Flooding Assessment

Cooma Hospital Key Worker Accommodation

NSW Health Infrastructure

03 April 2023

→ **The Power of Commitment**

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	A	D Bannigan	S Douglas	S Douglas	T Little		05.04.23

GHD Pty Ltd | ABN 39 008 488 373

16 Marcus Clarke Street, Level 7

Canberra, Australian Capital Territory 2601, Australia

T +61 2 6113 3200 | **F** +61 2 6113 3299 | **E** cbrmail@ghd.com | **ghd.com**

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Glossary of terms

Definitions	
Annual Exceedance Probability	The likelihood of a flood of a given magnitude occurring in any one year, expressed as a percentage.
Australian Height Datum	A common reference level used in Australia which is approximately equivalent to the height above sea level.
Catchment	The area drained by a stream or body of water or the area of land from which water is collected.
Probable Maximum Flood	The largest flood that could conceivably occur at a given location.
Proposal site	The area of land that is directly impacted on by a proposed Major Proposal that is under the EP&A Act, including access roads, and areas used to store construction materials (OEH 2014). Includes areas impacted by construction and operational footprints.
Study area	The area directly affected by the development and any additional areas likely to be affected by the development, either directly or indirectly (OEH 2014).

Abbreviations	
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
BOM	Bureau of Meteorology
CGM	Global Climate Model
LiDAR	Light Detection and Ranging
PMF	Probable Maximum Flood
RCP	Representative Concentration Pathway
REF	Review of Environmental Factors

1. Introduction

GHD has been engaged by NSW Health Infrastructure to prepare the REF documentation for the Key Worker Accommodation proposed for the Cooma Hospital site. It is proposed to construct 12 individual accommodation units to house transient works.

1.1 Purpose of this report

This report is prepared for NSW Health Infrastructure to assess and report on the Flooding Assessment for the Review of Environmental Factors (REF) which forms part of the SSDA approvals process. The purpose of this report is to document the nature of flooding at the proposed Cooma Hospital key worker accommodation site and stormwater impacts on surrounding areas. This report supports the REF for the proposal. The scope of assessment included:

— Identification of the existing flooding conditions in the proposal area

— Identification of stormwater impacts of the proposal

— Prepare a report summarising the findings of the study.

1.2 Scope and limitations

This report has been prepared by GHD for NSW Health Infrastructure and may only be used and relied on by NSW Health Infrastructure for the purpose agreed between GHD and NSW Health Infrastructure as set out in this report.

GHD otherwise disclaims responsibility to any person other than NSW Health Infrastructure arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at no additional cost if necessary.

1.3 Legislative context

An REF is prepared to satisfy NSW Health Infrastructure's duties under Section 5.5 of the Environmental Planning and Assessment Act 1979 (EP&A Act) to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity" and Section 5.7 in making decisions on the likely significance of any environmental impacts. This hydrology assessment forms part of the REF being prepared for the proposed Key Worker Accommodation and assesses the hydrology impacts of the proposal to meet the requirements of the EP&A Act.

1.3.1 Environmental Planning and Assessment Act 1979

The proposed development is a Division 5.1 activity under the EP&A Act. The EP&A Act forms the legal and policy platform for proposal assessment and approval in NSW and aims to, amongst other things, 'encourage the proper management, development and conservation of natural and artificial resources. All development in NSW is assessed in accordance with the provisions of the EP&A Act and the Environmental Planning and Assessment Regulation 2000. The determining authority for the project is Transport for NSW.

1.3.2 New South Wales Flood Prone Land Policy

The primary objective of the flood prone land policy is to reduce the impact of flooding and flood liability of owners and occupiers of flood prone land. The policy adopts a merit-based approach for development decisions in the floodplain taking into account social, economic and ecological factors, as well as flooding considerations.

The NSW Floodplain Development Manual (2005) supports the NSW Government's Flood Prone Land Policy. The manual provides strategies for managing occupation and use of the floodplain, conserving risk management principles. These are based on a hierarchy of avoidance, minimisation (using planning controls) and mitigation works. The manual applies to floodplains across NSW in both rural and urban areas and is used to manage major drainage issues in overland flooding areas.

1.3.3 Water Management Act 2000

The Water Management Act 2000 (WM Act) provides a framework for the sustainable and integrated management of water sources across NSW. The Act primarily deals with the establishment of management plans for committees who manage water management areas, issue of access licenses for users to retrieve water from a designated area and approvals for the use of water from a particular location.

Under Section 91 of the WM Act, approval is required for a 'controlled activity that is undertaken on 'waterfront land'. The proposed activity is not considered to be a controlled activity under the WM Act.

It is important to note that public authorities are exempt from carrying out a controlled activity on waterfront land (Section 91E of the WM Act) in accordance with clause 38 of the Water Management (General) Regulation 2011.

1.4 Cooma Monaro Local Flood Plan

The plan covers preparedness, response and recovery during flooding in the Cooma Monaro region. It outlines agency responsibilities including SES, Ambulance Service, Bureau of Meteorology and Council.

The plan notes that the topography of Cooma is such that evacuation would involve moving evacuees from lower parts of Cooma to higher ground.

On the receipt of flood warnings predicting Major flooding the Cooma Monaro SES Local Controller will determine the level of the threat and the need for evacuations. As soon as possible after the decision to evacuate is made, the Cooma Monaro SES Local Controller will issue evacuation warnings to the 'at risk' residents, indicating what people should do before evacuating and when actually doing so.

1.5 State Emergency Service (SES) correspondence

Following notification under section 2.13 of the state environmental planning policy 2021, the NSW SES has reviewed the proposal and provided the following advice:

– consider the impact of flooding on the infrastructure up to and including the PMF.
– pursue, if relevant, site design and stormwater management that minimises any risk to the community.
– ensure workers and people using the facility during and after the upgrades are aware of the flood risk, for example by using signage.
– develop an appropriate business emergency plan to assist in being prepared for, responding to and recovering from flooding.

1.6 Snowy Monaro Regional Council Development Design Specification D5

The development design specification D5, stormwater drainage design outlines Councils requirements in relation to stormwater management for developments. The objectives are:

– To ensure that inundation of private and public buildings located in flood-prone areas occurs only on rare occasions and that, in such events, surface flow routes convey floodwaters below the prescribed velocity/depth limits.
– To provide convenience and safety for pedestrians and traffic in frequent stormwater flows by controlling those flows within prescribed limits.
– Retain within each catchment as much incident rainfall and runoff as is possible and appropriate for the planned use and the characteristics of the catchment.

The specification states: Where the proposed development replaces an existing development, the on-site drainage system is to be designed in such a way that the estimated peak flow rate from the site for the design average recurrence interval (ARI) of the receiving minor system is no greater than that which would be expected from the existing development.

2. Site description

The Cooma Hospital and Health Services site is located in Bent Street Cooma, to the south of Cooma CBD. The proposed key worker accommodation is to be located on the eastern portion of the site, adjacent to Bombala Street. Cooma Creek passes the site approximately 200 m to the east of the proposed development. The site location in relation to Cooma Creek is shown on Figure 1.

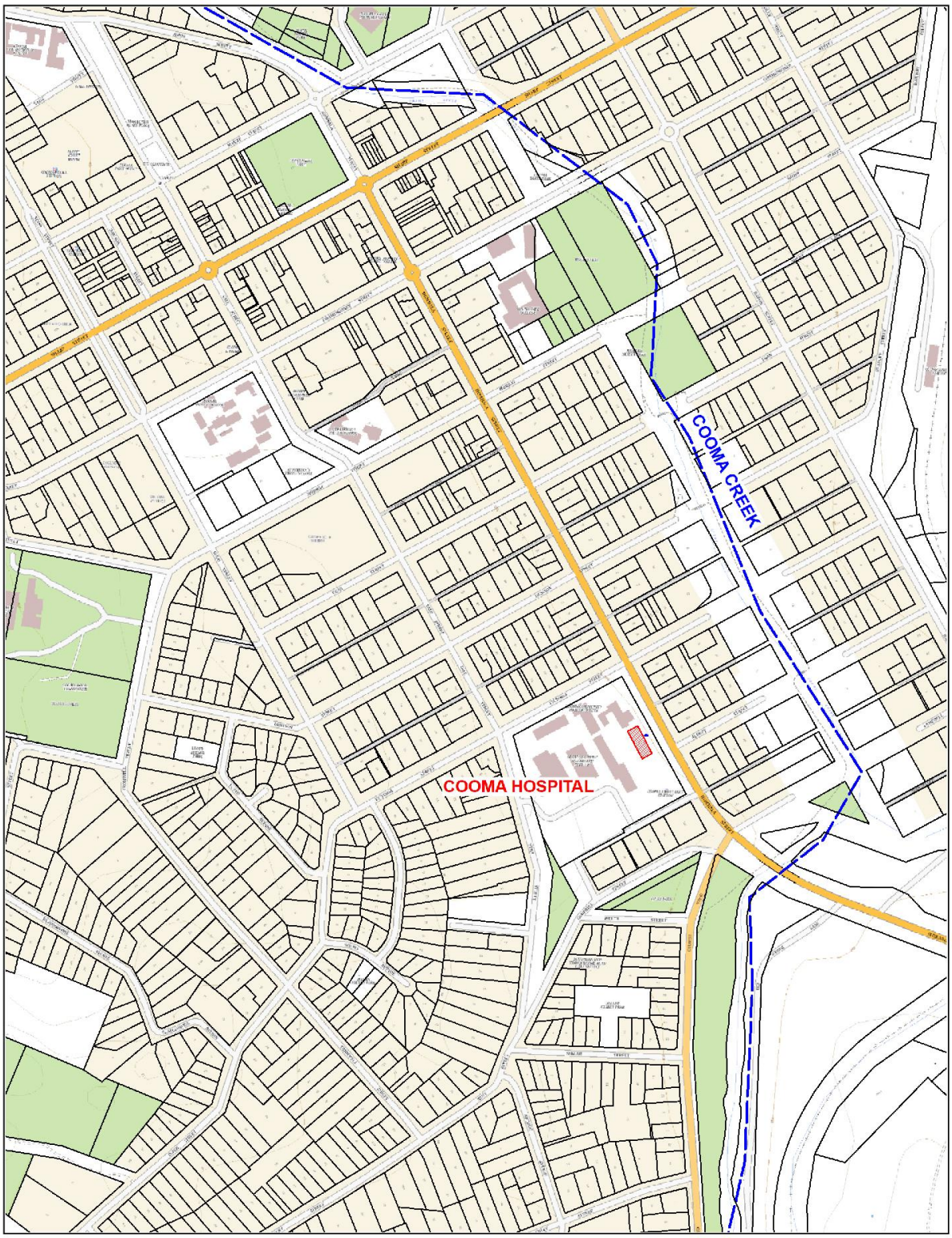

Figure 1 Site locality

Cooma Creek drains a catchment of 99 km^2 originating 20 km south of Cooma. The catchment rises from an elevation of 790 m AHD at Sharp St Cooma to around 1200 m AHD in the upper reaches. The catchment land cover is primarily open grassland and light forest. The Cooma Creek catchment plan upstream of Sharp Street Cooma is shown on Figure 2.

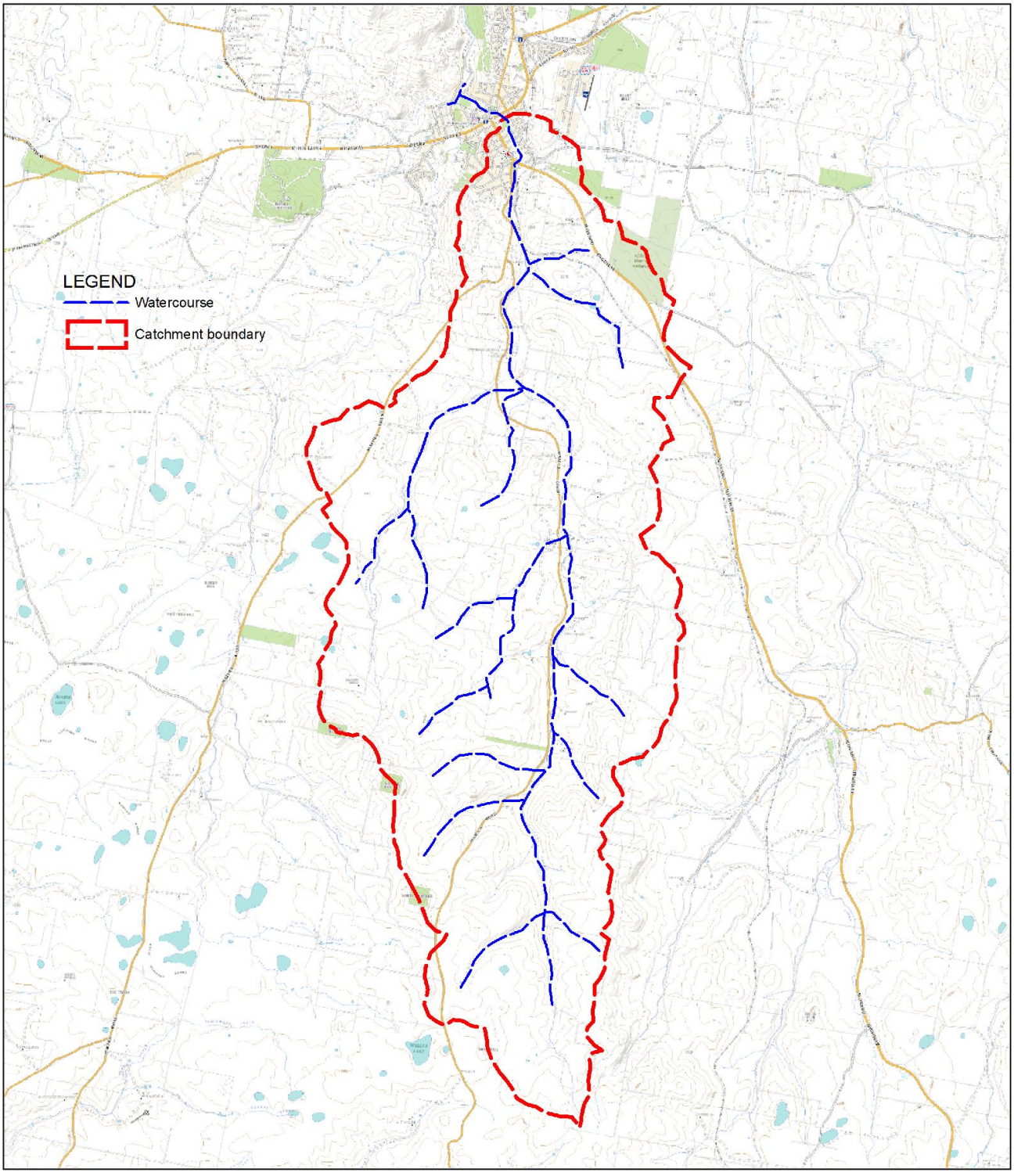

Figure 2 ***Cooma Creek catchment plan***

3. Available data

The data described below was utilised in the flooding assessment.

3.1 Previous Study

Snowy Monaro Regional Council, Flood and Floodplain Risk Management Studies, Flood Studies, DRAFT FINAL, June 2019.

SMEC Australia with assistance from GRC Hydro Pty Ltd were engaged by Council to prepare flood and floodplain risk management studies for the towns of Cooma, Bredbo, Berridale and Michelago. Hydrologic and hydraulic computer models were established for each of the study areas. These models were calibrated to historic flood data and validated using flood frequency analysis.

In relation to Cooma, it was found that the town is flood affected in events greater than the 10% AEP with areas of inundation in the vicinity of the levee on Cooma Creek. It was found that in rare flood events flows break out of Cooma and Cooma Back creeks and inundate urban areas.

3.2 Design Rainfall and loss rates

Design rainfalls, storm loss rates and preburst depths were obtained from the Australian Rainfall and Runoff 2019 data hub. The initial and continuing loss rates were adopted from the SMEC 2019 study. These are subtracted from the initial loss. Design rainfall depths are shown in ***Table 1***. Initial and continuing loss rates are shown in ***Table 2*** and preburst depths are shown in ***Table 3***.

Table 1 ***ARR,2019 Design rainfall depths (mm)***

Duration	AEP						
	63.20%	50%	20%	10%	5%	2%	1%
1 min	1.49	1.7	2.36	2.85	3.35	4.05	4.63
2 min	2.47	2.79	3.81	4.52	5.22	6.15	6.86
3 min	3.39	3.83	5.25	6.25	7.26	8.6	9.65
4 min	4.2	4.76	6.56	7.85	9.15	10.9	12.3
5 min	4.92	5.58	7.73	9.28	10.9	13.1	14.8
10 min	7.56	8.59	12	14.6	17.2	20.9	23.9
15 min	9.28	10.5	14.8	17.9	21.1	25.8	29.5
20 min	10.5	12	16.8	20.3	23.9	29.1	33.3
25 min	11.5	13.1	18.3	22.1	26	31.5	36
30 min	12.4	14	19.6	23.6	27.7	33.4	38.1
45 min	14.3	16.2	22.4	26.8	31.3	37.5	42.5
1 hour	15.7	17.7	24.4	29.1	33.9	40.4	45.6
1.5 hour	17.9	20.2	27.5	32.7	37.8	44.8	50.2
2 hour	19.6	22.1	30	35.5	41	48.3	54.1
3 hour	22.4	25.2	34	40.1	46.2	54.4	60.7
4.5 hour	25.7	28.9	38.9	45.9	52.8	62.2	69.5
6 hour	28.4	31.9	43.1	50.8	58.5	69	77.3
9 hour	32.9	36.9	49.9	59	68.1	80.8	90.8
12 hour	36.4	40.9	55.6	65.8	76.2	90.7	102
18 hour	41.9	47.2	64.5	76.7	89.1	107	121

Duration	AEP						
	63.20%	50%	20%	10%	5%	2%	1%
24 hour	46	51.9	71.3	85.1	99.2	119	135
30 hour	49.2	55.6	76.7	91.8	107	129	147
36 hour	51.8	58.7	81.2	97.3	114	137	156
48 hour	55.8	63.3	88	106	124	149	169
72 hour	60.9	69.3	96.6	116	136	163	185
96 hour	64.1	73	102	122	143	172	195
120 hour	66.4	75.6	105	126	148	177	201
144 hour	68.3	77.6	108	129	151	181	206
168 hour	69.9	79.3	110	131	153	185	210

Table 2 Initial and continuing losses

Parameter	Value
Impervious area initial loss (mm)	1
Pervious area initial loss (mm)	29.0
Pervious area continuing loss (mm/h)	0.5 (source SMEC 2019)

Table 3 Probability neutral pre-burst depths (mm)

min (h)\)	AEP					
	50.00%	20.00%	10.00%	5.00%	2.00%	1.00%
60 (1.0)	17.6	15.3	13.4	13.3	12.9	11.9
90 (1.5)	20	16.1	13.7	12.7	11.7	11.1
120 (2.0)	21.9	14.8	12.8	11.9	11.2	9.7
180 (3.0)	24	14.7	13.1	13.3	12.4	10.8
360 (6.0)	23.7	15.6	13.9	14.1	11.7	9.5
720 (12.0)	24.4	17	15.4	15.4	12.5	8.2
1080 (18.0)	26.2	20.1	19.4	19.5	16	11
1440 (24.0)	27.8	22	21.1	22	19.3	12.4
2160 (36.0)	30	24.6	24.2	25.3	23.9	16.1
2880 (48.0)	31.2	25.8	25.6	26.7	25	19.4
4320 (72.0)	32	26.8	27.6	29	27	22.3

The following additional information was used for the flooding assessment.

– LiDAR information obtained from ELVIS captured in June 2011.
– Aerial photography (Six Maps)

4. Site stormwater assessment

The proposed development will be constructed within the grounds of Cooma Hospital. as shown on Figure 3. Stormwater runoff from the accommodation roof, as well as from outdoor entertainment will be captured via a new pit and pipe system that will be connected to the Council drainage network located in Bombala Street. The Bombala Street drainage system connects to drainage in Victoria Street which discharges to Cooma Creek.

As noted in Section 1.6, Council requires that re-developments must not result in increased stormwater discharges compared to pre development conditions.

Figure 3 Site layout (proposed development adjacent to Bombala Street)

The drainage system at the site was analysed using DRAINS software (V2022.012) using an initial / continuing loss model. A DRAINS model was established to represent existing conditions and the effect of the additional impervious area resulting from the proposed accommodation on discharges was calculated for the 20% AEP and 1% AEP events.

The total hospital site area is 3.22 hectares. The existing impervious area was calculated to be 1.56 hectares which represents 48.5 percent of the site area. The proposed accommodation will increase the impervious area by 0.06 hectares to 1.62 hectares, or an additional 1.9% impervious area. The modelled flowrates for the existing and proposed scenario are shown in Table 4.

Table 4 Modelled site discharges

Scenario	20% AEP total site flowrate (m3/s)	1%AEP total site flowrate (m3/s)
Existing conditions	0.370	0.841
Proposed conditions	0.384	0.843
Change in flowrate	0.014	0.002
Percentage increase	3.8%	0.2%

The modelled stormwater impacts of the proposal in the 20% AEP are considered to be minor, given that stormwater will discharge directly to the Council street drainage system from where it will be conveyed directly to Cooma Creek and will not impact adjoining properties. The change in flows in a 1% AEP event is negligible.

5. Flooding Assessment

Following NSW SES advice outlined in Section 1.5, a flooding assessment has been carried out to determine the vulnerability of the development and community for events up to Probable Maximum Flood (PMF). The hydrology and hydraulic modelling for this assessment has relied on information provided in SMEC 2019 including model calibration parameters and critical storm durations. This assessment has examined the 1% AEP and PMF events in Cooma Creek and climate change scenarios.

5.1 Hydrologic Assessment

Design hydrographs for Cooma Creek at Sharp Street were derived using Watershed Bounded Network Model (WBNM) rainfall runoff routing model. The Cooma Creek catchment was subdivided as shown on Figure 4. The adopted loss rates were obtained from SMEC 2019.

For the 1%, 0.05% and 0.02% AEP events, design rainfall intensities and temporal patterns were input to the WBNM model. An aerial reduction factor was applied in accordance with Australian Rainfall and Runoff 2019. The 12 hour duration was found to be critical at Sharp Street by SMEC 2019 and this duration was adopted as critical in this assessment.

The Probable Maximum Precipitation was derived using Bureau of Meteorology Bulletin 53. SMEC 2019 found that the 3 hour duration PMP is critical for Cooma Creek and this event was modelled for this assessment.

Modelled peak discharges at Sharp Street are shown in Table 5.

Table 5 Modelled 1% AEP flowrates

Event	Modelled discharge (m^3/s)	SMEC 2019 reported discharge (m^3/s)	Comments
1% AEP	228	226	Modelled flow are consistent
0.05% AEP	273	251	SMEC flow is lower which may be due partly to hydraulic routing in TUFLOW model
0.02% AEP	329	277	SMEC flow is lower which may be due partly to hydraulic routing in TUFLOW model
PMF	2937	1515	SMEC discharge is not consistent with other locations reported. Higher PMF discharge has been adopted for this assessment.

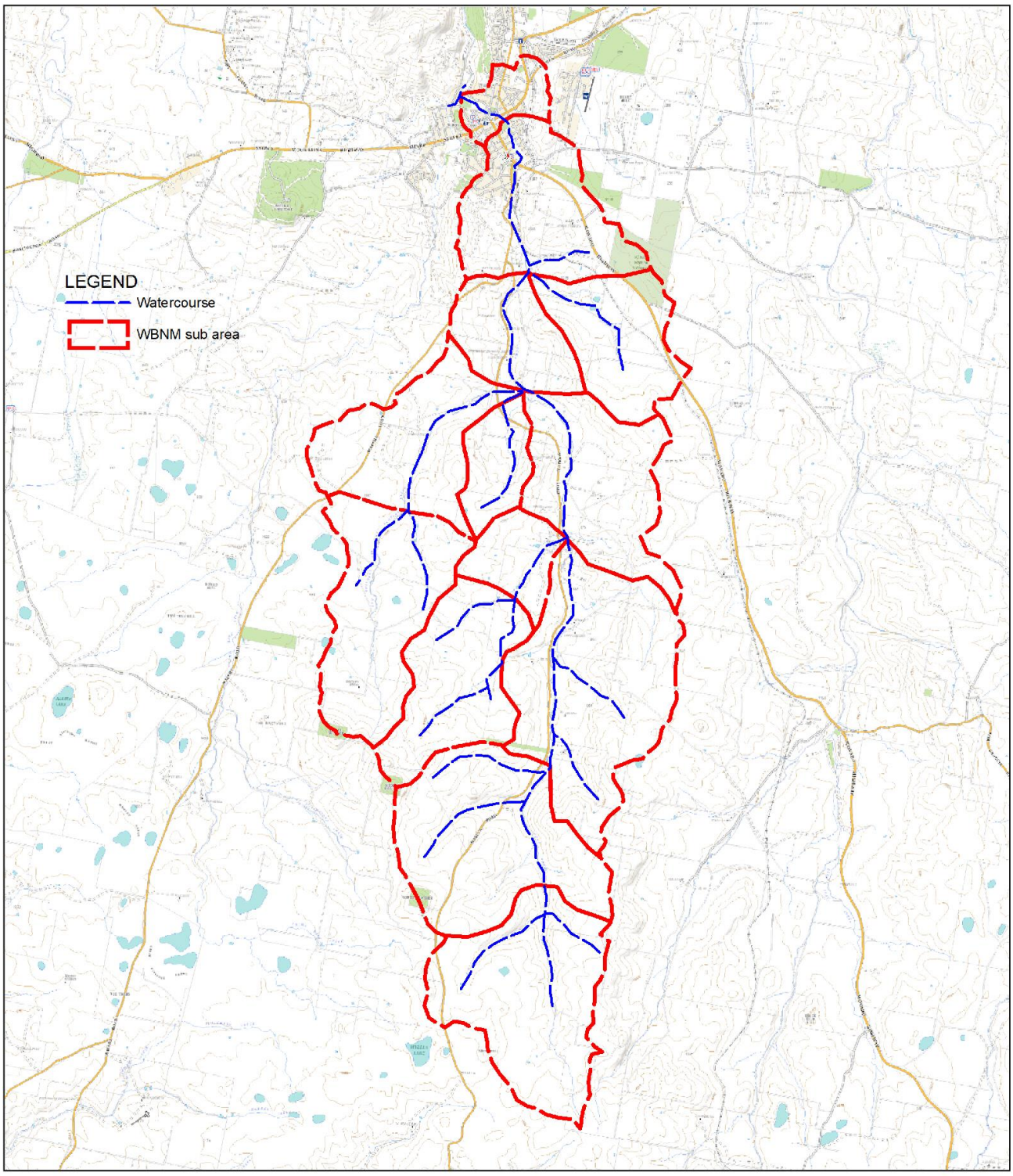

Figure 4 *WBNM model layout*

5.2 Hydraulic modelling

5.2.1 Model establishment

The hydraulics of Cooma Creek was modelled using TUFLOW (V2020-01-AB), a 2 dimensional (2D) hydrodynamic modelling software package. The model was prepared to replicate the results from the SMEC 2019 modelling. Accordingly, the model adopted a 5 m model grid with the model terrain surface based on 2011 LiDAR survey. Hydraulic features incorporated into the TUFLOW model included the bridges at Sharp Street and Bombala Street which were modelled as layered flow constrictions, and the structural levees that link the earthen levees and high ground installed along Cooma Creek which were modelled as terrain adjustments. Manning's 'n' friction parameters were estimated from aerial photography and the values documented in SMEC 2019. The model extent was taken to downstream of Sharp Street and to upstream of Bombala Street, in order to determine flood levels at the key worker accommodation site location. The modelled inflow hydrographs were derived from WBNM and input as boundary conditions to the model. The TUFLOW model layout is shown on Figure 5 .

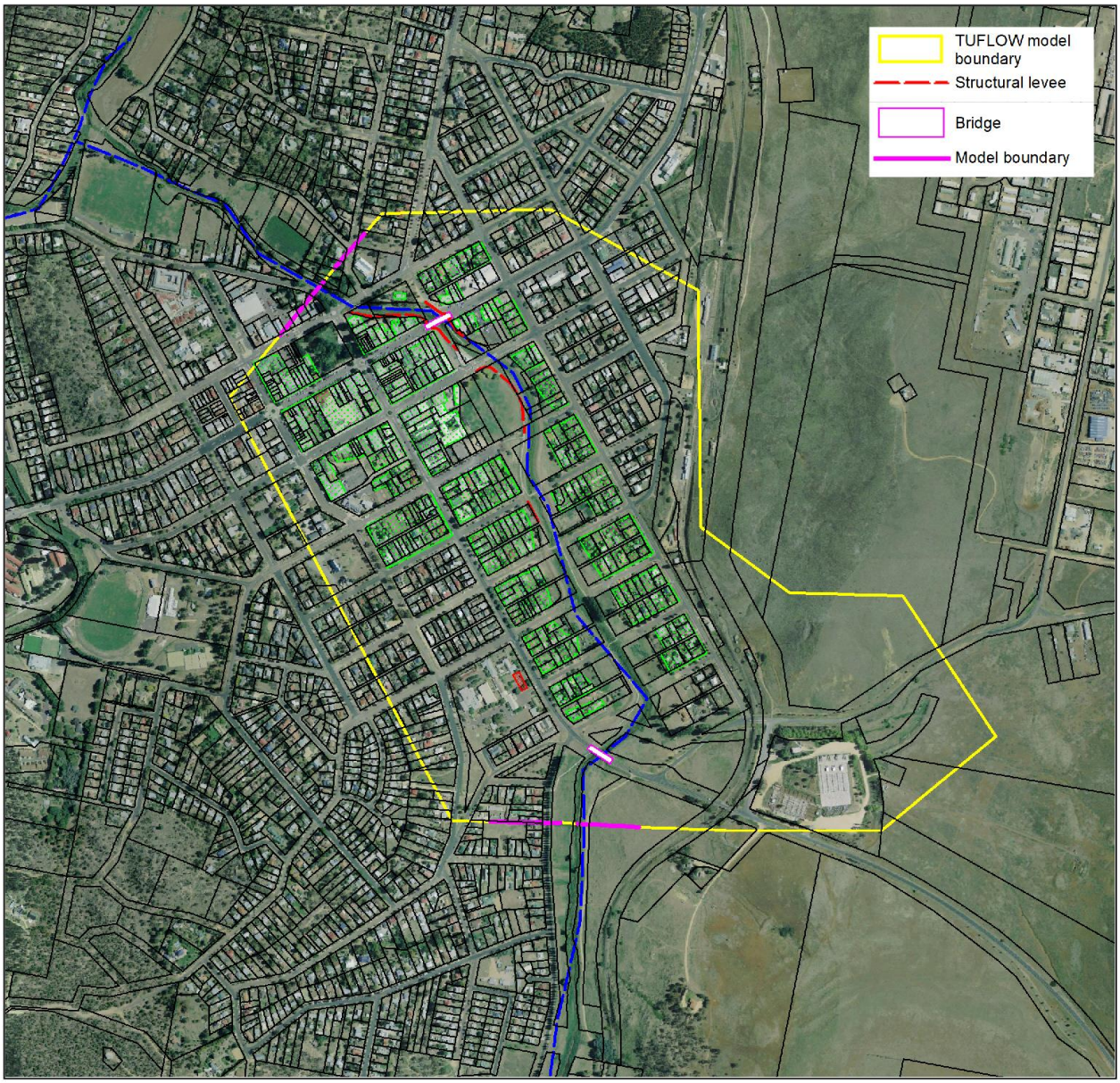

Figure 5 TUFLOW model layout

5.2.2 Results

5.2.2.1 1% AEP

The 1% AEP modelled flood depth and levels in proximity to the key worker accommodation are shown on Figure 6. The 1% AEP flood does not impact on the site. It should be noted that in a 1% AEP event, evacuation to and from Cooma via Sharp Street is not possible. Hospital personnel, while not in danger while they remain in the hospital grounds, would be unable to leave Cooma until floodwaters recede and roads are re-opened.

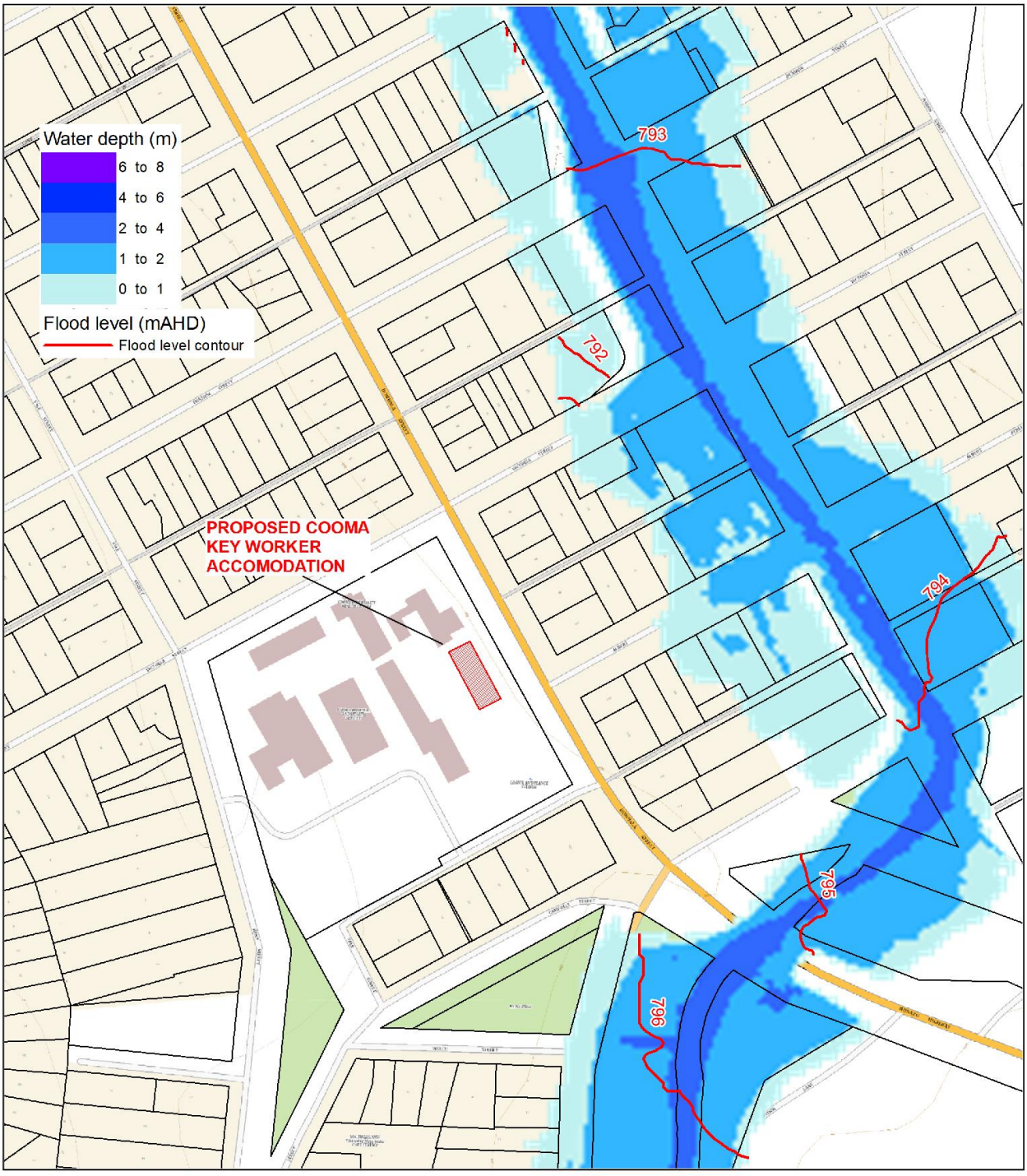

Figure 6 *1% AEP flood extent in proximity to key worker accommodation site*

5.2.2.2 1% AEP with Climate Change

Climate change impacts have been assessed using Australian Rainfall and Runoff 2019 (ARR 2019) guidelines. The ARR 2019 guidelines recommend that climate change should be considered for the design of significant infrastructure. This would include critical infrastructure such as hospitals.

The ARR 2019 climate change assessment processes adopt findings from the IPCC Fifth Assessment Report (IPCC, 2013). The process adopts projected changes from Global Climate Models (GCMs) and can be explored for four Representative Concentration Pathways (RCP's) for greenhouse gas and aerosol concentrations that were used to derive the GCMs. The use of RCPs 4.5 (low emissions) and 8.5 (high emissions) are recommended by the guidelines for the assessment.

The ARR 2019 guidelines provide a framework for the assessment of critical elements based on the following considerations:

– The assets effective service life or planning horizon; and
– The purpose and/or Nature of the Asset and consequences of its failure.

Where the design service life or planning horizon is considered to be "long", a more detailed screening analysis of climate change impacts with respect to the consequence of failure is warranted.

Given the critical nature and effective service life of the proposal, a screening analysis with respect to elements with a relatively long design life (such as the drainage network) is warranted during detailed design.

The 0.5% AEP (200 year ARI) and 0.2% AEP (500 year ARI) events are typically used used as proxies for the 1% AEP with climate change scenarios RCP 4.5 and RCP 8.5 respectively.

These events have been modelled in TUFLOW and it was found that the hospital grounds remain flood free in both events. The 0.2% AEP change in flood extent (1% AEP plus RCP 8.5 proxy) is shown on Figure 7 . It is concluded that the site would be expected to remain flood free in a 1% AEP event under a high emissions (RCP 8.5) climate change scenario.

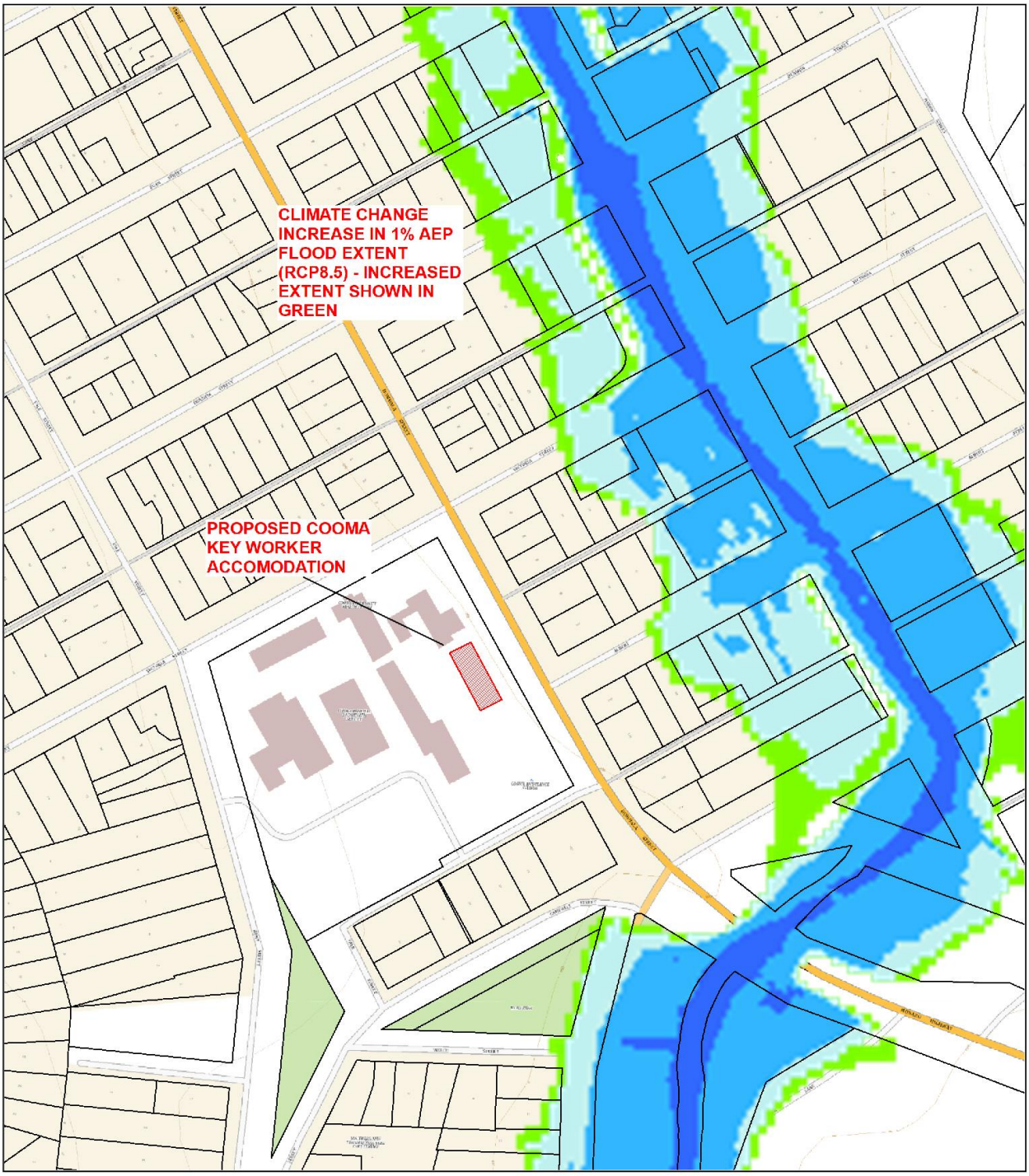

Figure 7 *Climate change impact in 1% AEP flood extent*

5.2.2.3 Probable Maximum Flood

The modelled PMF extent is shown on Figure 8. The PMF is seen to flood Bombala Street and the south eastern corner of the hospital site. The proposed key worker accommodation remains above the PMF level. Hospital personnel could shelter within the hospital grounds for all flood events up to a PMF. Vehicles would be unable to enter of leave the site via Bombala Street at the peak of a PMF, however the duration of inundation would be less than 1 hour. Hospital staff should be aware that heading south along Bombala Street would be hazardous and it would not be possible to cross Cooma Creek during a PMF. It is recommended that hospital staff and patients be

made aware of the potential flood hazard in Bombala Street and that they should shelter within the hospital grounds during major flooding until flood waters have subsided.

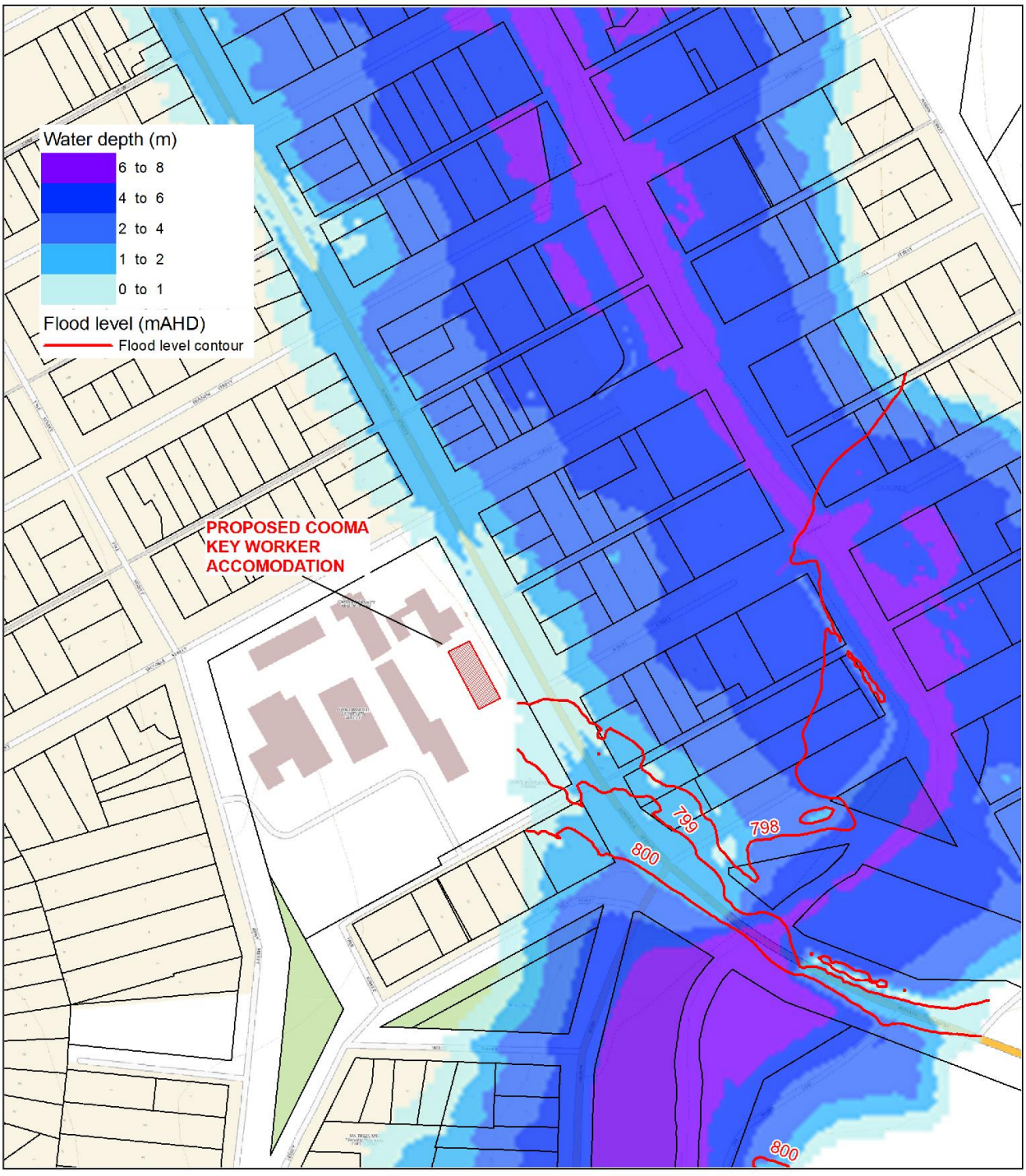

Figure 8 *Probable Maximum Flood (PMF) extent*

6. Conclusions

This flooding assessment has examined both potential stormwater impacts on surrounding land arising from the key worker accommodation proposal and potential impacts to hospital patients and personnel posed by flooding of Cooma Creek.

The investigation examined stormwater runoff from the hospital site under existing and proposed conditions. Stormwater discharge increases from the additional impervious area associated with the proposed key worker accommodation on the site were found to be small, with the 20% AEP discharge increasing by 3.8% and 1% AEP discharges increasing by 0.2%. This should not warrant further management measures such as on site detention, given that there are unlikely to be adverse flooding impacts from the development.

It was found that the hospital site is flood free in a 1% AEP flood event even under a future high emissions climate change scenario. In a PMF it was found that the keyworker accommodation building would be outside the extent of flooding, however evacuation to or from Bombala Street would be hazardous and signage to indicate the hazard would be advisable at any proposed Bombala Street entrance.

7. References

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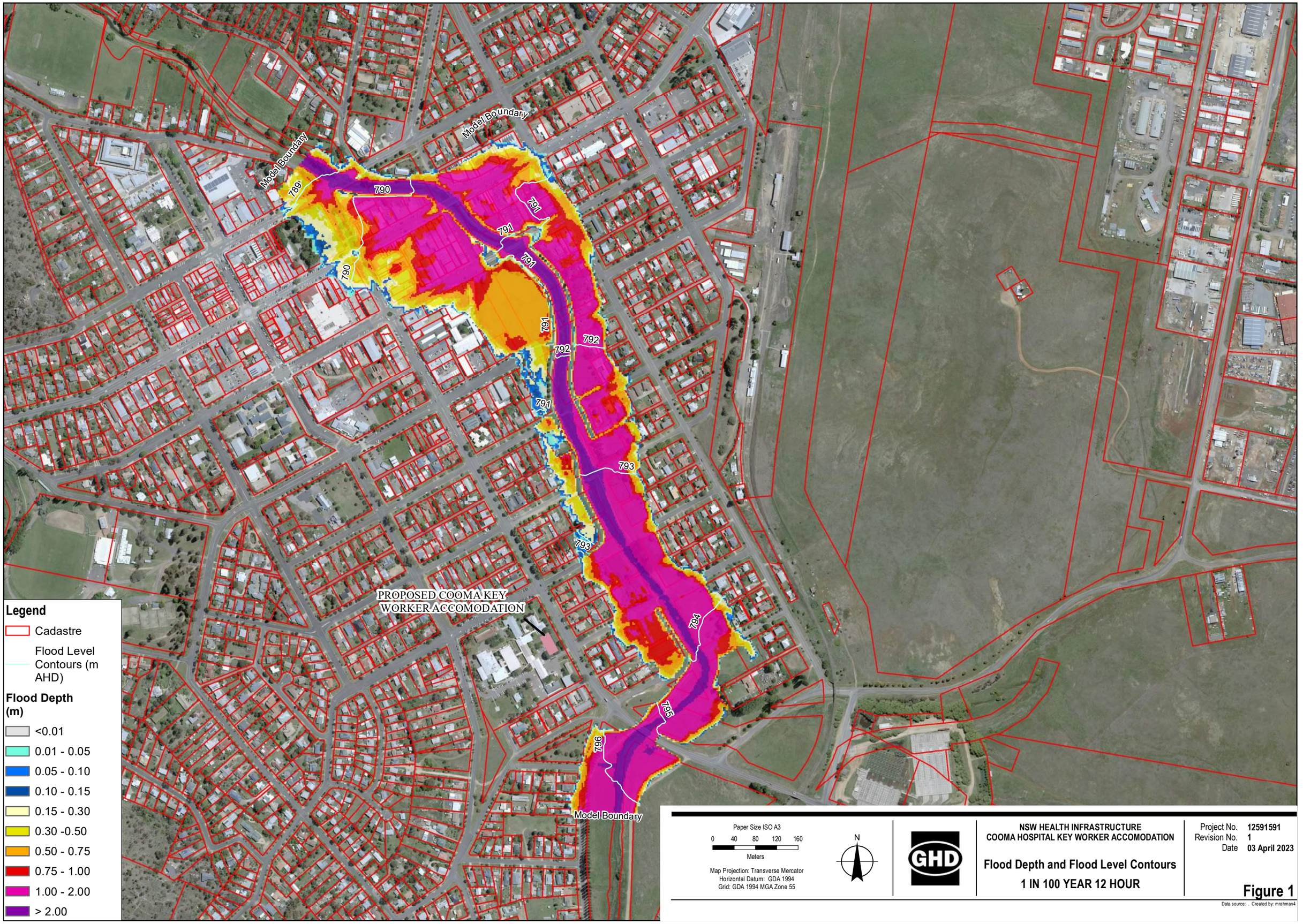
Appendix A
Flood Mapping



Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION

Flood Depth and Flood Level Contours
1 IN 100 YEAR 12 HOUR

Project No. 12591591
Revision No. 1
Date 03 April 2023

Figure 1

Data source: . Created by: mrahman4

Model Boundary

Model Boundary

789

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PROPOSED COOMA KEY WORKER ACCOMODATION

Model Boundary

Legend

- Cadastre
- Flood Level Contours (m AHD)

Flood Depth (m)

- <0.01
- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.15
- 0.15 - 0.30
- 0.30 -0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 2.00
- > 2.00

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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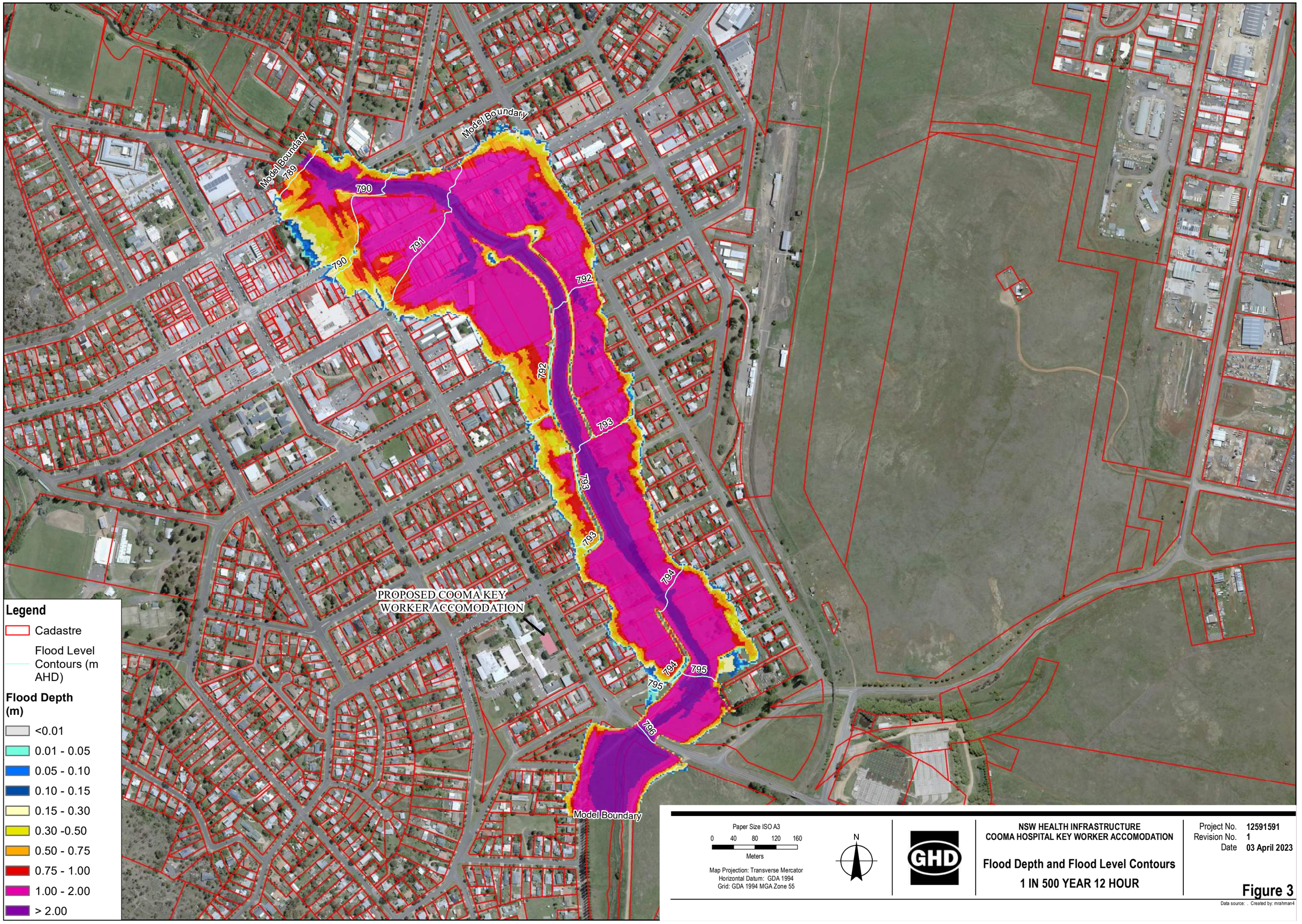
NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION

Flood Depth and Flood Level Contours
1 IN 200 YEAR 12 HOUR

Project No. **12591591**
Revision No. **1**
Date **03 April 2023**

Figure 2

Data source: . Created by: mrahman4


Model Boundary
Model Boundary
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PROPOSED COOMA KEY WORKER ACCOMODATION
Model Boundary
Legend
Cadastre
Flood Level Contours (m AHD)
Flood Depth (m)
<0.01
0.01 - 0.05
0.05 - 0.10
0.10 - 0.15
0.15 - 0.30
0.30 -0.50
0.50 - 0.75
0.75 - 1.00
1.00 - 2.00
> 2.00
Paper Size ISO A3
0 40 80 120 160
Meters
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55
N
GHD
NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION
Flood Depth and Flood Level Contours
1 IN 500 YEAR 12 HOUR
Project No. 12591591
Revision No. 1
Date 03 April 2023
Figure 3
Data source: . Created by: mrahman4

Model Boundary
Model Boundary
792
792
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800
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800
Model Boundary
PROPOSED COOMA KEY WORKER ACCOMODATION

Legend

- Cadastre
- Flood Level Contours (m AHD)

Flood Depth (m)

- <0.01
- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.15
- 0.15 - 0.30
- 0.30 -0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 2.00
- > 2.00

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

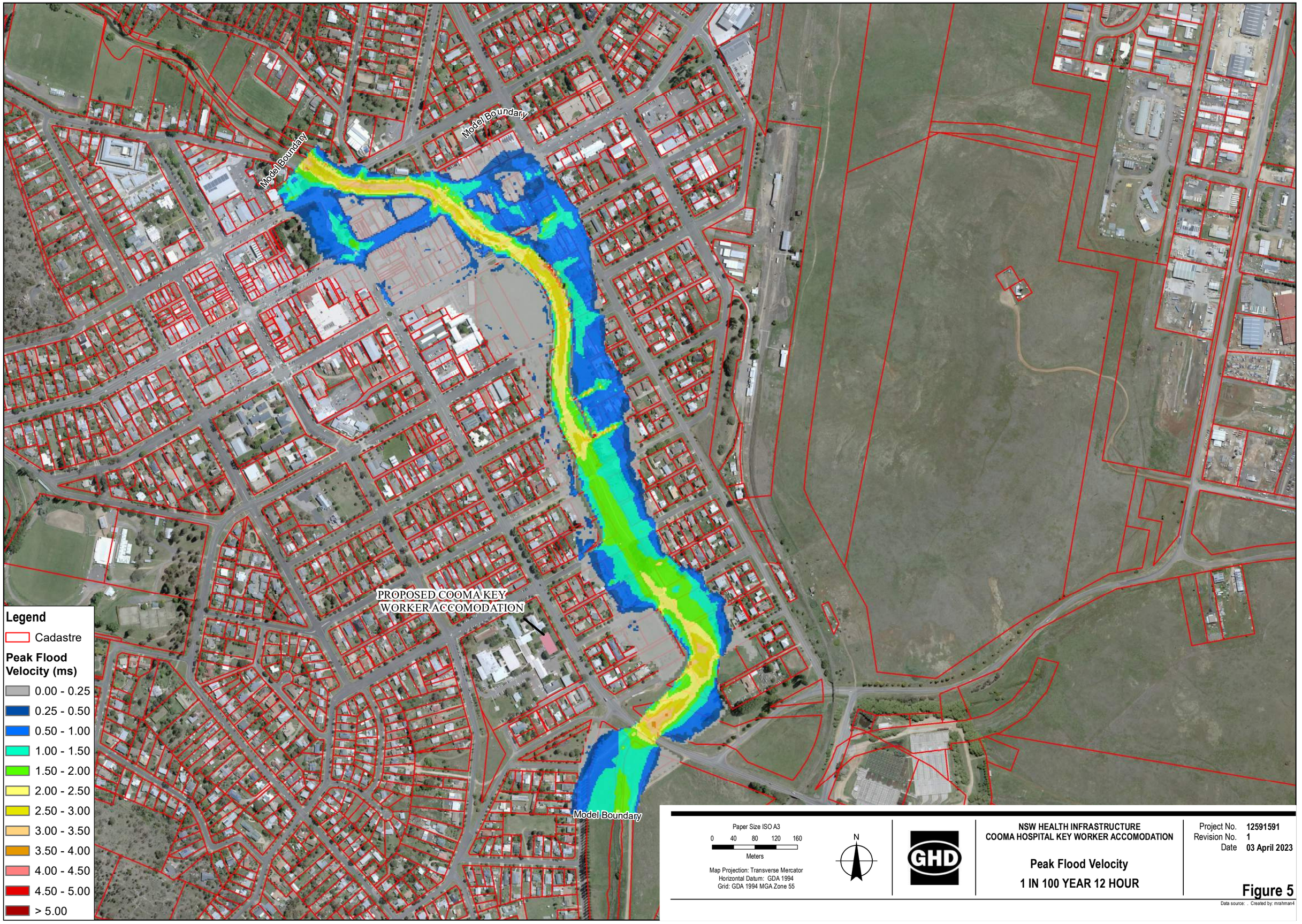
NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION

Flood Depth and Flood Level Contours
PMF 3 HOUR

Project No. **12591591**
Revision No. **1**
Date **03 April 2023**

Figure 4

Data source: . Created by: mrahman4



Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION

Peak Flood Velocity
1 IN 100 YEAR 12 HOUR

Project No. **12591591**
Revision No. **1**
Date **03 April 2023**

Figure 5

Data source: . Created by: mrahman4

Model Boundary

Model Boundary

PROPOSED COOMA KEY WORKER ACCOMODATION

Model Boundary

Legend

Cadastre

Peak Flood Velocity (ms)

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- 2.00 - 2.50
- 2.50 - 3.00
- 3.00 - 3.50
- 3.50 - 4.00
- 4.00 - 4.50
- 4.50 - 5.00
- > 5.00

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION

Peak Flood Velocity
1 IN 200 YEAR 12 HOUR

Project No. **12591591**
Revision No. **1**
Date **03 April 2023**

Figure 6

Data source: . Created by: mrahman4

Model Boundary

Model Boundary

PROPOSED COOMA KEY WORKER ACCOMODATION

Model Boundary

Legend

Cadastre

Peak Flood Velocity (ms)

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 1.00
- 1.00 - 1.50
- 1.50 - 2.00
- 2.00 - 2.50
- 2.50 - 3.00
- 3.00 - 3.50
- 3.50 - 4.00
- 4.00 - 4.50
- 4.50 - 5.00
- > 5.00

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

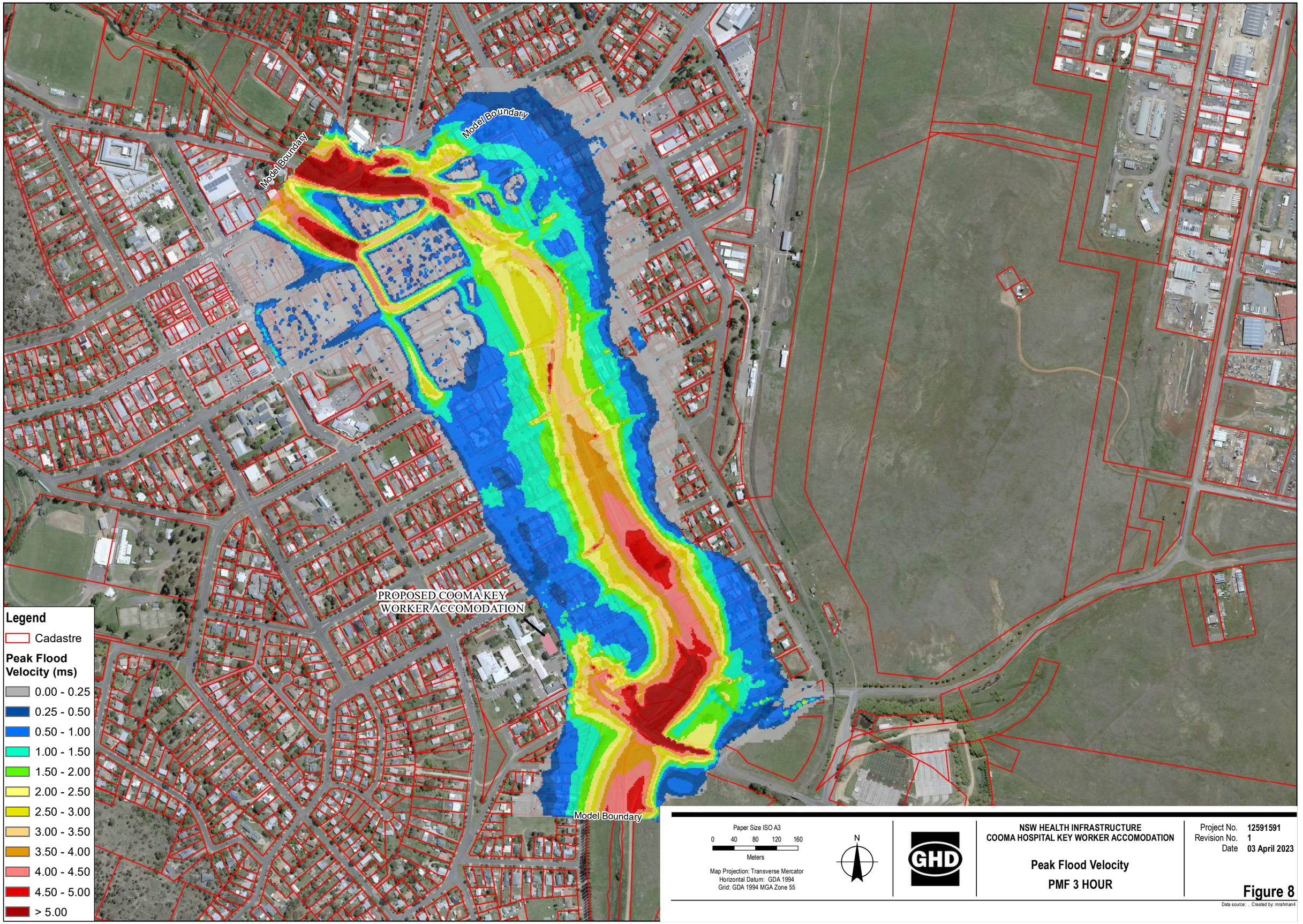
NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION

Peak Flood Velocity
1 IN 500 YEAR 12 HOUR

Project No. **12591591**
Revision No. **1**
Date **03 April 2023**

Figure 7

Data source: . Created by: mrahman4



Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION

Peak Flood Velocity
PMF 3 HOUR

Project No. **12591591**
Revision No. **1**
Date **03 April 2023**

Figure 8

Data source: . Created by: mrahman4

Model Boundary

Model Boundary

Model Boundary

PROPOSED COOMA KEY WORKER ACCOMODATION

Legend

Cadastre

Flood Hazard

- H1 - generally safe for people, vehicles and buildings
- H2 - unsafe for small vehicles
- H3 - unsafe for vehicles, children and elderly
- H4 - unsafe for people and vehicles
- H5 - unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6 - unsafe for vehicles and people. All building types considered vulnerable to failure

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION

Flood Hazard

1 IN 100 YEAR 12 HOUR

Project No. **12591591**
Revision No. **1**
Date **03 April 2023**

Figure 9

Data source: . Created by: mrahman4

Model Boundary

Model Boundary

Model Boundary

PROPOSED COOMA KEY WORKER ACCOMODATION

Legend

Cadastre

Flood Hazard

- H1 - generally safe for people, vehicles and buildings
- H2 - unsafe for small vehicles
- H3 - unsafe for vehicles, children and elderly
- H4 - unsafe for people and vehicles
- H5 - unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6 - unsafe for vehicles and people. All building types considered vulnerable to failure

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION

Flood Hazard

1 IN 200 YEAR 12 HOUR

Project No. **12591591**
Revision No. **1**
Date **03 April 2023**

Figure 10

Data source: . Created by: mrahman4

Model Boundary

Model Boundary

Model Boundary

PROPOSED COOMA KEY WORKER ACCOMODATION

Legend

- Cadastre

Flood Hazard

- H1 - generally safe for people, vehicles and buildings
- H2 - unsafe for small vehicles
- H3 - unsafe for vehicles, children and elderly
- H4 - unsafe for people and vehicles
- H5 - unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6 - unsafe for vehicles and people. All building types considered vulnerable to failure

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION

Flood Hazard

1 IN 500 YEAR 12 HOUR

Project No. **12591591**
Revision No. **1**
Date **03 April 2023**

Figure 11

Data source: . Created by: mrahman4

Model Boundary

Model Boundary

Model Boundary

PROPOSED COOMA KEY WORKER ACCOMODATION

Legend

- Cadastre

Flood Hazard

- H1 - generally safe for people, vehicles and buildings
- H2 - unsafe for small vehicles
- H3 - unsafe for vehicles, children and elderly
- H4 - unsafe for people and vehicles
- H5 - unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure
- H6 - unsafe for vehicles and people. All building types considered vulnerable to failure

Paper Size ISO A3

0 40 80 120 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

NSW HEALTH INFRASTRUCTURE
COOMA HOSPITAL KEY WORKER ACCOMODATION

Flood Hazard

PMF 3 HOUR

Project No. **12591591**
Revision No. **1**
Date **03 April 2023**

Figure 12

Data source: . Created by: mrahman4

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The Power of Commitment