Our Ref: NW30034-L02-2022: BCP/bcp
Contact: Dr Brett C. Phillips

29th June 2022

The Development Manager,
FIFECAPITAL
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Attention: Mr Richard Harris
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Dear Richard,

ADDITIONAL INFORMATION ON FLOODING
200 ALDINGTON INDUSTRIAL ESTATE (SSD-10479), KEMPS CREEK, NSW

Infrastructure Development & Consulting has raised a concern that: *No evidence of an assessment of climate change has been sighted with the FIA and/or FRA*.

The planned development of 200 Aldington Road, Kemps Creek is also estimated to reduce the 1% AEP flood storage by 343 m3 due to the proposed Road 5 embankment earthworks just encroaching into the 1% AEP flood extent as well the proposed Basin B encroaching to a limited degree into the 1% AEP flood extent.

Both these potential concerns are addressed as follows.

1. BACKGROUND

1.1 2020 Flood Risk Assessment for 200 Aldington Road, Kemps Creek

The 2020 Flood Risk Assessment report provides a high-level understanding of the opportunities and constraints of the site due to flooding and informed the development of a stormwater strategy/management plan for the 200 Aldington Industrial Estate based on the assessment of flooding under Benchmark Conditions[1].

The TUFLOW floodplain model assembled for the 2020 Flood Risk Assessment extends downstream beyond the Sydney Water Pipeline.

The TUFLOW floodplain model was run for the critical storm burst durations for the 2 yr ARI, 5 yr ARI, 100 yr ARI and PMF events under Benchmark Conditions. Flood levels and extent, depths, velocities and hazards under Benchmark Conditions are plotted for each of these events in Cardno, 2020.

[1] Cardno (2020) "Flood Risk Assessment, 200 Aldington Industrial Estate", *Final Report*, prepared for Fife Kemps Creek Pty Ltd, October, 27 pp + Apps

As described, in part, by Cardno 2020,

> *…. an assessment of the sensitivity of 100 yr ARI flood levels under pre-development conditions was undertaken in order to identify the benchmark conditions for this study.*

Table 1 summarises the 100 yr ARI flood levels extracted at 11 reference locations (0, 1, 2, 3, …10) identified in **Figure 1** for several different cases.

> *Based on this comparative assessment, Case E2, which incorporates Oakdale South and Oakdale West Industrial Estates which are currently under construction, was adopted as the benchmark conditions.*

It is noted that between Reference Locations 1 to 5 the Case 2 100 yr ARI flood levels are 0.2 m – 0.37 m higher than the 2015 Worley Parsons 100 yr ARI flood levels.

In 2021 and updated Flood Impact Assessment reports described the assessment of the impact of development which it is proposed to undertake in the 200 Aldington Road Industrial Estate (Cardno, 2021)[2]. It is noted that between Reference Locations 1 to 5 the PMF levels are 0.34 m – 0.9 m higher than the 100 yr ARI flood levels.

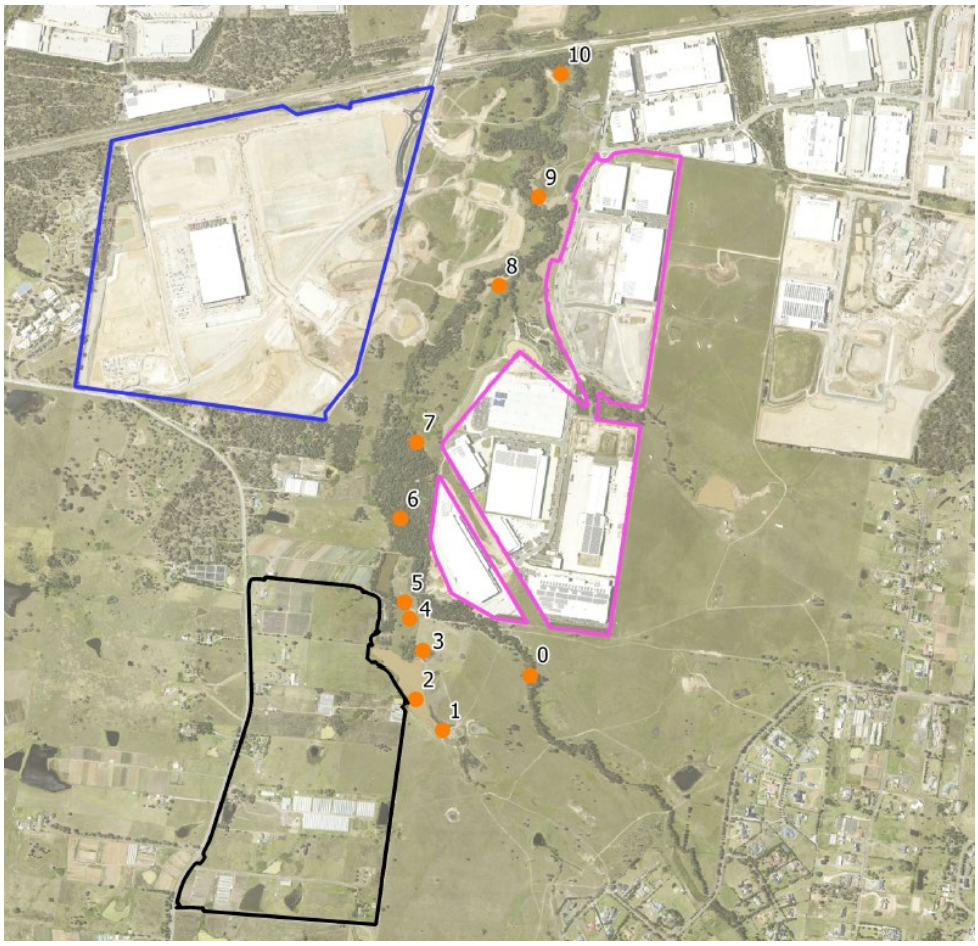

Figure 1 Reference Locations

[2] Cardno (2021) "Flood Impact Assessment, 200 Aldington Industrial Estate", *Final Report*, prepared for Fife Kemps Creek Pty Ltd, September, 29 pp + Apps

Table 1 Comparison of 100 yr ARI Flood Levels at Reference Locations

(Source: Table 4, Cardno, 2020)

Reference Location	Existing (2008 GHD) (mAHD) (a)	Existing (2015 Worley Parsons) (mAHD) (b)	Flood Level Difference (cm) (b) - (a)	Oakdale South + Oakdale West (Cardno, 2019) (mAHD) (c)	Flood Level Difference (cm) (c) - (a)	Revised Existing (E1) (mAHD) (f)	Flood Level Difference (cm) (f) - (a)	Flood Level Difference (cm) (f) - (b)	Revised Oakdale South + Oakdale West (E2) (mAHD) (g)	Flood Level Difference (cm) (g) - (c)	Flood Level Difference (cm) (g) - (f)
0	64.61	64.41	-20	64.56	-5	64.30	-31	-11	64.30	-26	0
1	64.05	63.80	-25	63.86	-19	64.07	2	27	64.07	21	0
2	64.01	63.68	-33	63.85	-16	63.91	-10	23	63.91	6	0
3	63.90	63.64	-26	63.79	-11	63.83	-7	19	63.83	4	0
4	63.12	62.47	-65	62.84	-28	62.75	-37	28	62.76	-8	1
5	63.10	62.37	-73	62.82	-28	62.73	-37	36	62.74	-8	1
6	62.02	61.41	-61	61.84	-18	61.63	-39	22	61.65	-19	2
7	60.26	60.00	-26	60.25	-1	60.14	-12	14	60.16	-9	2
8	57.67	57.27	-40	57.66	-1	57.48	-19	21	57.53	-13	5
9	56.68	56.26	-42	56.72	4	56.57	-11	31	56.62	-10	5
10	54.52	54.24	-28	54.51	-1	54.40	-12	16	54.41	-10	1

1.2 2020 Wianamatta (South) Creek Catchment Flood Study – Existing Conditions

As described, in part, by Advisian, 2020:[3]

> *The RMA-2 hydraulic flood model that was developed for the 'Upper South Creek Flood Study' (2015) has been updated to incorporate the latest available topographic data which has been derived from LiDAR, as well as information from recent flood investigations and recent industrial and urban developments that have occurred in parts of the catchment. This has included extensions to the RMA-2 flood model in the upper reaches of the study area, particularly in the vicinity of Bringelly Road.*
>
> *The XP-RAFTS hydrologic model that was applied as part of the 2015 Flood Study has also been updated. The results of simulations undertaken using the updated XP-RAFTS model indicate that peak flows for the 1% AEP 36 hour critical duration event are similar to those determined as part of the modelling completed for the 2015 Flood Study[4]. Peak flows along South Creek are generally within 2% of the corresponding flows determined in 2015, with a maximum change of up to 8% near the downstream boundary at Richmond Road. Changes along tributaries have greater variability with a maximum change of up to 15% (refer Figure 4.9).*

While the level of subcatchment discretisation increased elsewhere in the hydrological model there was no change in the subcatchment discretisation in the Ropes Creek catchment.

[3] Advisian (2020) "Wianamatta (South) Creek Catchment Flood Study – Existing Conditions", *Final Report*, Rev H, prepared for Infrastructure NSW, November, 27 pp + Maps + Apps

[4] Worley Parsons (2015) "Updated South Creek Flood Study", *Final Report*, 2 Vols, prepared for Penrith City Council, acting in association with Liverpool, Blacktown and Fairfield City Councils, 74 pp + Apps

2. CLIMATE CHANGE CONSIDERATIONS

As outlined in ARR, 2019:

> *Book 1 Chapter 6 uses output from the Climate Futures web tool developed by the CSIRO. Climate change projections are focussed on Natural Resource Management (NRM) 'clusters'* (see Figure 2*). Projected changes from Global Climate Models (GCMs) can be explored for 14 20-year periods and the four Representative Concentration Pathways (RCPs) for greenhouse gas and aerosol concentrations that were used to drive the GCMs.*
>
> *The RCPs are designated as 2.6, 4.5, 6.0 and 8.5, and are named according to radiative forcing values (W m^{-2}) in the year 2100 relative to pre-industrial values. Use of RCPs 4.5 and 8.5 (low and high concentrations, respectively) is recommended for impact assessment.*

The ARR Datahub[5]: provides a table of temperature increases and percentage increase in rainfall for a set of forecast years and RCP 4.5, 6 and 8.5 emissions schemes (CSIRO and BoM, 2015)[6]. ARR recommends the use of RCP4.5 and RCP 8.5 values. These values for the East Coast South Cluster which includes Sydney (see Figure 2) are tabulated below.

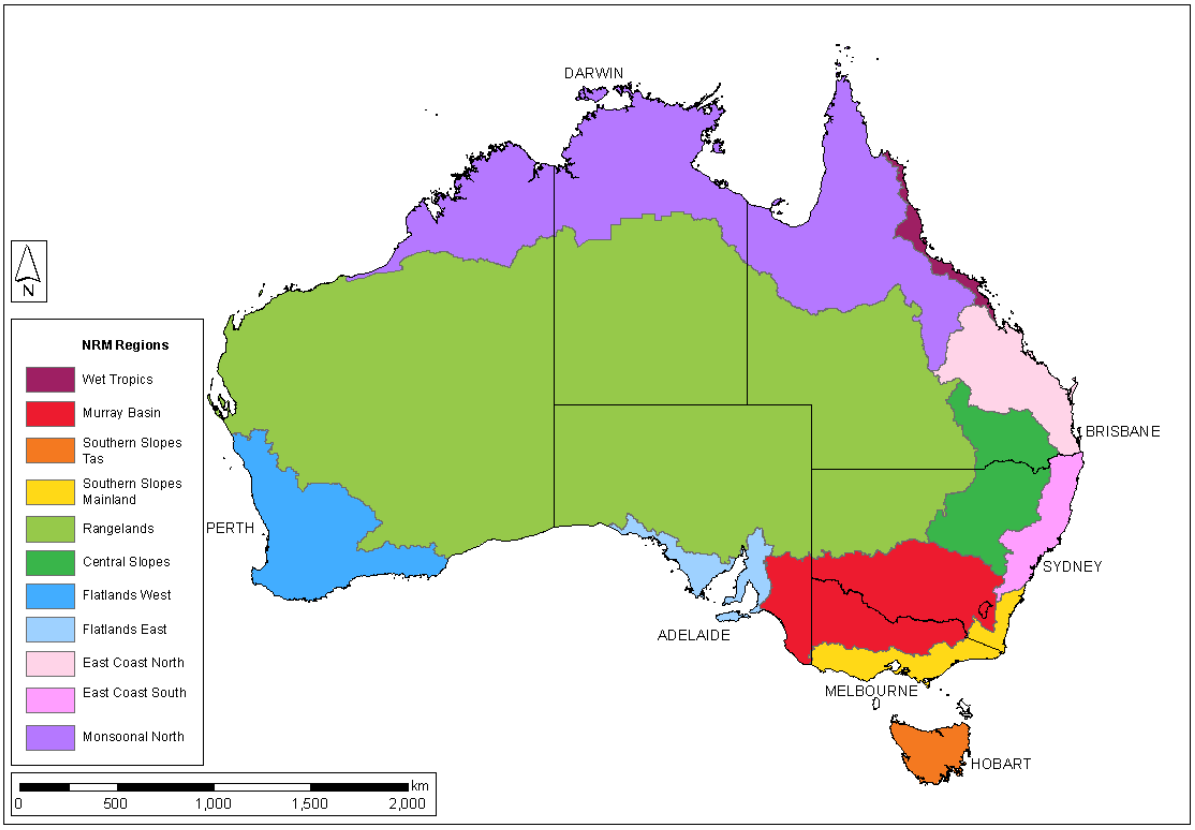

Figure 2 Locations of Natural Resource Management Clusters
(After ARR Book 1, Chapter 6, Figure 1.6.1)

[5] Babister, M., Trim, A., Testoni, I. and Rettalick, M. (2016) "The Australian Rainfall & Runoff Datahub", *Proceedings*, 37th Hydrology and Water Resources Symposium, 28 November - 2 December 2016, Queenstown, New Zealand.

[6] CSIRO and Bureau of Meteorology (2015), "Climate Change in Australia, Projections for Australia's NRM Regions". *Technical Report*, CSIRO and Bureau of Meteorology, Australia. Retrieved from www.climatechangeinaustralia.gov.au/en [http://www.climatechangeinaustralia.gov.au/en].

Interim Climate Change Factors for NRM East Coast South (Design Rainfall Increase in %)

Year	RCP4.5	RCP8.5
2030	4.3%	4.9%
2040	5.3%	6.8%
2050	6.4%	9.0%
2060	7.5%	11.5%
2070	8.5%	14.2%
2080	9.2%	16.9%
2090	9.5%	19.7%

As described, in part, by Advisian, 2020:[7]

> *The potential impacts of climate change are currently predicted to manifest as a rise in sea level and as an increase in rainfall intensities during major storms. Sea level rise is not expected to impact on the South Creek floodplain as it is elevated above the tidal limit of the Hawkesbury River.*
> *Although current climate models show significant uncertainty in quantifying the effect of climate change on rainfall intensity, the Climate Change in Australia Technical Report from CSIRO and BoM (2015) projects increased intensity of extreme rainfall events for the east coast with a high confidence.*
>
> *Scenarios of between 10% and 30% increase in rainfall intensity, as recommended in Practical Consideration of Climate Change (DECC, 2007), remain comparable to ranges projected by more recent research (e.g. CSIRO and BOM, 2015) and are considered appropriate for providing an informed assessment of the range of potential impacts and hence the sensitivity to climate change.*
>
> *The potential impacts of increased rainfall intensity associated with climate change can be assessed by comparing model results for the 1% AEP design flood with those for the 0.5% AEP (about a 15% increase in rainfall intensity) and 0.2% AEP (about a 35% increase in rainfall intensity) events.*
>
> *These relationships for the increase in rainfall intensity are reflective of the original ARR 2016 guidance which indicates that the IFD curves for the 0.5% and 0.2% AEP events are to be scaled from the 1% AEP event using 'growth factors' of 1.140 and 1.344, respectively.*
>
> *For the South Creek floodplain, 1% AEP flood levels have been compared to 0.2% AEP flood levels to provide an indication of the potential impact of increased rainfall intensities due to climate change, representing an approximately 35% increase in rainfall intensity. The associated flood level difference mapping is provided in Figures 8.1 to 8.8.*
>
> *The results show that sensitivity to change in the 1% AEP flood levels along South Creek, such as would result from climate change impacts on flood producing rainfall events, tested using the 0.2% AEP event …..*

It is noted that the 35% increase in rainfall intensity adopted by Advisian, 2020 to represent climate change is more conservative that the guidance provided by the ARR Datahub up to 2090 under RCP 8.5.

The estimated impact of climate change on 100 yr ARI flood levels in the vicinity of the subject property is plotted in **Figure 3.**

[7] Advisian (2020) "Wianamatta (South) Creek Catchment Flood Study – Existing Conditions", *Final Report*, Rev H, prepared for Infrastructure NSW, November, 27 pp + Maps + Apps

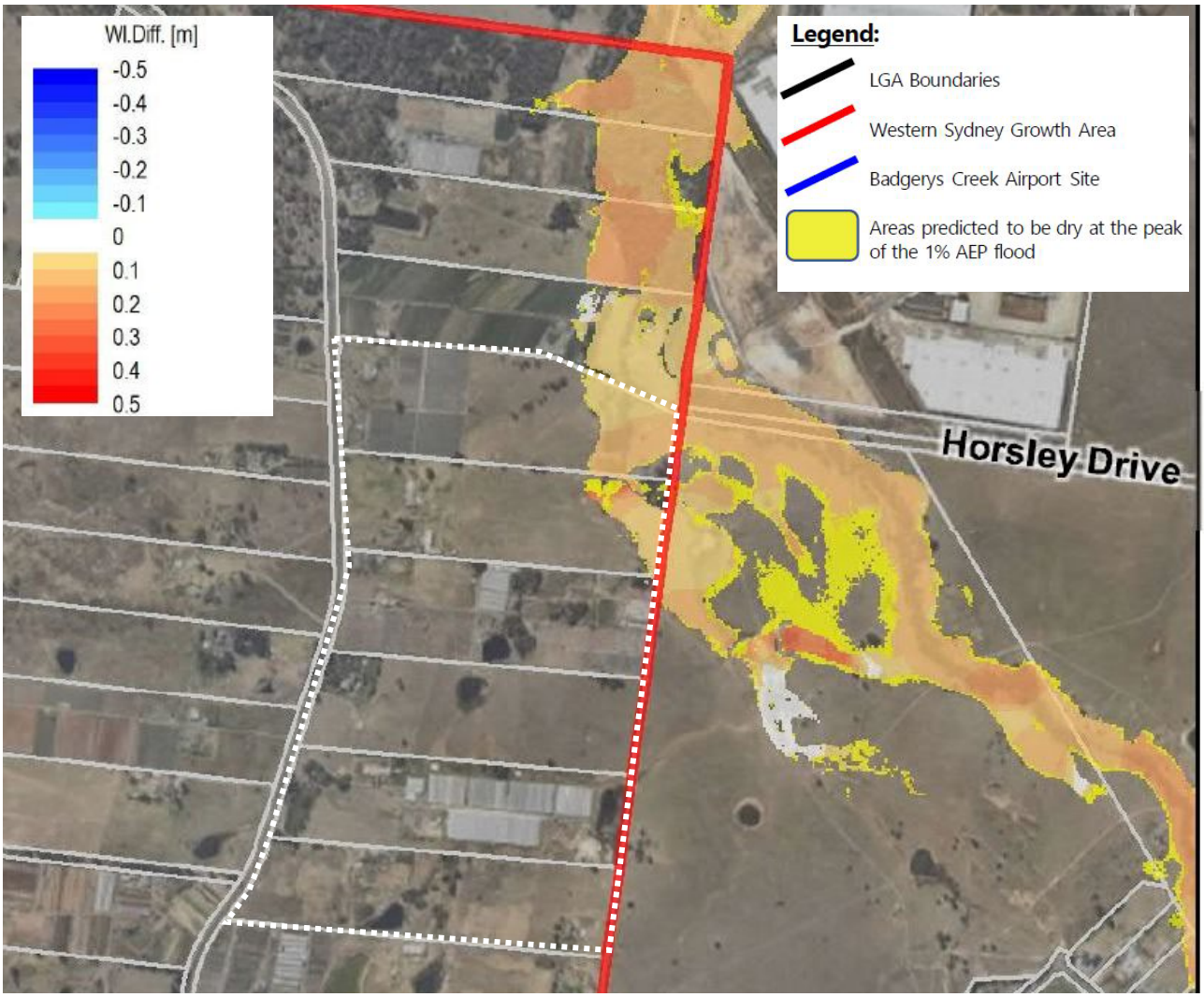

Figure 3 Impact of Climate Change on 100 yr ARI Flood Levels (after Figure 8.4, Advisian, 2020**)**

It is estimated from Figure 3 that the impact of climate change impact of climate change on 100 yr ARI flood levels in the vicinity of the subject property is broadly 0.15 m.

Given that between Reference Locations 1 to 5:

(i) the adopted benchmark 100 yr ARI flood levels are 0.2 m – 0.37 m higher than the 2015 Worley Parsons 100 yr ARI flood levels;

(ii) the PMF levels are 0.34 m – 0.9 m higher than the 100 yr ARI flood levels;

(iii) estimated from Figure 3 that the impact of climate change impact of climate change on 100 yr ARI flood levels in the vicinity of the subject property is broadly 0.15 m; and

(iv) the fill platforms typically have 4+ m freeboard to the PMF level;

then it is concluded that any impact of climate change or floodplain revegetation on mainstream flood levels will not have any impact on the development.

3. FLOOD STORAGE

The proposed earthworks in the floodplain are presented in Drawing 19-609-SKC124 Issue P1 which is attached. The extent of incursion of proposed earthworks into the 1% AEP flood extent is also delineated.

The planned development of 200 Aldington Road, Kemps Creek is also estimated to reduce the 1% AEP flood storage by 343 m^3 due to the proposed Road 5 embankment earthworks just encroaching into the 1% AEP flood extent as well the proposed Basin B encroaching to a limited degree into the 1% AEP flood extent.

The reduction in the 1% AEP flood volume was also compared to the 1% AEP 9 hour flood volume and was found to represent a 0.021% reduction in the flood volume.

It was concluded that the impact of the proposed earthworks on 200 Aldington Road on 1% AEP flood storage is negligible and will have nil impact on any adjoining development.

Yours faithfully

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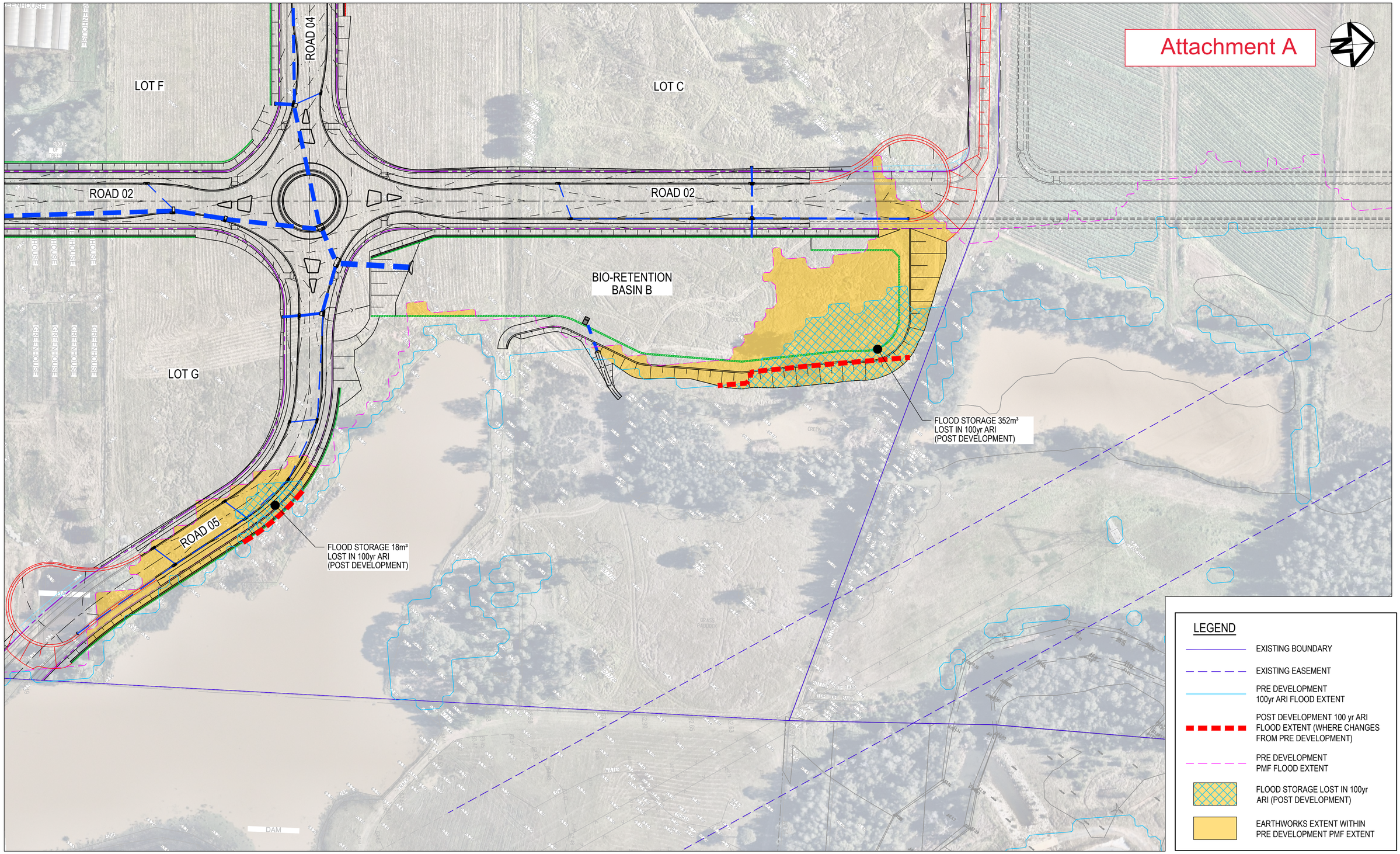
Dr Brett C. Phillips
Senior Principal
for **Cardno now Stantec**

Attachment A



LEGEND

- EXISTING BOUNDARY
- EXISTING EASEMENT
- PRE DEVELOPMENT 100yr ARI FLOOD EXTENT
- POST DEVELOPMENT 100 yr ARI FLOOD EXTENT (WHERE CHANGES FROM PRE DEVELOPMENT)
- PRE DEVELOPMENT PMF FLOOD EXTENT
- FLOOD STORAGE LOST IN 100yr ARI (POST DEVELOPMENT)
- EARTHWORKS EXTENT WITHIN PRE DEVELOPMENT PMF EXTENT

Issue	Description	Date
P1	ISSUED FOR INFORMATION	09-03-22

Bar Scales

0 15 30 45 60 75m

1 : 750 @ A1 1 : 1500 @ A3

Client

Stockland

FIFECAPITAL

Scales		Drawn	GB
	1:750	Designed	GB
Grid	MGA	Checked	AM
Height Datum	AHD	Approved	

Project

200 ALDINGTON ROAD, KEMPS CREEK

Title

EARTHWORKS IN FLOODPLAIN

Civil Engineers and Project Managers

at&l

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Status: FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

A1

Project - Drawing No.: 19-609-SKC124

Issue: P1

100mm on Original

Date Plotted: 10 Mar 2022 - 01:38PM File Name: F:\19-609 FKC\6.0 Drgs\Civil\Sketches\19-609-SKC124-Bio-Retention Basin B Earthworks In Floodplain Plan.dwg