



Flood Impact and Risk Assessment

for

1020 Melia Court, Castle Hill

for Castle Hill Glen Pty Ltd

SY230499 / 19 November 202320 November 2023 /
Revision B

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		Date
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Acronyms

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
DCP	Development Control Plan
DRAINS	1D hydrology and hydraulic software
DTM	Digital Terrain Model
FPL	Flood Planning Level
FFL	Finished Floor Level
GIS	Geographical Information System
LGA	Local Government Area
LiDAR	Light Detection and Ranging (also see ALS)
m	Measure of length / height / distance (metres)
m AHD	Meters above Australian High Datum
m/s	Measure of velocity (metres per second)
m ³ /s	Measure of flow rate (cubic metres per second)
THSC	The Hills Shire Council (Council)
ToC	Time of concentration
TUFLOW	A 1D and 2D hydraulic modelling software

Introduction

Northrop Consulting Engineers have been engaged to prepare flood impact and risk assessment for proposed development at 1020 Melia Court, Castle Hill.

The purpose of this report is to detail the flood behaviour of the site and assess the proposed development with respect to the development controls of THSC, and Ministerial Directions - Flooding.

Included herein is a:

- Methodology for our assessment.
- Description of the subject site and proposed development.
- Overview of the existing flood behaviour.
- Discussion of compliance with Ministerial Direction and Council policies.

Methodology

The subject site is not covered by an existing flood study and is located at the top of the catchment adjacent to a ridge line. A local flood study was prepared for this assessment using the following steps.

- Delineation of upstream catchments.
- Obtain design rainfall patterns using ARR data hub, BoM IFD site, and GSDM procedures.
- Estimate hydrological properties and peak flows using DRAINS software.
- Determine flood extents using TUFLOW.

The reporting has considered the following policies and documents.

- THSC LEP and DCP.
- Ministerial Directions - Flooding
- Flood Risk Management Manual (NSW Government, 2023)

Subject Site and Proposed Development

Subject Site

The subject site is located at 1020 Melia Court, Castle Hill. It comprises Lot 1020 and Lot 1021 DP876671, and Lot 2 DP576773. The site has an area of approximately 4.5 hectares and is bordered by residential properties to the north and southeast, and a Sydney Water reservoir and reserve to the southwest. Access to the site is via Glen Road to the west.

The site terrain is steep with elevations ranging from approximately from 193 metres AHD in the north of the site to approximately 129 metres AHD in the south. Several easements for drainage run through the north of the site from Melia Close, and a water supply easement runs through the middle of the site. The site is currently vacant with grass cover and medium to dense vegetation.

The existing site location and topography is presented overleaf in **Figure A1**.

Proposed Development

The proposed development comprises several residential towers, and a concept layout is presented overleaf in **Figure A2**.

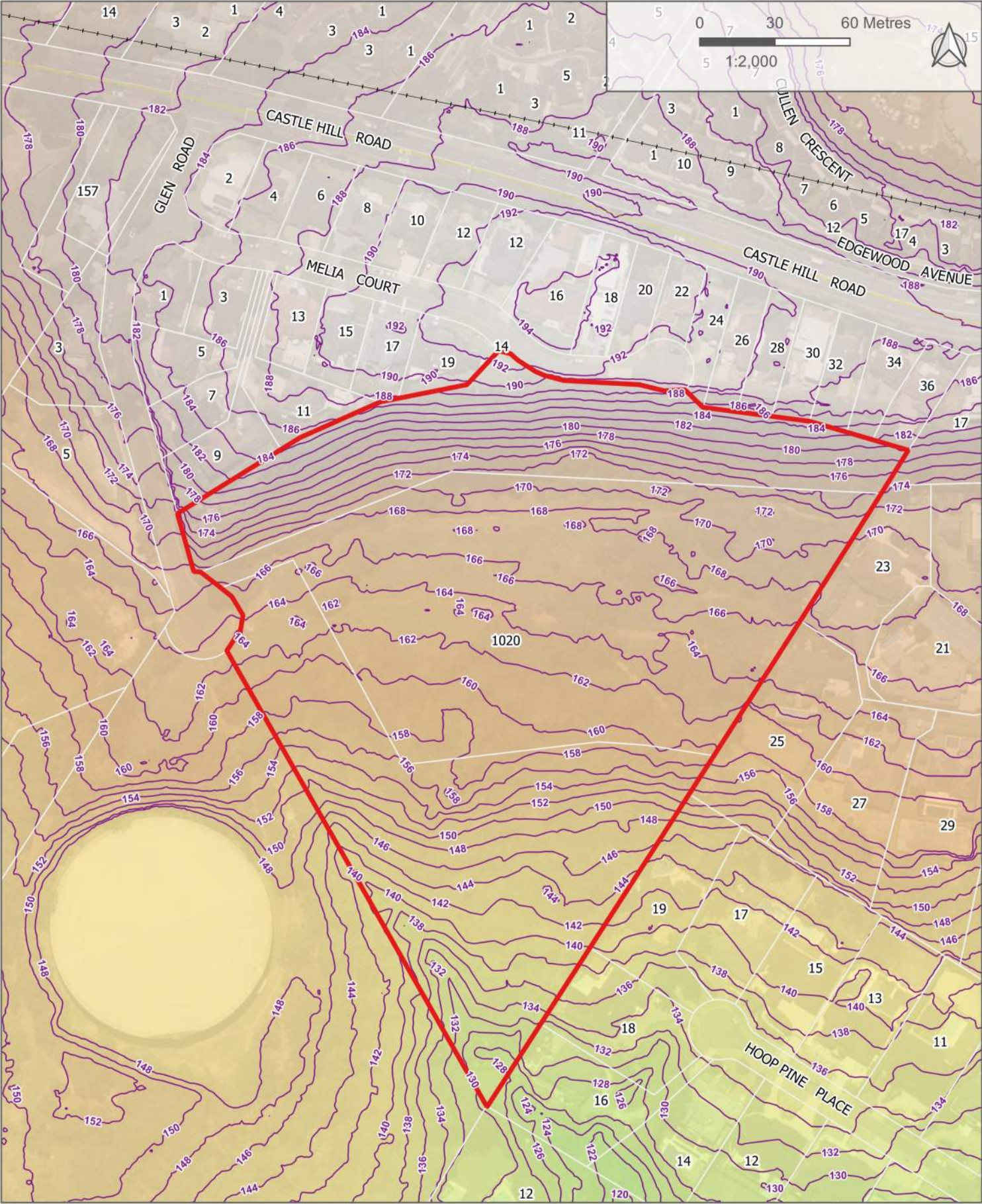
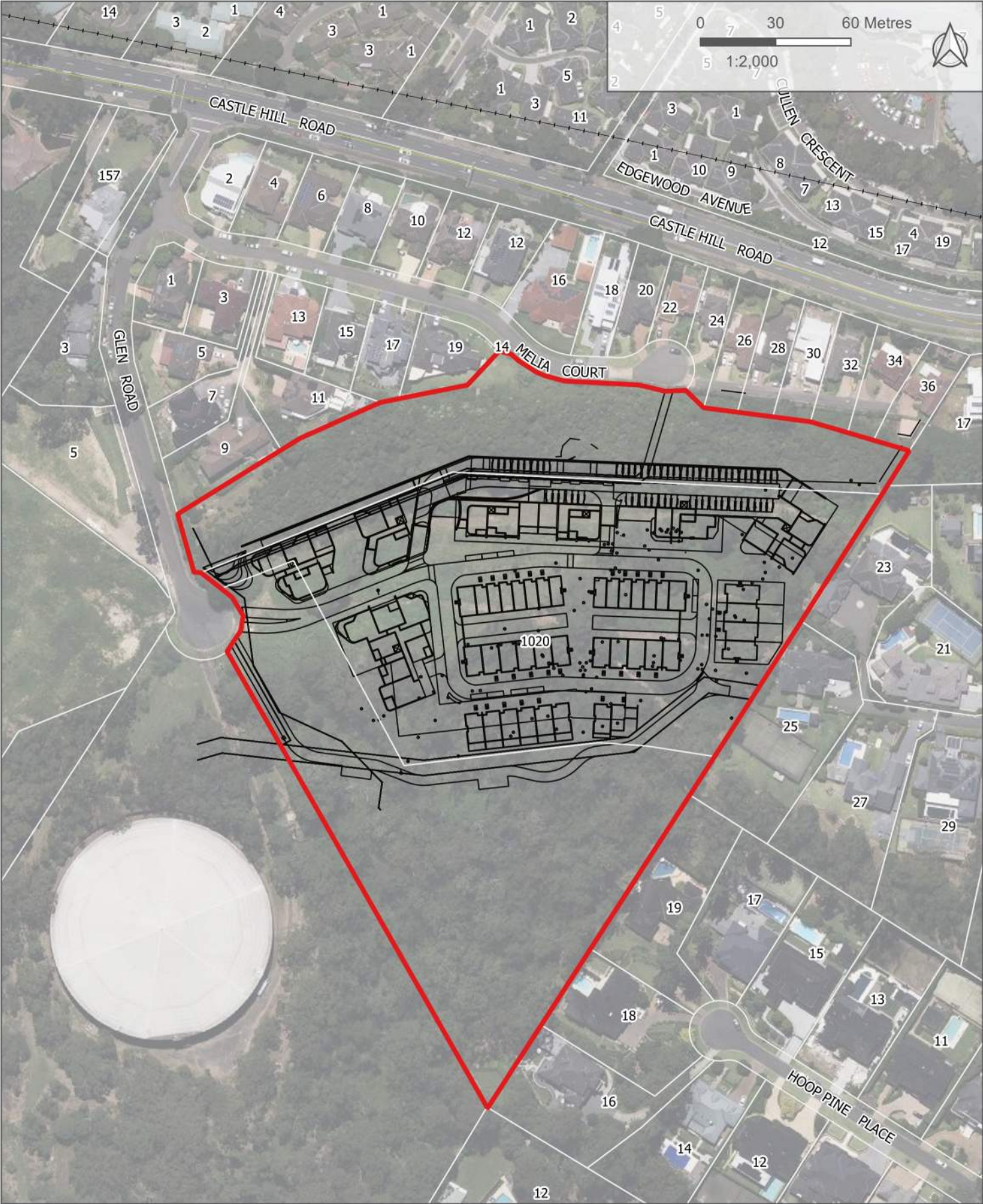


Figure A1

Locality

Glen Road
Planning Proposal





Legend
 Subject Site

Figure A2
Proposed Development
Glen Road
Planning Proposal

Catchments and Hydrological Model Setup

Catchments have been delineated from LiDAR survey and consideration has been given to the stormwater network and property boundaries and how they may influence the catchment delineation. A description of the catchments is presented below in Table 1 and catchment extents are presented overleaf in Figure A3

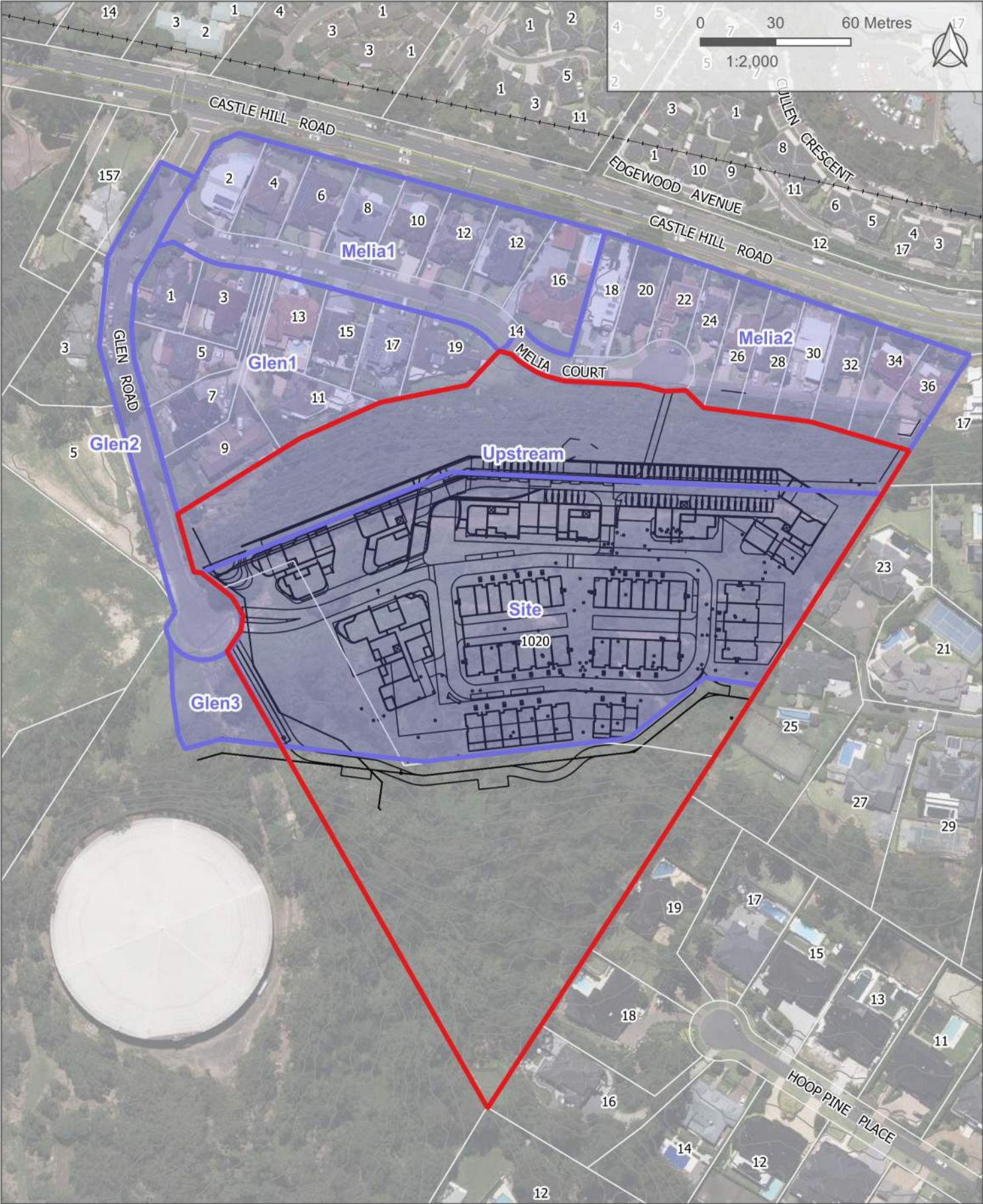
Table 1 - Catchment details

Catchment	Area (ha)	Impervious Fraction (%)	Pervious ToC (mins)	Impervious ToC (mins)	Comments
Melia1	0.831	80	5	2	Includes the eastern portion of Melia Court. Drains through two easements over subject site to the southwest.
Melia2	0.766	80	5	2	Includes the western portion of Melia Court and drains along Melia Court to Glen Road.
Glen1	0.832	80	5	2	Includes properties on the south of Melia Court and Glen Road draining to Glen Road.
Glen2	0.300	80	5	2	Includes Glen Road.
Glen3	0.113	0	5	-	Includes south of Glen Road to the west of the subject site.
Upstream	0.976	0	5	-	Includes densely vegetated slope to the south of Melia Court and north of the development area.
Site	2.203	0	5	-	Includes the development area upstream of the water supply easement.

Design rainfall has been obtained from the BoM with durations ranging from 5 minutes to 2 hours considered. Pre-burst rainfall has not been added, instead a low initial and continuing loss has been adopted. Values are summarised below in Table 2.

Table 2 - Losses

Loss	Value
Pervious initial loss	2mm
Pervious continuing loss	1mm/hr
Impervious initial loss	1mm
Impervious continuing loss	0mm/hr



Legend

Subject Site Catchments

Figure A3

Catchments

Glen Road
Planning Proposal

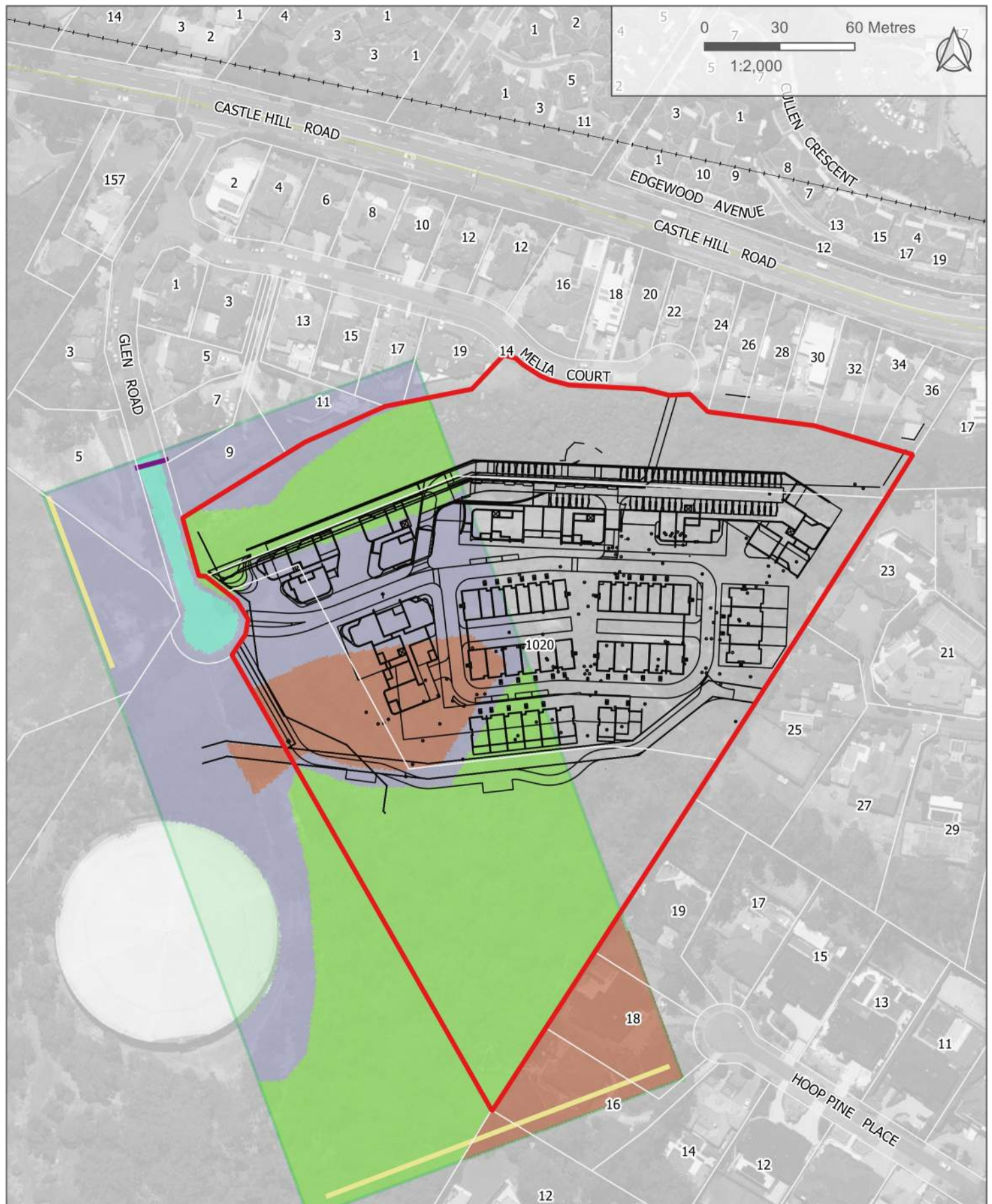


Hydraulic Model Setup

Two-dimensional hydraulic modelling was undertaken using the TUFLOW hydrodynamic modelling software. The TUFLOW model extent, boundary conditions, roughness values are shown overleaf in **Figure A4**.

The TUFLOW modelling parameters are as follows:

- TUFLOW version 2020-10-AD with Classic module was used.
- Model DTM with a 1m grid resolution incorporating LiDAR survey in the vicinity of the subject site.
- Upstream inflow hydrographs have been adopted from the maximum median temporal pattern from the total upstream catchment.
- Downstream tailwater conditions were entered as a free outfall for all outflow locations.
- No pit and pipe network from Glen Road has been assumed due to potential for blockage and the fact this will present a conservative flood assessment.



Legend

 Subject Site	Roughness
 Boundary Condition	0.015
 HT	0.04
 QT	0.08
 Model Extent	0.10

Figure A4

TUFLOW Model Setup

Glen Road
Planning Proposal



Flood Behaviour

Peak Flows

The peak flows from individual catchments, the total flow, and critical pattern is summarised below in

Table 3 - Peak flows

	50% AEP (m ³ /s)	10% AEP (m ³ /s)	5% AEP (m ³ /s)	1% AEP (m ³ /s)	1 in 500 AEP (m ³ /s)	PMF (m ³ /s)
Melia1	0.219	0.357	0.412	0.55	0.68	2.06
Melia2	0.202	0.329	0.38	0.51	0.63	1.90
Glen1	0.219	0.357	0.413	0.55	0.68	2.06
Glen2	0.079	0.129	0.149	0.20	0.25	0.74
Glen3	0.027	0.045	0.052	0.07	0.09	0.28
Upstream	0.236	0.388	0.447	0.60	0.74	2.42
Site	0.532	0.875	1.01	1.36	1.68	5.46
Total	1.41	2.33	2.66	3.65	4.53	14.60
Adopted Max Median	10min TP03	15min TP09	5min TP01	5min TP01	5m TP01	15min

Existing Flood Behaviour

The results of the existing case 1% AEP flood depth, elevation, velocity, and hazard are presented in **Figures B1-1 to B6-3** overleaf. Flood hazard categories have been based on the latest Australian Rainfall and Runoff 2019 categories presented in the below **Figure 1**.

The modelling indicates the total flow from the upstream catchment is generally contained within the drainage gully on the western side of the site, and to the south of Glen Road.

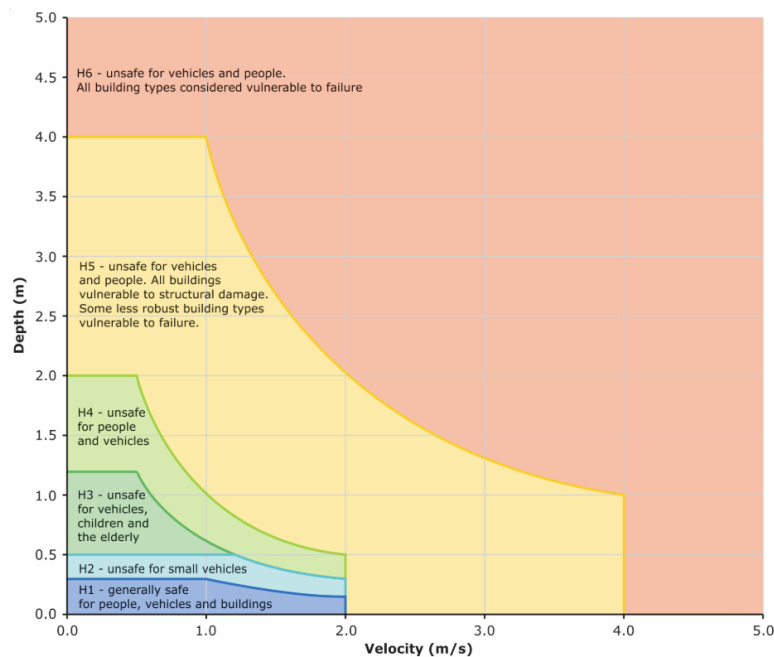
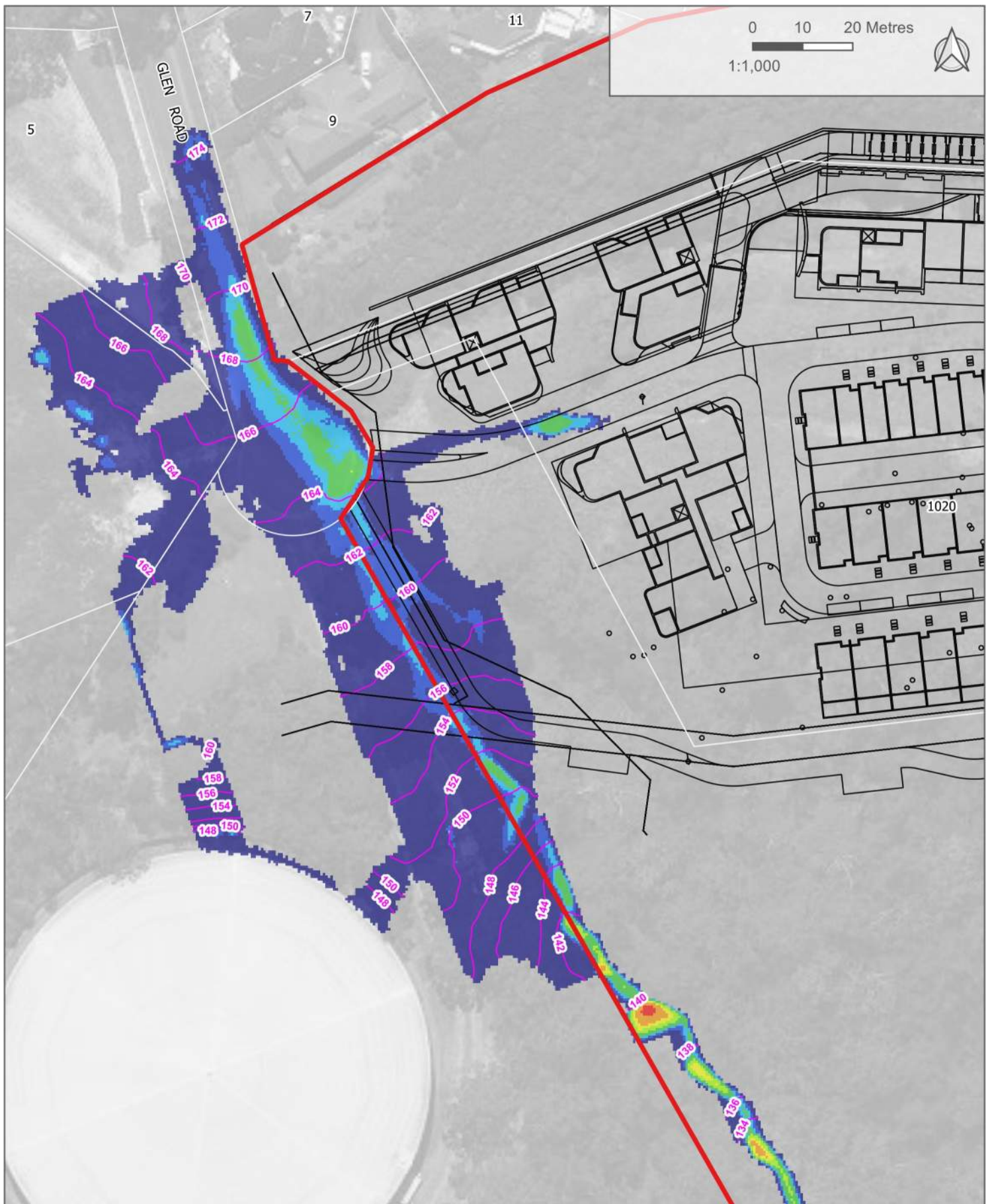


Figure 1 – Australian Rainfall and Runoff (2019) Hazard Categories



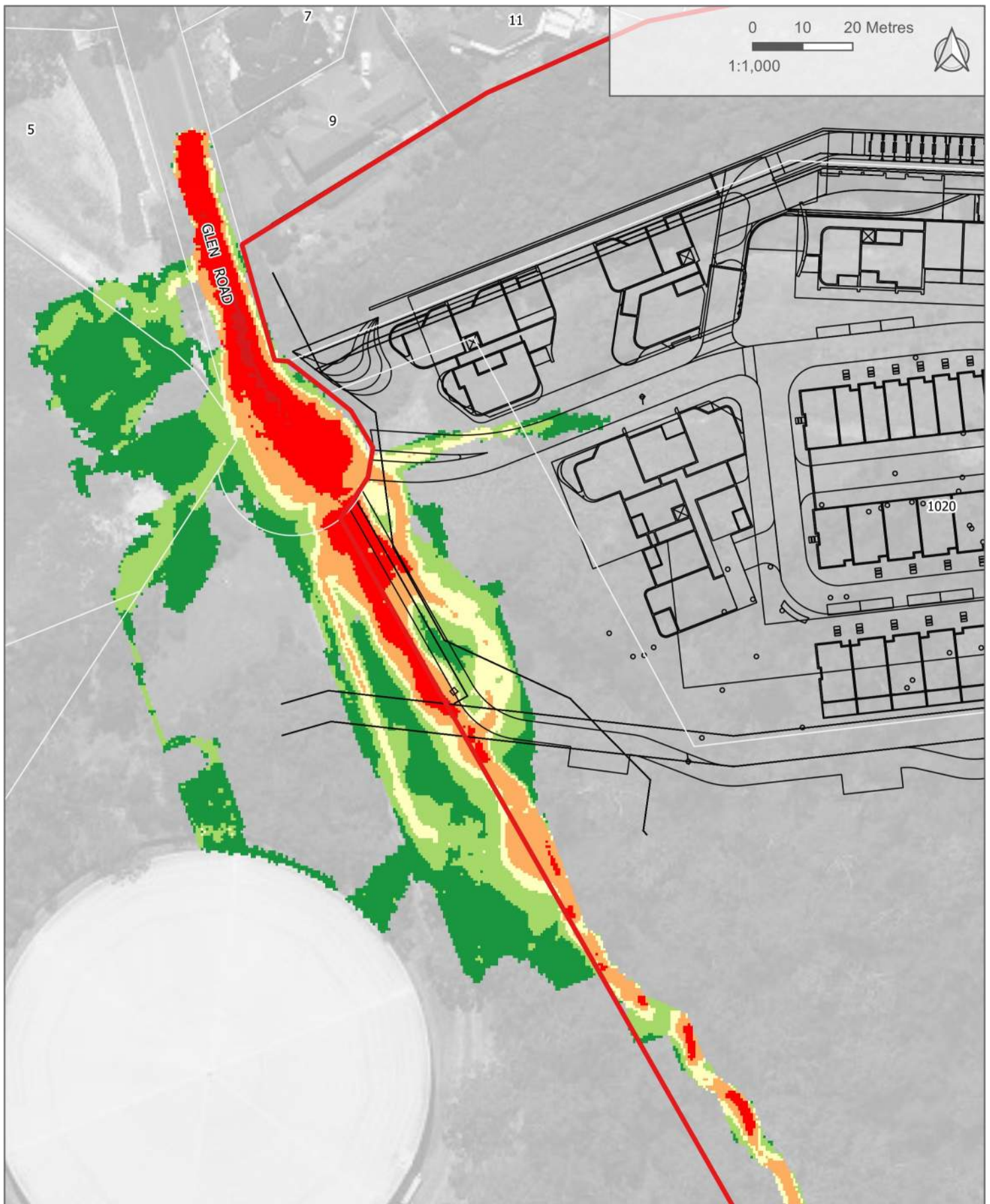
Legend

 Subject Site	Depth (m)	 0.50 - 0.75
— 2m Flood Contour	 <= 0.10	 0.75 - 1.00
	 0.10 - 0.20	 1.00 - 1.50
	 0.20 - 0.30	 1.50 - 2.00
	 0.30 - 0.50	 > 2.00

Figure B1-1

50% AEP Flood Depth and Elevation

Glen Road
Planning Proposal



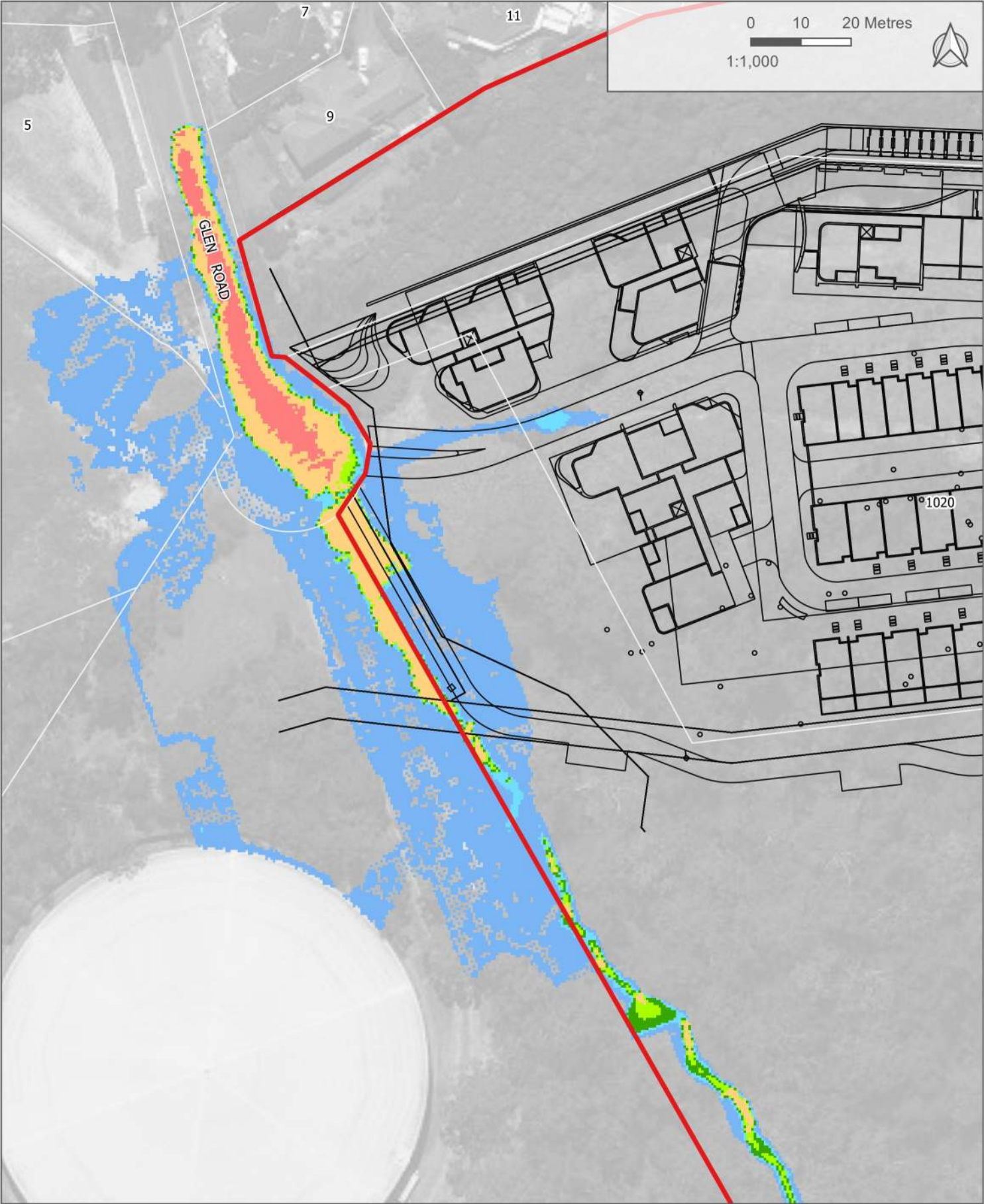
Legend

 Subject Site	Velocity (m/s)	 0.5 - 1.0
 <= 0.1	 1.0 - 2.0	
 0.1 - 0.5	 2.0 - 5.0	
	 > 5.0	

Figure B1-2

50% AEP Flood Velocity

Glen Road
Planning Proposal



Legend








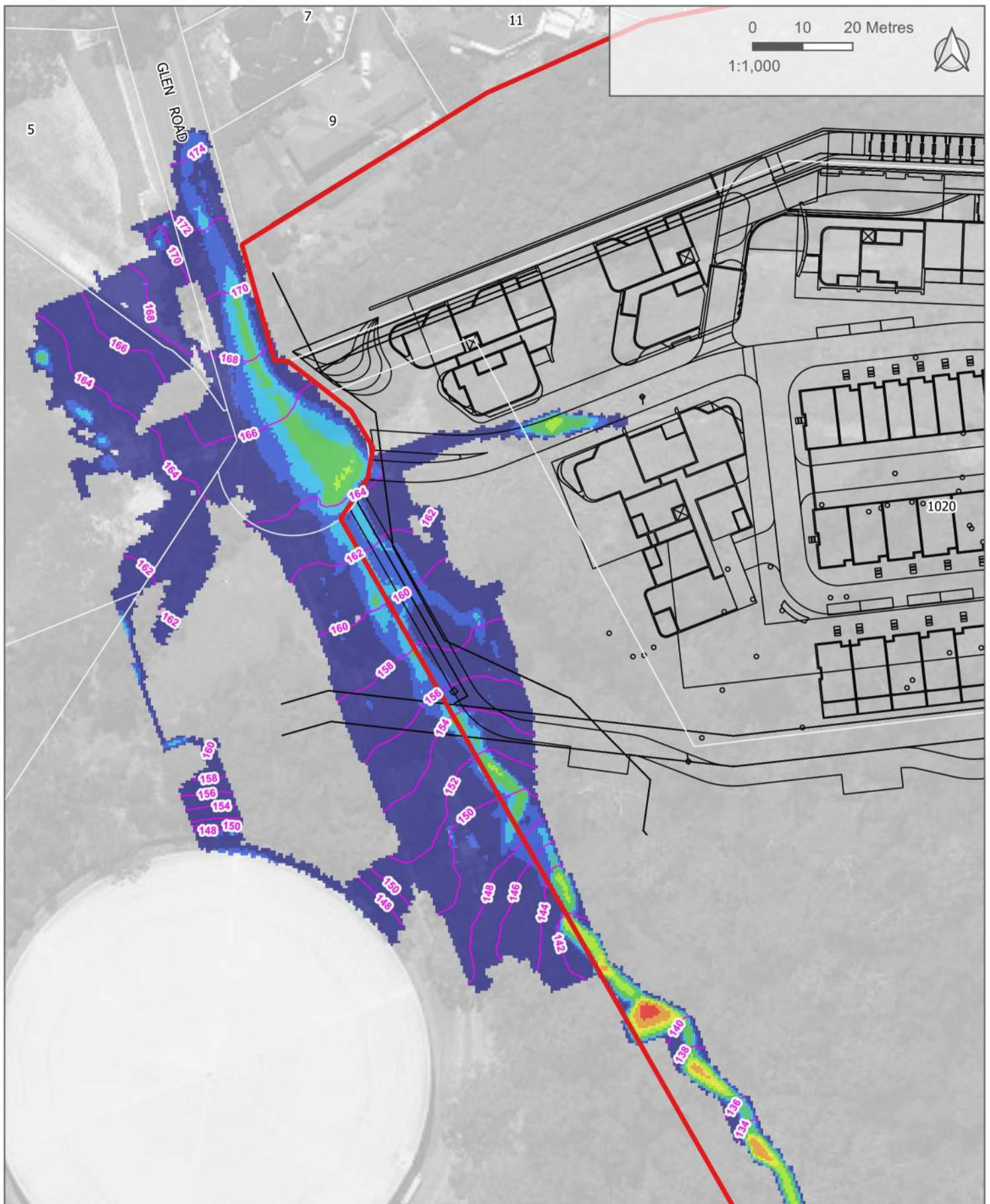
	Subject Site		H3
	H1		H4
	H2		H5
			H6

Figure B1-3
50% AEP Flood Hazard
Glen Road
Planning Proposal



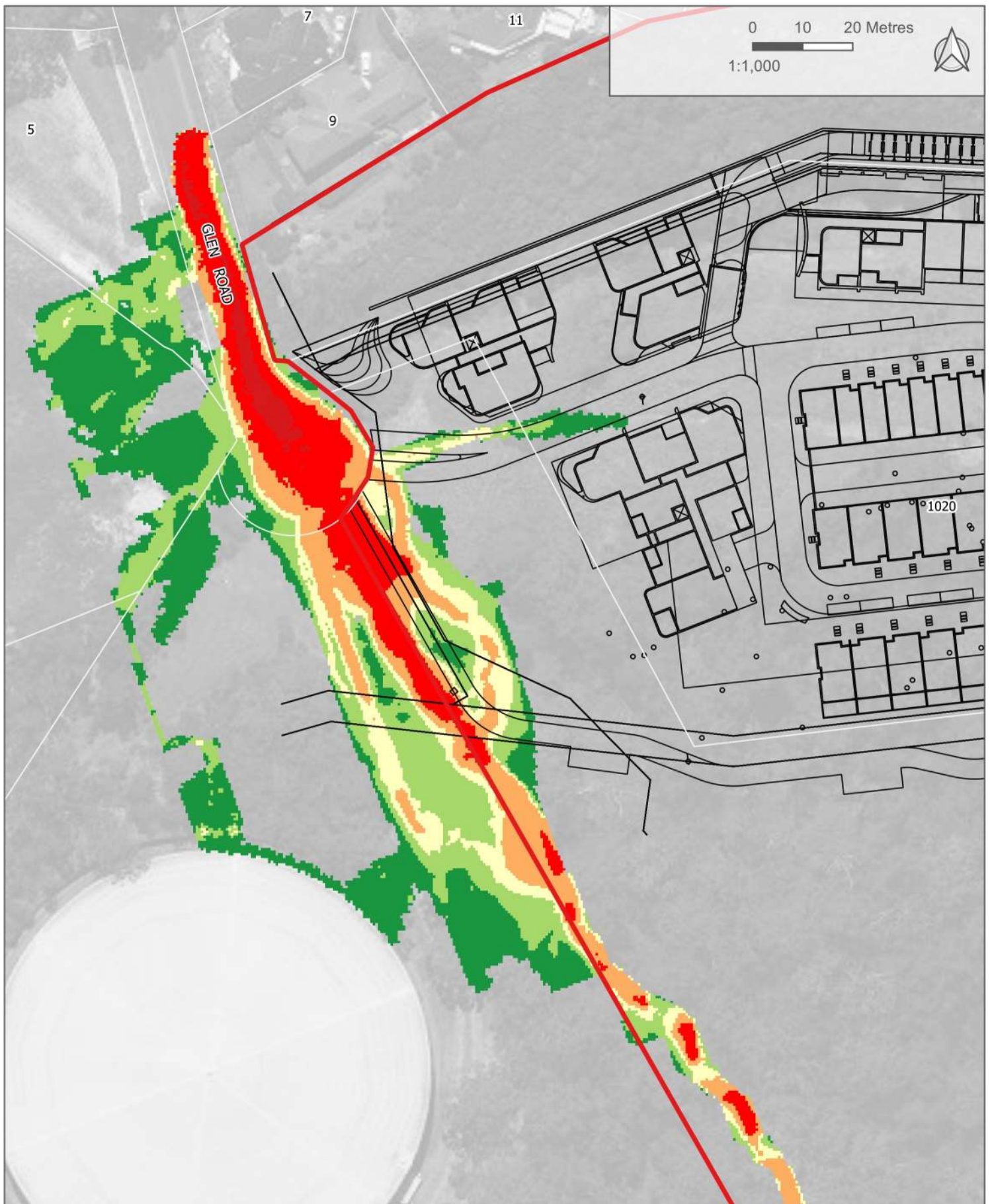
Legend

 Subject Site	Depth (m)	 0.50 - 0.75
— 2m Flood Contour	 <= 0.10	 0.75 - 1.00
	 0.10 - 0.20	 1.00 - 1.50
	 0.20 - 0.30	 1.50 - 2.00
	 0.30 - 0.50	 > 2.00

Figure B2-1

10% AEP Flood Depth and Elevation

Glen Road
Planning Proposal



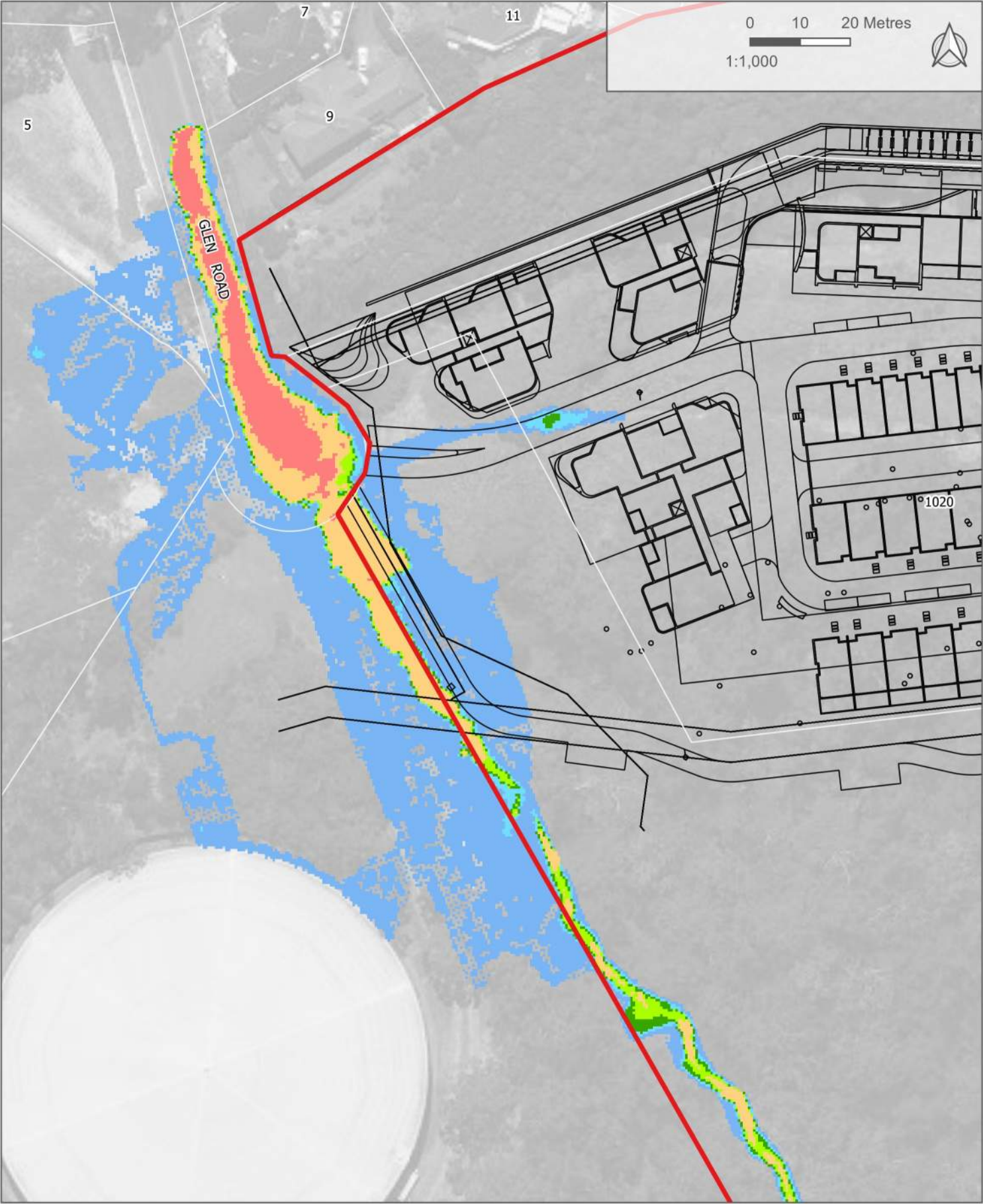
Legend

 Subject Site	Velocity (m/s)	 0.5 - 1.0
 <= 0.1	 1.0 - 2.0	
 0.1 - 0.5	 2.0 - 5.0	
	 > 5.0	

Figure B2-2

10% AEP Flood Velocity

Glen Road
Planning Proposal



Legend








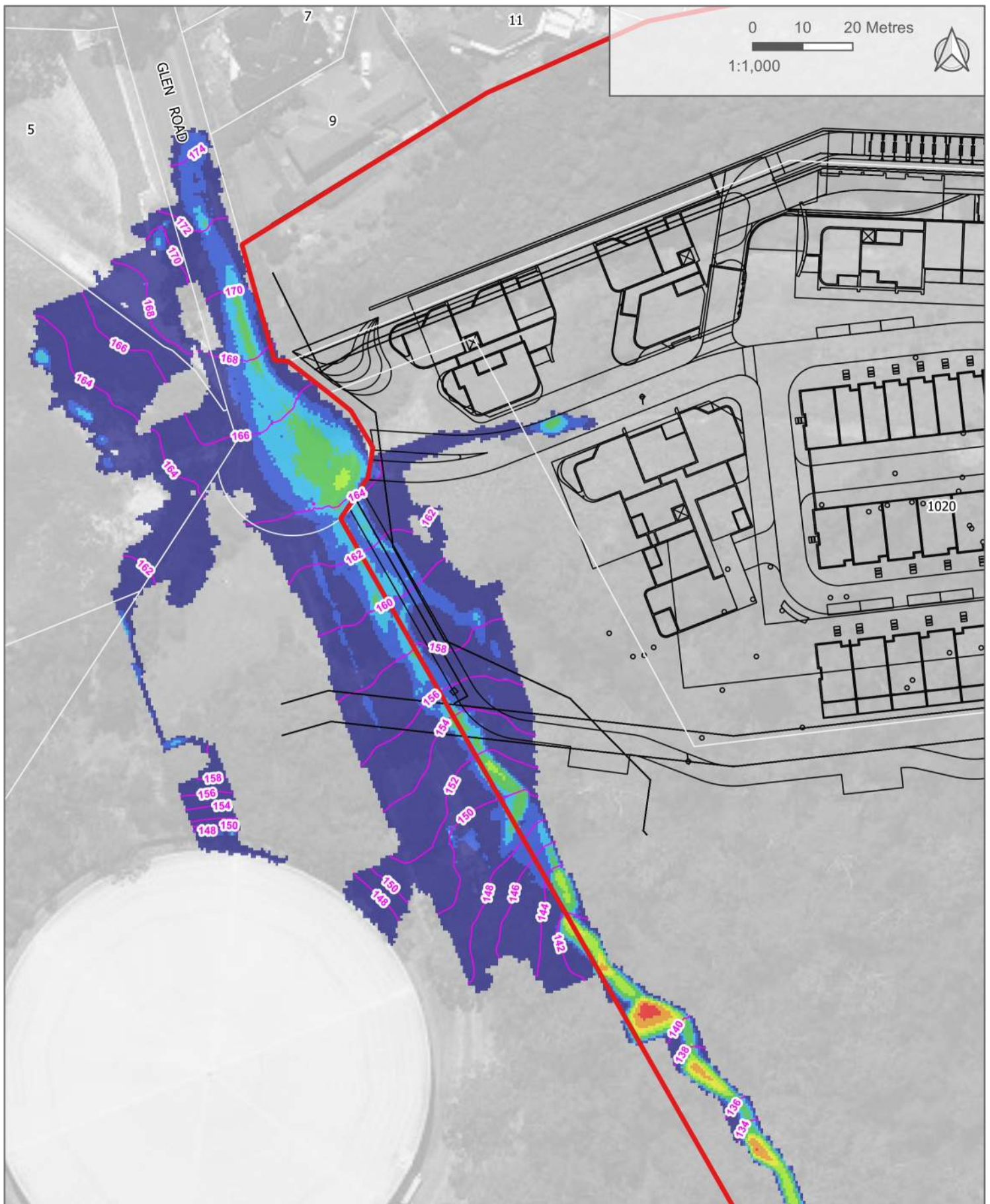
	Subject Site	Hazard		H3
				H4
				H5
				H6

Figure B2-3

10% AEP Flood Hazard

Glen Road
Planning Proposal



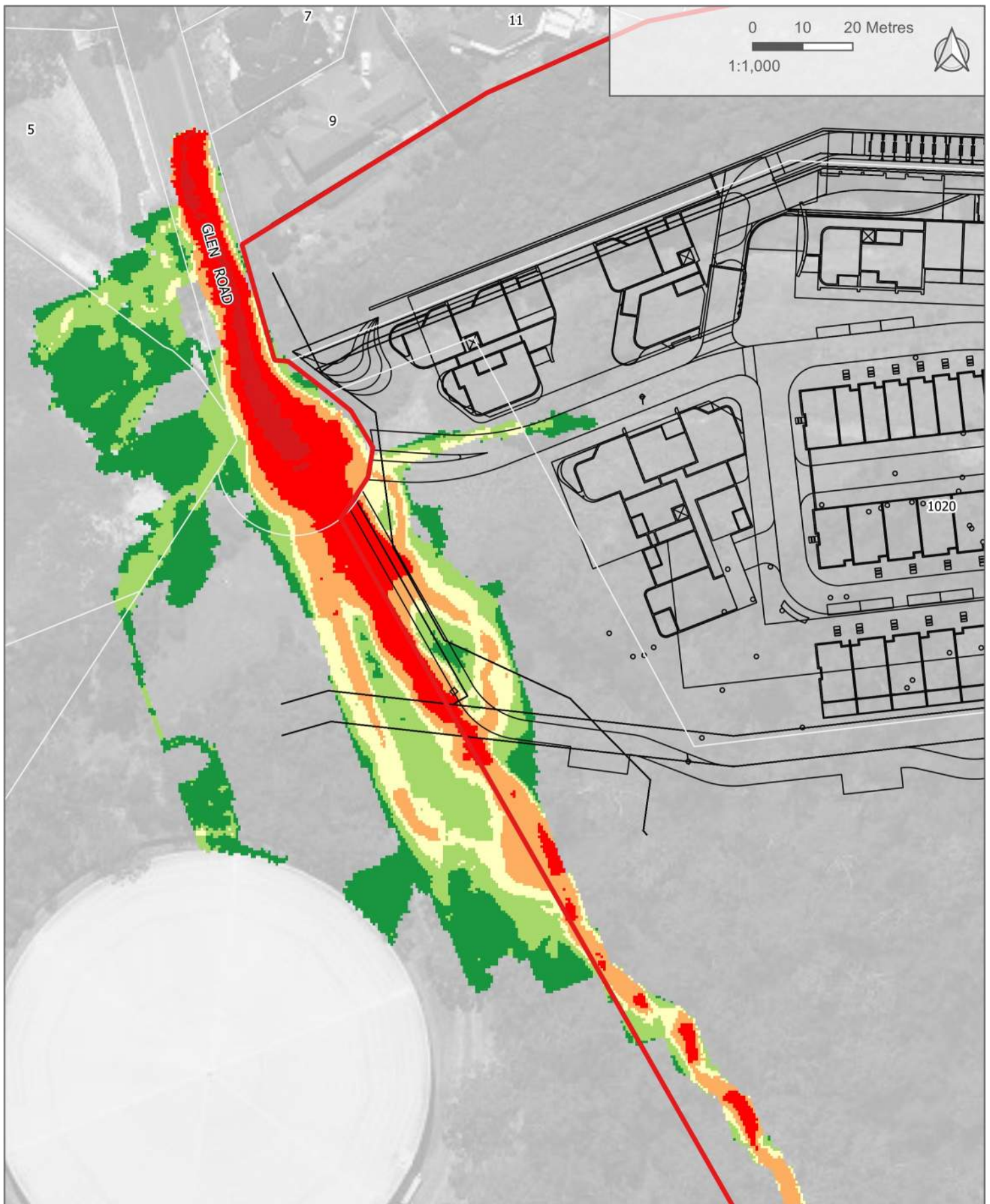
Legend

 Subject Site	Depth (m)	 0.50 - 0.75
— 2m Flood Contour	 ≤ 0.10	 0.75 - 1.00
	 0.10 - 0.20	 1.00 - 1.50
	 0.20 - 0.30	 1.50 - 2.00
	 0.30 - 0.50	 > 2.00

Figure B3-1

5% AEP Flood Depth and Elevation

Glen Road
Planning Proposal



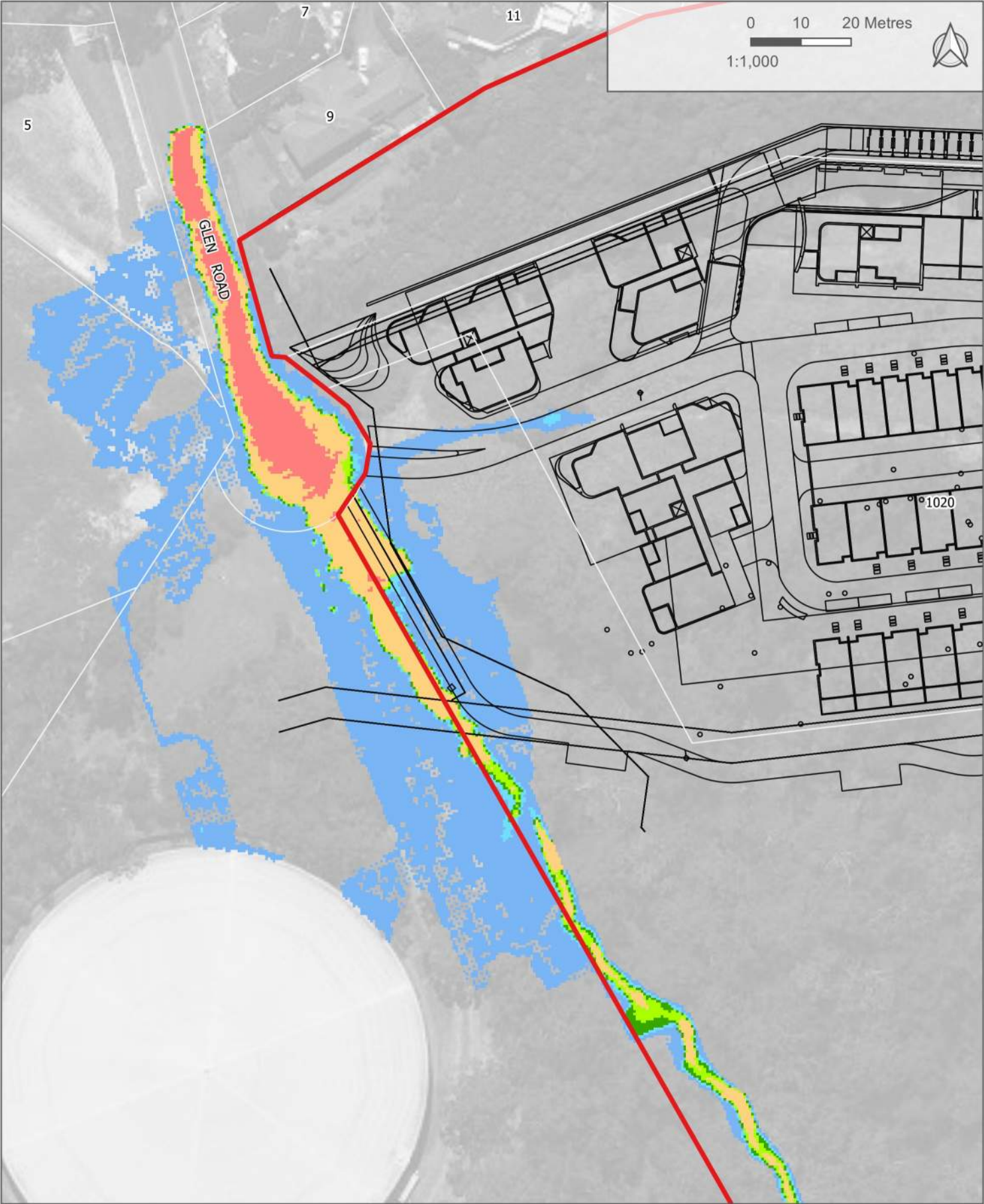
Legend

 Subject Site	Velocity (m/s)	 0.5 - 1.0
 <= 0.1	 1.0 - 2.0	
 0.1 - 0.5	 2.0 - 5.0	
	 > 5.0	

Figure B3-2

5% AEP Flood Velocity

Glen Road
Planning Proposal



Legend








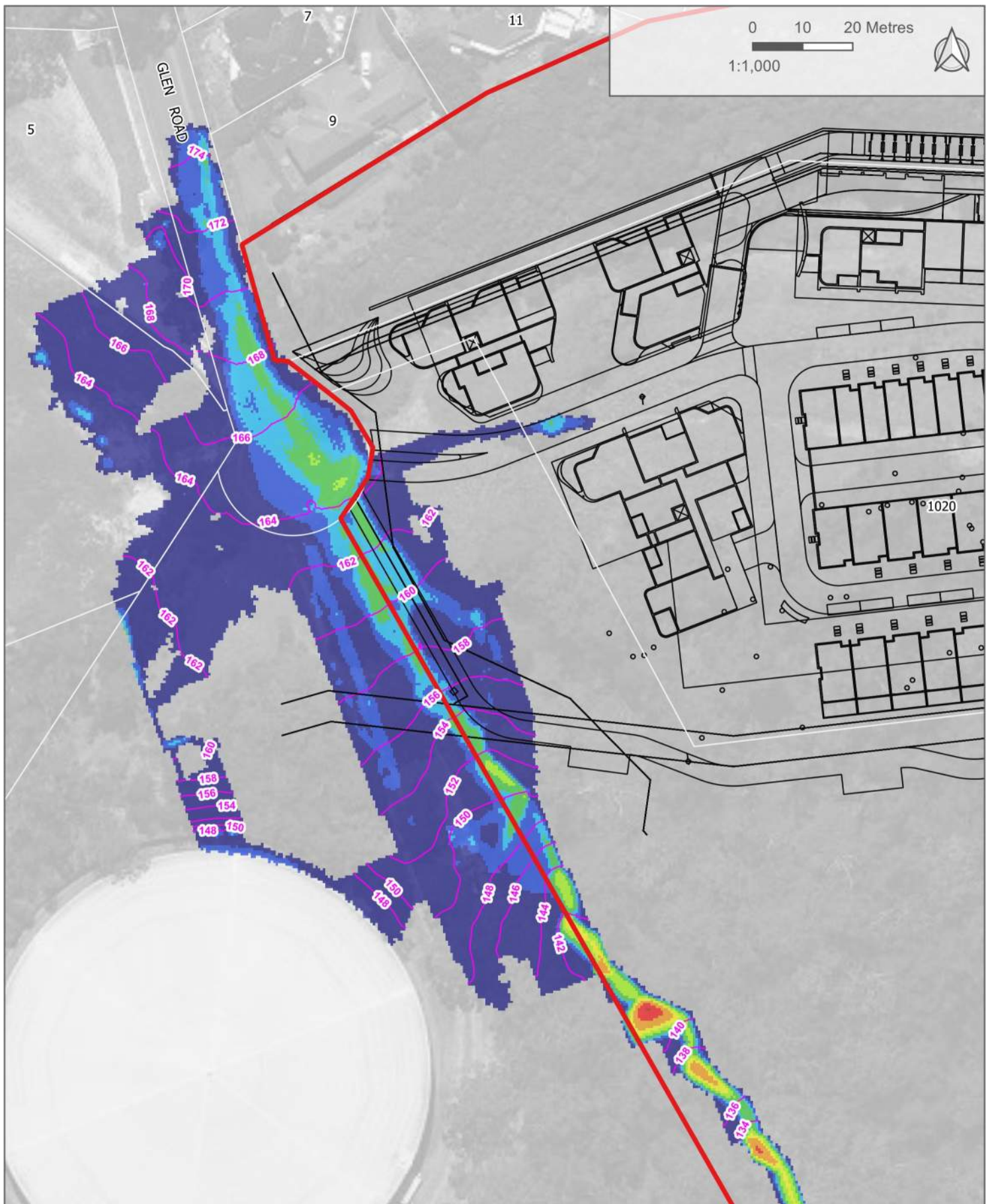
	Subject Site		H3
	H1		H4
	H2		H5
			H6

Figure B3-3
5% AEP Flood Hazard
Glen Road
Planning Proposal



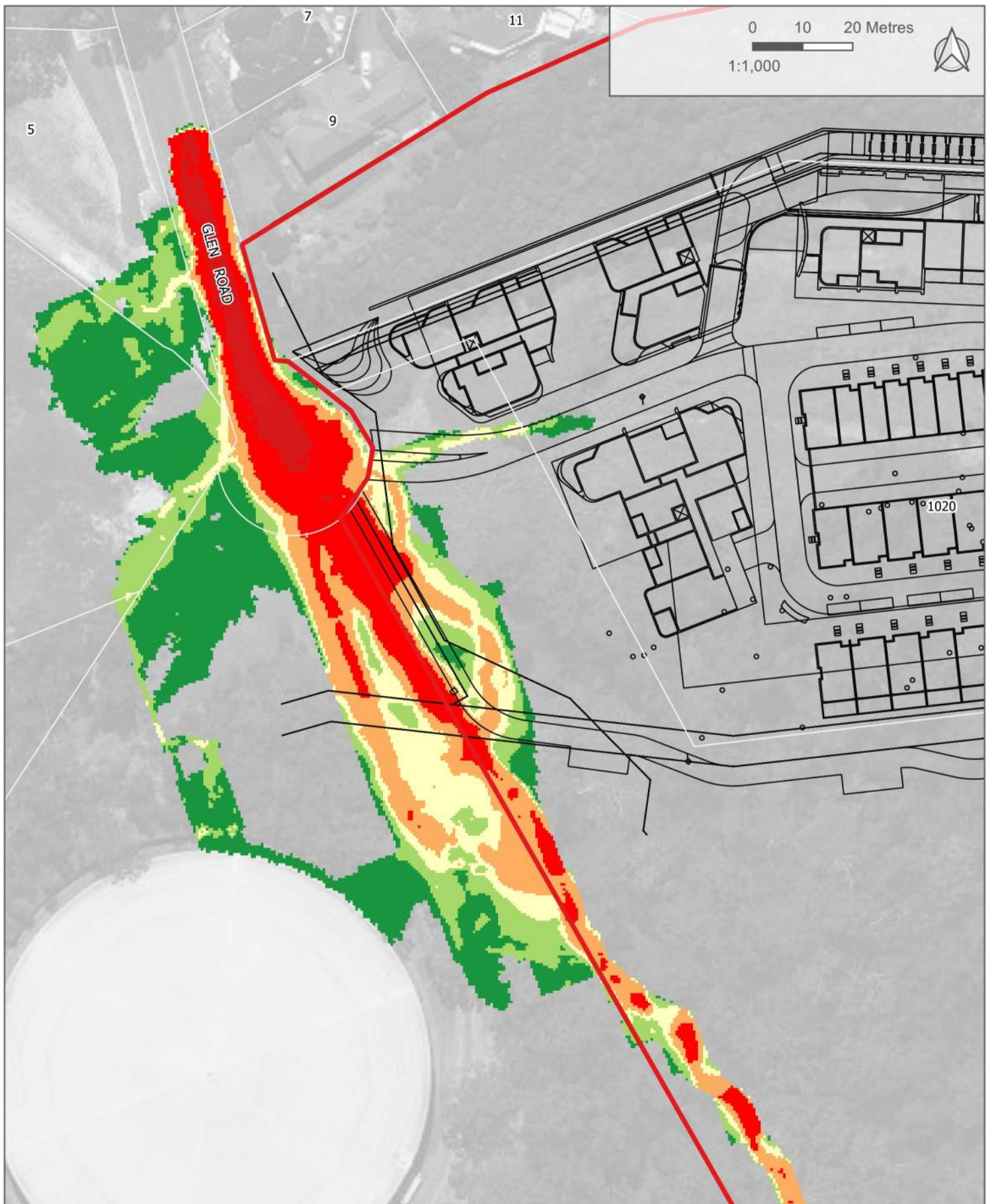
Legend

 Subject Site	Depth (m)	 0.50 - 0.75
— 2m Flood Contour	 <= 0.10	 0.75 - 1.00
	 0.10 - 0.20	 1.00 - 1.50
	 0.20 - 0.30	 1.50 - 2.00
	 0.30 - 0.50	 > 2.00

Figure B4-1

1% AEP Flood Depth and Elevation

Glen Road
Planning Proposal



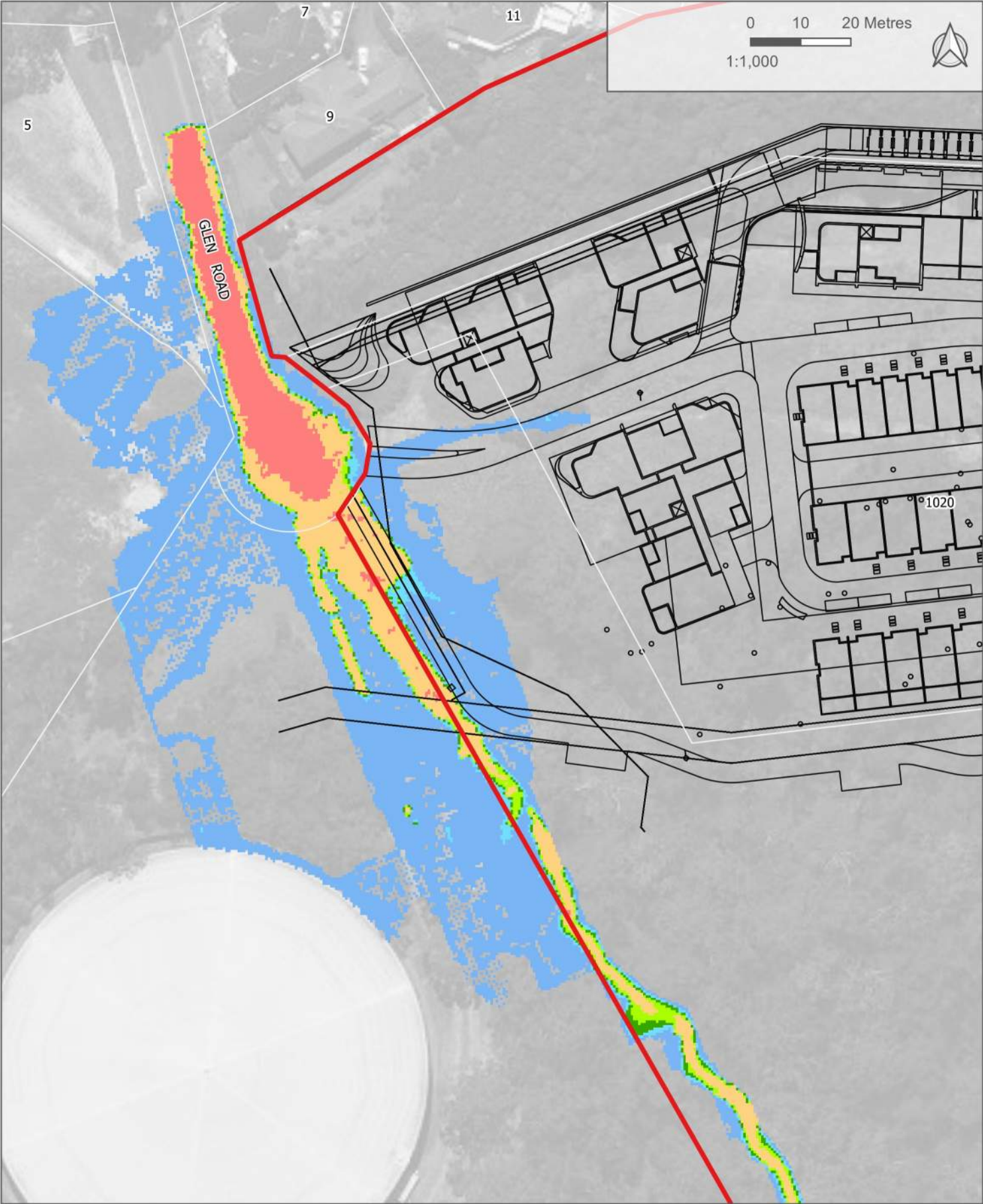
Legend

 Subject Site	Velocity (m/s)	 0.5 - 1.0
 ≤ 0.1	 1.0 - 2.0	
 0.1 - 0.5	 2.0 - 5.0	
	 > 5.0	

Figure B4-2

1% AEP Flood Velocity

Glen Road
Planning Proposal



Legend








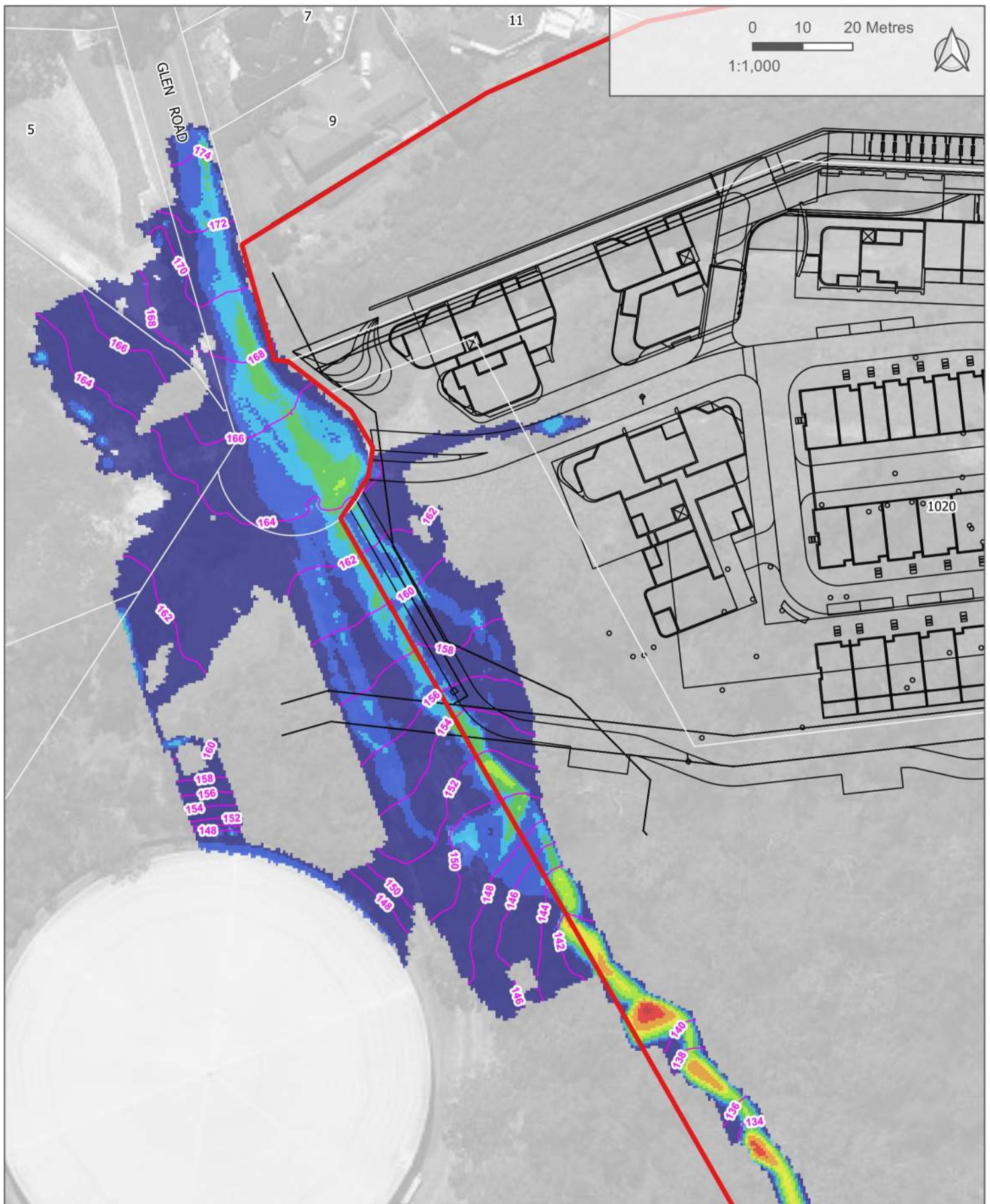
	Subject Site		H3
	H1		H4
	H2		H5
			H6

Figure B4-3
1% AEP Flood Hazard
Glen Road
Planning Proposal



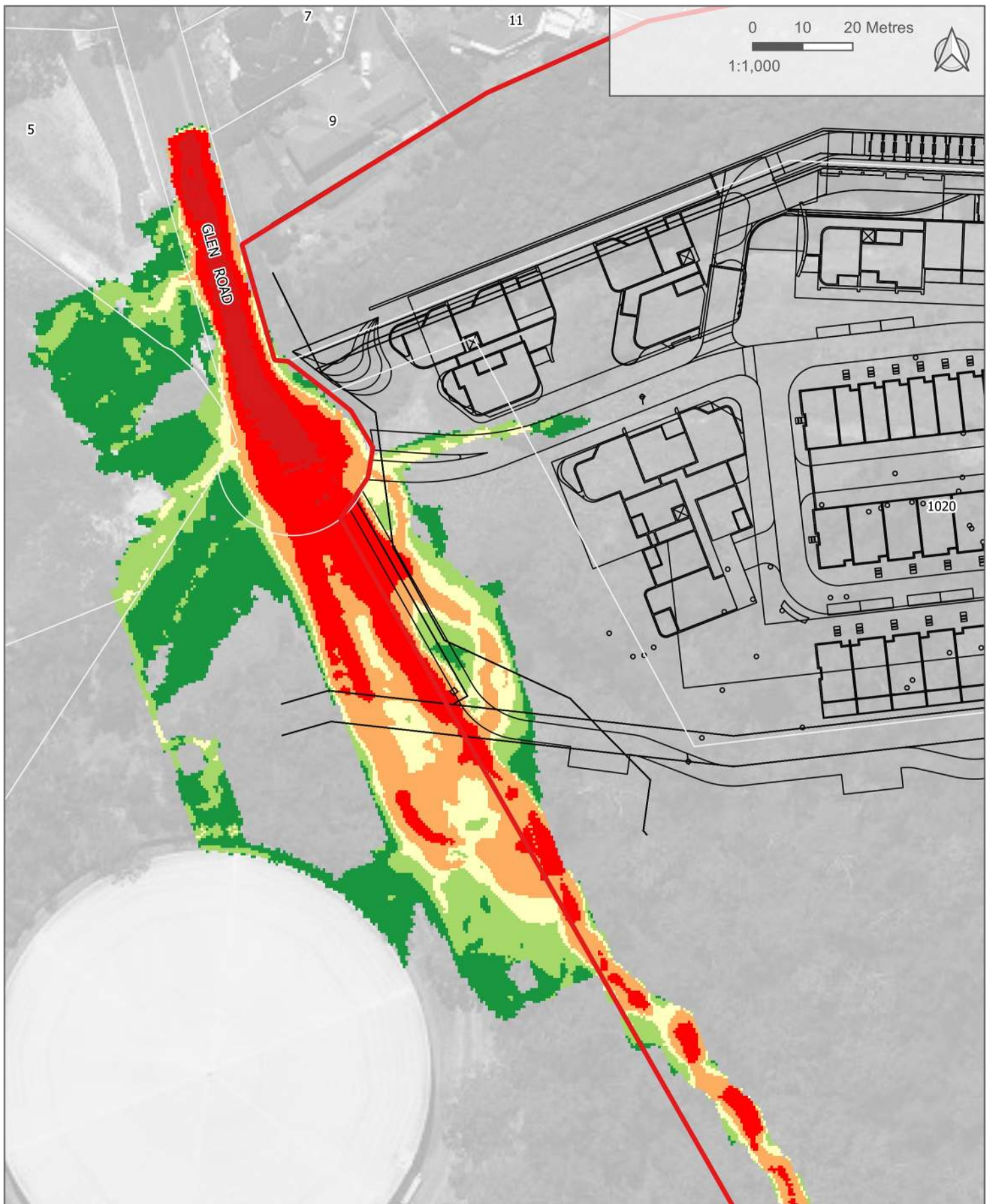
Legend

 Subject Site	Depth (m)	 0.50 - 0.75
— 2m Flood Contour	 <= 0.10	 0.75 - 1.00
	 0.10 - 0.20	 1.00 - 1.50
	 0.20 - 0.30	 1.50 - 2.00
	 0.30 - 0.50	 > 2.00

Figure B5-1

1 in 500 AEP Flood Depth and Elevation

Glen Road
Planning Proposal



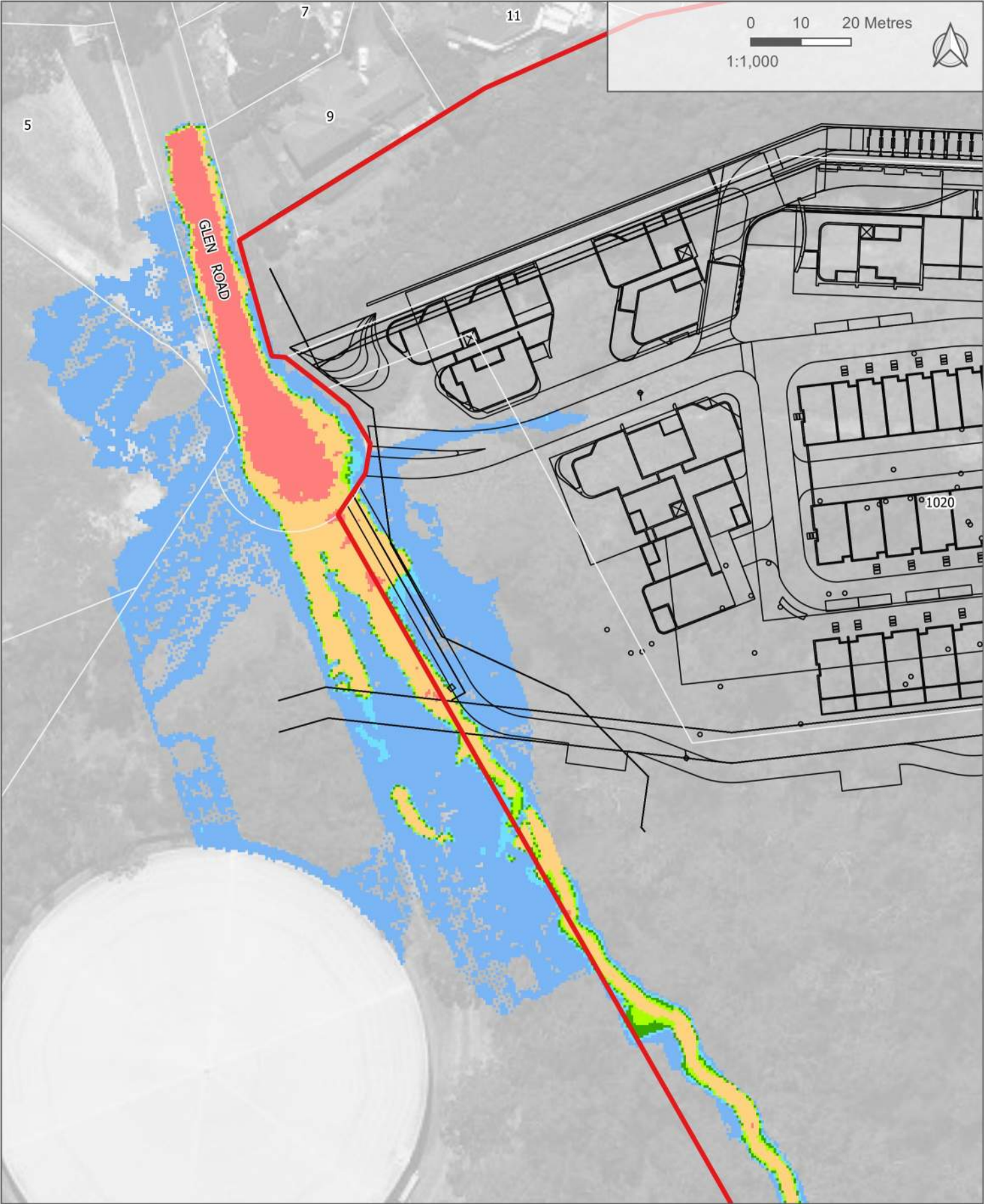
Legend

 Subject Site	Velocity (m/s)	 0.5 - 1.0
 ≤ 0.1	 1.0 - 2.0	
 0.1 - 0.5	 2.0 - 5.0	
	 > 5.0	

Figure B5-2

1 in 500 AEP Flood Velocity

Glen Road
Planning Proposal



Legend








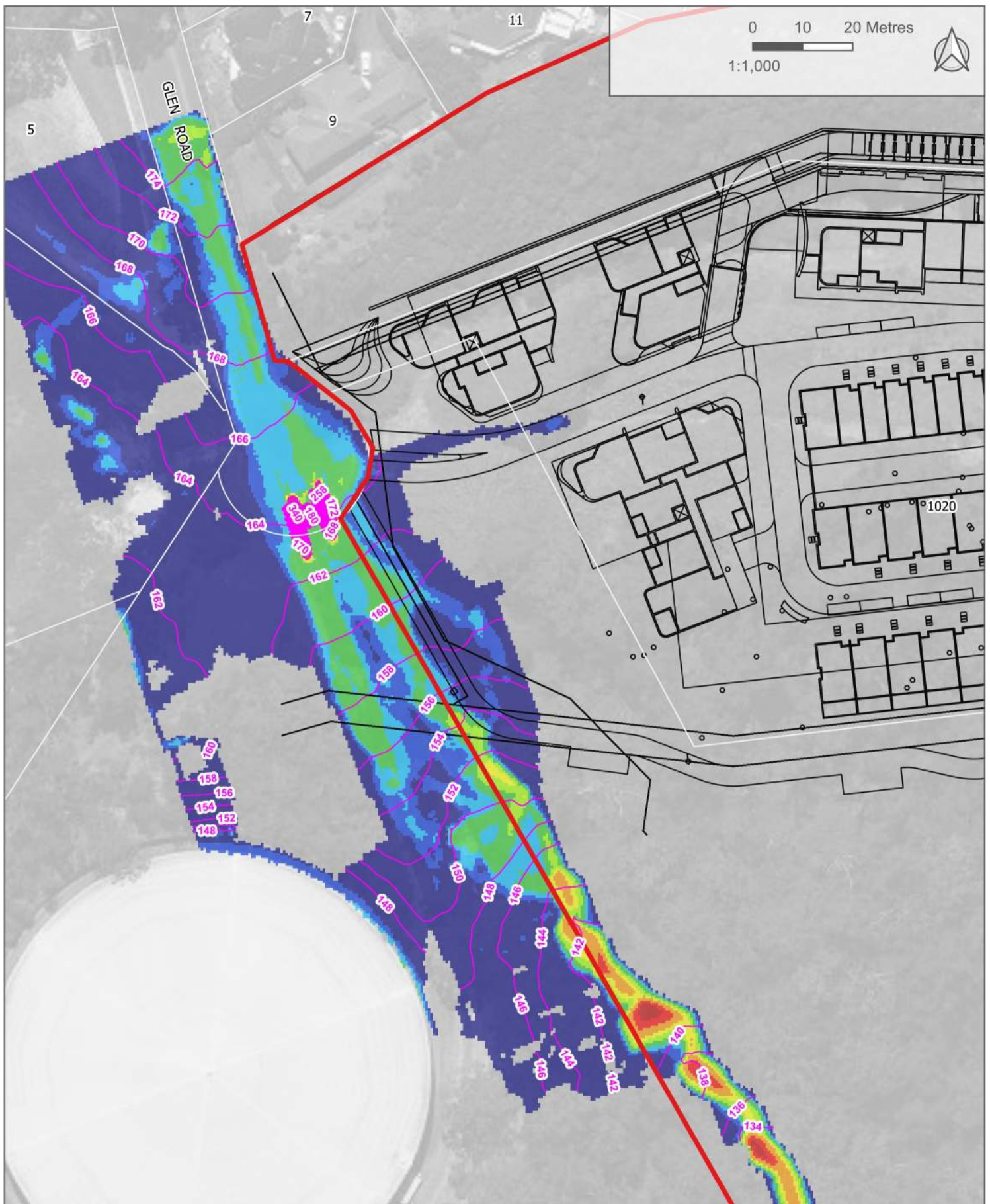
	Subject Site		H3
	H1		H4
	H2		H5
			H6

Figure B5-3
1 in 500 AEP Flood Hazard
Glen Road
Planning Proposal



Legend

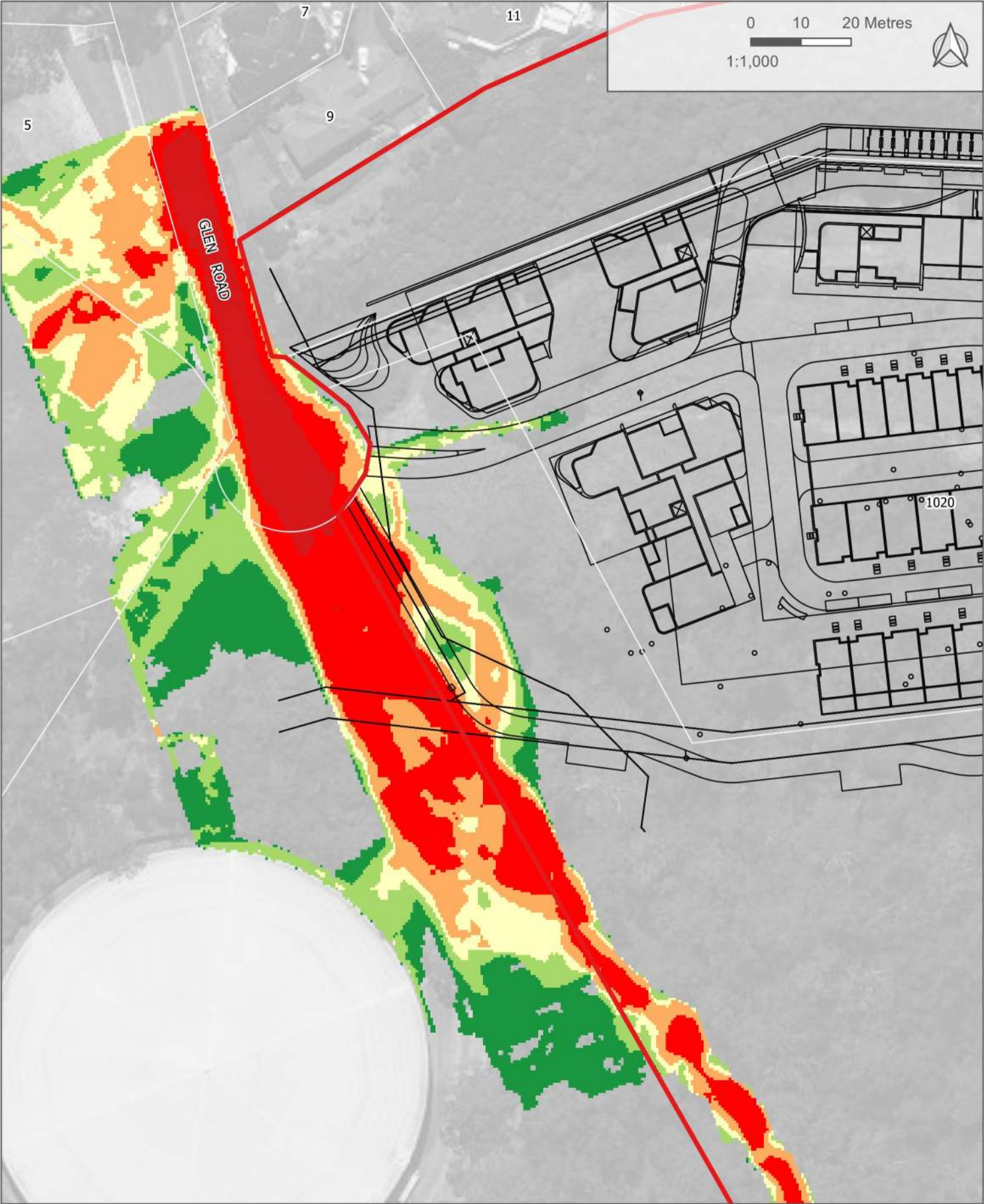
 Subject Site	Depth (m)	 0.50 - 0.75
— 2m Flood Contour	 <= 0.10	 0.75 - 1.00
	 0.10 - 0.20	 1.00 - 1.50
	 0.20 - 0.30	 1.50 - 2.00
	 0.30 - 0.50	 > 2.00

Figure B6-1

PMF Depth and Elevation

Glen Road
Planning Proposal





Legend








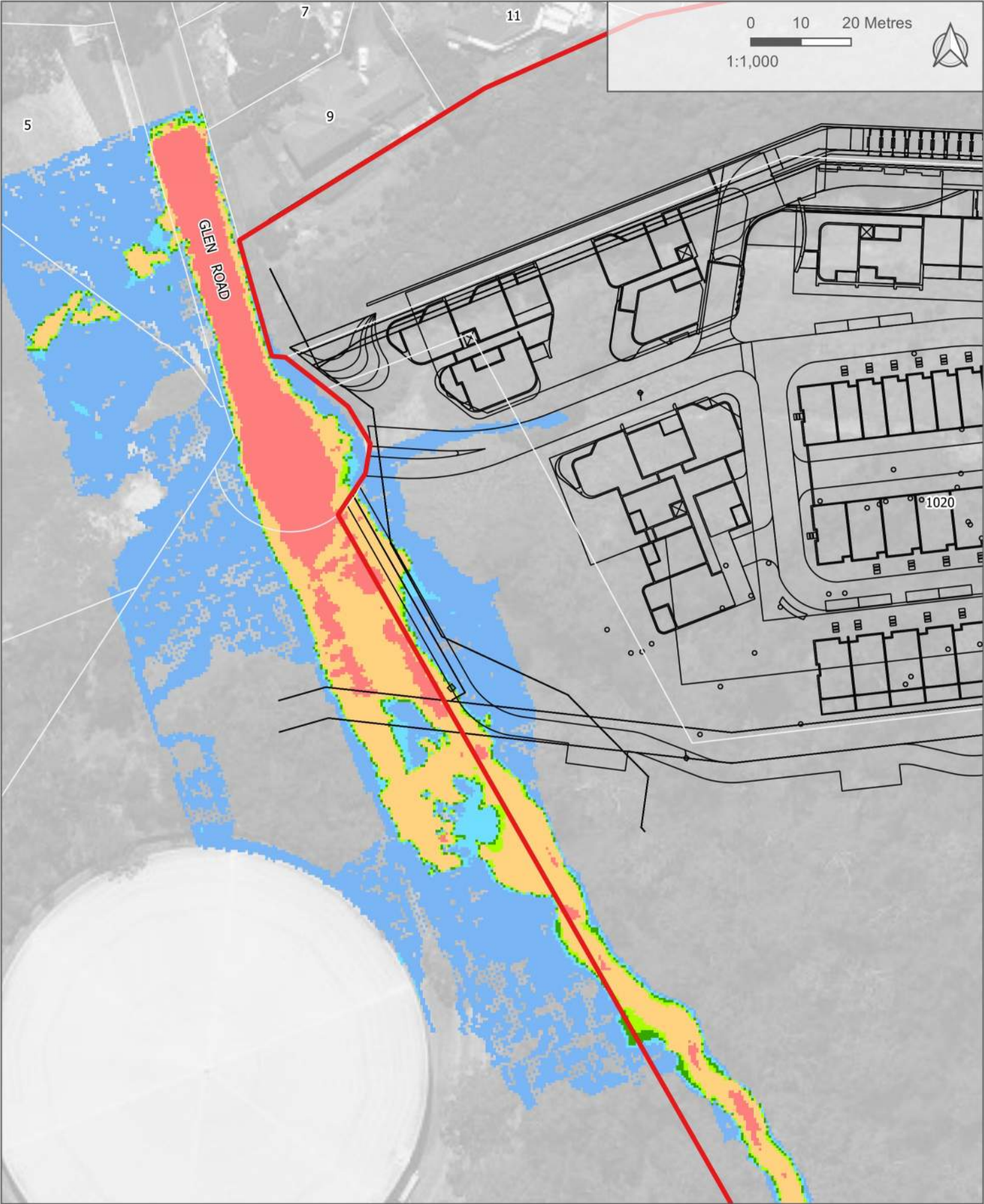
	Subject Site	Velocity (m/s)	 0.5 - 1.0
		 1.0 - 2.0	
		 2.0 - 5.0	
		 > 5.0	

Figure B6-2

PMF Velocity

Glen Road
Planning Proposal





Legend








	Subject Site		H3
	H1		H4
	H2		H5
			H6

Figure B6-3
PMF Hazard
Glen Road
Planning Proposal

Discussion

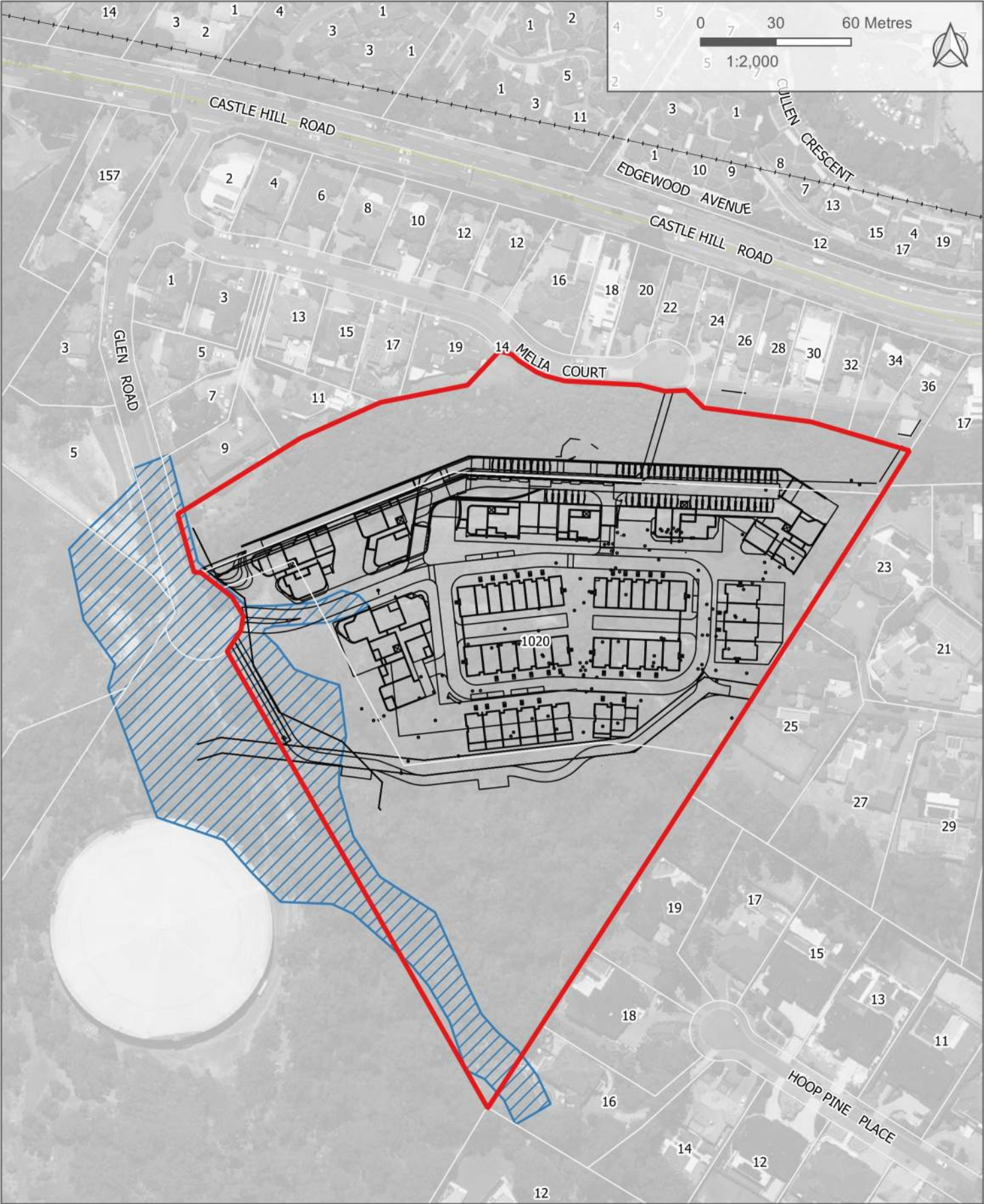
Scope of Flood Assessment

This study has been limited to flooding within the drainage gully to the west of the site. We note the sheet flow from the catchment to the south of Melia Court, and potential overflow from rainfall that exceeds the pipe network capacity from Melia Court.

We note in the PMF the total flow from these catchments is approximately $4.32\text{m}^3/\text{s}$. We believe standard engineering solutions can accommodate diversion of this flow including swales, or an inground pit and pipe network. This flow is not considered as “flooding” for the purpose of the LEP, DCP, and Ministerial Directions assessment. We believe it is appropriate to consider this as part of the detailed stormwater design.

Flood Planning Area

The Flood planning Area is presented overleaf in **Figure C1**.



Legend

 Subject Site  Flood Planning Area

Figure C1

TUFLOW Model Setup

Glen Road
Planning Proposal



Ministerial Direction – Flooding

The Ministerial Directions – Flooding is presented below in Table 4.

Table 4 – Ministerial Directions Flooding

Requirement	Response
4.1.1 A planning proposal must include provisions that give effect to and are consistent with:	
a) The NSW Flood Prone Land Policy.	<p>The subject site is located within the Flood Planning Area and as such, the provisions of the NSW Flood Prone Land Policy and Flood Risk Management Manual are applicable.</p> <p>The principles of the NSW Flood Prone Land Policy are expected to be satisfied through adoption of appropriate flood mitigation and controls.</p> <p>Review of THSC DCP requirements suggest these controls are expected to be feasible for the proposed development and are expected to be further assessed at Development Application phase.</p>
b) The principles of the Floodplain Development Manual 2005.	<p>The principles of the Flood Risk Management Manual 2023 are expected to be achievable through the implementation of the necessary development controls outlined in THSC DCP.</p> <p>This is expected to be further reviewed at Development Application Phase.</p>
c) The considering Flooding in land use planning guideline 2021, and	<p>The recommendations contained within this guideline are included under the The Hills LEP 2019.</p> <p>It is noted, The Hills LEP has not captured any additional “Special Flood Considerations” outlined by this guideline.</p> <p>Key flood constraints outlined in this guideline are summarised as;</p> <ul style="list-style-type: none"> • Flood Function • Flood Hazard • Flood Extent and Behaviour; and • Risk to Life <p>These elements have all been discussed in this assessment.</p>
d) Any adopted flood study and/or floodplain risk management plan prepared in	<p>The subject site is not covered by an existing flood study.</p>

Requirement	Response
accordance with the principles of the Floodplain Development Manual 2005 and adopted by the relevant council.	
4.1.2 A planning proposal must not rezone land within the flood planning area from Recreation, Rural, Special Purpose or Conservation Zones to a Residential, Business, Industrial or Special Purpose Zones.	The proposal looks to rezone a small amount of land within the Flood Planning Area.
4.1.3 A planning proposal must not contain provisions that apply to the flood planning area which:	
a) Permit development in floodway areas,	The development is located within a flood fringe area.
b) Permit development that will result in significant flood impacts to other properties,	The development is generally located outside the 1% AEP and is not expected to result in significant flood impacts. We believe it is feasible to include OSD as part of the proposed development and this will minimise impacts to adjoining properties.
c) Permit development for the purpose of residential accommodation in high hazard areas,	The development is located outside the mapped high hazard flood areas in the 1% AEP.
d) Permit a significant increase in the development and/or dwelling density of that land.	Intensification of dwelling density is expected to occur across the subject site. This is generally located outside the flood planning area.
e) Permit development for the purpose of centre-based childcare facilities, hostels, boarding houses, group homes, hospitals, residential care facilities, respite day care centres and senior housing, in areas where the occupants of the development cannot effectively evacuate,	We expect the development will be limited to residential dwellings.
f) permit development to be carried out without development consent except for the purposes of exempt development or agriculture. Dams, drainage canals, levees, still require development consent,	Subject to planning advice.
g) are likely to result in a significantly increased requirement for government spending on emergency management services, flood mitigation and emergency response measures, which can include but	The flood behaviour at the subject site arises from local catchment runoff which is not likely to result in significant increases in government spending for emergency management.

Requirement	Response
are not limited to the provision of road infrastructure, flood mitigation infrastructure and utilities, or	
h) permit hazardous industries or hazardous storage establishments where hazardous materials cannot be effectively contained during the occurrence of a flood event.	The proposal is not expected to include hazardous industries.
4.1.5 For the purposes of preparing a planning proposal, the flood planning area must be consistent with the principles of the Floodplain Development Manual 2005 or as otherwise determined by a Floodplain Risk Management Study or Plan adopted by the relevant council.	The definition of Flood Planning Area in The Hills LEP (2019) is consistent with the flood Risk Management Manual (2023). As such, the Flood Planning Area for the subject site is expected to be defined as the 1% AEP + 500mm.

Council Requirements and Assessment

The Council requirements have been obtained from the LEP and THSC Development Control Plan (DCP) 2012 Part C Section 6 Flood Controlled Land. The applicable requirements are summarised in below in Table 6.

The proposed development is categorised as “Residential”. THSC uses the following Flood Planning Level (FPL) definitions:

- FPL1 = Flood Planning Level 1 – 5% AEP.
- FPL2 = Flood Planning Level 2 – 1% AEP.
- FPL3 = THSC Flood Planning Level 3 – 1% AEP + 500mm Freeboard.
- FPL4 = PMF.

Table 5 – LEP requirements

Requirement	Comment
(1) The objectives of this clause are as follows	
(a) to minimise the flood risk to life and property associated with the use of land,	It is expected to be achieved through consideration to flooding related DCP design requirements. Refuge above the PMF is available on the subject site and it is feasible (subject to detailed design) to achieve rising road access to these locations.
(b) to allow development on land that is compatible with the flood function and behaviour on the land, taking into account projected changes as a result of climate change,	The development is generally located outside the flood planning area. We believe this is compatible with the flood function of the land.

Requirement	Comment
(c) to avoid adverse or cumulative impacts on flood behaviour and the environment,	The development is generally located outside the flood planning area. We believe satisfies this point.
(d) to enable the safe occupation and efficient evacuation of people in the event of a flood.	We believe evacuation would be limited to within the development to areas outside the PMF extent.
(2) Development consent must not be granted to development on land the consent authority considers to be within the flood planning area unless the consent authority is satisfied the development	
(a) is compatible with the flood function and behaviour on the land, and	The development is generally located outside the flood planning area. We believe this is compatible with the flood function of the land.
(b) will not adversely affect flood behaviour in a way that results in detrimental increases in the potential flood affectation of other development or properties, and	The development is generally located outside the flood planning area. We believe satisfies this point.
(c) will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the event of a flood, and	We believe evacuation would be limited to within the development to areas outside the PMF extent.
(d) incorporates appropriate measures to manage risk to life in the event of a flood, and	It is expected to be achieved through consideration to flooding related DCP design requirements. Refuge above the PMF is available on the subject site and it is feasible (subject to detailed design) to achieve rising road access to these locations.
(e) will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of riverbanks or watercourses.	To be considered as part of a future stormwater management plan. This plan would typically consist of water quality and quantity management measures, and riparian corridor design.
(3) In deciding whether to grant development consent on land to which this clause applies, the consent authority must consider the following matters	
(a) the impact of the development on projected changes to flood behaviour as a result of climate change,	Consideration has been given to the 1 in 500 AEP as a proxy for climate change. This does not significantly alter the flood behaviour.
(b) the intended design and scale of buildings resulting from the development,	The proposed scale of buildings is unlikely to impact flooding on other properties.
(c) whether the development incorporates measures to minimise the risk to life and ensure the safe evacuation of people in the event of a flood,	We expect the development could incorporate rising road access to areas outside the PMF extent.

Requirement	Comment
(d) the potential to modify, relocate or remove buildings resulting from development if the surrounding area is impacted by flooding or coastal erosion.	Future dwellings could be removed, and this is considered an unlikely scenario.

Table 6 – THSC DCP requirements

Item	Requirement	Assessment
General Controls – Section 2.2		
2.2 (a)	<p>The flood impact of the development is to be considered to ensure that the development will not increase flood effects elsewhere, having regard to:</p> <ul style="list-style-type: none"> • Loss of flood storage. • Changes in flood levels and velocities caused by alterations to the flood conveyance, including the effects of fencing styles. • The cumulative impact of multiple potential developments in the floodplain. 	<p>The site is marginally impacted by flooding in the 1% AEP. The development is unlikely to result in a significant loss of flood storage.</p> <p>We believe it is feasible to include OSD as part of the development to minimise the changes to flood levels and velocity.</p> <p>Given the urban nature of the area and marginal existing flood inundation, it is unlikely a cumulative impact of multiple development will result in a significant adverse overall impact.</p>
Residential – Section 2.5		
2.5 (b)	Habitable floor levels to be no lower than the 1% AEP + 500mm freeboard	Residential ground floor spaces will be above or protected to a level at or above the 1%AEP + 500mm.
2.5 (c)	Non-habitable floor levels to be equal to or greater than FPL3 where possible, or otherwise no lower than FPL1 unless justified by a site-specific assessment.	Non-habitable floor levels will be located at or protected to a minimum of FPL1.
2.5 (e)	All structures to have flood compatible building components below FPL3.	We believe it will be feasible to comply with this requirement given the type of development, and low flood hazard in the vicinity.
2.5 (f)	Applicant to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including FPL3, or FPL4 if required to satisfy evacuation criteria (i.e. use as a refuge area). An engineer's report may be required.	We believe it will be feasible to comply with this requirement given the type of development, and low flood hazard in the vicinity.
2.5 (g)	The flood impact of the development is to be considered to ensure that the development will not increase flood effects elsewhere, having regard to:	Flood impact comments as per Item 2.2 above.

Item	Requirement	Assessment
	<ul style="list-style-type: none"> • Loss of flood storage. • Changes in flood levels and velocities caused by alterations to the flood conveyance, including the effects of fencing styles. • The cumulative impact of multiple potential developments in the floodplain. 	
2.5 (i)	Garages or enclosed car parking must be protected from inundation by flood waters up to FPL2. Where 20 or more vehicles are potentially at risk, protection shall be provided to FPL3.	We believe it will be feasible to protect basement parking to 1% AEP + 300mm.
2.5 (j)	<p>Where the level of the driveway providing access between the road and parking space is lower than 0.3m below FPL2, the following conditions must be satisfied- when the flood level reach FPL2, the depth of inundation on the driveway shall not exceed:</p> <ul style="list-style-type: none"> • The depth at the road; or • The depth at the car parking space. A lesser standard may be accepted for single detached dwelling houses where it can be demonstrated that risk to human life would not be compromised. 	Not Applicable
2.5 (k)	All service conduits located below FPL3 are to be made fully flood compatible and suitable for continuous underwater immersion. Conduits are to be self-draining if subject to flooding.	This requirement will be addressed during detailed design stage.
2.5 (l)	<p>A when elements of the development, including vehicular and pedestrian access, are below FPL3. The site Flood Emergency Response Plan should relate to the land use and site conditions in conjunction with flood behaviour up to FPL2 expected to be experienced at the site. The plan should consider the following specific actions:</p> <ul style="list-style-type: none"> • Preparing for a flood. • Responding when a flood is likely. • Responding during a flood; and 	<p>A Site Flood Emergency Response Plan may be required for DA. The emergency response strategy is likely to include the following.</p> <ul style="list-style-type: none"> • Education and awareness prior to a flood occurring. • Summarising the available warning products from the BoM and SES. • Cancelling non-essential trips if severe weather is imminent. • Seeking refuge on-site once rainfall has commenced.

Item	Requirement	Assessment
	<ul style="list-style-type: none">Recovery after a flood. The flood plan should be consistent with the relevant NSW SES “FloodSafe” Guide.	

Conclusion

Northrop Consulting Engineers were engaged by Castle Hill Glen Pty Ltd to prepare the flood impact and risk assessment for the proposed development at 1020 Melia Court, Castle Hill. It was determined:

- The subject site is marginally affected by local overland flow from Glen Road and the upstream Melia Court.
- We believe it is feasible to implement standard engineering solutions such as swales and an inground pit and pipe network to divert upstream flow away from the proposed development.
- The proposed development generally complies with the Ministerial Directions – Flooding. A minor inconsistency is justified to the low magnitude of flow.
- We believe it is feasible to implement standard engineering solutions such as on-site detention tanks to mitigate the potential impact of the development on downstream flood behaviour.
- We believe it is feasible to comply with Council's DCP requirements from a floodplain management perspective by selecting appropriate floor levels, basement crest levels, and implementing OSD as suggested above.
- Due to the low flow magnitude and short duration of flow, we believe the most appropriate emergency response measure is shelter in place. This is in line with the Departments draft guidelines.

Should you have any queries, please contact the undersigned on (02) 4943 1777.

On behalf of NORTHROP CONSULTING ENGINEERS PTY LIMITED



Angus Brien

Principal Engineer

BEng (Civil) MIEAust CPEng RPEQ

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Document Register

Rev	Status	Prepared	Approved	Date
A	Draft	A Brien	A Brien	2/11/2023
B	For Approval	A Brien	A Brien	20/11/2023