacity to be based on the following:

Item	Summer	Winter	Occupancy	Equipment	Lighting
General Retail Spaces	22.5°C DB	21°C DB	5 m^2/person	15 W/m^2 (sensible)	22 W/m^2

- Tolerance is typically +/- 1.5 °C DB at point of control.
- Humidity is not controlled. It is anticipated to generally be in the range of 40-60% RH by virtue of the cooling coil performance.

Ventilation plant capacity to be based on the following:

Item	Design Criteria
General Retail Spaces	Mechanically ventilated with 10 l/s/person outside air as per AS1668.2:2012 requirements.

6.5 SIZING OF EQUIPMENT

Equipment will be selected incorporating a 10% safety margin on capacity unless specified otherwise.

All pipework will be designed in accordance the following criteria:

Parameter	Design Criteria
Max Pressure Drop	240 Pa/m
Maximum Velocity	2.4 m/s
Headers	80 Pa/m

All ductwork will be designed in accordance the following criteria unless otherwise advised by the Acoustic Consultant:

Parameter	Design Criteria
Max Pressure Drop	0.8 Pa/m
Maximum Riser Velocity	10 m/s
Maximum Main Velocity	8 m/s
Maximum Branch Velocity	4.5 m/s
Maximum Runout Velocity	2.5 m/s

THE STAR