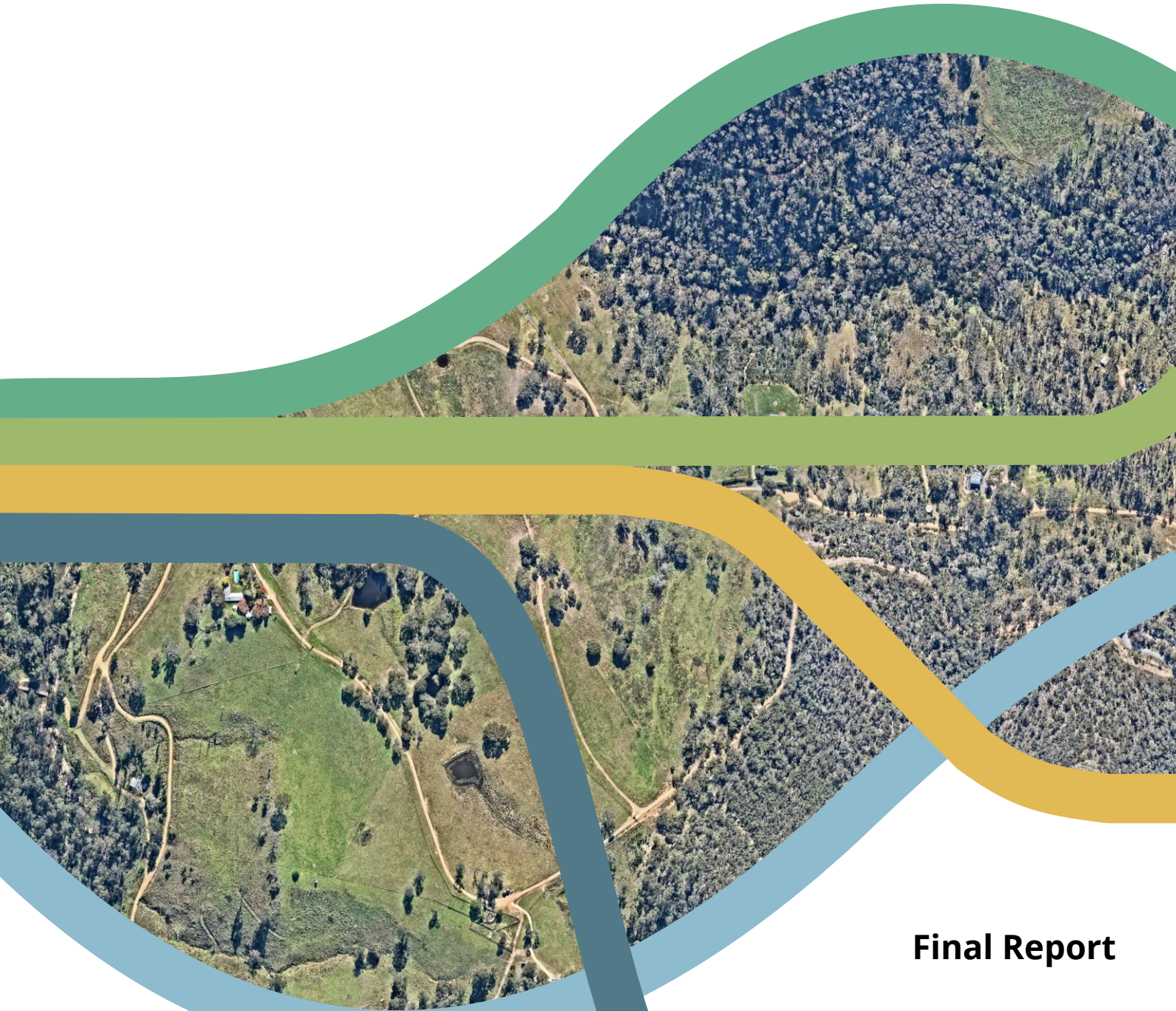
Flood Assessment

1551 Joadja Road, Joadja, NSW



Final Report

P2108462JR01V02

December 2023

Prepared For Fresh Hope Venues

environmental science & engineering

Project Details

Report Title	Flood Assessment: 1551 Joadja Road, Joadja, NSW
Client	Fresh Hope Venues
Document	P2108642JR01V02
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Document History

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Glossary of Terms

AEP	Annual exceedance probability: the probability of a flood event occurring within a year. A 1% AEP flood has a 1% chance of occurring in any given year.
ARR	Australian Rainfall & Runoff
BoM	Bureau of Meteorology
Council	Wingecarribee Shire Council (WSC)
DA	Development Application
FERP	Preliminary Flood emergency response plan
IFD	Intensity frequency duration: design rainfall data for frequent and infrequent storm events.
MA	Martens & Associates Pty Ltd
PMF	Probable maximum flood: the most extreme flood event possible for a certain location, with an approximate ARI of 100,000 to 10,000,000 years.

1 Introduction

1.1 Overview

Martens & Associates Pty Ltd (**MA**) have prepared this flood assessment to support a development application (**DA**) for a proposed eco-tourism resort at 1551 Joadja Road, Joadja, NSW (the **site**). Refer to Attachment A for proposed site layout.

1.2 Project Scope and Objectives

Project scope and objectives are:

1. Prepare a hydrologic model (WBNM) for the site to determine the peak flow of the 1% annual exceedance probability (**AEP**) flood, probable maximum flood (**PMF**) events.
2. Prepare a hydrologic model (WBNM) for an overland drainage path assessment.
3. Prepare a hydraulic model (TUFLOW) for the site under existing conditions.
4. Prepare relevant flood maps including flood extents, depths, levels, velocities, and hazards.
5. Comment on flood characteristics and model outcomes in existing conditions.
6. Prepare a preliminary flood emergency response plan (**FERP**) for the developed site.

1.3 Relevant Guidelines

This report has been prepared in accordance with the following guidelines and policies:

1. Commonwealth of Australia (2019), *Australian Rainfall and Runoff – A Guide to Flood Estimation.*
2. NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.
3. Wingecarribee Shire Council (2010), *Wingecarribee Local Environmental Plan (LEP).*
4. Wingecarribee Shire Council (2021), *Wingecarribee Development Control Plan (DCP)- Rural Lands.*

2 Site Description and Background Data

2.1 Location and Site Description

Existing site description summary is provided in Table 1.

Table 1: Existing site description summary.

Item	Description
Address	1551 Joadja Road, Joadja, NSW
Lot / DP	Lot 157/158/181/202 DP 751276
Site Area	Approximately 324 ha
Local Government Area (LGA)	Wingecarribee Shire Council (**WSC**)
Current Land Use	Rural/ Residential
Current Zoning	E3 Environmental Management
Site Description	The site is in the NSW Southern Highlands and contains an existing homestead, shed, riverside cottage and cattle yards, along with dense forest, and rural pastures.
Surrounding Land Uses	Rural pastures, dense forest. Bangadilly National Park lies to the south.
Site Elevation	Site elevations range from approximately 470 mAHD in the west to 560 mAHD to the east and south.
Site Drainage	Wingecarribee river runs from south to north through the western portion of the site. Schotts Creek runs from east to west and discharges to Wingecarribee river.

2.2 Catchment Description

We note the following regarding the catchment upstream of the site:

- The site is located within the Wingecarribee River catchment.
- The total catchment area to the site is approximately 60,000 ha.
- Upstream catchment is primarily rural land including farmland with stands of remnant and regrowth vegetation and includes the townships of Moss Vale, Robertson, Bowral and Berrima.
- A small portion of the catchment contains medium density urban development in Moss Vale, Bowral and Burradoo.

- The catchment includes Bong Bong Weir, Berrima Weir and Wingecarribee Reservoir.
- There are several minor catchments which originate on the site or just outside the site which flow through the site. These are predominately forested with some rural lands present.

2.3 Site Flood and Overland Flow Mechanisms

The site is likely affected by the following flood mechanisms:

- Overland flows from the site itself and the local upstream catchment (refer Section 2.2).
- Flood overbank flows from Wingecarribee River and Schotts Creek.

2.4 Previous Flood Studies

A review of previous flood investigations was undertaken to assess likely local flood behaviour and characteristics for the site and the Wingecarribee River catchment. Review identified two previous flood studies which would be relevant to this assessment.

2.4.1 SMEC (2014) Wingecarribee River Flood Study

SMEC conducted a flood assessment for this catchment on behalf of WSC and summarised the assessment in the *Wingecarribee River Flood Study Final Report* (2014), hereafter referred to as the SMEC flood study. As part of their study, SMEC used WBNM for hydrologic modelling and TUFLOW for hydraulic modelling.

The SMEC Wingecarribee River flood study adopted a 20 m topographic grid for TUFLOW modelling and included details of model inputs and results.

2.4.2 WMAwater (2022) Wingecarribee River Flood Study Update

WMAwater updated the previous flood study for the catchment completed by SMEC in 2014. Full details of the WMAwater model are provided in the *Wingecarribee River Flood Study Update (2022).* As part of their update, WMAwater used the latest Australian Rainfall and Runoff (**ARR**) guidelines (2019). The SMEC flood study used the previous ARR87 guidelines. The hydrologic model (WBNM) and hydraulic model (TUFLOW) were adopted as per the SMEC flood study. The WMAwater model and report have been verified and accepted by WSC.

The WMAwater Wingecarribee River flood study adopted a 3 m topographic grid for TUFLOW modelling and included model inputs and results details. We have relied upon the WMAwater flood study for hydrologic validation and comparison purposes.

2.5 Proposed Development

Architectural drawings prepared by Breathe Architecture Pty Ltd (Attachment A) indicate that the proposed development will include:

- Demolition of some existing structures across the site.
- Construction of an eco-tourism resort consisting of 2 communities and an arrival village.
- Community 1:
    - Interior and exterior homestead alterations including recreational and accommodation areas.
    - Construction of 2 buildings connected to the modified homestead, including a dining and accommodation area.
    - Construction of 10 cabins for tourist accommodation.
- Community 2:
    - Construction of a single storey building, including an outdoor dining area, multi-purpose room, and 12 bathrooms.
    - Construction of 22 glamping sites for tourist accommodation.
- Arrival village:
    - Construction of a single storey building, including reception, office staff room, utility room, laundry, commercial kitchen, and dining area.
    - Construction of 20 car bays and 3 bus bays around the building.

3 Hydrology Modelling

3.1 Methodology Overview

The DRAINS software package (version 2022.01 – 19 Jan 2022) was used with the WBNM hydrological engine to model the hydrology of the catchment for the 1% AEP and PMF events for a range of storm durations between 10 minutes and 24 hours. Three models were produced, these were:

1. Calibration Model – to match the resulting flows to the hydrology results from the WMAwater assessment.
2. Site Catchment Model – to predict the total flows arriving at the site from the Wingecarribee River and Schotts Creek.
3. Overland Flow Assessment Model – to model the minor overland flows adjacent to the Community 2 and Arrival village development areas, including the peak flow depths, levels, and widths.

3.2 Rainfall Data

Intensity Frequency Duration (**IFD**) data and rainfall temporal patterns were based on the Bureau of Meteorology (BOM 2022) Rainfall IFD Data System and the Australian Rainfall & Runoff (ARR 2019) Data Hub. Probable Maximum Precipitation (PMP) intensities and temporal distributions were determined using the BOM (2022) Generalised Southeast Australia Method.

3.3 Calibration Model

3.3.1 Overview

The calibration hydrology model was setup to replicate the hydrology models adopted by SMEC and WMAwater in their respective flood studies. The catchment area used by SMEC (SMEC WSC Figure A2, 2014), and subsequently adapted by WMAwater, was used, along with rainfall losses, and stream lag factor reported in the flood studies. Adopted parameters are summarised in Table 2. The impervious area percentage was obtained from the SMEC WSC flood study (Table 10-1, 2014). The lag parameter (C') was then modified so that resulting peak flows for the critical duration 24-hour 1% AEP event matched the WMAwater hydrology result for that event at 625 m^3/s.

Table 2: Adopted Hydrologic Parameters used WBNM modelling.

Parameter	Model Calibration Catchment
Initial Loss (mm)	7.1[1]
Continuing Loss (mm/h)	1.8[2]
Stream Lag	0.8[3]

[1] Obtained from the WMAwater flood study (Table 27). The initial loss was adopted based on undertaking for this modelling of the 1% AEP event for 24 hours storm durations.

[2] Obtained from the WMAwater flood study (Section 8.3).

[3] Obtained from the SMEC WSC flood study (Table 12-9).

3.3.2 Results

The calibration showed that a lag parameter of 2.4 produced a slight overestimation compared to the Council model results of 625 m^3/s, producing a peak flow rate of 636 m^3/s. This is considered the most suitable approach and a lag parameter of 2.4 was subsequently adopted for all hydrology models. A comparison of peak flow rates for various lag parameters has been provided in Table 3.

Table 3: Council study area peak flow rate comparison for various stream lag parameter.

WMAwater WSC (m^3/s)	Lag Parameter (C')	MA (m^3/s)	Difference (%)
625[1]	2.1[2]	698	+10
	2.5	617	-1.2
	2.4	636	+1.7

[1] Obtained from the WMAwater flood study (Table 32). Berrima Weir observation point.

[2] Obtained from the WMAwater flood study (Section 8.3).

3.4 Site Catchment Model

3.4.1 Overview

To predict the total flows arriving at the site, it was necessary to modify the calibration model to include the much larger upstream catchment to the site and add an additional catchment for Schotts Creek which runs through the site.

Site catchment delineation was developed using 2m LiDAR and topographic data provided by NSW DCS SS (2018 & 2022). The catchment is mostly undeveloped farmland with little impervious area. Impervious areas were estimated based on aerial photography (Nearmap, 2022) and the previously adopted impervious percentage from the calibration model.

3.4.2 Adopted Model Parameters

The adopted model parameters, except for areas, were as per the calibration model and are summarised in Table 4.

Table 4: Calibrated model parameters of site catchment modelling.

			Impervious Area		Pervious Area			
Sub-catchment [1]	Area (ha) [1]	Impervious (%) [2]	Initial Loss (mm)	Cont. Loss (mm/h)	Initial Loss (mm)	Cont. Loss (mm/h)	Lag Parameter[3]	Stream Lag
Wingecarribee River East Catchment	59061.37	3.7	1.5	0.0	7.1	1.8	2.4	0.8
Schotts Creek East Catchment	1042.95	0	1.5	0.0	7.1	1.8	2.4	0.8
Total	**60104.32**							

[1] Obtained based on LIDAR data and topographic data provided by NSW DCS SS (2018 & 2022).

[2] Adopted based on recent catchment aerials obtained from Nearmaps (2022).

[3] Adopted based on the model calibration result. Refer to Section 3.3.2.

3.4.3 Results

Results of peak flow rates for the site catchment arriving at the site for the critical duration 1% AEP and PMF events are summarised in Table 5. The critical storm duration was determined to be 24 hours for the 1% AEP and PMF events.

Table 5: Peak 1% AEP and PMF flow rates for critical duration storms estimated by DRAINS modelling for site catchments arriving at the site.

		Peak Catchment Flow Rates (m^3/s)		
Flood Event	Critical Storm Duration (hours)	Wingecarribee River East	Schotts Creek East	Total
1% AEP	24	1019.1	30.7	**1048.76**
PMF	24	5185.2	255	**5306.60**

3.5 Overland Flow Assessment Model

3.5.1 Overview

To determine the overland drainage path adjacent to the proposed Community 2 and Arrival area, modelling of 1% AEP and PMF event w undertaken for a range of storm durations from 20 minutes to 9 hours. This model adopted the same parameters as per the calibration model.

Sections of the overland flow paths were defined in the DRAINS software package based on the topography of the area and were used to determine overland flow characteristics including flow extents, water levels and depths. Cross-sections were determined at equal intervals based on terrain data and labelled as S1, S2, S3 and S4 with S1 being the most upstream and S4 being the most downstream cross-section within the proximity area via QGIS software.

3.5.2 Results

Results of the flow characteristics for the critical duration 1% AEP and PMF events are summarised in Table 6. To determine flow extents between these sections the widths were interpolated. These results are shown in Attachment B Map 14 and 15.

We note the following regarding modelled overland drainage path behaviour:

1. The flow extents of the overland drainage path do not affect the site in the 1% AEP and PMF event.
2. In 1% AEP and PMF event, the maximum water level adjacent to the proposed Community 2 development area (S2) is 537.89 mAHD and 538.15 mAHD respectively.
3. Velocities and hazard in the drainage path is intermediate in the 1% AEP and high in the PMF event, respectively.

Table 6: Overland drainage path result for the 1% AEP and PMF events.

Flood Event	Section	Max Flow Depth (m)	Max Flow Level (mAHD)	Max Flow Width (m)	Max Velocity (m/s)	Max D x V (m^2/s)
1% AEP	S1	0.17	542.50	29.8	0.9	0.15
	S2	0.31	537.89	24.1	0.9	0.27
	S3	0.28	533.17	17.2	0.9	0.26
	S4	0.20	530.19	16.9	0.9	0.18
PMF	S1	0.38	542.72	39.0	1.86	0.70
	S2	0.57	538.15	31.4	1.85	1.05
	S3	0.61	533.50	34.3	1.61	0.99
	S4	0.56	530.55	24.8	1.79	1.00

4 Hydraulic Modelling

4.1 Overview

The TUFLOW hydraulic model was used to determine flood characteristics including flood extents, levels, depths, velocities, and hydraulic hazard for the site. This model was setup to simulate the existing scenario which was then modelled for the critical 1% AEP and PMF events.

4.2 Model Setup

TUFLOW model construction for existing conditions consisted of:

1. 2 m LIDAR terrain data (NSW DCS SS, 2018) was used to create a 3D surface for the site and the local floodplain environment.

2. A 10 m topographic grid based on the available LIDAR data was created for the TUFLOW model.

3. The model domain was defined from a point 500 m upstream of the site to a point 500 m downstream of the site. Model boundary extents were generally placed along catchment ridgelines and / or connecting catchment high points surrounding the study area.

4. Inflow boundary conditions based on the critical duration 1% AEP and PMF hydrographs from DRAINS for each of the two sub-catchments discharging to the study area as per Table 5.

5. Computed water slopes of 0.7% for downstream model extent boundary conditions based on the slopes from available LIDAR data.

6. The thalweg (invert) of the drainage line along Wingecarribee River were modelled as z-shape modification to the existing model surface. Levels were adopted based on LiDAR data and the drainage line was adopted based on the latest aerial photography.

7. The dam on site was modelled and assumed as being at full capacity with an initial water level of 487.4 mAHD.

8. Manning's zones based on Nearmaps (2022) aerial photography of the study area with roughness coefficients adopted as per the WMAwater flood study and summarised in Table 7.

Table 7: Manning's roughness values adopted for TUFLOW modelling.

Catchment Material Type	Manning's Roughness Coefficient [1]
Waterbody without vegetation	0.03
Light vegetation	0.06
Dense vegetation	0.08
Creek channel	0.04

[1] Obtained from the WMAwater WSC flood study (Table 10). Where parameters were not provided in the WMAwater WSC flood study, roughness coefficients were adopted based on typical values from similar catchments.

4.3 Flood Results and Discussion

4.3.1 Flood Results

Flood mapping results (flood levels, depths, velocities, and hazard categories for the critical duration 1% AEP and PMF events in existing conditions are provided in Attachment B, with drawing references summarised in Table 8.

Table 8: Existing condition flood map drawing references in Attachment B.

Critical Duration Flood Event	Location	Water Level & Depth	Water Velocity	ARR Flood Hazard Categories[1]
1% AEP	Site Area	Map 02	Map 04	Map 06
	Community 1	Map 03	Map 05	Map 07
PMF	Site Area	Map 08	Map 10	Map 12
	Community 1	Map 09	Map 11	Map 13

[1] ARR flood hazard categories are based on ARR flood hazard curve (2019) definitions and are shown in Figure 1.

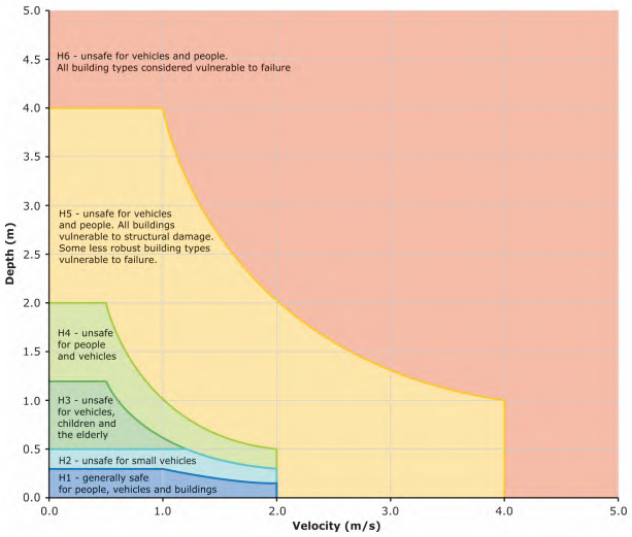


Figure 1: Flood Hazard Curves (Geoscience Australia, 2019).

4.3.2 Existing Conditions Flood Behaviour

1. The primary flood mechanism of the site is overbank flow flooding from Wingecarribee River.
2. In the 1% AEP and PMF event, the maximum water level adjacent to the proposed Community 1 is 479.87 mAHD and 486.71 mAHD, respectively.
3. Velocities in Wingecarribee River are high in the 1% AEP and PMF event (> 3.0 m/s).
4. Hazard categories in Wingecarribee River are categorised as H6 – unsafe for vehicles and pedestrians and unsuitable for all building types.

The proposed development is flood free and above the level of the 1% AEP and PMF flood events, therefore it is not necessary to model the proposed conditions.

5 Preliminary Flood Emergency Response Plan Comments

Although the site is likely affected by long duration and large-scale flooding from the Wingecarribee River, none of the development areas will be impacted by flooding in any flood event. A detailed site flood emergency response plan (FERP) is not considered necessary for this site, however the following preliminary comments are provided to mitigate risks associated with flooding:

1. The proposed eco-tourism resort development is not affected by the 1% AEP and PMF events and the egress route (Joadja Road) provides rising egress to Mittagong and the Hume Motorway. Thus, evacuation is the safest emergency response strategy for the site.

2. Rain events which cause flooding at the site are large-scale flood events, able to be forecast several hours or days in advance. Therefore, sufficient warning time exists before flooding commences to evacuate the site if deemed necessary.

3. If emergency services personnel (SES, Police etc.) issue an evacuation order for the site, all site occupants (visitors and staff) should evacuate.

4. The evacuation route from site is to turn right out of the site on to Jacks Valley Road and Joadja Road for 15km. Then left on to Greenhills Road for 1.7 km, right on to Wombeyan Caves Road for 7.5 km, and then left onto the Old Hume Highway towards either the Hume Motorway (Southbound), or Mittagong. Evacuees can proceed through Mittagong to the Hume Motorway Northbound if desired or follow emergency personnel's directions to evacuation centres.

5. The evacuation route from the site is approximately 30 km and is expected to take approximately 45 minutes via car.

6. Shelter-in-place is also an appropriate emergency response as the development areas are above the level of the PMF and include suitable accommodation and facilities to enable any people on site to remain there safely during a flood event.

7. Site management should monitor weather forecasts and warnings by subscribing to SES, BOM, Early Warning Network and other relevant warning systems.

8. Site management should maintain several flood emergency kits including torch with spare batteries, portable radio with spare batteries, first aid kit, high visibility vests, non-slip footwear and megaphone.

6 Flooding Compliance Assessment

Flood specific controls are provided in WSC DCP-Rural Lands in Part A, Section 5, Clause A5.9. According to Clause A5.9.5, the proposed development is categorised as residential.

Both hydrology and hydraulic model results show that the proposed development areas are above the water level of the 1% AEP and PMF events. Therefore, the flooding controls of the WSC DCP do not apply to the proposed development.

7 Summary and Recommendations

A detailed hydrologic and hydraulic model has been developed for the site using the LiDAR to assess local flood characteristics. The models were used to determine the existing flood conditions in the 1% AEP flood and PMF events.

Assessment indicated that:

1. The existing flood model is largely consistent with the adopted WSC flood studies parameters.
2. The entire proposed development, including the buildings, glamping and cabin area, is above the 1% AEP and PMF event.
3. The site can be safely evacuated in all flood events if necessary.
4. Alternatively, since the site is unaffected by the PMF and suitable accommodation facilities will be available on the site, shelter-in-place is also an acceptable flood emergency response.
5. Compliance with Council development control plan requirements relating to flooding for rural land is achieved.

8 References

Bureau of Meteorology (2003), *The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method*.

Bureau of Meteorology (2006), *Generalised Southeast Australia Method.*

Bureau of Meteorology (2023), *Rainfall IFD Data System*, http://www.bom.gov.au/water/designRainfalls/revised-ifd/.

NSW Department of Infrastructure, Planning and Natural Resources (2005), *Floodplain Development Manual*.

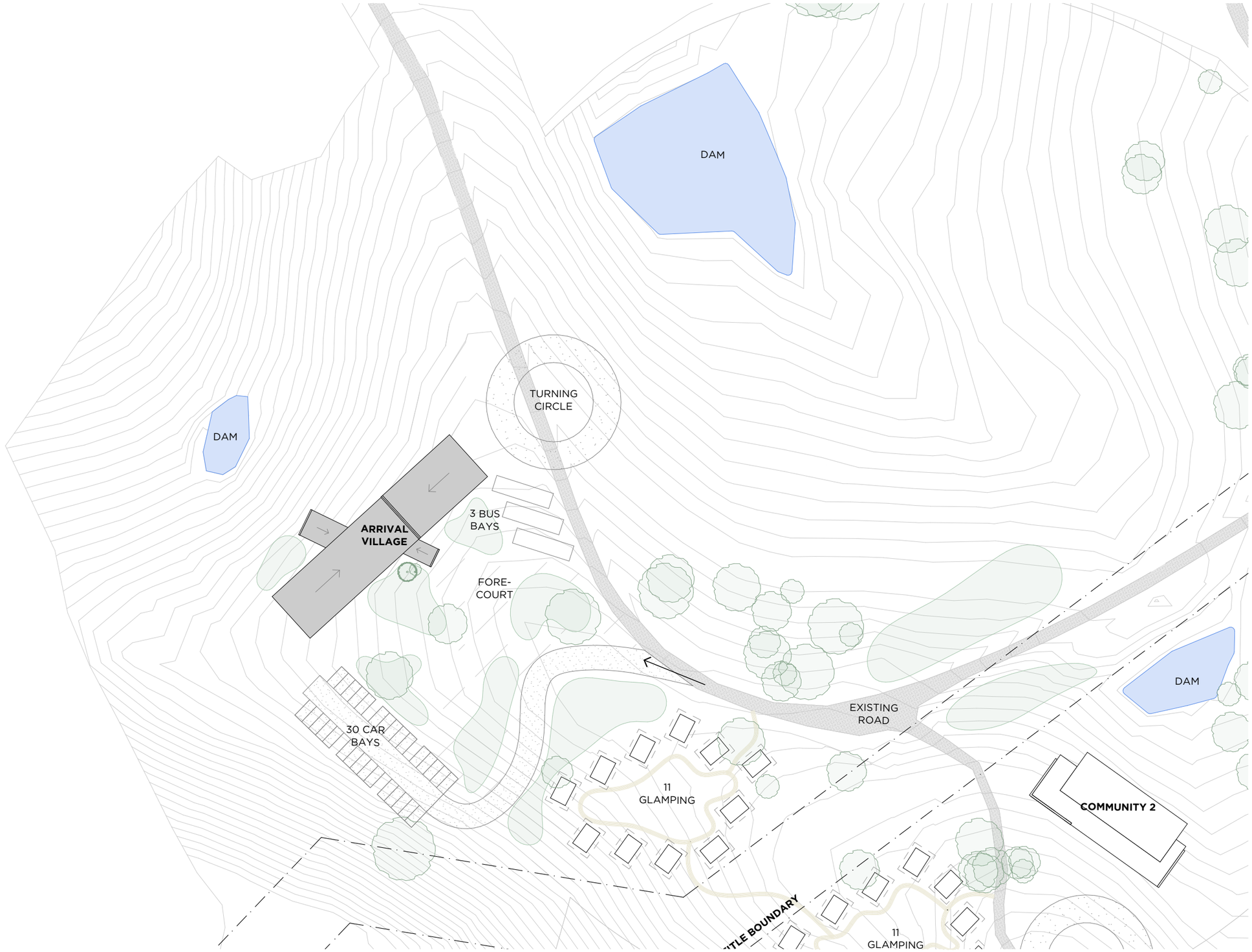
Wingecarribee Shire Council (2010), *Wingecarribee Local Environmental Plan (LEP).*

Wingecarribee Shire Council (2021), *Wingecarribee Development Control Plan (DCP)-Rural Lands.*

9 Attachment A – Proposed Site Layout

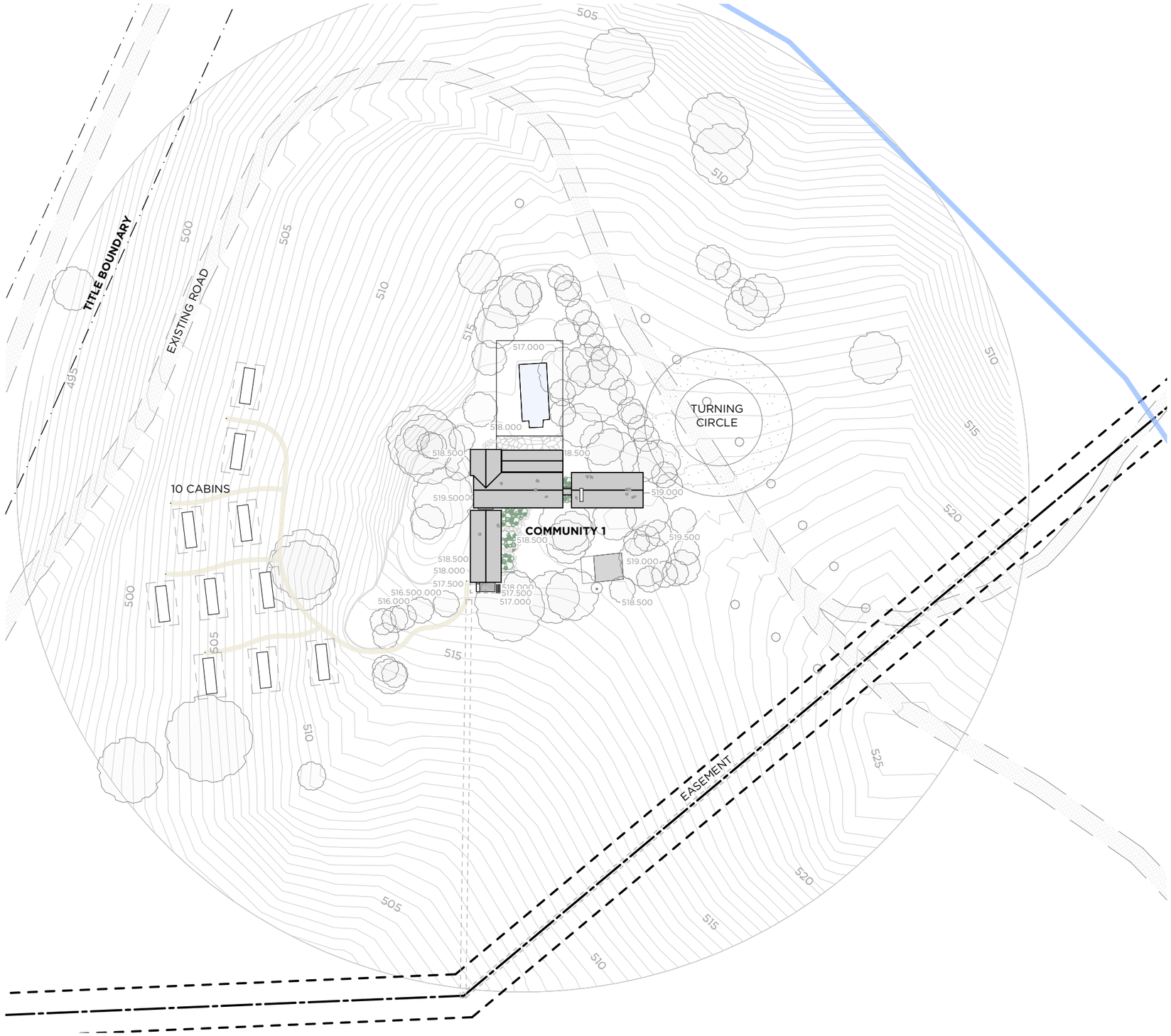
Site Plan

Arrival Village | 1:1000 @ A3



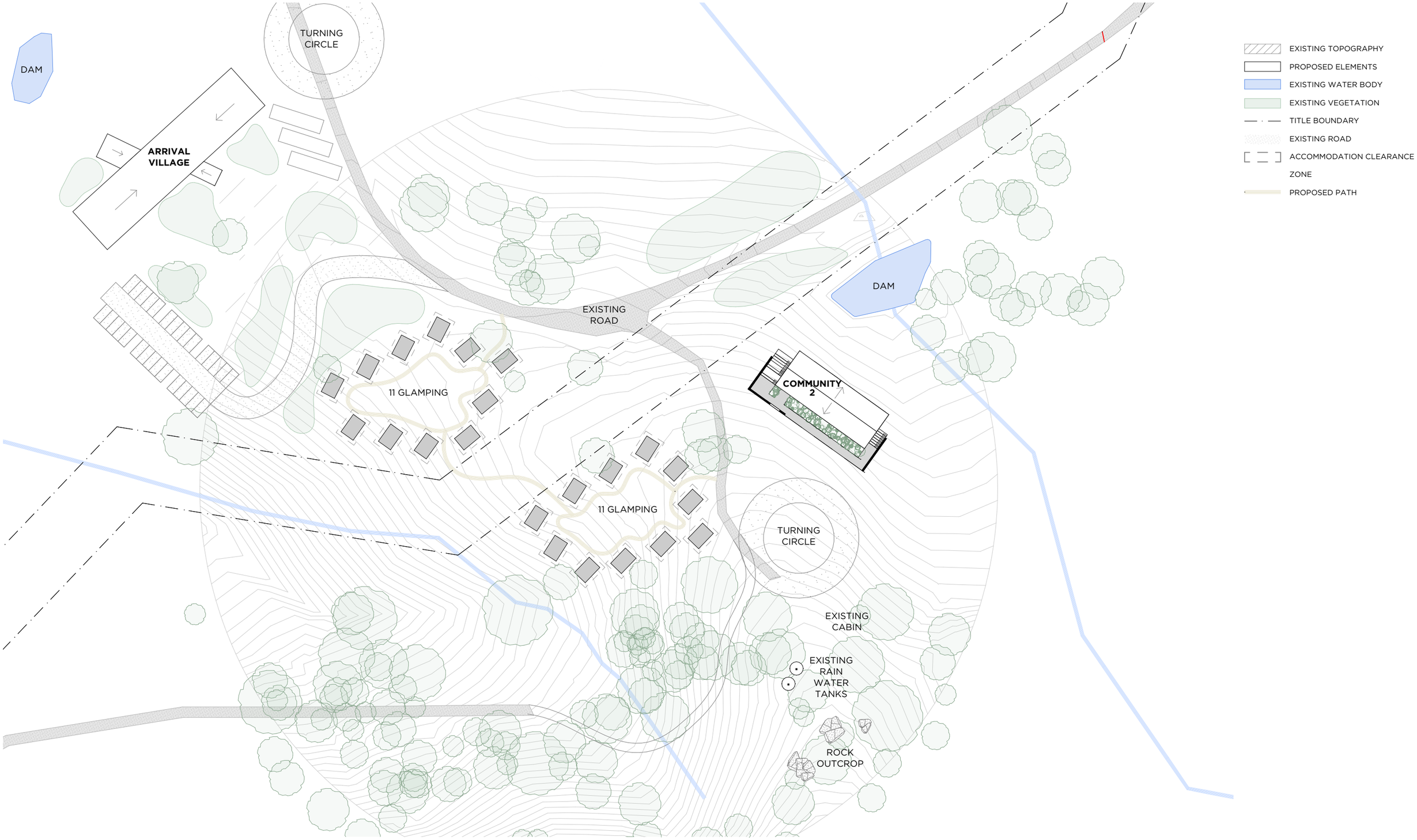
Site Plan

Community 1 | 1:1000 @ A3

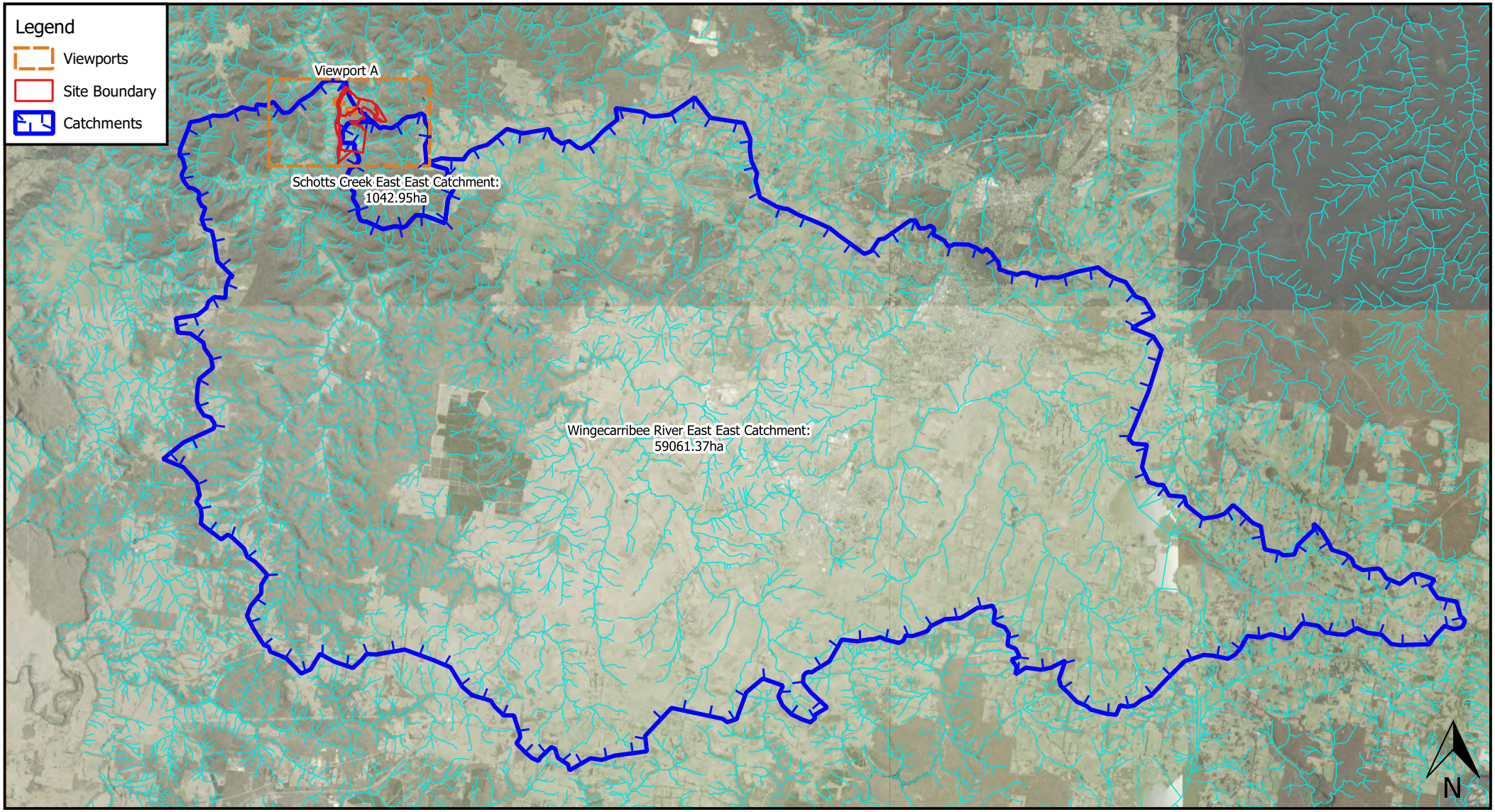


Site Plan

Community 2 | 1:1000 @ A3



10 Attachment B – Flood Maps



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Viewport Overview

Notes:
- Aerial, Site Boundary and Hydrolines from NSW Spatial Services (2023).

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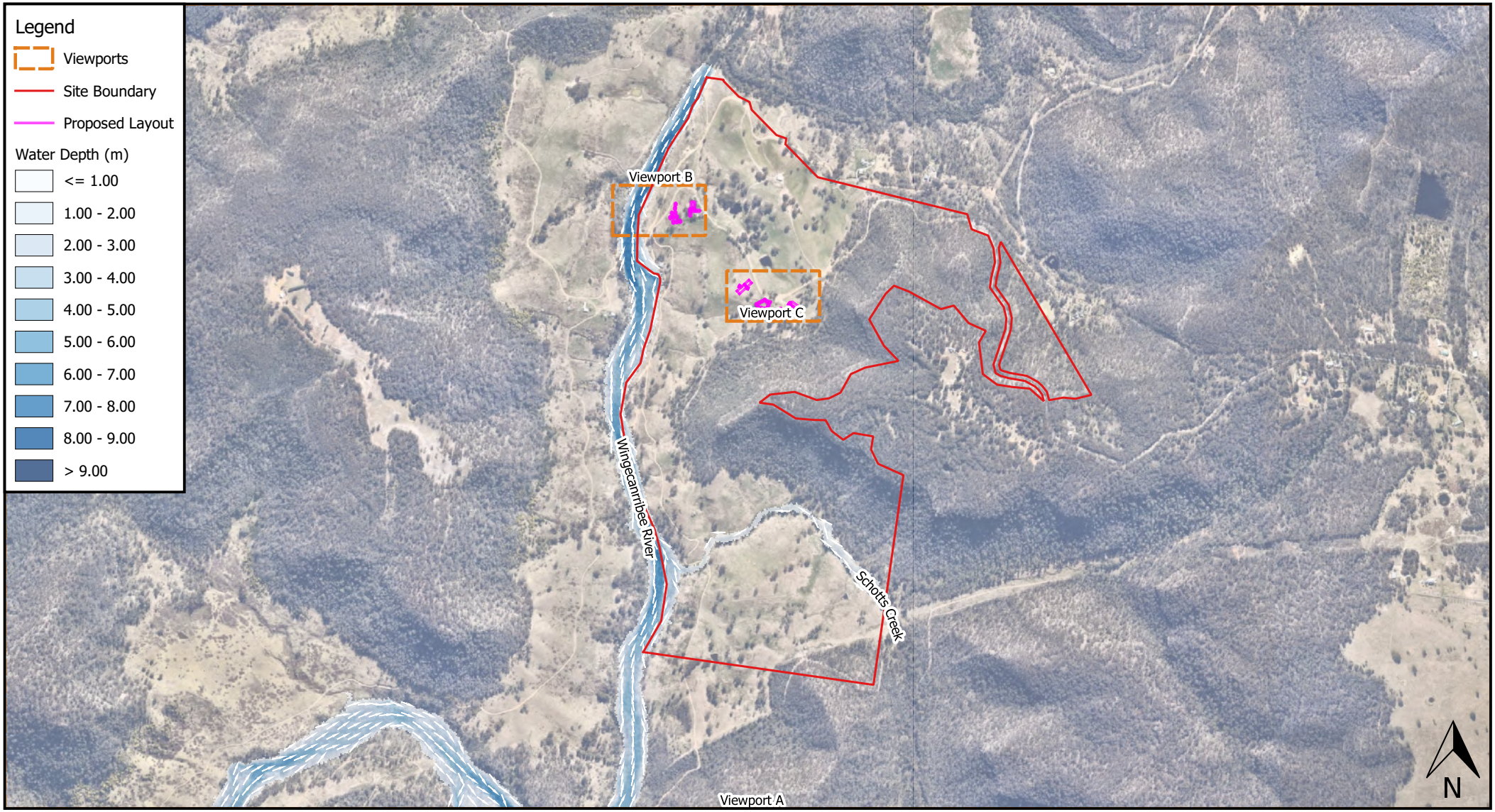
Project No: P2108462 Map Set: MS01-R01 EPSG: 28356

Map Title / Figure:

Overview and Catchments

Map 01	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date



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Viewport A

Notes:
- Aerial from Nearmap (2023).

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Project No: P2108462 Map Set: MS01-R01 EPSG: 28356

Map Title / Figure:

1% AEP Existing Condition Water Level (mAHD) & Water Depth (m)

Map 02	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date

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1:1250 @ A4

Viewport B

Notes:
- Aerial from Nearmap (2023).

Map Title / Figure:

1% AEP Existing Condition Water Level (mAHD) & Water Depth (m) - Community 1

Map 03	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date

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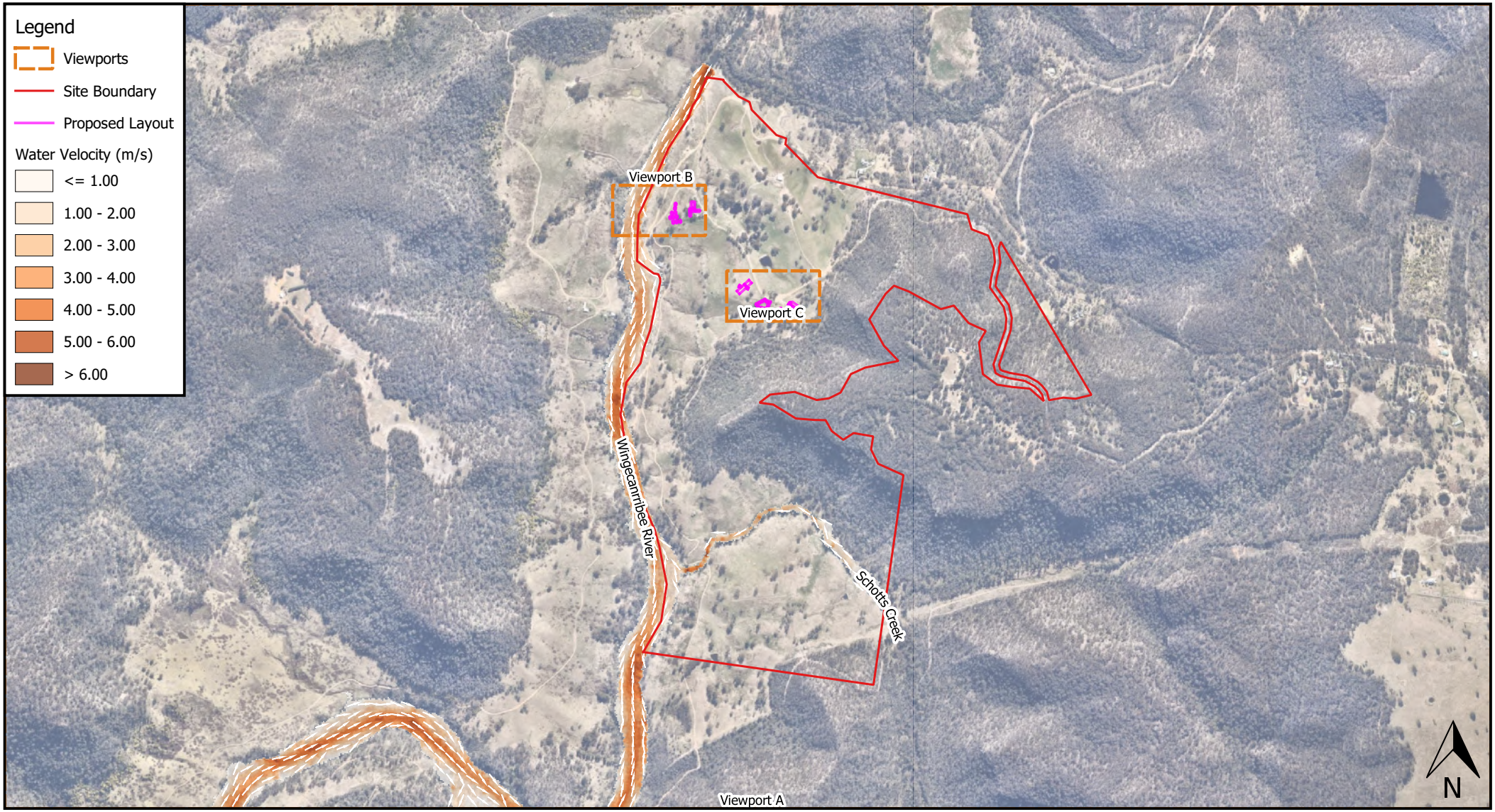

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Viewport A

Notes:
- Aerial from Nearmap (2023).

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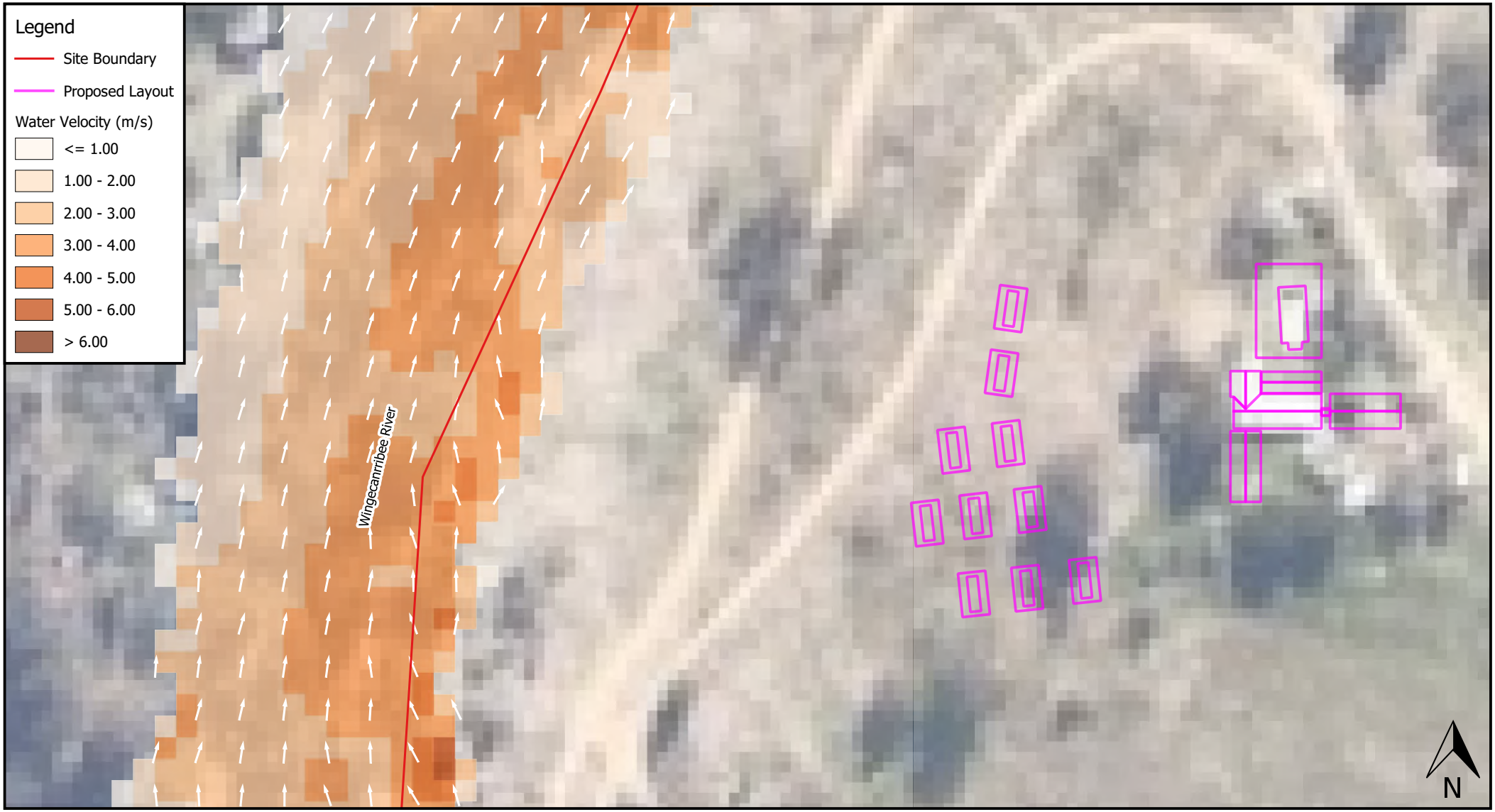
Environment | Water | Geotechnics | Civil | Projects

Project No: P2108462 Map Set: MS01-R01 EPSG: 28356

Map Title / Figure:

1% AEP Existing Condition Water Velocity (m/s)

Map 04	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date



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Viewport B

Notes:
- Aerial from Nearmap (2023).

Map Title / Figure:

1% AEP Existing Condition Water Velocity (m/s) - Community 1

Map 05	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date

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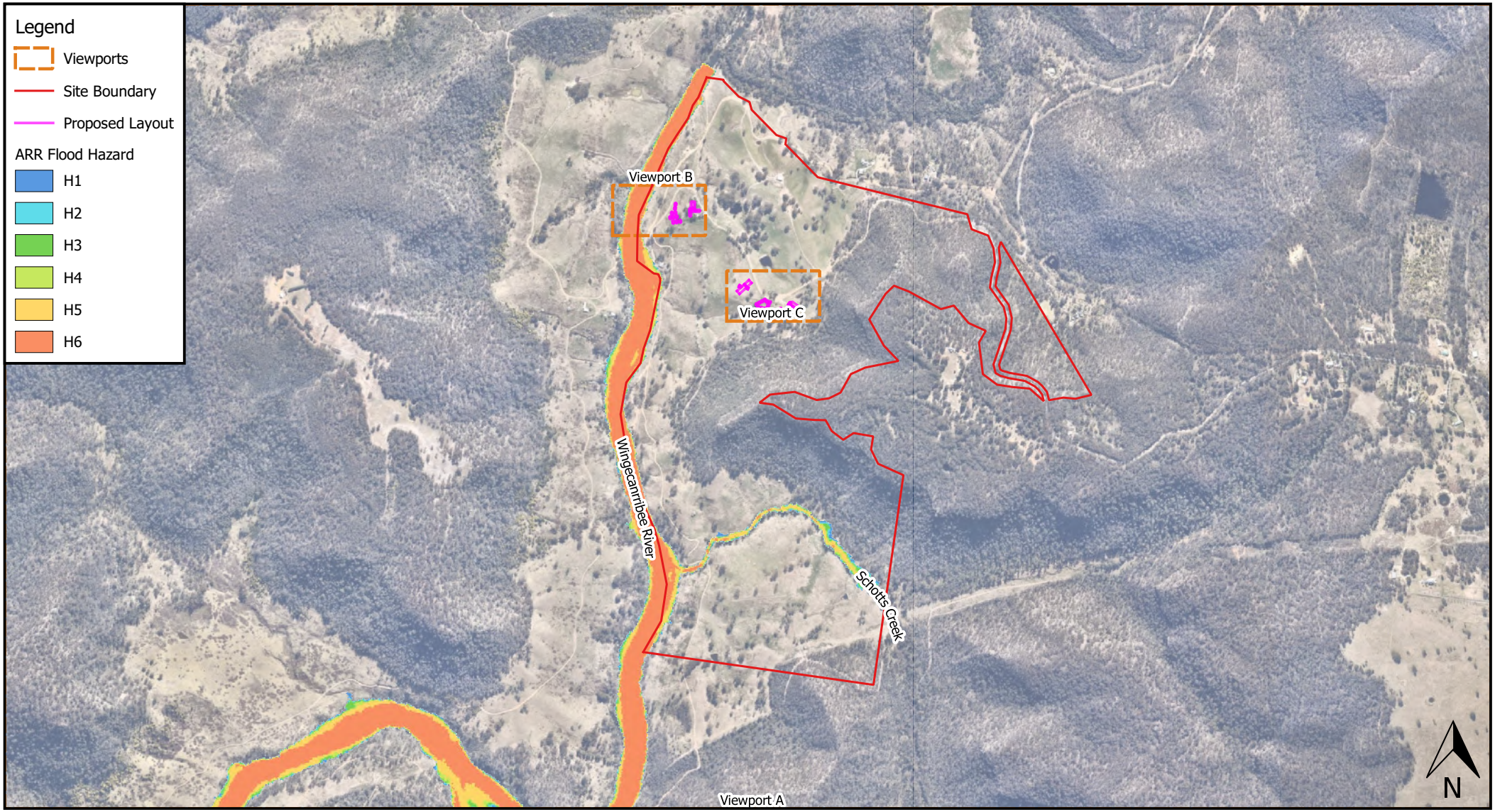
Project No: P2108462 Map Set: MS01-R01 EPSG: 28356



0 200 400 600 800 1,000 m

1:20000 @ A4

Viewport A

Notes:
- Aerial from Nearmap (2023).
- Flood hazard based on Australian Rainfall and Runoff (2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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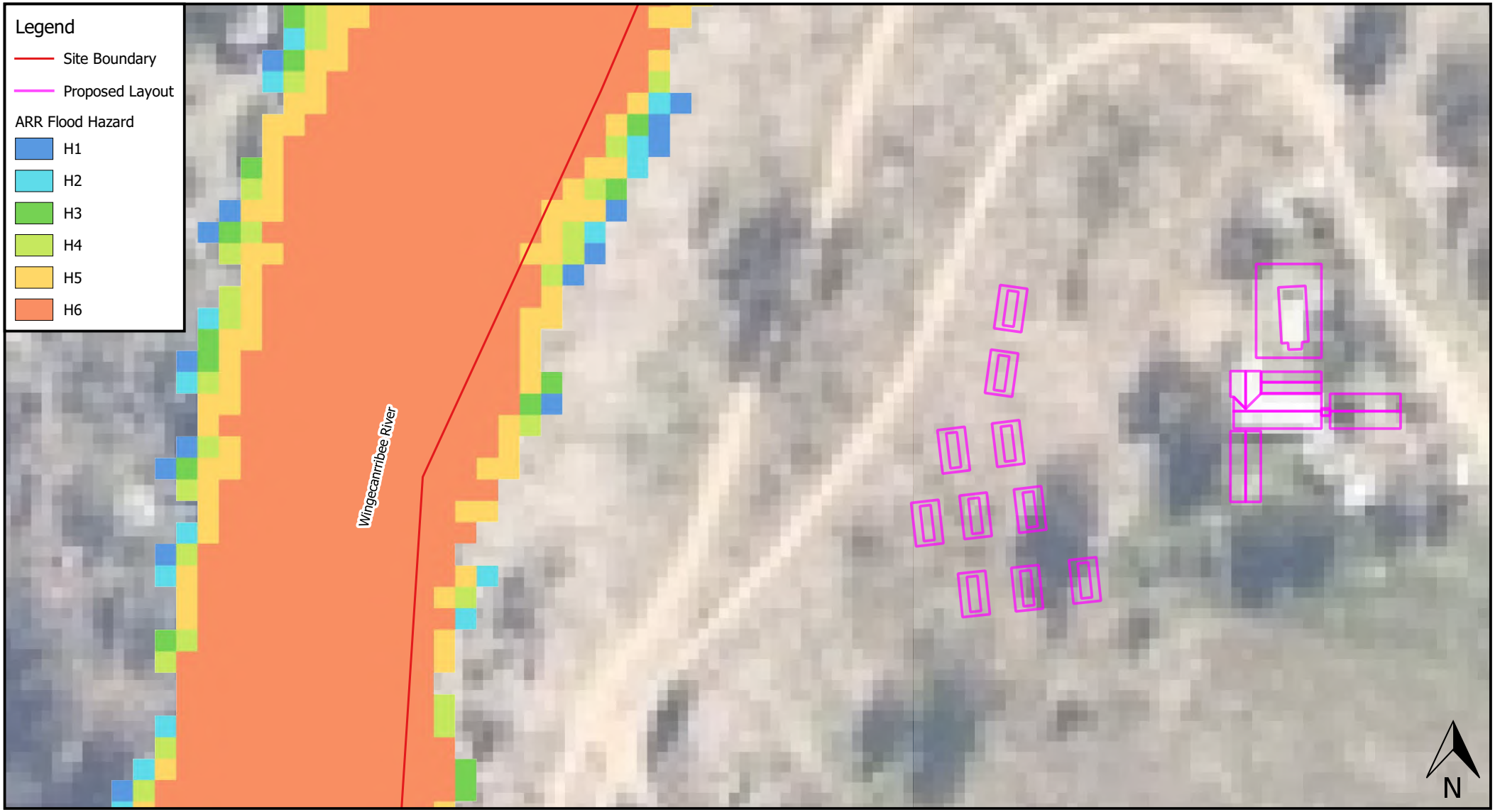
Project No: P2108462 Map Set: MS01-R01 EPSG: 28356

Map Title / Figure:

1% AEP Existing Condition Provisional ARR Flood Hazard Categories

Map 06	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date



0 10 20 30 40 50 m

1:1250 @ A4

Viewport B

Notes:
- Aerial from Nearmap (2023).
- Flood hazard based on Australian Rainfall and Runoff (2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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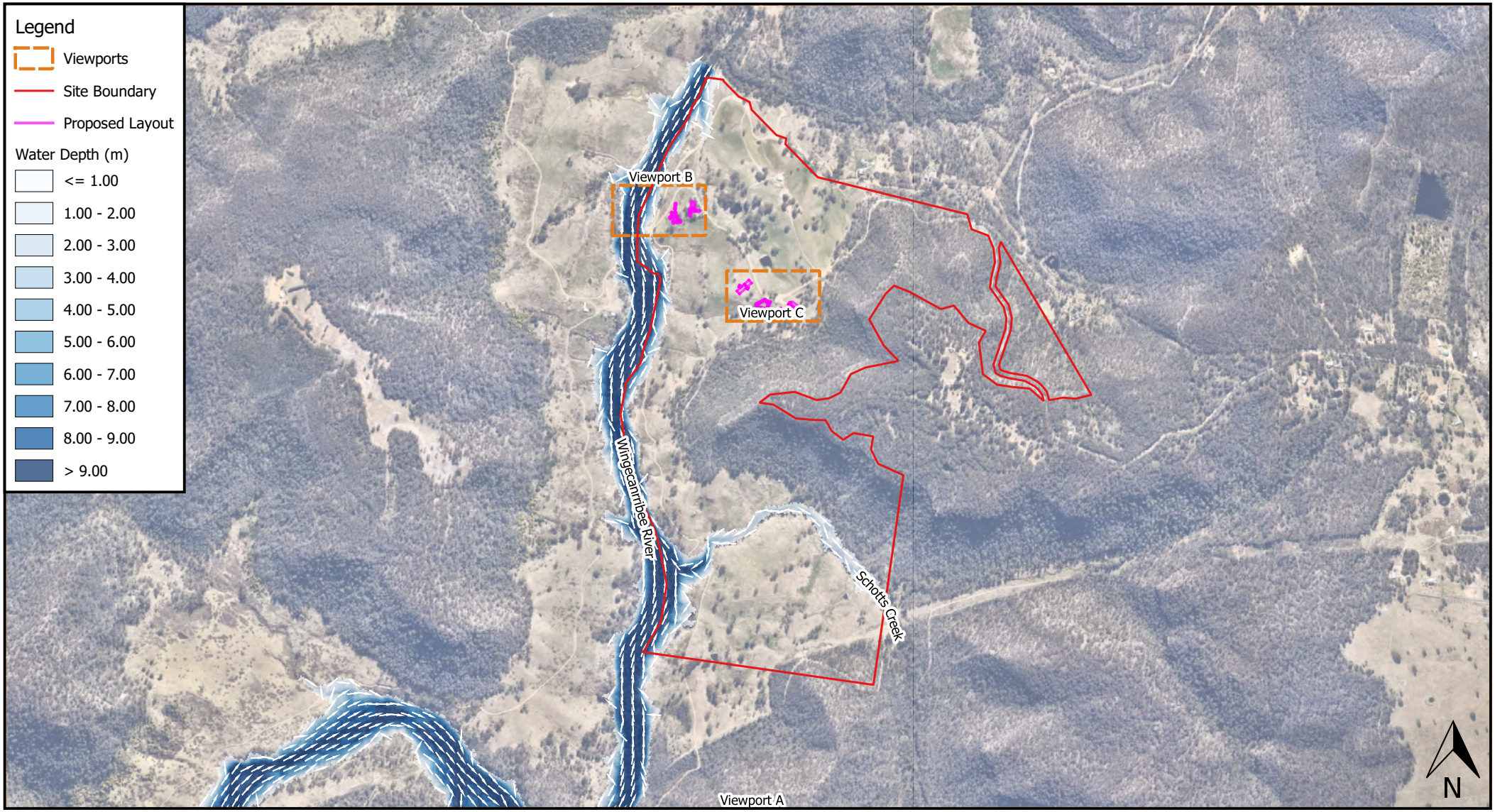
Project No: P2108462 Map Set: MS01-R01 EPSG: 28356

Map Title / Figure:

1% AEP Existing Condition Provisional ARR Flood Hazard Categories - Community 1

Map 07	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date



0 200 400 600 800 1,000 m

1:20000 @ A4

Viewport A

Notes:
- Aerial from Nearmap (2023).

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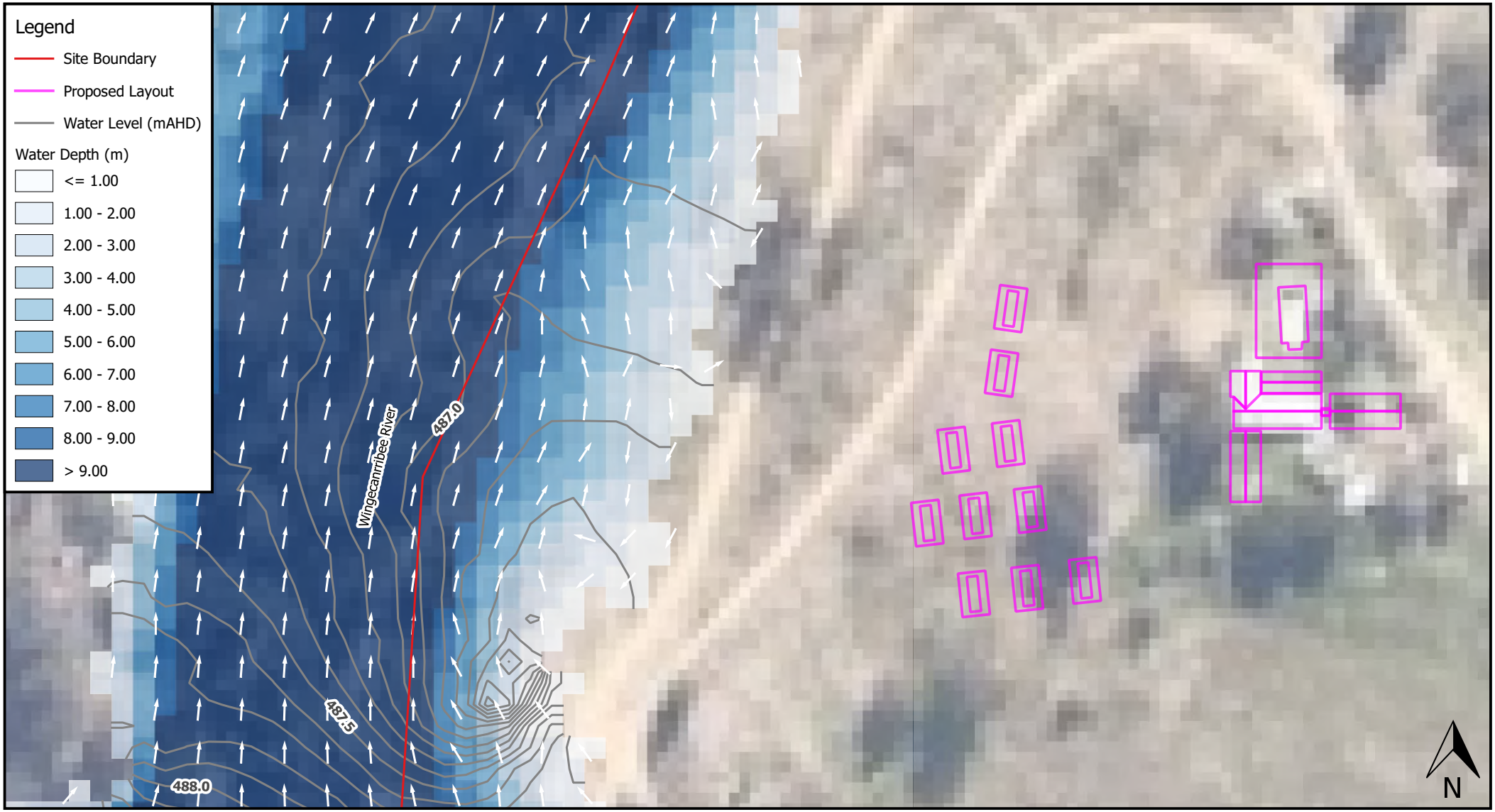
Project No: P2108462 Map Set: MS01-R01 EPSG: 28356

Map Title / Figure:

PMF Existing Condition Water Level (mAHD) & Water Depth (m)

Map 08	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date



0 10 20 30 40 50 m

1:1250 @ A4

Viewport B

Notes:
- Aerial from Nearmap (2023).

Map Title / Figure:

PMF Existing Condition Water Level (mAHD) & Water Depth (m) - Community 1

Map 09	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date

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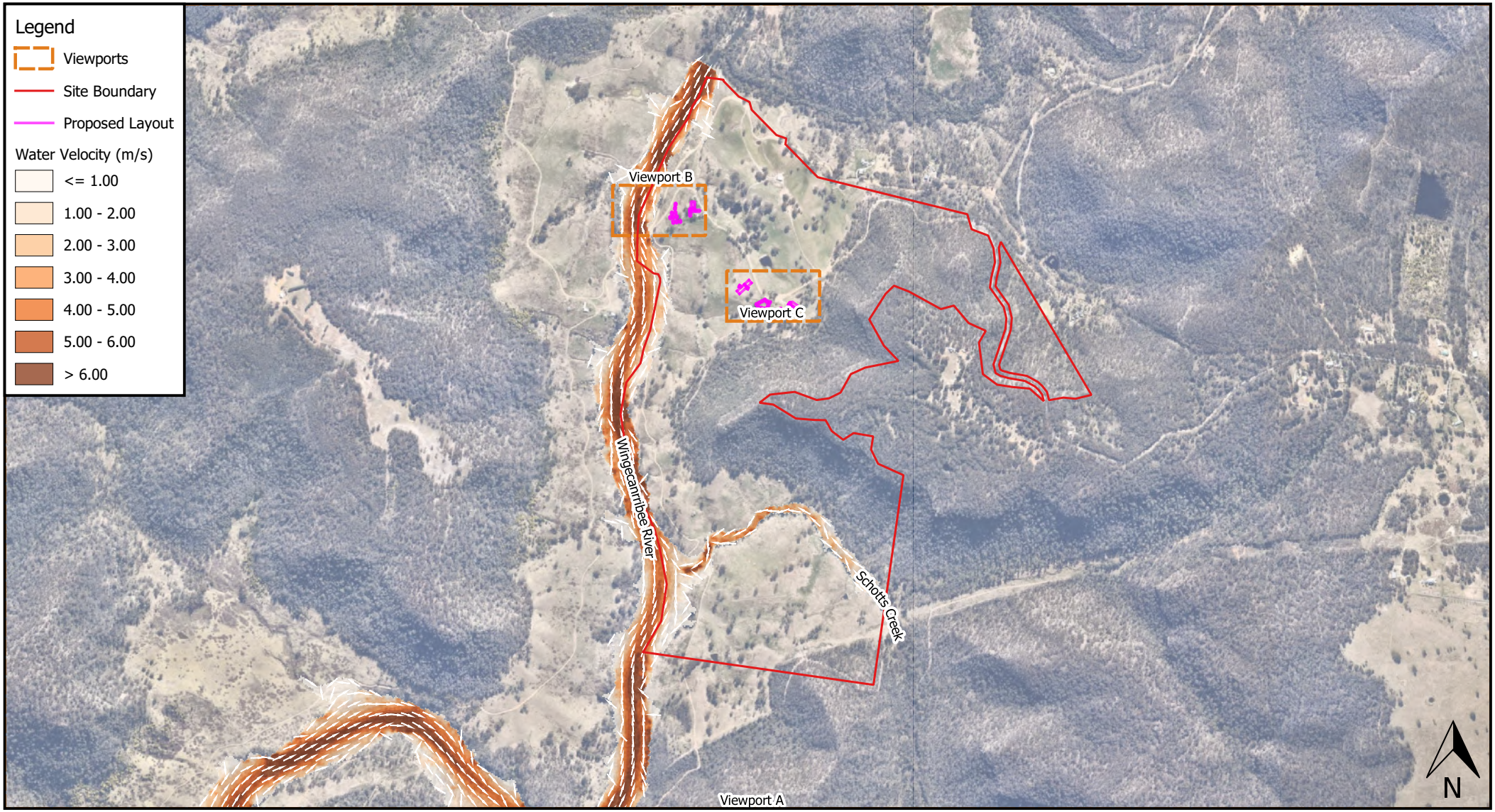

0 200 400 600 800 1,000 m

1:20000 @ A4

Viewport A

Notes:
- Aerial from Nearmap (2023).

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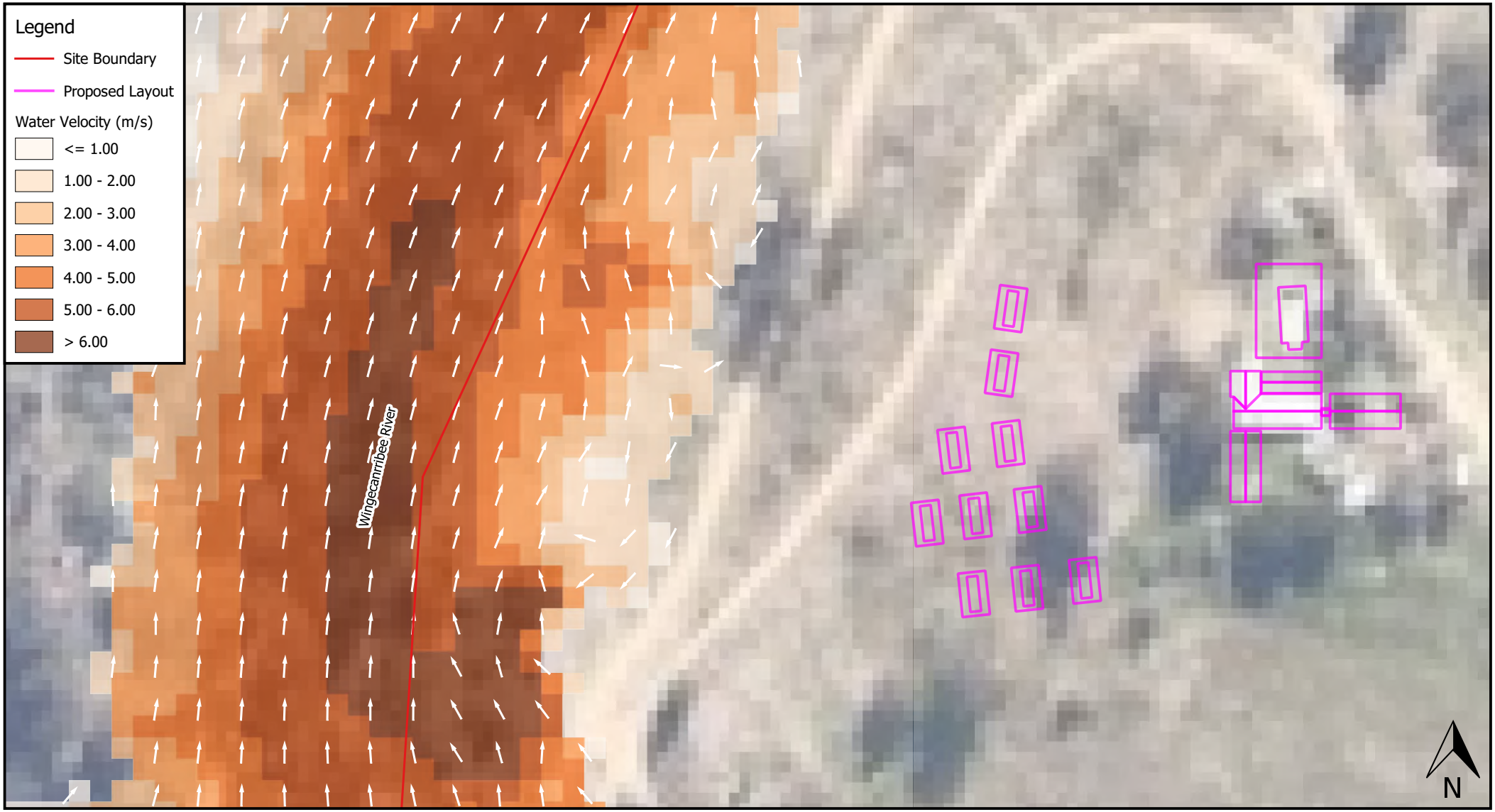
Project No: P2108462 Map Set: MS01-R01 EPSG: 28356

Map Title / Figure:

PMF Existing Condition Water Velocity (m/s)

Map 10	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date



0 10 20 30 40 50 m

1:1250 @ A4

Viewport B

Notes:
- Aerial from Nearmap (2023).

Map Title / Figure:

PMF Existing Condition Water Velocity (m/s) - Community 1

Map 11	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date

Project No: P2108462 Map Set: MS01-R01 EPSG: 28356

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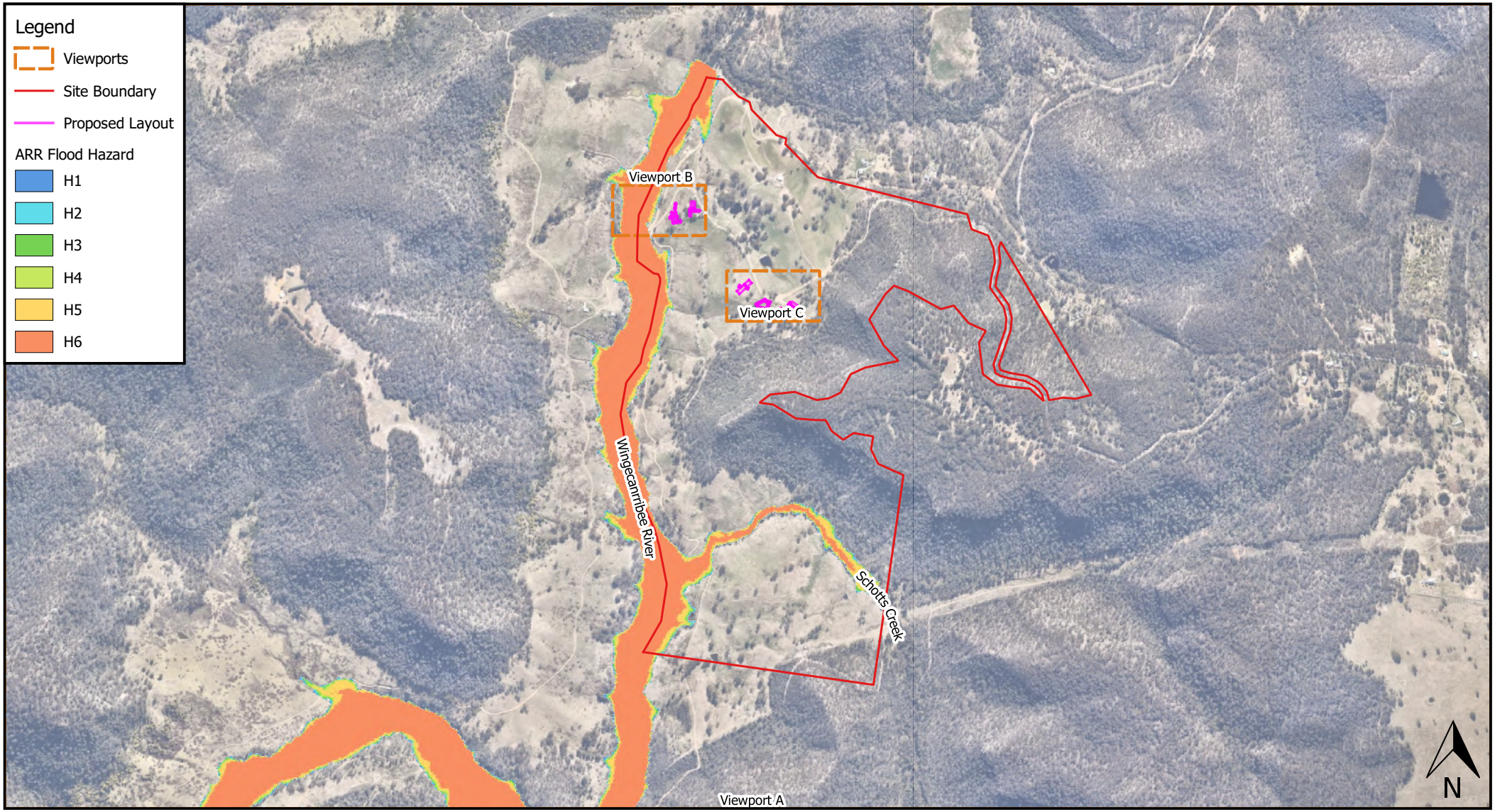

0 200 400 600 800 1,000 m

1:20000 @ A4

Viewport A

Notes:
- Aerial from Nearmap (2023).
- Flood hazard based on Australian Rainfall and Runoff (2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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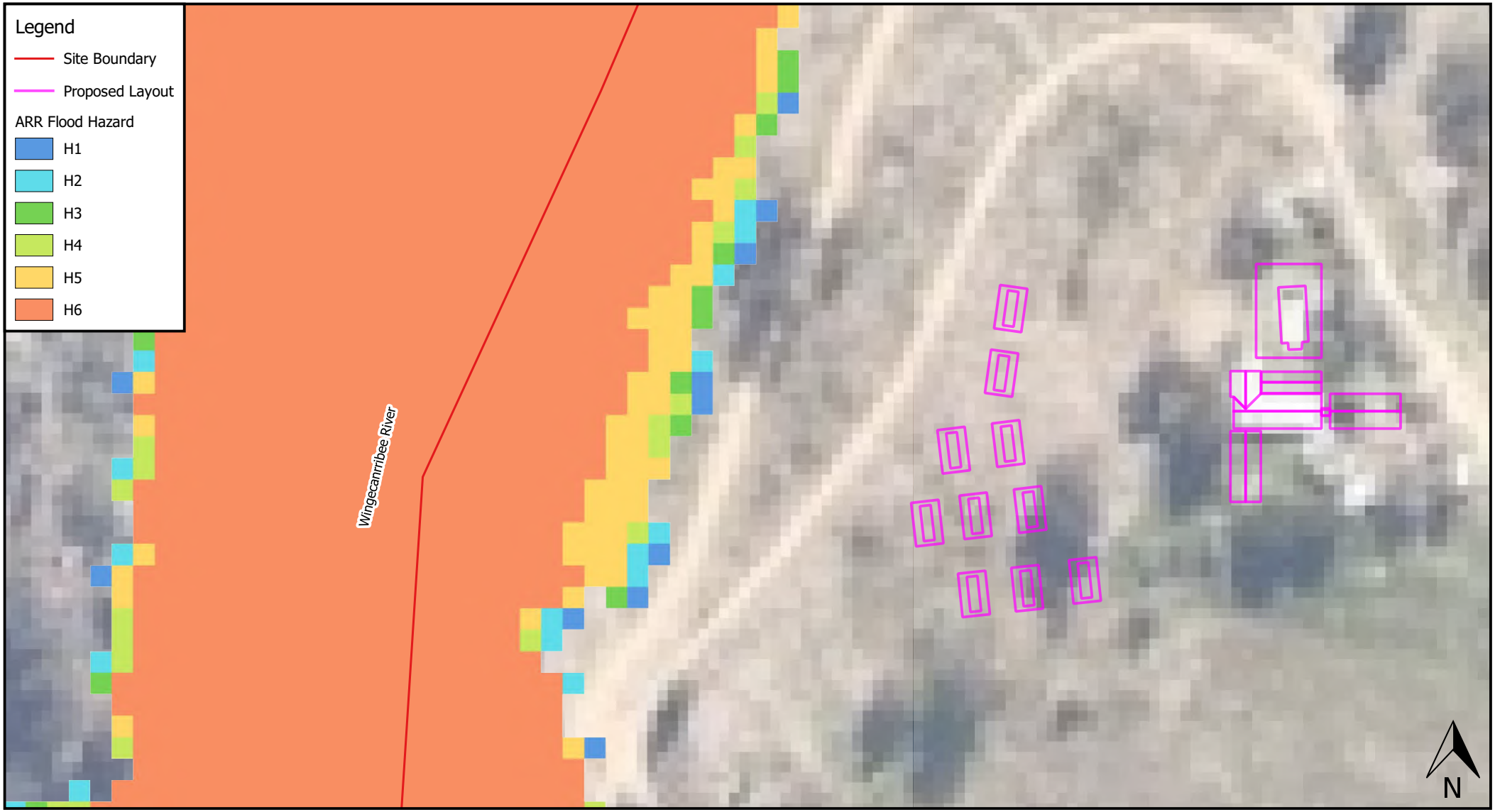
Project No: P2108462 Map Set: MS01-R01 EPSG: 28356

Map Title / Figure:

PMF Existing Condition Provisional ARR Flood Hazard Categories

Map 12	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date



0 10 20 30 40 50 m

1:1250 @ A4

Viewport B

Notes:
- Aerial from Nearmap (2023).
- Flood hazard based on Australian Rainfall and Runoff (2019) 'A Guide to Flood Estimation' combined flood hazard curves.

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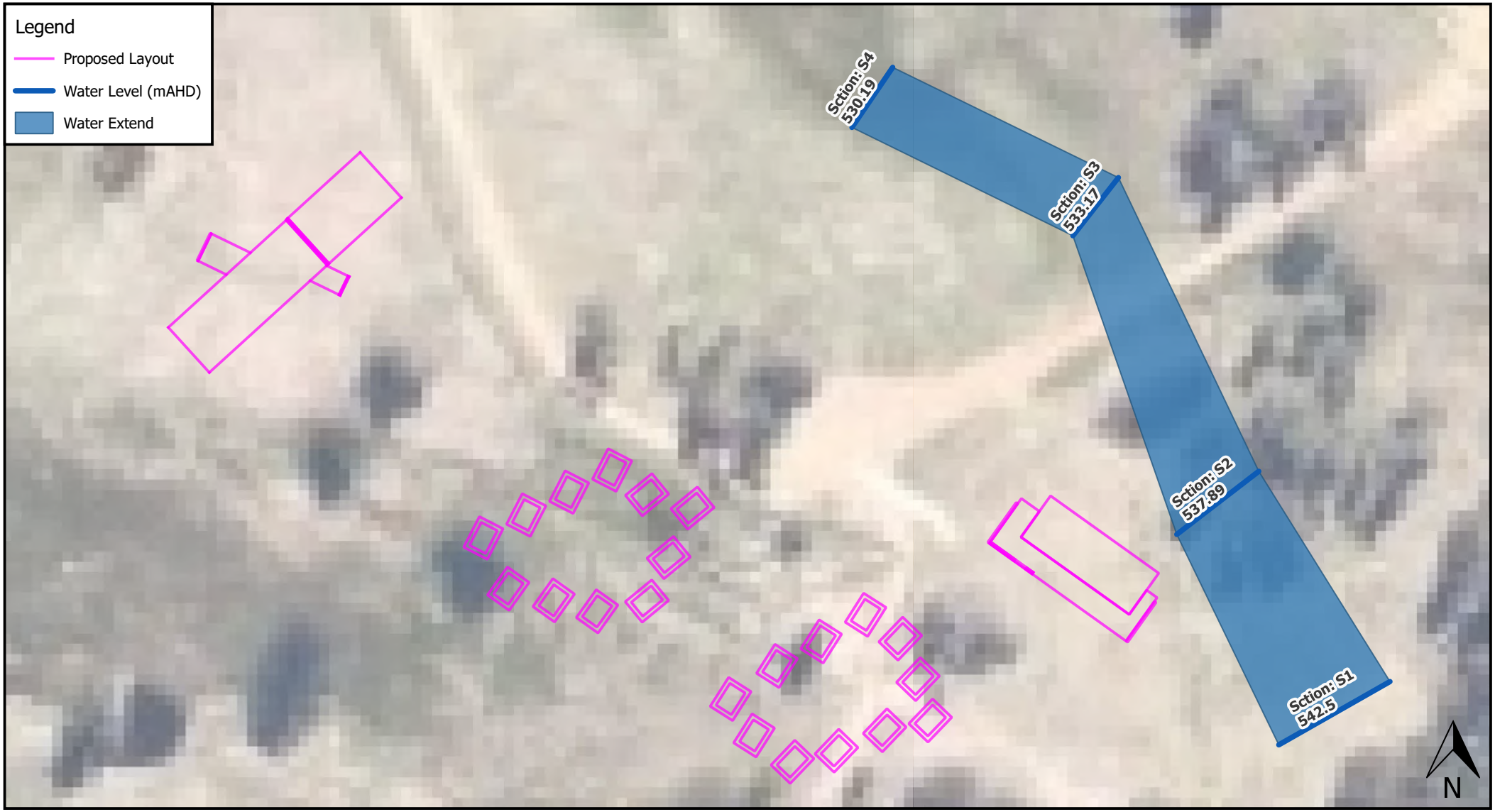
Map Title / Figure:

PMF Existing Condition Provisional ARR Flood Hazard Categories - Community 1

Map 13	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date



0 10 20 30 40 50 m

1:1250 @ A4

Viewport C

Notes:
- Aerial from Nearmap (2023).

Project No: P2108462 Map Set: MS01-R01 EPSG: 28356

Map Title / Figure:

1% AEP Existing Condition Water Level (mAHD) & Water Extents - Arrival Village & Community 2

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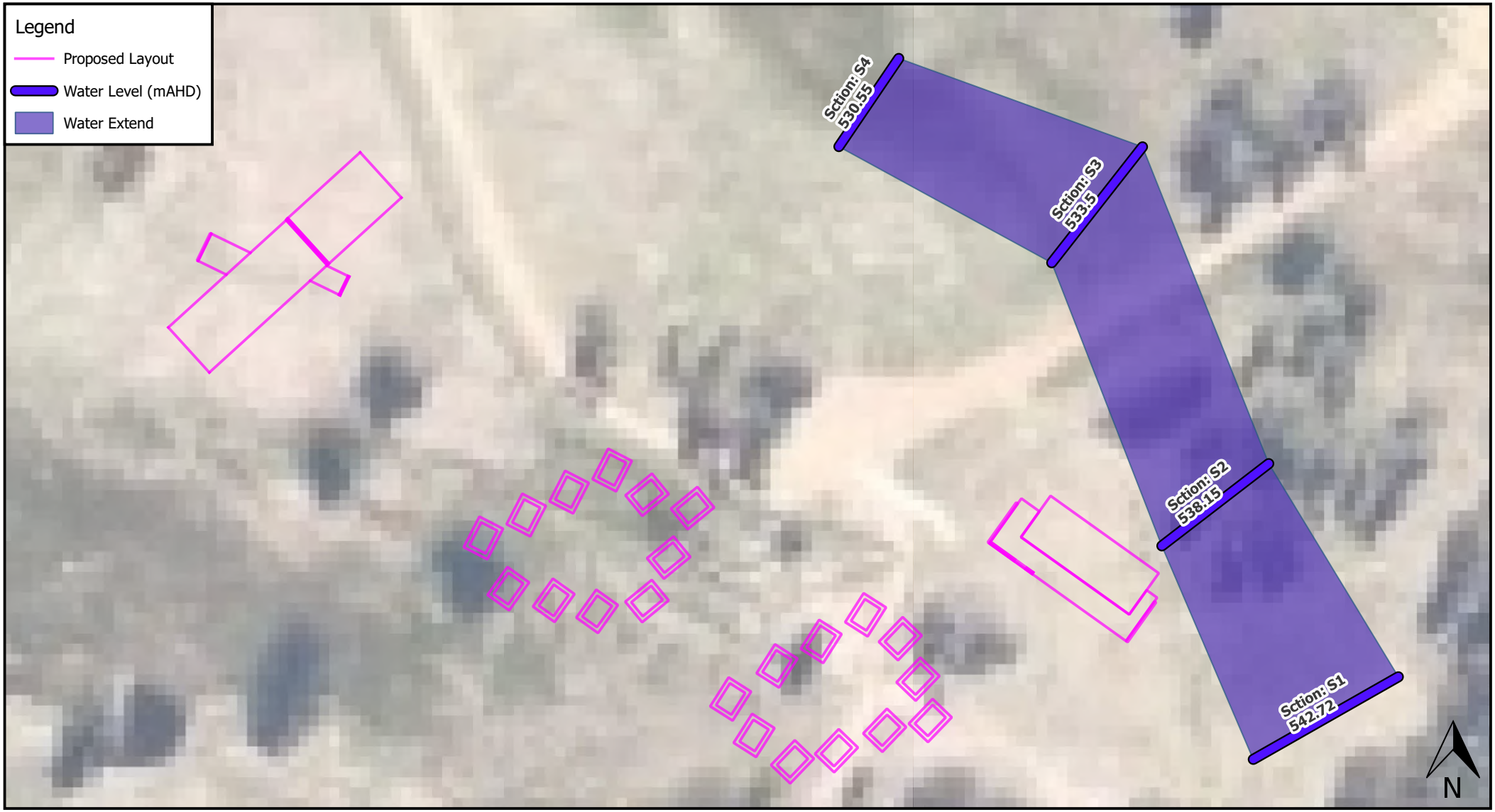
Map 14	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date



0 10 20 30 40 50 m

1:1250 @ A4

Viewport C

Notes:
- Aerial from Nearmap (2023).

Project No: P2108462 Map Set: MS01-R01 EPSG: 28356

Map Title / Figure:

PMF Existing Condition Water Level (mAHD) & Water Extents - Arrival Village & Community 2

Map 15	Map
1551 Joadja Road, Joadja, NSW	Site
Eco-Tourism Resort Development	Project
Flood Assessment	Sub-Project
Fresh Hope Venues	Client
15/12/2023	Date

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