Friday, 4 June 2021

Project No. 2018-6350000

Revision No. 1

Mr Brodie McHutchinson
Carmichael Tompkins Property Group (CTPG)
Level 14
Aurora Place

Dear Brodie,

North Shore School Precinct - Masterplan and Stage 1 Project

We have reviewed the comments contained within the letter dated 23/3/21 from Planning, Industry and Environment and specifically in relation to flooding. Please find enclosed an updated flood report from GRC Hydro and below commentary on the issues outlined and how they have been addressed.

1. The flood impact assessment determines that the proposed development will worsen flood affectation within the school site in the 1% AEP as shown in Figure 3. This impact must be addressed and mitigated.
   Response
   The analysis concludes that flooding is generally reduced due to the propsoed pit and pipe infrastructure which reduces overland flow through the school site. There are some areas of redistribution of shallow overland flow within the school site but this does not correspond to any increase in flood risk. External to the school, there are improvements in flooding at the Carlow and Miller street intersection due to the drainage upgrade and the bypassing of a bottleneck in the system at this intersection.

2. Mapping is limited to 1% AEP Flood depth. There are no maps to show the impacts of the development on flood hazard in the 1% AEP. This information is required to guide decisions on the proposed works and on any mitigation options.
   Response
   The report has been updated to include mapping illustrating the flood impact for the 1% AEP.

3. The report does not provide maps to show the impact of the development on flood behaviour for the PMF event. This information is required to ensure emergency management response on the site is adequately considered. The proposed development is an education facility which is classified as vulnerable development. Flood risk for the full range of flooding should be adequately addressed and documented. An emergency response plan should be prepared to ensure the safety of students, teachers and members of the school community.
   Response
   The report has been updated to include mapping illustrating the flood impact for the PMF event. An emergency response plan has also been included in the report.

WARREN SMITH CONSULTING ENGINEERS PTY LTD		SINCE 1981.	NSW Level 9, 233 Castlereagh St Sydney 2000 NSW Australia	VIC Level 20/485 La Trobe St Melbourne 3000 Vic Australia
ACN 002 197 088	ABN 36 300 430 126	wsp@warrensmith.com.au		
Hydraulic Fire Civil Utilities Infrastructure		www.warrensmith.com.au	PH +61 (2) 9299 1312	PH +61 (3) 8648 9942

Please contact me if you have any further questions on the subject.

Yours faithfully,
WARREN SMITH CONSULTING ENGINEERS PTY LIMITED

Michael Cahalane
Director - Civil & Water Engineering

Mobile: 0433 522 569
Email: michael@warrensmith.com.au

Job Number: *180078*
Date: *29 April 2021*

Warren Smith and Partners
Level 9, 233 Castlereagh St
Sydney, NSW 2000

GRC Hydro
Level 9, 233 Castlereagh Street
Sydney NSW 2000

Tel: +61 2 9030 0342
www.grchydro.com.au

Re: Marist College North Shore, Flood Risk Assessment for SSDA

Introduction

Development of Marist College North Shore is proposed. The development will include significant alterations to existing buildings and construction of new buildings within the school's site on Miller Street and Carlow Street in North Sydney. The site is located in the very upper catchment of Willoughby Creek and can experience shallow overland flow flooding. Flood risk mitigation has been incorporated into the design, including a large-scale drainage pit upgrade to drain more runoff through a stormwater trunk upgrade, and locating new buildings above the area's flood planning levels. The proposed changes have been assessed using an existing flood model and found to not cause offsite adverse flooding impacts. Overall, the assessment meets the State Significant Development Application (SSDA) Secretary's Environmental Assessment Requirements (SEARs) regarding flooding and flood risk.

Site Description

The school occupies an area of approximately 1.2 ha bounded by Carlow Street to the north and Miller Street to the east, in North Sydney. Cassins Ave is a dead-end laneway that ends at the western side of the school site. The school is comprised of a number of two to three-storey buildings around outdoor areas including basketball courts. It is diagonally opposite St Leonards Park.

The site slopes down from west to east, with an elevation range of around 83.4 mAHD at the Cassins Ave entrance to 81 mAHD at the corner of Miller and Carlow streets. There is an existing stormwater trunk drain running through the site, from Cassins Ave through to the Carlow/Miller intersection. The trunk varies in size from 750 mm x 500 mm at Cassins Ave, then a 900 mm x 900 mm section through part of the school, before three sections of 1200 mm x 600 mm, 1200 mm x 800 mm and finally 1200 mm x 750 mm when it reaches the intersection. At that point the trunk abruptly decreases to 500 mm x 600 mm before reverting to a slightly larger 900 mm diameter through St Leonards Park. This decrease acts as a choke point on the trunk drainage line. Aside from various pits and feeder pipes along its length, there is large drainage pit at the east end of Cassins Ave that was built relatively recently.

Existing Flood Behaviour

The site is affected by a shallow overland flowpath originating at Cassins Ave and flowing through the site to St Leonards Park. The design flood behaviour was established by the North Sydney Flood Study (North

Sydney Council, 2017) which used a TUFLOW hydraulic model. That model was then recently updated for the North Sydney Floodplain Risk Management Study and Plan (North Sydney Council, currently in draft) and used to assess flooding at the site. The update included changing from Australian Rainfall and Runoff 1987 to Australian Rainfall and Runoff 2019 and using updated dimensions of the trunk drainage system. Flood behaviour has been described with reference to the 10% AEP, 1% AEP and Probable Maximum Flood (PMF) in the following section.

Flood Behaviour in 10% AEP Event

The existing flood behaviour for the 10% AEP event is shown in Figure 1. In this event, there is a peak flow of approximately 0.2 m^3/s that enters the site at Cassins Ave, with a flow depth of around 0.1 m. This flow path then turns to the north before existing the site on to Miller Street. The flow path through the school is poorly defined with walls and buildings potentially blocking flow at several locations. The critical storm duration is 60 minutes, and for that event the entire flood event lasts around 45 minutes, with significant flow limited to a 20 minute period. Figure 2 shows the flood hazard in the 10% AEP event and shows that virtually all flow is categorised as the lowest level of hazard (H1) that generally poses no threat to pedestrians or buildings.

Flood Behaviour in 1% AEP Event

The existing flood behaviour for the 1% AEP event is shown in Figure 3. In this event, there is a peak flow of approximately 1.1 m3/s that enters the site at Cassins Ave, with a flow depth of around 0.3 m. This flow path then turns to the north before exiting the site at two points on Miller Street and on Carlow Street. The critical storm duration is 45 minutes, and for that event the entire flood event lasts around 30 minutes, with significant flow limited to a 20 minute period. As shown on Figure 4, the flood hazard in the 1% AEP is still most H1, although there are localised areas of H2 hazard. H2 hazard is generally safe for pedestrians but is unsafe for small vehicles.

Flood Behaviour in PMF

The Probable Maximum Flood represents the largest flood that can possibly occur and at a return period of around 1 in 10 million years in urban areas, is 100,000 times rarer than the 1% AEP, itself expected to occur every 100 years on average. For this reason, the PMF is not used in design of stormwater infrastructure. However, it is useful when considering the full range of flooding, when choosing a location for new facilities that fall under critical or sensitive uses. It has been considered here as other events (e.g. 0.2% or 0.5% AEP) were not available.

The PMF flood behaviour is shown on Figure 5. The same flowpaths are present as in the 1% AEP but depths increase to 0.9 m and flow at Cassins Avenue is up to 10.2 m^3/s. As shown on Figure 6, the flood hazard in the PMF is H4-H5 along the flowpath through the school, and other inundated areas are between H1 and H3 hazard. Children can be unsafe in H3 hazard while all pedestrians are unsafe in H4.

Climate Change

The recent Council studies assessed the impact of climate change on flood behaviour. The FRMS&P found that the 1% AEP flood level on Miller Street and on Carlow Street will be 0.02 m higher under a RCP4.5 emissions scenario, and 0.04 m under a RCP8.5 scenario. This is a marginal increase due to increase in rainfall intensities – there is no impact of sea level rise on flooding at the site. Due to the small upstream catchment, climate change will not cause any significant increase in flood risk at the site.

There are several factors to consider in assessing flood risk at the site, as follows:

- Flooding at the school can occur with little or no warning, due to the small size of the upstream catchment. Flooding may be unexpected given the absence of any watercourse or swale.
- Flooding is likely to be of short duration (typically less than one hour) and may pass in a matter of minutes.
- The flooding is of shallow depth and relatively low velocity. This means in the 1% AEP event, nearly all areas contain only 'H1' hazard, which is classified as being generally safe for people, vehicles and buildings.
- While virtually all flood events will pose low hazard flooding, in the largest possible flood (Probable Maximum Flood), there is up to H5 hazard flow, which would pose a significant risk to life to anyone caught in the flow path.
- While floor levels of all buildings are not known, there is no indication that hazardous flooding would occur inside any buildings in most flood events.
- The site is a high school and will not contain specifically vulnerable people. In the event of a flood, occupants can take refuge in the various school buildings.
- In the PMF, the flow path through the school is between H2 and H4 hazard, with areas of up to H5 hazard.

Overall, the site has low flood risk in that in nearly all flood events, the flow does not pose significant risk to students or teachers who may be outside, nor will it cause hazardous flooding inside buildings. There is significant risk in an extreme flood such as the PMF. Development of the site should ensure this risk is not increased.

SEARs SSDA Requirements

The SEARs State Significant Development Application requirements include three pertaining to flooding, as follows:

- Identify any associated flood risk on the site (detailing the most recent flood studies for the project area)
- Consider any relevant provisions of the NSW Floodplain Development Manual (DIPNR, 2005), including the potential effects of climate change, sea level rise and an increase in rainfall intensity,
- Include design solutions for mitigation, if there is a material flood risk associated with the development.

These requirements have been met by the proposed development, as detailed in this report.

Proposed Development and Flood Risk Assessment

The proposed development involves construction of new buildings and upgrade of the trunk drainage system. From a flood risk perspective, the relevant aspects of the development are how it mitigates flood risk at the site, its impact on the existing flood behaviour and the location of any new buildings relative to the flood extent. In this regard, the main flood mitigation measure is that the upgraded and deviated trunk drain will now take significantly more overland flow, and the overland flowpath has been completely blocked at one location and re-routed to the south, for extreme flood events. The following section describes flooding at the site under the proposed conditions across a range of flood events, followed by a flood impact assessment.

Flood Behaviour under Proposed Conditions

The proposed development will significantly reduce flooding at the site by diverting more flow into the trunk drainage system. The peak flood depth and level in the 10% AEP, 1% AEP and PMF is shown on Figure 7, Figure 9 and Figure 11, while Figure 8, Figure 10 and Figure 12 shows the flood hazard for the same events. The following changes are noted in comparison to the existing flood behaviour:

- In the 10% AEP event, virtually all of the site is no longer flooded. 100% of the overland flow is diverted into the upgraded trunk drainage via the new drainage pits. This represents a significant improvement for common flood events that currently cause minor flooding through the school.
- In the 1% AEP, flooding is reduced but still occurs to a shallow depth across the school grounds. The overland flow at Cassins Avenue is reduced from 1.1 m^3/s in the existing case to 0.8 m^3/s in the proposed case. The reduced flow means that all overland flow is drained from the site via the trunk drain, removing the continuous flow path that currently exists. Flood hazard is largely unchanged as it was only H1 in most areas in the existing case, though one area of H1-H2 flow onto Miller Street is now no longer flooded. Overall, flood hazard is marginally improved in the 1% AEP event.
- In the PMF, flood depths are generally similar in the existing and proposed. Overland flow at Cassins Avenue is 10.2 m^3/s, compared to 10.3 m^3/s in the existing case. Regarding hazard, the flowpath through the school is between H2-H4 hazard, with areas of up to H5 hazard, in the existing case. In the proposed case, the PMF flows onto Miller Street via the school entrance on the south side of the auditorium. This entrance ensures that while the existing flowpaths have been diverted and not entirely removed, for events larger than the 1% AEP where this overland flow may be activated. The hazard in the proposed case is H3 in the central recreation area, before discharging onto Miller Street with H4-H5 flow. Overall, flood hazard is slightly improved in the PMF event, as there are fewer continuous areas of H4-H5 hazard through the school.

Overall, the proposed development has been designed to mitigate flooding by diverting significantly more flow into the diverted trunk drain via a large-scale pit upgrade. The diversion will mean the trunk will bypass the choke point near the Miller/Carlow intersection and connect into the existing trunk on the downstream side of the intersection. Besides resulting in less overland flow through the school, this improves the capacity at the Miller/Carlow intersection where some properties are flood prone.

Flood Impact Assessment

Figure 13 and Figure 14 shows the flood level impact based on comparison of the existing and proposed flood behaviour for the 1% AEP and 10% AEP events, respectively. As per the figures:

- In a 10% AEP flood event, there is a large area that is no longer flooded within the school. There are also reductions in flooding at Cassins Avenue and downstream of the school near the Miller/Carlow intersection. There are no areas of adverse impact.
- In a 1% AEP flood event, there are the same areas of benefit at Cassins Avenue and at Miller/Carlow downstream. Within the school, there are areas of both increase and decrease in the depth of flooding. This is due to the proposed development regrading the school grounds which redistributes the shallow flow of 0.1-0.2 m that enters the school. This also results in a newly flooded area. Although some areas of increase are present, the flooding is certainly reduced

compared to the existing case, with 27% less overland flow entering the school, and areas of increase/newly flooded are with shallow overland flow ponding in the school. There are no adverse impacts on flooding outside of the school.

Overall, the impact assessment shows that flooding is generally reduced due to the flood mitigation features incorporated in the design of the school. Some areas of increase are present in the 1% AEP event, but these are due to redistribution of shallow overland flow and do not correspond to any increase in flood risk. As previously described, the large-scale trunk upgrade and deviation drains significantly more overland flow and by diverting the trunk from the Carlow/Miller intersection, where there is a bottleneck in the trunk drainage where it reduces in size, the proposed development improves flooding at the intersection and for properties in this area.

Proposed Floor Levels

The proposed development includes several new buildings. Proposed floor levels have been reviewed and are at or above the 1% AEP flood level, as follows:

- The auditorium building has several entrances from the central recreation area, where the 1% AEP flood level is 83.88 mAHD and the proposed entrances are at 84.00 mAHD.
- There is also an entrance at 84.00 mAHD to the auditorium foyer, on the south side of the building, where the closest flood level is 83.72 mAHD.
- There is an auditorium entrance on Miller Street where the flood level and the 1% AEP level are 81.76 m AHD (It is noted that 1% AEP flooding in this area are very minimal, with between 0 and 0.03 m depth).
- The new café/kitchen facility is 85.3 mAHD, above the flood level of 83.88 mAHD in the recreation area.
- The basement car park entrance on Carlow Street is located west of the flood-affected area. The entrance is at 83.40 mAHD while the nearest 1% AEP level is 82 mAHD.

Emergency Response Plan

Emergency response procedures for the school should be updated to include flood risk. Flooding does not pose significant risk to the students and staff in the majority of flood events, however, as a sensitive use, procedures should be in place in the event of a dangerous flood occurring. As with other urban areas affected by overland flow, the greatest risk will be to students or staff outside of the school buildings, compared to the relatively safe environment of any of the school buildings. The following strategy should be incorporated into the school's emergency response procedures:

1. The school grounds can be affected by flooding as a result of heavy rainfall to the west of the school in North Sydney. Flooding will typically occur as flow entering the school at the Cassins Avenue entrance, pooling in outdoor areas, and in large floods, then flowing onto Miller Street via the entrance south of the amphitheatre. In most flood events, depths will be 0.3 m or less, but depths of 0.5-1.0 m are possible over large areas in extreme floods.
2. In smaller flood events, flow on Cassins Avenue may not affect the school as it will enter the drainage pits and be drained via underground stormwater drainage.
3. There may be little to no warning of flooding occurring at the site. The Bureau of Meteorology will issue warnings for severe weather that specify affected areas in Sydney. With several such warnings issued in a typical year, it is likely that most warnings will not result in flooding at the site.

4. Any flooding that does occur will typically last less than one hour, though longer durations are possible.
5. To be prepared for flooding: ensure relevant staff are briefed on potential flooding and how to respond. In the event of very heavy rainfall at the school, visually monitor the school grounds for flooding particularly the Cassins Avenue entrance. If flooding appears imminent (e.g., increasing flow on Cassins Avenue), instruct all students and staff to move indoors.
6. During a flood: keep all students and staff inside. As a precaution, move to levels above ground level. Do not attempt to travel – hazards such as flooded roads and fallen trees will present greater danger compared to staying inside.
7. After a flood: ensure students and staff are accounted for and check for hazards (e.g., fallen trees or other debris) in the school grounds. Update these notes with any relevant lessons learned.

Conclusions

The flood risk assessment has considered a range of design flood events (10% AEP, 1% AEP and PMF) at the school site, and the effect of the proposed development. In the existing case, there is a low hazard overland flowpath through part of the site when the trunk drainage capacity is exceeded. The proposed development involves a large new section of trunk drainage, combined with several large new drainage pits, that will divert a significant portion of overland flow into the trunk drain and then avoid the current constriction at the Miller/Carlow intersection. Modelling found that this slightly improved flooding in both a 10% AEP and 1% AEP both upstream and downstream of the school site. Within the site, the flood mitigation features greatly improved flooding in a 10% AEP event and slightly improve a 1% AEP event, with the 1% AEP no longer having a continuous flowpath through the site. In a PMF event, the overland flowpath will move south of the proposed auditorium onto Miller Street. The impact in the PMF event was assessed and showed a slight overall improvement in flood hazard at the site. An Emergency Response Plan has also been prepared to guide preparation and response to flooding at the school. Overall, the three SEARs requirements pertaining to flooding have been satisfied by the proposed development.

Yours Sincerely,

Felix Taaffe

Felix Taaffe
Senior Engineer

Email: felix@grchydro.com.au
Tel: +61 422 224 754

Flood Depths (m)

< 0.1	0.3 to 0.5
0.1 to 0.2	0.5 to 1.0
0.2 to 0.3	> 1.0

Major Flood Level Contours Spacing = 1 m

Minor Flood Level Contours Spacing = 0.2 m

Buildings

Study Area

Cadastral Boundaries

Stormwater Pits

Stormwater Pipes

N W E S

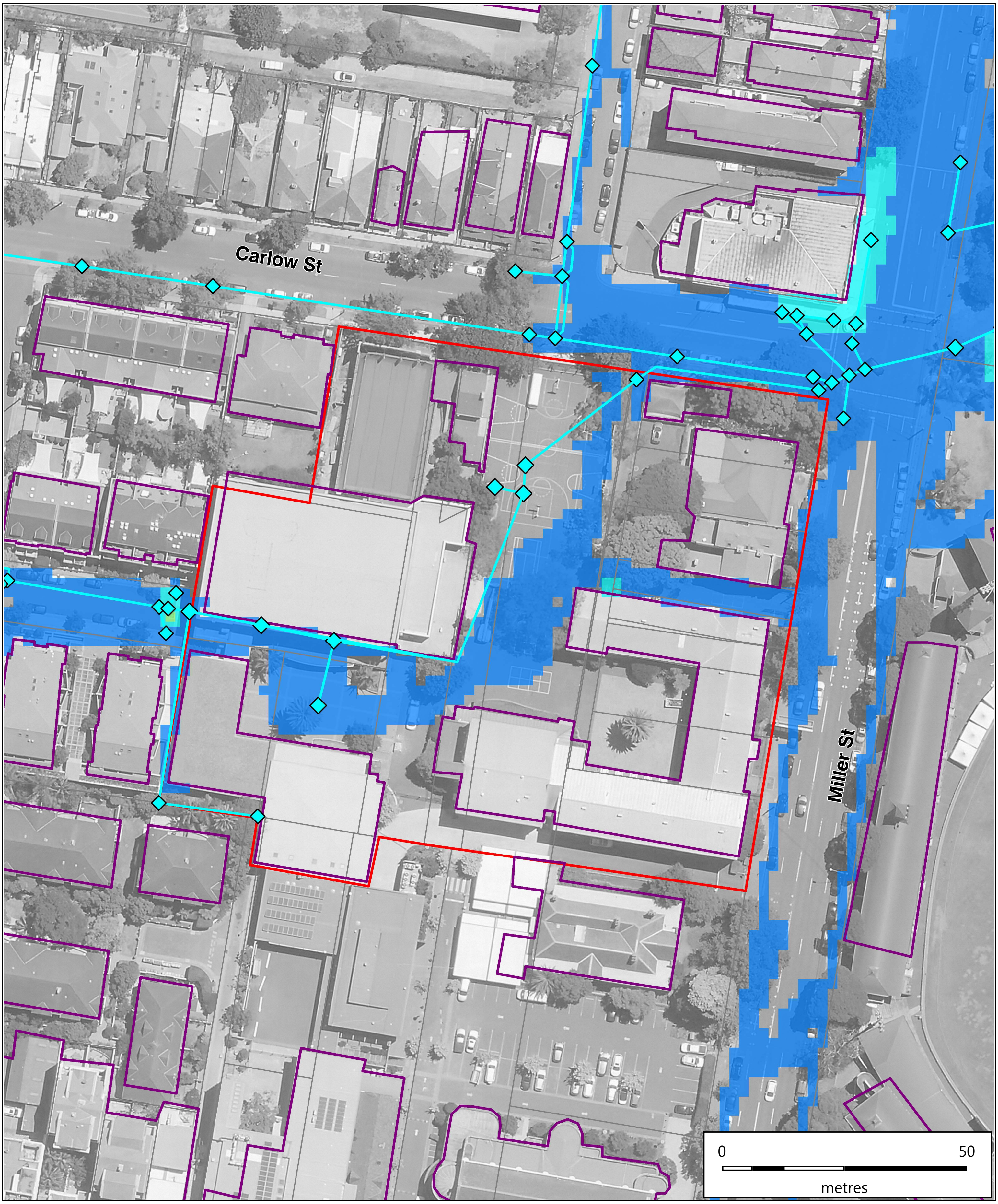
TITLE : **10% AEP DESIGN EVENT - Existing Case - Peak flood depths & levels**

PROJECT: Marist College Re-development

PROJECT No. 180078

DATE: April 2021 | SCALE: 1:1000 | FIGURE NUMBER: 01

grc HYDRO



Flood Hazard Categories

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

Stormwater Pits

Stormwater Pipes

Study Area

Buildings

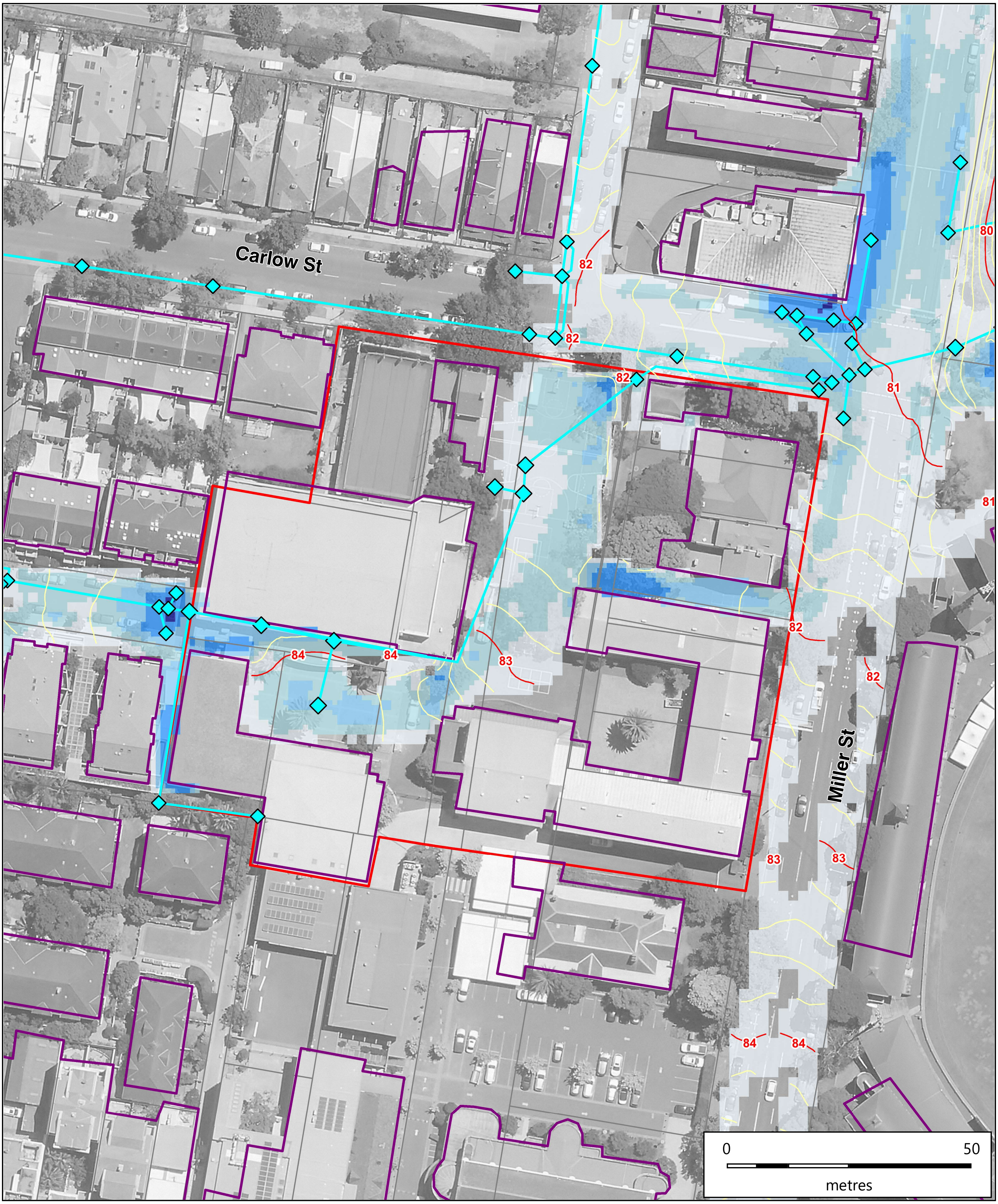
Cadastral Boundaries

N W E S

TITLE :	**10 % AEP DESIGN EVENT - Existing Case - Peak flood hazard**
PROJECT:	Marist College Re-development
PROJECT No.	180078

DATE: April 2021 | SCALE: 1:1000 | FIGURE NUMBER: 02

grc HYDRO



Flood Depths (m)
< 0.1
0.1 to 0.2
0.2 to 0.3
0.3 to 0.5
0.5 to 1.0
> 1.0

Major Flood Level Contours Spacing = 1 m
Minor Flood Level Contours Spacing = 0.2 m

Stormwater Pits
Stormwater Pipes

Study Area
Buildings
Cadastral Boundaries

N W E S

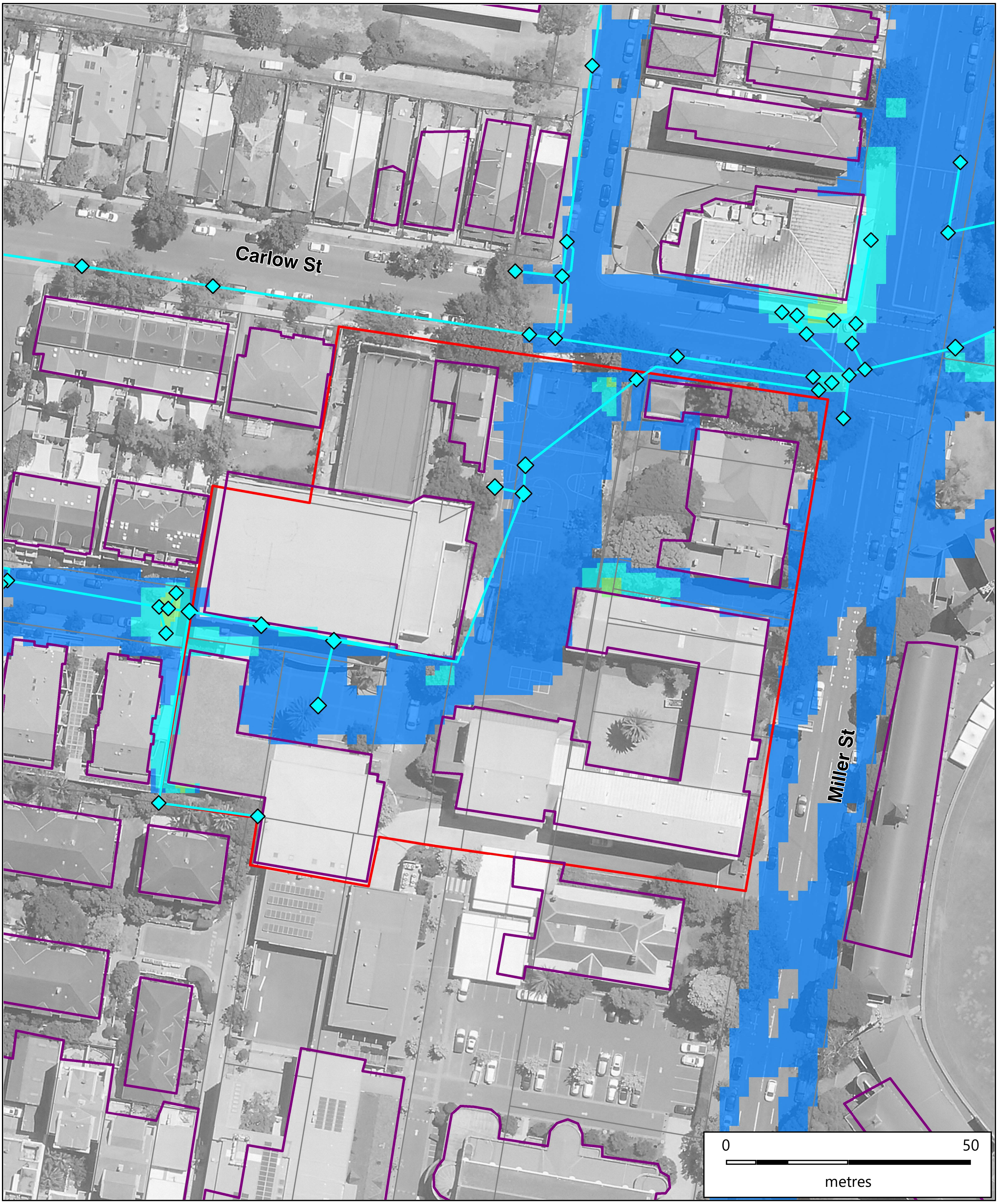
TITLE : **1% AEP DESIGN EVENT - Existing Case - Peak flood depths & levels**

PROJECT: Marist College Re-development

PROJECT No. 180078

DATE: April 2021 | SCALE: 1:1000 | FIGURE NUMBER: 03

grc HYDRO



Flood Hazard Categories

H1 H4
H2 H5
H3 H6

Stormwater Pits

Stormwater Pipes

Study Area

Buildings

Cadastral Boundaries

N W E S

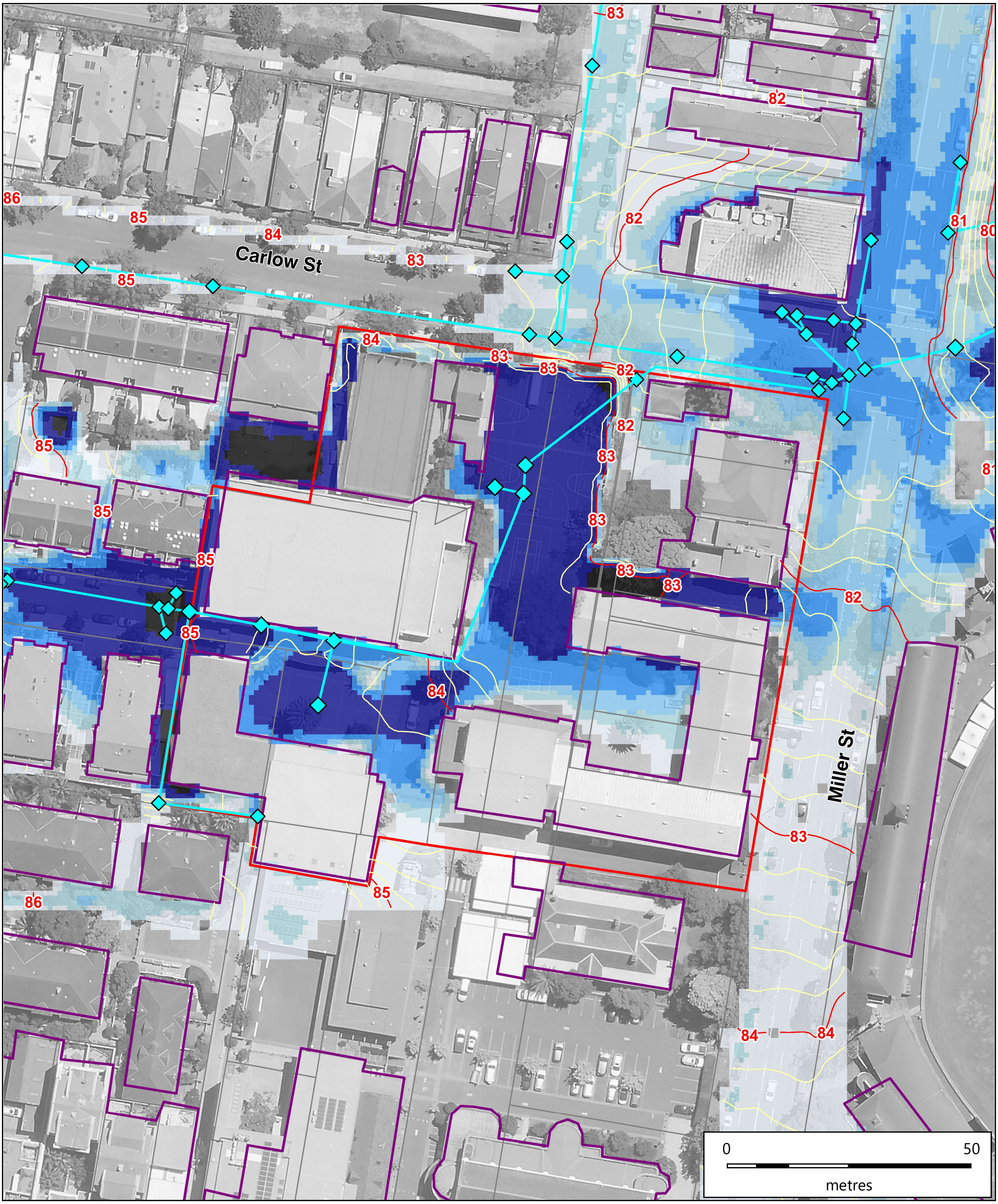
TITLE : **1% AEP DESIGN EVENT - Existing Case - Peak flood hazard**

PROJECT: Marist College Re-development

PROJECT No. 180078

DATE: April 2021 | SCALE: 1:1000 | FIGURE NUMBER: 04

grc HYDRO



Flood Depths (m)

- 0< 0.1
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.5
- 0.5 to 1.0
- > 1.0

Major Flood Level Contours
Spacing = 1 m

Minor Flood Level Contours
Spacing = 0.2 m

Study Area

Buildings

Cadastral Boundaries

Stormwater Pits

Stormwater Pipes

N
W E
S

TITLE : **PMF DESIGN EVENT - Existing Case - Peak flood depths & levels**

PROJECT: Marist College Re-development

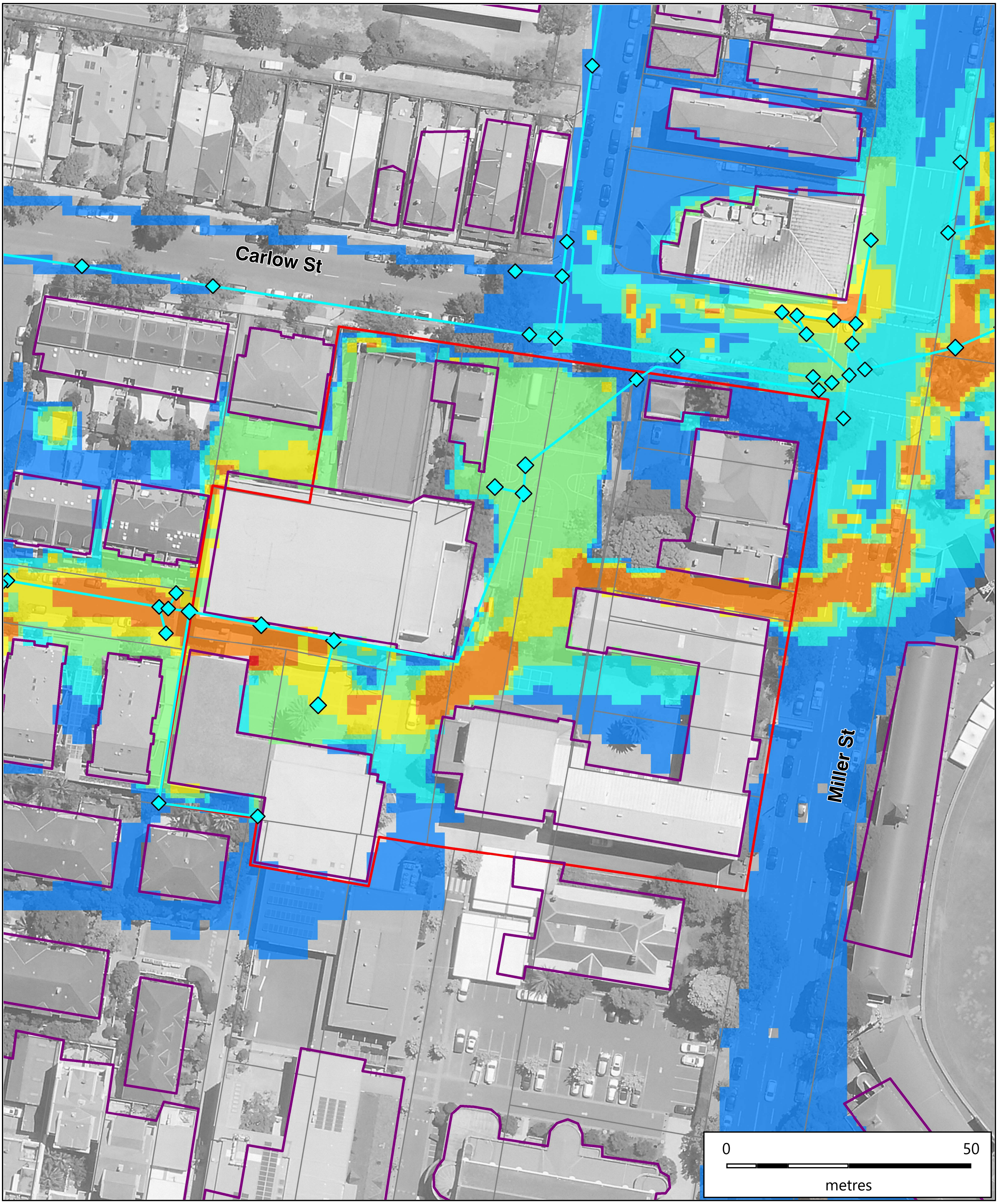
PROJECT No. 180078

DATE: April 2021

SCALE: 1:1000

FIGURE NUMBER: 05

grc HYDRO



Flood Hazard Categories

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

Stormwater Pits

Stormwater Pipes

Study Area

Buildings

Cadastral Boundaries

N W E S

TITLE : **PMF DESIGN EVENT - Existing Case - Peak flood hazard**

PROJECT: Marist College Re-development

PROJECT No. 180078

DATE: April 2021 | SCALE: 1:1000 | FIGURE NUMBER: 06

grc HYDRO

Flood Depths (m)

- < 0.1
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.5
- 0.5 to 1.0
- > 1.0

- Stormwater Pipes (to be Demolished)
- Proposed Pits
- Proposed Pipes
- Major Flood Level Contours Spacing = 1 m
- Minor Flood Level Contours Spacing = 0.2 m
- Proposed Buildings
- Cadastral Boundaries
- Study Area
- Stormwater Pits
- Stormwater Pipes

TITLE :	**10% AEP DESIGN EVENT - Proposed Case - Peak flood depths & levels**
PROJECT:	Marist College Re-development
PROJECT No.	180078
DATE: April 2021	SCALE: 1:1000
FIGURE NUMBER:	07

N W E S

grc HYDRO

Flood Hazard Categories

H1
H2
H3
H4
H5
H6

Stormwater Pipes (to be Demolished)
Proposed Pits
Proposed Pipes
Stormwater Pits
Stormwater Pipes
Study Area
Proposed Buildings
Cadastral Boundaries

N W E S

TITLE : **10 % AEP DESIGN EVENT - Proposed Case - Peak flood Hazard**

PROJECT: Marist College Re-development

PROJECT No. 180078

DATE: April 2021 | SCALE: 1:1000 | FIGURE NUMBER: 08

grc HYDRO

Flood Depths (m)

- < 0.1
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.5
- 0.5 to 1.0
- > 1.0

Stormwater Pipes (to be Demolished)

Proposed Pits

Proposed Pipes

Major Flood Level Contours Spacing = 1 m

Minor Flood Level Contours Spacing = 0.2 m

Proposed Buildings

Cadastral Boundaries

Study Area

Stormwater Pits

Stormwater Pipes

N
W E
S

TITLE : **1% AEP DESIGN EVENT - Proposed Case - Peak flood depths & levels**

PROJECT: Marist College Re-development

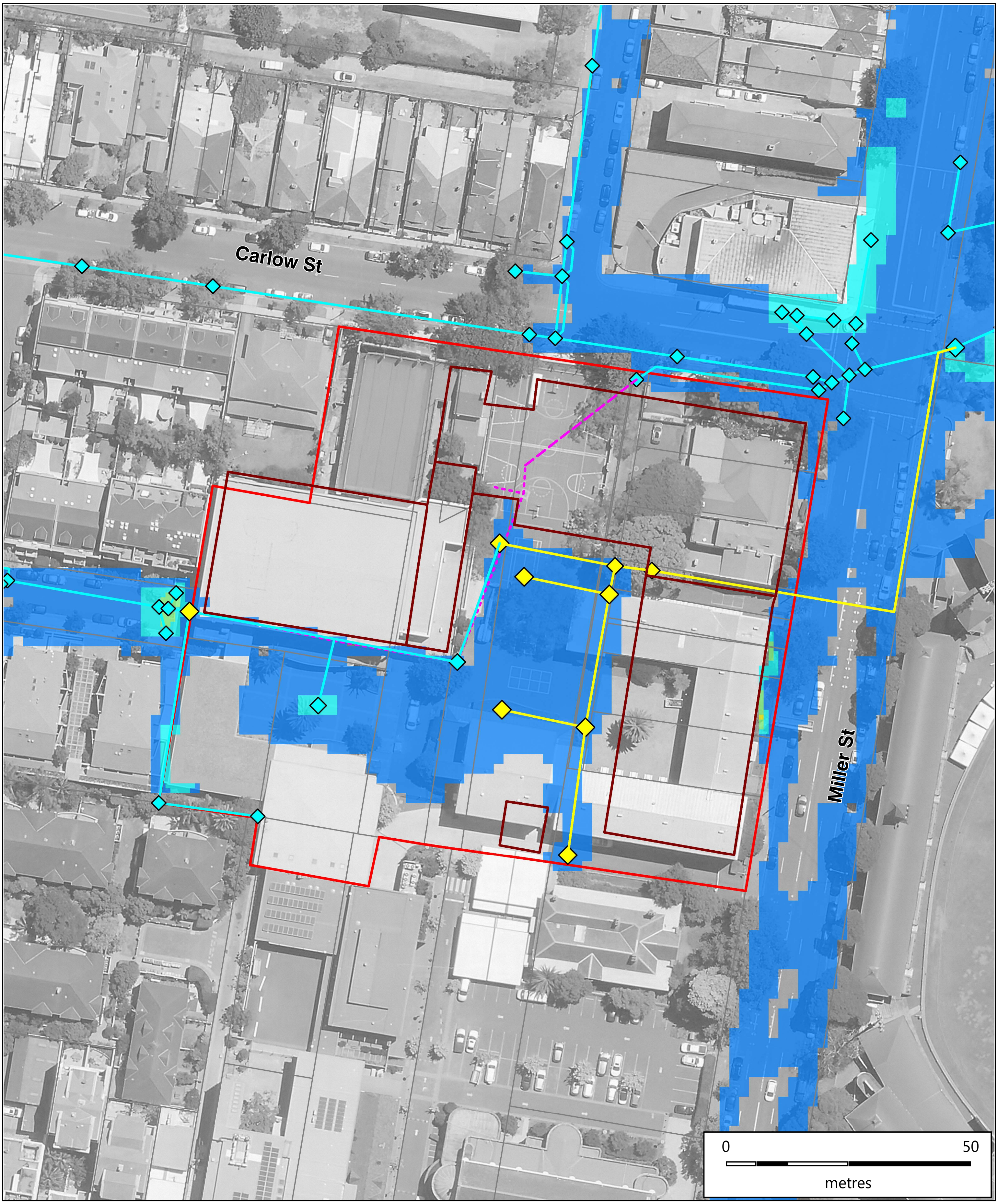
PROJECT No. 180078

DATE: April 2021

SCALE: 1:1000

FIGURE NUMBER: 09

grc HYDRO



Flood Hazard Categories

H1 H2 H3 H4 H5 H6

Stormwater Pipes (to be Demolished)

Proposed Pits

Proposed Pipes

Stormwater Pits

Stormwater Pipes

Proposed Buildings

Study Area

Cadastral Boundaries

N W E S

TITLE : **1% AEP DESIGN EVENT - Proposed Case - Peak flood hazard**

PROJECT: Marist College Re-development

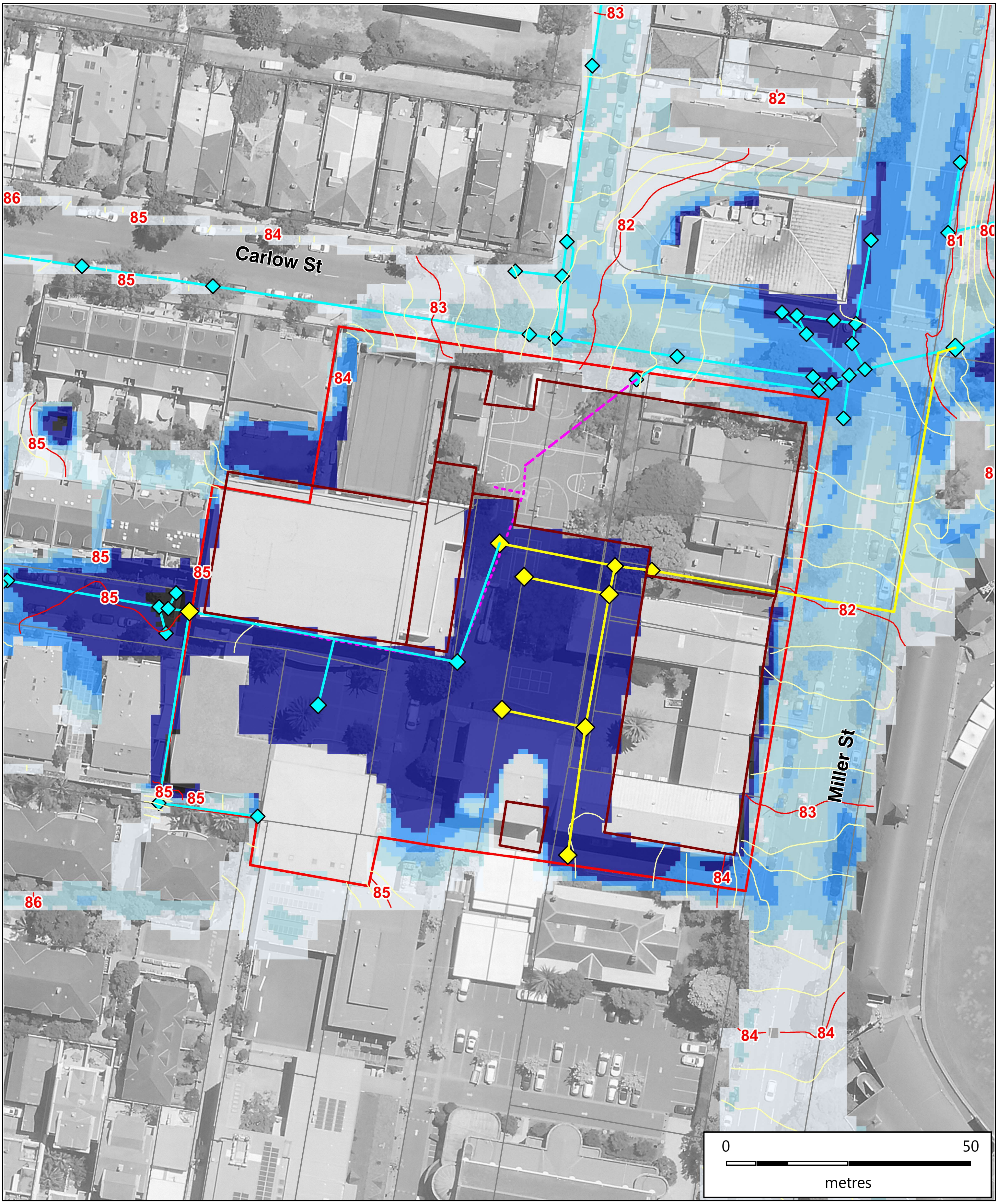
PROJECT No. 180078

DATE: April 2021

SCALE: 1:1000

FIGURE NUMBER: **10**

grc HYDRO



Flood Depths (m)

< 0.1	0.3 to 0.5
0.1 to 0.2	0.5 to 1.0
0.2 to 0.3	> 1.0

Stormwater Pipes (to be Demolished)

Proposed Pits

Proposed Pipes

Major Flood Level Contours Spacing = 1 m

Minor Flood Level Contours Spacing = 0.2 m

Proposed Buildings

Cadastral Boundaries

Study Area

Stormwater Pits

Stormwater Pipes

N W E S

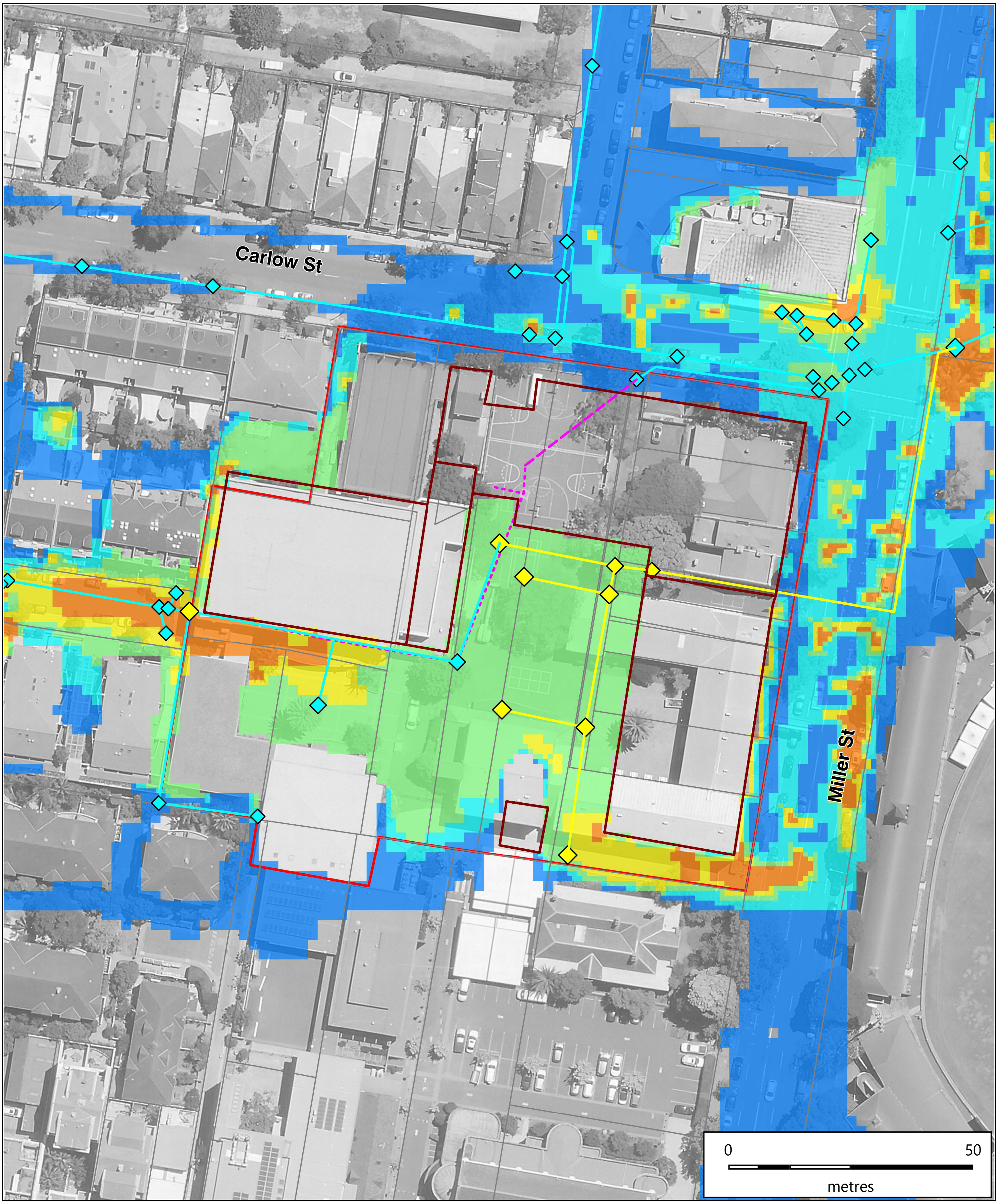
TITLE : **PMF DESIGN EVENT - Proposed Case - Peak flood depths & levels**

PROJECT: Marist College Re-development

PROJECT No. 180078

DATE: April 2021 | SCALE: 1:1000 | FIGURE NUMBER: 11

grc HYDRO



Flood Hazard Categories

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

Stormwater Pipes (to be Demolished)

Proposed Pits

Proposed Pipes

Stormwater Pits

Stormwater Pipes

Study Area

Proposed Buildings

Cadastral Boundaries

N W E S

TITLE : **PMF DESIGN EVENT - Proposed Case - Peak flood hazard**

PROJECT: Marist College Re-development

PROJECT No. 180078

DATE: April 2021 | SCALE: 1:1000 | FIGURE NUMBER: 12

grc HYDRO

Change in Level (m)

< -0.3	-0.1 to -0.01	0.1 to 0.2	Stormwater Pipes (to be Demolished)	Cadastral Boundaries
-0.3 to -0.2	No Impact	0.2 to 0.3	Proposed Buildings	Study Area
-0.2 to -0.1	0.01 to 0.1	> 0.3	Proposed Pits	Stormwater Pits
No Longer Flooded	Newly Flooded		Proposed Pipes	Stormwater Pipes

N W E S

TITLE : **10 % AEP DESIGN EVENT - Proposed Case - Peak Flood Level Impacts**

PROJECT: Marist College Re-development

PROJECT No. 180078

DATE: April 2021 | SCALE: 1:1000 | FIGURE NUMBER: 13

grc HYDRO

Change in Level (m)

< -0.3	-0.1 to -0.01	0.1 to 0.2
-0.3 to -0.2	No Impact	0.2 to 0.3
-0.2 to -0.1	0.01 to 0.1	> 0.3
No Longer Flooded	Newly Flooded	

Stormwater Pipes (to be Demolished)
Proposed Buildings
Proposed Pits
Proposed Pipes
Cadastral Boundaries
Study Area
Stormwater Pits
Stormwater Pipes

N W E S

TITLE : **1% AEP DESIGN EVENT - Proposed Case - Peak Flood Level Impacts**

PROJECT: Marist College Re-development

PROJECT No. 180078

DATE: April 2021 | SCALE: 1:1000 | FIGURE NUMBER: 14

grc HYDRO