

RESIDENTIAL DEVELOPMENT

28 BEESLEY STREET & 4-10 FILMER STREET, WEST END

FLOOD RISK ASSESSMENT

FOR: BEESLEY DEVELOPMENT GROUP

REPORT NUMBER: R003 - G23085



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Document Control

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01	26/03/2024	CH	CH	Original Issue
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NOMENCLATURE

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ALS	Aerial Laser Survey
ARR	Australia Runoff and Rainfall
BoM	Bureau of Meteorology
Council	Brisbane City Council
DA	Development Application
DFE	Defined Flood Event
FFL	Finished Floor Level
FOC	Flood Overlay Code
FRA	Flood Risk Assessment
MBA	Michael Bale & Associates
RFL	River Flood Level

In-line with the recent implementation of ARR (Ball, et al., 2019), design storm events are described in terms of AEP, the probability of a storm event magnitude exceeded in any given year as a percentage. This terminology was implemented to replace the ARI, of which is commonly misinterpreted, for example, that a 1 in 10 year ARI will occur exactly once in every ten years. The reference equivalency of standard design storm events are presented below:

AEP (%)	ARI (year)	Shorthand
50	1 in 1.44	Q2
20	1 in 4.48	Q5
10	1 in 9.49	Q10
5	1 in 20	Q20
2	1 in 50	Q50
1	1 in 100	Q100
0.5	1 in 200	Q200
0.2	1 in 500	Q500
0.05	1 in 2,000	Q2,000
0.01	1 in 10,000	Q10,000
0.001	1 in 100,000	Q100,000

CONTENTS

Nomenclature	ii
1 Introduction.....	1
2 Flood Hazard	2
2.1 Simulated	2
2.2 Forecasts & Warnings.....	2
2.3 Observed	2
3 Risk Assessment	4
3.1 Stakeholders	4
3.2 Risk Matrix	5
3.3 Mitigation & Control Measures	7
3.4 Other Considerations.....	10
4 Conclusion & Qualifications.....	11
5 References	12

TABLES

Table 1-1 Key Development Elevations	1
Table 2-1 Design Flood Levels	2
Table 2-2 Brisbane River Access Closure	2
Table 2-3 Brisbane River Gauge Correlation	3
Table 3-1 Flood Risk Assessment	5

FIGURES

REFERENCE DRAWINGS

APPENDICES

1 INTRODUCTION

This FRA has been prepared by MBA to support the DA of Lot 6-11 on RP10925. Council indicates the site is flood affected, and as such the DA must be compliant with the FOC.

The aim of this FRA is to demonstrate the safety, environmental, social and economic risks associated with the proposed development are compatible with the flood hazard and the risk to people is minimised.

The site discharges into the Brisbane River at Victoria Bridge via the Beesley Street stormwater pipe network.

The proposed development encompasses a seven (7) multi-storey residential tower with a single podium parking level, as per plans included in the reference drawings. Key development elevations are provided in Table 1-1.

TABLE 1-1 TOWER A KEY DEVELOPMENT ELEVATIONS (APPROVED)

Building Category	BCC FPL (mAHD)	Site Elevation (mAHD)	Compliance
Filmer Street Kerb	-	5.28	Exceeds
Beesley Street Kerb	-	4.70	Exceeds
Site Entry Crest	5.40	5.40	Complies
Lobby Area	7.00	7.22	Exceeds
Substation	7.20	7.20	Complies
Residential Tenancy	7.20	12.10	Exceeds

The proposed site encompasses residential uses, featuring:

- A dedicated on-site manager tasked with implementing flood procedures and guiding on-site personnel.
- An estimated population of 126 permanent residents.
- On-site parking facilities accommodating 83 vehicles.
- Provision of on-site generators and fuel reserves to ensure emergency power availability.

These provisions are designed to ensure the safety, functionality, and resilience of the proposed development in the face of potential flood events.

2 FLOOD HAZARD

2.1 SIMULATED

The source of river flooding is backwater surcharge of the South Brisbane pipe network extending from Victoria Bridge. The latest Brisbane River flood model (BMT, 2020) was obtained and relevant results extracted.

Table 2-1 lists the predicted site flood levels, as illustrated in the attached flood maps.

TABLE 2-1 DESIGN FLOOD LEVELS

Event AEP (%)	Brisbane River (mAHD)
2	4.60
1	6.64*
0.2	9.91
0.05	12.70
0.001	25.47

* DFE

Appendix B presents access long section profile illustrated in the flood maps. The worst-case simulated flood periods causing access closure are presented in Table 2-2. Closure is considered >0.3 m depth at the site entrance kerb.

TABLE 2-2 BRISBANE RIVER ACCESS CLOSURE

Event AEP (%)	Minimum Time to Closure	Maximum Isolation
1	2 days 2 hours	2 days 18 hours
0.001	8.5 hours	8 days 12 hours

Table 2-2 indicates that sufficient Brisbane River flood warning periods available to site occupants to prepare accordingly.

During the 2011 Flood Event, the Brisbane River peaked at 6.20m (AHD). This level exceeded the major flood level trigger of 3.50m (AHD). The initial major flood warning issued by the Bureau of Meteorology was at 9.28am on Tuesday the 11th of January 2011, the peak flood level of 4.46m (AHD) occurred at 3:00am on Thursday the 13th of January 2011. This provided a 1 day and 18-hour warning time. *Information Provided via the Flood summary for the Brisbane River by the Bureau of Meteorology for December 2010 and January 2011.*

It is recommended that when a major flood warning is issued, all occupants that wish to re-locate vehicles do so within 24hours of initial warning.

2.2 FORECASTS & WARNINGS

BoM issues quantitative (height and time) flood forecasts for the Brisbane River catchment every 3 to 6 hours, with a target lead time of **24 hours** during a potential storm event (BoM, 2018). Council also provides an early warning flood alert service. Heavy rainfall forecasts could be used to provide overland flow flood warnings. Refer to below sources of information:

- www.bom.gov.au/qld/warnings;
- BoM Telephone Weather Services 1300 659 219; and
- ABC local radio 612 AM.

2.3 OBSERVED

BoM has a relatively extensive network of stream gauges that provide real-time flood conditions across the region, as illustrated in the attached reference drawings.

The [Brisbane City \(143838\)](#) gauge provides an indication of the Brisbane River flood conditions affecting the site. Table 2-3 presents the estimated gauge level correlating to event magnitude and depth and site entrance kerb.

TABLE 2-3 BRISBANE RIVER GAUGE CORRELATION

Event AEP (%) / Classification	Brisbane City Gauge (mAHD)	Depth at Site Entrance Filmer St Kerb (m)	Depth at Beesly Street Low Point (m)
Minor	1.70	-	-
10	1.85	-	-
5	2.28	-	-
Moderate	2.60	-	-
2	3.25	-	-
Major	3.50	-	-
1	4.56	1.36	1.94
0.2	7.35	4.63	5.21
0.05	9.93	7.42	8.00
0.001	24.00	20.19	20.77

3 RISK ASSESSMENT

3.1 STAKEHOLDERS

The key stakeholders exposed to or affected by the risk of flooding include:

BUILDING MANAGER

The on-site building manager has access to this FRA and as such are fully aware of the flood risk to the site. They will direct residents, staff and visitors, as per procedures listed in Section 3.3.1.

RESIDENTS

Will shelter on site or evacuate to a flood refuge if forecast period allows, based on site manager advice.

VISITORS

The above stakeholders are responsible for directing visitors where appropriate.

3.2 RISK MATRIX

The flood risks associated with the proposed use must be compatible with the hazard. Table 3-1 presents the site risk assessment matrix. The risk matrix framework is attached in Appendix C. Mitigation and control measures are discussed in more detail in Section 3.3.

TABLE 3-1 FLOOD RISK ASSESSMENT

Element / Threat	Hazard	Likelihood	Consequence	Risk Rating	Mitigation / Control Measure	Residual Risk
Brisbane River flood event	Isolation	Unlikely – 1% AEP may cause isolation	Major – Injury due to insufficient preparation, clean-up costs, repair of assets	Moderate 15	Site preparation, office closure, emergency backup generation	Low 4
Emergency services	Urgent medical attention required during site isolation	Unlikely – 1% AEP may cause isolation	Catastrophic – in the event of death or serious injury	High 19	Consider early evacuation of high risk patrons. First aid supplies stored on-site	Low 4
Vehicles, equipment and storage materials	Undercroft inundation	Unlikely – 1% AEP may overtop site entry crest	Major – significant clean up, damage and or loss	High 15	Flood barriers, relocation of assets	Low 3
Environment	Release hazardous materials	Rare – Hazardous materials not anticipated to be stored on-site	Major – potential toxic effects that cannot be immediately contained	Moderate 10	Ensure containers can withstand inundation without release	Low 1
Climate change	Potential increase in flood levels resulting in more frequent isolation events	Possible – predictions have confidence limits	Major (up to 1.5m) change to flood levels	High 18	Conduct revised FRA in 2050 (or when more accurate predictions are confirmed)	Moderate 10
Electrical Services	Energised electrical wire or pole partially or totally submerged in water creating an electrical field in the water that will cause a serious electrical shock hazard.	Possible – electrical services external to the site may also be affected (i.e. downed power lines)	Catastrophic – in the event of death or serious injury	Extreme 22	All electrical services are to be installed above the RFL + 500 mm (7.2 mAHD)	Moderate 12

Element / Threat	Hazard	Likelihood	Consequence	Risk Rating	Mitigation / Control Measure	Residual Risk
Post event clean-up	Contact with contaminated objects, infection	Possible	Major – may result in serious injury or illness	High 18	Use of appropriate PPE	Low 4
Post event utilities	Utilities and services (water, gas, electrical) may be affected	Possible	Major	High 18	Ensure a suitably qualified professional checks all services and ancillary appliances / devices prior to use	Low 1

3.3 MITIGATION & CONTROL MEASURES

As noted in Table 3-1 a number of mitigation solutions are proposed in order to reduce the risk of the proposed site use is compatible with the flood hazard, as detailed below.

3.3.1 SITE MANAGER

Based on the above flood hazards, the building manager will provide direction to all residents, including available warning time, and evacuation procedures arising from storm events to reduce the likelihood and consequence of isolation and minimise the burden placed on emergency services.

It is recommended that the building manager setup a SMS push service to provide updates / instructions during a storm event. This service generally exists in similar facilities as part normal operations. It is also recommended that all affected parties subscribe to the BoM Queensland weather warning RSS feed (or similar).

A site emergency management kit should be maintained on site within in a dedicated accessible storage cupboard. It should at a minimum contain:

- Mobile phone charger / external batteries;
- Portable radio with wind-up/spare batteries;
- Torches / lanterns with wind-up/spare batteries;
- First Aid kits (including manual/booklet) and common medications;
- Tarpaulin and duct tape; and
- Waterproof bags and/or heavy duty plastic garbage bags.

Refer to Appendix D for BCC guide to Flood preparation and Emergency Management Kit checklists for residents and businesses.

When Brisbane River flood forecast (generally **>24 hour** notice) is issued above an isolating event (>4 mAHD at Brisbane City Gauge and/or major Brisbane River flooding, the building manager must:

- Direct all residents to prepare for flood isolation within the forecast period, noting:
 - Units are safe and function as a shelter in place refuge;
 - Consider relocation of high risk medical residents;
 - Consider relocation of high risk/ vulnerable residents as lifts may become inoperative.
 - Consider relocation of ground floor vehicles to elevated surrounding areas and storages to units;
 - Take appropriate actions for shelter in place, including:
 - Obtain sufficient supplies for isolation of several days (dependent on forecasts);
 - Charge all devices and batteries prior to potential outage;
 - Fill sinks/containers for potable water.
- Do not enter flood waters and check the **road closure dashboard**. Avoid contact with flood water as it may be contaminated or subject to currents and other hazards. If you must enter shallow water, wear shoes to protect feet and don't proceed beyond knee-depth. Keep in contact with other people and do not go anywhere alone;

Immediately following an event:

- If the building has sustained damage and/or assistance is required, contact the SES or Council's Disaster Hotline. Unless critical, do not enter damaged buildings until inspected by qualified personnel and deemed as safe;

- Every source of electricity can be extremely dangerous if / has been submerged. Treat every electrical item with the greatest respect and beware of potential contaminated water, sewage, hazardous debris;
- Check with electricity, gas and water authorities to determine whether supplies to your area have been interrupted and are safe to be turned on by you. If the water supply system has been flooded, you must assume it is contaminated; and
- Some roads may still be closed. Beware of damaged power lines, bridges, trees and do not enter any floodwaters.

3.3.2 FLOOD RESILIENT BUILDING MATERIALS

Use flood resilient materials for the site ground floor will support economic, social and environmental recover following a flood event.

Flood resilient design and construction can reduce the long-term costs by reducing expected costs associated with flood damage and insurance premiums. The intent of these material is to minimise clean-up effort post event and potentially remove need to fully rebuild following an event.

Flood Resilient Building Guidance for Queensland Homes (Queensland Reconstruction Authority, 2019) gives guidance on the use of flood resilient materials for building design and construction and should be referred to as part of the site's internal design.

3.3.3 ELECTRICAL SERVICES

As part of the proposed building internal fit out, electrical services including switchboards, general purpose outlets and other critical electrical services should be situated above 7.2 mAHD (RFL + 500 mm) in accordance with Council's Flood Overlay Code.

3.3.4 OPERATION OF LIFTS

In rare flood events, the Beesley Street & Filmer Street road reserves fronting the development site will become completely inundated with flood waters. The probability of a power outage is likely. When flood waters rise above RL 4.00m at the Brisbane River Gauge and/or are inundating the Beesley Street / Filmer Street road frontage, it is recommended that the Building Manager ensures all lifts remain inoperative until flood waters subside and building power is restored.

It is recommended that the Building Manager/Body Corporate committee activate "Flood Mode" for building access and egress when flood water levels rise above RL 4.00m (AHD) at the Brisbane River Gauge, or when floodwaters are visible within Beesley Street/Filmer Street in front of the site.

During "Flood Mode," the building management function will involve off all lifts at a higher level to prevent residents from becoming trapped in the event of a power loss or if floodwaters enter the lift well above the ground floor immunity flood levels. It is suggested that the lifts remain out of operation once floodwater levels rise above RL 4.00m (AHD) at the Brisbane River Gauge or are visible within Filmer Street in front of the site.

3.3.5 EMERGENCY EVACUATION

Once the lifts are inoperable, occupants requiring emergency evacuation must evacuate the development via the fire stairs.

If flood warnings are issued indicating a level of RL4.00m(AHD) or higher, the building manager must ensure that all flood warning signs are erected to guide access to the tenancies from the fire stairs. Additionally, the door accessing the fire stairs from the ground floor should be kept open to allow access for emergency services.

The fire stairs will be accessible to the public, allowing emergency services to access the building via this location and contact all floors as necessary using the provided emergency phone.

The most economical evacuation route for at-risk areas involves evacuating the building and proceeding south down Beesley Street.

The evacuation distance from the farthest point of the building is less than 150m. Based on a conservative estimate of pedestrian walking speed at 0.5m/s, it's estimated to take approximately 5.0 minutes to reach the Evacuation Point on Beesley Street.

3.3.6 VEHICULAR ACCESS

Vehicular entry to the development will be via Filmer Street. In the event of flood warnings reaching or exceeding RL4.00m(AHD), it is imperative for the building manager to promptly notify occupants, visitors, and staff regarding the imminent closure of the vehicular access. Additionally, appropriate signage should be promptly installed.

A low point has been identified within Beesley Street. Should flood waters be visible within the kerb and channel of the Filmer Street/Beesley Street intersection the building manager must ensure all evacuation is seized and all remaining occupants, visitors and staff shelter in place until the flood waters recede.

3.3.7 RELOCATION OF ASSETS

Where practical, vulnerable equipment should be permanently moved, stored or secured at higher elevations within the site and potentially floating materials should be suitable fixed or anchored to minimise damage and loss.

Flooding associated with the Brisbane River has a longer warning time and as such there may be an ability to prepare the site for potential inundation. To reduce the impact to the ground floor assets, consider temporary relocation of ground floor vehicles to higher surrounding areas and any storage to upper floors.

When a flood warning is issued for the Brisbane area, the Building Manager / Body Corporate manager must inform all occupants of the potential flooding. This will provide a minimum of 24 hours for any occupants to relocate their cars and/or possessions on the ground floor to flood immune areas. As the ground floor is immune to flood waters in all flood events up to and including a DFL flood event, this relocation is not mandatory, and will be at the discretion of all occupants.

3.3.8 HAZARDOUS MATERIAL STORAGE

Storage containers for any potentially hazardous materials must be able to withstand inundation without release and should be anchored if necessary. It is noted storage of hazardous chemicals must be compliant with Table 8.2.11.3.M of the Flood Overlay Code (Brisbane City Council, 2019).

3.3.9 STORAGE CAGES

There are six (6) storage cages located on the ground floor which residents can use to store personal belongings. In rare flood events, the probability that these cages will be inundated by flood water is likely.

It is recommended that the Building Manager/ Body Corporate Committee make all owners aware that these areas are subject to flooding and valuable belongings (such as antique furniture, paintings, family photos, etc.) should not be stored in these areas as they are likely to be damaged during a flood event.

This notification of flood risk should be incorporated into the Body Corporate by-laws, building management documentation, and/or resident induction booklets to ensure ongoing awareness of the flood hazard associated with these storage areas.

3.3.10 REVISED FRA

Forecast scenarios generally consider a combination of both increased rainfall intensities and sea level rise and has been considered in the Brisbane River study (BMT, 2020).

Climate change may adversely affect flood hazard at the site, with potential Brisbane River 1% AEP flood level increases of 1.35 m (CC2) and 2.75 m (CC4).

As such, a revised FRA for the site should be undertaken in 2050 (or sooner should more accurate climate change predictions be established or confirmed) to ensure compliance.

3.4 OTHER CONSIDERATIONS

3.4.1 LIABILITY

The owner of the site will need to absolve Council and assume responsibility for all losses, damage and costs that might be incurred as a result of flooding to the extent required by law.

3.4.2 PERPETUATION OF RISK TO FUTURE OWNERS

The site owner(s) are required to ensure that all current and future site & building managers are aware of the flood hazard, flood risk and flood mitigation recommendations of this FRA.

Whilst it is anticipated that any future site owner should conduct their own site-specific due diligence prior to purchase, should the site be sub-leased, rented, sold or otherwise controlled by another third party, the site owner(s) are to provide this FRA that that third party.

3.4.3 FLOOD AFFECTED AREAS

The attached figures illustrate the predicted Brisbane River flooding for design storm events. They identify public and private premises at risk of flooding in the immediate vicinity of the site.

3.4.4 PERSONS WITH DISABILITY / SPECIAL NEEDS

Should a person with disability or special needs be on -site at any time extra vigilance should be paid to current and forecast weather conditions to ensure that an expedited evacuation can be conducted well in advance of any flood hazard affecting the site.

3.4.5 INSURANCE & CLAIMS

It is highly recommended to ensure the site has appropriate flood insurance coverage for the building structure, internal fitting and other assets. Expert advice should be sought in terms of insurance coverage for the site.

Insurance claims should be considered immediately following a flood event and should be done prior to cleaning or disposing of damaged items. It is recommended that photos are taken of and damage or evidence of inundation (i.e. debris or mud lines after flood waters recede) to assist with claims.

Floodwaters are usually dirty / mud laden and factors like depth of inundation and duration of inundation can affect the amount of deposited mud during an event and as the waters recede. Cleaning up can be quite time consuming and labour intensive. The use of flood resilient materials will generally reduce the post flood recovery clean up and replacement costs.

4 CONCLUSION & QUALIFICATIONS

This FRA has been prepared by MBA and specifically to support the proposed DA. This FRA has been conducted in accordance with Council's Flood Overlay Code and Council's Flood Planning Scheme Policy.

A number of mitigation solutions are proposed in order ensure the proposed site use is compatible with the flood hazard and minimises disruption to site operations, property damage and recovery over a flood event. With these measures in place, the site can effectively be operated.

Our analysis and overall approach was specifically catered for the particular project requirements, and may not be applicable beyond this scope. For this reason any other third parties are not authorised to utilise this report without further input and advice from MBA.

The accuracy of the report is dependent upon the accuracy of information provided by others.

5 REFERENCES

- Ball, J., Babister, M., Nathan, R., Weeks, W., Weinmann, E., Retallick, M., & Testoni, I. (Eds.). (2019). *Australian Rainfall and Runoff: A Guide to Flood Estimation*. Commonwealth of Australia (Geoscience Australia).
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- Queensland Reconstruction Authority. (2019). *Flood Resilient Building Guidance for Queensland Homes*.



Figures



LEGEND

- Site
- Cadastre
- Access

Flood depth (m)

- 0.01 - 0.1
- 0.1 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.0
- Above 2.0

Flood Level Contour (mAHD)

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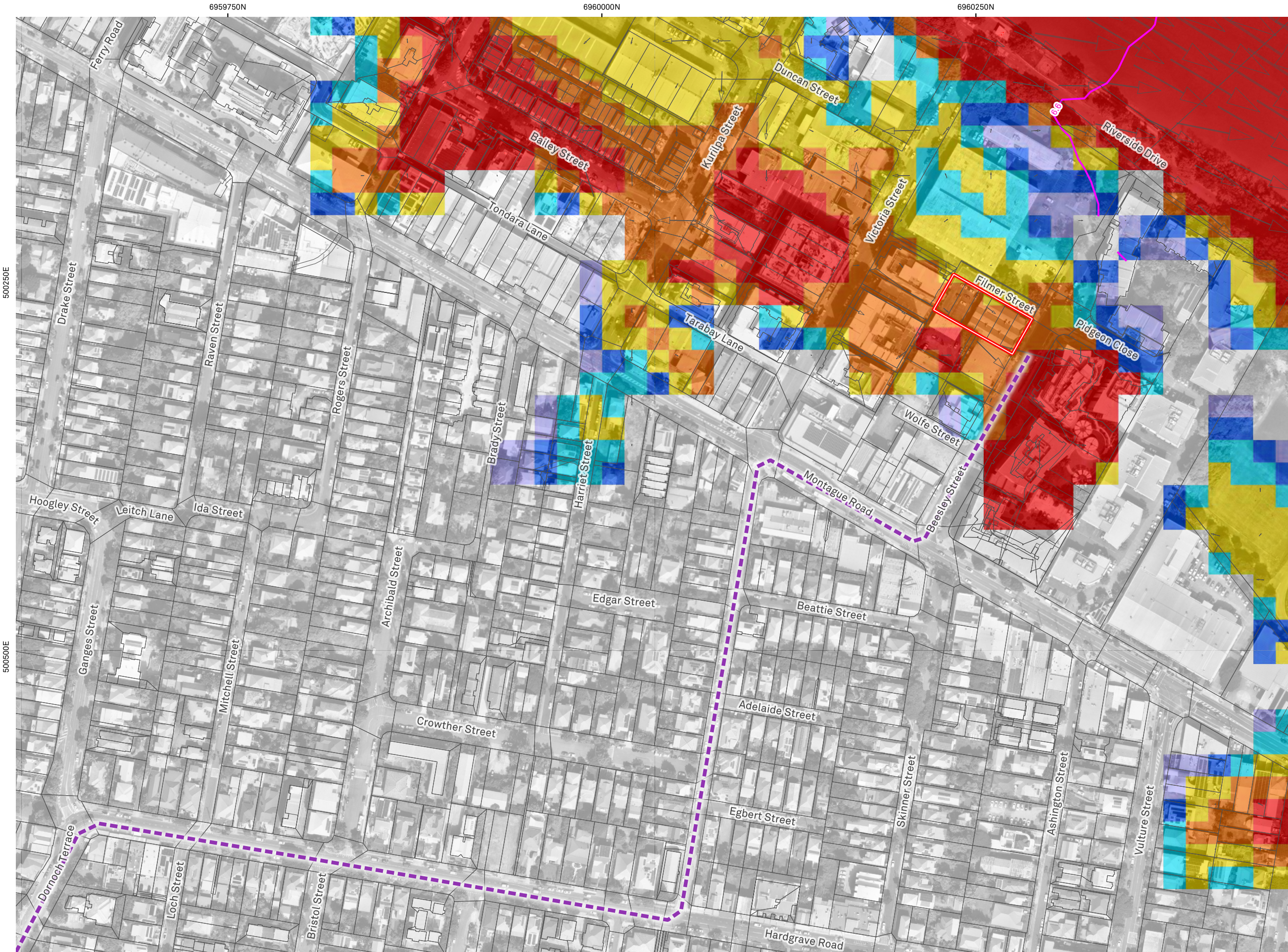
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FIGURE 1

2% AEP BRISBANE RIVER FLOOD MAP (BMT, 2020)

28 Beesley Street, West End
Flood Emergency Management Plan



LEGEND

- Site
- Cadastre
- Access
- Flood depth (m)
 - 0.01 - 0.1
 - 0.1 - 0.3
 - 0.3 - 0.6
 - 0.6 - 1.2
 - 1.2 - 2.0
 - Above 2.0
- Flood Level Contour (mAHD)

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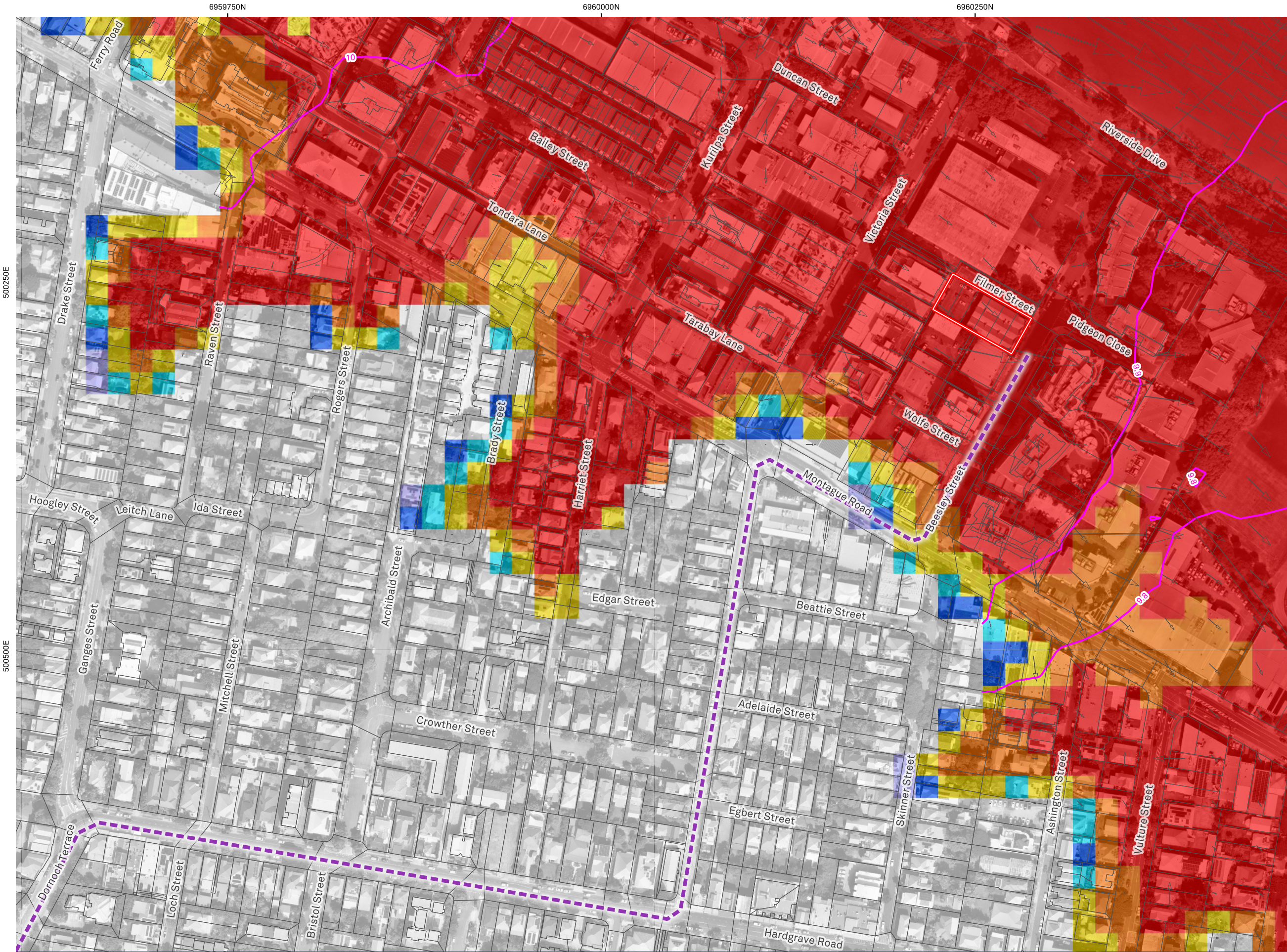


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J24014

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FIGURE 2
1% AEP BRISBANE RIVER FLOOD MAP (BMT, 2020)
28 Beesley Street, West End
Flood Emergency Management Plan



LEGEND

- Site
- Cadastral
- Access

Flood depth (m)

- 0.01 - 0.1
- 0.1 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.0
- Above 2.0

Flood Level Contour (mAHD)

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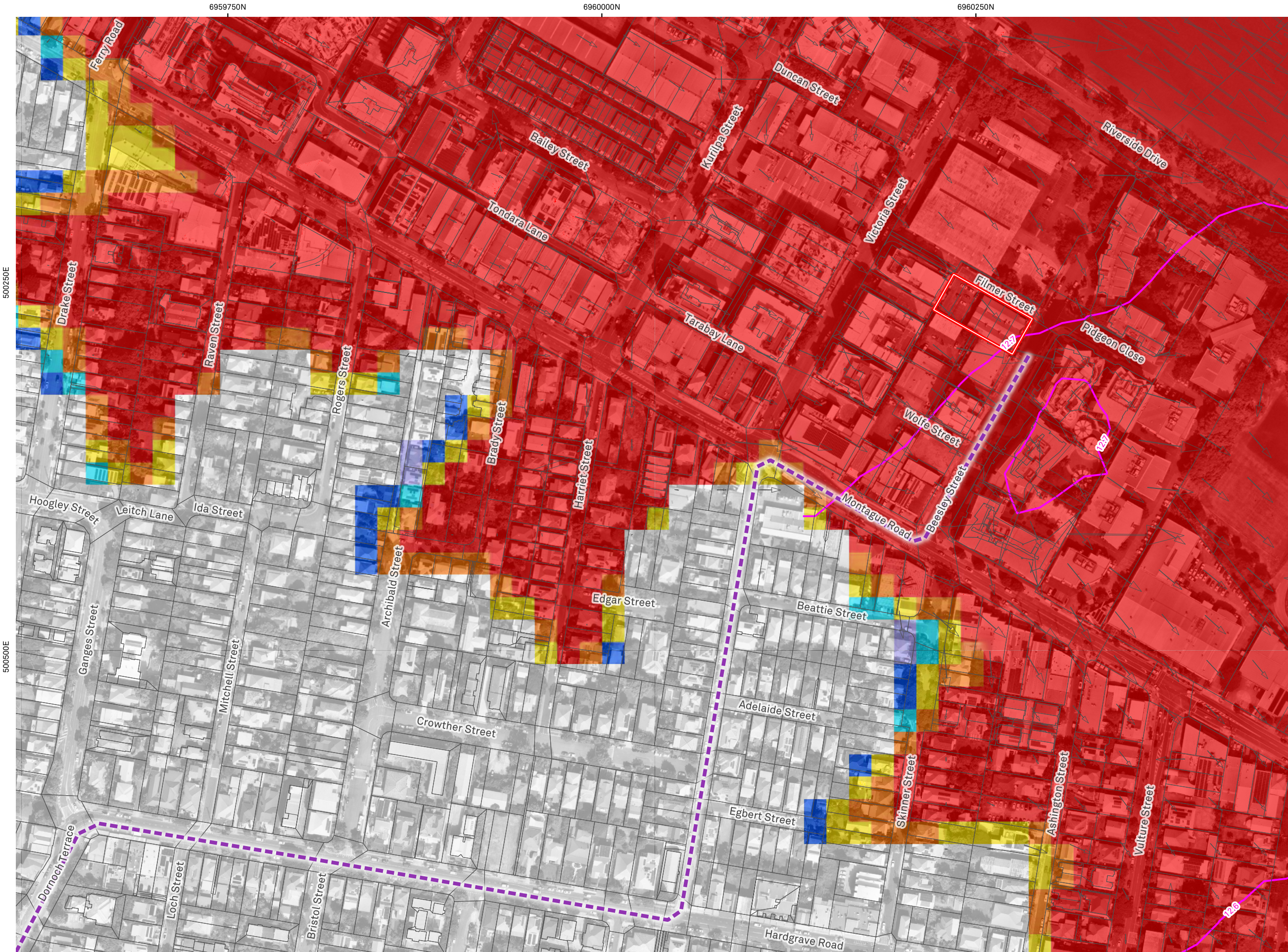
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0 40 80 120 160 200 m

FIGURE 3
0.2% AEP BRISBANE RIVER FLOOD MAP (BMT, 2020)
28 Beesley Street, West End
Flood Emergency Management Plan



LEGEND

- Site
- Cadastral
- Access

Flood depth (m)

- 0.01 - 0.1
- 0.1 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.0
- Above 2.0

Flood Level Contour (mAHD)

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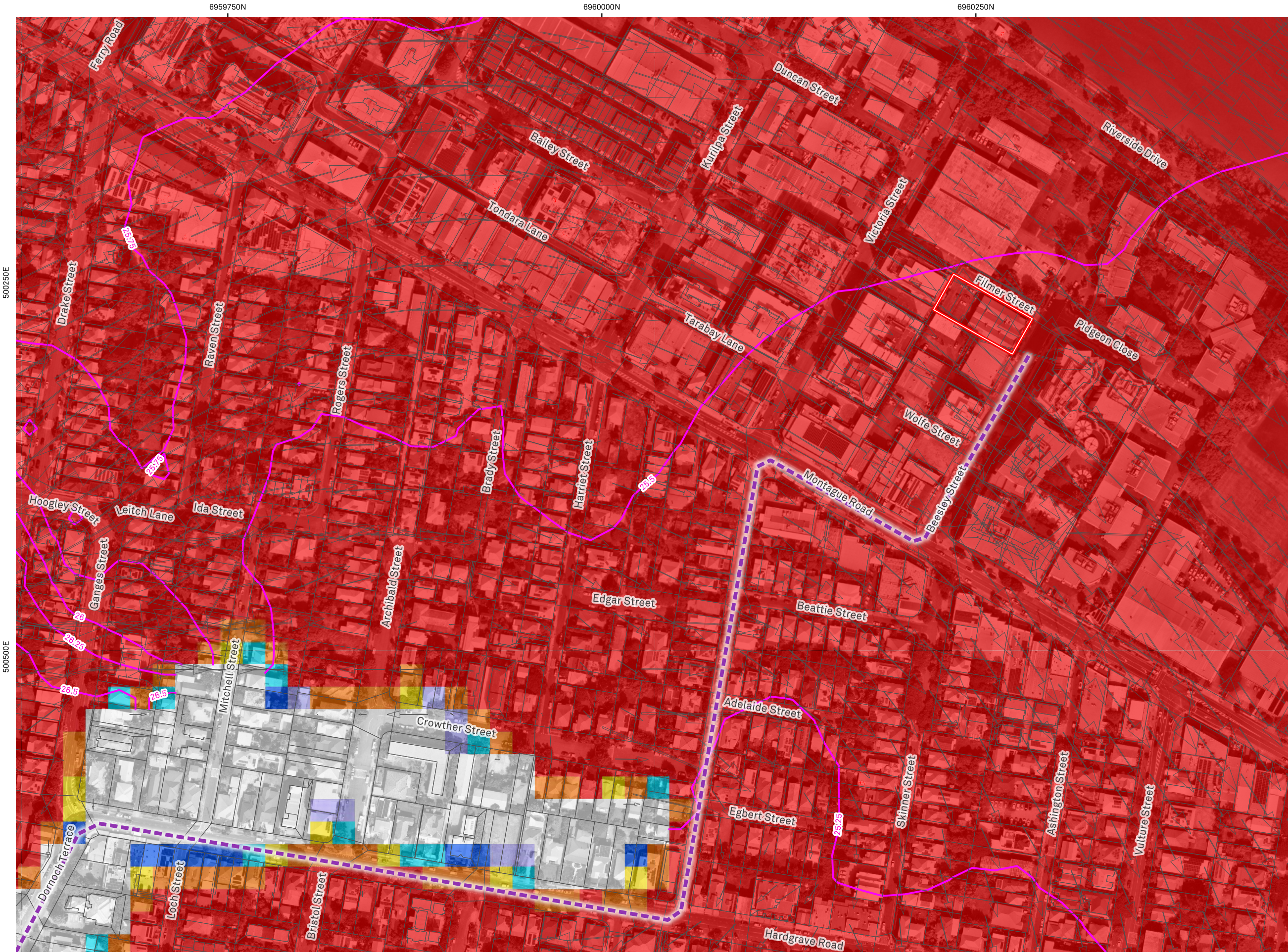
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0 40 80 120 160 200 m

FIGURE 4

0.05% AEP BRISBANE RIVER FLOOD MAP (BMT, 2020)

28 Beesley Street, West End
Flood Emergency Management Plan



LEGEND

- Site
- Cadastral
- Access

Flood depth (m)

- 0.01 - 0.1
- 0.1 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.0
- Above 2.0

Flood Level Contour (mAHD)

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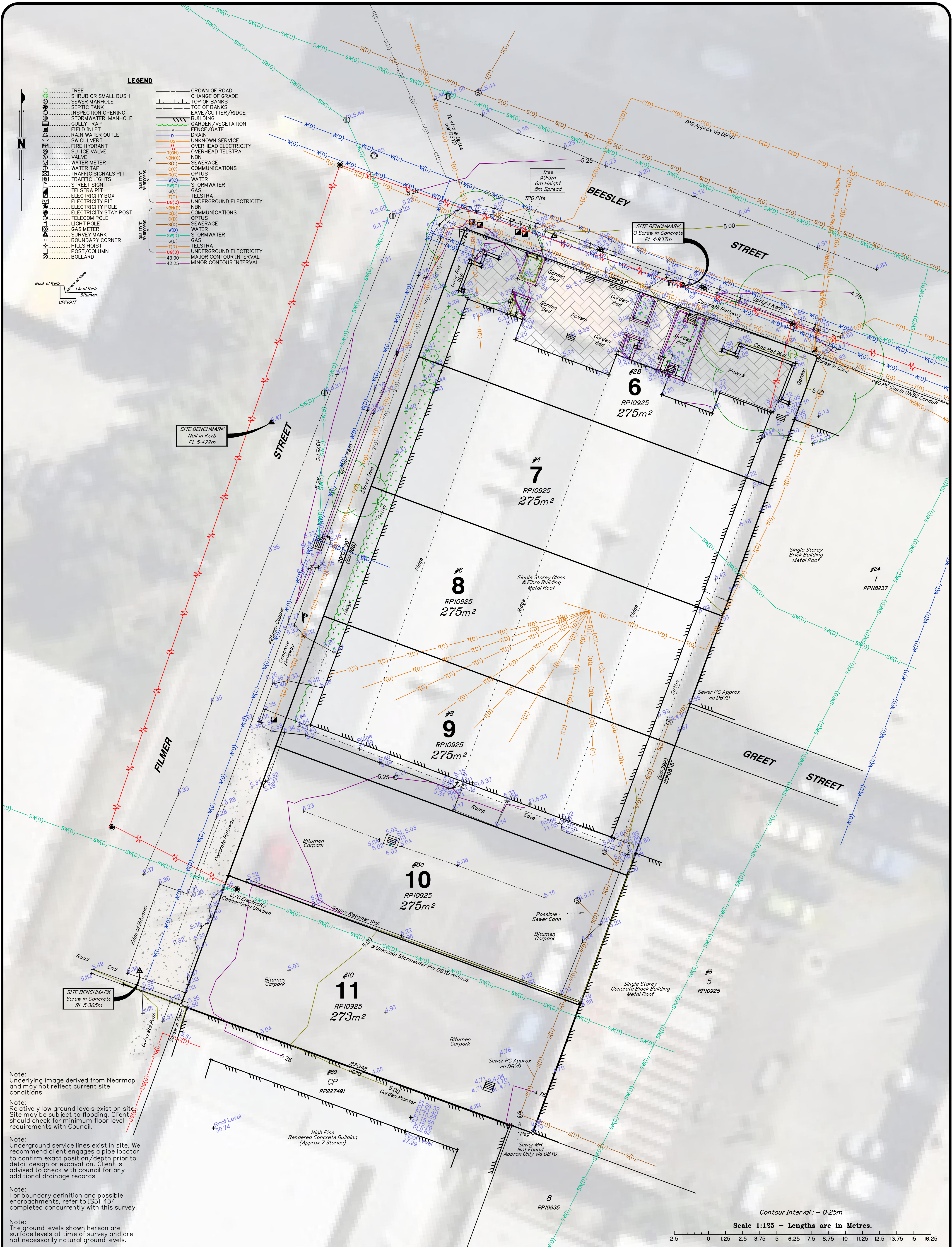
0 40 80 120 160 200 m

FIGURE 5
0.001% AEP BRISBANE RIVER FLOOD MAP (BMT, 2020)
28 Beesley Street, West End
Flood Emergency Management Plan



Appendix A

Site Survey & Architectural Layout



Note:
Underlying image derived from Nearmap and may not reflect current site conditions.

Note:
Relatively low ground levels exist on site. Site may be subject to flooding. Client should check for minimum floor level requirements with Council.

Note:
Underground service lines exist in site. We recommend client engages a pipe locator to confirm exact position/depth prior to detail design or excavation. Client is advised to check with council for any additional drainage records.

Note:
For boundary definition and possible encroachments, refer to IS311434 completed concurrently with this survey.

Note:
The ground levels shown hereon are surface levels at time of survey and are not necessarily natural ground levels.

This plan is prepared for the purpose of designing new construction on the land and should not be used for any other purpose. Underground services shown hereon have been located by field survey where possible. Prior to any Demolition, Construction or Excavation on the site, the relevant Authority should be contacted for the possible location of further underground services. The Real Property Boundaries have not been defined by this survey and have been compiled from IS311434. Exact Bearings, Dimensions and Areas are subject to a Cadastral Survey. Check Title for any Easements.

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[Signature]
Cadastral Surveyor

Date: 12/04/2022

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Tocu Beesley Trust

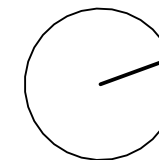
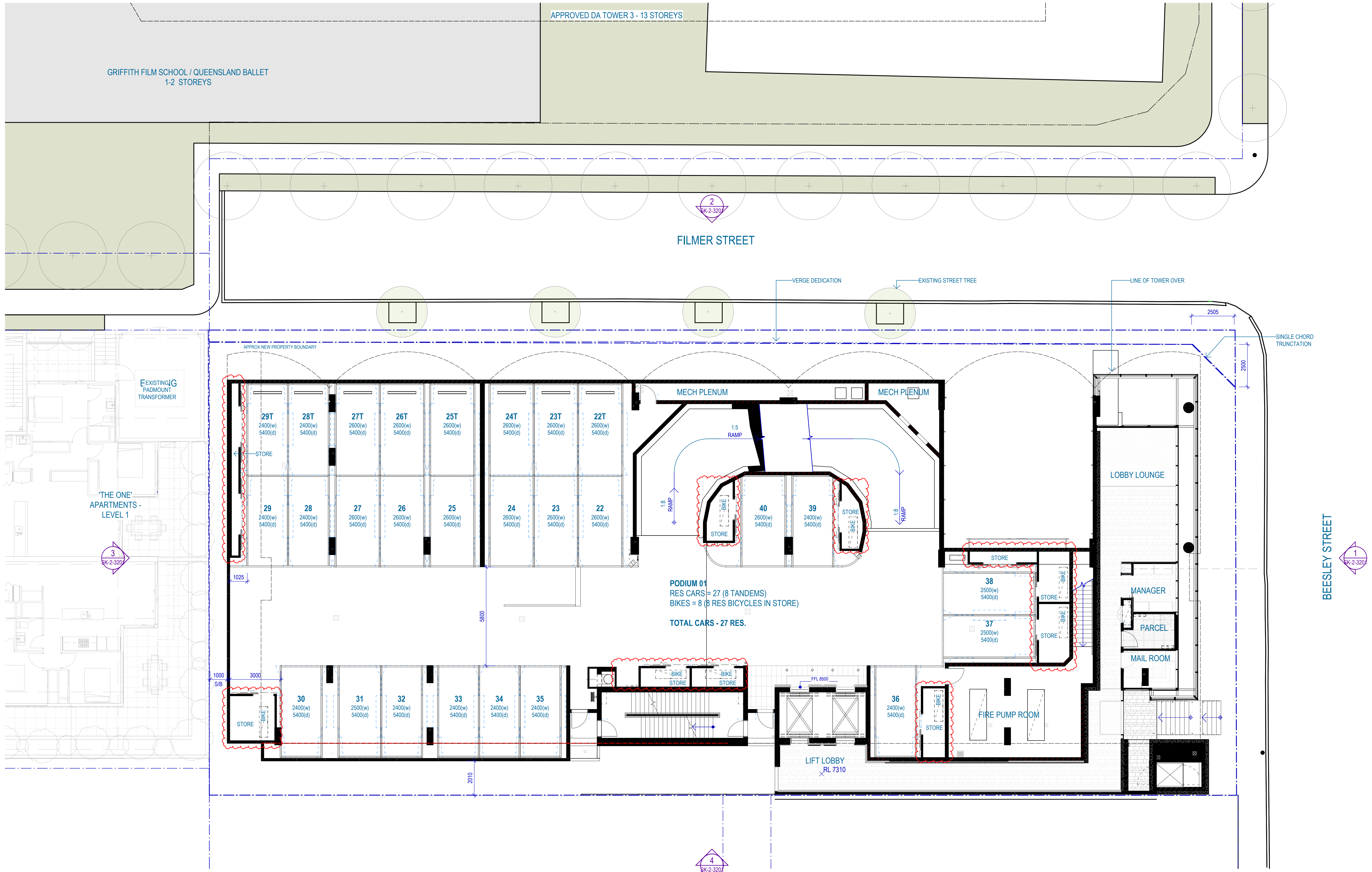
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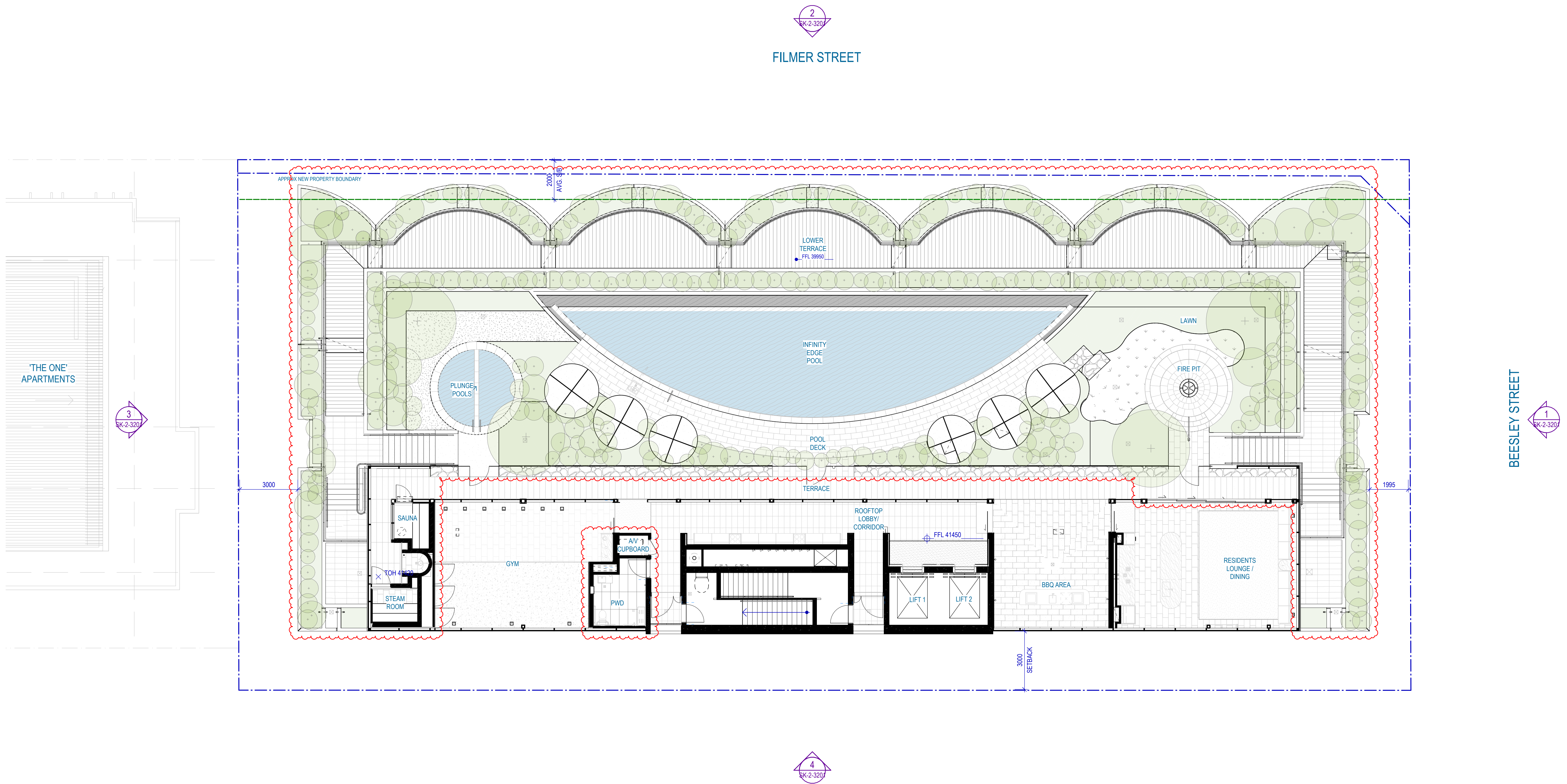
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on RP10925
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Corner of Filmer Street

WEST END
Brisbane City Council

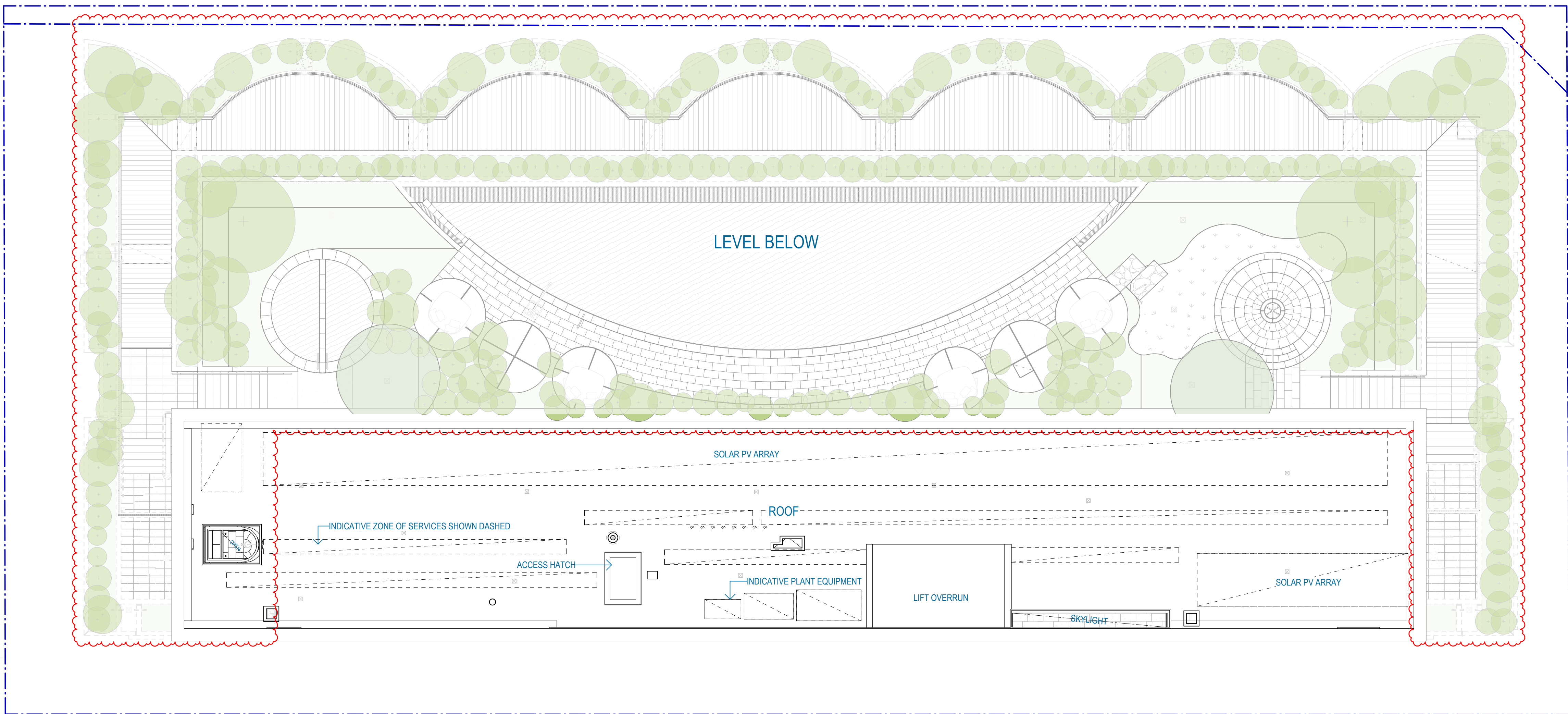
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Drawn	JTH	Reduced: PW/ETG
Checked	RRI	REVISION A
REFERENCE No 9666-22		
PLAN No. 9666-300-01		


Statewide
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CONSULTING SURVEYORS
AND TOWN PLANNERS
3/123 Link Road Victoria Point, QLD 4165
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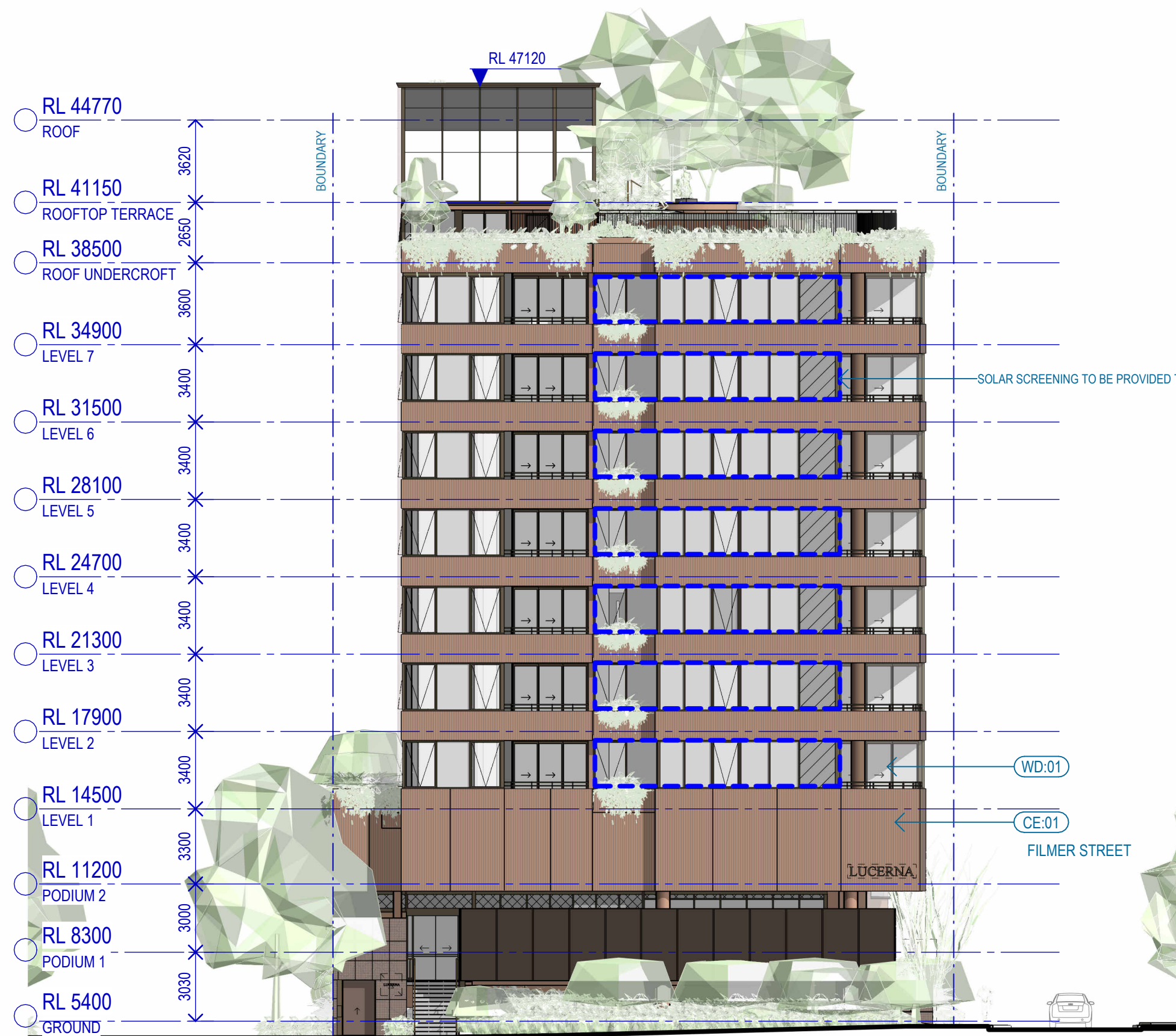
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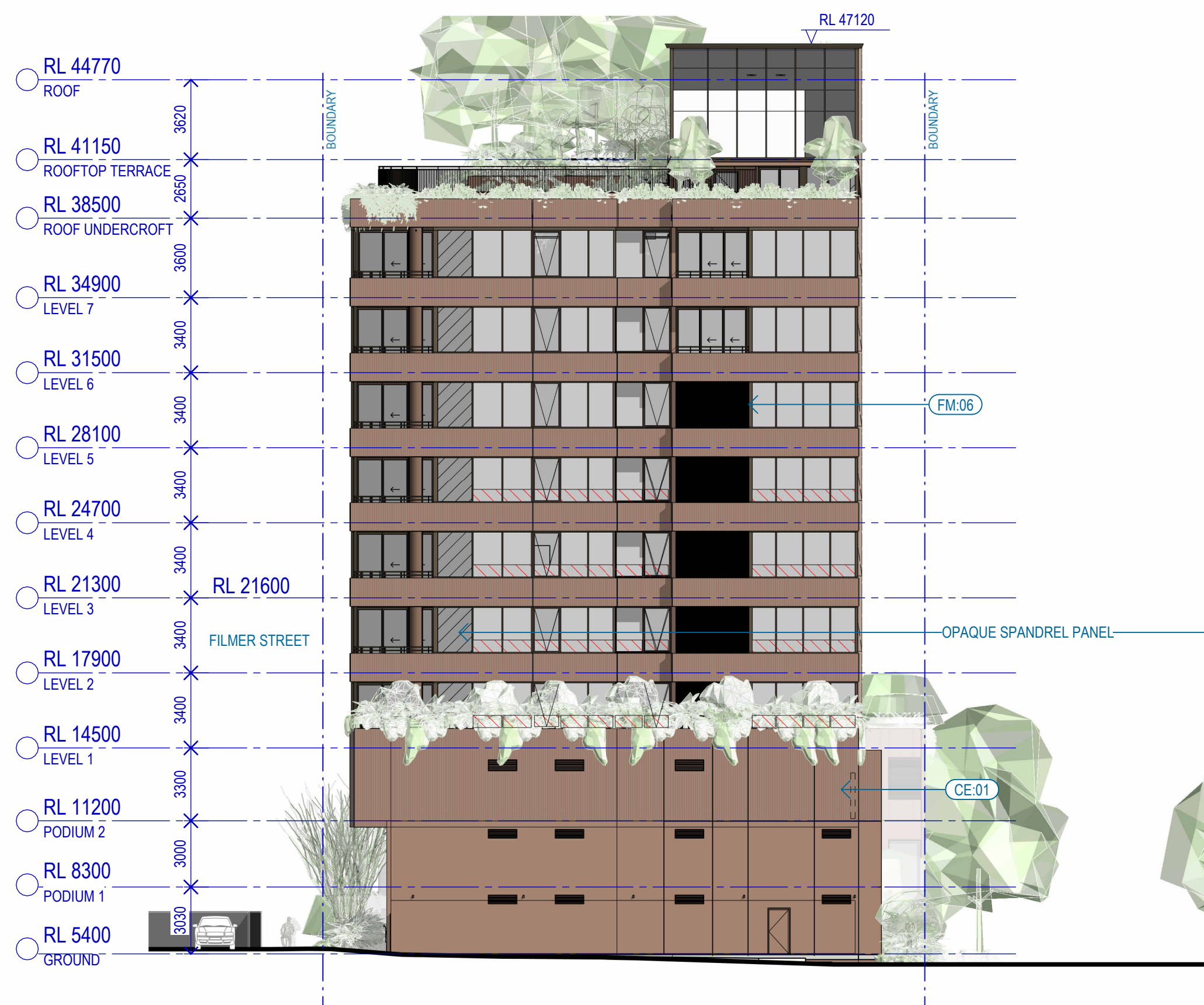
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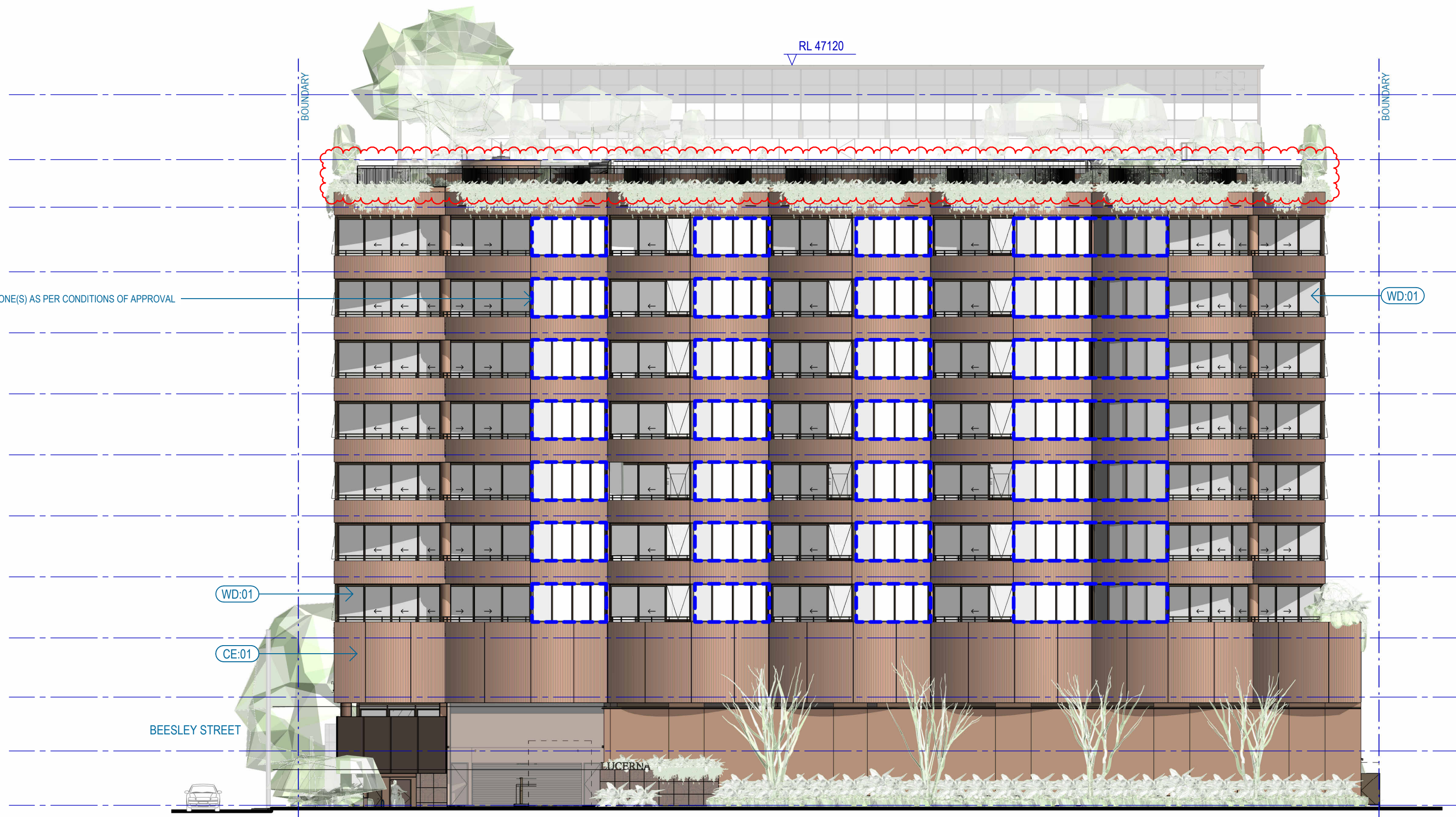
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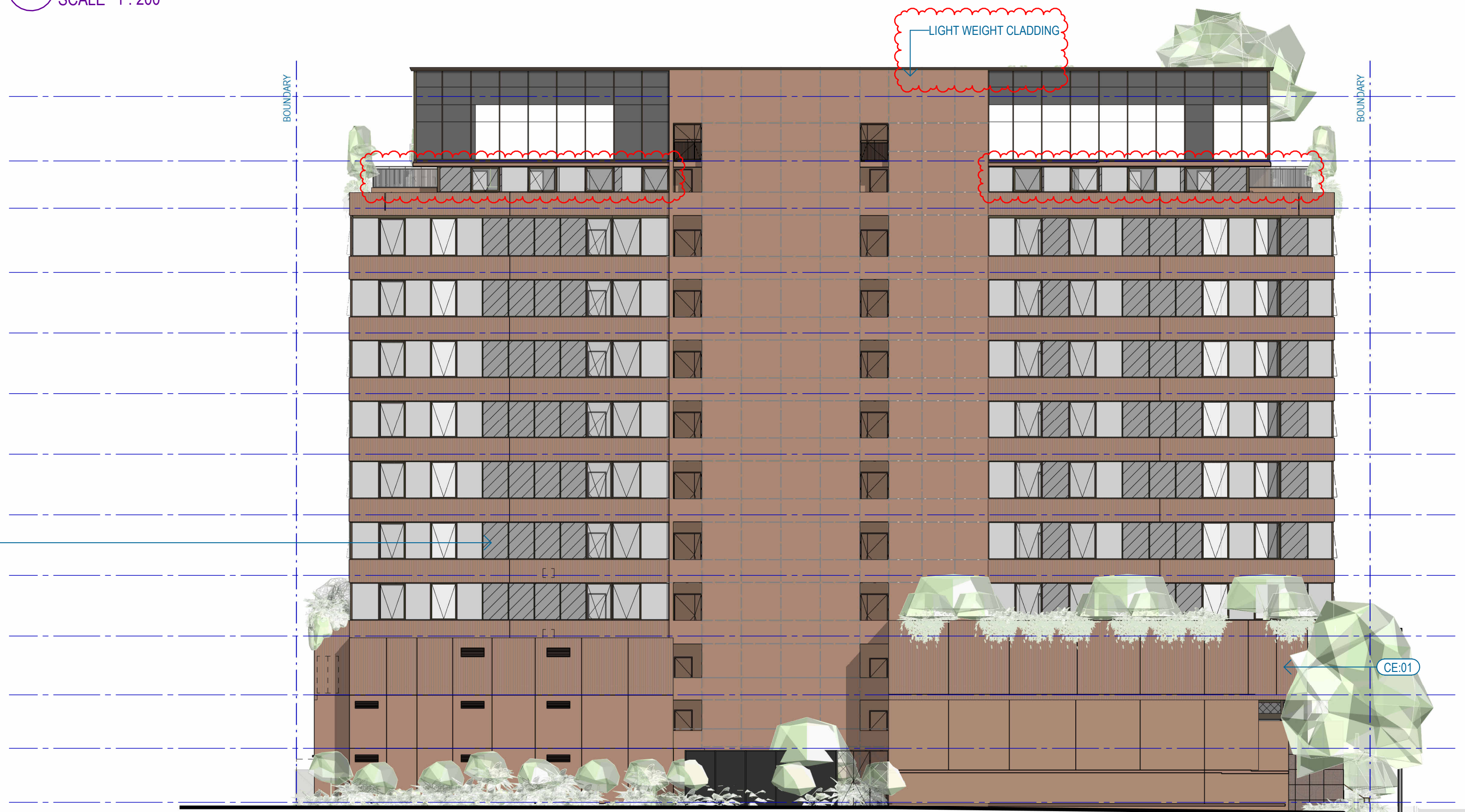
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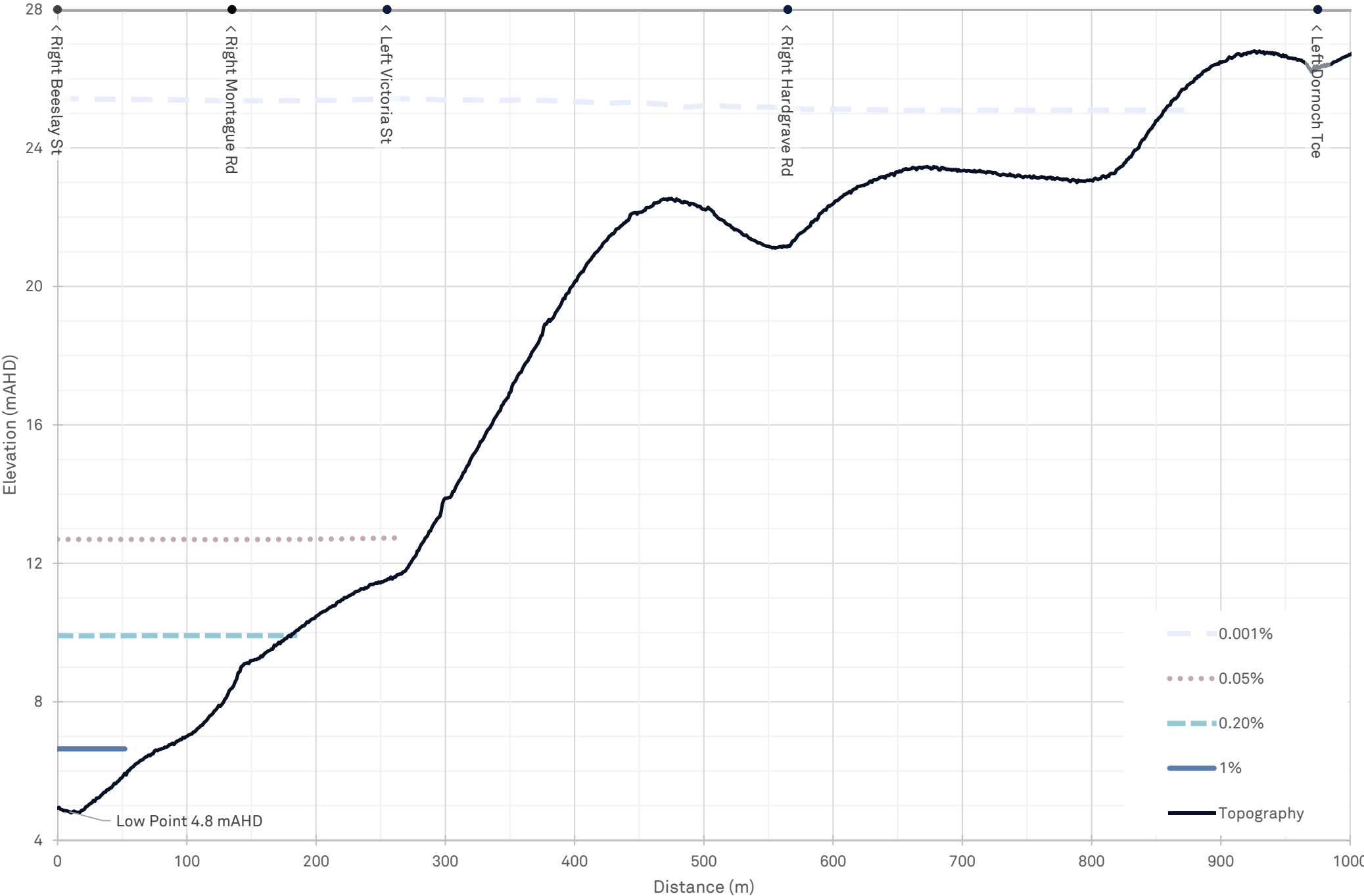
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- CE-01 - PRECAST CONCRETE, TEXTURED/FORMLINER
 - FA-01 - CONCRETE SLAB - BALCONIES
 - CE-03 - INSITU CONCRETE SLAB - TYPICAL
 - FM-01 - HORIZONTAL METAL BALUSTRADE, BRONZE POWDERCOAT FINISH
 - FM-02 - VERTICAL METAL BALUSTRADE, BRONZE POWDERCOAT FINISH
 - FM-03 - METAL FRAMING TO LOBBY GLAZED SCREENS
 - FM-04 - METAL FRAMING TO LOBBY GLAZING
 - FM-06 - VERTICAL BATTEN PRIVACY SCREEN, BRONZE POWDERCOAT FINISH
 - MA-01/MA-02 - FEATURE GABION WALL
 - WD-01 - FULL HEIGHT GLAZING SYSTEM WITH SLIDING DOORS AND OPERABLE WINDOWS WHERE INDICATED, BRONZE FINISH TO MULLIONS
-  EXTENT OF PRIVACY SCREENING AS PER DA CONDITIONS



Appendix B

Access Long Section

Access Long Section





Appendix C

Risk Matrix

RISK MATRIX FRAMEWORK

LIKELIHOOD	CONSEQUENCE				
	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
ALMOST CERTAIN	MODERATE 11	HIGH 16	EXTREME 20	EXTREME 23	EXTREME 25
LIKELY	MODERATE 7	HIGH 13	HIGH 17	EXTREME 21	EXTREME 24
POSSIBLE	MODERATE 5	MODERATE 8	HIGH 14	HIGH 18	EXTREME 22
UNLIKELY	LOW 2	LOW 4	MODERATE 9	HIGH 15	HIGH 19
RARE	LOW 1	LOW 3	MODERATE 6	MODERATE 10	MODERATE 12

RISK

EXTREME	Immediate action required to mitigate hazard. Activity must not start or continue until the risk is reduced.
HIGH	Site manager must give approval for activity to commence or continue. More suitable mitigation measures should be investigated
MODERATE	Activity to proceed once risk is reduced to as low as reasonably practicable and mitigation measures are implemented.
LOW	Work to proceed while monitoring and managing risk. No additional controls or mitigation measures required.

CONSEQUENCE / SEVERITY

	People	Asset / Building
INSIGNIFICANT	Short term issue, no injuries, near miss, or inconvenience to usual routine	Minimal or no damage, no repair needed to continue with business as usual
MINOR	First Aid required, minor injury or illness, no risk to life or limb,	Minor damage, low repair cost
MODERATE	Professional medical intervention required	Significant damage and high repair cost
MAJOR	Serious injury or illness, lost time injury or illness, non-permanent disability	Critical damage, very high cost to repair or replace, potential asset write-off
CATASTROPHIC	Risk to life or limb, fatality or injury / illness with permanent disability	Catastrophic damage, repair costs exceeds asset value, replacement required

LIKELIHOOD / PROBABILITY

ALMOST CERTAIN	The event is expected to occur in most normal circumstances	63% AEP
LIKELY	Will probably occur in most circumstances	10% AEP
POSSIBLE	Might occur at some time	2% AEP
UNLIKELY	Could occur at some time	1% AEP
RARE	May occur only in exceptional circumstances	0.05% AEP



Appendix D

BCC Flood Guide & Emergency Management Kit Checklist



Flooding in Brisbane

A guide for residents

photo provided by Conan Whitehouse

Brisbane is a great place to live, work and relax – it's a safe, vibrant, green and prosperous city, valued for its friendly and optimistic character and enjoyable lifestyle. Flooding in Brisbane is natural and part of our environment, and we need to be prepared for flooding and the impact it can have on our homes and families.

While Brisbane City Council is working hard to reduce the impact of flooding, there are simple things residents can do to protect themselves, their homes and families.

Be prepared for flooding

Don't wait until it's too late. Council has a range of free tools and information to help residents understand their property's potential flood likelihood and how to be prepared. These include the following:

Interactive Flood Awareness Map – Identify the likelihood and sources of flooding that may affect your property. Learn about the extent of Brisbane's major historic river floods.

FloodWise Property Report – Download a FloodWise Property Report for flood information relating to building or renovating your home.

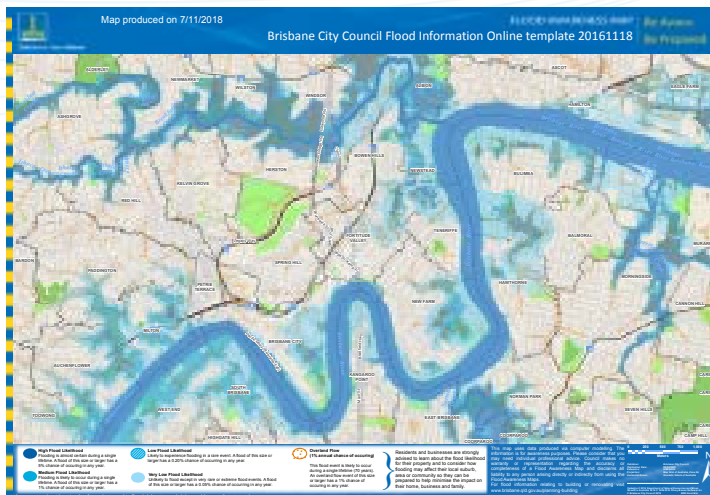
Severe Weather Early Warning Alert Service – Sign up to receive free alert notices of severe thunderstorms, destructive winds and potential flooding.

For more information and to access these tools, visit brisbane.qld.gov.au, call Council on 3403 8888 or visit your nearest Council regional business centre.



Don't wait until it's too late. Be prepared.

Dedicated to a better Brisbane



Use Council's Flood Awareness Maps to determine your flood likelihood

Council's Flood Awareness Maps help you understand your property's flood likelihood. Visit brisbane.qld.gov.au/beprepared, call Council on **3403 8888** or visit your nearest Council regional business centre to identify your property's potential flood risk.

What do the shaded areas on the Flood Awareness Maps mean?

The Flood Awareness Maps are an awareness tool to provide an indication of the likelihood of a flood occurring from one or more sources: creek, river, overland flow and storm tide. Flood Awareness Maps do not provide information about the depth or speed of flood water. Use the FloodWise Property Report for information about flood levels specific to your property. Visit brisbane.qld.gov.au/planning-building

High flood likelihood

Flooding is almost certain to occur during a single lifetime (70 years) in a high likelihood area. A flood of this size or larger has a 5% chance of occurring in any year. Residents and businesses are **strongly advised** to learn about the flood likelihood for their property so they can be prepared to help minimise the impact on their home, business and family.

Medium flood likelihood

Flooding is likely to occur during a single lifetime (70 years) in a medium likelihood area. A flood of this size or larger has a 1% chance of occurring in any year. Residents and businesses are **advised** to learn about the flood likelihood for their property so they can be prepared to help minimise the impact on their home, business and family.

Low flood likelihood

This area may experience flooding in a rare flood event. A flood of this size or larger has a 0.2% chance of occurring in any year. Residents and businesses **should consider** how flooding may affect their local area, suburb or community. Flooding is unlikely in a low flood likelihood area, but may still occur.

Very low flood likelihood

This area is unlikely to flood except in a very rare or extreme flood event. A flood of this size or larger has a 0.05% chance of occurring in any year. Residents and businesses **should consider** how flooding may affect their local area, suburb or community. Flooding is very unlikely in a very low flood likelihood area, but may still occur.

Overland flow

Overland flow can occur in this area. Residents and businesses are strongly advised to learn about the overland flow paths surrounding their property so they can be prepared to help minimise the impact on their home, business and family.

High impact

In high impact areas, overland flow is almost certain to occur during a single lifetime (70 years). An event of this size or larger has a 5% chance of occurring in any year. The overland flow is generally unsafe for people, vehicles and buildings.

Medium impact

For the majority of medium impact areas, overland flow is very likely to occur during a single lifetime (70 years). An event of this size or larger has a 2% chance of occurring in any year. The overland flow is generally unsafe for people, vehicles and buildings, however these hazards are experienced less frequently than in high impact areas.

Low impact

For the majority of low impact areas, overland flow is likely to occur during a single lifetime (70 years). An event of this size or larger has a 1% chance of occurring in any year. The overland flow is generally safe for people, vehicles and buildings, however certain areas can experience greater hazards.

Flood Awareness Maps include flooding from all sources: creek, river, overland flow and storm tide.

All floods are different and may occur from one or a combination of these four sources.



Creek flooding

happens when intense rain falls over a creek catchment. Run-off from houses and streets also contributes to creek flooding. The combination of heavy rainfall, run-off and the existing water in the creek causes creek levels to rise.



River flooding

happens when widespread, prolonged rain falls over the catchment of a river. As the river reaches capacity, excess water flows over its banks causing flooding. River flooding downstream can occur hours after the rain has finished.



Overland flow

is run-off that travels over the land during heavy rainfall events. Overland flow can be unpredictable because it is affected by localised rainfall and urban features such as stormwater pipes, roads, fences, walls and other structures. The actual depth and impact of overland flow varies depending on local conditions but it generally occurs quickly.



Storm tide flooding

happens when a storm surge creates higher than normal sea levels. A storm surge is caused when a low pressure system or strong onshore winds force sea levels to rise above normal levels. The impact from storm tide or storm surge is increased during high tides and king tides and can affect low-lying areas close to tidal waterways and foreshores.



Floodwater may rise very slowly and be slow moving. This is normally associated with Brisbane River flooding, which occurs after prolonged periods of heavy rain across the whole catchment. Floodwater can also rise quickly and be very fast moving, and then recede quickly. This is normally associated with creek flooding.

Many properties unaffected by the 2011 Brisbane River flood may still be at risk from other sources of flooding including creek, storm tide and overland flow.

Don't wait until it's too late. Be prepared.

Council is working hard to reduce the impact of flooding but we all have a responsibility to understand our flood likelihood and be better prepared to minimise the impact of flooding on our homes, property and businesses. **Once you have used Council's Flood Awareness Map to identify the likelihood of flooding on your property, use the tips in the following tables to put a plan in place for your home and family.**

Personal possessions

Consider how and where to move valuables during a flood event

- Store valuables and possessions (jewellery, passports, financial statements etc.) safely during a flood event.
- Consider where you can safely store your vehicle/s.
- If you have a home computer, back up your files regularly and keep a copy that you can easily take with you in an emergency.

Your local area

Know your local area and talk with your neighbours

- Consider how potential loss of power, road closures and interruptions to public transport could affect you.
- Talk to your neighbours. Those living in the area for a long time may have experienced previous flood events.
- Consider how you can help your community. The elderly, disabled or families with young children may need your help to evacuate during a flood. You could help by storing other's belongings, transporting valuables, cooking meals or donating items such as clothes or blankets.
- During heavy rain or flooding, observe where water is likely to rise from, flow through or collect around your property and local area.
- Even if you live or work on top of a hill, heavy rain can cause damage to possessions and structures.
- Consider that the type of building you live in (unit complex, two-storey or low-set house) may influence how your household and property are affected during a flood.
- Never drive through or enter flood waters.

How to prepare for flooding

Brisbane's weather checklist

Understand Brisbane's climate and weather patterns

- Sign up for Council's Early Warning Alert Service. Visit brisbane.qld.gov.au/beprepared
- Pay attention to radio, television and online weather updates.
- Visit bom.gov.au for the latest weather updates.

Flooding and your property

Understand how water flows in and around your property and street

- Observe where water flows from and to during heavy rain. This will indicate the path of potential floodwaters.
- Consider that properties near a river, creek, gully or tidal waterway are more likely to flood.
- Consider how fast-moving floodwaters may damage your home and interfere with evacuation plans.
- Consider loss of power, road closures and interruptions to public transport.
- Consider how close your property is to bordering other Flood Awareness Map flood likelihood areas.

Building or renovating

Check Brisbane's City Plan

- You must comply with City Plan planning requirements. Visit brisbane.qld.gov.au/planning-building
- Download a FloodWise Property Report for information about building and development for a specific property. Visit brisbane.qld.gov.au/planning-building

Insurance

Make sure you are appropriately insured

- Talk to your insurer about flood insurance and your property.

Have an evacuation plan

Use the information on the back page of this guide to create an emergency plan and emergency kit

- Prepare an emergency kit.
- Have emergency contact phone numbers easily accessible.
- Consider your pets. They may need temporary-to-long-term alternative shelter away from your home during a flood.
- Plan multiple evacuation routes. Some roads may be cut off by floodwaters.

Don't wait until it's too late. Be prepared.

EMERGENCY KIT CONTENTS checklist

Prepare your emergency kit in advance and keep it somewhere you can easily access. Consider including the following items in a waterproof container.

Household

- ☐ waterproof torch with spare batteries and bulbs, or wind-up torch
- ☐ portable radio with spare batteries
- ☐ mobile phone with charger (preferably car charger)
- ☐ first aid kit, including essential medications and copies of prescriptions
- ☐ list of emergency and personal phone numbers
- ☐ credit cards and cash
- ☐ drinking water and non-perishable food
- ☐ manual can opener
- ☐ toiletry items, e.g. toilet paper, anti-bacterial wipes, toothpaste, toothbrush and soap
- ☐ sealable waterproof bags
- ☐ spare keys for house and car
- ☐ tools, e.g. wrench, pliers, utility knife
- ☐ sturdy gloves and rubber boots
- ☐ personal valuables
- ☐ back-up copy of computer files.

Baby and children

- ☐ baby needs, e.g. formula, nappies
- ☐ change of clothes
- ☐ toys.

Pets

- ☐ pet supplies, e.g. water and food dishes, food, blankets.

Important documents

- ☐ inventory of house and contents
- ☐ wills
- ☐ insurance documents and policy numbers
e.g. life/car/house/contents
- ☐ birth and marriage certificates
- ☐ passports/visa details
- ☐ medical details, e.g. medicare, immunisation records and private health funds
- ☐ financial documents, e.g. bank statements, credit cards, shares.

Emergency plan

1. Prepare a list of important phone numbers, including key family members and friends who can help. Other important contacts include medical, service and financial providers.
2. Put emergency numbers somewhere you can easily access.
3. Find out which radio station you should listen to for frequent flood updates.
4. Designate a person outside your area, such as a relative or friend, as your emergency household contact.
5. As a household, discuss and agree on your evacuation plan. Remember to include your pets and consider if your neighbours need help to evacuate.
6. Make sure everyone in your family knows what to do in a flood.
7. Prepare an emergency kit (use the checklist on this page as a guide).

Emergency contact details

Life threatening emergencies 000

Police/fire/ambulance (mobiles 000 and 112)

State Emergency Service (SES) 132 500

Energex 13 19 62

Brisbane City Council 3403 8888

Check Council's website (brisbane.qld.gov.au), Facebook page (facebook.com/BrisbaneCityCouncil) and Twitter feed (@brisbanecityqld) for regular updates during an emergency event.

The Queensland Government will also update its alert website (qldalert.com) during a flood or other emergency event.

Check the Queensland Police Service Facebook page (facebook.com/QueenslandPolice) or Twitter feed (@qpsmedia) for regular updates.

Brisbane City Council excludes all liability to any person arising directly or indirectly from using this flood preparedness guide, titled *Flooding in Brisbane – A guide for residents*, and any information or material cited in it. The information in this guide is general information provided to help you decide if you need professional advice relevant to your particular situation.

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Brisbane Qld 4001



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An aerial photograph of Brisbane, Australia, showing the city's layout along the river. A vertical scale on the right side of the image indicates heights in meters, ranging from 1 to 2. The title 'Flooding in Brisbane' is prominently displayed in white text on an orange background, with the subtitle 'A guide for businesses' below it.

Flooding in Brisbane

A guide for businesses

Brisbane is a thriving, world-class city, enjoyed by residents and visitors. Like many cities around the world, Brisbane has been built on a floodplain. This means we need to be prepared for flooding and the impact it can have on our homes, families and businesses.

Through smart planning and building across the city, our thriving industrial and commercial precincts have expanded and developed around our many waterways. Our growing economy, combined with our warm, sub-tropical climate, is a major attractor for the many new businesses and residents arriving in Brisbane each year.

However, with these benefits come the natural risks of living with flooding. Although we can never remove the risk, the impacts of these events can be minimised through good planning and preparation.

Flooding can affect your business, either directly through water damage to premises, stock and equipment, or indirectly through disruptions to power, communication and transport services. We all have a role to play in minimising the impact of flooding. There are many simple things businesses can do to prepare themselves, their workforce and their customers.

Be prepared for flooding

Don't wait until it's too late. Council has a range of free tools and information that can help businesses understand their potential flood risk and how to be prepared.

It is important to identify your flood risk, understand how a flood might affect the area your business is located in and what to do to ensure business continuity.

Interactive Flood Awareness Map – Identify the flood risk for your business location.

Flood Awareness Map – Download a printable Flood Awareness Map for your business.

Flooding in Brisbane guide – Use this guide to help prepare for flooding and to minimise flood risk to your business.

Interactive Flood Source Map – Identify the type or sources of flooding that may affect your business.

Interactive Historical Flood Map – Learn about the history of Brisbane's major river floods.

FloodWise Property Report – Download a FloodWise Property Report for flood information relating to building, renovating or fit-outs for your business.

Council's Business Hotline – Phone 133 BNE (133 263) 24 hours a day, seven days a week to discuss how to prepare your business for an emergency.

All of these products are available to download or view on Council's website. Visit www.brisbane.qld.gov.au/beprepared or call Council on (07) 3403 8888 or visit your nearest Council regional business centre.

Don't wait until it's too late. Be prepared.



Dedicated to a better Brisbane

The Flood Awareness Maps include flooding from all sources: creek, river, overland flow and storm tide.

All floods are different and may occur from one or a combination of these four sources.



Creek flooding

happens when intense rain falls over a creek catchment. Run-off from houses and streets also contributes to creek flooding. The combination of heavy rainfall, run-off and the existing water in the creek causes creek levels to rise.



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FloodWise Property Report

Use the FloodWise Property Report for flood information relating to building, renovating or fit-outs for your business.

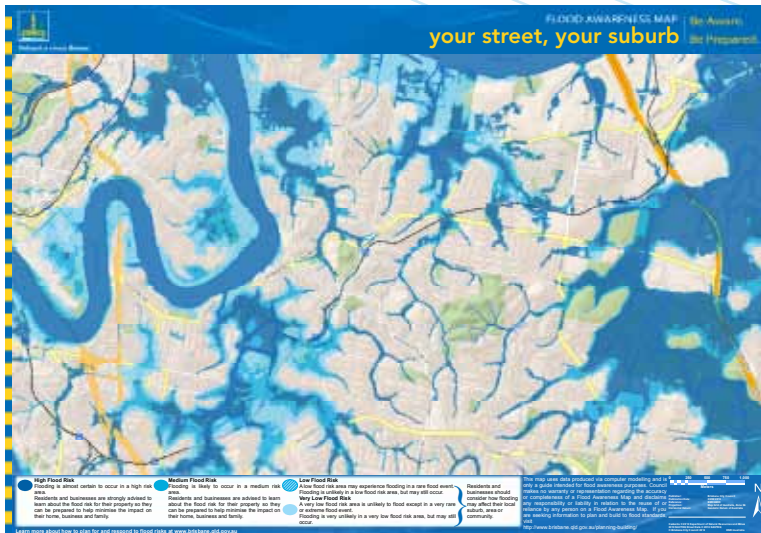
If you are in the high or medium flood risk area, it is likely that there are building requirements for developing or fitting-out a premises to ensure your new development addresses potential flooding issues. The FloodWise Property Report provides estimated flood levels for all properties in Brisbane.

Visit www.brisbane.qld.gov.au/planning-building, call Council on (07) 3403 8888 or visit your nearest Council regional business centre for a FloodWise Property Report specific to the property location of your business.

Be prepared and make a plan

It makes good business sense to have a plan to minimise the impact of flooding on your business, regardless of whether your business is in a high, medium, low or very low flood risk area.

Talk to your insurer about flood insurance for your business.



Use Council's Flood Awareness Maps to determine the flood risk for your business

Council's Flood Awareness Maps help you understand your business' flood risk. Visit www.brisbane.qld.gov.au/beprepared, call Council on (07) 3403 8888 or visit your nearest Council regional business centre to identify your business' potential flood risk.

What do all these areas on the Flood Awareness Maps mean?

The Flood Awareness Maps are an awareness tool to provide an indication of the likelihood of a flood occurring from one or more sources: creek, river, overland flow and storm tide. The maps do not provide information about the depth or speed of flood water. Use the FloodWise Property Report for information about flood levels specific to your property. Visit www.brisbane.qld.gov.au/planning-building

High flood risk

Flooding is almost certain to occur in a high risk area. Residents and businesses are **strongly advised** to learn about the flood risk for their property so they can be prepared to help minimise the impact on their home, business and family.

Medium flood risk

Flooding is likely to occur in a medium risk area. Residents and businesses are **advised** to learn about the flood risk for their property so they can be prepared to help minimise the impact on their home, business and family.

Low flood risk

This area may experience flooding in a rare flood event. Residents and businesses **should consider** how flooding may affect their local area, suburb or community. Flooding is unlikely in a low flood risk area, but may still occur.

Very low flood risk

This area is unlikely to flood except in a very rare or extreme flood event. Residents and businesses **should consider** how flooding may affect their local suburb, area or community. Flooding is very unlikely in a very low flood risk area, but may still occur.



How to prepare for flooding

All businesses should have a business continuity plan to ensure their business can operate if something unforeseen like a severe weather event, fire, or natural disaster should happen.

Below are some guidelines to help your business, employees and customers to be safe and ready for potential flood impacts.

You can find more practical advice and templates to help you complete an emergency plan at www.business.qld.gov.au

INSURANCE

- Check your business insurance policies – are you insured for flood damage, business disruption and lost income?

BUSINESS CONTINUITY

- Have a plan for stock or other equipment that needs special protection from floodwaters. If relocating equipment ensure you store them in an area that will not be affected by flood waters.
- Develop a business continuity plan to use if you are unable to return to your business for a period of time. Consider if there is somewhere else you and your staff can continue to work from.
- Ensure all computer files are backed up off-site so you can still access them in the event your workplace computers are damaged or inaccessible for a period of time.
- Have a process in place for accounting – payroll, banking, accounts payable and receivable.
- Make a list of the essential items you need to run your business if you can't access your workplace. Can you keep backups or spares?
- Think about what help you will need after a flood. If you have warning, make arrangements in advance to line up help and support. This may save you time and money after a flood.
- Consider after hours and emergency phone numbers that can be used if you can't access your workplace – how easily can these be communicated via a voicemail message, website or social media?

EMPLOYEES, SUPPLIERS AND CUSTOMERS

- Make a list of contact details for all members of your workforce. This should include mobile phone, email, and an emergency contact who may know their whereabouts should they not be contactable.
- Position emergency numbers for employees and suppliers in a readily-accessible place.
- Make a contact list of key suppliers and customers who may be affected by your business being flooded. For example, would you need to cancel any regular deliveries?
- Consider whether your staff need special assistance to evacuate in an emergency. For example, sight or hearing impaired, people with a disability, elderly.
- Have a process to inform all staff of an emergency evacuation. Consider an evacuation warning system and meeting point.
- Arrange staff training and regular evacuation drills.

EMERGENCY AND EVACUATION PLANS

PREPARATION

- Keep a record of your security procedures – what needs to be done before exiting the premises? Do windows/doors need to be locked? Is there an alarm that needs to be set? Make sure you have staff who know what to do.
- Develop an evacuation plan and display the maps.
- Prepare an emergency kit using the emergency kit contents checklist on the back page.
- Conduct regular practice evacuation drills with staff.

DURING AN EVENT

- Activate call diversions and/or set up a message service.
- Erect signage on doors advising of closure periods and alternate contact details.
- Turn off electricity, gas and water.
- Activate data backup and computer security.
- Secure doors and windows.
- Pay attention to radio, television and online news weather updates.



UTILITIES

- Make a list of important contacts (telephone and email), including building supervisors and owners, and electricity, water, gas, and telephone providers.
- Know what you need to do to make your workplace safe – where do you turn off power, water, gas? These should be marked on a map with any necessary instructions, and kept with your emergency plan.

HAZARDOUS MATERIALS

- If you have hazardous chemicals, oil or other substances, make sure they are stored safely from floods and other hazards. This might also include garbage that could become rotten if left for a period of time.
- Visit www.brisbane.qld.gov.au and search **hazardous waste disposal** for requirements on how to appropriately dispose of hazardous materials.

UNDERSTAND BRISBANE'S CLIMATE AND WEATHER PATTERNS

- Listen to weather reports to check if storms or heavy rain are forecast.
- Visit www.bom.gov.au to check weather radars and forecasts for the Brisbane area.

UNDERSTAND YOUR LOCAL AREA

- When it rains heavily, watch where the water comes from and where it goes.
- Consider your location. Is your business close to a river, creek, gully, or tidal waterway that may cause flooding? If you are located close to a creek, water may move quickly through your business during a flood. Consider how this may affect your preparation plans.
- Consider how local roads or areas that flood frequently during heavy rainfall may affect access to your business for you, your workforce, and your customers.

USE LOCAL KNOWLEDGE

- Ask local traders and businesses what their flood experience is in your area, and share your knowledge with other local businesses. This will also help build a local network so you can pool resources and help each other if a flood occurs.

Never drive through or enter floodwaters.

Many businesses located within a medium flood risk area were affected by flooding in the 1974 and 2011 Brisbane River floods.

Check Brisbane's City Plan if you are building or renovating.
www.brisbane.qld.gov.au/planning-building

Don't wait until it's too late. Be prepared.

EMERGENCY KIT CONTENTS checklist

The following list is a guide to business information and supplies that can help if your business is evacuated. Use a waterproof container to house the following items.

- ❑ Have a hard copy list of important numbers including insurance policy numbers and emergency phone numbers (Council, SES, Police, fire and ambulance) – refer to the Emergency contact details.
- ❑ Important documents, e.g. business account information, credit cards, insurance paperwork.
- ❑ Valuables and computer backup data.
- ❑ Portable radio and torch with spare batteries.
- ❑ First aid kit.
- ❑ List of special needs and physical aids.
- ❑ Additional blankets, food, water and first aid (for staff that might be stranded).
- ❑ Spare set of master keys.

Emergency contact details

Life threatening emergencies 000

Police/fire/ambulance (mobiles 000 and 112)

State Emergency Service (SES) 132 500

Energex 13 19 62

Brisbane City Council (07) 3403 8888

During a flood you may also need to contact a range of people and services for help. Keep these numbers in your list of important contacts.

- Medical providers (doctor or hospital, health fund).
- Service providers (plumbers, electricians, gas and electricity providers, vet).
- Financial providers (bank, insurance provider, real estate agent).

Check Council's website (www.brisbane.qld.gov.au), sign up to our Facebook page (facebook.com/BrisbaneCityCouncil) and Twitter feed (@brisbanecityqld) updates during an emergency event.

The Queensland Government will also update its alert website (www.qldalert.com) frequently during a flood or other emergency event.

Sign up to the Queensland Police Service Facebook (www.facebook.com/QueenslandPolice) or Twitter feed (@qpsmedia) for regular updates.

More information about creating an emergency plan can be found at www.brisbane.qld.gov.au

Brisbane City Council excludes all liability to any person arising directly or indirectly from using this flood preparedness guide, titled *Flooding in Brisbane - A guide for businesses*, and any information or material cited in it. The information in this guide is general information provided to help you decide if you need professional advice relevant to your particular situation.

