

# TECHNICAL ADDENDA - Flooding

## RESPONSE TO PARRAMATTA CITY COUNCIL COMMENTS



**Project No:** S20156 / SE22005  
**Project:** Telopea Concept Masterplan  
**Date:** 14 February 2022  
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**Reviewed:** Scott Mortimer

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This document has been prepared to provide technical details to supplement the response to comments received from Parramatta City Council on the Telopea Concept Masterplan and Stage 1 SSDA in particular Council Attachment B Technical Assessment – Item 13.1.

This document is supplementary to the Masterplan Flood Assessment (BG&E, S20156-REP-HYD-0001\_C, 10th November 2020). Only flooding from the creek is considered in this assessment. Overland flows have been considered by others.

### 1. Australian Rainfall and Runoff 2019 and 1987

#### Council Attachment B Technical Assessment - Item 13.1.b)

*The flood study provided by the applicant (BG&E, 10/11/2020) highly under-estimated flow at upstream of Kissing Point Road in The Ponds Creek. The previous study by SKM (Subiaco Creek Sub-Catchment Management Plan, SKM, Final Report, June 2006) estimates flow to be 84 m<sup>3</sup> /s which is councils approved study at present. However, flood study by applicant (BG&E dated 10/11/2020) estimates 64.5 m<sup>3</sup>/s which is significantly less. While it is understood that flood study by SKM adopted ARR87 rainfall while flood study (by applicant) adopted ARR2019 rainfall, the result should be close enough or demonstrated that current study is correct.*

#### Response

As noted in the Masterplan Flood Assessment, hydrologic modelling adopted the Australian Rainfall and Runoff (ARR) 2019 approaches which supersedes the previous ARR published in 1987. ARR2019 provides a more robust assessment than ARR1987 as it is based on longer records of Australian rainfall data. There are a number of differences between ARR2019 and ARR1987 which means the newer ARR is considered more accurate for flow prediction:

- Intensity-Duration-Frequency (IFD) data – ARR2019 uses considerably more gauges than ARR87 to derive the IFD design data. In addition, gauges used in ARR2019 have a longer record (additional 30 years) and therefore the newer IFD data is considered more accurate.
- Areal reduction factors (ARF) – ARR87 determined ARFs based on data from the USA. Under ARR2019 the ARF calculations have been revised and are now based on Australian data.
- Losses – in ARR87 the recommended losses were based on personal communication to the authors at the time. National advice has now been developed for both rural and urban catchments and analysis undertaken to validate losses at a number of gauged catchments including the nearby Parramatta

Hospital catchment. The local flood frequency analysis (FFA) reconciled losses were adopted for this study (refer below).

- Temporal Patterns – ARR87 assumed one single pattern of rainfall over time. ARR2019 has revised this to adopt an ensemble of 10 patterns based on historic records from which the pattern which produces the peak flow above the mean flow is selected.
- Pre-bursts – ARR87 considered only the storm burst while ARR2019 allows for consideration of pre-burst and pre-burst losses.

A comparison of the design IFD data from ARR1987 and ARR2019 is shown in Figure 1. For storm burst durations of about 20 minutes and longer, the ARR2019 design rainfall depths are lower than the ARR1987 rainfall depths. For the 30 minute and 45 minute duration storms that were found to be critical, the ARR2019 design rainfall depth is 15% to 5% lower than the ARR1978 design rainfall depth. This would contribute to the differences between the ARR1987 derived flows from the Subiaco Creek Sub-Catchment Management Plan and the ARR2019 derived flows in the Telopea Masterplan Flood Assessment.

ARR2019 recommends using values from local catchments and validated data where data is available. The losses adopted for the Telopea Masterplan Flood Assessment were taken from the NSW Flood Frequency Assessment (FFA) Reconciled losses for the Parramatta Hospital catchment as described in section 2.3.1 of the Telopea Masterplan Flood Assessment report (initial loss = 5.2 mm, continuing loss = 0.004 mm/hr). Given that the losses adopted are from a similarly urban catchment adjacent to the Telopea site catchment these losses are considered more accurate than assumed values typically used with ARR1987 methods.

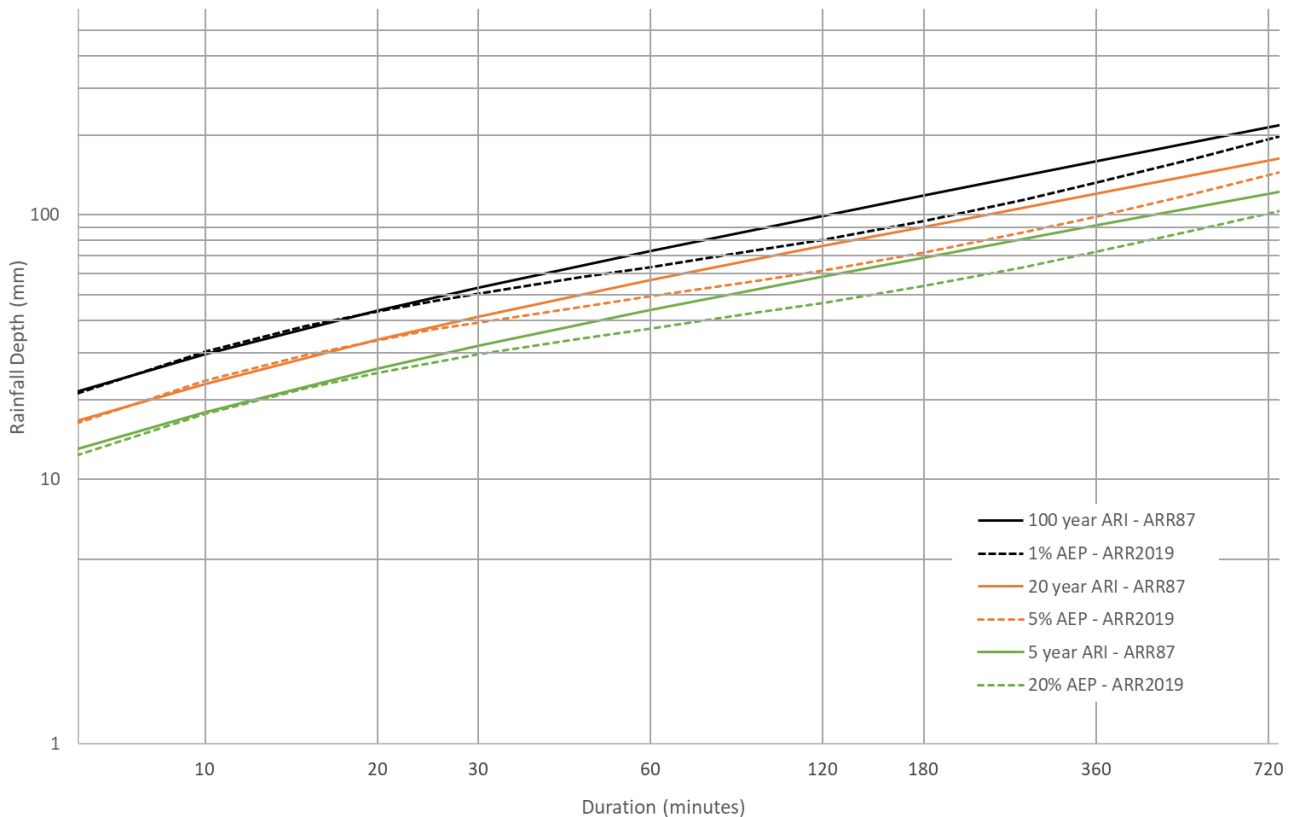


Figure 1: Comparison of design rainfall depths – ARR87 IFD and ARR2019 IFD data

## 2. Climate Change

### Council Attachment B Technical Assessment - Item 13.1.c)

*c. Climate change scenario with sea level rise should be adopted included in accordance with the industry guidelines and latest DPIE recommended requirements.*

#### Response

Sea level rise will not affect the site as the elevations are over 20 m above sea level.

The ARR DataHub interim climate change factors suggest a 19.7% increase in rainfall for the year 2090 based on the RCP 8.5 scenario at the site locations. The XP-RAFTS model was modified to include a 19.7% rainfall increase for climate change for the 1% AEP event. A comparison of the peak flows is shown in Table 1.

Table 1: Peak flows with and without climate change

	20 min	30 min	45 min	1 hour
<b>Kissing Point Road</b>				
1% AEP	56.0	62.6	64.5	59.5
1% AEP plus Climate Change	71.7	75.5	78.0	71.8
<b>Sturt Street</b>				
1% AEP	55.2	61.7	60.9	55.8
1% AEP plus Climate Change	66.7	74.6	73.5	67.7

The climate change hydrographs were run through the TUFLOW model to understand the potential implications of climate change in the 1% AEP event. Mapping is included as Figures A1 and A2 showing peak water level and change in predicted peak water level.

As a result of climate change, the 1% AEP flood level in the vicinity of the site is predicated to increase by no more than 160 mm. This is comfortably within the 500 mm freeboard applied to the flood planning levels. No additional lots are predicted to become inundated from the creek flooding.

## 3. Blockage

### Council Attachment B Technical Assessment - Item 13.1.e)

*e. For culverts, the application of blockage should be in accordance with ARR2019 guidelines and the design flood level at the site should be the higher of the blocked or unblocked scenario.*

#### Response

Blockage analysis in accordance with ARR2019 Book 6, Chapter 6 is summarised in Table 2. Where there adopted classification could be subjective, the most conservative suitable value has been adopted.

**Table 2: Blockage analysis summary**

	<b>Stuart Street</b>	<b>Kissing Point Road</b>	<b>Comment</b>
L <sub>10</sub>	2 m	2 m	The average length of the longest 10% of the debris reaching the site. Assumed as large trees and/or vehicles based on site observations.
Control Dimension Inlet Clear Width (W) (m)	8 m	3 m (each cell)	Width of opening.
Debris availability	High	High	ARR describes High debris availability as: “Urban areas that are not well maintained and/or where old paling fences, sheds, cars and/or stored loose material etc., are present on the floodplain close to the water course.” and “Natural forested areas with thick vegetation and extensive canopy cover, difficult to walk through with considerable fallen limbs, leaves and high levels of floor litter.”
Debris mobility	Medium	Medium	The main debris source is close to streams (High classification) however “the receiving stream in frequently overtops” (Low classification). Therefore Medium classification adopted
Debris transportability	Medium	Medium	The creek has about a 1% slope and velocities typically less than 2 m/s. ARR describes High as “Steep bed slopes (> 3%) and/or high stream velocity (V > 2.5 m/s)” and Low as “Flat bed slopes (< 1%) and/or low stream velocity (V < 1m/s).”
<b>1% AEP Debris potential</b>	<b>Medium</b>	<b>Medium</b>	<b>High-Medium-Medium</b>
<b>Design blockage value - Inlet blockage</b>	<b>0%</b>	<b>10%</b>	$W < L_{10}$ – 50% blockage for Medium debris potential $L_{10} \leq W \leq 3 \times L_{10}$ – <b>10% blockage for Medium debris potential</b> $W > 3 \times L_{10}$ – <b>0% blockage for Medium debris potential</b>

The results of the ARR blockage assessment show that each structure has a low percentage blockage. Even when assuming a larger L<sub>10</sub> of 3 m where  $W < L_{10}$  at Kissing Point Road, the worst-case blockage at Kissing Point Road would be 50%.

For the flood modelling, a worst-case scenario was assumed and the flood model was run for the following blockage scenarios at Sturt Street and Kissing Point Road for the 1% AEP event. Based on the outcomes of the ARR2019 blockage assessment (refer Table 2) a 50% blockage is actually very unlikely.

- Both structures unblocked
- Both structures blocked to 50%
- Sturt Street structure blocked by 50% and Kissing Point Road structure unblocked
- Kissing Point Road blocked by 50% and Sturt Street structure unblocked

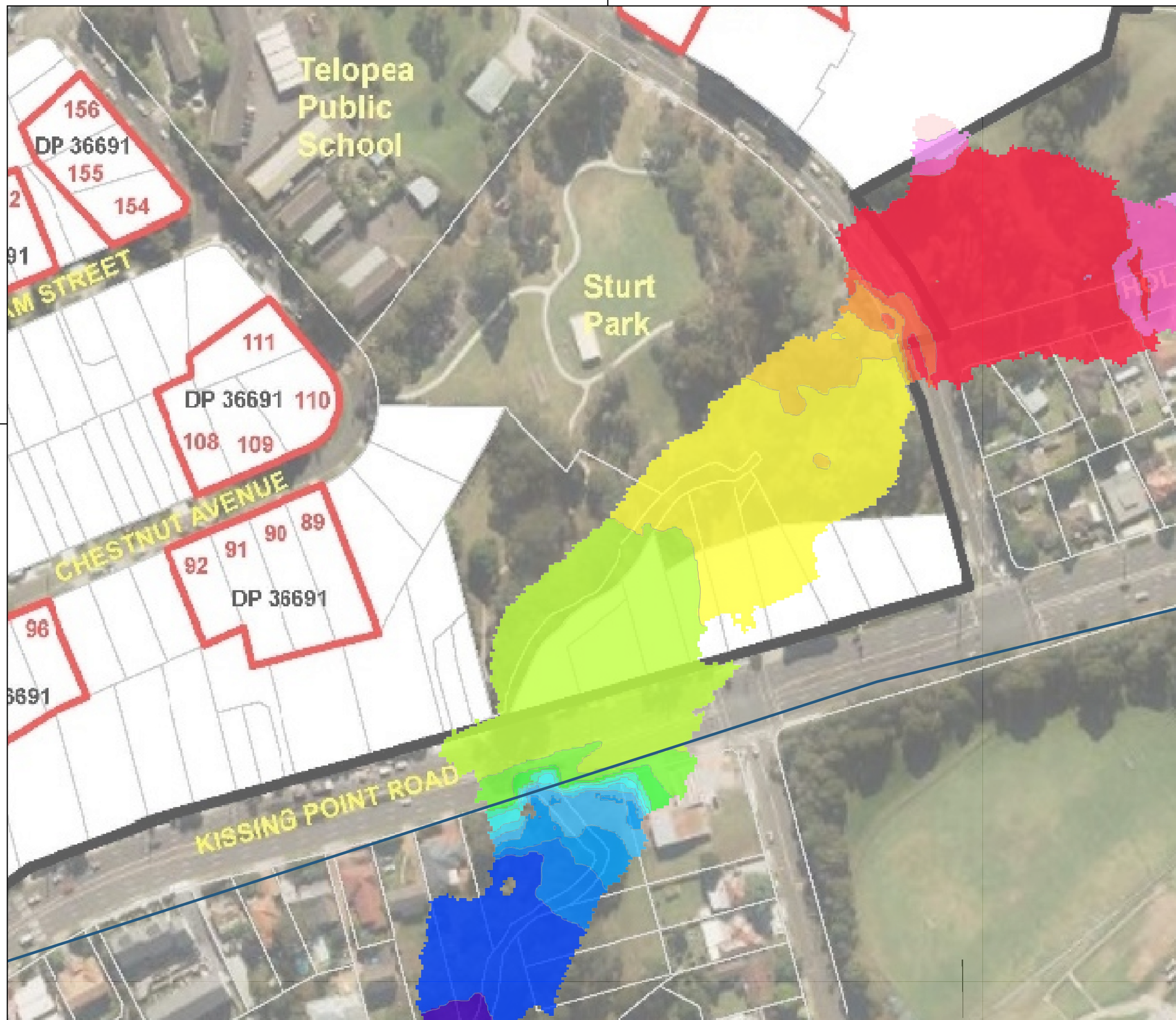
Flood mapping showing the 1% AEP predicted flood levels under the blockage scenario and the difference between 1% AEP flood levels with and without blockage are provided in Figures A3 and A4.

The maximum of the combined scenarios results in predicted increases in water level of 150 mm upstream of Kissing Point Road and 170 mm upstream of Sturt Street. There is increased overtopping of both roads although the steep gradient towards the sag point in the roads mean that the flood extent is not increased considerably. No additional lots within the Telopea Estate become flood affected.

#### **ATTACHMENTS**

Attachment A – Flood Mapping





## Legend

— Flood Level contour (250 mm)

Flood Level (mAHD)

- ≤ 22.75
- 22.75 - 23
- 23 - 23.25
- 23.25 - 23.5
- 23.5 - 23.75
- 23.75 - 24
- 24 - 24.25
- 24.25 - 24.5
- 24.5 - 24.75
- 24.75 - 25
- 25 - 25.25
- 25.25 - 25.5
- 25.5 - 25.75
- 25.75 - 26
- 26 - 26.25
- 26.25 - 26.5
- 26.5 - 26.75
- 26.75 - 27
- 27 - 27.25
- > 27.25

6258500

NOTE: Only mainstream flooding from The Ponds Creek has been assessed. Overland flow flooding is subject to a separate assessment by others.

Climate change has been adopted as a 19.7% increase in rainfall as per the ARR2019 DataHub recommendation for the area.

0 10 20 30 40 50 m

DRAWN: LB  
REVIEWED: SM  
APPROVED: LB

DATE: 14/2/2022  
PROJECT: Telopea Estate Master Plan Flood Assessment  
CLIENT: Frasers Property Telopea Developer Pty Ltd



FIGURE A 1 –  
The Ponds Creek  
1% AEP Flood Level  
With Climate Change

DATUM GDA 1994 MGA Zone 56





## Legend

Increase in peak flood level (m)

□ No change (+/- 0.01)

□ 0.001 - 0.05

□ 0.05 - 0.1

□ 0.15 - 0.2

□ > 0.2

□ Was Dry - Now Wet

NOTE: Only mainstream flooding from The Ponds Creek has been assessed. Overland flow flooding is subject to a separate assessment by others.

Climate change has been adopted as a 19.7% increase in rainfall as per the ARR2019 DataHub recommendation for the area.

0 10 20 30 40 50 m

DRAWN: LB  
REVIEWED: SM  
APPROVED: LB

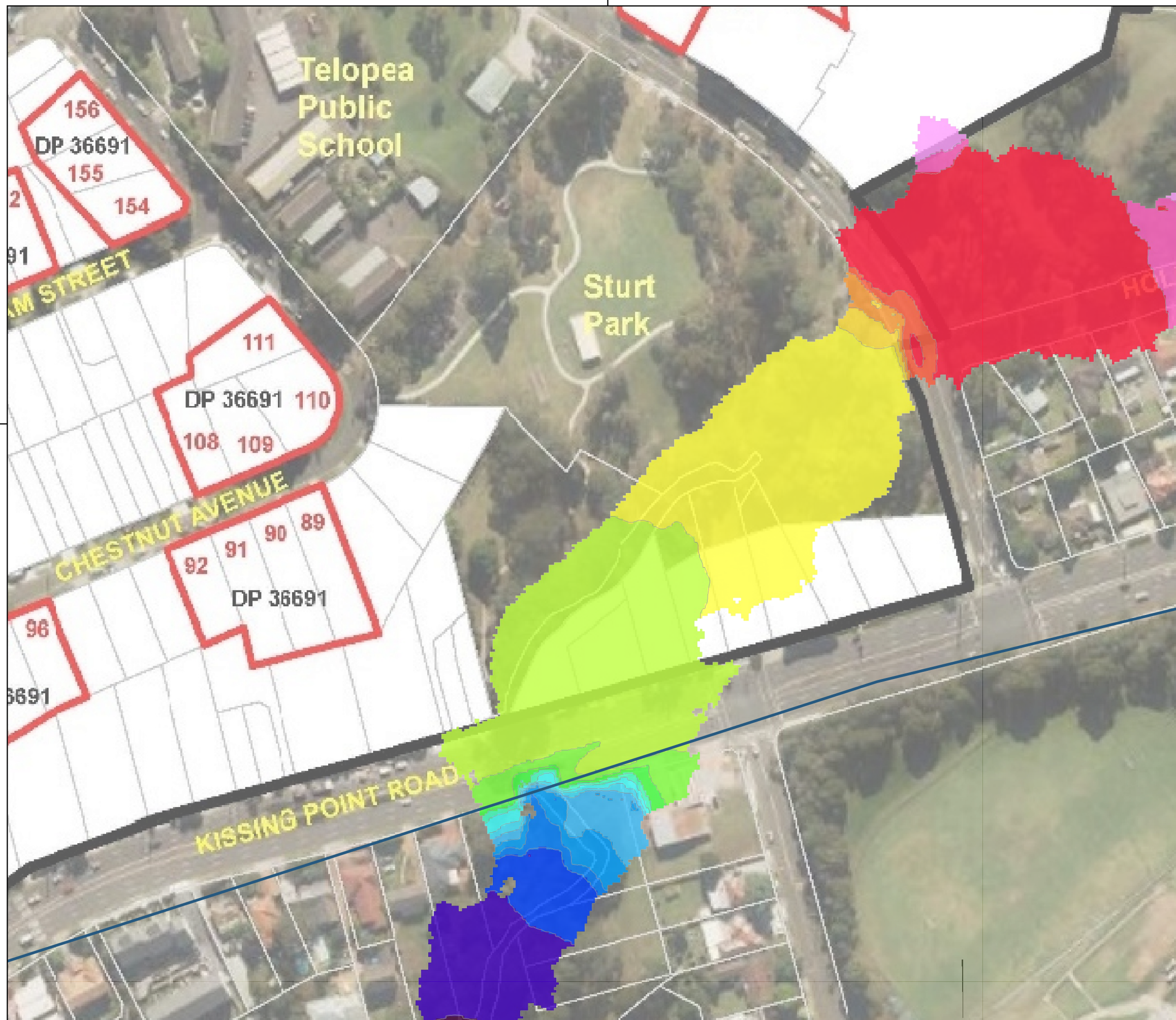
DATE: 14/2/2022  
PROJECT: Telopea Estate Master Plan Flood Assessment  
CLIENT: Frasers Property Telopea Developer Pty Ltd



FIGURE A 2 –  
The Ponds Creek  
Increase in 1% AEP Flood Level  
Due to Climate Change

DATUM GDA 1994 MGA Zone 56





## Legend

— Flood Level contour (250 mm)

Flood Level (mAHD)

- ≤ 22.75
- 22.75 - 23
- 23 - 23.25
- 23.25 - 23.5
- 23.5 - 23.75
- 23.75 - 24
- 24 - 24.25
- 24.25 - 24.5
- 24.5 - 24.75
- 24.75 - 25
- 25 - 25.25
- 25.25 - 25.5
- 25.5 - 25.75
- 25.75 - 26
- 26 - 26.25
- 26.25 - 26.5
- 26.5 - 26.75
- 26.75 - 27
- 27 - 27.25
- > 27.25

6258500

NOTE: Only mainstream flooding from The Ponds Creek has been assessed. Overland flow flooding is subject to a separate assessment by others.

Structure blockage assumes worst case flood level of 50% blockage at Kissing Point Road or Sturt Sturt Street and both structures blocked to 50%.

0 10 20 30 40 50 m

DRAWN: LB  
REVIEWED: SM  
APPROVED: LB

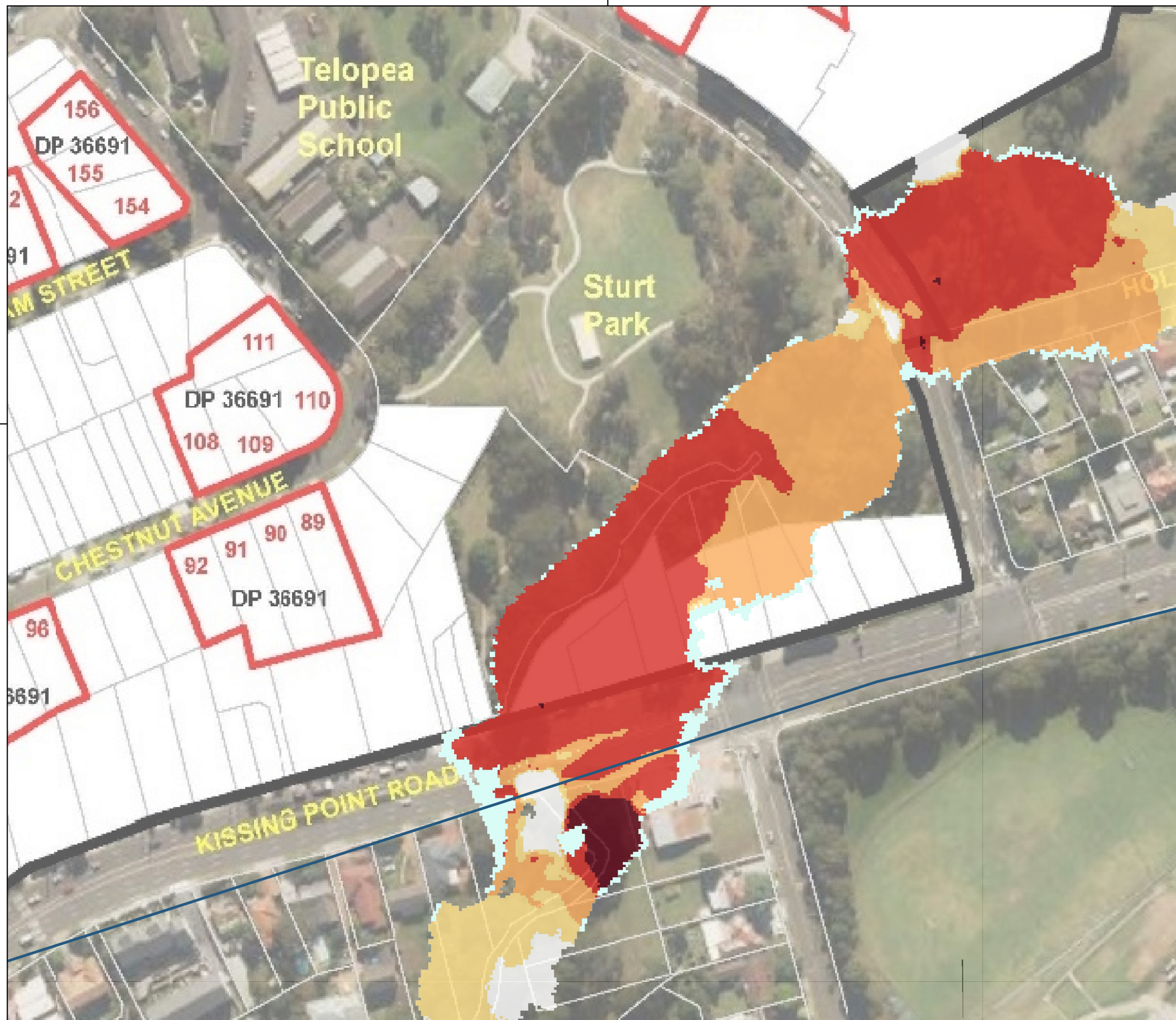
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FIGURE A 3 –  
The Ponds Creek  
1% AEP Flood Level  
With 50% Blockage

DATUM GDA 1994 MGA Zone 56





## Legend

Increase in peak flood level (m)

□ No change (+/- 0.01)

■ 0.001 - 0.05

■ 0.05 - 0.1

■ 0.15 - 0.2

■ > 0.2

■ Was Dry - Now Wet

NOTE: Only mainstream flooding from The Ponds Creek has been assessed. Overland flow flooding is subject to a separate assessment by others.

Structure blockage assumes worst case flood level of 50% blockage at Kissing Point Road or Sturt Sturt Street and both structures blocked to 50%.

0 10 20 30 40 50 m

DRAWN: LB  
REVIEWED: SM  
APPROVED: LB

DATE: 14/2/2022  
PROJECT: Telopea Estate Master Plan Flood Assessment  
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FIGURE A 4 –  
The Ponds Creek  
Increase in 1% AEP Flood Level  
Due to 50% Structure Blockage

DATUM GDA 1994 MGA Zone 56