

27 April 2023

NL180224 B07 [A]

Wyee Land Pty Ltd
Ben Johnson
Suite 6, 257-259
Central Coast Highway
Erina NSW 2250

Dear Ben,

Re: Lot 171 DP1212974 - 482 Bushells Ridge Road, Wyee

Northrop Consulting Engineers have undertaken a detailed flood investigation on behalf of Wyee Land Pty Ltd to assess the flood behaviours for Lot 171 DP1212974 located within the Radcliffe, Wyee subdivision, herein referred to as the 'subject site'. Through assessing the flood levels and hazard within the 1 in 2000 AEP and PMF flood event, the proposed rezoning of the subject site, in response to the RFI signed 28 February 2023, has been investigated.

This assessment has been conducted using the most recent Flood Impact Assessment titled "Radcliffe, Wyee Subdivision – Flood Impact Assessment for proposed modification to Development Consent DA2178/2018", dated the 17 November 2022, and herein referred to as "The previous Flood Impact Assessment (Northrop, 2022)".

The purpose of this correspondence is to outline the changes made to the previous Flood Impact Assessment (Northrop, 2022), including the updates to the original XP-STORM modelling and to present the results of the updated modelling. Provided below is a description of the subject site, the proposed modification, the updates to the original modelling and a summary of the results.

The Subject Site

The subject site is contained within the Radcliffe Wyee Subdivision and located at 482 Bushells Ridge Road, Wyee, otherwise known as Lot 171 DP1212974. In its existing condition, the site contains redundant water treatment plant infrastructure.

The subject site is located adjacent to Mannering Creek which runs in an easterly direction through Wyee and into Mannering Lake, east of the subject site. A major creek crossing exists across Soreina Drive adjacent to the western boundary of the site which enables access across Mannering Creek.

Proposed Development

It is proposed that the subject site is rezoned to R2 land, to be compatible with residential development in the future. To determine the feasibility of the rezoning, the lot is proposed to be filled to reduce the flood hazard in the PMF.

		Date
Prepared by	DN	27/04/2023
Checked by	GB	27/04/2023
Admin	CB	27/04/2023

Model Updates

The following provides a brief outline of the changes made to the original XP-STORM flood model which was prepared as part of the previous Flood Impact Assessment (Northrop, 2022).

As part of this assessment, additional hydrology was required within the model. This involved the 1 in 2000 AEP rainfall depths. Using Table 8.3.2 of the ARR 2019 Guidelines, a Growth Factor of 1.698 was applied to the 1 in 100 AEP rainfall depth and was adopted for each of the scenarios enveloped.

Existing Case

The previous Developed Case scenario used in the Flood Impact Assessment (Northrop, 2022) has been used as the existing case scenario for this investigation. Given this scenario has been submitted for assessment by Council, it was considered as the base case scenario.

Developed Case

Changes have been made in the model to the proposed development location. This involved the removal of the existing water treatment plant infrastructure, in addition to filling the subject site. Two scenarios were tested within the XP-STORM model, as shown in Figure 2 and Figure 3, to assess the flood hazard within the PMF:

- Pad level set at the critical 1% AEP flood level plus 500mm freeboard (22.5m AHD)
- Pad level raised to the maximum fill level, equivalent to the crest of Cudmore Crescent (23.8m AHD)

The model was run for a duration of 2- and 6-hours for the 1 in 2000 AEP, and 15-minutes and 2-hours for the PMF and included both the blocked and unblocked scenarios of the Soreina Drive culverts on Mannering Creek.

Results

The flood results are presented in Attachment A.

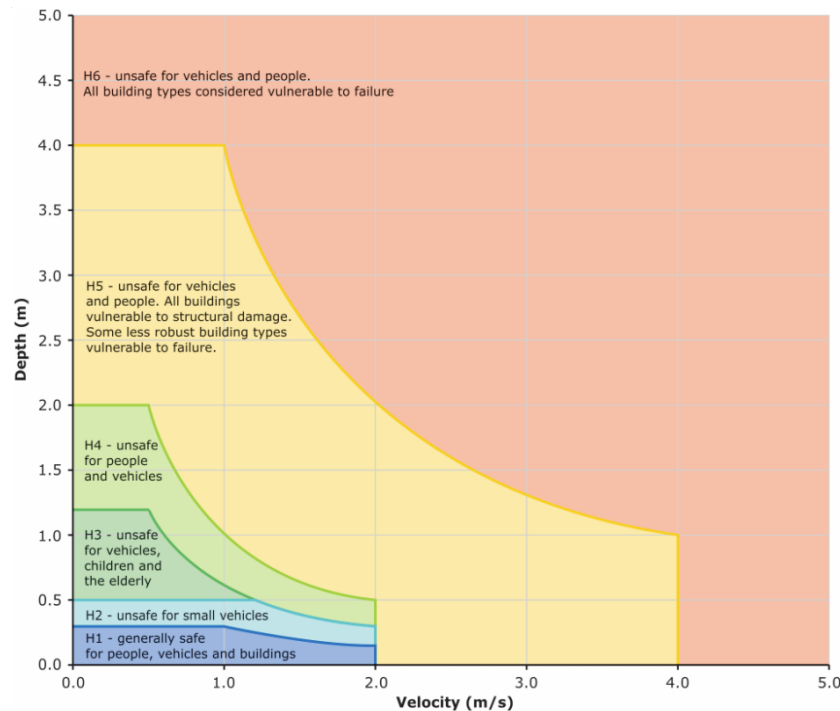
Flood Hazard

The flood hazard for the PMF design storm events is presented in Figures A1 to Figure A3 of Attachment 1. Figure A1 presents the existing case model and includes the redundant water treatment plant infrastructure, which was removed for each of the developed scenarios.

Flood hazard is based on the latest Australian Rainfall and Runoff guidelines, as shown in **Graph 1** overleaf. Note that the figures have been created by enveloping the maximum results for both critical durations and both blockage scenarios. This has been prepared to capture the highest likely water levels both upstream and downstream of the creek crossings.

During the PMF, the flood hazard conditions across the majority of the subject site are generally H5. The below **Graph 1** suggests buildings constructed in this area are vulnerable to structural damage, requiring consideration to be given to the suitability of these hazards during future development for the lot.

Two pad fill levels were adopted to assess the flood hazard in the PMF, with the intent to reduce the hazard across the subject site whilst minimising the impacts of filling the subject site. Figure A2 presents the site filled to a level equivalent to the 1% AEP flood elevation plus 500mm of freeboard. Given the removal of the Greywater Plant and redistribution of flows, a hazard category H5 was reported across the entire subject site. In Figure A3, through raising the level of the site to the adjacent road crest, the hazard category was generally reduced to H1 and H2, with a small section along the western boundary showing H4.



Graph 1 - Flood Hazard Categories (ARR 2019 - Figure 6.7.9)

Flood Impact

A comparison of the 1 in 2000 AEP and 1% AEP flood elevation is included in Figure B1. This represents each of the developed case scenarios, with the subject site outside of the flood extent in the 1% AEP flood event.

The pre to post developed flood depth comparisons for the PMF events are presented in Figures C1 to Figure C3 of Attachment 1, illustrating the impacts of each of the developed scenarios.

Figures C1 and C2 present the impacts of the proposed development in each of the developed case scenarios. In Scenario 1, the PMF flood level in the lots to the southeast increases up to approximately 55mm, with 40mm in the road. In Scenario 2, the extent of increases is reduced however there is a greater depth of increase. In the road network, an increase of 560mm is shown at the road sag, with 360mm in an existing residential lot.

Discussion

Fill Level

The department has suggested a hazard category of less than H4 is desirable in the PMF in order to be rezoned as R2. Scenario 1 demonstrates whilst the 1% AEP and 1 in 2000 AEP flood extent does not impact the site, the PMF inundates the site and results in a hydraulic hazard category of H5 generally. Scenario 2 illustrates a fill level which matches the crest of Cudmore Crescent and results in a reduction across the site generally to H1 and H2 with a fraction of the western end of the site at H4. We believe this is appropriate given the site is not flood affected in the 1 in 2000 AEP and structural stability is still possible in the PMF based on **Graph 1**.

Flood Impact

Due to the filling of the proposed site, there are minor changes in the hazard categories for the properties surrounding. For each of the impacted areas, however, the hydraulic category has remained consistent with the existing case conditions of unsafe for pedestrians and/ or vehicles. The greatest changes from the proposed scenarios, result in impacts within Cudmore Crescent.

Scenario 1 shows the extent of the H2 hazard has extended further across the lots to the southeast and have not increased the overall hazards in any surrounding lots. Similarly, in Scenario 2 the lots to the southeast are relatively consistent with the existing hazard. There are increases in the lots to the south, with the hazard category changing from H1 to H3. Additionally, the hazard category of Cudmore Crescent is increased from H3 to H5.

We believe this is appropriate based on Cudmore Crescent already being non-trafficable in this event, and the hazard likely on these affected residential lots being a maximum of H3.

Conclusion

An updated assessment has been undertaken for Lot 171 in response to the RFI signed 28 February 2023. Through this investigation, the mitigation options for the proposed subject site, to be rezoned as R2, have been assessed. The proposed modifications including the removal of the existing redundant water treatment plant, and filling of the subject site to achieve a flood hazard category outside of H4 – H6.

The investigation concludes that filling will achieve these requirements across the majority of the lot, with a small section subject to H4 hazard. The filling is unlikely to result in an increase in hazard to H4 on the existing residential lots. We note these results are for the PMF which is an exceptionally rare event, and the site is “flood free” in the 1 in 2000 AEP for both scenarios considered.

We commend our findings for review. Should you have any queries regarding this correspondence, please feel free to contact the undersigned on (02) 4943 1777.

Prepared by



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Reviewed by



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RPEQ Member SIA FMA

Limitation Statement

Northrop Consulting Engineers Pty Ltd (Northrop) has been retained to prepare this report based on specific instructions, scope of work and purpose pursuant to a contract with its client. It has been prepared in accordance with the usual care and thoroughness of the consulting profession for the use by Wyee Land Pty Ltd.

The report is based on generally accepted practices and standards applicable to the scope of work at the time it was prepared. No other warranty, express or implied, is made as to the professional advice included in this report except where expressly permitted in writing or required by law, no third party may use or rely on this report unless otherwise agreed in writing by Northrop.

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Attachment 1 – Flood Figures

Figure List

Figure 1 – Existing Case Surface Elevation

Figure 2 – Developed Case Scenario 1 Surface Elevation

Figure 3 – Developed Case Scenario 2 Surface Elevation

Figure A1 – Existing Case – PMF Flood Hazard

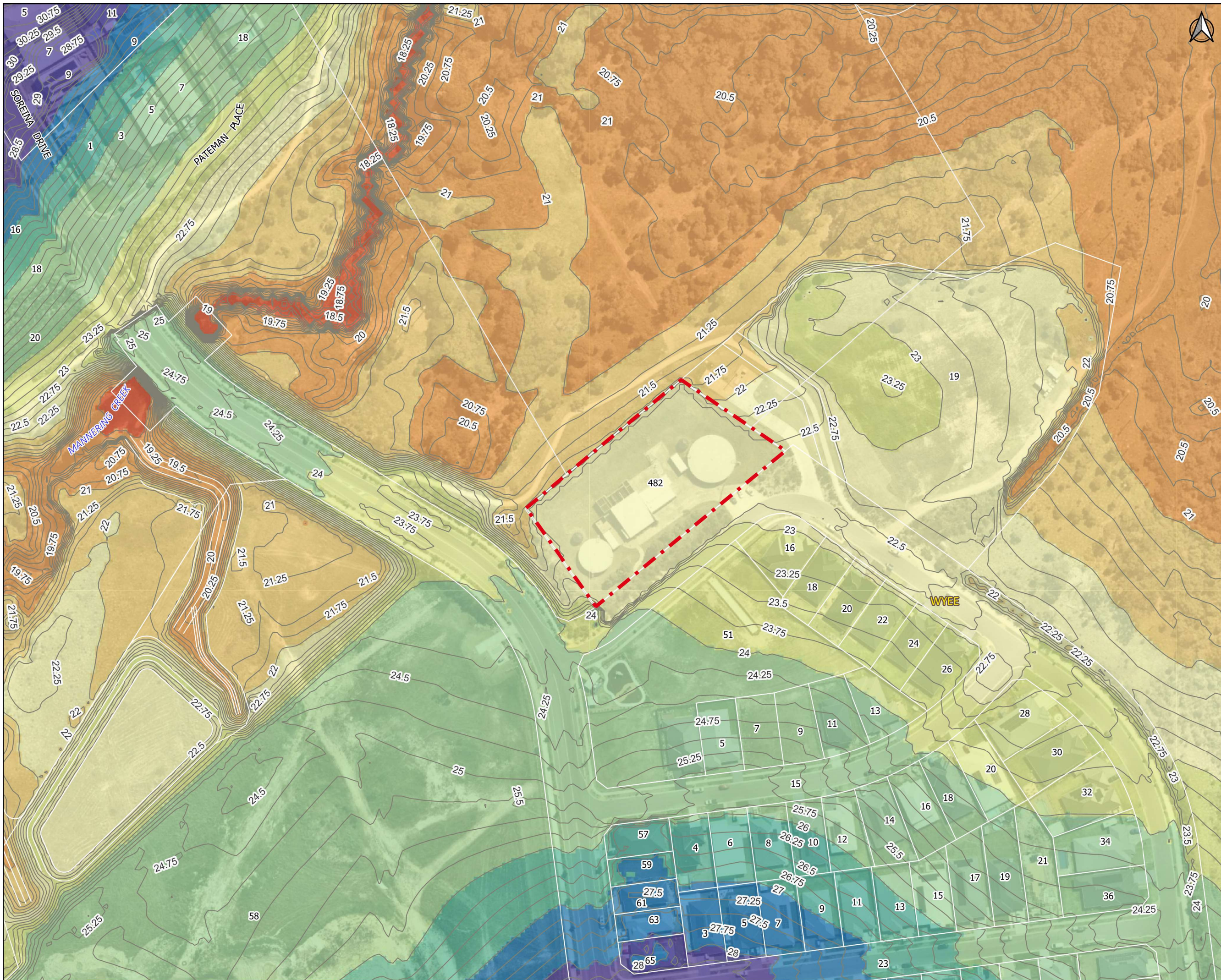
Figure A2 – Developed Case Scenario 1 – PMF Flood Hazard

Figure A3 – Developed Case Scenario 2 – PMF Flood Hazard

Figure B1 – Developed Case – 1 in 2000 AEP Minus 1% AEP Flood Elevation

Figure C1 – Developed Case Scenario 1 Pre to Post Comparison – PMF Flood Elevation

Figure C2 – Developed Case Scenario 2 Pre to Post Comparison – PMF Flood Elevation



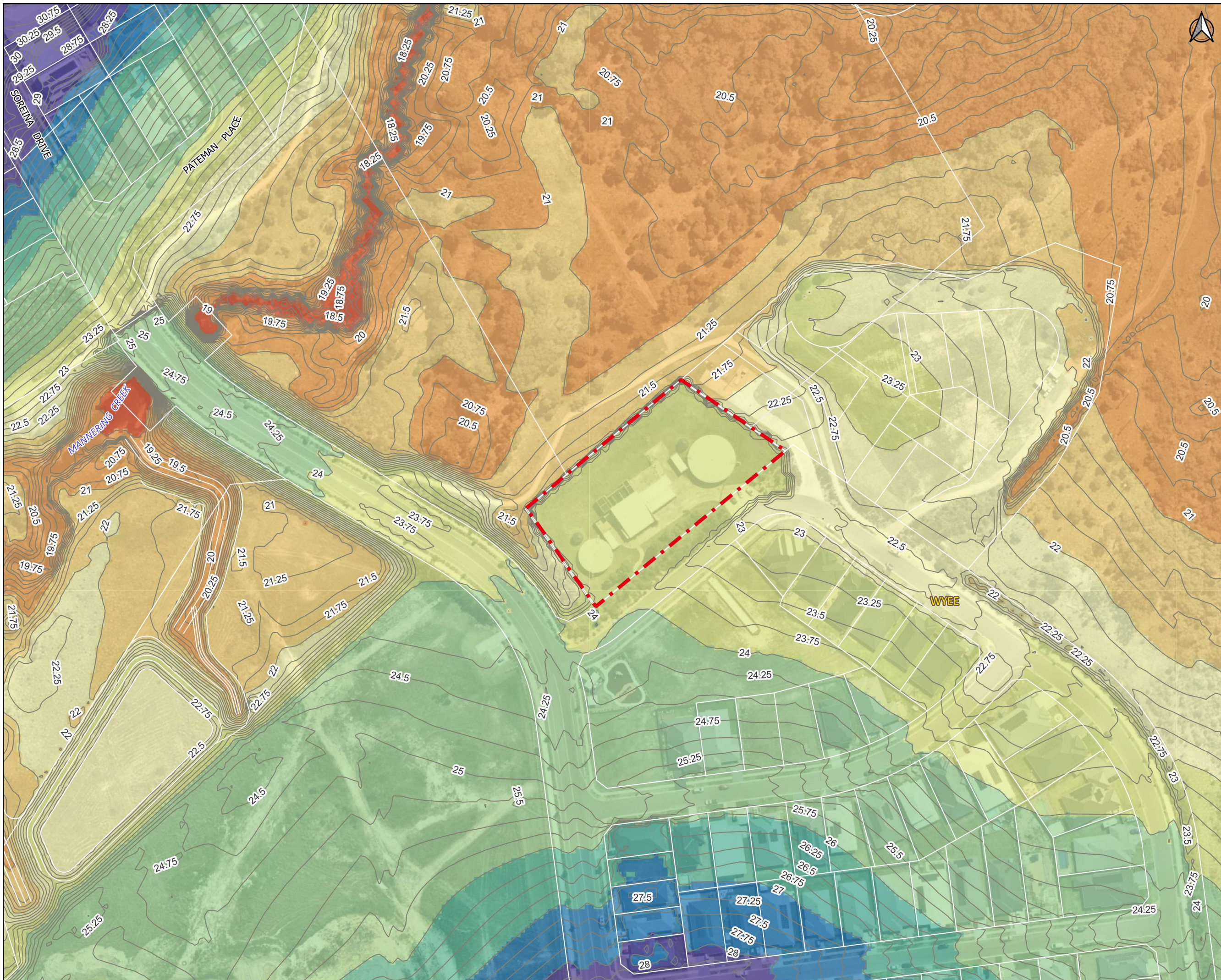
- Legend**
- Subject Site
 - Cadastral
 - Contours (0.25m)
- Surface Elevation(mAHD)**
- <= 16.0
 - 16.0 - 17.0
 - 17.0 - 18.0
 - 18.0 - 19.0
 - 19.0 - 20.0
 - 20.0 - 21.0
 - 21.0 - 22.0
 - 22.0 - 23.0
 - 23.0 - 24.0
 - 24.0 - 25.0
 - 25.0 - 26.0
 - 26.0 - 27.0
 - 27.0 - 28.0
 - 28.0 - 29.0
 - > 29.0

0 20 40 Metres
1:1,500

Figure 2
Developed Case
Scenario 1
Surface Elevation

Radcliffe Subdivision
Wyee, NSW
482 Bushells Ridge Road





Legend

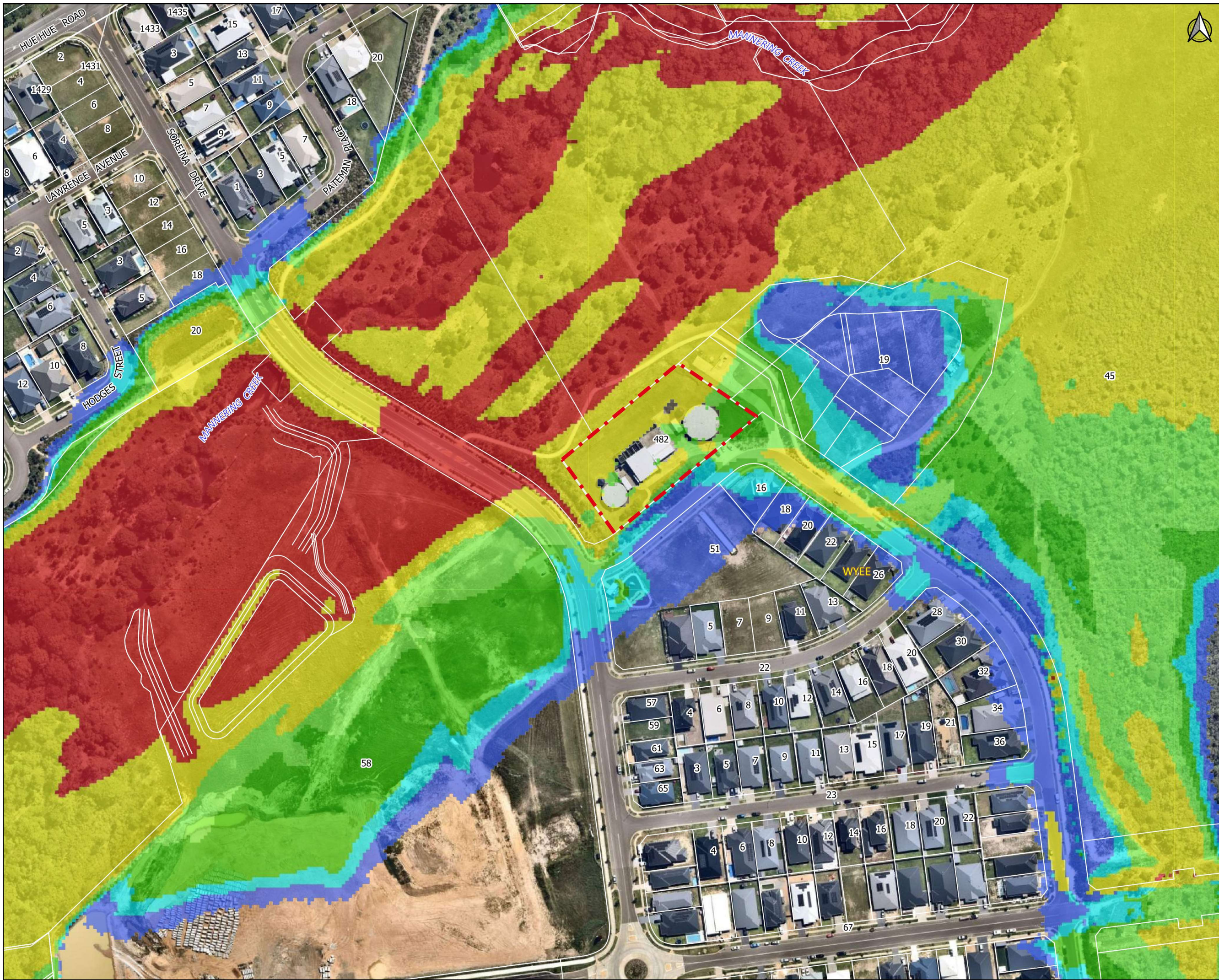
- Subject Site
- Cadastre
- Contours (0.25m)
- Surface Elevation(mAHD)**
 - <= 16.0
 - 16.0 - 17.0
 - 17.0 - 18.0
 - 18.0 - 19.0
 - 19.0 - 20.0
 - 20.0 - 21.0
 - 21.0 - 22.0
 - 22.0 - 23.0
 - 23.0 - 24.0
 - 24.0 - 25.0
 - 25.0 - 26.0
 - 26.0 - 27.0
 - 27.0 - 28.0
 - 28.0 - 29.0
 - > 29.0

0 20 40 Metres
1:1,500

Figure 3
Developed Case
Scenario 2
Surface Elevation

Radcliffe Subdivision
Wyee, NSW
482 Bushells Ridge Road





Legend

Subject Site

Cadastre

AR&R Hazard Categories

H1

H2

H3

H4

H5

H6

0 30 60 Metres

1:2,000

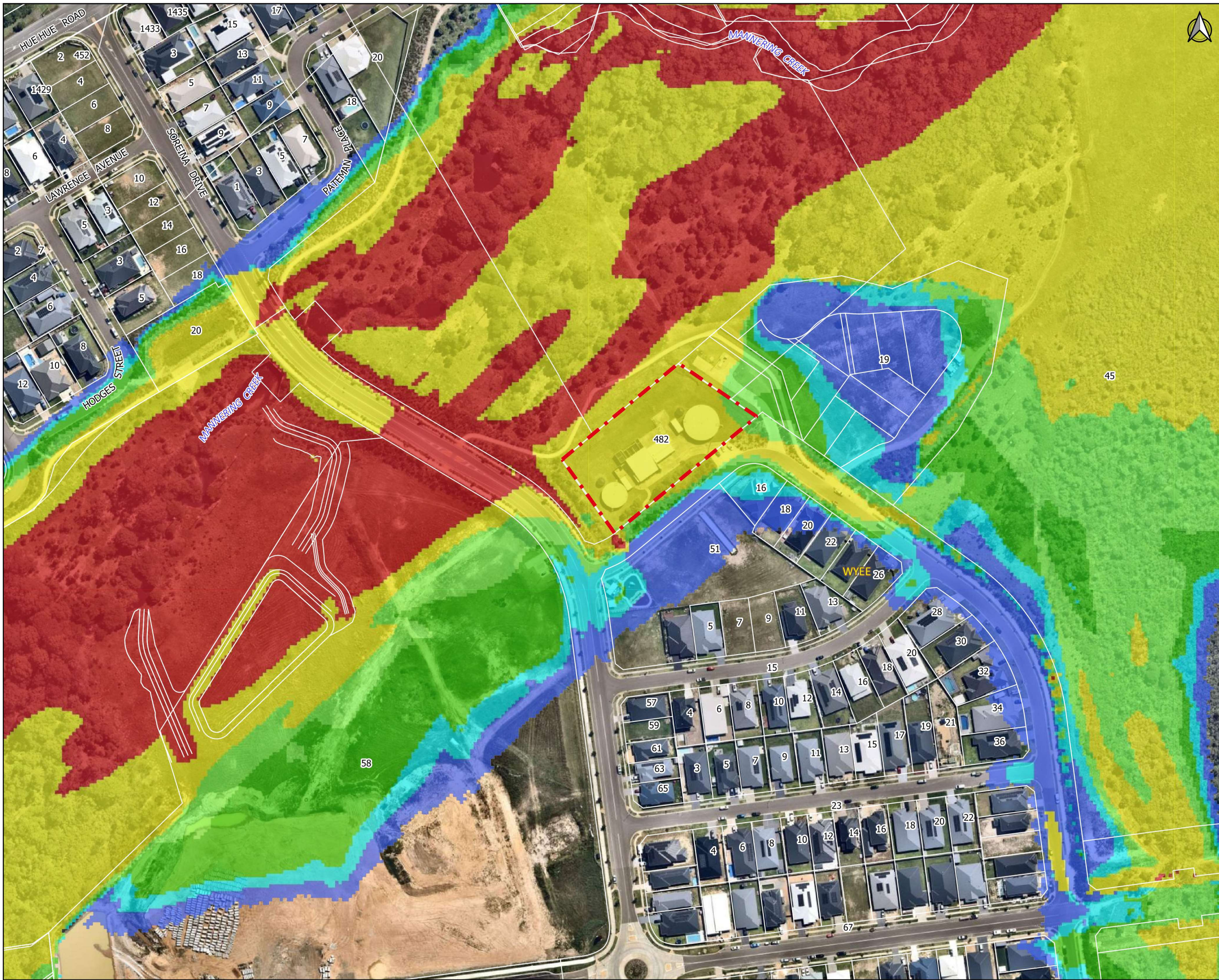
Figure A1 [A]

Existing Case
PMF Flood Hazard
Categories (AR&R19)

Radcliffe Subdivision
Wyee, NSW
482 Bushells Ridge Road

STEVENS GROUP

NORTHROP



Legend

Subject Site

Cadastre

AR&R Hazard Categories

H1

H2

H3

H4

H5

H6

0 30 60 Metres

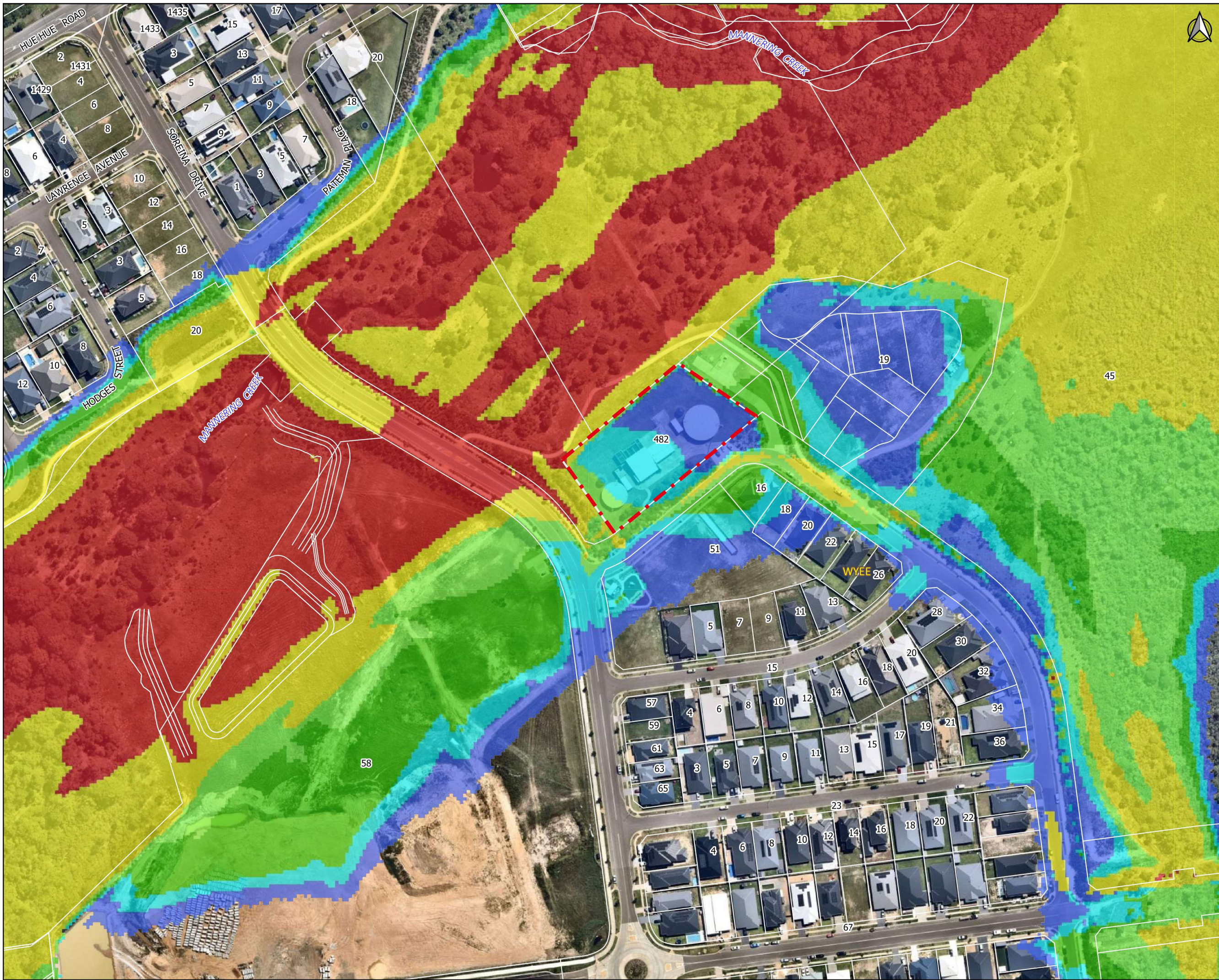
1:2,000

Figure A2 [A]
Developed Case -
Scenario 1
PMF Flood Hazard
Categories (AR&R19)

Radcliffe Subdivision
Wye, NSW
482 Bushells Ridge Road

STEVENSGROUP

NORTHROP



Legend

Subject Site

Cadastre

AR&R Hazard Categories

H1

H2

H3

H4

H5

H6

0 30 60 Metres

1:2,000

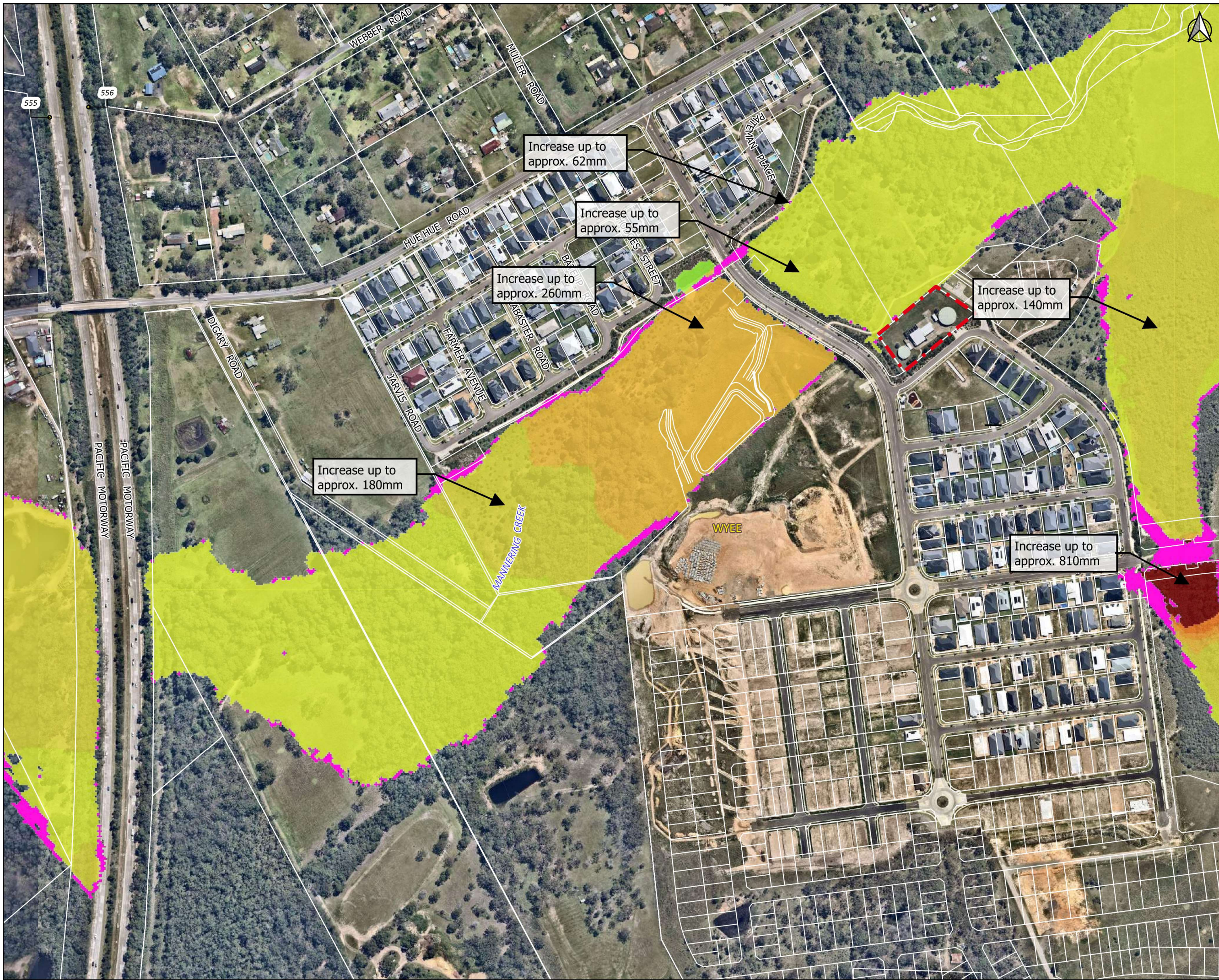
Figure A3 [A]

Developed Case -
Scenario 2
PMF Flood Hazard
Categories (AR&R19)

Radcliffe Subdivision
Wyee, NSW
482 Bushells Ridge Road

STEVENS GROUP

NORTHROP



Legend

Subject Site

Cadastre

Wet / Dry

Was Dry Now Wet

Was Wet Now Dry

Elevation Difference (m)

≤ -0.50

$-0.50 - -0.40$

$-0.40 - -0.30$

$-0.30 - -0.20$

$-0.20 - -0.10$

$-0.10 - -0.01$

$-0.01 - 0.01$

$0.01 - 0.10$

$0.10 - 0.20$

$0.20 - 0.30$

$0.30 - 0.40$

$0.40 - 0.50$

> 0.50

0 70 140 Metres

1:1

Figure B1 [A]

Developed Case

1 in 2000 AEP

Minus 1% AEP

Maximum Envelope

Radcliffe Subdivision
Wyee, NSW
482 Bushells Ridge Road

STEVENS GROUP

NORTHROP



Legend

Subject Site

Cadastre

Wet / Dry

Was Dry Now Wet

Was Wet Now Dry

Elevation Difference (m)

≤ -0.50

$-0.50 - -0.40$

$-0.40 - -0.30$

$-0.30 - -0.20$

$-0.20 - -0.10$

$-0.10 - -0.01$

$-0.01 - 0.01$

$0.01 - 0.10$

$0.10 - 0.20$

$0.20 - 0.30$

$0.30 - 0.40$

$0.40 - 0.50$

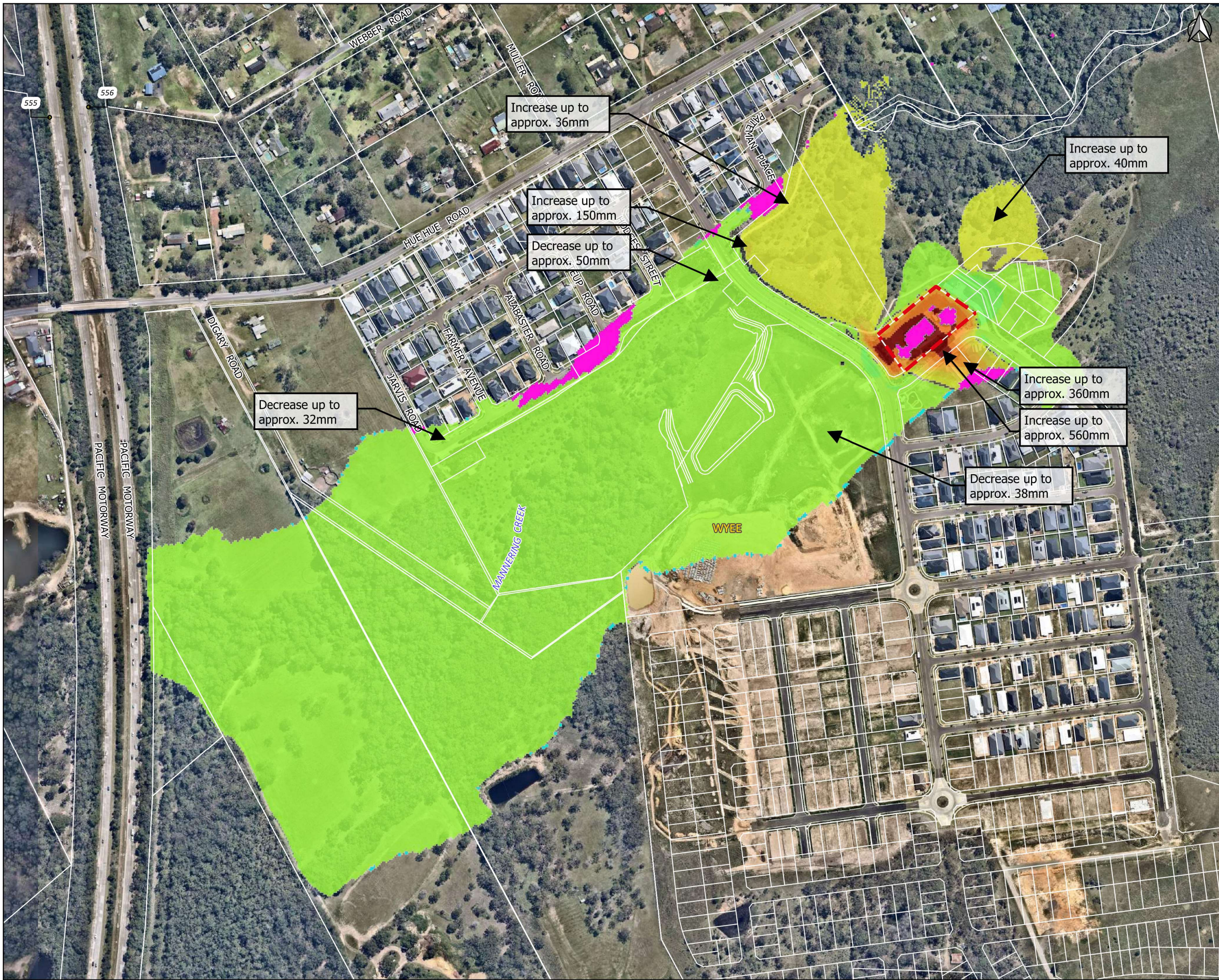
> 0.50



Figure C1 [A]
Pre to Post Comparison
Developed Case -
Scenario 1
PMF Flood Elevation
Maximum Envelope

Radcliffe Subdivision
Wyee, NSW
482 Bushells Ridge Road





Legend

Subject Site

Cadastre

Wet / Dry

Was Dry Now Wet

Was Wet Now Dry

Elevation Difference (m)

≤ -0.50

$-0.50 - -0.40$

$-0.40 - -0.30$

$-0.30 - -0.20$

$-0.20 - -0.10$

$-0.10 - -0.01$

$-0.01 - 0.01$

$0.01 - 0.10$

$0.10 - 0.20$

$0.20 - 0.30$

$0.30 - 0.40$

$0.40 - 0.50$

> 0.50

0 70 140 Metres

1:4,000

Figure C2 [A]
Pre to Post Comparison
Developed Case -
Scenario 2
PMF Flood Elevation
Maximum Envelope

Radcliffe Subdivision
Wyee, NSW
482 Bushells Ridge Road

STEVENS GROUP

NORTHROP