Our Ref: 109785-13-Bingara Gorge FN St1 SW Compliance Letter.docx
DC:fl

25 October 2018

Lend Lease
Level 2, 88 Phillip Street
Parramatta NSW 2150

Attn: **Rich Boers**

Subject: **Bingara Gorge; Fairways North (Stage 1) Development Application Stormwater Compliance Letter**

Dear Rich,

J. Wyndham Prince has prepared a stormwater compliance letter to support the subdivision Development Application of the proposed Fairways North (Stage 1) development within the Bingara Gorge estate at Wilton. This stormwater compliance letter should be read in conjunction with the following documents:

- Engineering design drawings:
  - NA82013043-64-C1000 to C1044 (Rev A) prepared by Cardno;
  - Supplementary drawings 10978513/DA01 to DA07 (Rev A) prepared by JWP;
- Bingara Gorge Flooding, Stormwater & Water Quality Management Strategy Report (JWP Rpt1D, 2015);

The supplementary engineering design drawings 10978513/DA01 to DA07 provide the detail to ensure compliance with the stormwater management strategy principles set out in the overarching Bingara Gorge Flooding, Stormwater & Water Quality Management Strategy Report prepared by J. Wyndham Prince in November 2015 (JWP Rpt1D, 2015).

1. BACKGROUND

The Bingara Gorge development site is located within the Wollondilly Shire Local Government area. The site consists of approximately 460 ha of land bounded by existing residential area of Wilton to the south, Allens Creek to the east and north and the F5 South Western Freeway to the north west.

The overarching Bingara Gorge Flooding, Stormwater & Water Quality Management Strategy Report (JWP Rpt1D, 2015) included a Stormwater Retention and Reuse Scheme that supplements the irrigation needs of the proposed golf course within the Bingara Estate. This scheme ensures that nutrient and sediment loads off the Bingara Estate are retained on site and that environmental flows to downstream ecosystems are maintained. The capture of the first flush stormwater flows (8 mm east, 9 mm west) to localised tanks and storage ponds, together with a rising main transfer system to the main lake for re-use on the golf course delivers the required stormwater quality management outcomes for the site.

The report also concluded that capture and storage of the first flush flows provides a benefit to the stormwater quantity management on the site. Hydrology modelling confirmed that peak post development flows (without detention basins – but managed by the Retention and Re-use Scheme) are less than existing conditions peak flows downstream of the site within Allens Creek.

J. Wyndham Prince understand that golf course works and associated collection ponds and main lake, together with pump transfer and golf course irrigation/re-distribution system have been constructed. A regional 350 m² bio-retention raingarden downstream of the main lake will need to be constructed as part of this Stage 1 development.

2. PROPOSED DEVELOPMENT

The Fairways North (Stage 1) development is located in the western portion of the Bingara Gorge Estate. As this development results in an overall lot yield greater than 1165 lots, a 350 m² regional bio-retention raingarden downstream of the main lake will need to be constructed as part of this Stage 1 development. Refer to Bingara Gorge Flooding, Stormwater & Water Quality Management Strategy Report (JWP Rpt1D, 2015) for further details.

The proposed development includes the subdivision of land to provide 232 residential lots, seven (7) residue lots and one (1) association property lot together with supporting road and stormwater infrastructure. Regional stormwater collection tanks and storage ponds, together with a rising main transfer system will deliver collected stormwater runoff to a centralised lake for distribution/re-use on the adjacent golf course. An on-lot bio-swale will treat two (2) lots on the very northern tip of the development.

Plate 2-1 provides an overview of the location of the proposed subdivision. For further details, please refer to Cardno engineering design drawings NA82013043-64-C1000 to C1044 (Cardno) and 978513/DA01 to DA07 (J. Wyndham Prince).

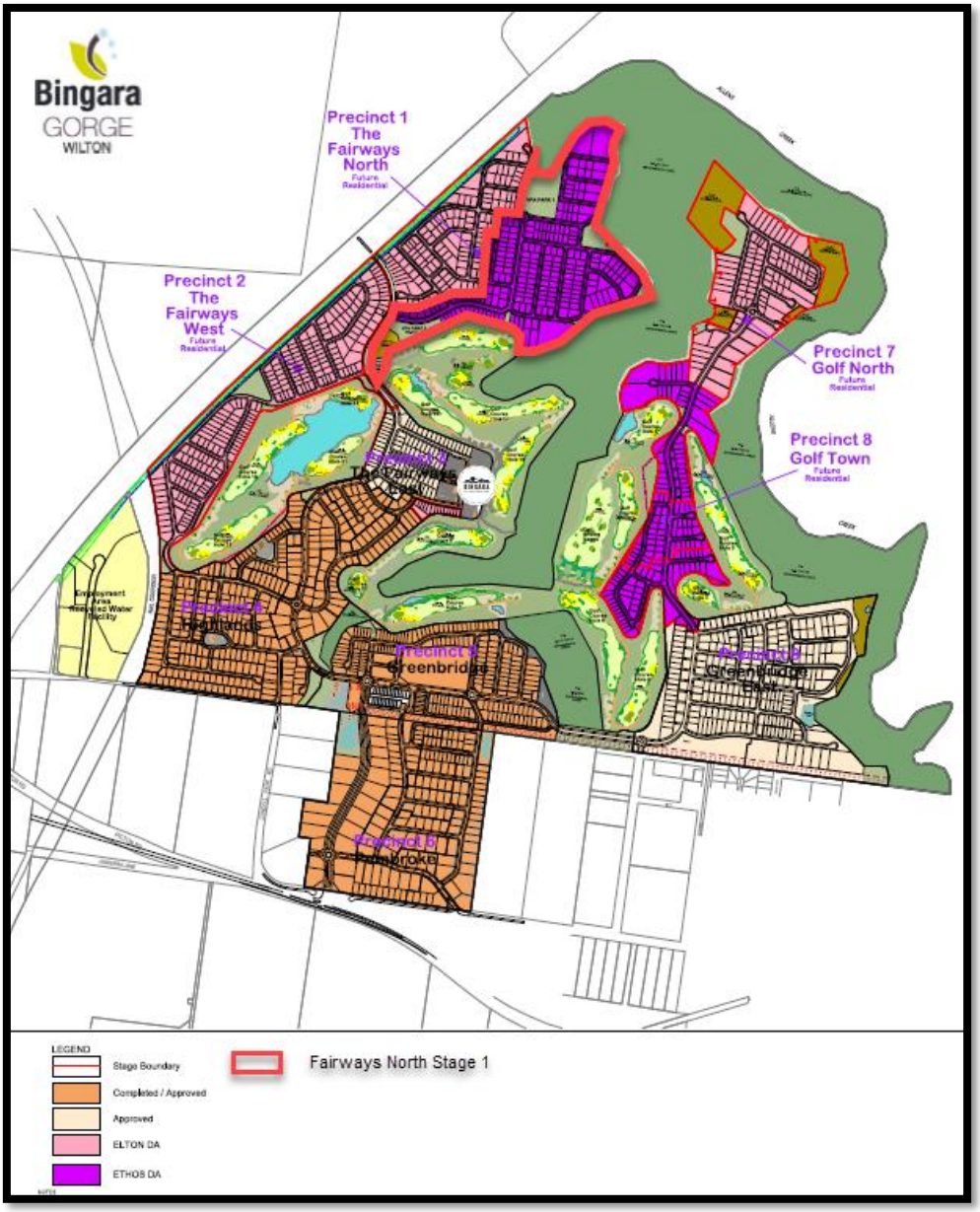


Plate 2-1 – Fairways North Stage 1 Site Locality

3. STORMWATER MANAGEMENT

The overarching Stormwater & Water Quality Management Strategy (JWP, 2015) required a series of stormwater management controls to be implemented. A copy of the following figures from the 2015 strategy are provided in Appendix A:

- Figure 7.1 – Bingara Gorge Stormwater Management Plan;
- Figure 7.3 – Bingara Gorge Typical Water Re-use/Treatment Cycle Schematic;
- Figure 9.1 – Bingara Gorge HEC-RAS layout, 100 Year ARI Flood extents and Manning's Section Locations.

Supplementary Stormwater Strategy Plans 978513/DA01 to DA07 are provided in Appendix B. Compliance with the stormwater management controls (JWP, 2015) is detailed in Table 3-1.

Table 3-1 Stormwater Compliance

Stormwater Control Measure	Compliance with Controls
Stormwater Quality	
• Local drainage from the urban and golf course areas should be filtered using in-line filter pit inserts or equivalent to remove gross pollutants.	• Pit filter inserts or Gross pollutant traps will need to be provided prior to discharge to the collection ponds/tanks.
• First flush flows from urban areas (8 mm east/9 mm west) are to be captured and re-directed to stormwater re-use storages for golf course irrigation. • Regional 350 m² bio-retention raingarden to be included downstream of main lake. • Total Phosphorous concentration to be less than or equal to 0.035 mg/L and Total Nitrogen concentration to be less than or equal 0.700 mg/L downstream of the site.	• Four (4) storage tanks will capture and transfer the first 9 mm of stormwater runoff. • Two (2) collection ponds located to the northwest and east of the site provide the storage for the first 9 mm of rainfall from the upstream catchment. • An on-lot bio-retention swale to treat Catchment 11 will ensure pollutant concentration targets are met. • Refer engineering drawings 978513/DA01 to DA07 for catchments and location of devices.
Stormwater Quantity (Flood Control)	
• The capture and re-use of first flush stormwater flows re-use scheme to achieve water quality outcomes also provides stormwater quantity management.	• Hydrology modelling confirmed that with the capture and storage of the first 9 mm of rainfall, post development flows are less than existing conditions downstream of the site (JWP Rpt1D, 2015). • The overarching stormwater management and flooding report (JWP Rpt1D, 2015) confirmed that the 1% AEP flood levels in Allens and Stringbark Creeks are well below the level of the proposed lots (i.e. more than 0.61 m freeboard).
Erosion and Sediment Controls	
• Erosion and sediment control measures are to be implemented during the construction phase in accordance with the requirements of Wollondilly Shire Council and the guidelines set out by Landcom (the "Blue Book" 2004).	• A sediment and erosion control plan will need to be submitted to support the future Construction Certificate application process.

3.1 Stormwater Storage Calculations

The overarching stormwater management and flooding report (JWP Rpt1D, 2015) required capture and transfer for the first 9 mm of rainfall from the western portion of the Bingara Gorge estate to a centralised main lake for re-distribution on the adjacent golf course.

The following calculated storage volumes relate to the Fairways North Stage 1 Development (together with catchments considered in adjacent Development Applications).

Tank FNS1-T1

- Fairways North Stage 1 Catchment Area to tank = 1.46 ha;
- Total Catchment (10) Area to tank = 1.46 ha – refer 978513/DA02;
- Storage volume Required - 14,600 m² x 0.009 m = 131.4 m³;
- Storage volume Proposed = 135 m³ (refer engineering drawing 978513/DA03).

Tank FNS1-T2

- Fairways North Stage 1 Catchment Area to tank = 2.10 ha;
- Total Catchment (9) Area to tank = 2.10 ha – refer 978513/DA02;
- Storage volume Required - 21,000 m² x 0.009 m = 189 m³;
- Storage volume Proposed = 190 m³ (refer engineering drawing 978513/DA03).

Tank FNS1-T3

- Fairways North Stage 1 Catchment Area to tank = 1.13 ha;
- Total Catchment (7) Area to tank = 1.13 ha – refer 978513/DA02;
- Storage volume Required - 11,300 m² x 0.009 m = 101.7 m³;
- Storage volume Proposed = 105 m³ (refer engineering drawing 978513/DA05).

Tank FNS1-T4

- Fairways North Stage 1 Catchment Area to tank = 2.5 ha;
- Total Catchment (3) Area to tank = 11.47 ha – refer 978513/DA02;
- Storage volume Required - 114,700 m² x 0.009 m = 1032.3 m³;
- Storage volume Proposed = 1035 m³ (refer engineering drawing 978513/DA05).

Pond FNS1-B1

- Fairways North Stage 1 Catchment Area to pond = 5.16 ha;
- Total Catchment (4&5) Area to pond = 12.3 ha – refer 978513/DA02;
- Storage volume Required - 123,000 m² x 0.009 m = 1107 m³;
- Storage volume Proposed = 1110 m³ (refer engineering drawing 978513/DA03).

Pond FNS1-B2

- Fairways North Stage 1 Catchment Area to pond = 11.86 ha;
- Total Catchment (8) Area to pond = 11.86 ha – refer 978513/DA02;
- Storage volume Required - 118,600 m² x 0.009 m = 1067.4 m³;
- Storage volume Proposed = 1075 m³ (refer engineering drawing 978513/DA03).

3.2 Updated Water Quality Modelling

Due to the existing landform of Catchment 11 (refer engineering drawing 978513/DA02), it is impractical to grade Lots 214 and 215 on the northern tip of the development (refer Cardno drawing C1009) back to a regional collection tank or pond.

The MUSIC water quality model that supported the Bingara Gorge Flooding, Stormwater & Water Quality Management Strategy Report (JWP Rpt1D, 2015) has been updated to reflect the on-lot treatment of this catchment.

The following amendments have been made to the model:

- Catchment 11 area of 1.59 ha directed to on-lot bio-swale (refer engineering drawing 978513/DA02 and DA03);
- Original 37.8 ha Catchment C+D has been reduced by 1.59 ha (i.e is now 36.21 ha);
- Pond C+D storage and re-use reduced proportionately to reflect reduced catchment to pond;

All other music model areas and parameters are unchanged.

Iterations were undertaken in MUSIC 6.3.0 to confirm that the original re-use scheme and 350 m² bio-retention raingarden downstream of the main lake, together with bio-swale to treat Catchment 11 will achieve the pollutant concentration targets downstream of the site.

It was found that a 450 m² bio-retention swale would achieve the required treatment for catchment 11. Table 3-2 provides details of the estimated mean annual pollutant loads and reductions for the Bingara Gorge Estate (total 1800 lots). Estimated pollutant concentrations are provided in Table 3-3.

Table 3-2 Estimated Pollution Load Reductions – (Bingara Gorge 1800 Lots)

Pollutant	Allens Creek		
	Source	Discharge	Reductions
Flow (ML/yr)	1320	1170	11.4%
TSS (kg/yr)	203000	37200	81.7%
TP (kg/yr)	357	173	51.5%
TN (kg/yr)	2690	1880	30.1%
GP (kg/yr)	34800	0	100.0%

Table 3-3 Estimated Pollution Load Reductions – (Bingara Gorge 1800 Lots)

	Western Catchment			Eastern Catchment			Allens Creek		
	TSS (mg/L)	TP (mg/L)	TN (mg/L)	TSS (mg/L)	TP (mg/L)	TN (mg/L)	TSS (mg/L)	TP (mg/L)	TN (mg/L)
Mean	4.910	0.035	0.635	2.780	0.013	0.119	5.010	0.035	0.637
Standard Deviation	6.81	0.039	0.501	11.90	0.051	0.456	7.25	0.040	0.503
Median	2.20	0.020	0.600	0.00	0.000	0.000	2.20	0.020	0.600
Maximum	142	0.395	3.42	140	0.496	3.63	141	0.382	3.42
Minimum	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.00
10%ile	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.000	0.00
90%ile	15.1	0.100	1.42	0.000	0.000	0.000	15.1	0.100	1.42

MUSIC Model Ref: 9785_13_MU4.sqz

Tables 3-2 and 3-3 demonstrate that the mean pollutant concentration targets of 0.035 mg/L (TP) and 0.700 mg/L are satisfied both within the site and at the downstream boundary at Allens Creek.

4. SUMMARY AND CONCLUSION

As we understand it, the proposed Fairways North Stage 1 development will result in a lot yield greater than the 1,165 lots originally approved at the Bingara Gorge Estate. The Bingara Gorge Flooding, Stormwater & Water Quality Management Strategy Report (JWP Rpt1D, 2015) was prepared to support an overall lot yield of 1800 lots. As part of this strategy update, a 350 m² bio-retention raingarden was proposed downstream of the main lake to ensure that pollution concentration targets were met downstream of the site.

In addition to the main lake and associated stormwater irrigation/re-use infrastructure already constructed in the Bingara Gorge estate, the regional 350 m² bio-retention raingarden downstream of the main lake is proposed to be constructed as part of the Fairways North Stage 1 development. Updated stormwater quality modelling can be prepared as part of the future Construction Certificate stage to support the staged delivery of this device if necessary.

Due to landform constraints, a bio-retention swale to treat two (2) lots at the very northern tip of the Fairways North Stage 1 development is proposed to treat this catchment. Updated water quality modelling has confirmed that together with the original re-use scheme (JWP Rpt1D, 2015), a 450 m² swale to treat these two (2) lots will ensure that the mean pollutant concentration targets of 0.035 mg/L (TP) and 0.700 mg/L are satisfied both within the site and at the downstream boundary at Allens Creek.

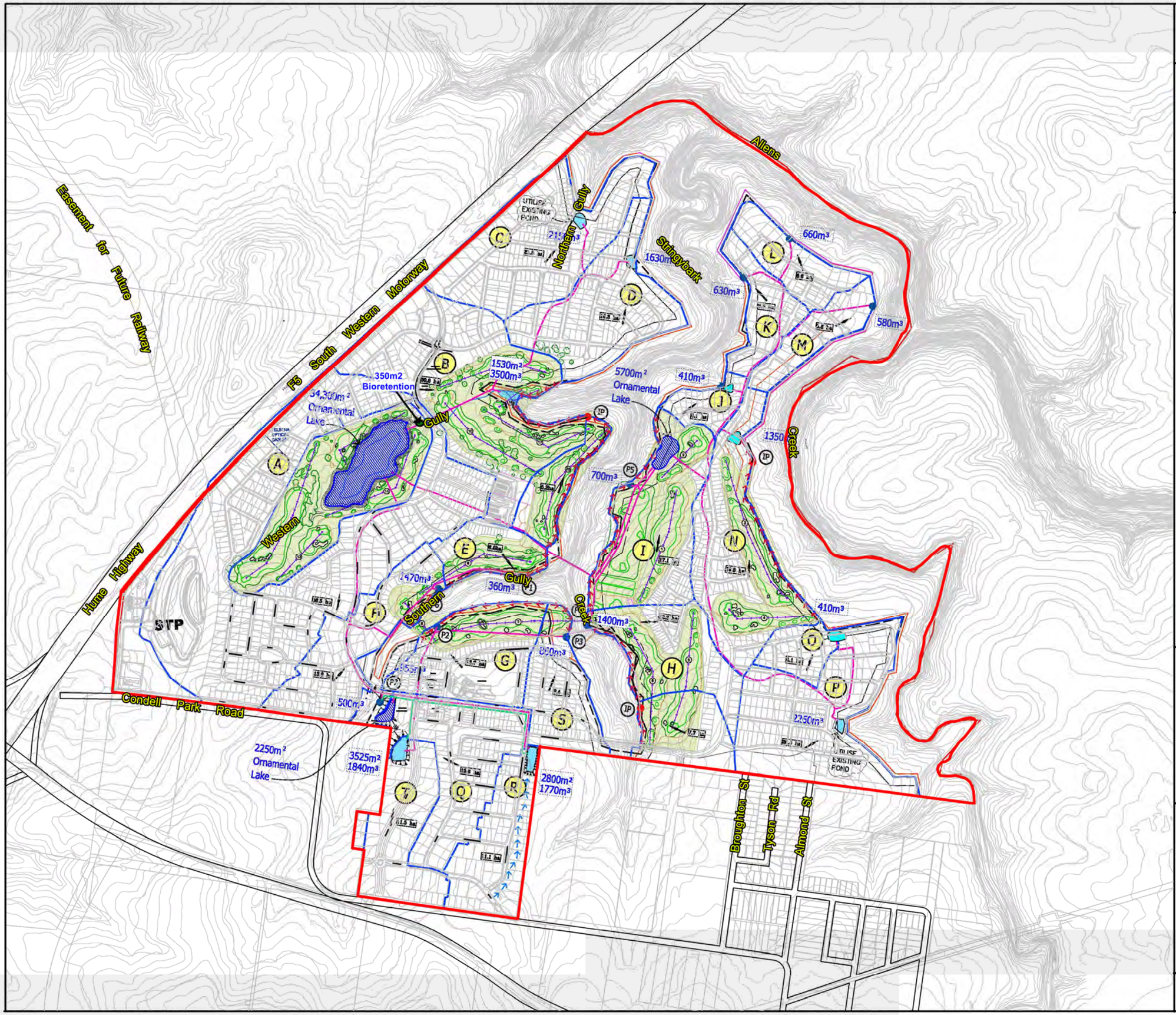
The collection and transfer of the first 9 mm of rainfall from the remainder of the site to a centralised existing main lake is consistent with the Bingara Gorge Flooding, Stormwater & Water Quality Management Strategy Report (JWP Rpt1D, 2015). The stormwater management principles in this overarching report are maintained, and therefore we believe that the stormwater management strategy is suitable for Development Application approval. Further details will be provided as part of the Construction Certificate application process to confirm the final configuration.

Should there be any queries regarding this matter please do not hesitate to contact David Crompton on (02) 4720 3340 or dcrompton@jwprince.com.au.

Yours faithfully
J. WYNDHAM PRINCE

DAVID CROMPTON
Manager – Stormwater and Environment Group

APPENDIX A – FIGURES FROM JWP 2015 BINGARA GORGE FLOODING, STORMWATER & WATER QUALITY MANAGEMENT STRATEGY REPORT



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LEGEND

- SITE BOUNDARY
- SUBCATCHMENT BOUNDARY EXTENTS
- WATER RE-USE RISING MAIN
- P3 PUMP AND PUMP WELL/STORAGE TANK
- STORMWATER GRAVITY PIPE
- GOLF COURSE EDGE TREATMENT DIVERSION DRAIN REFER DETAIL FIGURE 7
- CATCH DRAIN SHOWING FLOW DIRECTION
- IP SURFACE INLET PIT FOR GRAVITY DRAINAGE PIPE
- ORNAMENTAL LAKE – PERMANENT WATER BODY BEING REPLENISHED BY WATER STORAGE IRRIGATION PONDS
- WATER STORAGE IRRIGATION POND TO CAPTURE DEVELOPMENT RUNOFF FLOWS WITH PUMPOUT SYSTEM
- FULL EXTENT OF PROPOSED GOLF COURSE
- 7.5ha SUB-CATCHMENT BOUNDARY, TOTAL AREA & FLOW DIRECTION
- H CATCHMENT DESIGNATION LABEL
- 340m² SURFACE AREA OF 2m DEEP WATER STORAGE IRRIGATION POND
- 340m² 500m³ AVERAGE SURFACE AREA AND STORAGE VOLUME OF WATER STORAGE IRRIGATION POND DESIGNED AS PART OF THESE WORKS
- GRAY LAND EVAPORATION TOP UP SYSTEM
- BIORETENTION SYSTEM

N W E S

Scale 1: 12,500@ A3

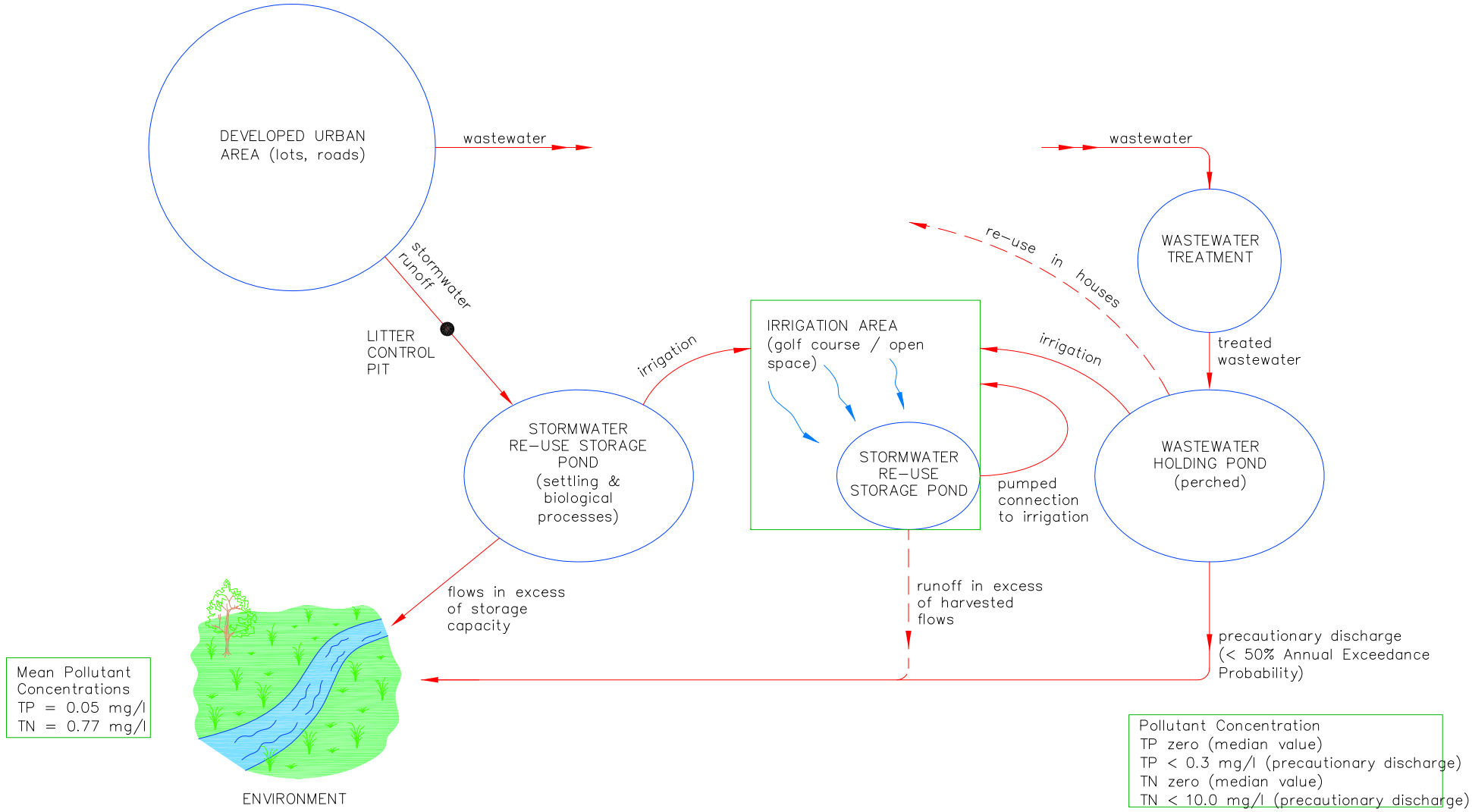
500 0 m

Figure 7.1

Bingara Gorge

Stormwater Management Plan

File Name: 9785-02Fig7.1_SWMP
Date : 23/11/15 Issue : C



TYPICAL WATER RE-USE/TREATMENT CYCLE SCHEMATIC

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9785Fig7.3 A

BINGARA GORGE

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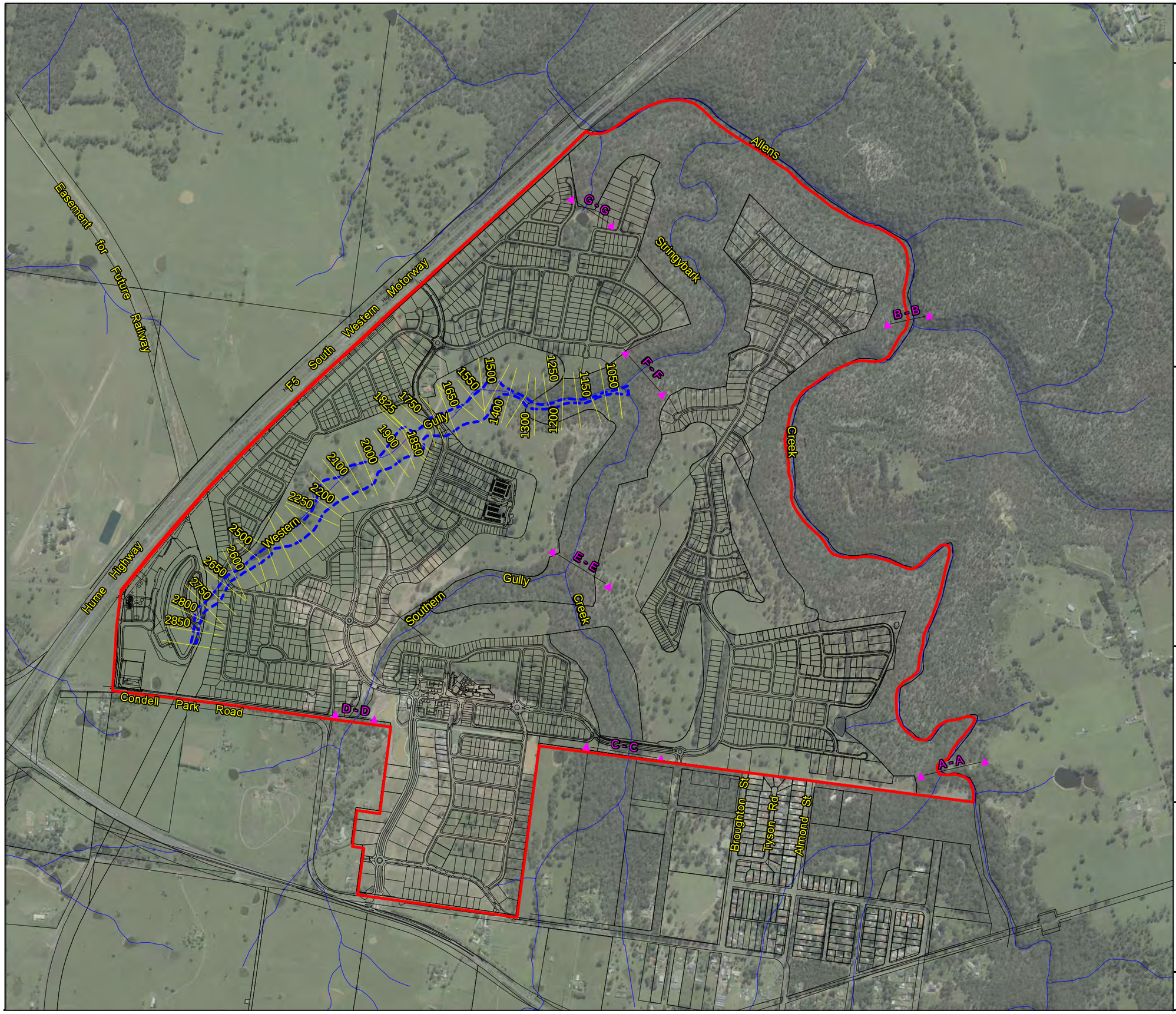
FIGURE 7.3



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LEGEND

- BINGARA GORGE SITE BOUNDARY
- 2800 HEC-RAS SECTION AND CHAINAGE
- 100 YEAR ARI FLOOD EXTENTS
- MANNING'S SECTION LOCATION

N W E S

Scale 1: 12,500@ A3

500 0 m

Figure 9.1

Bingara Gorge

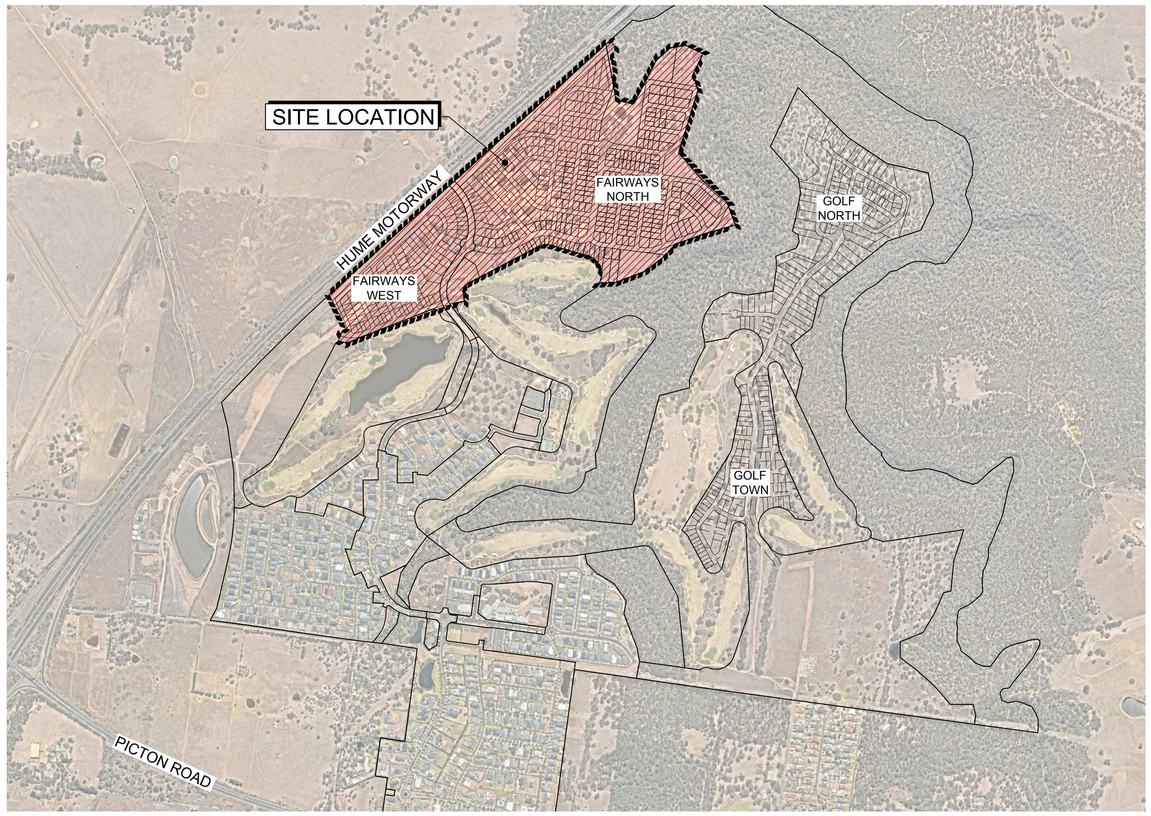
HEC-RAS Layout, 100 Year ARI Flood Extents and Manning's Section Locations

File Name: 9785-02Fig9.1_Hydraulic
Date : 14/4/15 Issue : B

APPENDIX B – FAIRWAYS NORTH (STAGE 1 & 2) AND FAIRWAYS WEST STORMWATER MANAGEMENT STRATEGY PLANS

BINGARA GORGE WILTON
FAIRWAYS NORTH AND FAIRWAYS WEST
DEVELOPMENT APPLICATION

PROPOSED STORMWATER STRATEGY



LOCALITY SKETCH

CIVIL PLAN INDEX		
PLAN NO.	PLAN NAME	REV
978513/DA01	COVER SHEET	A
978513/DA02	OVERALL SITE AND CATCHMENT PLAN	A
978513/DA03	ENGINEERING PLAN SHEET 1	A
978513/DA04	ENGINEERING PLAN SHEET 2	A
978513/DA05	ENGINEERING PLAN SHEET 3	A
978513/DA06	ENGINEERING PLAN SHEET 4	A
978513/DA07	RAINGARDEN PLAN AND TYPICAL SECTION	A

Prepared By:

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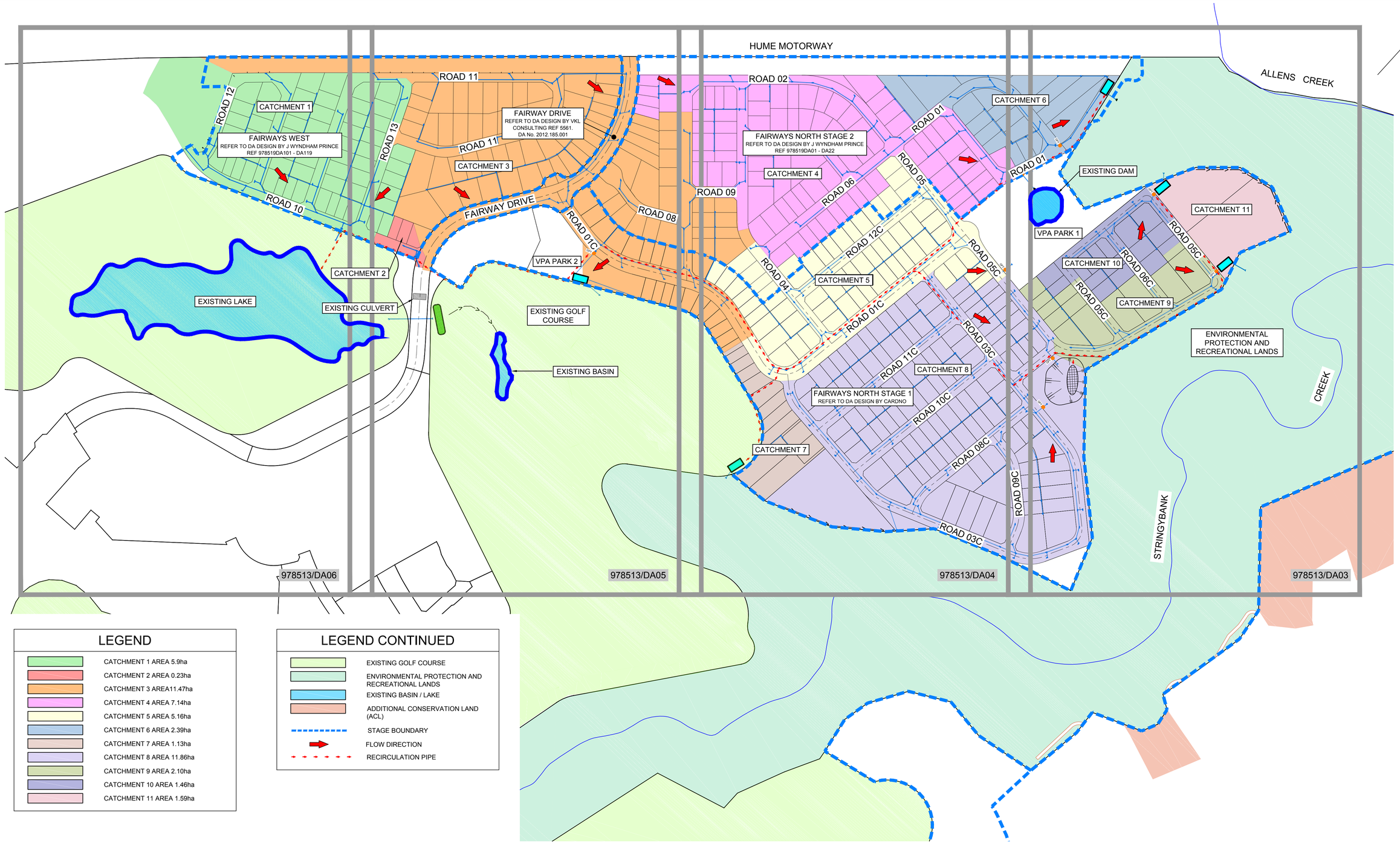
PLAN No. 978513/DA01 A

FILE No. 978513DA01

Plotted: October 8, 2018 File Name: J:\9785 - Bingara Gorge Wilton\9785 13 Golftown And Fairway North And West\Drawings\CD\DA\Fairways North And West\978513DA01.dwg



LEGEND

- CATCHMENT 1 AREA 5.9ha
- CATCHMENT 2 AREA 0.23ha
- CATCHMENT 3 AREA11.47ha
- CATCHMENT 4 AREA 7.14ha
- CATCHMENT 5 AREA 5.16ha
- CATCHMENT 6 AREA 2.39ha
- CATCHMENT 7 AREA 1.13ha
- CATCHMENT 8 AREA 11.86ha
- CATCHMENT 9 AREA 2.10ha
- CATCHMENT 10 AREA 1.46ha
- CATCHMENT 11 AREA 1.59ha

LEGEND CONTINUED

- EXISTING GOLF COURSE
- ENVIRONMENTAL PROTECTION AND RECREATIONAL LANDS
- EXISTING BASIN / LAKE
- ADDITIONAL CONSERVATION LAND (ACL)
- STAGE BOUNDARY
- FLOW DIRECTION
- RECIRCULATION PIPE

1:2500 (AT A1)
1:5000 (AT A3)

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METRES

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	AMENDMENT	DES	DRN	CKD	APR	DATE
A	ISSUE FOR DA APPROVAL	KM	CC	FL	MS	08/10/18

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AZIMUTH: MGA
DATUM: AHD
ORIGIN:

BINGARA GORGE WILTON
FAIRWAYS NORTH STAGE 1 & 2 AND WEST
PROPOSED STORMWATER STRATEGY
OVERALL SITE AND CATCHMENT PLAN

PLAN No: 978513/DA02 A
FILE No: 978513DA02
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	AMENDMENT	DES	DRN	CKD	APR	DATE

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AZIMUTH: MGA
DATUM: AHD
ORIGIN:

BINGARA GORGE WILTON
FAIRWAYS NORTH STAGE 1 & 2 AND WEST
PROPOSED STORMWATER STRATEGY
ENGINEERING PLAN SHEET 1

PLAN No: 978513/DA03 A
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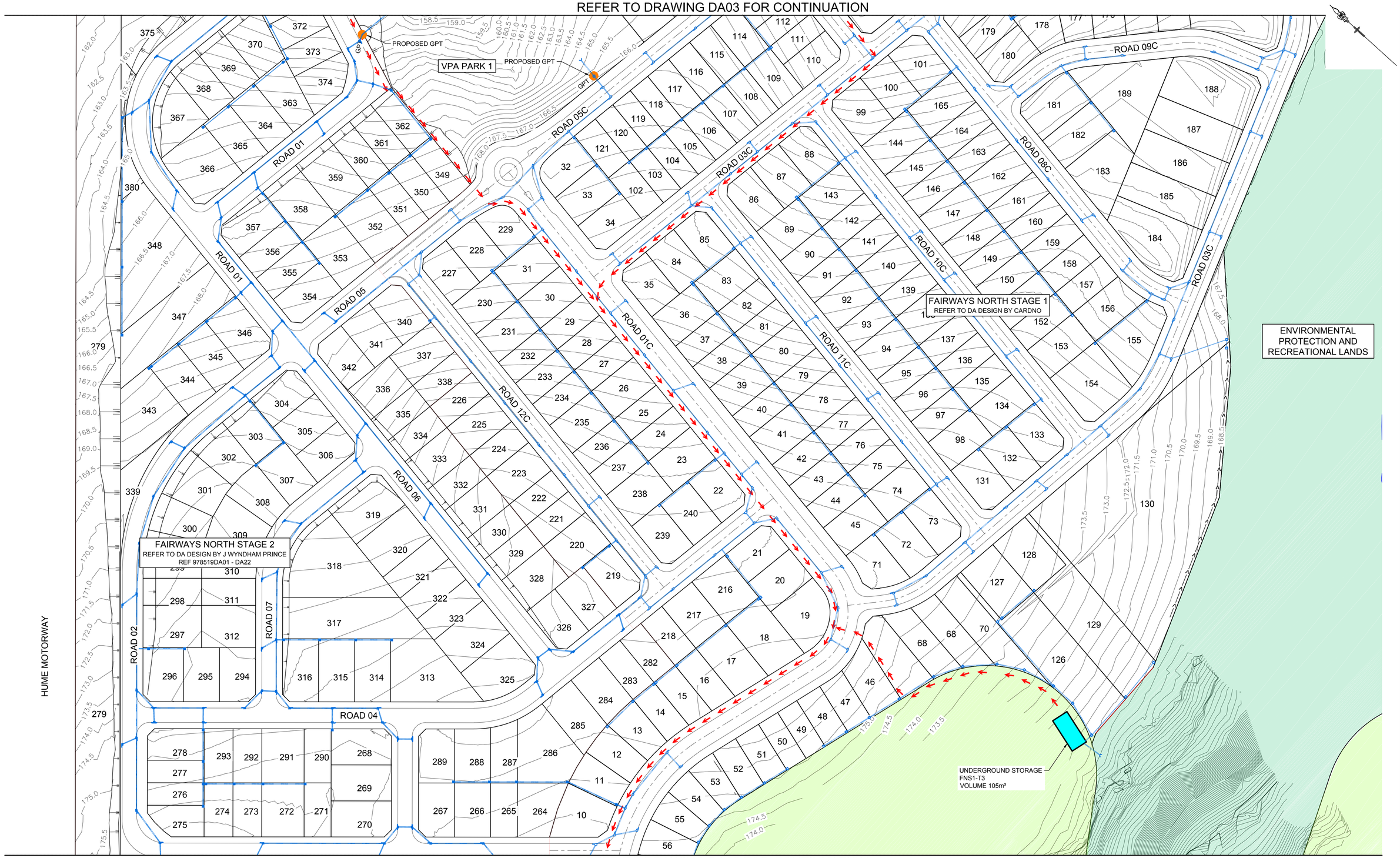

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NOTE:

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BINGARA GORGE WILTON
FAIRWAYS NORTH STAGE 1 & 2 AND WEST
PROPOSED STORMWATER STRATEGY
ENGINEERING PLAN SHEET 2

PLAN No: 978513/DA04 A
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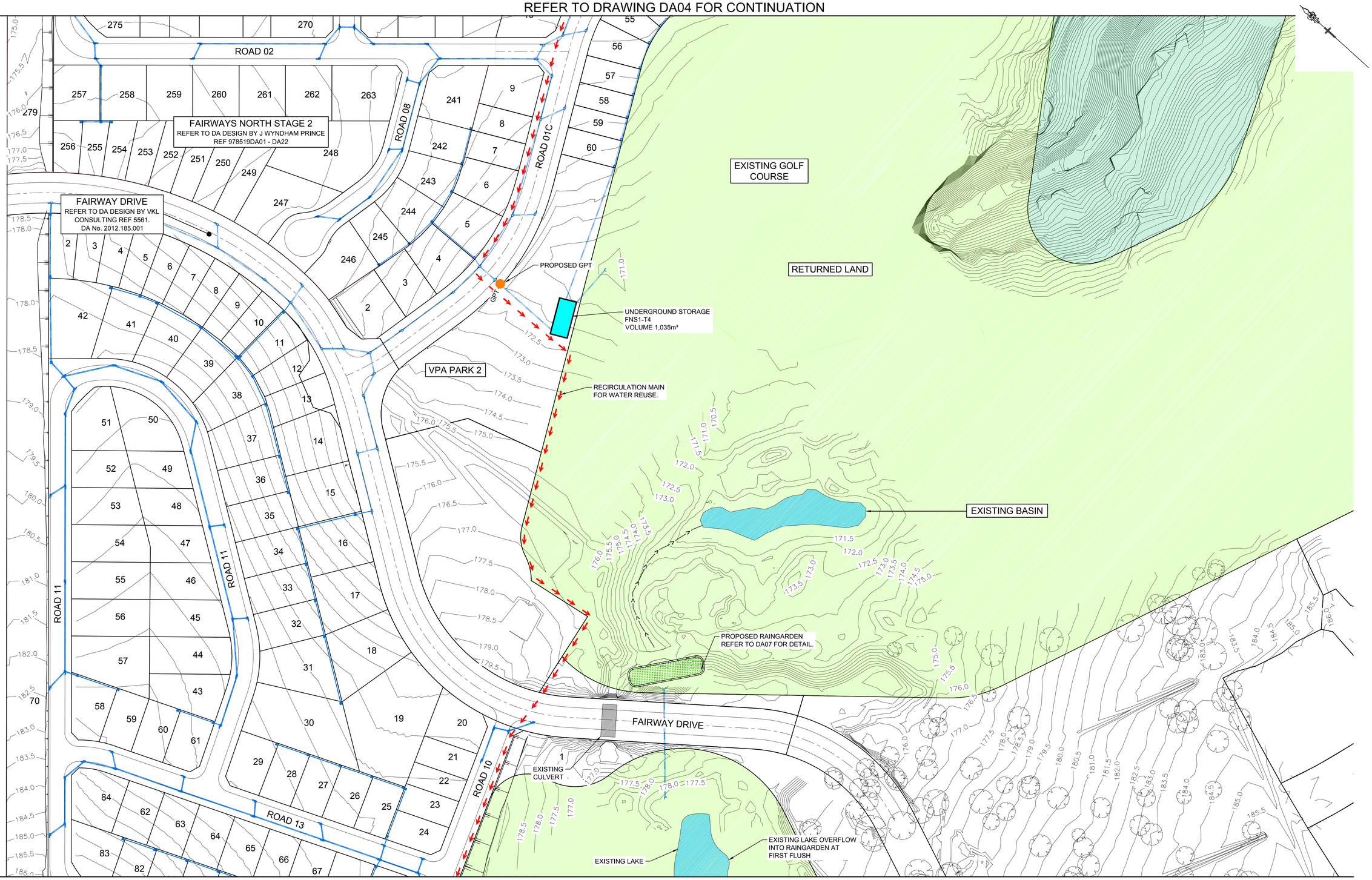

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BINGARA GORGE WILTON
FAIRWAYS NORTH STAGE 1 & 2 AND WEST
PROPOSED STORMWATER STRATEGY
ENGINEERING PLAN SHEET 3

PLAN No: 978513/DA05 A
FILE No: 978513DA05
SHEET SIZE: A1 ORIGINAL

Plotted: 8 October , 2018 2:07:29 PM File Name : J:\9785 - Bingara Gorge Wilton\9785 13 Golftown And Fairway North\Drawings\CD\DA\Fairways North And West\978513DA05.dwg

REFER TO DRAWING DA05 FOR CONTINUATION

NOTE:

REFER TO DA03 FOR LEGEND.

1:1000 (AT A1)
1:2000 (AT A3)

20 10 0 10 20 30 40 50 60 70 80 90 100

METRES

A	ISSUE FOR DA APPROVAL	KM	CC	FL	MS	08/10/18
	AMENDMENT	DES	DRN	CKD	APR	DATE

J. WYNDHAM PRINCE

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AZIMUTH: MGA

DATUM: AHD

ORIGIN:

CLIENT: lendlease

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BINGARA GORGE WILTON

FAIRWAYS NORTH STAGE 1 & 2 AND WEST

PROPOSED STORMWATER STRATEGY

ENGINEERING PLAN SHEET 4

PLAN No: 978513/DA06 A

FILE No: 978513DA06

SHEET SIZE: A1 ORIGINAL

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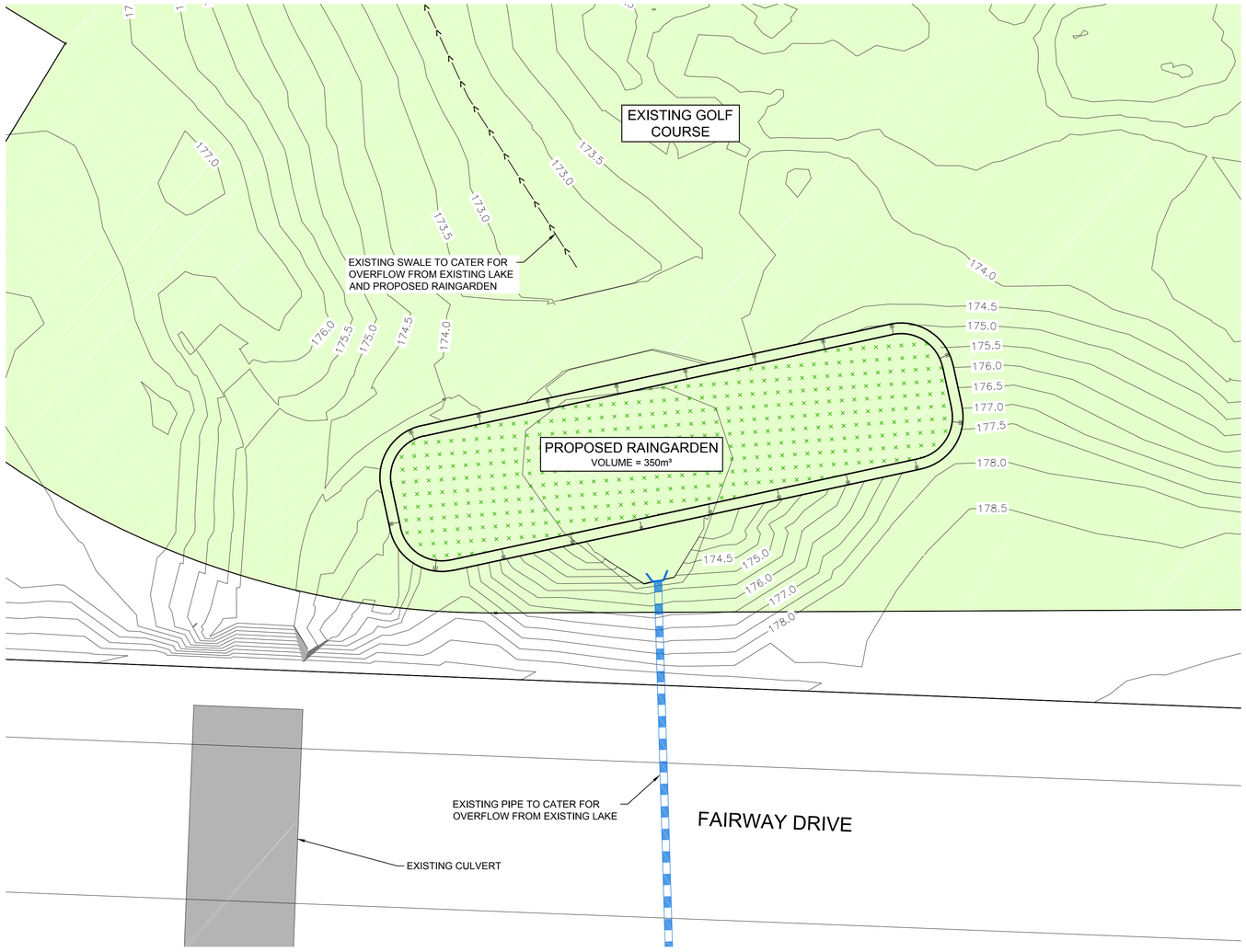
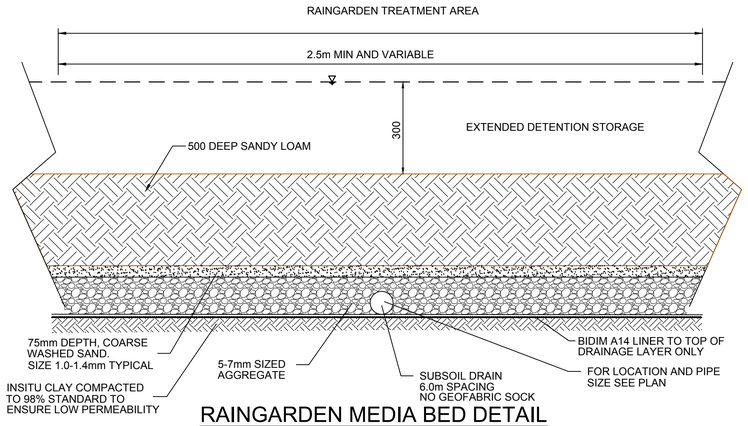


RAINGARDEN PLAN

SCALE 1:100



RAINGARDEN MEDIA BED DETAIL

SCALE 1:20

1:20 (AT A1) 400 200 0 400 800 1200 1600 2000 MILLIMETRES

1:100 (AT A1) 1:200 (AT A3) 2 1 0 1 2 3 4 5 6 7 8 9 10 METRES

A	ISSUE FOR DA APPROVAL	KM	CC	FL	MS	08/10/18
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BINGARA GORGE WILTON

FAIRWAYS NORTH STAGE 1 & 2 AND WEST

PROPOSED STORMWATER STRATEGY

RAINGARDEN PLAN AND TYPICAL SECTION

PLAN No: 978513/DA07 A

FILE No: 978513DA07

SHEET SIZE: A1 ORIGINAL

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