pitt&sherry

Specialist Knowledge.
Practical Solutions.

Pitt & Sherry (Operations) Pty Ltd
ABN 67 140 184 309

Phone 1300 748 874
info@pittsh.com.au
pittsh.com.au

Located nationally —
Melbourne
Sydney
Brisbane
Hobart
Launceston
Newcastle
Devonport

9 August 2022

Jacob Ziesel
Stormwater Systems Engineer - Analyst
City of Hobart
GPO Box 503
HOBART Tasmania 7001

Dear Jacob

Re: PLN-21-471 – Review of Advertised Documents – Flooding and Stormwater – Rev 01

pitt&sherry have been engaged by City of Hobart (Council) to undertake a technical review of the flooding and drainage material provided from the proposed development at 173 – 179 Campbell Street Hobart (PLN-21-471).

The subject of the review is to determine:

- Whether Council have sufficient information to assess the development under the planning scheme (HIPS E15 – Inundation Prone Areas Code and E7 Stormwater Management Code)
- Whether the development is acceptable under those clauses of the planning scheme; and
- If it is acceptable, what can be reasonably conditioned for.

The following advertised documents have been reviewed:

- PLN-21-471 - 175 CAMPBELL STREET HOBART TAS 7000 - Advertising Documents - 1 of 6 - Plans.PDF
- PLN-21-471 - 175 CAMPBELL STREET HOBART TAS 7000 - Advertising Documents - 2 of 6 - Planners and Architects Report.PDF; and
- PLN-21-471 - 175 CAMPBELL STREET HOBART TAS 7000 - Advertising Documents - 3 of 6 - Engineering Reports.PDF.

The review has been based on how the material supplied responds to planning requirements.

1. Development Assessment

1.1 E7 – Stormwater Management Code

Table 1: E7.7.1 Stormwater Drainage and Disposal

Objective: To ensure that stormwater quality and quantity is managed appropriately.

Acceptable Solution	Performance Criteria
A1 Stormwater from new impervious surfaces must be disposed of by gravity to public stormwater infrastructure.	**P1** Stormwater from new impervious surfaces must be managed by any of the following: a) disposed of on-site with soakage devices having regard to the suitability of the site, the system design and water sensitive urban design principles b) collected for re-use on the site; c) disposed of to public stormwater infrastructure via a pump system which is designed, maintained and managed to minimise the risk of failure to the satisfaction of the Council.
A2 A stormwater system for a new development must incorporate water sensitive urban design principles for the treatment and disposal of stormwater if any of the following apply: a) the size of new impervious area is more than 600 m2; b) new car parking is provided for more than 6 cars; **c)** a subdivision is for more than 5 lots.	**P2** A stormwater system for a new development must incorporate a stormwater drainage system of a size and design sufficient to achieve the stormwater quality and quantity targets in accordance with the State Stormwater Strategy 2010, as detailed in Table E7.1 unless it is not feasible to do so.
A3 A minor stormwater drainage system must be designed to comply with all of the following: a) be able to accommodate a storm with an ARI of 20 years in the case of non-industrial zoned land and an ARI of 50 years in the case of industrial zoned land, when the land serviced by the system is fully developed; b) stormwater runoff will be no greater than pre-existing runoff or any increase can be accommodated within existing or upgraded public stormwater infrastructure.	**P3** No Performance Criteria
A4 A major stormwater drainage system must be designed to accommodate a storm with an ARI of 100 years.	**P4** No Performance Criteria

Response

A1/P1

Page 12 of the advertised documents (engineering reports) presents the proposed stormwater point for the site. A DN225 pipe is proposed to be connected to the DN1800 Park Street Rivulet Drain. Figure 8 and Figure 9 show the plan and long section of the proposed connection demonstrating the site can be connected to the public stormwater system. As such. The development complies with A1

A2/P2

The planning response detailed on page 13 of the engineering reports states the development meets the acceptable solution A2. Although, the assessment provided responds to P2. The most reasonable approach for a development of this size is to assess the site against P2 which has been done.

There are inconsistencies with how the water quality assessment is presented. Under the response to planning criteria on Page 13, a table of treatment train effectiveness is presented, along with a model schematic (Figure 1). There is no further information provided on how these model results were obtained

On page 60 of the engineering reports, a different water quality assessment is presented with a different model schematic and different results (Figure 2). This assessment does provide sufficient information to assess water quality compliance.

Figure 10 - MUSIC Schematic

	Sources	Residual Load	% Reduction
Flow (ML/yr)	1.19	1.19	0
Total Suspended Solids (kg/yr)	245	14.8	93.9
Total Phosphorus (kg/yr)	0.49	0.144	70.5
Total Nitrogen (kg/yr)	3.43	1.63	52.4
Gross Pollutants (kg/yr)	46.2	0	100

Figure 11 - MUSIC Results

Figure 1: Water quality results presented in response to planning criteria (JMG - Page 13)

Parameter	Required Load Reduction (%)	MUSIC Modelled Load Reduction (%)	State Stormwater Targets Achieved
Total Suspended Solids (TSS) (kg/yr)	80.0	79.9	Y
Total Phosphorous (TP) (kg/yr)	45.0	76.6	Y
Total Nitrogen (TN) (kg/yr)	45.0	45.2	Y
Total Pollutants (kg/yr)	90.0	99.2	Y

Figure 2: Water quality results presented in Flussig Report (Flussig - Page 60)

The information provided from Page 59 to Page 62 of the engineering reports provides sufficient detail for council to accept.

It should be noted the model results presented in the planning response to P2 do not have any technical background. A reasonable approach has been undertaken for this part of the assessment as an assessment has been provided that demonstrates compliance. It is recommended that council condition that an appropriate water quality management system be implemented meeting the Stormwater Quality Targets.

A3/P3

The internal site drainage has been appropriately sized for the development. The peak flow rates presented in the rational method calculation and pipe size proposed are reasonable to convey flow to the public stormwater system. Although, the performance of the drainage system could be impacted by the proposed detention basin.

Part of a stormwater detention assessment has been undertaken, although there are important hydraulic features of the detention basin that have not been documented. Page 14 of the engineering reports states that a basin is to be provided that limits flow to the pre-developed condition with a suitably size orifice. No detail has been provided for the orifice size or the peak operating levels of the basin.

Detail should have been provided to demonstrate that the basin/orifice arrangement does not raise the peak water level above the design surface level. Hence based on the information provided, it is not possible to accept the response provided for A3. Based on the review undertaken, this is likely something that can be addressed, and council can condition an appropriate detention and drainage system to be provided with supporting calculations.

In addition to the drainage system servicing the site, the development proposes to realign an existing DN525 council stormwater main. As the development proposes to alter part of the existing minor drainage system, proposed design should be assessed under A3.

The hydraulic analysis associated with the realignment is presented in Page 54 to Page 57 of the engineering reports (Flussig). A long section / hydraulic grade line has been presented for the proposed case. Based on the information presented, it is not possible to determine whether or not the capacity of the minor drainage system is adequate under the assumption that the tailwater level in the downstream network was below the ground.

Based on the information presented it is not possible to accept the proposed realignment. It is recommended that the realignment is conditioned such that the pipe provided ensures the 5% AEP HGL is below the ground level with an assumed tailwater level also below ground.

A4/P4

The proposed development is located within a flood affected area. A major overland flow path exists at the rear of the property. The proposed development footprint is within this area.

A design to accommodate this flow path has not been provided. The flood modelling undertaken has classified the flood hazard as predominantly H5 and some areas of H6.

A major stormwater drainage system is required a system to provide safe conveyance of stormwater runoff and a specific level of flood mitigation. The flood hazard category estimated and proposed use in the major stormwater drainage path does not constitute safe conveyance of floodwater.

The physical design of the development has not appropriately considered the overland flow path and relied upon administrative measures to attempt to manage the risk. The proposed solution accepts there will be damage to property (cars).

The response to A4 provided on Page 14 state all habitable floors are located more than 300mm above the calculated 1% AEP flood level. It is noted that the HIPS defines a habitable building as a building of Class 1 - 9 of the Building Code of Australia. The National Construction Code defines carparks as a class 7a building. As such the not all habitable floor areas are above the 1% AEP flood level.

Based on the information provided, the development does not comply with A4.

1.2 E15 – Inundation Prone Areas Code

As the site is impacted by riverine inundation, the items from Code E15 relating to riverine inundation need to be responded to. These are E15.7.4 and E15.7.5. Only items relating to new buildings have been detailed below

Table 2: E15.7.4 Riverine Inundation Hazard Areas

Objective: To ensure that the risk from riverine, watercourse or inland flooding is appropriately managed and takes into account the use of buildings	
Acceptable Solution	**Performance Criteria**
A1 A new habitable building must have a floor level no lower than the 1% AEP (100yr ARI) storm event plus 300mm	**P1** A new habitable building must have a floor level that satisfies the following: a) Risk to users of the site, adjoining or nearby land is acceptable; b) Risk to adjoining or nearby property or public infrastructure is acceptable; c) Risk to buildings and other works arising from riverine flooding is adequately mitigated through siting, structural or design methods; d) Need for future remediation works is minimised; and e) Provision of any developer contribution required pursuant to policy adopted by Council for riverine flooding protection works.
Response	
A1/P1 **As the carpark is a Class 7a building, the carpark is considered to be a habitable building. As the proposed car park floor level is 15.70m AHD, and the 1% AEP + CC flood level is estimated to be 18.015m AHD, A1 is not achieved and the performance criteria must be responded to.** **A specific response to P1 has not been provided. The review of the compliance against P1 has been undertaken based on the information presented in the engineering reports.** **(a) <u>Risks to users of the site, adjoining or nearby land is acceptable.</u>** **Page 80 of the engineering reports presents flood hazard maps for both the existing and developed case for the 1% AEP + climate change event. The maps show an increase in flood hazard category on the site through the lowering of the ground level to facilitate the design of the car park. The flood hazard is predominantly H5 with some areas of H6. The flood hazard category H5 means *unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.* H6 means *unsafe for vehicles and people. All building types considered vulnerable to failure.* The level of flood risk within the carpark is considered to be unacceptable. It is noted the flood hazard rating on the site has increased when compared to the existing condition.**	

The proposed approach to manage risk is to implement a Flood Emergency Management Plan (FEMP). There is no discussion regarding alternate options for managing flood risk. The following comments are provided on the proposed FEMP:

- **The engineering report states, depth in the car park rises from an initial noticeable depth of 50mm to maximum in a period of around 9.5 minutes (engineering reports, Page 13 - JMG). It is noted the maximum depth is approximately 2.2m. This is the time it takes to reach peak depth, but no comment has been provided on the time it takes to which flow becomes hazardous to people and infrastructure. This will be shorter and hence further reduces the time available to vacate affected areas.**
- **An understanding of how the flood hazard changes with time is required. The assumption of adopting a FEMP based on the time to peak depth is not appropriate. The documentation provided to support a FEMP as being possible is lacking adequate detail.**
- **The time for noticeable overland flow to hazardous flooding is too short for a flood emergency management plan to be appropriately implemented. It appears the approach relied upon will be for people to notice flood water and will make a decision to remove themselves from the area. There is no time for instruction or intervention from a flood warden. The emergency response system relies on automated measures as warning devices, although it is likely they may only provide minutes of warning.**
- **Figure 3 shows an exert from the Australian Disaster Resilience Manual 20 and presents an example evacuation timeline. For this example, only the first four steps are relevant. For a FEMP to work, the time between the first indication of flooding and the prediction of inundation height, plus the response initiation time must be less than the time where flood water first becomes hazardous (noting this is less than 9.5 minutes). There has been no discussion in the material provided on evacuation timeline.**
- **A risk assessment is documented in Appendix A of the report (Page 88 of engineering reports). Risk Ref No. D2 recognises there is a risk to personal safety within the car park and waste room. The assessment nominates a consequence of moderate for a risk that could result in serious injury or death. This does not appear to be correct.**
- **The risk assessment states that with implementation of the flood emergency management plan that the consequence, reduces from moderate to minor. The consequence will not change with the implementation of administrative risk reduction measures. There is still the consequence of serious injury and death.**
- **The JMG report accepts that cars may become damaged and have suggested the body corporate insurance may be able to recover losses. This still means people will be without a car for a period of time. Insurance should not need to be relied upon if the risk is known prior to the development be constructed; and**
- **The flood hazard categorisation is predominantly H5 and some H6 and represents hazards typically found in defined river and creek channels. Areas that contain this level of hazard would normally be left clear of development. It is not recommended to place infrastructure or provide incentive for people to access areas like this.**

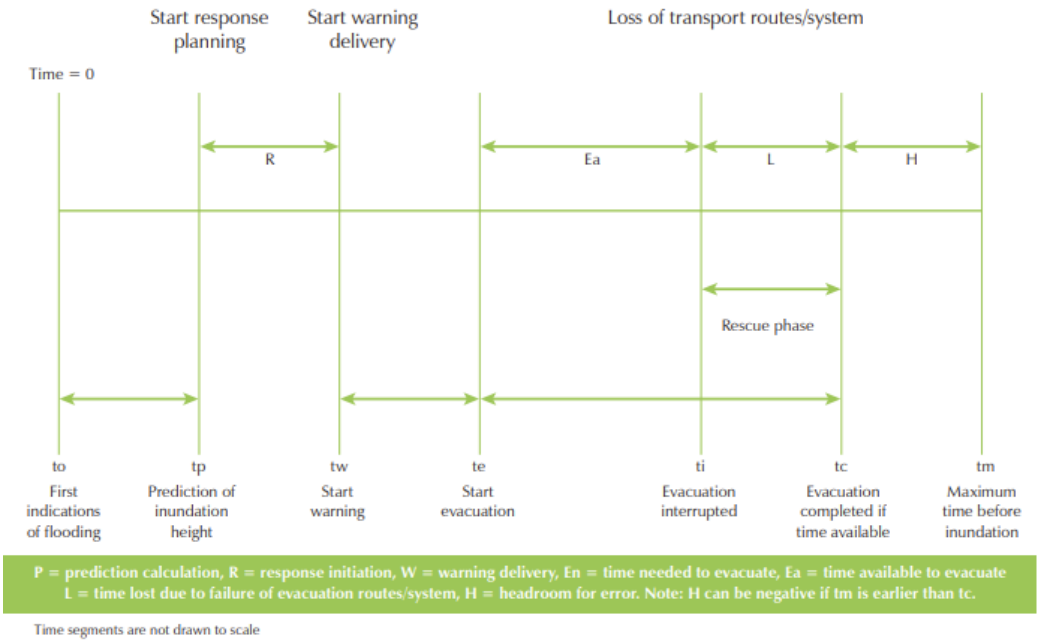

Figure 3: Flood evacuation timeline (Figure 2: Australian Disaster Resilience Manual 20: Flood Preparedness, 2009, Australian Institute for Disaster Resilience CC BY-NC)

The proposed design exposes users to an unacceptable level of risk with a mitigation option that cannot guarantee the safety of people and accepts the damage to property will occur. The proposed approach does not meet P1 (a)

(b) <u>Risk to adjoining or nearby property or public infrastructure is acceptable.</u>

Section 2.4.1 of the Flussig Report states there will be no displacement of overland flow over other property. A graph is provided in Figure 7, although, this only demonstrates a change at a single point. A comparison between the flood maps provided in Appendix B, Pre-Development 1% AEP + CC and Post-Development 1% AEP + CC, do show an increase in flood depth downstream, a minor decrease in flood extent onto Campbell Street, an increase in the flood extent within the Brooker Avenue Road Reserve and a minor increase in flood extent behind Woolworths.

A high level review of the flood hazard maps suggests the extent of H6 hazard increases downstream.

Furthermore, figure 6 (page 75 of the engineering reports) shows an increase in peak flow rate of approximately 13% within the Brooker Avenue Road reserve.

To appropriately quantify the change in flood behaviour, a water level difference / flood afflux map or suitably detailed equivalent information is required. This has not been provided and hence there isn't enough information provided to adequately address P1 (b). This is information that should have been provided at this stage of the development assessment. As such it cannot be conditioned.

(c) <u>Risk to buildings and other works arising from riverine flooding is adequately mitigated through siting, structural or design methods</u>

With regard to mitigation options relating to structural design of the development, the engineering report has recommended the building be designed to resist flood forces. A review of the structural design is beyond the scope of this assessment although this item can be conditioned.

(d) <u>Need for future remediation works is minimised</u>

By allowing the overland flow path to pass through the car park introduces a problem for the development to deal with in the future. Damage to cars and building utilities are likely which will impose burden on those living at the proposed development site.

(e) <u>Provision of any developer contribution required pursuant to policy adopted by Council for riverine flooding protection works</u>

Developer contribution not applicable for this development.

Table 3: E15.7.5 Riverine, Coastal Investigation Area, Low, Medium, High Inundation Hazard Areas

Objective: To ensure that landfill and mitigation works do not unreasonably increase the risk from riverine, watercourse and inland flooding, and risk from coastal inundation.	
Acceptable Solution	**Performance Criteria**
A1 For landfill, or solid walls greater than 5 m in length and 0.5 m in height, there is no acceptable solution.	**P1** Landfill, or solid walls greater than 5 m in length and 0.5 m in height, must satisfy all of the following: a) no adverse affect on flood flow over other property through displacement of overland flows; b) the rate of stormwater discharge from the property must not increase; and c) stormwater quality must not be reduced from pre-development levels.
Response	

A1/P1

As the proposed development introduces a new structure into the development site that is greater than 5m, A1 cannot be achieved and the performance criteria (P1) must be addressed.

(a) <u>no adverse affect on flood flow over other property through displacement of overland flows;</u>

Section 2.4.1 of the Flussig Report states there will be no displacement of overland flow over other property. A graph is provided in Figure 7, although, this only demonstrates a change at a single point. A comparison between the flood maps provided in Appendix B, Pre-Development 1% AEP + CC and Post-Development 1% AEP + CC, do show an increase in flood depth downstream, a minor decrease in flood extent onto Campbell Street, an increase in the flood extent within the Brooker Avenue Road Reserve and a minor increase in flood extent behind Woolworths.

A high level review of the flood hazard maps suggests the extent of H6 hazard increases downstream.

To appropriately quantify the change in flood behaviour, a water level difference / flood afflux map or suitably detailed equivalent information is required. This has not been provided and hence there isn't enough information provided to adequately address P1 (b). The review of flood maps provided suggests there is a change, but it is not possible to ascertain the impact. This is information that should have been provided at this stage of the development assessment. As such it cannot be conditioned.

(b) <u>the rate of stormwater discharge from the property must not increase</u>

Figure 6 (page 75 of the engineering reports) shows an increase in peak flow rate of approximately 13% within the Brooker Avenue Road reserve. The statement provided in the response to planning criteria (page 82 of the engineering reports) states no change. The response is inconsistent with the detail provided in the report. P1 (b) has not been achieved. Information should have been provided at this stage. It is not recommended to condition for this.

(c) <u>stormwater quality must not be reduced from pre-development levels</u>

The response stated on page 82 of the engineering reports suggest there is no evidence that stormwater quality will be reduced. Based on the review of the site this is reasonable and can be accepted.

2. Summary

A review of documentation has been undertaken that intends to address relevant provisions in the *Hobart Interim Planning Scheme 2015*, in particular, the Inundation Prone Areas Code (E15) and the Stormwater Management Code (E7). The outcome of the assessment is summarised below:

- E7.7.1 A1/P1 – Can accept
- E7.7.1 A2/P2 – Condition for. Can be achieved, although inconsistencies provided within the report
- E7.7.1 A3/P3 (Detention system) – Condition for. Missing information relating to the detention system proposed.
- E7.7.1 A3/P3 (DN525 realignment) – Condition for. Sufficient information has not been provided that demonstrates the new main meets the capacity requirement (5% AEP). Recommend an agreed and reasonable tailwater below ground be adopted for pipe sizing.
- E7.7.1 A4/P4 – not achieved. The overland flow path passes through the car park. It appears the design has not considered options for overland flow. E7.7.1 A4/P4 states the overland flow path must be designed to provide safe conveyance of stormwater runoff. The results of the flood hazard assessment indicate that the stormwater flows through the site are no safe for people or infrastructure.
- E15.7.4 A1/P1 - not achieved. Development relies on A1, assuming the habitable floor is the building structure and rooms within it. The HIPS defines a habitable building as buildings of Class 1 – 9 per the Building Code of Australia (now the National Construction Code (NCC)). A carpark is considered to be a Class 7a building and hence is to be considered a habitable building. The documentation provided was assessed against P1. The approach adopted leaves an unacceptable level of residual risk; and
- E15.7.5 A1/P1 – not achieved. Sufficient information has not been provided to quantify the impact on adjoining property.

The proposed development is located in an area affect by extremely hazardous flood water in a 1% AEP + Climate Change flood event. The primary issue is part of the development exposes users to an unacceptable level of risk, which is in conflict with the purpose of the code, and in particular E15.7.4/P1. It is our opinion that the management measure proposed (emergency management plan) is not appropriate for this situation. Even if a detailed flood emergency plan could be developed, there would be a problem enacting the plan as the time required to enact the plan would be far longer than the flood response time.

It is reasonable to assume a person could be located within the basement carpark at the onset of flooding. They could be exposed the highly hazardous flooding (as defined by Australian Rainfall & Runoff Flood Hazard Categorisation- Book 6 – Chapter 7) and hence we do not believe the development in its current form meets the requirements of the HIPS.

Yours sincerely,

Joshua Coates
Associate Civil / Hydraulic Engineer CPEng NER