NSW Independent Planning Commission
11 Gibbons St
Review of Mechanical Ventilation System

COMMERCIAL-IN-CONFIDENCE

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Team Catalyst
ACN 114 572 084
"Driving Sustainability through Teamwork"
e: pcthomas@teamcatalyst.com.au
m: 0417 405 478

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Document control

Issue	*Date*	*Description*	*Author*
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1 BACKGROUND

The NSW Independent Planning Commission (IPC) have received a State Significant Development (SSD) Application for 11 Gibbons Street, Redfern from the Department of Planning and Environment's (DPE) for determination. The Application was submitted by St George Community Housing Sustainability Pty Ltd (SGCH). SGCH is seeking approval to construct and operate an 18-storey social and affordable housing development at 11 Gibbons Street, Redfern.

The IPC is seeking a response to questions relating to the proposed development specifically relating to the mechanical ventilation system. The response to these questions will assist in strengthening the IPC's understanding of the proposed ventilation system and help in determining whether the system would be reliable and effective in providing a comfortable indoor environment for future residents.

Documentation of the ventilation system design for the proposed apartments, as provided by NSW IPC has been reviewed, and commentary has been provided in the following sections. The scope addressed in this report is to:

"*Advise whether the system would have the ability to provide future tenants with a comfortable and viable system of ventilation i.e. will the system be able to support the likely loads required particularly during extreme weather events*."

1.1 DISCLAIMER

This review addresses the scope as detailed above, as per the requirements of the NSW Independent Planning Commission and specifically excludes all other aspects eg., BCA/NCC compliance, and compliance with other codes and standards, acoustics, fire, etc. This will remain the responsibility of the client/builder, and each sub-consultant and contractor.

The design of the building and it's sub-systems remain the responsibility of each design consultant/contractor. Team Catalyst does not warrant or indemnify designs, and cannot be held responsible, for the building not achieving it's performance requirements in the future.

Detailed design calculations are excluded from this scope of works, which is limited to check calculations, review and commentary only.

2 DOCUMENTS

The following documents were provided by NSW IPC for review:

183106-ME-20000 - GROUND FLOOR HVAC LAYOUT.pdf	22/07/2019 11:04 AM	Adobe Acrobat Docu...	1,296 KB
Appendix 6 NS18138-M01-1.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	417 KB
Appendix 6 NS18138-M03-1.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	659 KB
Appendix 6 NS18138-M04-1.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	616 KB
Appendix 6 NS18138-M05-1.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	570 KB
Appendix 6 NS18138-M06-2.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	192 KB
Appendix 6 NS18138-M07 -1.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	572 KB
Appendix 6 NS18138-M08-1.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	629 KB
Appendix 6 NS18138-M09-1.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	622 KB
Appendix 6 NS18138-M10-1.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	714 KB
Appendix 19 BCA Report.PDF	19/07/2019 4:35 PM	Adobe Acrobat Docu...	849 KB
Appendix 19 Fire Safety Strategy.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	3,178 KB
Att 1 Ground Level current.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	5,738 KB
SSD 7749 11 Gibbons Street - Recommended Conditions of Consent.pdf	19/07/2019 4:35 PM	Adobe Acrobat Docu...	270 KB
1 Acoustic Assessment.pdf	14/06/2019 3:39 PM	Adobe Acrobat Docu...	13,402 KB
2 Design Verification Statement.pdf	14/06/2019 3:39 PM	Adobe Acrobat Docu...	199 KB
3 Response to issues raised pages 9-18.pdf	14/06/2019 3:39 PM	Adobe Acrobat Docu...	162 KB
3A TCPLedit Response to issues raised pages 9-...	24/07/2019 12:42 AM	Adobe Acrobat Docu...	183 KB
5 Acoustic report.pdf	14/06/2019 3:40 PM	Adobe Acrobat Docu...	13,120 KB
7 Northrop Advice Re Onsite Battery Storage.pdf	14/06/2019 3:40 PM	Adobe Acrobat Docu...	86 KB
Appendix 9 BASIX Certificate.pdf	14/06/2019 3:36 PM	Adobe Acrobat Docu...	254 KB
Appendix 9 Class 2 Summary.pdf	14/06/2019 3:36 PM	Adobe Acrobat Docu...	1,492 KB
Appendix 9 Stamped Drawings.pdf	14/06/2019 3:39 PM	Adobe Acrobat Docu...	61,231 KB

3 REVIEW / COMMENTARY

3.1 DESIGN CONCEPT DESCRIPTION

The design concept for the ventilation systems seems to be:

- central supply outside air (COAS) system fan on the roof
- distributed through the building via a central supply duct
- at each level there are duct branches to each apartment, via fire dampers, terminating in header box in each apartment
- supply ducts to each bedroom only, from header box in each apartment
- these supply ducts seem to be twin 75mm “supply air tubes”
- trickle vents on windows designed to act as relief paths
- local (each apartment) exhaust systems for bathroom and laundry
- local exhaust system for kitchen rangehood

No functional description document detailing a control strategy was provided, however, there is a sketch (Image 2 below) and the following paragraph given in the document extract provided by NSW IPC entitled “3 Response to issues raised pages 9 – 18.pdf” (italics are the author’s)

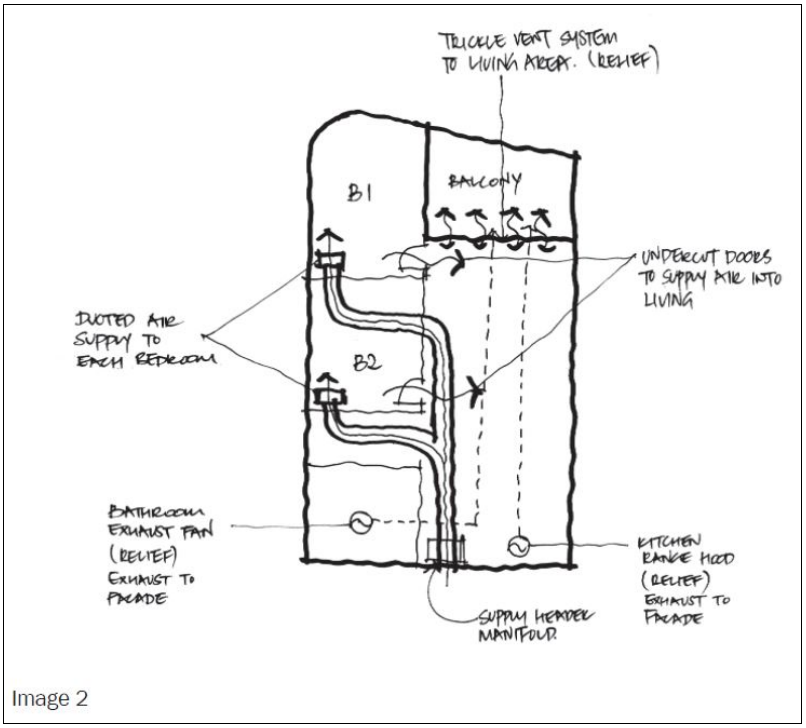

Image 2

“The COAS will pump natural air from the roof at the rates required to achieve adequate air flow for healthy apartments – at a minimum rate of 20L/s per bedroom, thereby complying with AS1668.2 2012 by providing 10L/s per occupant. The *system automatically balances* to ensure this minimum amount of air flow is maintained.”

3.2 REVIEW: APARTMENT VENTILATION SYSTEMS

Table A1 in AS 1668.2 nominates "minimum effective outdoor airflow requirements based on occupancy". This is generally used to size mechanical ventilation systems to ensure odour and pollutant control. However, AS 1668.2 makes no statement with respect to ventilation requirements and thermal comfort. It is not clear how this minimum level of unconditioned outside air is predicted to provide thermal comfort in the habitable spaces, particularly on cold winter nights and hot summer days. Justification for how this mechanical ventilation system addresses thermal comfort in the apartments has not been sighted.

Table A1 in AS 1668.2 requires 10 L/s/person for bedrooms and also for "living rooms and general". Since the proposed ventilation system seems to supply outside air only to the bedrooms; it would seem that the design as proposed may not fully comply with the minimum requirements of AS 1668.2.

It is not clear how the system will "automatically balance". The control strategy to show how balancing would be achieved has not been sighted.

The sketch in Image 2 above indicates that the Invisivent trickle ventilation system is being proposed as a path for relief air, with supply air being provided by the COAS system. However, a review of the Invisivent brochure indicates that the product seems to be designed to be used in a supply configuration. The following is an extract from the online specification brochure (italics are the author's):

"The RENSON® Invisivent®*EVO* HF is a thermally broken, discrete and self-regulating flap ventilator that can be installed on top of an aluminium, timber or uPVC window frame. *Its interior flap deflects the incoming air upwards, causing an optimal spread of fresh air in the room*. Inside is a 3.9 x 9.25mm perforated profile that acts as an insect mesh (removable for cleaning purposes)."

How well would the product perform in a relief air path role, ie., when the kitchen and/or bathroom exhaust systems are off, but the continuous mechanical ventilation system is operational, and supplying outside air to the bedrooms, that are then distributed to other rooms via the undercut doors?

All Invisivent product representations in their brochures show installation above a DGU (double glazed unit) window system. Notes from the stamped Appendix 9 DA drawing DA0000 state the following:

- **Bedroom Glazing: Double Glazing U-Value = 3.4 (maximum), SHGC = 0.53 (±5%), Rw=44**
- **All Other glazing: High performance, low-e single glazing, U-Value = 4.3 (maximum), SHGC = 0.47 (±5%), Rw=39**

Is the installation of this product appropriate above a single glazed window system framing as noted in the drawings?

Equipment, grill or louvre schedules have not been provided, so it was not possible to carry out meaningful check calculations.

Bathroom doors should be specified with an undercut (similar to bedroom doors) to allow for exhaust system makeup air.

Have fan performance curves been considered to meet the system pressures required to provide rated airflow capacity for the exhaust system ductwork configurations as proposed? The proposed duct runs are significantly longer than typical for such systems.

Has condensation potential been considered for these long exhaust system ductwork? Any condensation in these ducts (particularly the kitchen ducts, which must handle steam from cooking), could increase the risk of mould growth and associated negative impacts on health.

The main COAS fan does not allow for filtration on the proviso that the air intakes are located on the roof. However, the apartments are located between two line sources of significant car exhaust pollution (Gibbons and Regent streets), and it is recommended that air quality measurements are reviewed, either by measurement or by modelling, to test this premise. CO, SOx, NOx and PM10 particulate concentrations would be some of the variables to be reviewed.

3.3 COMMENTARY: THERMAL COMFORT FOR APARTMENTS

It is noted that comments in this section may not apply to "regulatory" compliance, but address issues relating to real thermal discomfort for tenants.

As the mechanical ventilation system (not the exhaust systems) is to run continuously, the apartment will be subject to continuous air exchange with outside ambient air. This outside ambient air, particularly on winter nights, is being supplied directly into the bedrooms, where residents will be sleeping. A rough estimate, using 20 L/s per bedroom suggest this rate of outside air supply is between 0.5 and 0.8 ACH; and this figure could double if AS 1668.2 requirements for living rooms are also included. That is, on a cold night, when the outside temperature is say 4C, all of the air in the apartment has the potential to be replaced with air at 4C within one to two hours.

This air exchange has the potential to increase thermal discomfort quite significantly in habitable spaces, particularly the bedrooms in winter as no air-conditioning (heating or cooling?) is envisaged. The situation would be reversed for hot days, and also for warm humid nights, predicted to increase in frequency due to climate change and global warming. Warm humid nights could also result in high levels of thermal discomfort for these apartments.

The predicted 8 star NatHERS rating would not have accounted for the continuous supply of unconditioned outside air supplied by the mechanical ventilation system as discussed above. To do so, it would have to be modelled as infiltration rather than ventilation (not strictly accurate as fan heat would need to be accounted for, but CheNath does not include any HVAC components that can be modelled) to account for the impact on heating/cooling energy. This cannot have been done in the current analysis since the user does not have explicit control of ventilation/infiltration rates in the three CheNath simulation engine interfaces (AccuRate, BERS Pro and FR5) that are demanded by BASIX. In any case, in "regulatory" mode, the user is not allowed to make such changes to the simulation analysis. *Note that the CheNath energy simulation engine (via the SCRATCH file) DOES allow for zone level infiltration to be defined*. CheNath is the energy simulation engine that underpins the dynamic thermal simulation calculations for NatHERS.

Thermal bridging is not required to be accounted for when carrying out the NatHERS energy analysis. In practise, depending on the construction systems being used, thermal bridging may cause the R-values to be de-rated by 20 – 30%. This theory-to-practise disconnect would also serve to increase thermal discomfort within the habitable spaces as no air-conditioning systems are proposed.

We would strongly recommend the use of double glazed units for all windows. While the NatHERS analysis may show little improvement in terms of energy/GHG reductions, there are real improvements in space Mean Radiant Temperatures (MRT) for occupants. MRT is the temperature that is experienced by occupants, and is an integrated function of the temperatures of all surfaces that can be "seen" by an occupant. Use of double glazing improves (increases – winter, decreases – summer) the temperature of the inside pane of glass, and has the effect of bringing the MRT of a space closer to the Mean Air Temperature (MAT), that which can be measured by a thermometer. These parameters can be readily predicted and reviewed by using more sophisticated simulation software than NatHERS.

The exhaust systems for kitchen, bathroom and laundry, it is presumed, will be run on an intermittent basis as required. They would exhaust much larger quantities of indoor air to the outside (as compared to the mechanical ventilation systems). This would also result in large quantities of outdoor air (hot in summer, cold in winter) being pulled under negative pressure through the trickle vent (Invisivent) system, although, it is hoped, for much shorter time periods. These situations will also result in potential increase of occupant thermal discomfort. It is noted that in this situation, the Invisivent would act as a supply (inlet) air path.

No window system detail has been sighted. In extremely hot weather conditions, expected to increase in frequency due to climate change, if there is a grid failure, operable windows would be a critical component to provide some measure of psychological relief for occupants. Are the proposed window systems able to opened or are they fixed pieces of glazing?

3.4 REVIEW: OTHER

An extract from the recommended conditions of consent is provided below:

MECHANICAL VENTILATION

B34. All mechanical ventilation systems shall be installed in accordance with the BCA and shall comply with Australian standards AS1668.2 and AS3666 - Microbial Control of Air Handling and Water Systems of Building, to ensure adequate levels of health and amenity to the occupants of the building and to ensure environment protection. Details shall be submitted to the Certifying Authority prior to the issue of the relevant Construction Certificate.

B35. The mechanical exhaust system for the ground floor retail/commercial tenancy is to be designed to be capable of accommodating exhaust requirements in accordance with relevant Australia Standards, in order to allow for the event that the tenancy is approved for future use as a food premises or other use which requires mechanical exhaust.

The comms room on the ground floor is not provided with fresh air, and is considered to be non-compliant with AS 1668.2 for technicians working in the space for extended periods of time.

Also, there is no tundish or adequate drainage shown for the comms room FCU, and it is therefore non-compliant with AS366 microbial standard.

The cleaner's room on ground floor should be provided with an exhaust air system, and not an outside air system as shown on the current plans.

The ground floor retail/commercial tenancy does not seem to comply with DA condition of B35 exhaust system provisions.