142-150 Narrow Neck Road, Katoomba

Natural Ventilation Assessment

Management 7bbh

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Suite 305, Level 3, 19A Boundary St
Darlinghurst, NSW 2010

Prepared by:

SLR Consulting Australia

SLR Project No.: 610.033104

Revision: R01-v1.2

12 January 2026

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
R01-v1.2	12 January 2026	Dr Farzin Ghanadi	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy
R01-v1.1	5 November 2025	Dr Neihad Al-Khalidy	Dr Peter Georgiou	Dr Neihad Al-Khalidy
R01-v1.0	11 August 2025	Dr Neihad Al-Khalidy	Dr Peter Georgiou	Dr Neihad Al-Khalidy
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Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Management 7bbh (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Executive Summary

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Management 7bbh to assess the natural cross ventilation of the proposed mixed-use development (comprising Blocks A, B, C, D, E, F, G & H) located at 142-150 Narrow Neck Road, Katoomba.

This report forms part of the HDA for the project site.

SLR has been tasked with numerical modelling the articulated single-fronted apartments, which have been designed with operable windows facing the building indentations:

- Unit A, Unit B, Unit C, Unit D, Unit E, Unit F, Unit G and Unit H. Refer **Figure 2**

This report is in the form of a quantitative assessment utilising Computational Fluid Dynamics (CFD).

The State Environmental Planning Policy (SEPP) Housing SEPP (2021) supported by the Australian Design Guide is relevant to the assessment of the natural ventilation through residential components of proposed development. Section 4B-3 of the Australian Design Guide states that:

At least 60% of apartments are naturally cross ventilated in the first nine storeys of the building. Apartments at ten storeys or greater are deemed to be cross ventilated only if any enclosure of the balconies at these levels allows adequate natural ventilation and cannot be fully enclosed.

The proposed development implements a number of the ADG recommendations to maximize the natural cross ventilation throughout the development.

- The proposed development has been provided with openings on multiple sides of the apartments for the majority of proposed floor plans, allowing it to make use of wind-induced natural ventilation throughout the year and thereby minimising energy costs.
- In general, the overall depth of the units does not exceed 18 m as per the Design Criteria of Objective 4B-3.

Natural cross ventilation to many single aspect apartments is achieved via building indentations. This is anticipated within ADG Section 4B which states in its opening paragraph that "*Natural cross ventilation is achieved by apartments having more than one aspect with direct exposure to the prevailing winds,* ***or*** *windows located in significant different pressure regions, rather than relying on purely wind driven air*".

SLR collaborated with the design team during the early design stage to optimize the placement of openings and amplify airflow dynamics driven by pressure differentials across the units. This collaboration led to strategic building indentations and enlarged openings facing the building slot, enhancing ventilation performance. A representation of the final design concept is illustrated in **Figure 4** and **Figure 5**.

The following conclusions have been drawn from the quantitative numerical CFD modelling results:

- Unit A, Unit B, Unit C, Unit D, Unit E, Unit F, Unit G and Unit H of the level 2 apartments will be naturally cross ventilated.
- The results for the apartments on higher levels are similar.

The results above are based on a wind speed of 2 m/s at a height of 10 metres (m). As wind speeds increase, the airflow through the apartments will intensify accordingly.

When the modelling was applied to the current apartment layout, Revision B 18 December 2025, it was found that 63.0% of the apartments (138 of 218) would be naturally ventilated thereby meeting the ADG requirement.

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1.0 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Management 7bbh to assess the natural ventilation of the proposed mixed-use development (comprising Blocks A, B, C, D, E, F, G & H) located at 142-150 Narrow Neck Road, Katoomba.

This report forms part of the HDA for the project site.

SLR has been tasked with modelling the articulated single fronted apartments, which have been designed with operable windows facing the building indentations

- Unit A, Unit B, Unit C, Unit D, Unit E, Unit F, Unit G and Unit H. Refer **Figure 2**

This assessment has been initially based on the DA Drawings, Issue August 2024. SLR subsequently applied the modelling outcomes to the latest drawings dated December 2025, resulting in an updated summary of the natural ventilation performance. See Section 6 for further details.

1.1 Proposed Site

The subject site is currently heavily vegetated along Narrow Nick Road to the West. There is a mix of single and two storey residential buildings to the North along Glencoe Road and there are new three-bedroom duplexes along the Escarpments to the South. The golf course is located to the east of the developments. The site is located in a residential zone - refer **Figure 1**.

Figure 1 Project Site Location

Image: Courtesy Nearmap, October 2024

1.2 Development Description

The proposed multi-building mixed-use development (refer **Figure 2)** spans 16,839 m^2 and comprises

- 8 residential buildings (4-storeys each)
- 52 Serviced apartments
- A restaurant and communal spaces
- 218 residential units

Figure 2 Representative Masterplan – Revision A (8 January 2026)

The surroundings of 142–150 Narrow Neck Road, Katoomba feature a mix of natural parks and modest residential buildings.

The area along Narrow Neck Road includes around 115 properties, mostly residential homes and holiday retreats.

2.0 Katoomba Wind Climate

The data of interest in this study are the mean hourly wind speeds experienced throughout the year, how these winds vary with azimuth, and the seasonal break up of winds into the primary Region wind seasons.

2.1 Annual and Seasonal Variations

Key characteristics of Katoomba Regional Wind Climate are illustrated in two representative wind roses shown in **Appendix B** taken from Bureau of Meteorology (BoM) data recorded during the period 1957-2010 at Farnell Road, Katoomba. The distance between Katoomba (Farnells Road) and 142 Narrow Neck Road, Katoomba is approximately 1.77 kilometres (km). The following conclusions can be achieved from the weather data:

- The prevailing wind direction in Katoomba, NSW is generally westerly to west-northwesterly (WNW) throughout the year, especially during cooler months when wind speeds tend to be higher.
- The average wind speed in Katoomba, NSW varies throughout the year, but based on recent data, the annual average wind speed is approximately 9.9 km/h (2.75 m/s), with slightly higher speeds during the winter months. For example:
    - July and August tend to have higher averages around 12.2–12.5 km/h
    - May and June average around 10–11.4 km/h
    - Calmer months (February and March) average closer to 7–8 km/h

2.1.1 Wind Exposure at the Site – the “Local”’ Wind Environment

Close to the ground, the “regional” wind patterns described above are affected by the local terrain, topography and built environment, all of which influence the “local” wind environment.

- As noted in **Section 2.1**, the site is currently surrounded by a mix of natural parks and modest residential buildings to all directions.
- The site will, therefore, receive low to moderate wind shielding depending upon oncoming wind direction at lower levels, with upper levels exposed to higher winds from a number of wind directions.

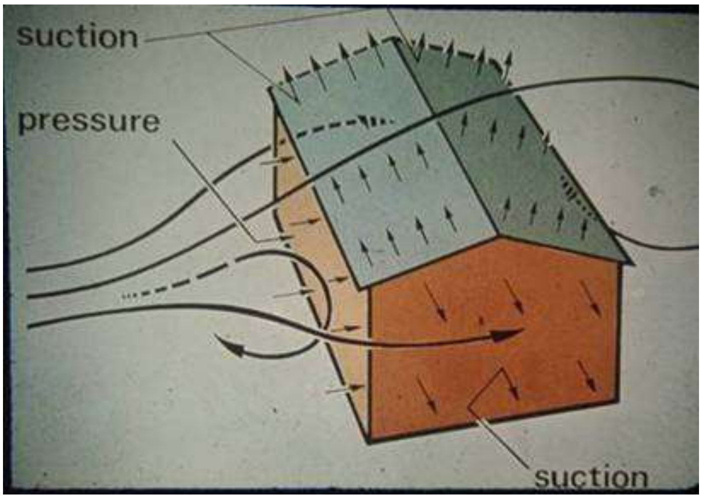
3.0 Natural Ventilation - General Principles

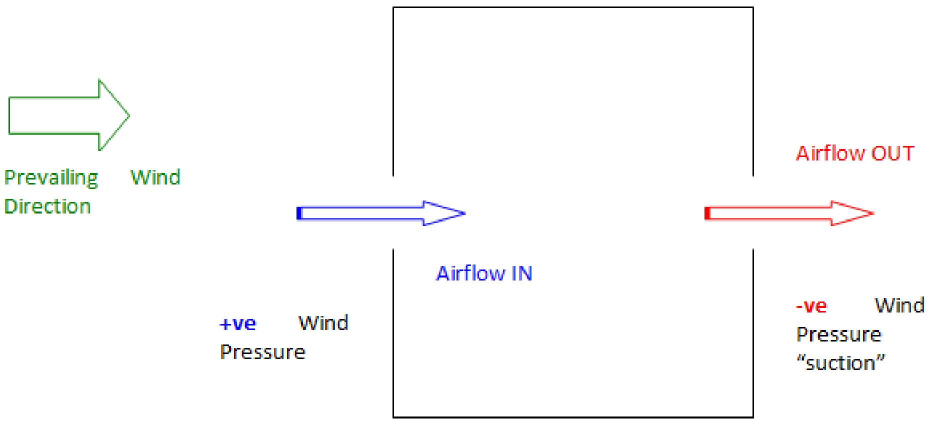
A key feature of the proposed development is the incorporation of façade openings designed to enable various spaces within the development buildings to make use of wind–induced natural ventilation throughout the year thereby minimising energy costs.

Wind-induced natural ventilation works on the straightforward principle of differential pressure. If a building envelope has multiple openings and there exists a pressure difference between those openings, e.g. the wind pressure at one opening is greater than the pressure at the other opening; airflow will be pushed through the building in the direction positive to negative.

The resulting amount of airflow through the building envelope will be a function of the magnitude of the pressure differential, size of the various building openings and degree of "blockage" in between. These features are illustrated in **Figure 3.**

Figure 3 Wind-Induced Natural Ventilation via Differential Pressure





4.0 Apartment Design Guide Requirements

The Housing (2021) SEPP (State Environmental Planning Policy) supported by the Australian Design Guide is relevant to the assessment of the natural ventilation through residential components of proposed developments.

The guide begins by defining natural ventilation as the movement of sufficient volumes of fresh air through an apartment to create a comfortable indoor environment. This is generally achieved by apartments having more than one aspect with direct exposure to the prevailing winds, or windows located in significant different pressure regions, rather than relying on purely wind driven air.

The guide comes in three parts. The first looks at the ventilation of all habitable room. The second deals with the ventilation of single aspect apartments and the third covers natural cross ventilation.

Section 4B-3 of the Australian Design Guide has the following design criteria:

- At least 60% of apartments are naturally cross ventilated in the first nine storeys of the building. Apartments at ten storeys or greater are deemed to be cross ventilated only if any enclosure of the balconies at these levels allows adequate natural ventilation and cannot be fully enclosed.
- Overall depth of a cross-over or cross-through apartment does not exceed 18m, measured glass line to glass line.

The following points from the design guide are also noted.

- The area of unobstructed window openings should be equal to at least 5% of the floor area served.
- Design depths should be a maximum of 8 metres (Section 4D of the guide) to maximise ventilation and airflow.
- Courtyards or building indentations have a width to depth ratio of 2:1 or 3:1 to ensure effective air circulation and avoid trapped smells.

Natural cross ventilation to many single aspect apartments is achieved via building indentations. This is anticipated within ADG Section 4B which states in its opening paragraph that "**Natural cross ventilation is achieved by apartments having more than one aspect with direct exposure to the prevailing winds, or windows located in significant different pressure regions, rather than relying on purely wind driven air**".

4.1 Effective Cross Ventilation

There are no specific requirements (eg air changes per hour) in the ADG guideline. However, AS1668.2-2002 "The use of ventilation and air-conditioning in buildings Part 2" states:

- Ventilation design for indoor air contaminant control (excluding requirements for the health aspects of tobacco smoke exposure)" recommends 3 air changes per hour for habitable rooms to satisfy the air quality requirements.

ASHRAE recommends that homes receive 0.35 air changes per hour but not less than 15 cubic feet of air per minute (cfm) per person (7.5 l/s/person).

The City of Sydney (CoS) has provided a design guide to be used to confirm the adequacy of natural ventilation proposals in apartment buildings in that do not meet the prescriptive requirements of the Apartment Design Guide (ADG) Objective 4B-1 (eg apartments in noisy road).

- The CoS design guide requires 10 litres/second/person where the number of persons is equal to the number of bedrooms in the apartment +1 for 85% of all hours in the year for cross-through and cross-over apartments, or 90% of all hours in the year for all other apartments.
- This allows designs to deliver smaller opening sizes than required by the prescriptive design guidance of the ADG.
- The CoS design guideline also states that specific façade pressure coefficients may be determined using wind tunnel or computational fluid dynamic (CFD) testing which more accurately accounts for the surrounding features (buildings, streets, topography).

The objective of the ADG is to ensure that indoor air quality and thermal comfort is optimised, and reliance on mechanical ventilation reduced. The ADG provides design guidance to allow for effective cross ventilation well above the minimum ASHRAE or City of Sydney (Alternative natural ventilation of apartments in noisy environments) requirements.

SLR considers the 3 air changes per hour suitable to provide effective cross ventilation, reduce reliance on mechanical ventilation and satisfy the air quality requirements. The adopted air changes per hour in the current study is significantly above the minimum ASHRAE or City of Sydney air quality requirements.

5.0 Quantitative CFD Methodology and Assessment

Recesses and articulations create pressure and velocity differences across the various facades and encourage cross ventilation through an increased number of apartments. From experience SLR has found that numerical solutions including Computational Fluid Dynamics (CFD) and wind tunnel studies can prove these apartments to provide appropriate through apartment ventilation and circulation for natural ventilation requirements.

SLR has been tasked with modelling the Level 2 apartments, which have been designed with operable windows facing the building indentations:

- Unit A, Unit B, Unit C, Unit D, Unit E, Unit F, Unit G and Unit H.

SLR collaborated with the design team during the early design stage to optimize the placement of openings and amplify airflow dynamics driven by pressure differentials across the units. This collaboration led to strategic building indentations and enlarged openings facing the building slot, enhancing ventilation performance. A representation of the final design concept is illustrated in **Figure 4** and **Figure 5**.

Figure 4 Examples of Modelled Apartment – Level 2 and above

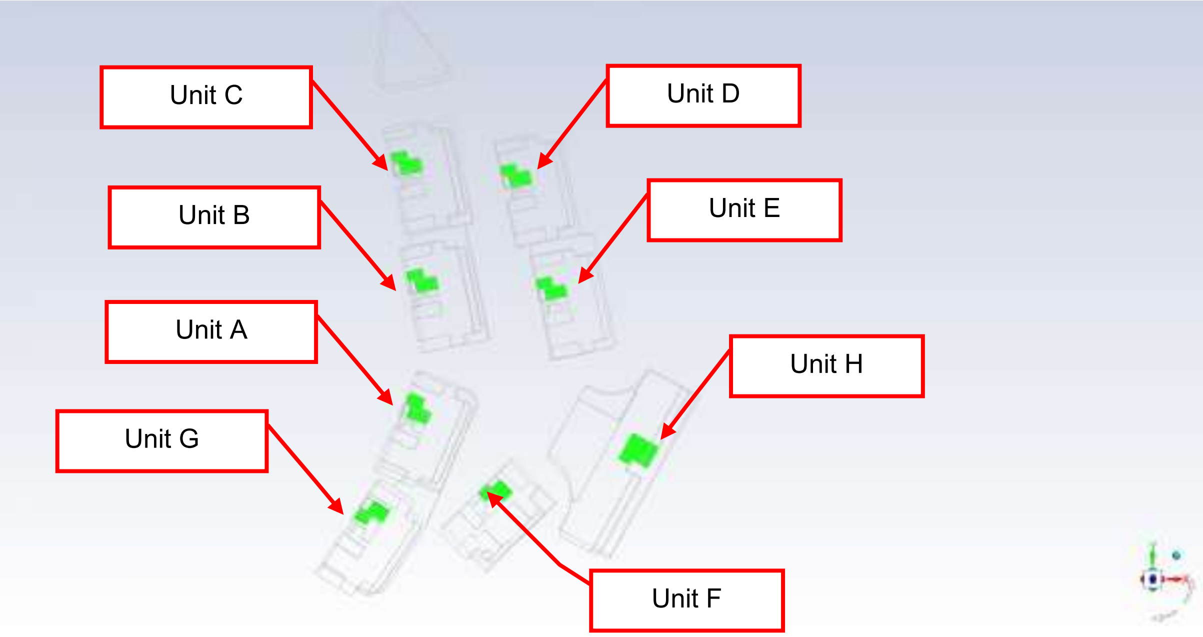
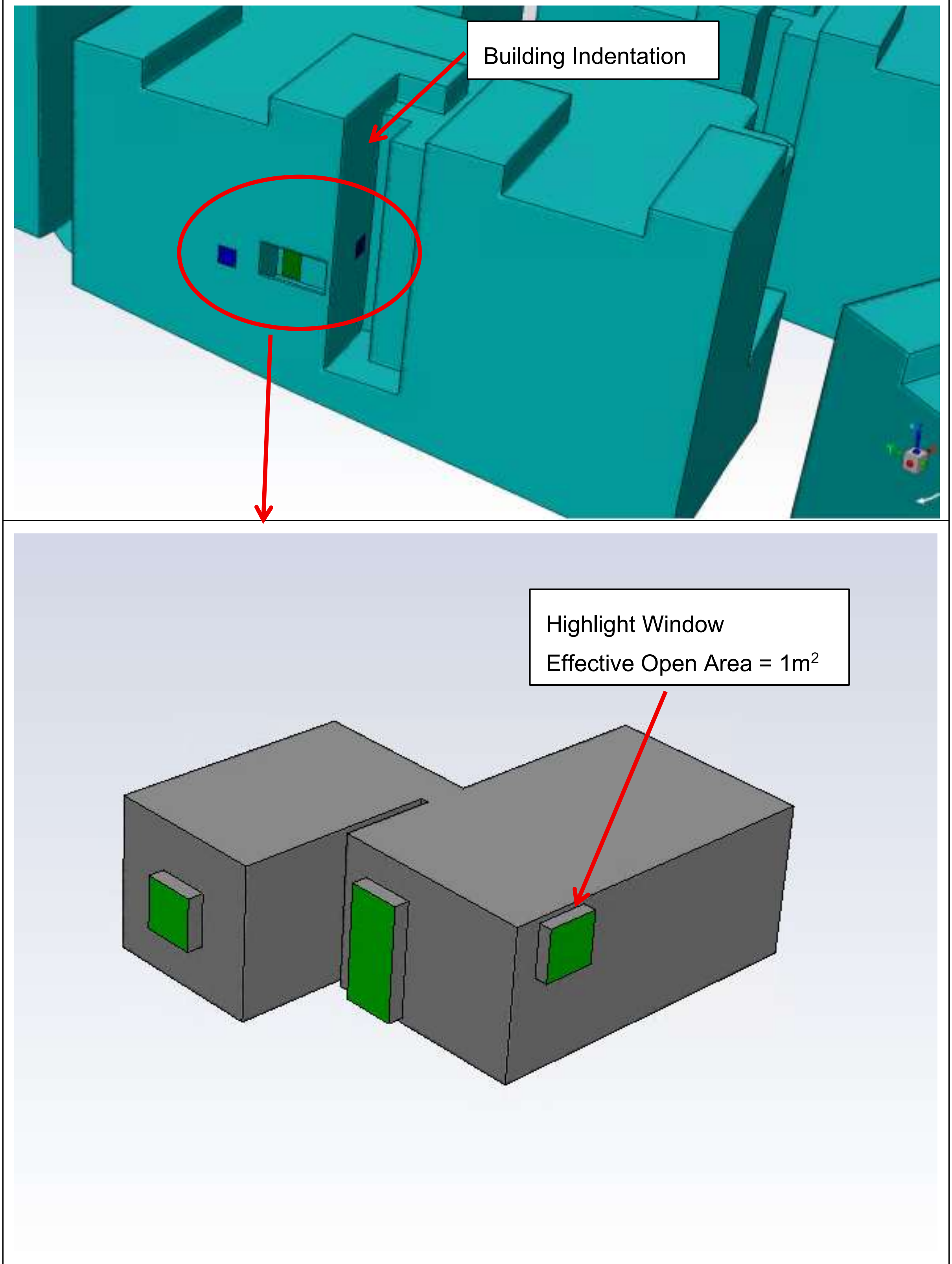


Figure 5 Proposed Design for a Selected Unit

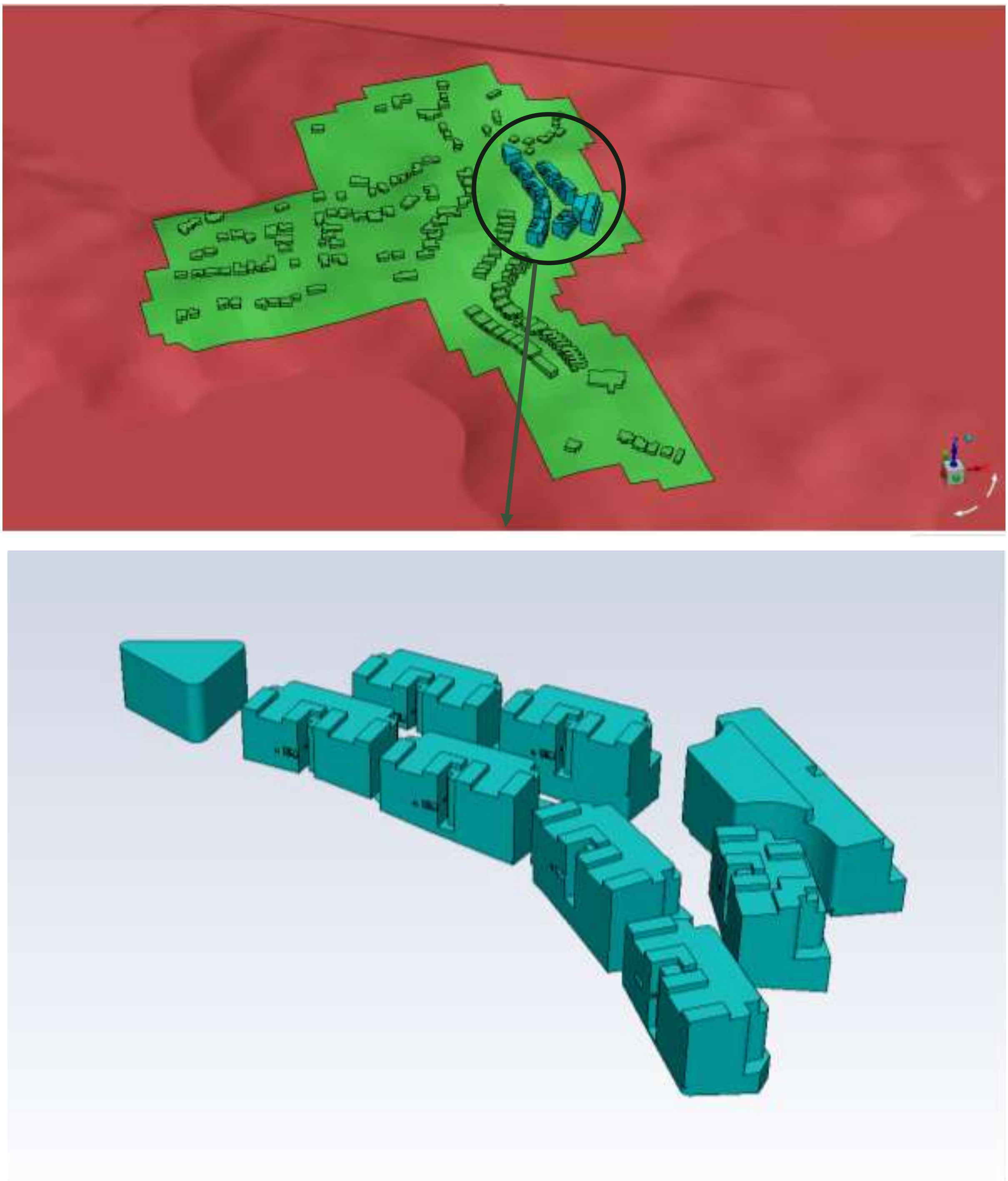


ALL windows are assumed open for the natural cross ventilation study

5.1 Geometry for CFD Modelling

SLR constructed a detailed model of the proposed development and its surrounding context using Creo Parametric. This model was subsequently imported into ANSYS for simulation preparation. **Figure 6** presents the model specifications. Notably, the developed model accommodates the site's intricate topography, ensuring accurate representation of terrain complexities.

Figure 6 Computational Domain for CFD Modelling



5.2 CFD Modelling Set

The prevailing wind direction in Katoomba, NSW is generally westerly to west-north-westerly (WNW) throughout the year. However, in the current study the following eight wind directions have been considered, and a weighted average based on the probability of occurrence by wind direction has been calculated.

- North
- Northeast
- Esat
- Southeast
- South
- Southwest
- West
- Northwest

In each case, a mean wind speed of 2 m/s was used at reference 10 m height.

As mentioned in Section 2.1 the annual average wind speed for the project site is 2.75 m/s and exceeds 2 m/s. The site's numerical modelling results in this study are therefore conservative and the volume of air moving through the apartments will likely increase with increasing approaching wind speeds.

Simple blocks were used for nearby surrounding buildings to include the impact of the surroundings on the natural ventilation for the proposed building. All velocities in the images are in metres per second and the simulation results are presented at a height of 1.5 metres above the floor level. This height is indicative only to show the flow around the apartment. SLR uses the modelled mass flow rates to check there is at least three air changes per hour for each apartment.

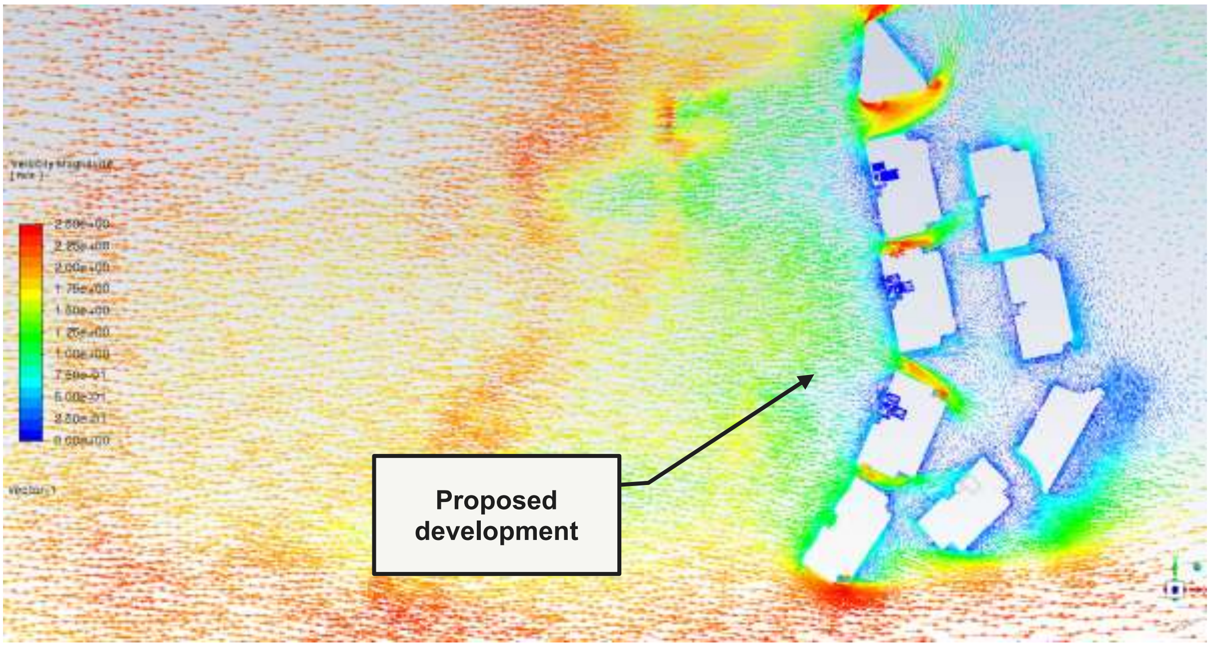
Typical apartment openings are outlined as follows: Balconies are accessed through sliding doors, featuring a large operable area. The effective open area of the highlight windows for units facing the indentation has been modelled in accordance with the provided architectural drawings

5.3 CFD Results

Figure 7 an example of the CFD Simulation output – for west winds – covering the entire project domain.

- The proposed development receives low level shielding for the upstream buildings to the north and east
- The CFD model captures the fluid flow characteristics in significant detail. Wind is approaching the site from the west at 270˚ as per the given boundary condition. Wind is then tunnelled between the buildings and accelerated near the edges and stagnated and recirculated behind the buildings.

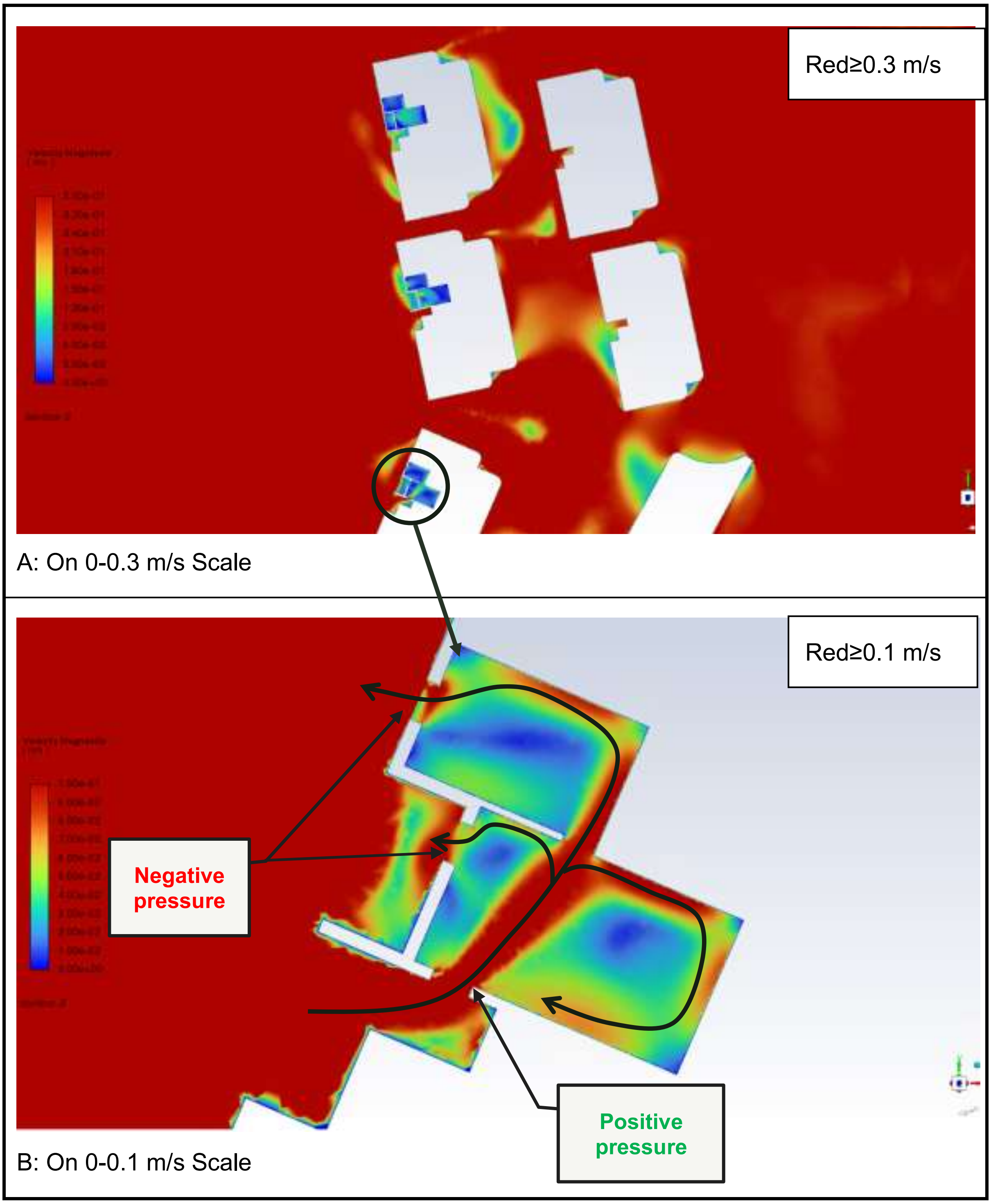
Figure 7   Site-Wide Wind Output from the CFD Simulation (West Winds)



The figure below illustrates representative flow patterns through Apartments A, B, and C under westerly wind conditions. Air enters the living areas via open windows oriented toward the building indentation and exits through the sliding door and secondary bedroom windows. This movement is driven by pressure differentials across the openings.

Comprehensive results for all other units and wind directions are provided in **Appendix A**.

Figure 8 Airflow Example – Buildings A, B and C



SLR deems an apartment to have adequate natural cross ventilation if it shows reasonable airflow. Reasonable airflow is defined as achieving a weighted average of at least three air changes per hour, with a minimum airflow of 0.1 m/s in certain areas and shows good flow from room to room without short circuiting. The ADG also states *"For an apartment to be considered cross ventilated, the majority of the primary living space and n-1 bedrooms (where n is the number of bedrooms) should be on a ventilation path"*.

Images of the CFD results are detailed in **Appendix A** and summarised in the following table.

Table 1 Air Changes per Hour – Level 2 Apartments

Tested Apartment[1]	N Winds	NE Winds	E Winds	SE Winds	S Winds	SW Winds	W Winds	NW Wind	Weighted average[2]
Unit A	15.81	6.56	10.32	1.79	2.31	5.29	4.17	13.81	**8.6**
Unit B	1.33	8.57	3.67	5.48	5.50	9.50	11.14	14.22	**8.1**
Unit C	2.48	10.18	7.78	7.86	7.86	8.11	5.73	21.79	**8.3**
Unit D	6.54	7.11	7.68	5.31	5.35	6.62	9.71	2.95	**6.9**
Unit E	4.90	9.63	13.18	2.31	2.41	12.12	3.27	1.73	**5.3**
Unit F	3.66	1.68	7.19	13.69	13.42	2.36	7.27	0.24	**5.3**
Unit G	8.01	6.70	7.41	9.53	-9.52	6.89	8.49	9.79	**7.4**
Unit H	10.14	7.32	17.02	14.64	14.66	3.86	2.25	2.04	**8.6**

Note 1: The results for the apartments on higher levels are similar.

Note 2: The weighted average is determined based on the probability of occurrence at the project site. The wind frequency from the west quadrant (e.g. southwest) is greater than that from the east quadrant (e.g., northeast).

The results above are based on a mean wind speed of 2 m/s at a height of 10 metres. As wind speeds increase, the airflow through the apartments will intensify accordingly.

In conclusion, the pressure difference at the openings is sufficient to generate the necessary flow through the apartments in question.

6.0 Revised Plans

In the time since the initial modelling was completed the layout for the apartments has been developed and revised. Using the current drawing set SLR has applied the findings of the modelling to arrive at a summary of the natural ventilation.

Figure 9 Representative Floorplan – Revision B (18 December 2025)

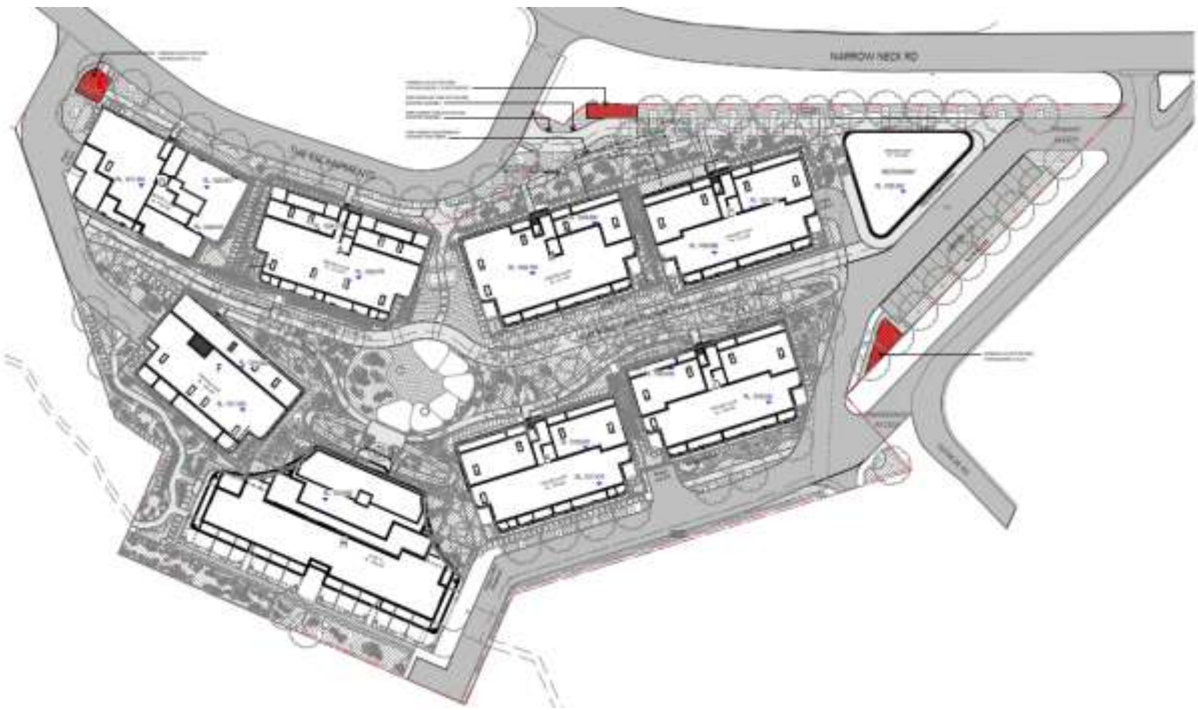


Table 2 Ventilation Summary

Building	Apartments	Dual Aspect	Modelling	Skylights	Combined	%
A	32	16	3	1	20	62.5%
B	32	16	3	1	20	62.5%
C	32	16	3	1	20	62.5%
D	32	16	3	1	20	62.5%
E	32	16	3	1	20	62.5%
F	24	8		2	10	41.7%
G	27	16	3	2	21	77.7%
H	7	6	1		7	100%

Overall this gives a passing rate of 63.0%.

7.0 Conclusion

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Management 7bbh to assess the natural cross ventilation of the proposed mixed-use development (Blocks A, B, C, D, E, F, G & H) located at 142-150 Narrow Neck Road, Katoomba.

This report forms part of the State Significant Development Application (SSDA) for the project site.

SLR has been tasked with modelling the articulated single fronted apartments, which have been designed with operable windows facing the building indentations

- Unit A, Unit B, Unit C, Unit D, Unit E, Unit F, Unit G and Unit H. Refer **Figure 2**

This report is in the form of a quantitative assessment utilising Computational Fluid Dynamics (CFD).

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- The proposed development has been provided with openings on multiple sides of the apartments for the majority of proposed floor plans, allowing it to make use of wind-induced natural ventilation throughout the year and thereby minimising energy costs.
- In general, the overall depth of the units does not exceed 18 m as per the Design Criteria of Objective 4B-3.

Natural cross ventilation to many single aspect apartments is achieved via building indentations. This is anticipated within ADG Section 4B which states in its opening paragraph that "*Natural cross ventilation is achieved by apartments having more than one aspect with direct exposure to the prevailing winds,* ***or*** *windows located in significant different pressure regions, rather than relying on purely wind driven air*".

SLR has collaborated with the design team during the early design stage to optimize the placement of openings and amplify airflow dynamics driven by pressure differentials across the units. This collaboration led to strategic building indentations and enlarged openings facing the building slot, enhancing ventilation performance. A representation of the final design concept is illustrated in **Figure 4** and **Figure 5**.

The following conclusions have been drawn from the quantitative numerical modelling of the analysed units:

- Unit A, Unit B, Unit C, Unit D, Unit E, Unit F, Unit G and Unit H of the level 2 apartments will be naturally cross ventilated.
- The results for the apartments on higher levels are similar.

The results above are based on a wind speed of 2 m/s at a height of 10 metres. As wind speeds increase, the airflow through the apartments will intensify accordingly.

When the modelling was applied to the current apartment layout, Revision B 18 December 2025, it was found that 63.0% of the apartments (138 of 218) would be naturally ventilated thereby meeting the ADG requirement.

8.0 Feedback

At SLR, we are committed to delivering professional quality service to our clients. We are constantly looking for ways to improve the quality of our deliverables and our service to our clients. Client feedback is a valuable tool in helping us prioritise services and resources according to our client needs.

To achieve this, your feedback on the team’s performance, deliverables and service are valuable and SLR welcome all feedback via https://www.slrconsulting.com/en/feedback.
We recognise the value of your time, and we will make a $10 donation to our Charity Partner - Lifeline, for every completed form.

Appendix A Vector Flow Diagrams

142-150 Narrow Neck Road, Katoomba

Natural Ventilation Assessment

Management 7bbh

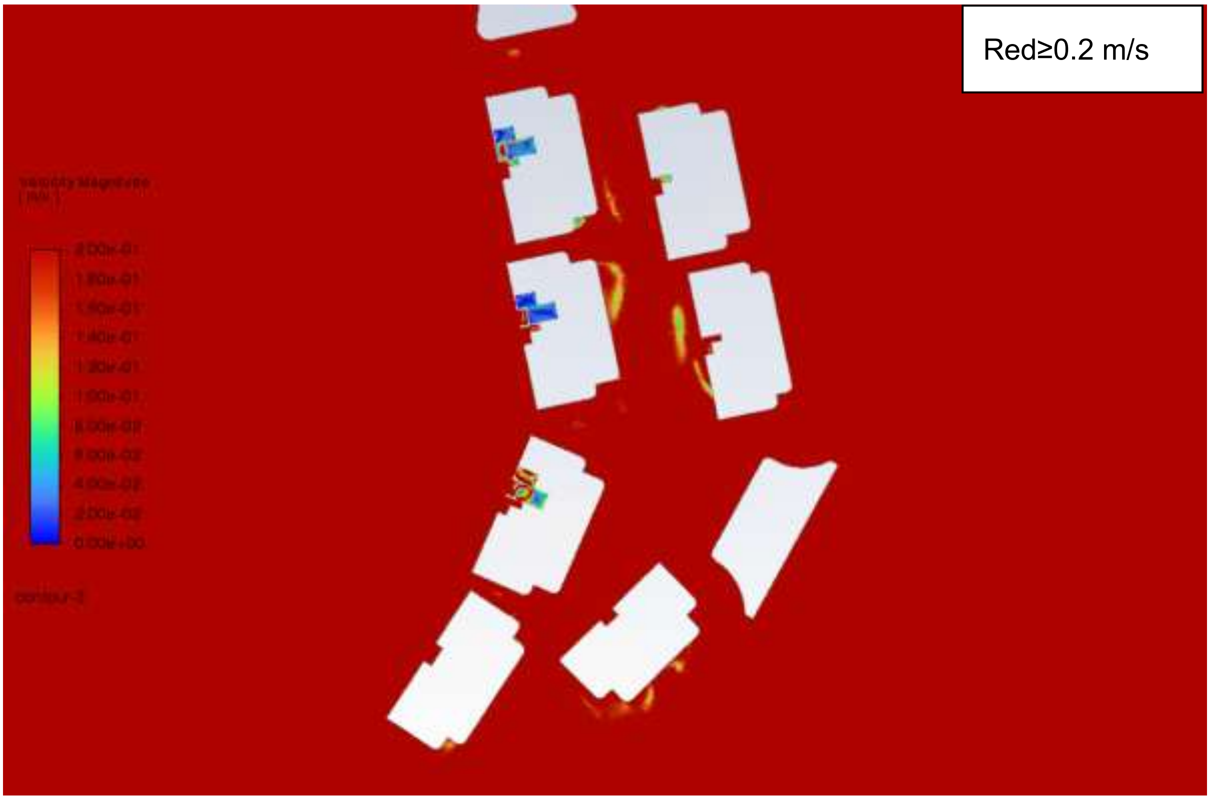
SLR Project No.: 610.033104

Revision: R01-v1.1

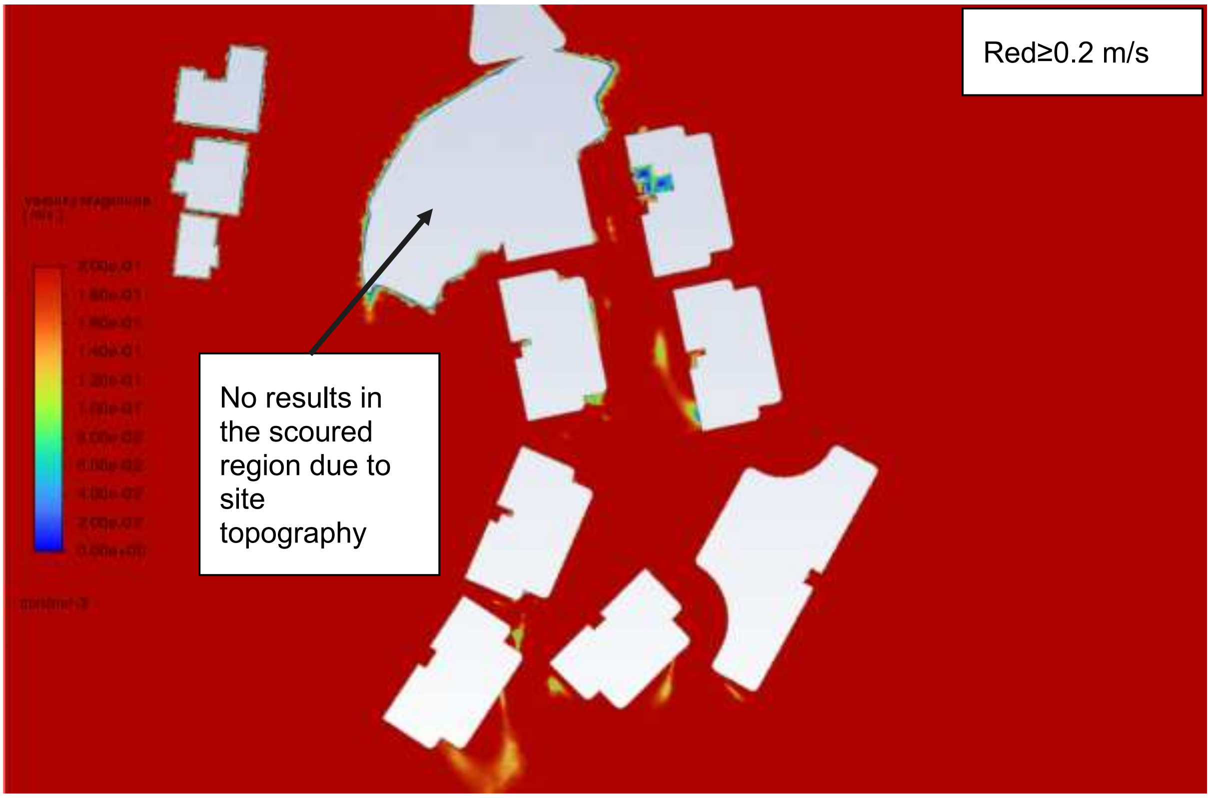
5 November 2025

North

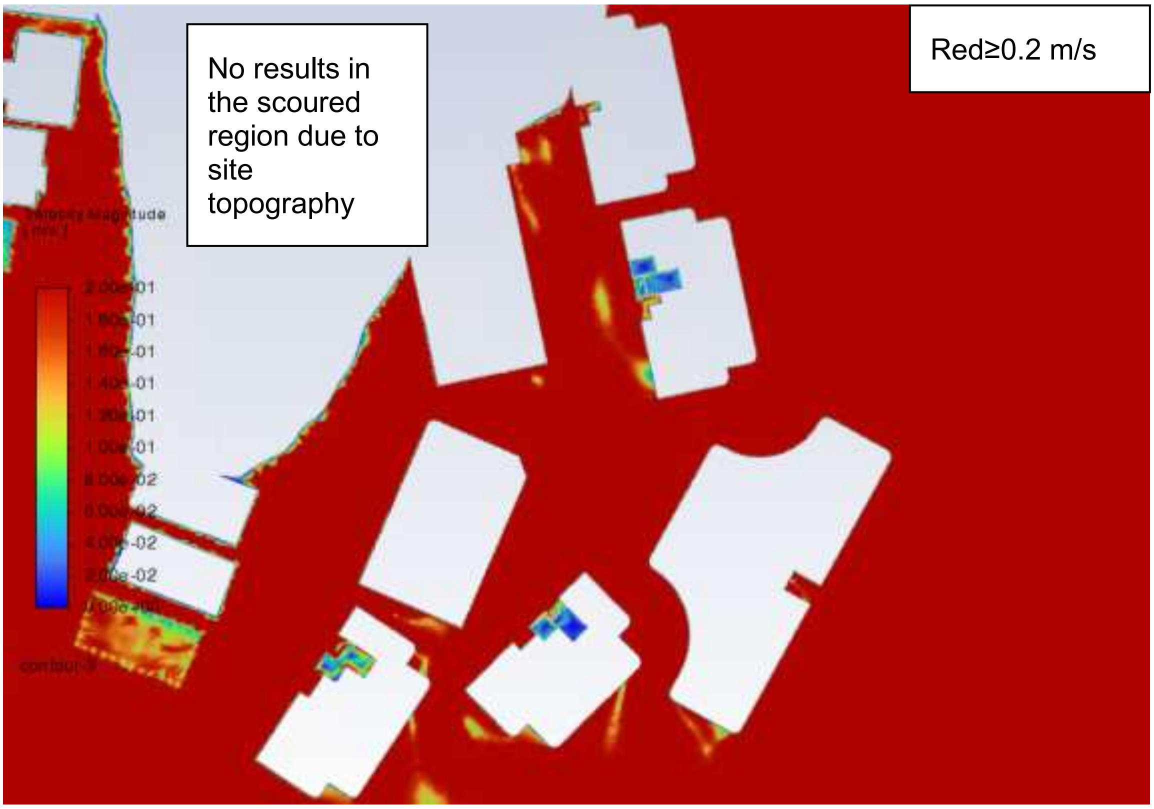
Unit A, Unit B & Unit C



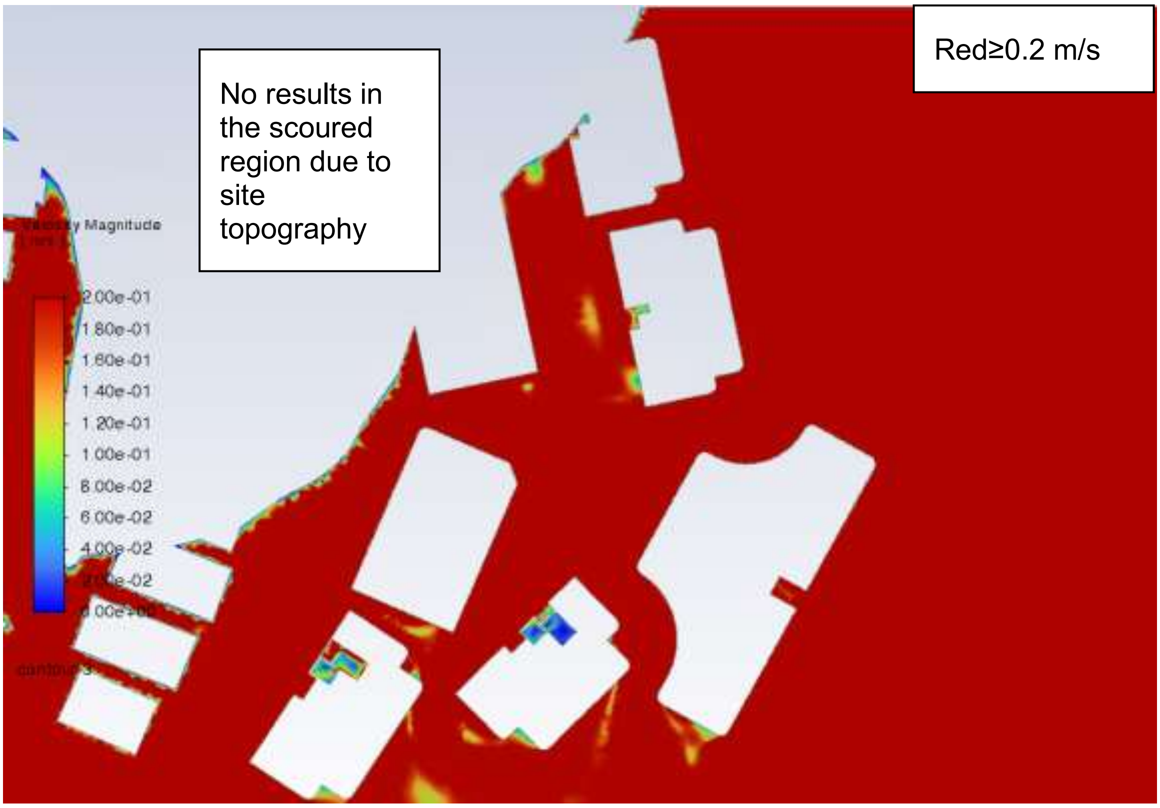
Unit D



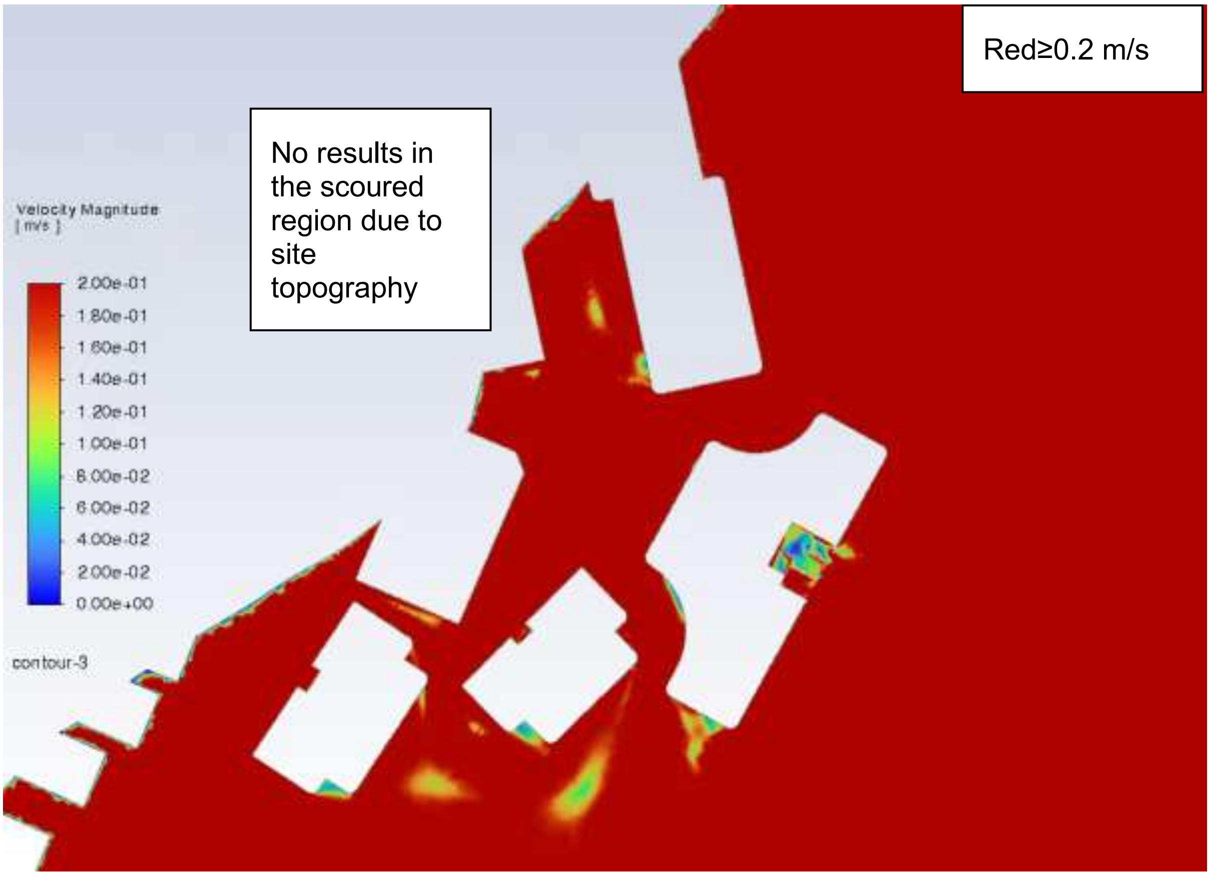
Unit E and Unit G



Unit - F



Unit - H


Red≥0.2 m/s
No results in the scoured region due to site topography
Velocity Magnitude
[m/s]
2.00e-01
1.80e-01
1.60e-01
1.40e-01
1.20e-01
1.00e-01
8.00e-02
6.00e-02
4.00e-02
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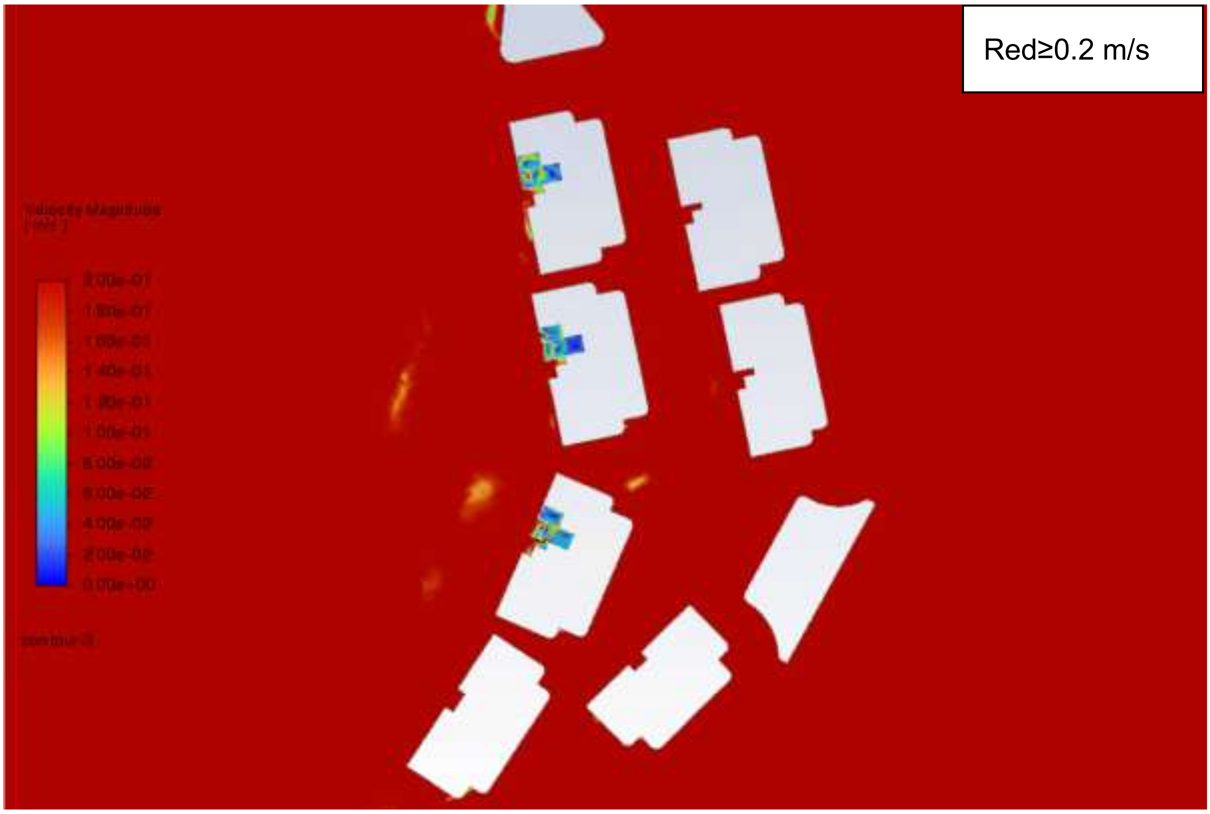
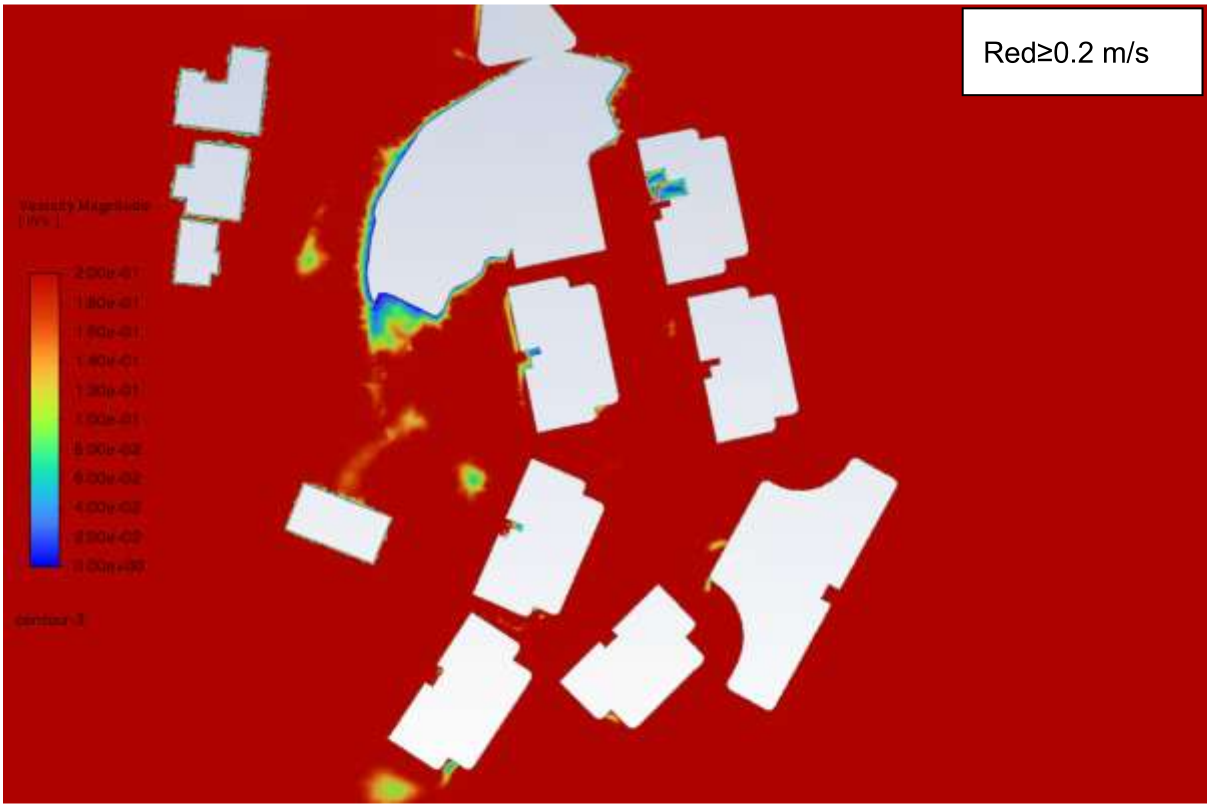
0.00e+00
contour-3

North East

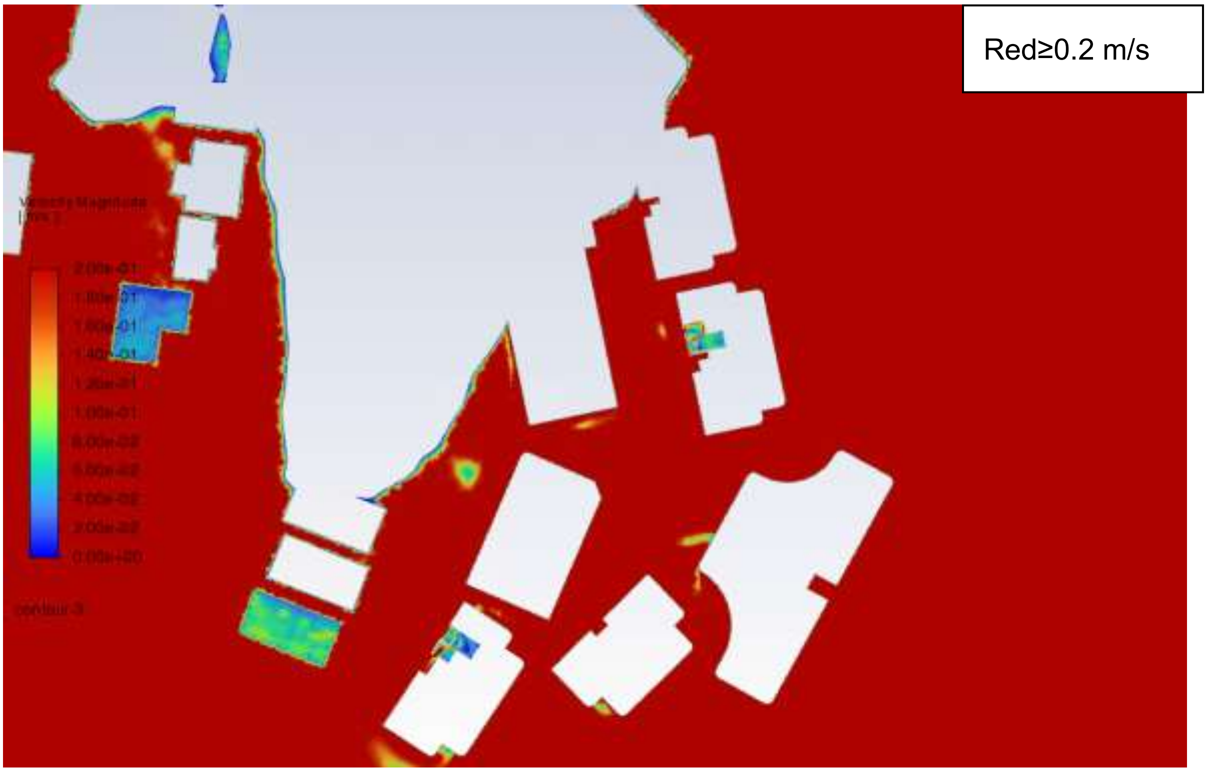
Unit A, Unit B & Unit C



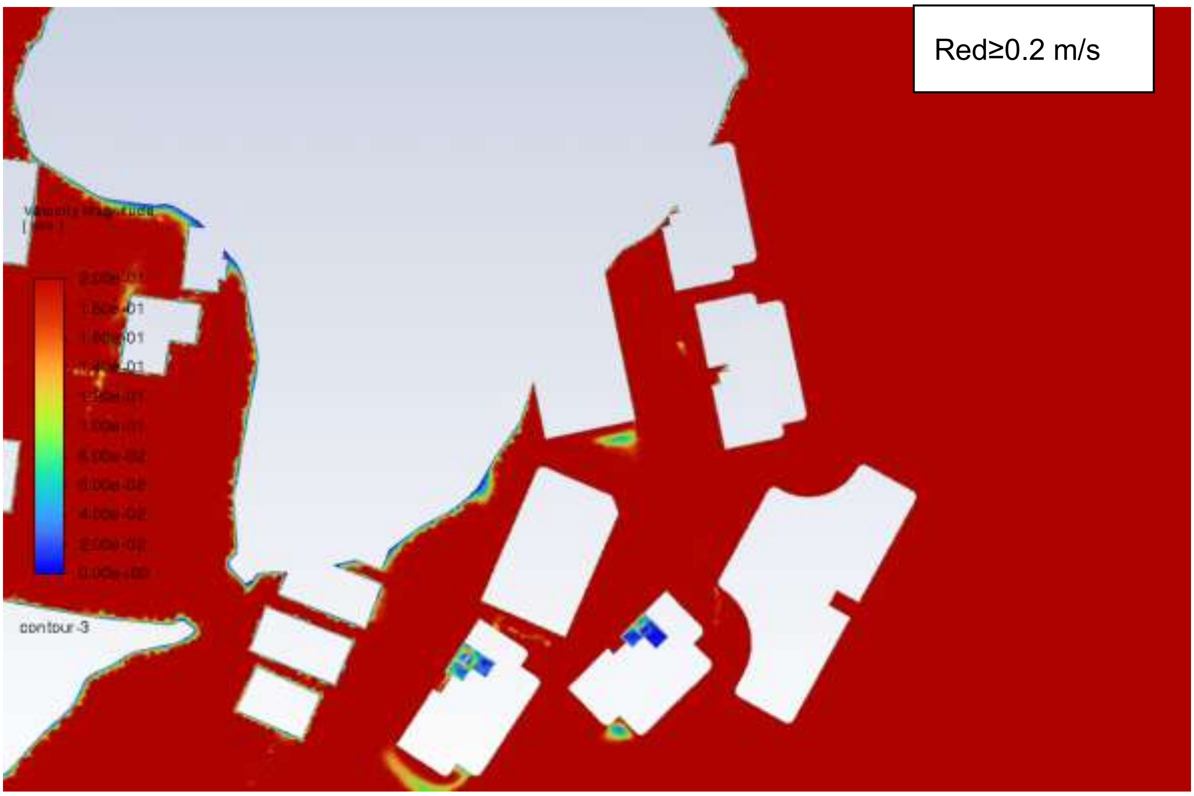
Unit D



Unit E and Unit G



Unit - F

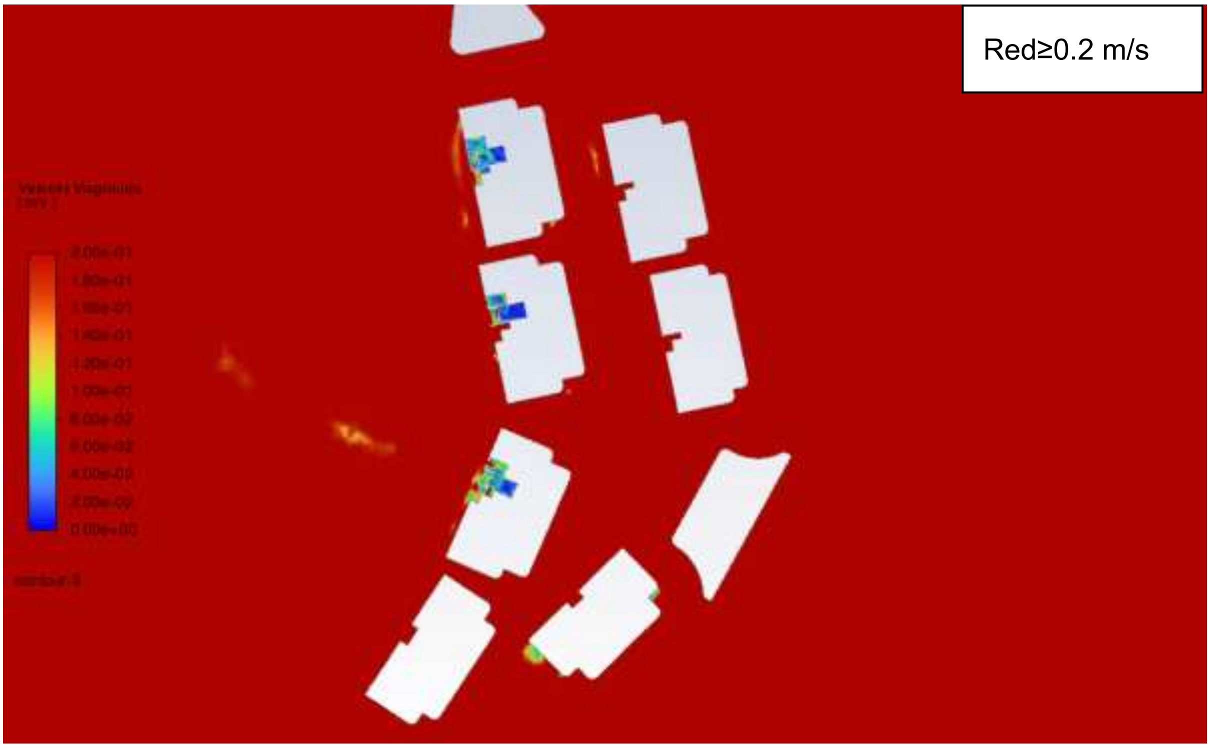


Unit - H

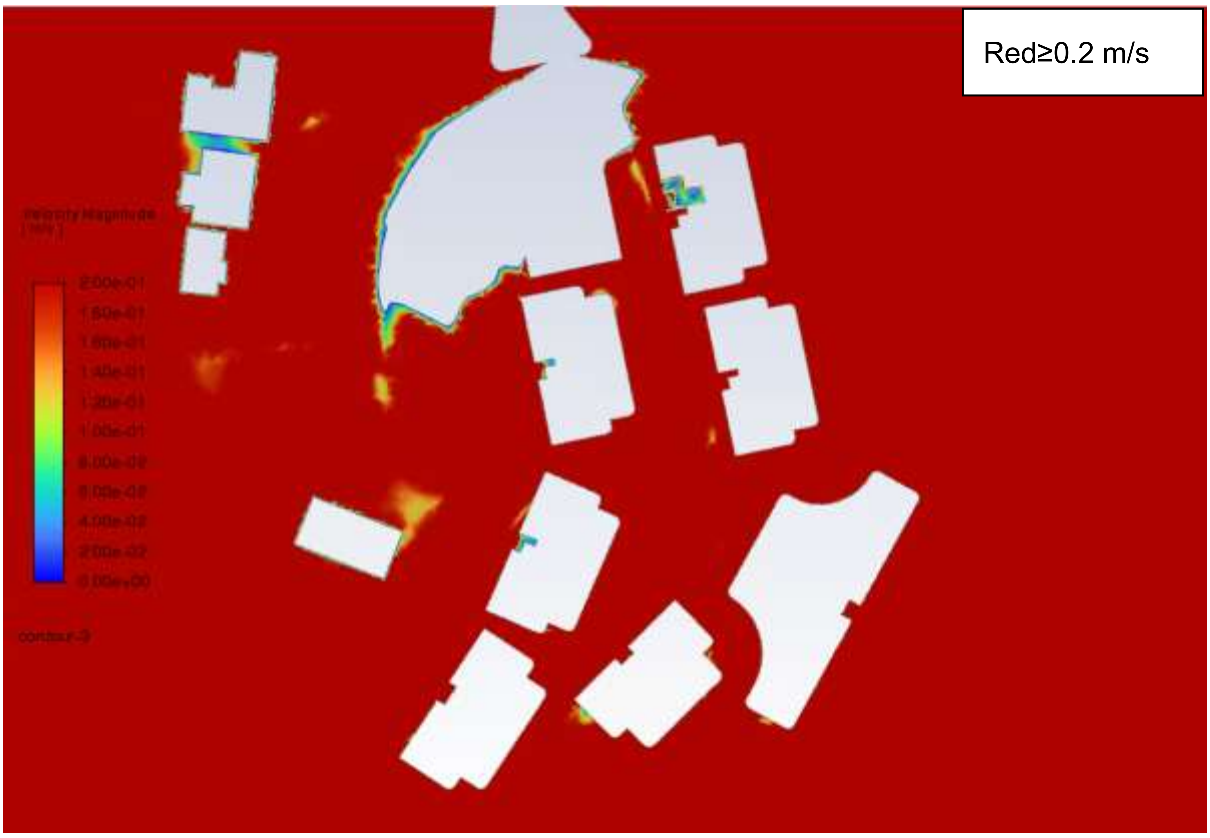

Red≥0.2 m/s
Velocity Magnitude
[m/s]
2.00e-01
4.00e-02
2.00e-02
0.00e+00
contour-3

East

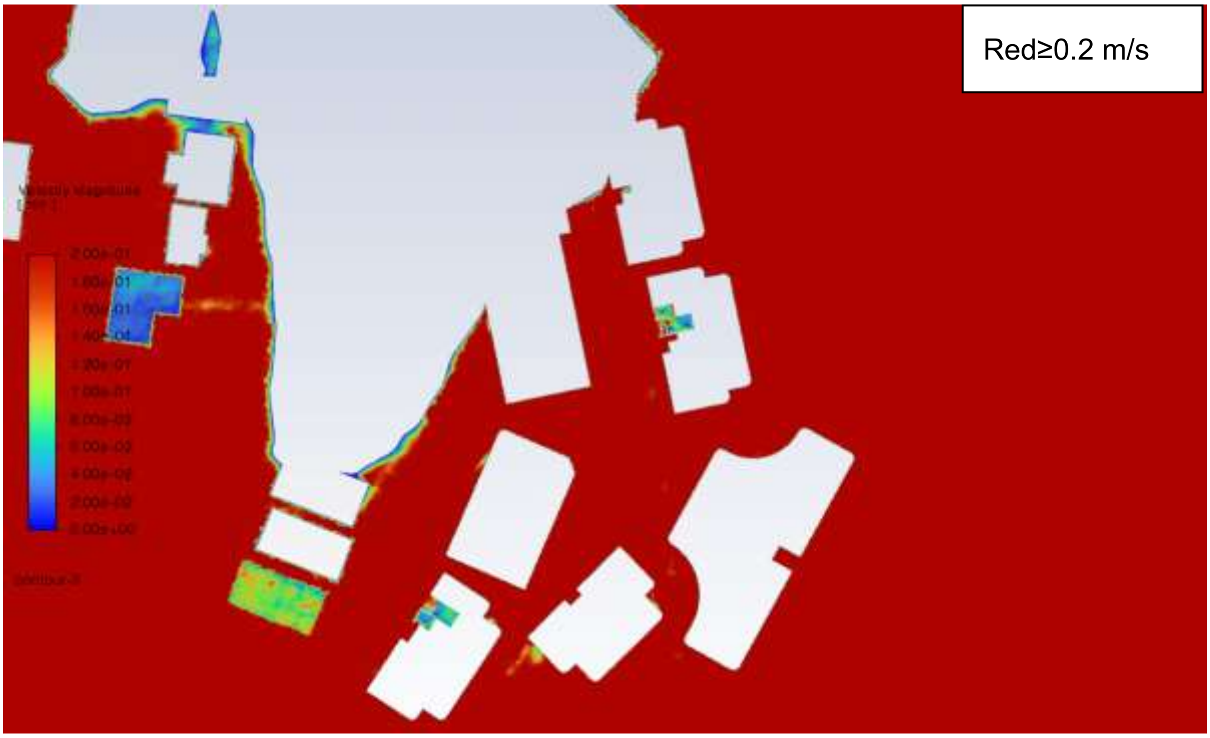
Unit A, Unit B & Unit C



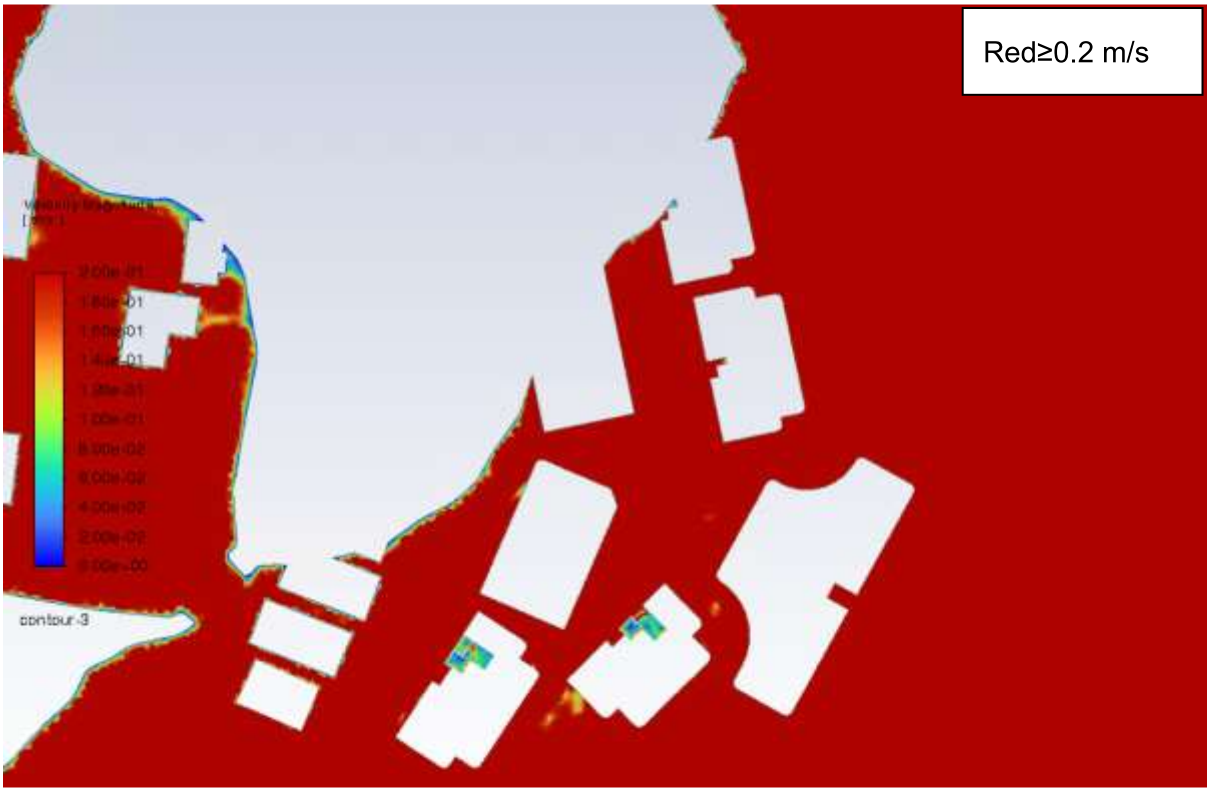
Unit D



Unit E and Unit G



Unit - F

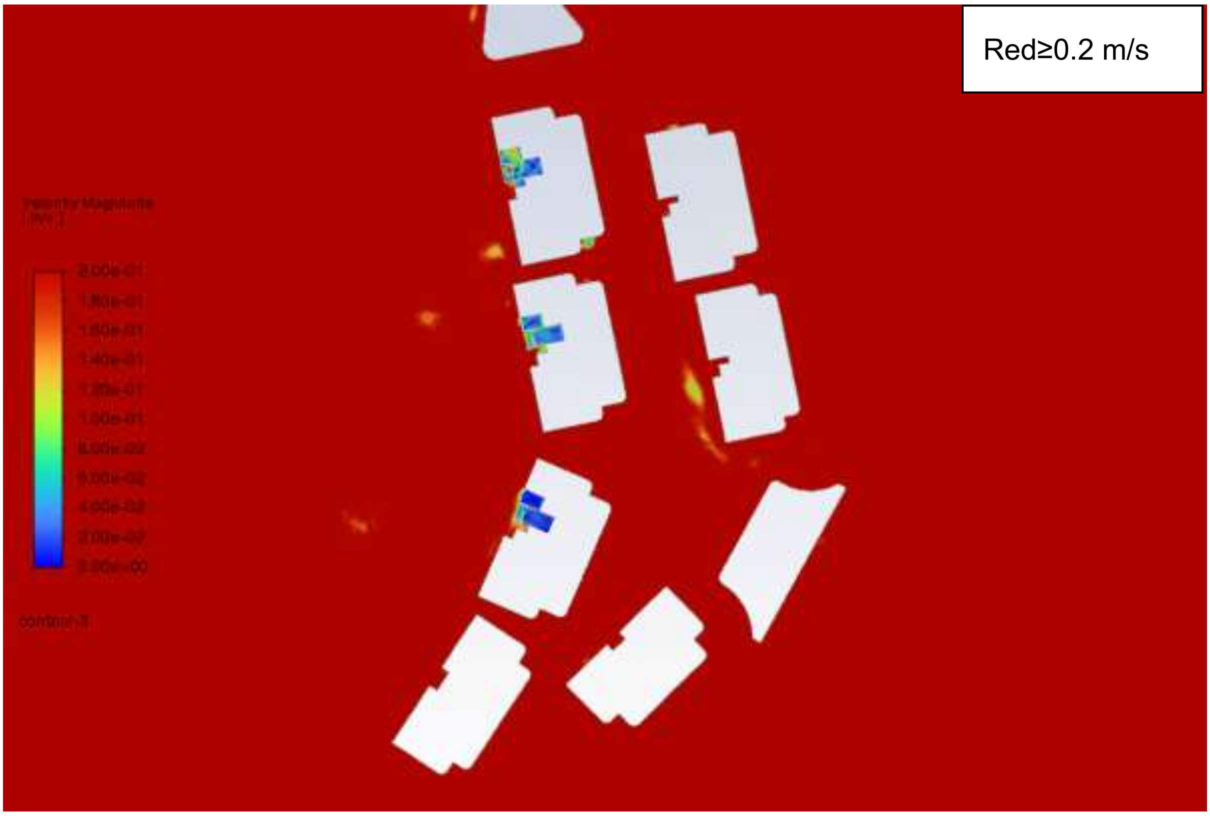


Unit - H

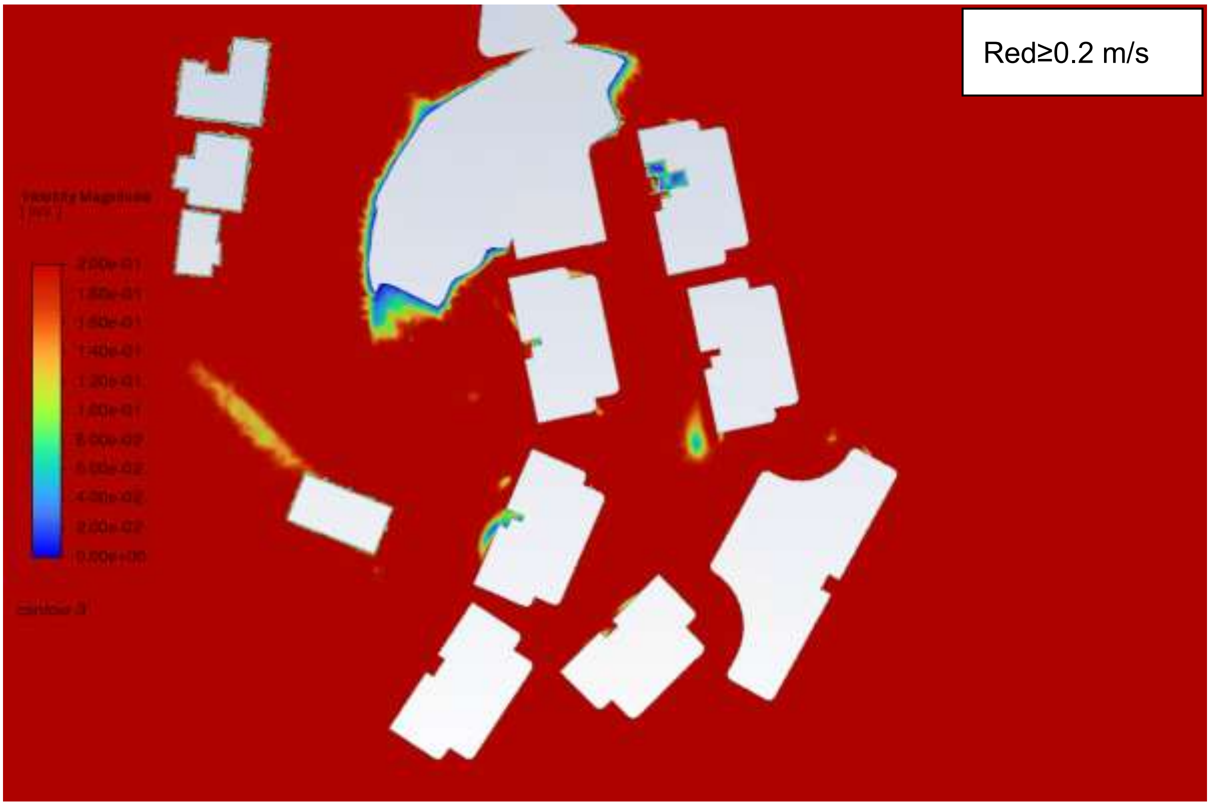

Red≥0.2 m/s
Velocity Magnitude
[m/s]
2.00e-01
4.00e-02
2.00e-02
0.00e+00
contour-3

South East

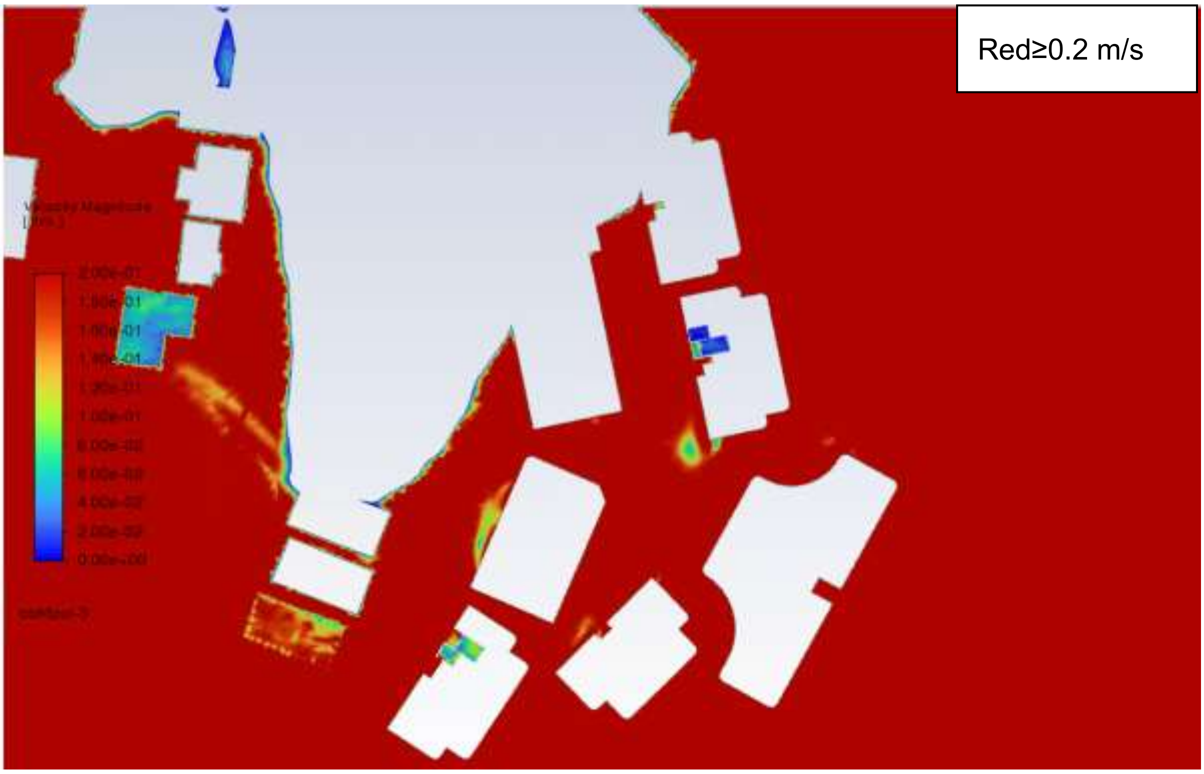
Unit A, Unit B & Unit C



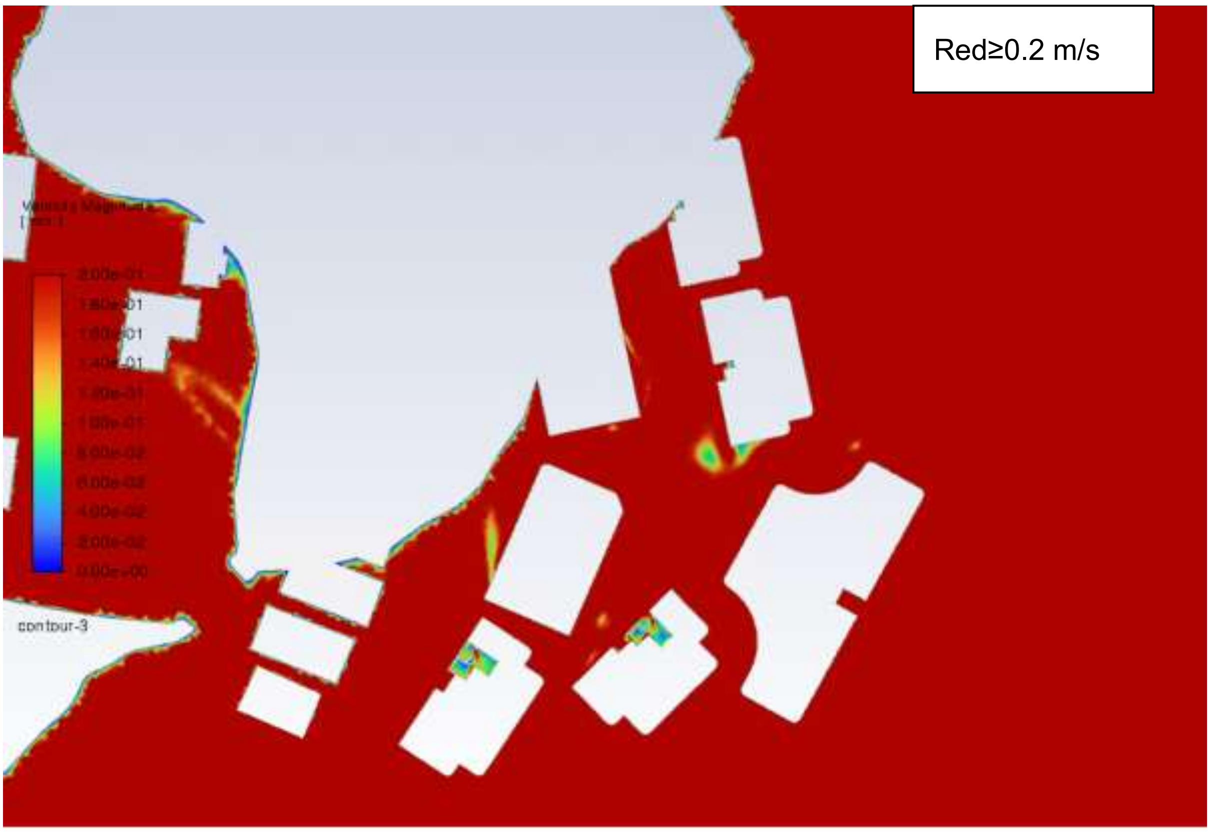
Unit D



Unit E and Unit G



Unit - F

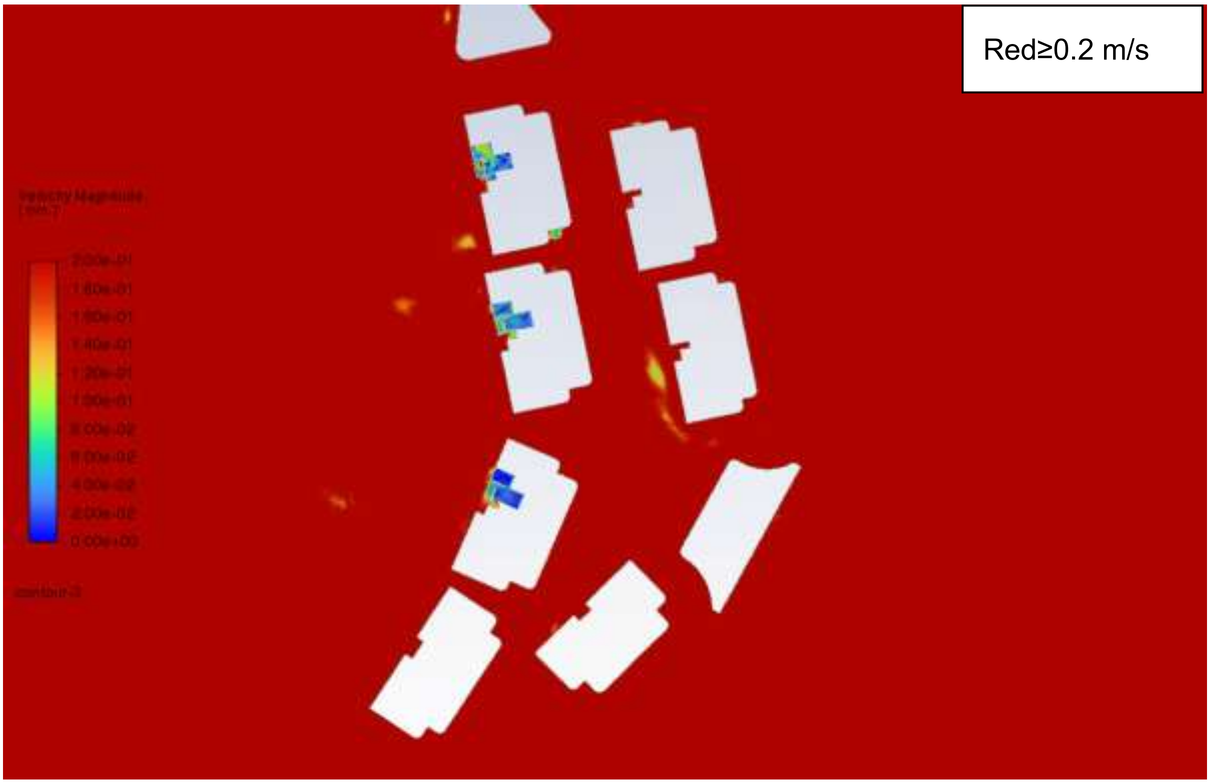


Unit - H

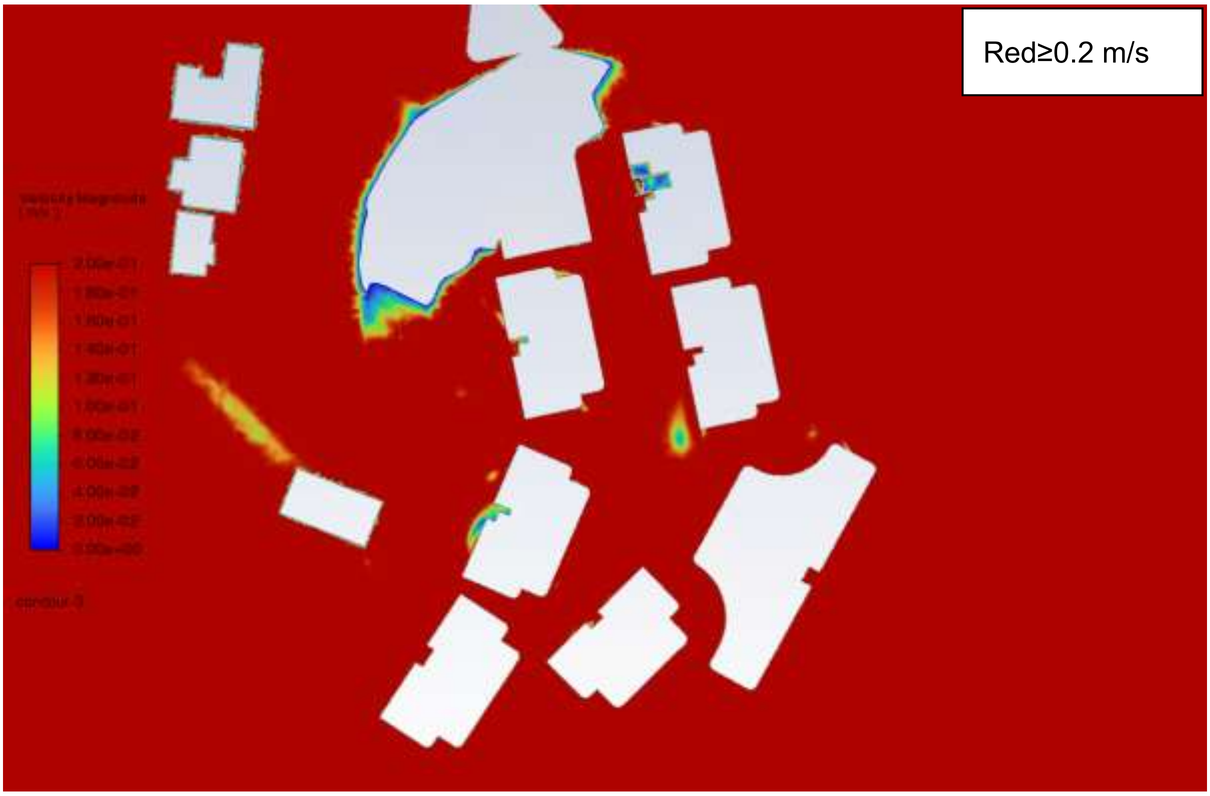

Red≥0.2 m/s
Velocity Magnitude
[m/s]
2.00e-01
4.00e-02
2.00e-02
0.00e+00
contour-3

South

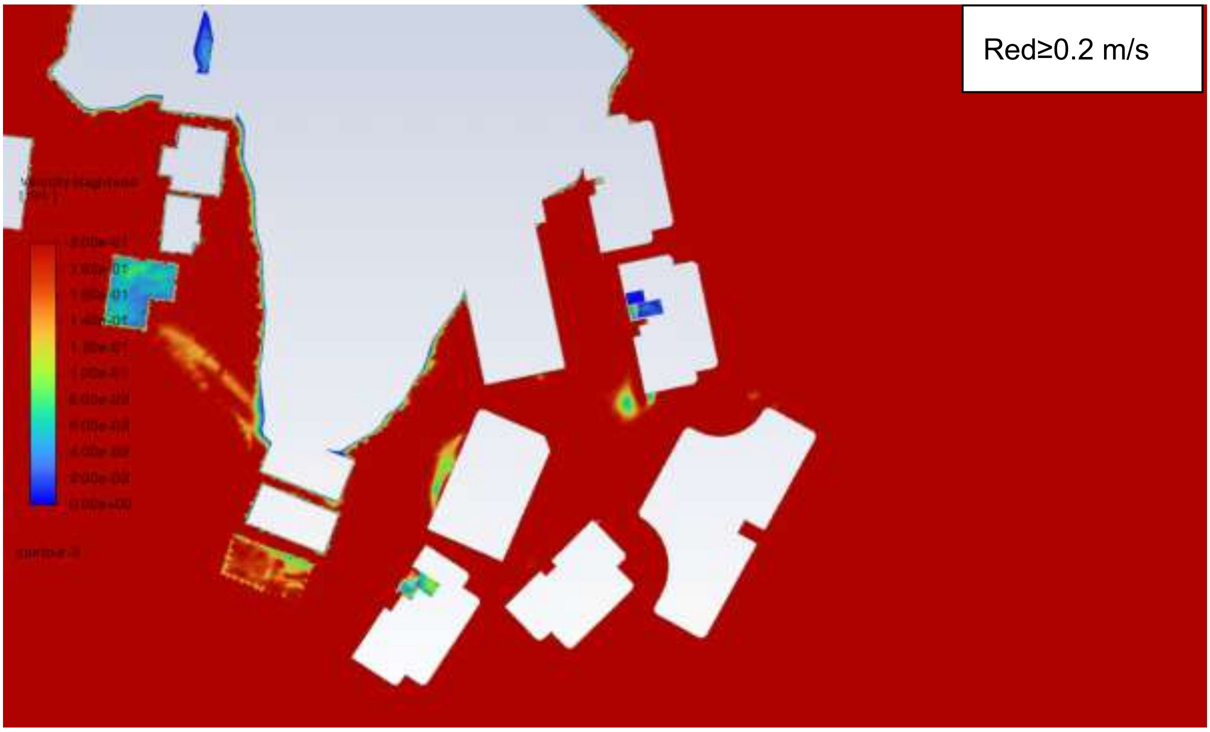
Unit A, Unit B & Unit C



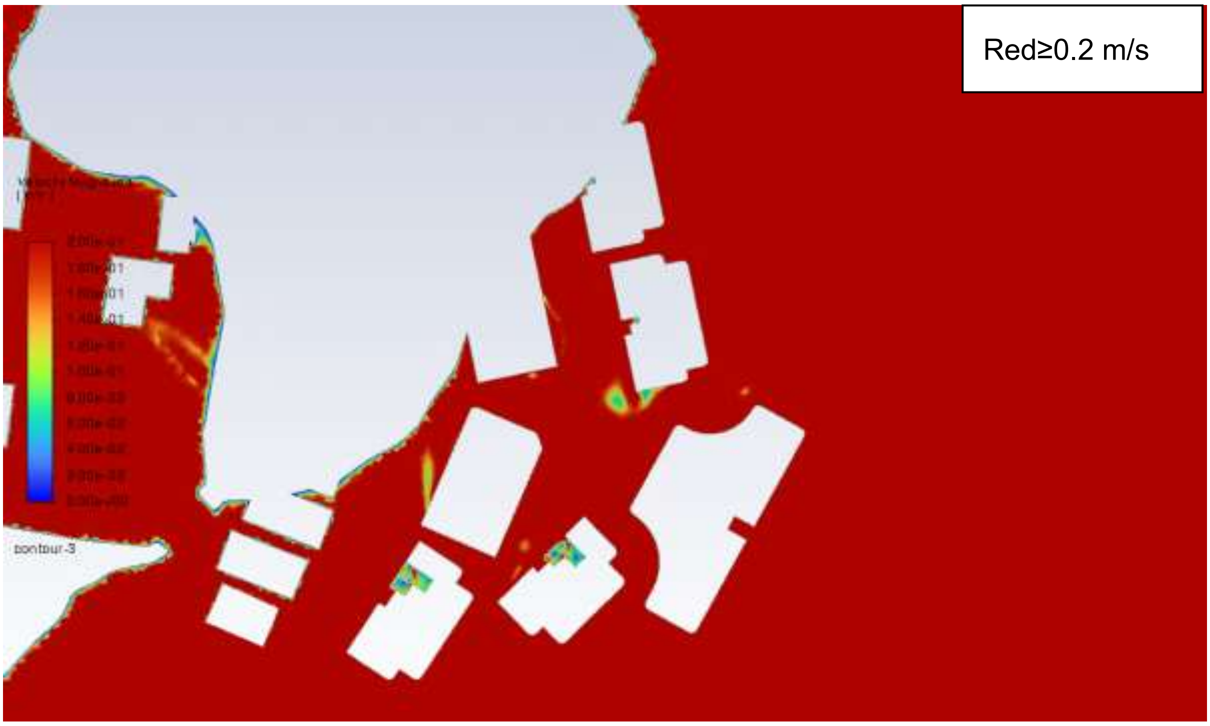
Unit D



Unit E and Unit G



Unit - F

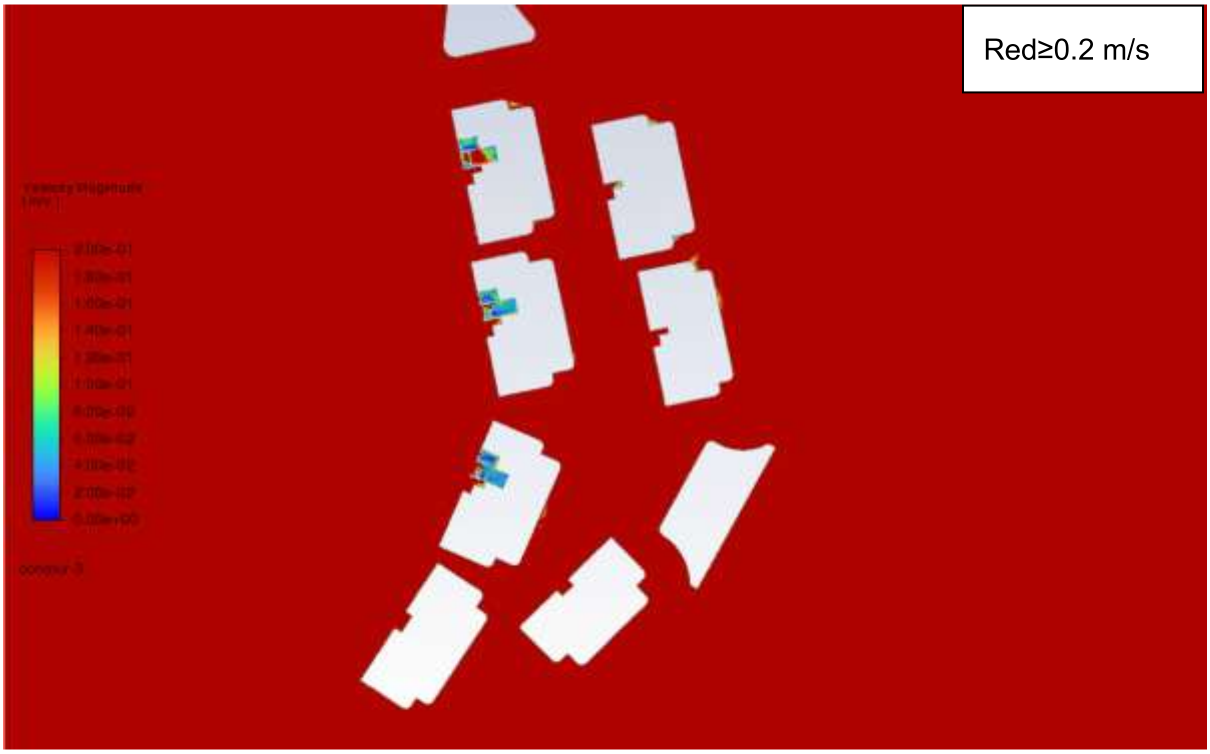


Unit - H


Red≥0.2 m/s
Velocity Magnitude
[m/s]
2.00e-01
4.00e-02
2.00e-02
0.00e+00
contour-3

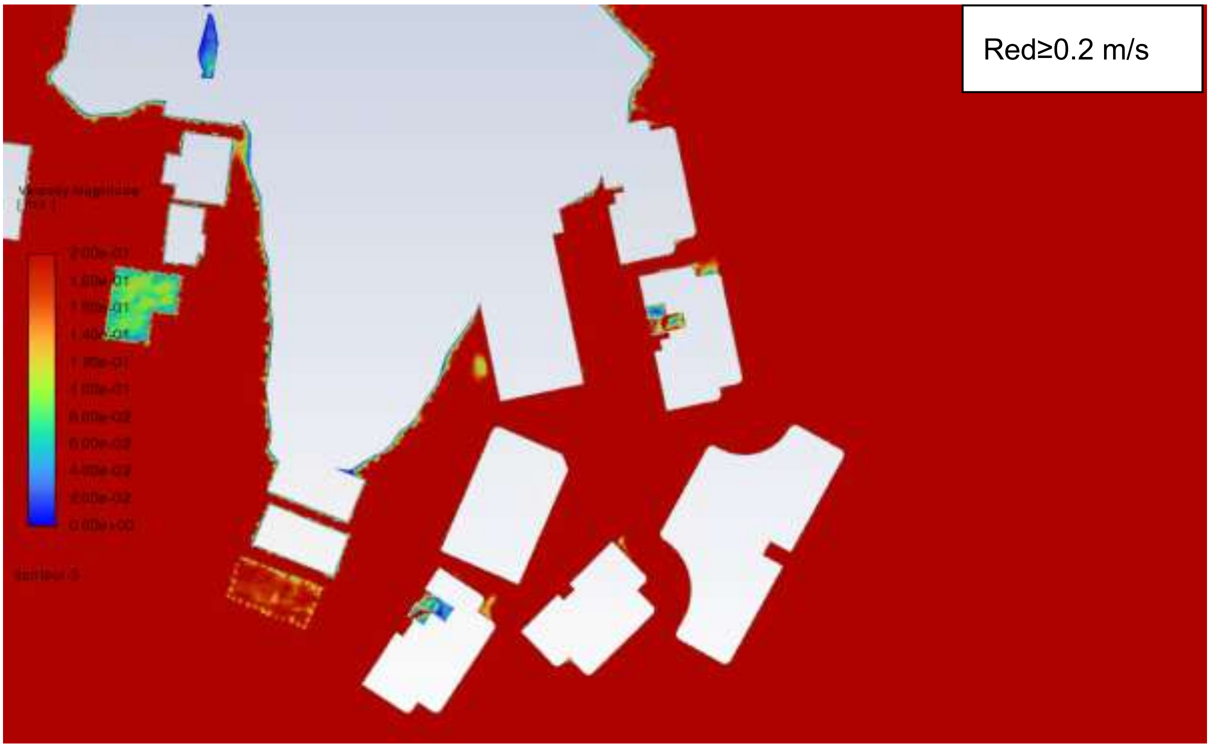
South West

Unit A, Unit B & Unit C

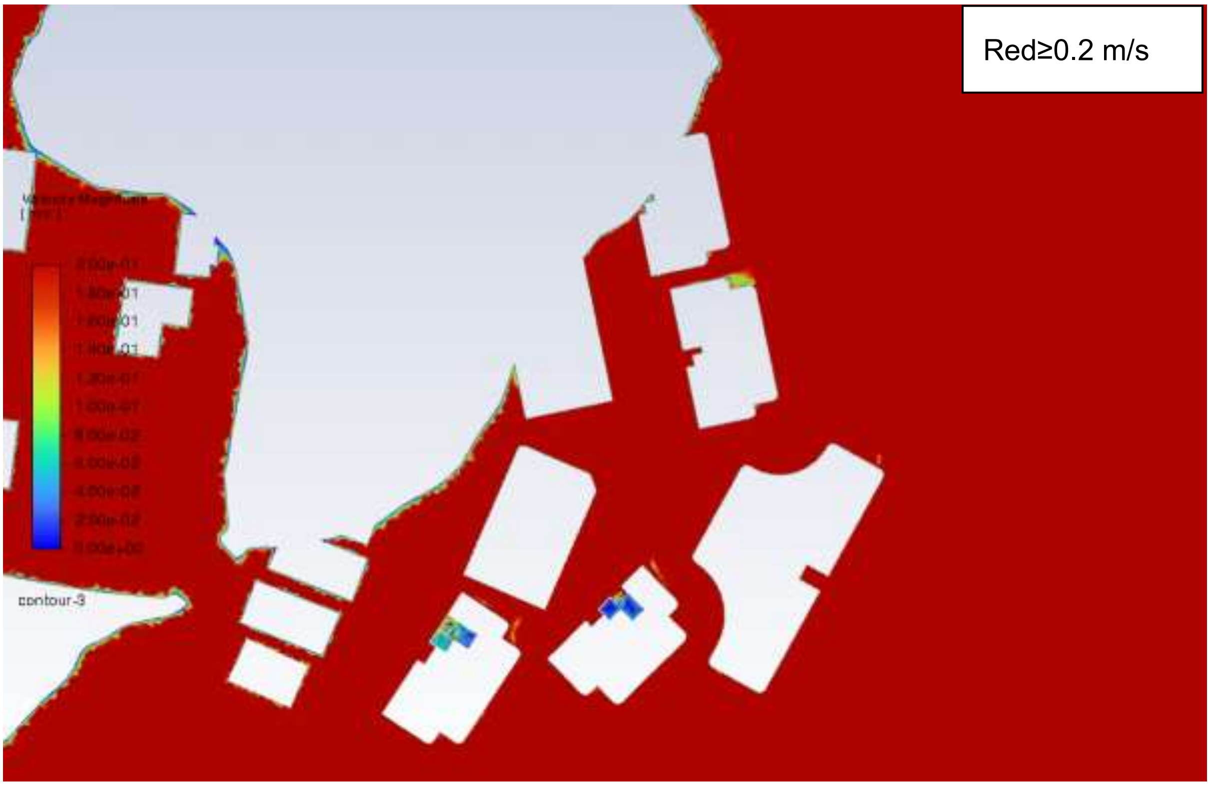


Unit D

Unit E and Unit G



Unit - F

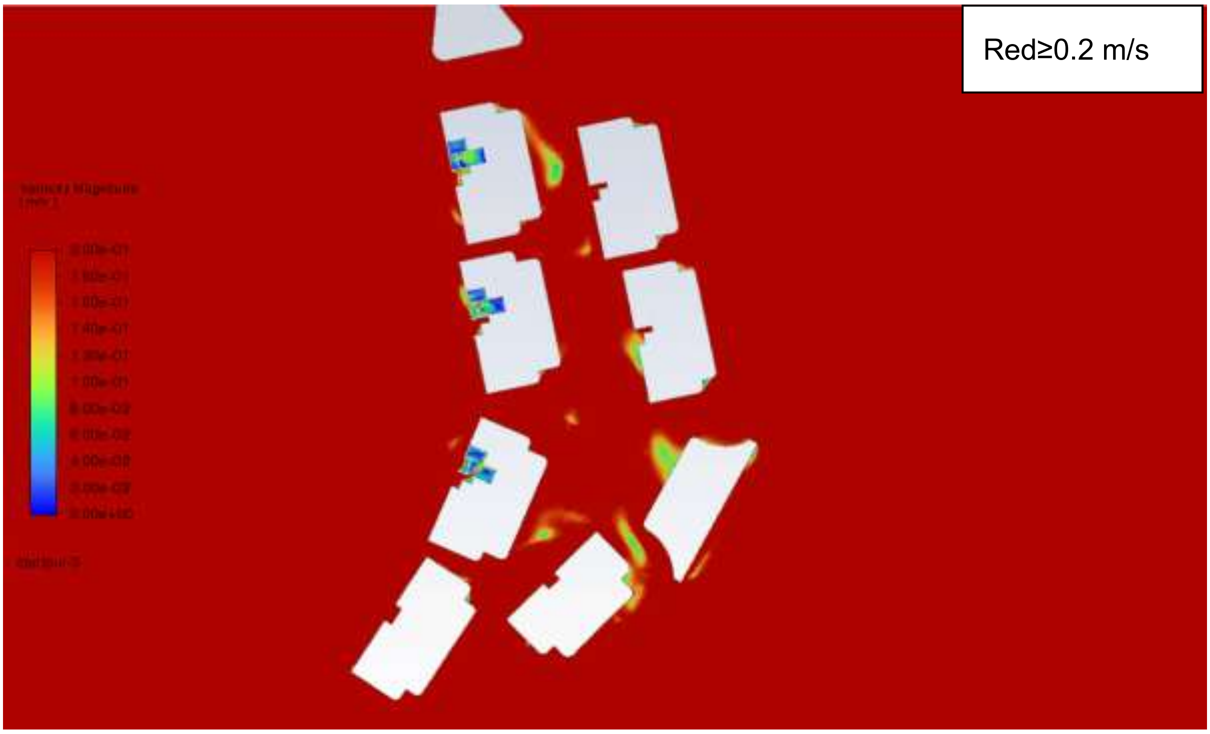


Unit - H

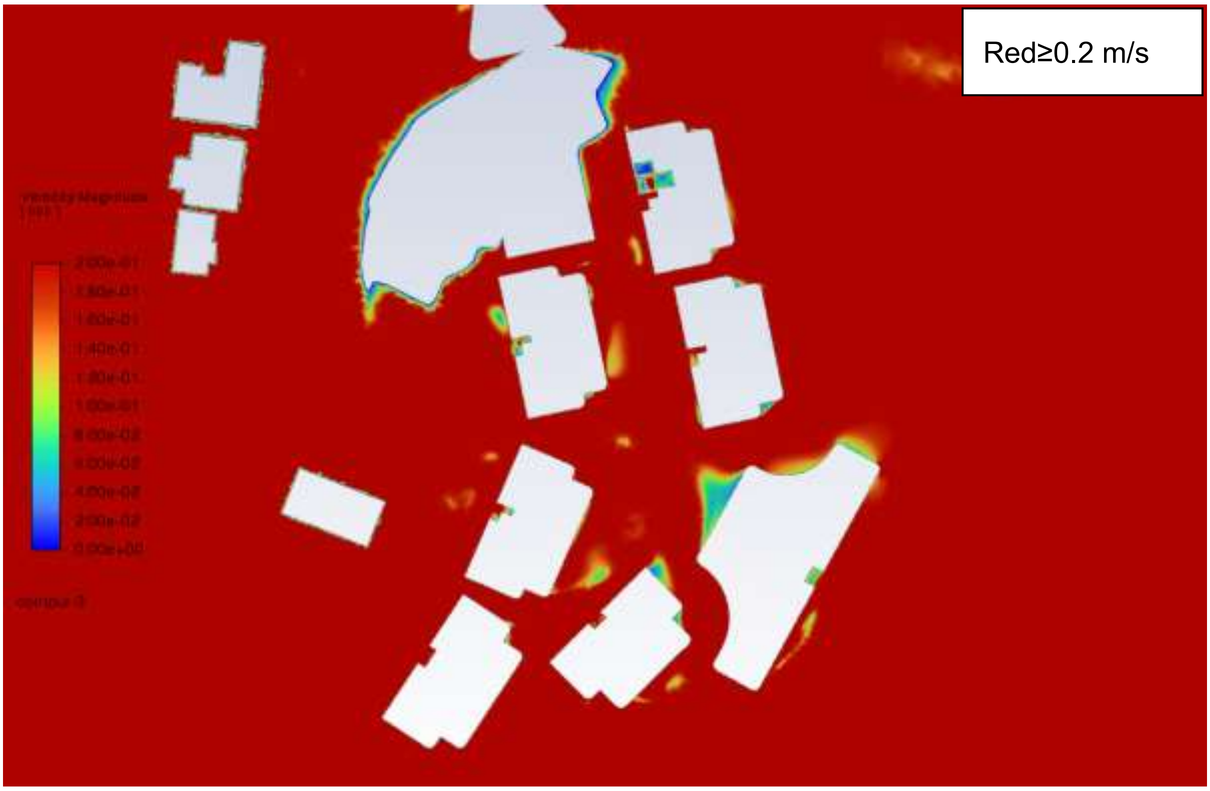

Red≥0.2 m/s
Velocity Magnitude
[m/s]
2.00e-01
4.00e-02
2.00e-02
0.00e+00
contour-3

West

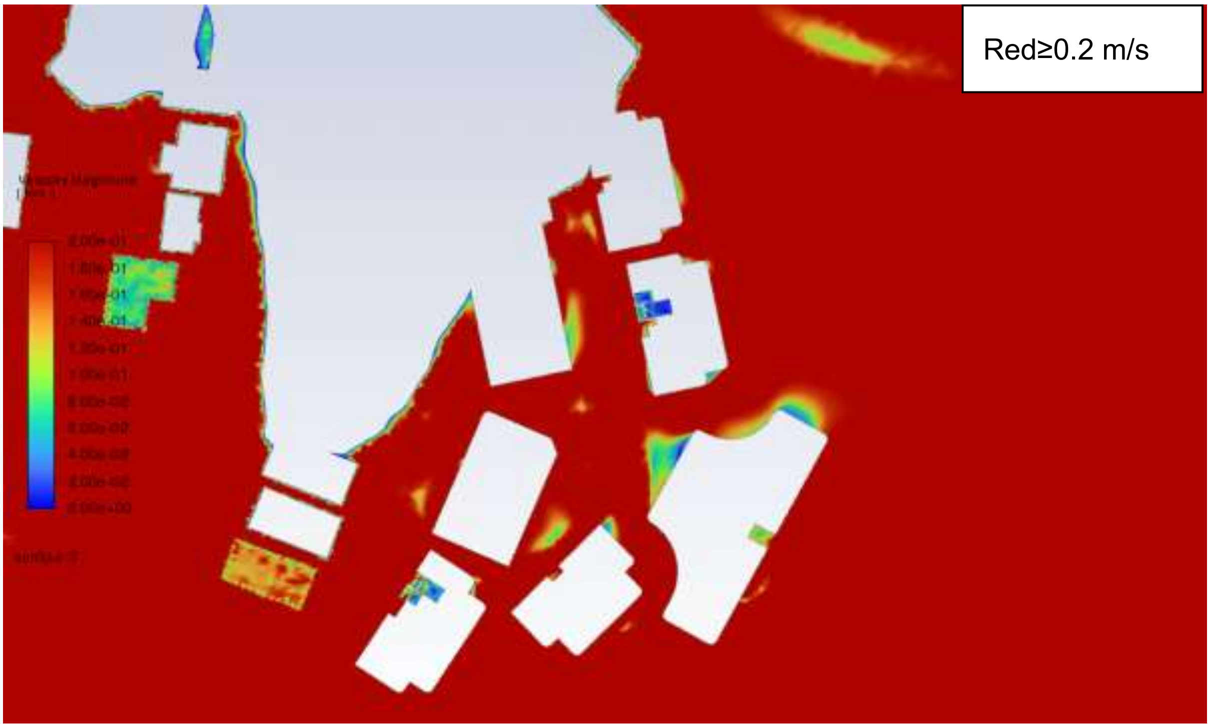
Unit A, Unit B & Unit C



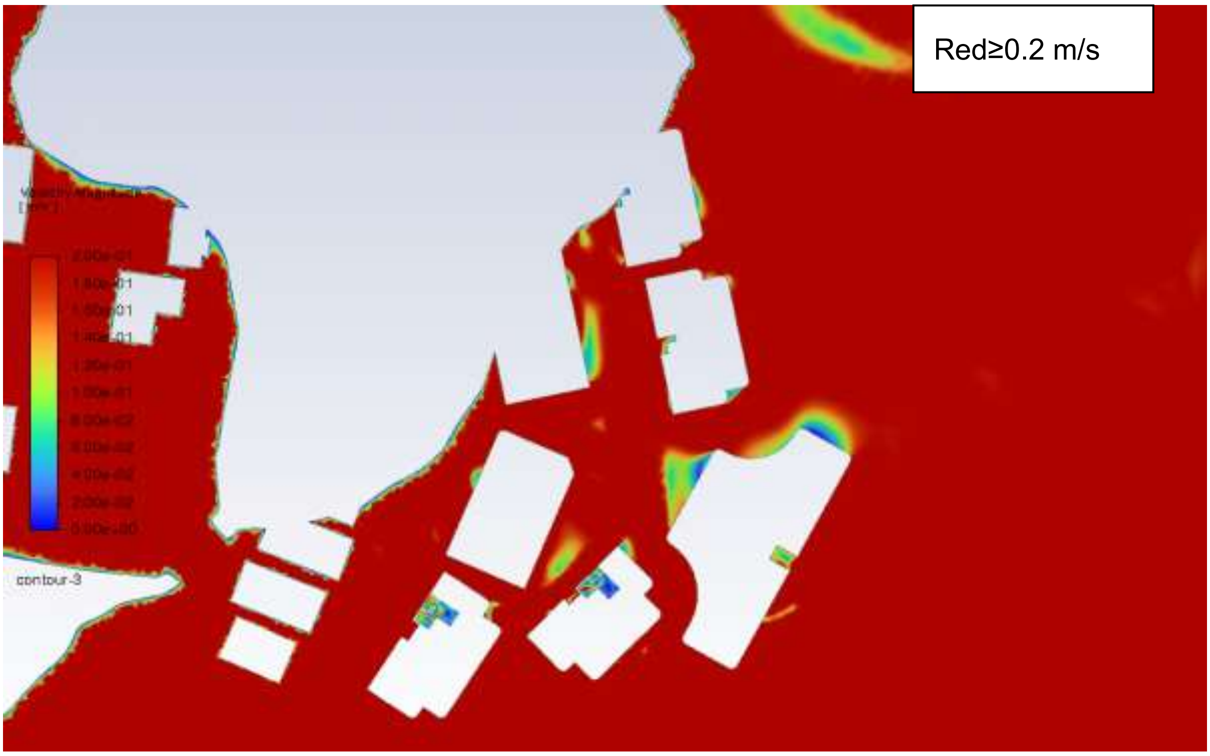
Unit D



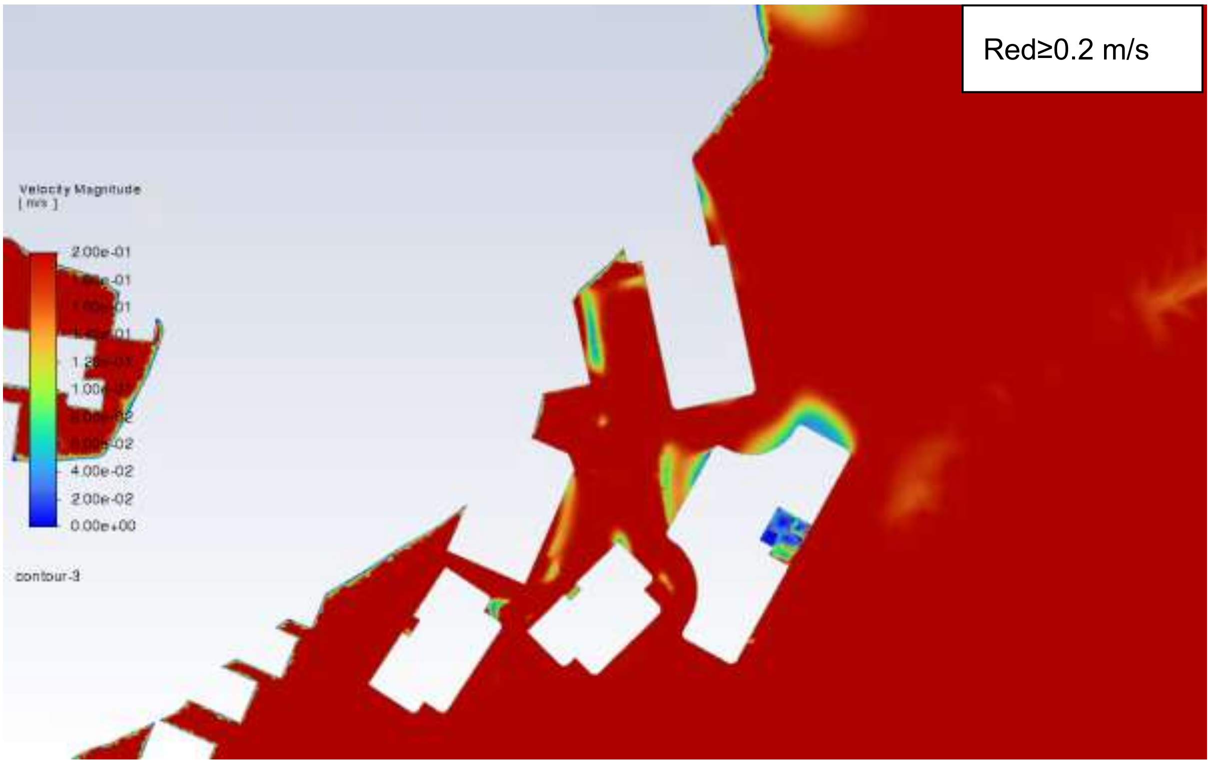
Unit E and Unit G



Unit - F

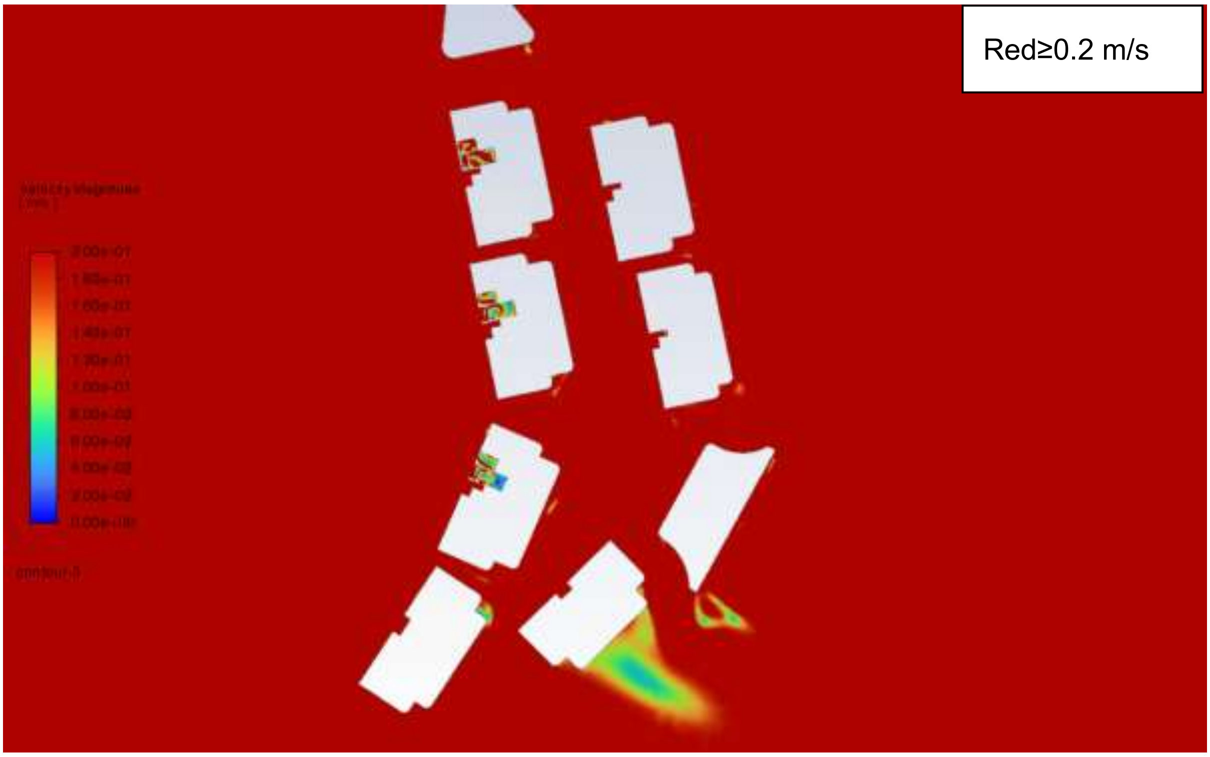


Unit - H

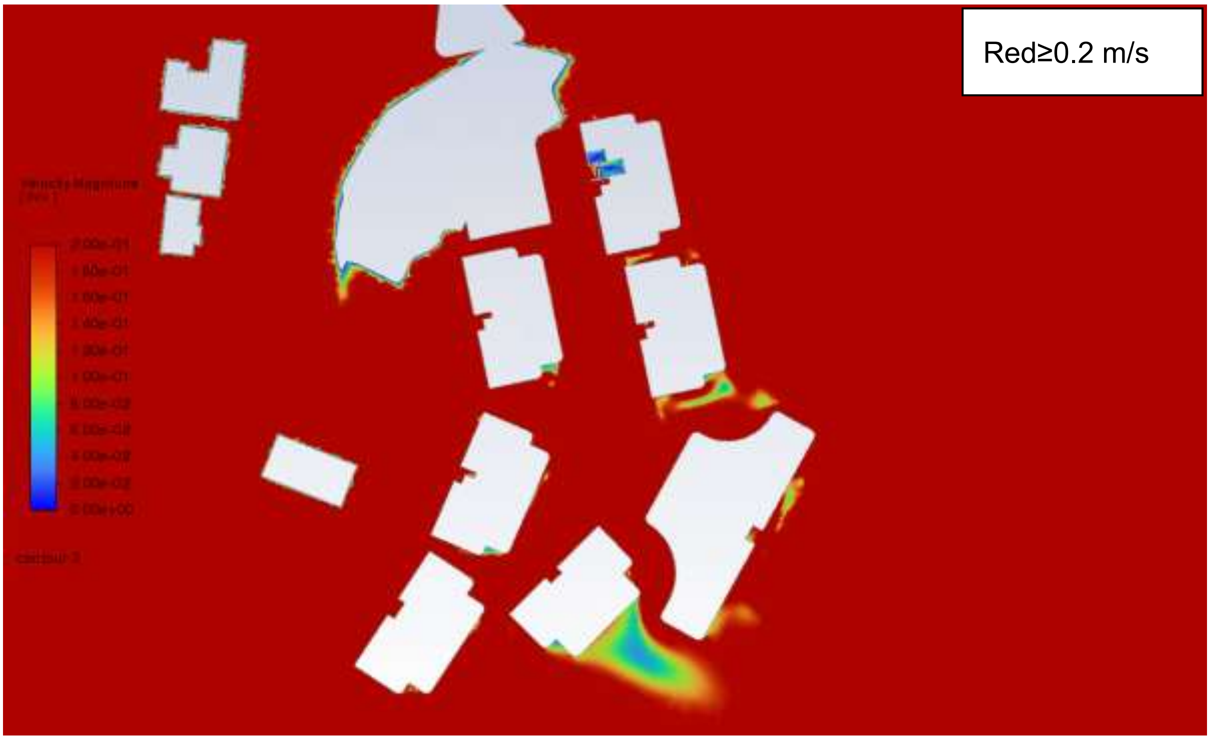

Red≥0.2 m/s
Velocity Magnitude
[m/s]
2.00e-01
4.00e-02
2.00e-02
0.00e+00
contour-3

Northwest

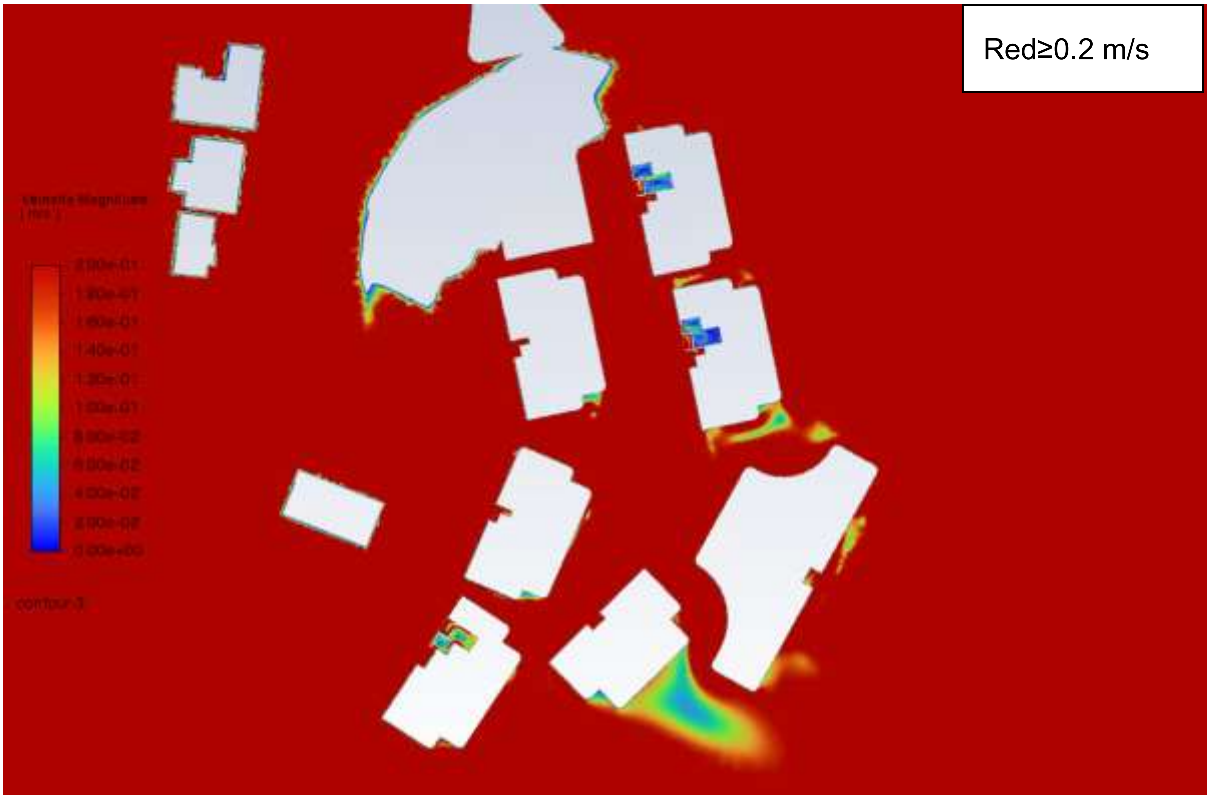
Unit A, Unit B & Unit C



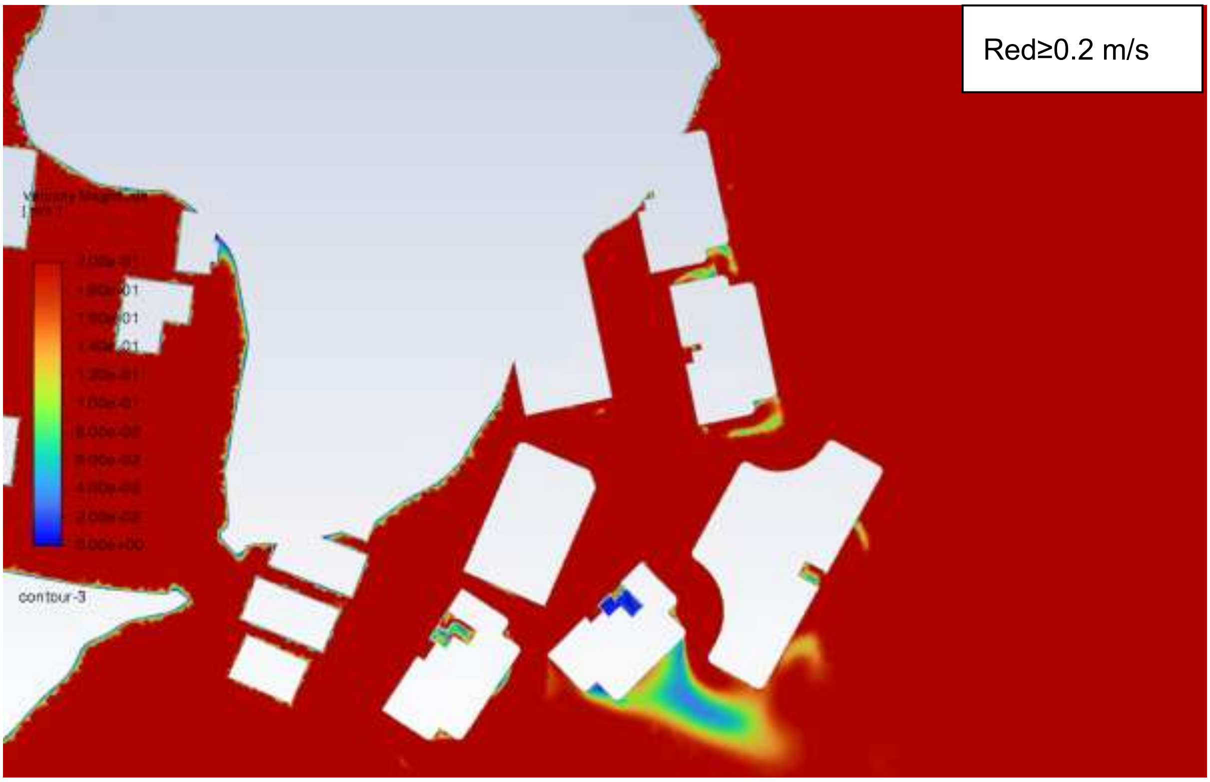
Unit D



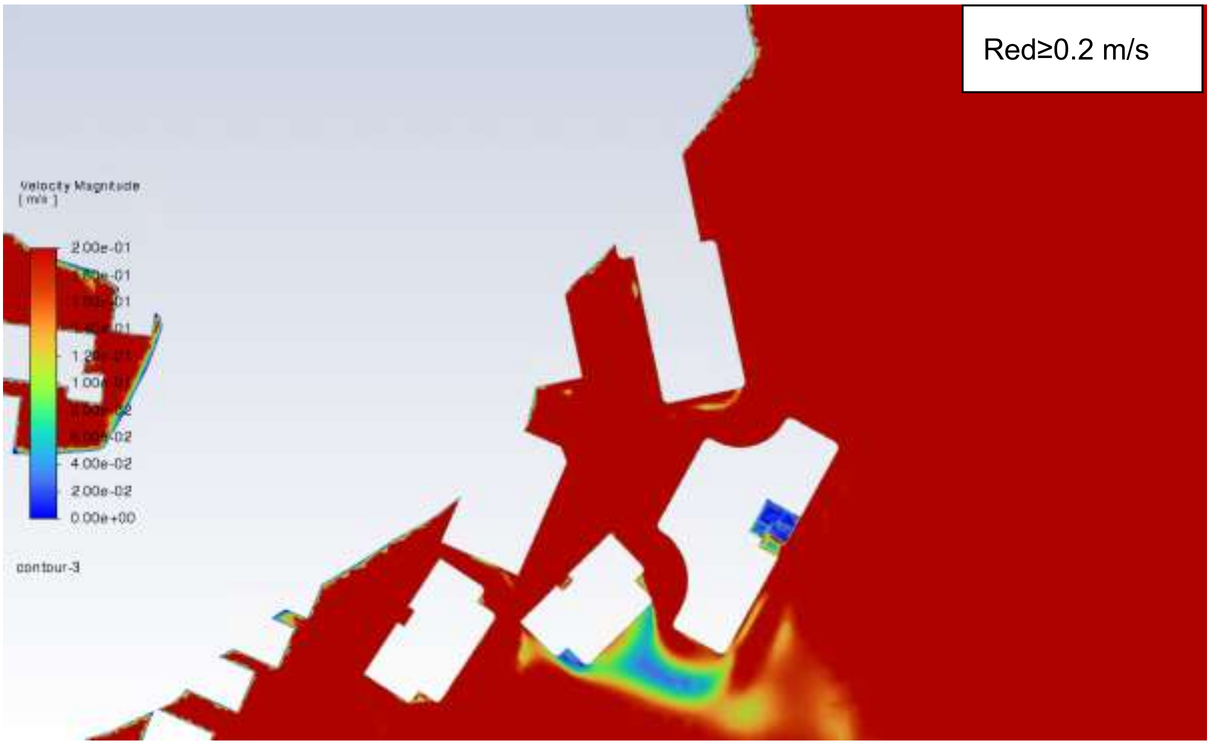
Unit E and Unit G



Unit - F



Unit - H


Red≥0.2 m/s
Velocity Magnitude
[m/s]
2.00e-01
4.00e-02
2.00e-02
0.00e+00
contour-3

Appendix B Weather Data

142-150 Narrow Neck Road, Katoomba

Natural Ventilation Assessment

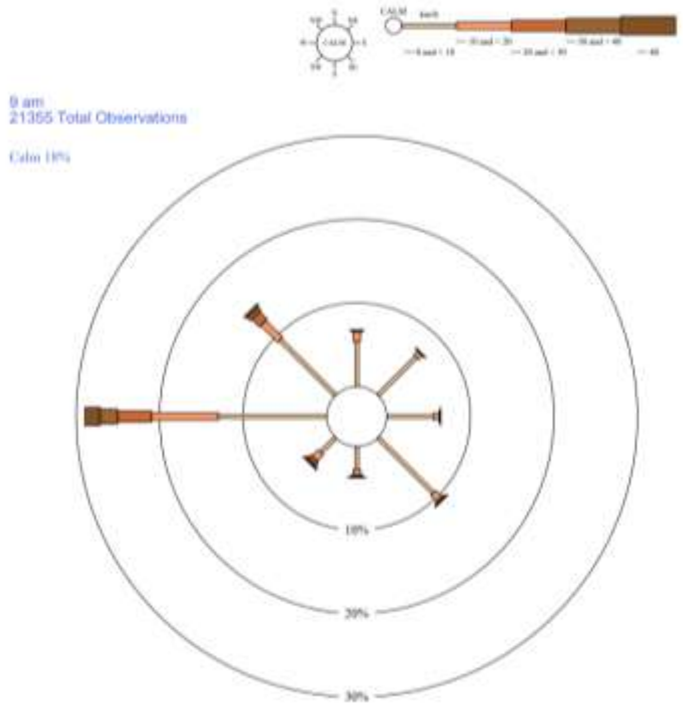
Management 7bbh

SLR Project No.: 610.033104

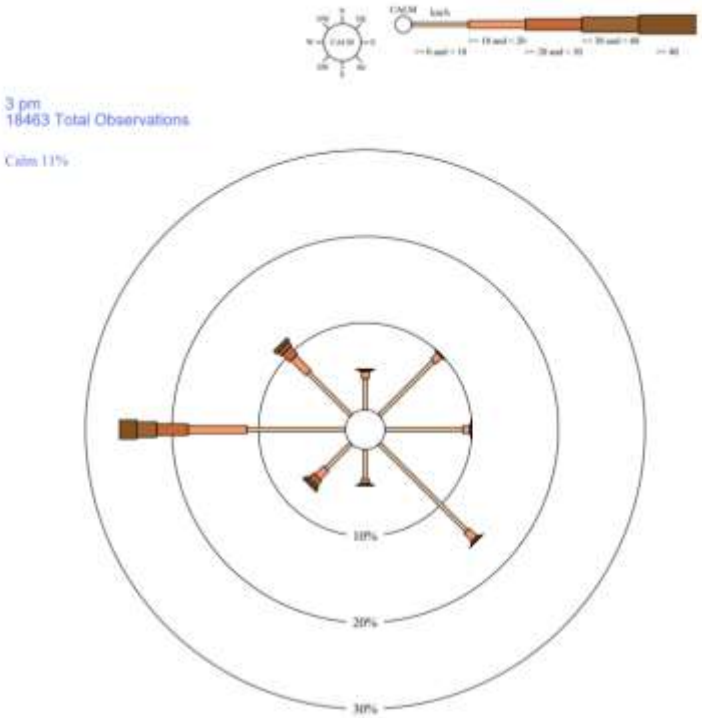
Revision: R01-v1.1

5 November 2025

9 am


9 am
21355 Total Observations
Calm 10%
10%
20%
30%

3 pm


3 pm
18463 Total Observations
Calm 11%
10%
20%
30%

Making Sustainability Happen