

2-4 Kayuga Close, Caves Beach

Flood Risk Assessment

Prepared for: DJRD Unit Trust
Date: 27 July 2026
Prepared by: Stantec Australia Pty Ltd
Ref: 304001649

Stantec Australia Pty Ltd

Level 9, The Forum, 203 Pacific Highway, St Leonards NSW 2065
Tel: +61 2 8484 7000 Web: www.stantec.com

\\AU2028-PPFSS01\SHARED_PROJECTS\304001649\TECHNICAL\REPORTS\FLOOD IMPACT ASSESSMENT\304001649-00-RP-FL-CAVESBEACHFIA-DFT-V04.DOCX



Stantec Australia Pty Ltd
Level 9, The Forum, 203 Pacific Highway
Sydney NSW 2065
Tel: +61 2 9496 7700
ABN 17 007 820 322 www.stantec.com/au

Revision

Site Address: 2-4 Kayuga Close, Caves Beach

Real Property Description: Lot 3 & 4 / DP251324

Proposed Development: Construction of new ambulance station

Client: DJRD Unit Trust

Local Authority: Lake Macquarie City Council

Stantec Reference: 304001649-00-RP-FL-CavesBeachFIA-apr-v04

Stantec Australia Pty Ltd

Jacob Lee
Team Leader – Flooding & Drainage

Revision	Date	Comment	Prepared By	Approved By
001	16.08.23	Issue for Approval	LDS	JMB
002	22.09.2025	Issue for Approval	JL	AA
003	3.11.2025	Issue for Approval	JL	AA
004	27.07.2026	Issue for Approval	GF	JL

DISCLAIMER

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided to applicable authorities having jurisdiction and others for whom the Client is responsible, Stantec does not warrant the services to any third party. The report may not be relied upon by any other party without the express written consent of Stantec, which may be withheld at Stantec's discretion.

COPYRIGHT ©

This report is the property of Stantec, and is licensed to the Client for use on this project. Reproduction of this document for this project shall only be undertaken in full. Reproduction for other purposes without the permission of Stantec is prohibited.

[illegible]

Appendices

[REDACTED]

[REDACTED]

[REDACTED]

Introduction

Site Overview

The proposed development at 2-4 Kayuga Close, Caves Beach involves the construction of a new ambulance station to service the Swansea / Caves Beach area. The existing site consists of two (2) warehouse buildings with separate access driveways from Kayuga Close. An existing Ausgrid substation is located in the lot to the north of the site. The existing buildings are proposed to be demolished to make way for the proposed ambulance station. Refer to Figure 1 for an aerial view of the site.



Figure 1: Aerial View of the Site





Proposed Development

The proposed development consists of a single building with both internal and external car parking area. The entire building area is proposed to be raised above the existing ground levels to provide adequate flood protection to the new building. Refer to Appendix A.



Existing flood behaviour

The site is located adjacent to Plains Gully Creek which is a relatively small catchment subject to flash flooding (flooding within 6 hours of rainfall) as identified in the *Flood Studies for Eight Residual Lake Macquarie Waterway Tributary Catchments* (WMAwater, 2021).

Plains Gully Creek outlets to the entrance of Lake Macquarie (Swansea Channel) and is subject to estuarine flood mechanisms including high tides, wave run up and oceanic flooding components. The downstream flood behaviour in Swansea Channel is identified in the *Lake Macquarie Waterway Flood Risk Management Study and Plan* (WMAwater, 2012).



2. Methodology

2.1 Flood impact assessment

A flood impact assessment is undertaken using TUFLOW (hydraulic model software) using model files provided by Lake Macquarie City Council (LMCC). The model files provided were prepared for the *Flood Studies for Eight Residual Lake Macquarie Waterway Tributary Catchments* (WMAwater, 2021) (the catchment flood study) which is the latest flood study available for the Plains Gully Creek catchment.

The catchment flood study included the Plains Gully Creek catchment which runs south to north adjacent to the project site and ultimately discharges to Black Neds Bay and Swansea Channel at the entrance of Lake Macquarie.

This hydraulic model, being the latest hydraulic model to assess flooding within the Plains Gully Creek catchment, was obtained from LMCC to undertake a flood impact assessment for the site and determine flooding characteristics including depths, velocities, hazard, direction, duration and warning. No changes were made to the flood model obtained from LMCC, except for the incorporation of detailed survey (refer Appendix B).

The flood behaviour is identified for the pre-development and post development scenario. The post development scenario includes representation of the civil design surface provided by ACOR Consultants Pty Ltd to represent the schematic design surface (refer Appendix C).

2.2 Flood hazard classification

General flood hazard vulnerability classifications are identified in accordance with the *Australian Disaster Resilience Guideline 7-3 Flood Hazard*. The classifications are divided into six (6) categories; H1 – H6, as shown in Figure 2.

A flood hazard classification of between H1 and H4 is equivalent to a low hazard in the NSW Floodplain Development Manual 2005. A H5 to H6 flood hazard is equivalent to a high hazard.

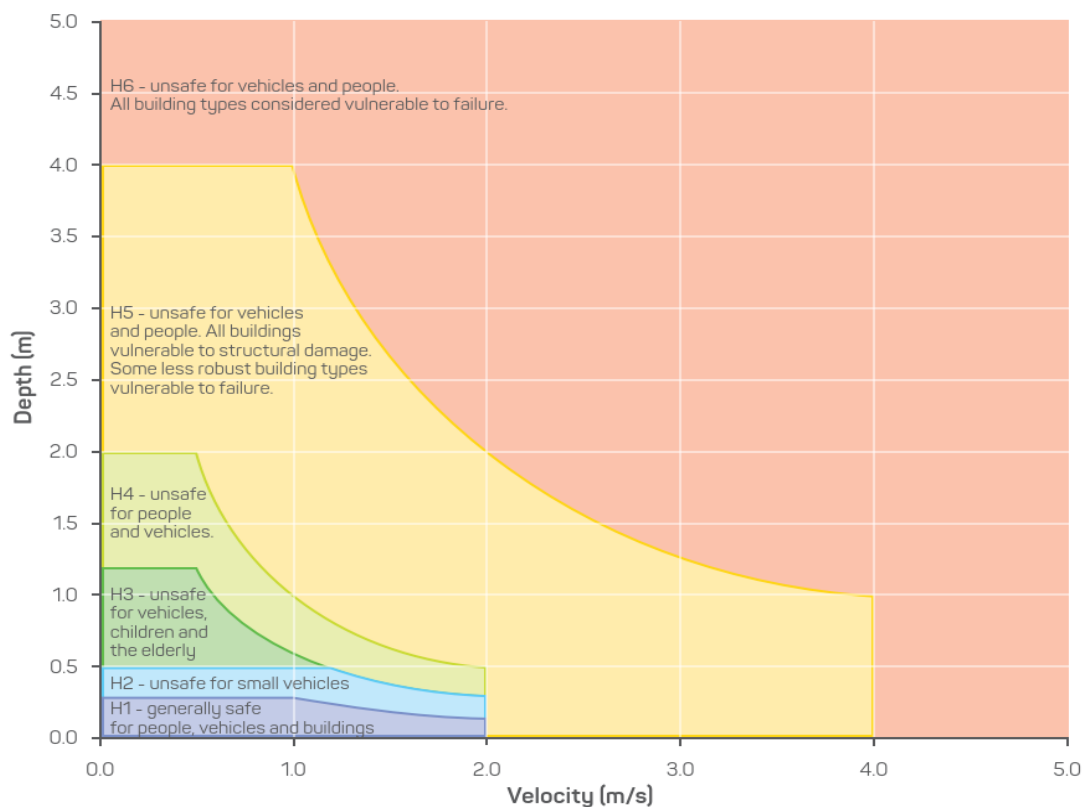


Figure 2: Flood (AIDR, 2017)



Emergency Management

The primary response is the evacuation of people and vehicles from the premises prior to a flood occurring (for Lake Macquarie waterway and Swansea Channel flooding). The secondary response — intended as a backup to the primary response and for flash flooding from Plains Gully Creek — would involve people leaving their vehicles in the carpark and sheltering in place (SIP) within the building envelope structure for only a few hours. This would only be required if evacuation is incomplete when flooding approaches hazardous levels.

Boundary condition

The catchment flood study had the objective of identifying pluvial (overland) flooding and applied a 20% AEP ocean level of 1.24mAHD as a static boundary. To maintain consistency with the model adopted by Council this boundary condition was applied to identify the flood planning level and inform the flood impact assessment.

An additional scenario was included which applies the 1% AEP ocean boundary in accordance with the *Modelling the Interaction of Catchment Flooding and Oceanic Inundation in Coastal Waterways* (Office of Environment and Heritage, 2015). Site specific information was included from the lake flood study which found that the wave set-up component would be limited to 0.2m from ocean derived waves and 0.05m from wind driven waves. Climate change was also considered by increasing the ocean water level by 0.9m. This results in a peak ocean boundary of 2.6mAHD.



Flood Assessment



Flood extent

The site is located outside the 1% AEP flood extents and is completely inundated in the PMF flood event, with relatively shallow depths fronting Kayuga Close and increasing to approximately 350mm at the rear of the site adjacent to PGC.

Refer Appendix A for pre-development and post development flood extent hydraulic model results.



Flood Velocity

The velocity of floodwaters that could potentially affect the project site was assessed based on the hydraulic modelling. Again, the site is located outside the 1% AEP flood extent. A peak flood velocity of 1.5m/s is observed adjacent to the north-east of the proposed ambulance station in a small, localised area. The majority of the site experiences flood velocities of less than 0.8m/s.

Refer Appendix A for pre-development and post-development flood velocity hydraulic model results



Flood Hazard

Refer to Appendix A for pre-development and post development peak flood hazard classification model results based on the AIDR hazard classifications.

The existing site is classified as low hazard H1-H2 in the PMF. Kayuga Close is classified as a H3 hazard in the PMF; however, this flood hazard is not experienced for extended periods of time, with H3 classification observed 30 minutes into the critical duration storm event and reducing to a H1-H2 hazard 75 minutes following the storm burst.

Strathmore Road is classified as a H5 hazard in the PMF storm event at the Plains Gully Creek crossing. This hazard classification is not observed for extended periods of time during the critical duration PMF.

Refer to Table 1 and Table 2 for the maximum flood hazard classification over 5-minute intervals for a period of time in Kayuga Close and Strathmore Road, respectively, in the critical PMF flood event.



Table 1: Kayuga Close – Maximum Flood Hazard Classification During PMF Event (within trafficable section of road)

Storm Duration (min)	Hazard Classification (5-minute Interval)																											
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120			
030	H1			H2			H3									H2						H1						

Table 2: Strathmore Road – Maximum Flood Hazard Classification During PMF Event (within trafficable section of road)

Storm Duration (min)	Hazard Classification (5-minute Interval)																									
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	
030	H1		H2	H3	H5										H4			H3		H2				H1		

H1	Generally safe for vehicles and people	H4	Unsafe for all people and vehicles
H2	Unsafe for small vehicles	H5	Unsafe for vehicles and people
H3	Unsafe for vehicles, children, elderly	H6	Unconditionally dangerous

Access to the site from Strathmore Road will be cut off for approximately 60 minutes (H4-H5 hazard) in the PMF flood event. A maximum flood hazard of H4 is observed in the 1% AEP event which recedes within a short duration.



Only the critical duration storm durations are identified in this study, which are the 120 minute duration (Temporal Pattern 4640) for the 1% AEP and 30 minute duration for the PMF. The flood study (WMAwater, 2021) identifies the depth of inundation over Strathmore Road for a full range of flood events Table 3.

Table 3 Strathmore Road Inundation for full range of flood events

Road crest (mAHD)	20% AEP Flood depth (m)	10% AEP Flood depth (m)	5% AEP Flood depth (m)	2% AEP Flood depth (m)	1% AEP Flood depth (m)	0.5% AEP Flood depth (m)	0.2% AEP Flood depth (m)	PMF
2.60	0.12	0.26	0.37	0.5	0.59	0.66	0.75	1.38

Assuming an 80 year lifespan for the development:

- Strathmore Road has a 100% chance of being inundated by shallow waters at least once (20% AEP event)
- Strathmore Road has an 80% chance of being inundated by deep waters at least once (2% AEP event)

The flood study only identifies flooding associated with Plains Gully Creek in shorter duration events; however, Strathmore Road is also liable to flooding from elevated levels in Lake Macquarie waterway and the Swansea Channel due to intense widespread rainfall over the Lake Macquarie catchment and elevated sea levels during high astronomic tides, storm surge and wave setup and runup.

The PMF level identified in the *Lake Macquarie Waterway Flood Risk Management Study and Plan* (WMAwater, 2012) is 2.81mAHD in 2050 (considering 0.4m of sea level rise) and 3.27mAHD in 2100¹ (considering 0.9m of sea level rise).

The hydraulic model files associated with the *Lake Macquarie Waterway Flood Risk Management Study and Plan* were obtained and the PMF catchment rainfall scenario with a 1% AEP 2100 ocean boundary was modelled. It is identified that the peak PMF level of 3.27mAHD only occurs upstream of the Swansea Bridge. The peak PMF level downstream of Swansea Bridge (the site) is associated with an extreme storm surge ocean water level which is 2.60mAHD.

The peak water level of 2.60mAHD does not inundate Strathmore Road as shown in Appendix A.

Flood Impact

The development is located outside the 1% AEP flood extent and therefore there is no flood impact associated with the development for events up to and including the 1% AEP event.

The development results in a flood impact during the PMF as shown in Appendix A PMF Impact hydraulic model results. The finished floor of the development is shown to be dry except for the carpark which is affected by low hazard flooding during the PMF.

The development results in a 50mm reduction in flood levels to the west of the development, and a 50mm increase in flood levels to the east of the development. The increase is mostly localised within the Plains Gully Creek corridor however several adjacent lots are affected by flood level increases (refer PMF Impact (Pre-development – Post-development Flood level) plan in Appendix A). The flood level change only results in localised / disconnected increases to the hazard classification of affected properties in the post-development (refer PMF Impact (Pre-development – Post-development Flood Hazard) plan in Appendix A

It is noted that the properties are already observed to be liable to flooding during the PMF, and flood hazard classifications of the properties are not adversely increased. Based on merit, the flood impact should not be considered adverse or significant and should be allowable considering the benefits provided by a new ambulance station in the area.

¹ It is noted that the 3.27mAHD level reported in this study was not obtained from hydraulic model results, instead a 0.9m sea level rise factor was applied to the peak envelope of the PMF upstream and downstream of Swansea Bridge.

3.5 Flood planning level

The PMF flood levels (from Plains Gully Creek flooding) within the site is RL 3.4mAHD. As such, a floor level of RL 3.4mAHD has been applied to the proposed building, including the raised carpark at the rear of the site. As such, adequate protection will be afforded to the building to protect it from floodwaters entering the building and causing extensive damages. Additionally, all electrical installations shall also be located above the PMF flood level. The building structure envelope should be designed to cater for hydrodynamic and / or hydrostatic pressure from the floodwaters in the PMF event.



4. Emergency management

A shelter in place (SIP) emergency response strategy refers to the internal movement of residents in a development to areas above the probable maximum flood (PMF) before the development is inundated. The *Shelter in place guideline for flash flooding* (Department of Planning, Housing and Infrastructure, 2025) outlines requirements and considerations for the suitability of a SIP strategy in the context of proposed land use and catchment characteristics. The guidance is considered in Table 4.

Table 4 SIP requirements

SIP requirement	Consistency of proposed development
Does shelter in place align with existing emergency management strategies for the area, as determined through the flood risk management process and by the NSW SES	Evacuation is NSW SES's primary response strategy as detailed in Volume 1 of the Lake Macquarie City Flood Emergency Sub Plan (2022) (the local flood plan). The NSW SES identifies that Caves Beach "faces risks from high tides, storm surges, and heavy rainfall, with the highest flood level recorded at 1.25 meters AHD in 1949. Flooding is influenced by runoff, inflows from the Pacific Ocean via the Swansea Channel, and flash floods during intense rain, particularly when lake levels are high. King tides can also cause flooding in low-lying areas, especially near Bowman Street." Lake Macquarie City currently monitors and maintains a flash flood warning system for Lake Macquarie City Council Flood Warning Network; as well as the Flood Warning System which is operated by Manly Hydraulics Laboratory, and is linked to the Lake Macquarie Flood Watch MHLFIT. Flash flood warning systems provide some form of notification of flooding, however, they cannot always provide detailed information on the severity of the event, the location of rainfall (until it is occurring), or provide adequate lead time to communicate the warning to the community and allow for safe evacuation. These systems also increasingly use forecast rainfall, often prior to detection of rain on the ground or within a very short period of detected rainfall or rising water levels. They are therefore likely to provide limited timely advice to the community and issues with false alerts can be expected (Department of Planning and Environment, 2023). Refer to section 2.3.
Has evacuation off-site (the primary emergency management strategy) been investigated and determined to be unachievable	Yes. Off-site evacuation is not achievable due to the external access roads becoming inundated with high hazard floodwater (H5) within 30 minutes of the storm burst. This is not considered enough effective warning time and therefore evacuation off-site is determined to be unachievable.
Does the development include medical centres, emergency service and community facilities, and sensitive and hazardous land uses, some of which may not be suitable for shelter in place	Yes. The development includes emergency service facilities.
Shelter in place for greenfield development is not supported	Greenfield development is not proposed.



SIP requirement	Consistency of proposed development
Whether there is existing government developed flood warning systems that give advanced detailed forecasts of flash flooding to allow sufficient time to evacuate to the proposed refuge locations.	Yes. Lake Macquarie City Council maintains the Lake Macquarie City Council Flood Warning Network (Manly Hydraulics Laboratory, 2025) which provides rainfall and flood level monitoring data in the Lake Macquarie catchment. The monitoring network can be used to inform emergency response decisions during flooding.
Can the community effectively be informed of the risks associated with the emergency management strategy.	Yes, this can be imposed as a condition of the future development that employees are effectively informed, and appropriate drills are undertaken.
Detailed assessment of evacuation off-site (the primary emergency management strategy) to determine that evacuation off-site is not achievable.	Yes, a hydraulic model is used to identify that evacuation is not feasible due to lack of effective warning time.
The flood behaviour at the site, with consideration of climate change and assessment of the potential maximum duration of isolation up to and including the PMF to identify that: - flash flooding is the only flood risk present at the site, whether it be from overland flooding, local creek or riverine flooding, and - the flooding occurs within less than 6 hours from the commencement of causative rain and the duration of shelter in place due to isolation by floodwaters is less than 12 hours from the commencement of rainfall, and - the development is not subject to high hazard flooding (e.g. floodways, high hazard H5 or H6 areas) or surrounding roadways are not subject to high hazard flooding.	The site is vulnerable to flash flooding from Plains Gully Creek which may cut off the site 30 minutes following the onset of rainfall. The only roadway servicing the development is subject to high hazard (H5) flooding and may be damaged during the PMF resulting in longer durations of isolation. A secondary access to Gray Street is proposed which will provide access only affected by a low hazard during flash flood events. A business emergency plan will be prepared which will ensure workers and people using the facility during and after the upgrades are aware of the flood risk and there is a plan to prepare, respond and recover during a flood.
how shelter in place will be: - used as part of the site's emergency management response, including actions before, during and after sheltering in place, and - communicated to occupants and visitors of the building and how this communication will be maintained for the life of the development.	A business emergency plan will be prepared prior to the construction and operation of the proposed development. The plan is to outline responsibilities, and relevant parties should review and be familiar with their roles. Inductions will be held to educate staff on their role during a flood event. Future operators are to be educated on the potential flood risk and actions that will be undertaken during a flood event. As part of this education, evacuation drills will be conducted regularly to ensure residents are aware of the procedures for evacuation. Lessons will also be held and pamphlets provided that address flood risks and highlight dangerous behaviours during a flood event. These lessons could be based on materials available on the NSW SES website.
Table 12 of EM01 should be used to consider whether the risks could be effectively managed.	In the context of Table 12 of <i>Support for emergency management planning: Flood risk management guideline EM01</i> (Department of Planning and Environment, 2023), the development is Sensitive development used in emergencies. All new emergency response hospitals and emergency response headquarters should be located in areas of the floodplain that are lower risk and can be readily evacuated within the available time and with the available resources. The headquarters will be located above the PMF and evacuation will be managed through the business plan.



SIP requirement	Consistency of proposed development
An understanding of the secondary risks and how the proponent proposes they will be managed is outlined in the flood impact and risk assessment (FIRA). Secondary risks include medical emergencies, building fire, health and wellbeing.	Consideration needs to be given to how secondary risks will be managed for the duration of flooding. This will be included in the emergency plan.
The consent authority should reflect the following design criteria in relevant conditions of consent: - the floor level of the shelter in place part of the development be above the PMF, and - structural soundness for conditions in a PMF event, considering flood and debris forces, be verified by a suitably qualified structural engineer, and - area and access to the area does not rely on access to electricity, is self-directing, and have clearly marked internal access for all people on site, including consideration of access for potential occupants and/or visitors.	The finished floor of the development would be located above the PMF. A suitably qualified structural engineer will need to provide certification that the building can withstand the effects of floodwaters.
The consent authority may also consider the following design criteria when setting relevant conditions of consent depending on the scale and type of development: - protection from weather and appropriate heating and cooling - access to personal hygiene facilities such as a toilet - a minimum floor space of 2 m² per person - items for self-sufficiency that are stored, maintained and are regularly updated in an accessible location above the PMF, including sufficient drinking water and food for occupants, fire extinguishers, radios and torches with spare batteries, and a first aid kit with an automated external defibrillator (AED) - centralised communal shelters may be considered but must be freely accessible internally at all times and externally accessible during events - access is provided to on site systems that generate power of the shelter in place location during and after the event for a full range of flood events up to the PMF - detail how these requirements will be maintained and enforced for the life of the development.	The entire development will be located above the PMF and can include the design criteria identified.

The proposed development is a sensitive land use as an emergency service facility and should ideally be in an area of the floodplain that is lower risk and can be readily evacuated within the available time and with the available resources. A secondary access via Gray Street is proposed to provide access during flash flood events and the facility has been raised above the PMF. An appropriate business emergency plan will be prepared prior to operation of the facility during times of flood. Provided the secondary access is constructed and a suitable emergency plan prepared, there would not be a significant impact to the risk to the safety of the environment associated with the proposed works.



5. NSW State Emergency Service consultation

NSW State Emergency Service were notified under Part 2.2 Section 2.13 of the *State Environmental Planning Policy (Transport and Infrastructure) 2021* in relation to the proposed works.

NSW SES acknowledged that the proposed ambulance station is located above the PMF level at the site; however, it noted that flood depths and velocities on surrounding roads may affect vehicle stability, constrain evacuation and emergency response, and potentially result in isolation during larger flood events.

NSW SES also noted that access around Caves Beach may be affected by elevated levels in Black Neds Bay in combination with local runoff, with access reduced in the 1% AEP event and cut during a PMF event.

The advice recommends that the assessment consider flooding up to and including the PMF, climate change effects, site design and stormwater measures that reduce flood risk, flood awareness for staff and users, procedures for closing and securing the worksite when flood risk is forecast, preparation of a business emergency plan, and notification to NSW SES where road delays may affect emergency vehicle movements.

The proposed works consider the response of the State Emergency Service; the risk of flooding is considered for the PMF as well as climate change effects associated with sea level rise. A business emergency plan will be prepared and ongoing consultation with the State Emergency Service would be undertaken as required.



6. Recommendations

6.1 Flood planning level

The ambulance station should be set at a floor level of RL 3.4mAHD, which is the maximum flood level within the site in the PMF flood event. Furthermore, all critical infrastructure shall be located above the PMF flood level.

The proposed building envelope structure is to be designed to withstand the hydrostatic pressures experienced in the PMF flood event to protect the building from damage and/or failure; this must also take into account the effects of erosion and scour. Materials must be capable of resisting damage, deterioration, corrosion or decay, taking into account the likely time the material would be in contact with flood water and the likely time it would take for the material to subsequently dry out. This must be considered for structural purposes including, but not limited to, load bearing columns, bracing members, structural connections, fasteners, wall framing members, and the like.

All electrical switches must be located above the PMF flood level. All electrical conduits and cables installed below the PMF flood level must be waterproofed or placed in waterproof enclosures. Ductwork, tanks, gas storage cylinders and the like must be placed above the PMF flood level or anchored to resist flood-related actions.

6.2 Emergency management

A business emergency plan is to be prepared prior to construction and operation of the proposed development. The plan should address flood preparedness, response and recovery procedures; identify triggers for evacuation, shelter in place and worksite closure; outline responsibilities for staff and facility managers; include procedures for monitoring Bureau of Meteorology warnings and other available flood warning information; and require workers and facility users to be made aware of flood risk through inductions, signage and regular training. The plan should also include procedures for securing materials and equipment prior to forecast flooding and for notifying NSW SES where significant road delays or closures may affect emergency vehicle movements.

6.3 Emergency access

As identified in section 3.3, Strathmore Road is liable to flooding in events as frequent as 20% AEP. An alternative access route has been investigated through a connection to Gray Street. The low point of Gray Street (approximately 1.3mAHD) is located lower than Strathmore Road so is less reliable during Lake Macquarie flooding however it has a smaller upstream local catchment so is cut off by lower hazard classification (H4) during Plains Gully Creek PMF (refer Post-development PMF Hazard Classification plan in Appendix A). The secondary access to Gray Street should be retained in the design and delivered prior to operation of the facility.



7. Conclusion

A flood impact assessment has been prepared for the proposed ambulance station at 2-4 Kayuga Close, Caves Beach using the hydraulic model files associated with the *Flood Studies for Eight Residual Lake Macquarie Waterway Tributary Catchments* (WMAwater, 2021), which is the latest available flood study for the Plains Gully Creek catchment. The assessment has considered existing and post-development flood behaviour, including flood extent, level, velocity, hazard, flood impact, emergency access and emergency management requirements.

The site is located outside the 1% AEP flood extent but is affected by flooding during the PMF. The proposed finished floor level and critical infrastructure are to be located above the PMF flood level of RL 3.4mAHD, which provides flood immunity for the building during the full range of assessed design flood events. The assessment identifies localised changes in PMF flood levels adjacent to the development; however, these changes occur in areas already affected by PMF flooding and do not result in an adverse increase in flood risk to surrounding properties.

NSW State Emergency Service consultation has been undertaken under Part 2.2 Section 2.13 of the *State Environmental Planning Policy (Transport and Infrastructure) 2021*. The building is located above the PMF level, however surrounding roads may be affected by flood depths and velocities that could constrain evacuation, emergency response and vehicle stability, and may result in isolation during larger flood events.

These risks are to be mitigated through implementation of the recommendations in this report, including construction of the secondary access to Gray Street, preparation and implementation of a business emergency plan, flood awareness measures for staff and facility users, monitoring of flood warning information, procedures for closing and securing the worksite when flood risk is forecast, and notification to NSW State Emergency Service where significant road delays or closures may affect emergency vehicle movements.

Subject to the recommended flood planning level, structural design, emergency management and access measures being implemented, the proposed development is considered capable of appropriately managing flood risk for the site and surrounding area. On this basis, the proposed ambulance station is considered acceptable from a merit based flood risk perspective. There will be no significant impact on the matters of flood risk in regard the safety of the environment.



8. References

- AIDR. (2017). *Australian Disaster Resilience Guideline 7-3 Flood Hazard*. Australian Institute for Disaster Resilience.
- Department of Planning and Environment. (2023). *Support for emergency management planning: Flood risk management guideline EM01*. Parramatta: Environment and Heritage Group, Department of Planning and Environment.
- Department of Planning, Housing and Infrastructure . (2025). *Shelter in place guideline for flash flooding* .
- Manly Hydraulics Laboratory. (2025). *Lake Macquarie FloodWatch*. Retrieved from <https://www.mhl.nsw.gov.au/users/LakeMac/>
- Office of Environment and Heritage. (2015). *Modelling the Interaction of Catchment Flooding and Oceanic Inundation in Coastal Waterways*.
- WMAwater. (2012). *Lake Macquarie Waterway Flood Risk Management Study and Plan*.
- WMAwater. (2021). *Flood Studies for Eight Residual Lake Macquarie Waterway Tributary Catchments* . Lake Macquarie City Council.



9. Appendices



Appendix A Hydraulic model results



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Pre-development 1% AEP Flood Extent

Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_Pre1pcFloodExtent

Legend

- Site
- Watercourse
- Cadastre
- Flood level contour (mAHD)

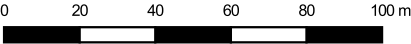
Flood depth (m)

- 0.0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

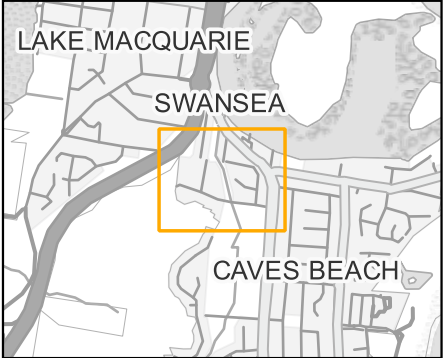
DRAFT - Not For Construction

Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



Scale at A3: 1:2000



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Pre-development 1% AEP Flood Velocity

Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_Pre1pcFloodVelocity

Legend

- Site
- Watercourse
- Cadastre

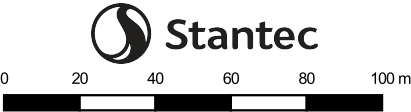
Flood velocity (m/s)

- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4

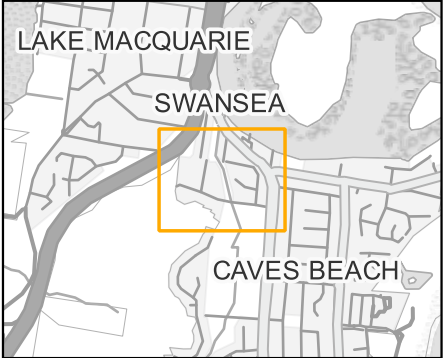
DRAFT - Not For Construction

Notes:
1. Map displayed in GDA94 / MGA zone 56

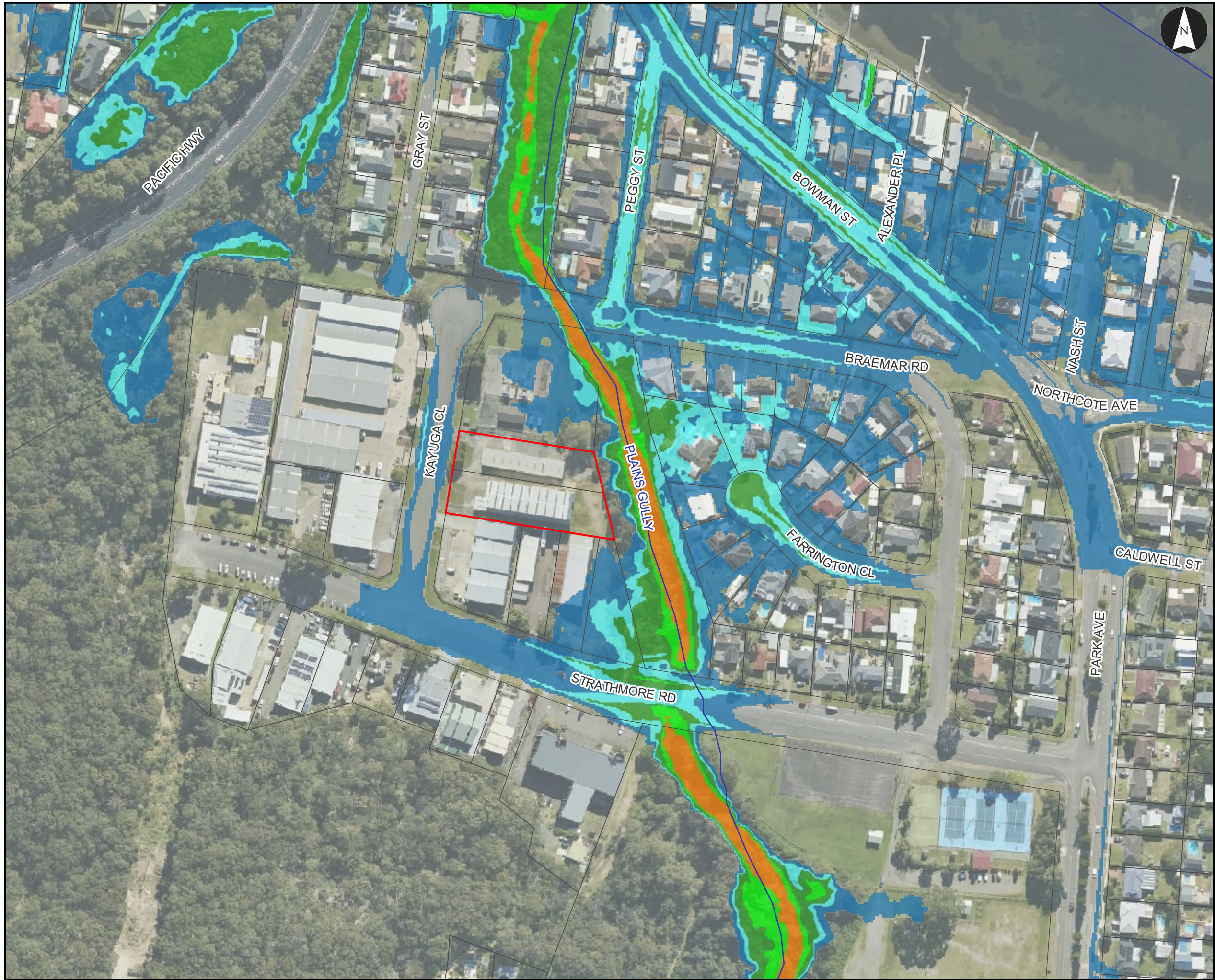
References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



Scale at A3: 1:2000



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Pre-development 1% AEP Flood Hazard Classification
Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_Pre1pcFloodHazard

Legend

- Site
- Watercourse
- Cadastre

Hazard classification

- H1
- H2
- H3
- H4
- H5
- H6

DRAFT - Not For Construction

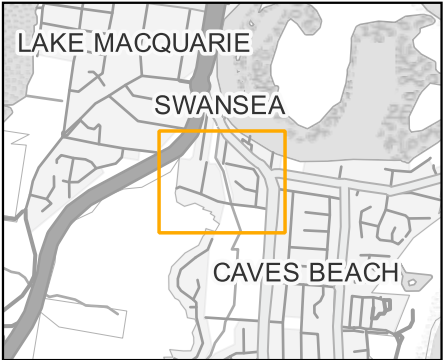
Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)

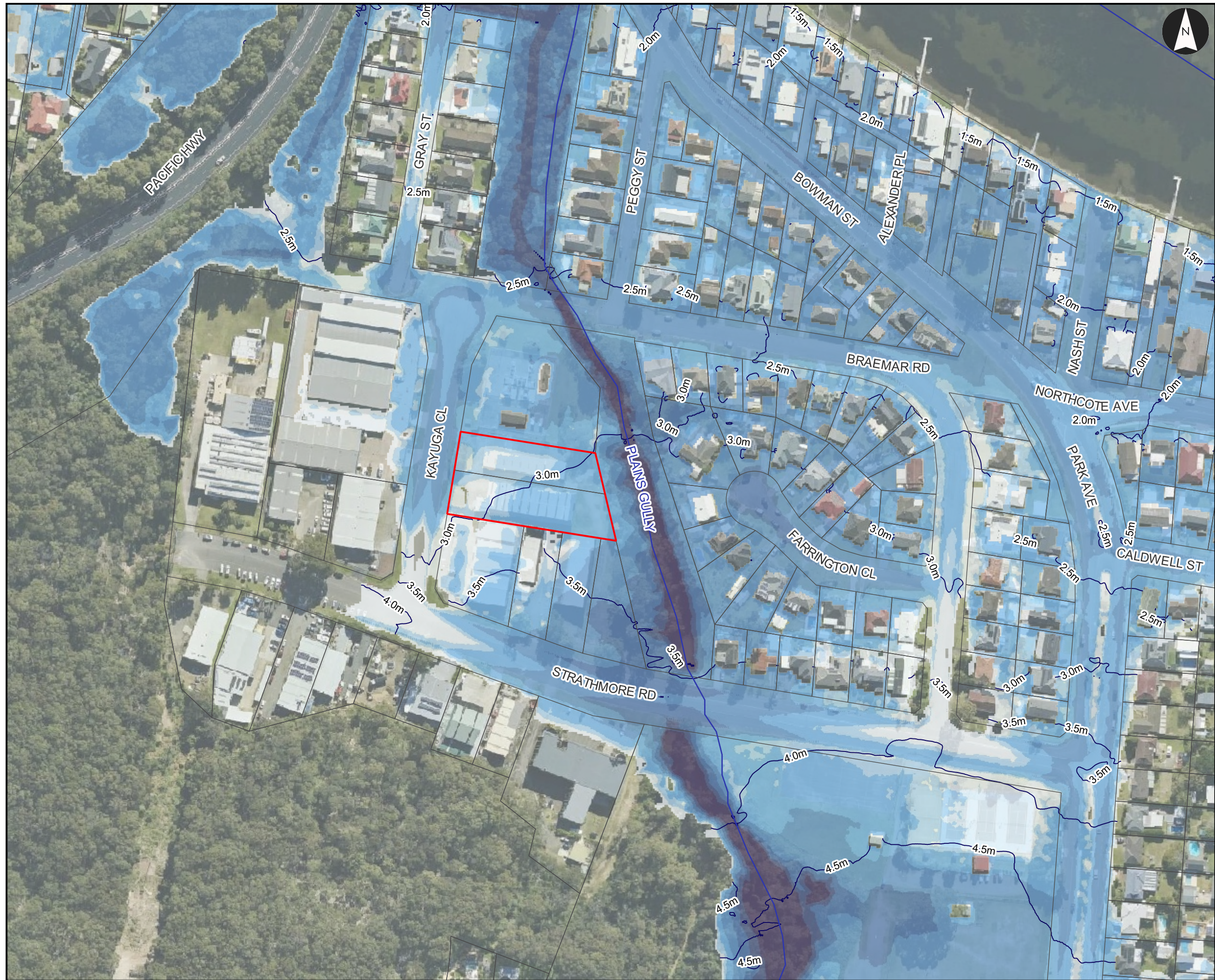


0 20 40 60 80 100 m

Scale at A3: 1:2000



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.gqz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Pre-development PMF Extent

Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_PrePMFExtent

Legend

- Site
- Watercourse
- Cadastre
- Flood level contour (mAHD)

Flood depth (m)

- 0.0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

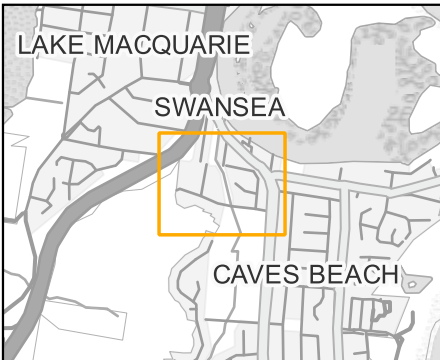
DRAFT - Not For Construction

Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



Scale at A3: 1:2000



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Pre-development PMF Velocity

Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_PrePMFVelocity

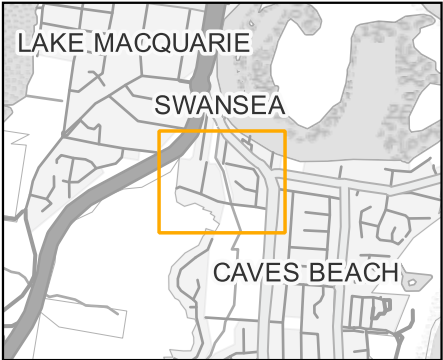
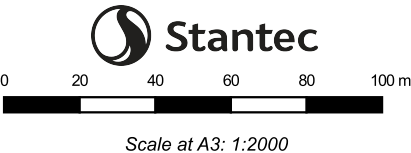
Legend

- Site
- Watercourse
- Cadastre
- Flood velocity (m/s)**
 - 0 - 1
 - 1 - 2
 - 2 - 3
 - 3 - 4
 - > 4

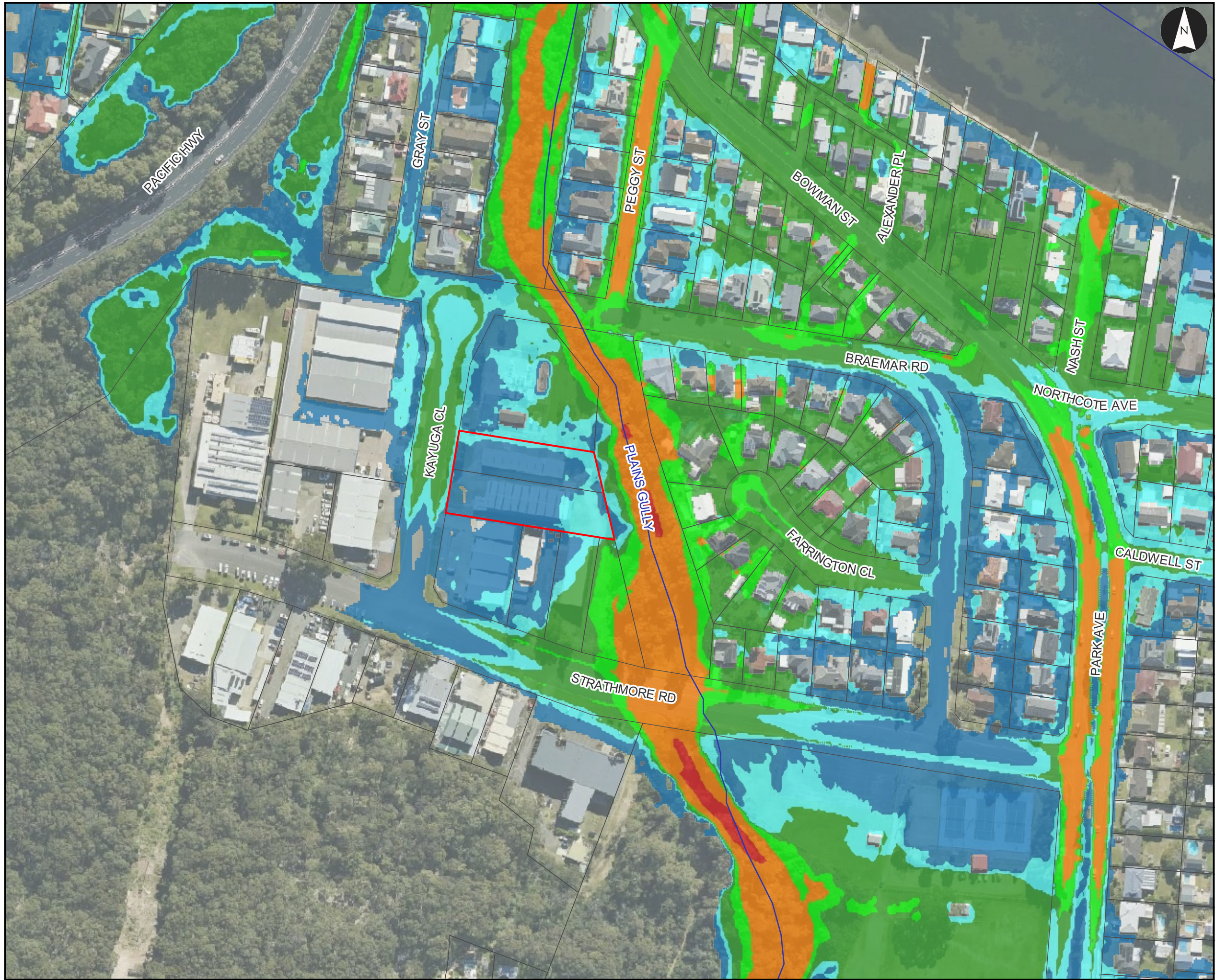
DRAFT - Not For Construction

Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Pre-development PMF Hazard Classification

Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_PrePMFHazard

Legend

- Site
- Watercourse
- Cadastre

Hazard classification

- H1
- H2
- H3
- H4
- H5
- H6

DRAFT - Not For Construction

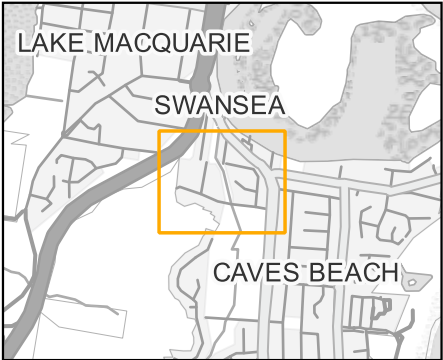
Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



0 20 40 60 80 100 m

Scale at A3: 1:2000



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Post-development 1% AEP Flood Extent
Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_Post1pcFloodExtent

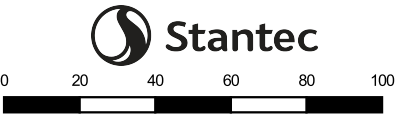
- Legend**
- Site
 - Watercourse
 - Cadastre
 - Flood level contour (mAHD)

- Flood depth (m)**
- 0.0 - 0.1
 - 0.1 - 0.2
 - 0.2 - 0.5
 - 0.5 - 1.0
 - 1.0 - 1.5
 - 1.5 - 2.0
 - > 2.0

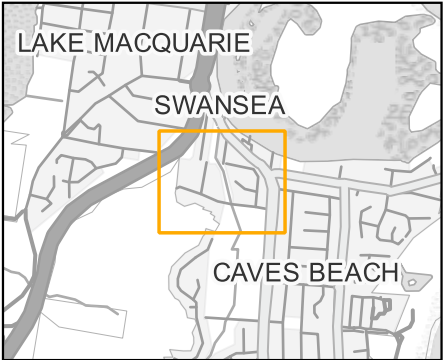
DRAFT - Not For Construction

Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



Scale at A3: 1:2000



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Post-development 1% AEP Flood Velocity
Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_Post1pcFloodVelocity

Legend

- Site
- Watercourse
- Cadastre

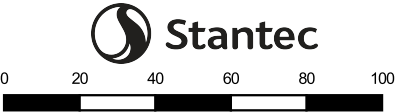
Flood velocity (m/s)

- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- > 4

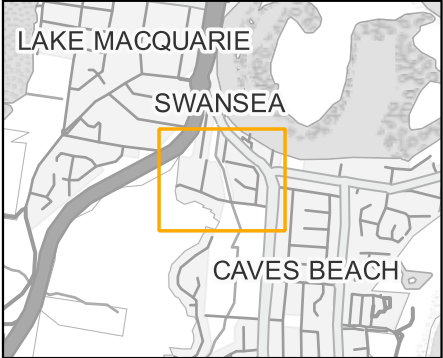
DRAFT - Not For Construction

Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



Scale at A3: 1:2000



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Post-development 1% AEP Flood Hazard Classification
Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_Post1pcFloodHazard

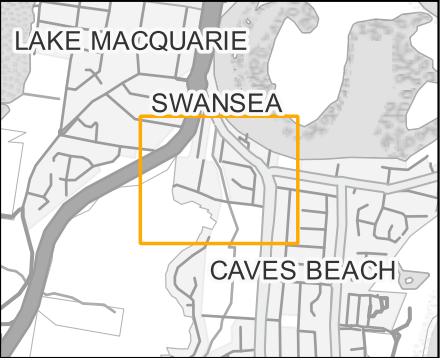
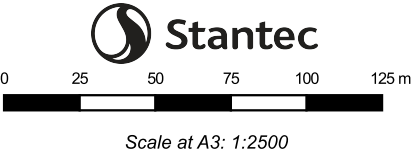
Legend

- Site
- Watercourse
- Cadastre
- Hazard classification**
- H1
- H2
- H3
- H4
- H5
- H6

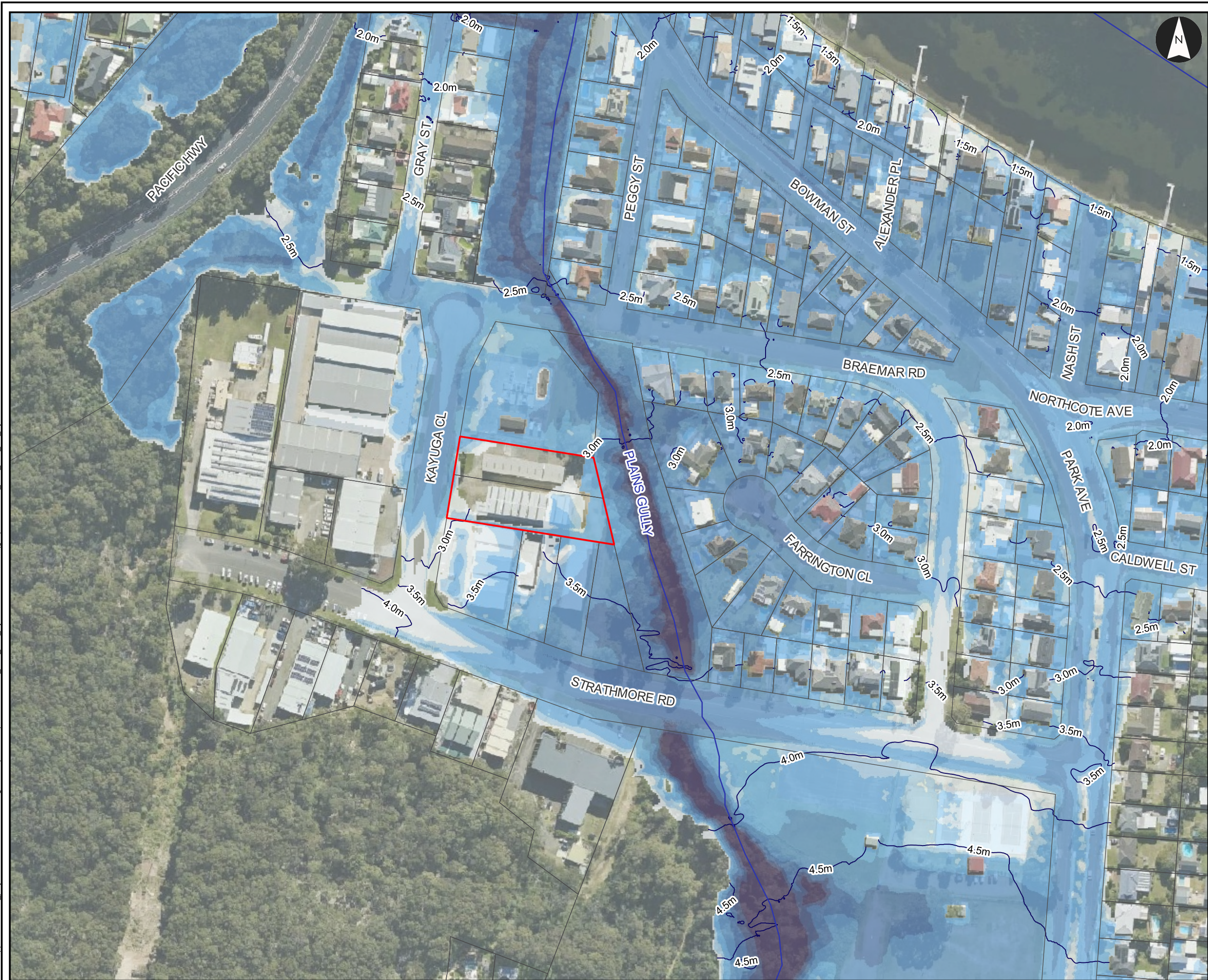
DRAFT - Not For Construction

Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Post-development PMF Extent

Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_PostPMFExtent

Legend

- Site
- Watercourse
- Cadastre
- Flood level contour (mAHD)

Flood depth (m)

- 0.0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

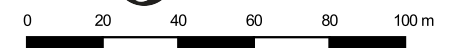
DRAFT - Not For Construction

Notes:

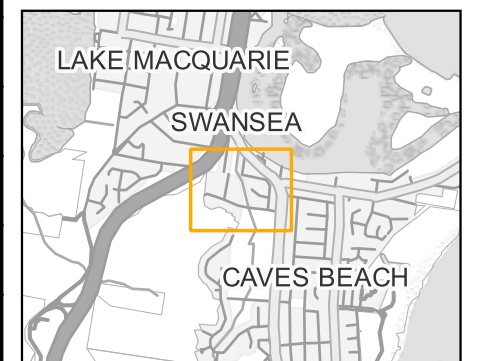
- Map displayed in GDA94 / MGA zone 56

References:

- Aerial imagery (MetroMap, September 2025)
- Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



Scale at A3: 1:2000



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Post-development PMF Velocity

Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_PostPMFVelocity

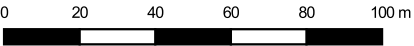
Legend

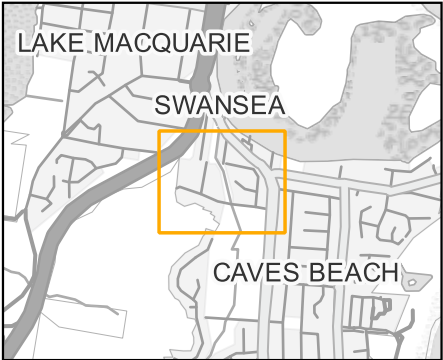
- Site
- Watercourse
- Cadastre
- Flood velocity (m/s)**
 - 0 - 1
 - 1 - 2
 - 2 - 3
 - 3 - 4
 - > 4

DRAFT - Not For Construction

Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



Scale at A3: 1:2000



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Post-development PMF Hazard Classification
Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_PostPMFHazard

Legend

- Site
- Watercourse
- Cadastre

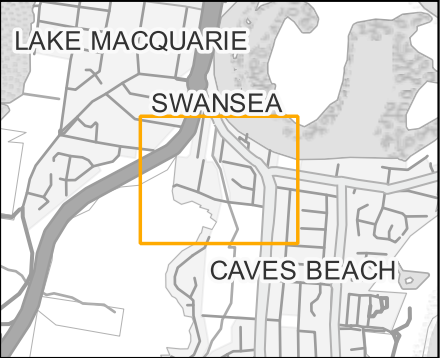
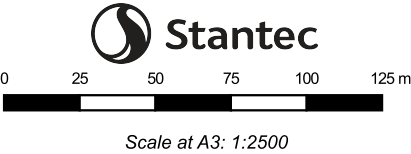
Hazard classification

- H1
- H2
- H3
- H4
- H5
- H6

DRAFT - Not For Construction

Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.gqz | 304001649_STN_Q01_DR_HydraulicModelResults 01



PMF Impact (Pre-development - Post-development Flood Level)
Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_PostPMFImpact

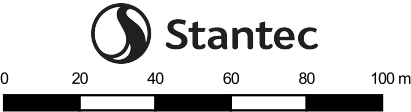
Legend

- Site
- Watercourse
- Cadastral
- Flood level difference (m)**
 - Was Wet Now Dry
 - < -0.3
 - 0.3 - -0.2
 - 0.2 - -0.1
 - 0.1 - -0.05
 - 0.05 - -0.02
 - 0.02 - 0.02
 - 0.02 - 0.05
 - 0.05 - 0.1
 - 0.1 - 0.2
 - 0.2 - 0.3
 - > 0.3
 - Was Dry Now Wet

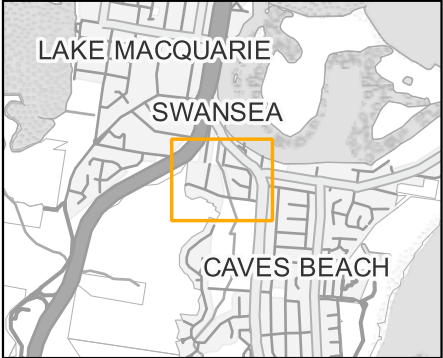
DRAFT - Not For Construction

Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastral (Department of Customer Service, Spatial Services, 2025)



Scale at A3: 1:2000



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.qgz | 304001649_STN_Q01_DR_HydraulicModelResults 01



PMF Impact (Pre-development - Post-development Flood Hazard Classification) 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_PostPMFHazardImpact

Legend

Site
Watercourse
Cadastre

Flood hazard classification difference

Was wet now dry
-2
-1
0
1
2
Was Dry now Wet

DRAFT - Not For Construction

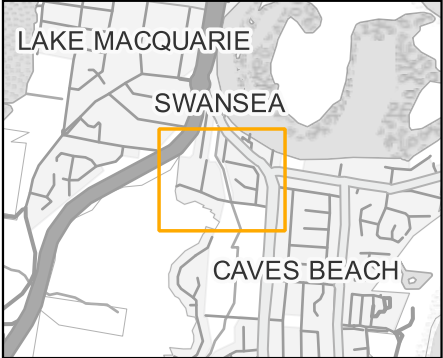
Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)

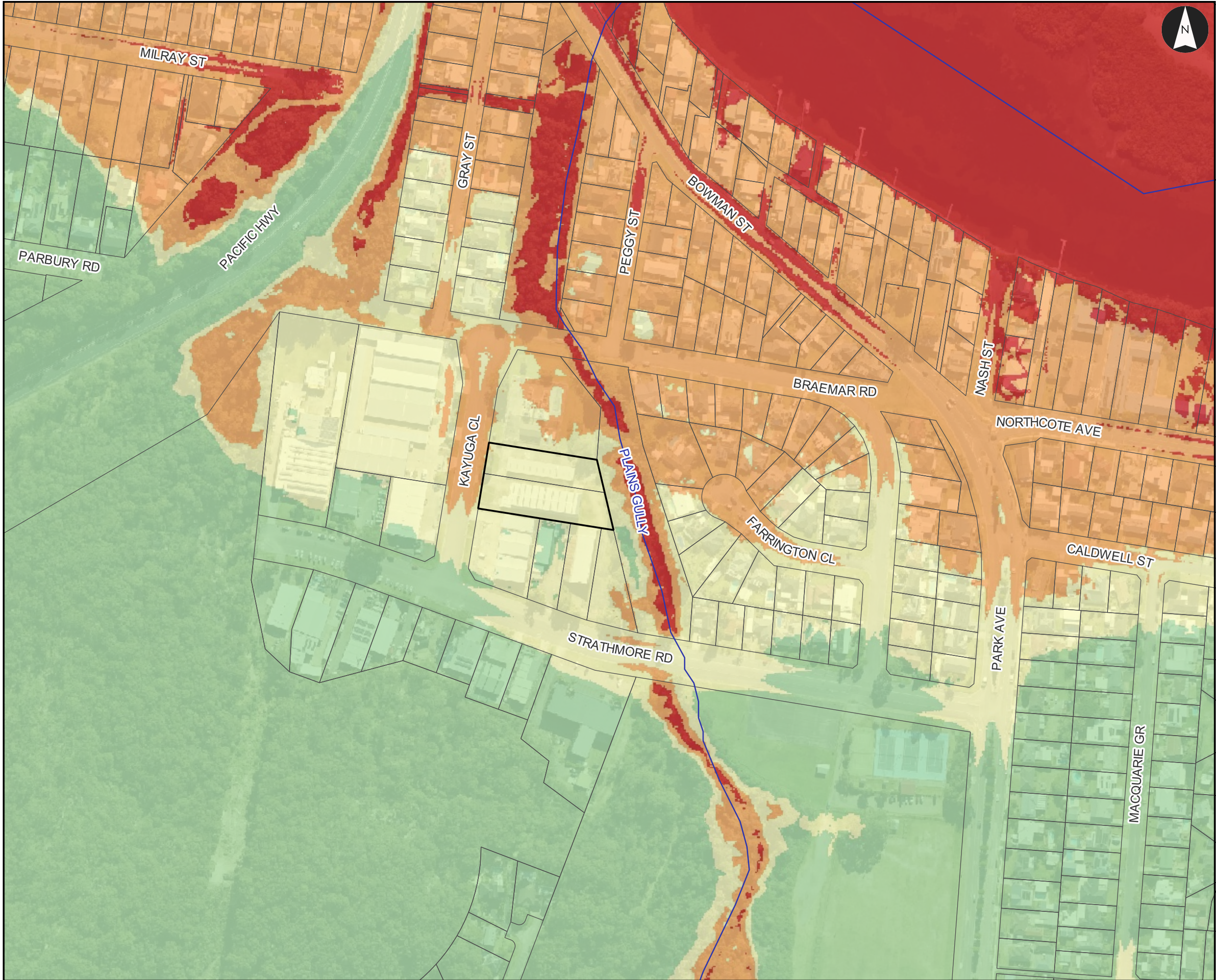
 **Stantec**

0 20 40 60 80 100 m

Scale at A3: 1:2000



\\au2028-pfss01\shared_projects\304001649\technical\gis\workspaces\Mapset\304001649_STN_Q01_HydraulicModelResults.gqz | 304001649_STN_Q01_DR_HydraulicModelResults 01



Elevation Classification

Caves Beach, NSW 2281

Project: 2-4 Kayuga Close Flood Assessment
Client: DJRD
Project Code: 304001649

Date: 2025-09-22 Rev: 02
304001649_STN_Q01_DR_ElevationClassification

Legend

- Site
- Watercourse
- Cadastre

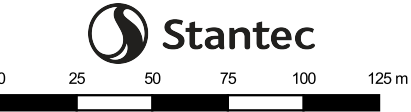
Elevation Classification (mAHD)

- $\leq 1.24\text{mAHD}$:
Below 20% AEP
Lake Macquarie Level
- $1.24\text{mAHD} - 2.32\text{mAHD}$:
Below 1% AEP 2100
Lake Macquarie Level
- $2.32\text{mAHD} - 3.4\text{mAHD}$:
Above 1% AEP 2100
Lake Macquarie Level
- $> 3.27\text{mAHD}$
Above Lake Macquarie PMF (2100)

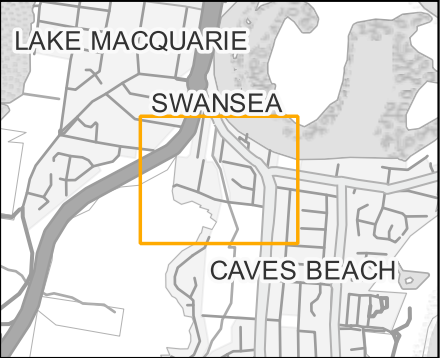
DRAFT - Not For Construction

Notes:
1. Map displayed in GDA94 / MGA zone 56

References:
1. Aerial imagery (MetroMap, September 2025)
2. Watercourse and Cadastre (Department of Customer Service, Spatial Services, 2025)



Scale at A3: 1:2500



Appendix B Survey



IMPORTANT NOTES

- ONLY VISIBLE SERVICES HAVE BEEN LOCATED BY SURVEY.
- THE POSITION OF THE UNDERGROUND SERVICES IS APPROXIMATE ONLY AND HAS BEEN SCALED FROM THE RELEVANT AUTHORITY'S SERVICES PLANS USING THE 'BEFORE YOU DIG AUSTRALIA' SERVICE. SEARCH DATE: 21/03/2023
- NOT ALL SERVICE INFORMATION MAY BE SHOWN DUE TO UNAVAILABILITY OF SERVICE PLANS OR CURRENT INFORMATION.
- INDEPENDENT ENQUIRIES FOR UP-TO-DATE SERVICE LOCATIONS THROUGH THE RELEVANT AUTHORITIES MUST BE UNDERTAKEN PRIOR TO COMMENCEMENT OF ANY WORKS/EXCAVATION. EXACT SERVICE POSITIONS SHOULD BE ESTABLISHED BY APPROPRIATE MEANS. WE RECOMMEND PROFESSIONAL SERVICE LOCATORS.
- THE BOUNDARIES SHOWN ON THIS PLAN ARE BASED ON OUR FIELD SURVEY. TO FORMALISE THESE DIMENSIONS, WE WOULD RECOMMEND THE PREPARATION OF A REDEFINITION PLAN, SUITABLE FOR LODGEMENT AND REGISTRATION WITH NSW LAND REGISTRY SERVICES.
- SOME BOUNDARIES SHOWN ON THIS PLAN ARE BASED ON INFORMATION DERIVED FROM NSW SPATIAL SERVICES- DIGITAL CADASTRAL DATABASE (DCDB). NO FIELD SURVEY HAS BEEN UNDERTAKEN TO DETERMINE THE ACCURACY OF THE BOUNDARIES AS SHOWN.
- THIS PLAN SHOULD NOT BE USED FOR BUILDING WORKS CLOSE TO OR ON THE BOUNDARY, OR TO PROSCRIBED SET-BACKS WITHOUT FURTHER SURVEY INVESTIGATION.
- CRITICAL LEVELS (E.G. FLOOR LEVELS) AND CRITICAL LOCATIONS (E.G. STRUCTURES) THAT HAVE NOT BEEN SHOWN MUST BE VERIFIED BY FURTHER SURVEY PRIOR TO FINAL DESIGN.
- NO EXCAVATIONS HAVE BEEN MADE TO DETERMINE THE EXTENT TO WHICH ANY SUBJECT WALLS, FOUNDATIONS OR FOOTINGS MAY ENCROACH UPON ADJOINING LAND.
- NO EXCAVATIONS HAVE BEEN MADE TO DETERMINE THE EXTENT TO WHICH ANY ADJOINING WALLS, FOUNDATIONS OR FOOTINGS MAY ENCROACH UPON SUBJECT LAND.
- ALL TREE DIMENSIONS, HEIGHT (H), CANOPY (C) AND TRUNK DIAMETER (D) HAVE BEEN ESTIMATED. IF ACCURATE DIMENSIONS ARE REQUIRED FOR DESIGN PURPOSES, FURTHER SURVEY SHOULD BE REQUESTED.
- CONTOURS SHOWN DEPICT THE TOPOGRAPHY. CONTOURS DO NOT REPRESENT THE EXACT LEVEL AT ANY PARTICULAR POINT, EXCEPT AT SPOT LEVELS SHOWN.
- THIS PLAN MUST REMAIN UNALTERED AS ISSUED BY MONTEATH & POWYS. ALTERING ANY PART OF THIS PLAN DESTROYS THE INTEGRITY OF THE PLAN. ANY REVISIONS REQUESTED MUST BE ISSUED BY MONTEATH & POWYS.
- THESE NOTES ARE AN INTEGRAL PART OF THIS PLAN. REPRODUCTION OF THIS PLAN OR OF ANY PART OF THIS PLAN, WITHOUT THESE NOTES BEING INCLUDED IN FULL, WILL RENDER THE INFORMATION SHOWN ON SUCH REPRODUCTION INVALID AND NOT SUITABLE FOR USE.

SURVEY INFORMATION

- THE SURVEY IS ON GROUND CO-ORDINATES.
-THE ORIGIN OF CO-ORDINATES IS SSM 107142
MGA CO-ORDINATES
E 372866.297 N 6336955.806
(GDA 2020) (ZONE 56)
-SOURCE OF CO-ORDINATES: SCIMS
-DATE 22/03/2023
- ALL REDUCED LEVELS ARE ON AUSTRALIAN HEIGHT DATUM (A.H.D.)
-ORIGIN OF LEVELS SSM 107142, RL 3.672
-SOURCE OF REDUCED LEVELS: SCIMS
-DATE OF REDUCED LEVELS 22/03/2023
- CONTOUR INTERVAL IS 0.2m.
- MGA AND ISG CO-ORDINATE SYSTEMS ARE BASED ON A MATHEMATICAL EARTH MODEL AND SUBJECT TO VARIABLE SCALE FACTORS. DISTANCES CALCULATED FROM CO-ORDINATES MAY VARY SIGNIFICANTLY FROM GROUND MEASUREMENTS. IF FURTHER CLARIFICATION IS REQUIRED CONTACT MONTEATH AND POWYS.

(A) - RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S) EXCEPTING LAND BELOW A DEPTH FROM THE SURFACE OF 15.24 METERS
SUBJECT TO LEASES - SEE CERTIFICATE OF TITLE



REVISIONS

No	REVISION	SVY	DFT	CHK	DATE
2	LEVELS ON ADJOINING BUILDINGS ADDED	PAW	MAK	LAS	17/09/24
1	ISSUE TO CLIENT	KL	CK	BJB	30/03/23

COPYRIGHT NOTICE
THIS DOCUMENT REMAINS THE PROPERTY OF
MONTEATH & POWYS PTY LTD. (C)

CONDITIONS OF USE.
THIS DOCUMENT MAY ONLY BE USED BY THE CLIENT
FOR THE PURPOSE FOR WHICH IT WAS COMMISSIONED.
USE OF THE DOCUMENT FOR ANY OTHER PURPOSE
IS NOT PERMITTED UNLESS PRIOR WRITTEN APPROVAL
HAS BEEN OBTAINED FROM MONTEATH & POWYS PTY LTD.



PLANNING PROJECT MANAGEMENT SURVEYING 3D SPATIAL

monteathpowys.com.au
P (02) 4926 1388



NEWCASTLE SYDNEY GUNNEDAH MUSWELLBROOK

Surveyed	Drafted	Checked	Client
KL	CK	BJB	
Original Size		A1	
DO NOT SCALE			

TSA MANAGEMENT			Sheet No.
DETAIL SURVEY OF LOT 3 AND LOT 4 DP251324 CAVES BEACH			1/2
CAD File: 230150A_02			Revision 2
Ref No: 23/0150		Date: 24/03/2023	

LINE TYPES

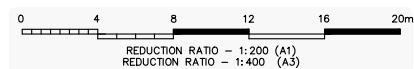
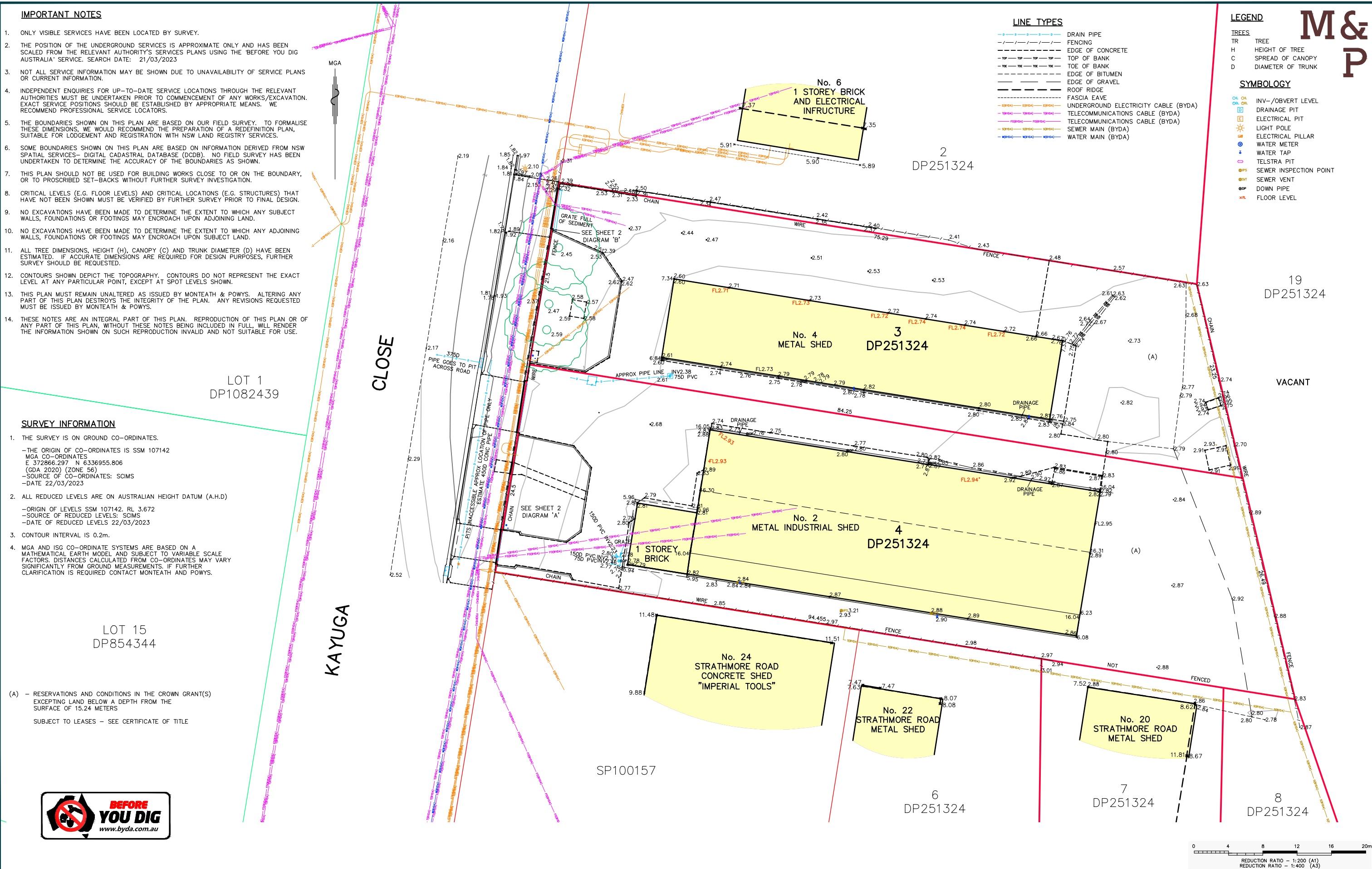
---	DRAIN PIPE
- - - - -	FENCING
=====	EDGE OF CONCRETE
=====	TOP OF BANK
=====	TOE OF BANK
=====	EDGE OF BITUMEN
=====	EDGE OF GRAVEL
=====	ROOF RIDGE
=====	FASCIA EAVE
---	UNDERGROUND ELECTRICITY CABLE (BYDA)
---	TELECOMMUNICATIONS CABLE (BYDA)
---	TELECOMMUNICATIONS CABLE (BYDA)
---	SEWER MAIN (BYDA)
---	WATER MAIN (BYDA)

LEGEND

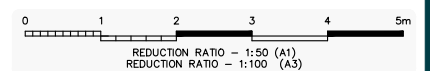
TREES	
TR	TREE
H	HEIGHT OF TREE
C	SPREAD OF CANOPY
D	DIAMETER OF TRUNK

SYMBOLLOGY

INV	INV-/OVERT LEVEL
DP	DRAINAGE PIT
EP	ELECTRICAL PIT
LP	LIGHT POLE
EP	ELECTRICAL PILLAR
WM	WATER METER
WT	WATER TAP
TP	TELSTRA PIT
SP	SEWER INSPECTION POINT
SV	SEWER VENT
DP	DOWN PIPE
FL	FLOOR LEVEL



 **BEFORE
YOU DIG**
www.byda.com.au



REVISIONS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
-----------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--