

# MORWELL NORTH DCP

## DRAINAGE REVIEW

09 June 2016

E14166



**This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.**

**By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissemination, distribution or copying of this document is strictly prohibited.**

<b>INDEX</b>	<b>PAGE</b>
EXECUTIVE SUMMARY	1
REPORT ON FINDINGS	
1. INTRODUCTION	3
2. FUNCTIONAL DESIGN	3
3. CHANGE TO NET DEVELOPABLE AREA	6
4. CHANGE TO ESTIMATED COSTS	7
5. CONCLUSIONS	7
<b>APPENDICES</b>	
1. Site Context Plan	8
2. Site Photos	9
3. Changes in Drainage Costs	10
4. Functional Design Plans	11

#### DOCUMENT ISSUE

ISSUE VERSION	DATE	DESCRIPTION	PROJECT CONSULTANTS	DIRECTOR APPROVAL
1	31 Mar 2016	DRAFT ISSUE		
2	21 April 2016	FINAL		
3	09 June 2016	FINAL - AMENDED		

## **EXECUTIVE SUMMARY**

The work in this report provides definition to the concept contained within the Morwell North-West Development Contributions Plan (“DCP”) for the major drainage corridor.

This will allow the Latrobe City Council to –

1. Have an independent assessment of hydraulic flows for the area of the DCP
2. Be able to identify 1 in 100 year flood levels along the line of the major drainage corridor.
3. Be able to show and define the connected elements of the main drainage corridor –
  - a. Channels – cross-sections, levels and gradients
  - b. Main Storage – weir, batters, floors
  - c. Main wetlands within the Main Storage (WR-02)
  - d. Low-flow outfall from Main Storage – match-in to construction; extent of downstream works required outside of the DCP area
  - e. Culvert structures – location, size, extent
4. Have updated information about sizing of Wetland/Retarding basins WR-01 and WR-04
5. Have technical information for the main drainage corridor that shows –
  - a. Base flow levels and gradients on longitudinal section
  - b. Main Storage batters and floors
  - c. Inflow channel batters and floors
  - d. Functional information for later detailed design and construction
6. For roads –
  - a. Enable road levels to be determined around the Main Storage and across feeder channels
  - b. Enable decisions to be made on the use of minor retaining walls around the edges of the Main Storage at road reserve interfaces
7. Enable strategy to be put in place for dealing with developers as to –
  - a. How detailed design is to be undertaken in a coordinated way
  - b. How construction is to be undertaken in a coordinated way
8. Identify matters outside the DCP warranting consideration –
  - a. Capacity of the Latrobe Road culverts
  - b. Maintenance on the outfall drain upstream of Latrobe Road
9. Improve the basis for costing of DCP items and Council works

The main points arising from the drainage review for design are –

1. The Functional Design has defined the required extent and levels for channels conveying overland drainage flows along the main drainage alignment and the nature and extent of the main retarding basin storage within this alignment.
2. The extent of required channels in the upper reach east of English Street is wider than the available space as provided on the development plan layout. This requires adjustment to the development plan layout.
3. Definition of levels has been achieved for the 1 in 100 year rainfall event passing through this catchment, enabling Council to control the level requirements for future development adjacent to the main drainage alignment.
4. The volume of the Main Storage that is required is 40,100m<sup>3</sup> for a 1 in 100 year (3-hour) storm as compared to the Spiire reported figure of 30,000m<sup>3</sup>. This Main Storage maintains pre-development flows by retarding (storing) outflows during the peak runoff period, thereby mitigating potential flooding.
5. The Main Storage takes up all of the available space in the section north of Gordon Street.
6. The main wetland has to be within the Main Storage and will be inundated by high flows.
7. Channel flows (CH02) previously proposed to be offline have now been incorporated into the main storage basin (WR02)
8. Part of the small park on the north side of Gordon Street has to be utilized for channel flow and storage.
9. A weir and outfall culvert (6 x 1050mm dia) has to be located in the embankment at the north end of the Main Storage.
10. The existing low-flow outfall from Latrobe Road has been deviated near the embankment to match in to the low-flow pipes at the weir.
11. DCP Culverts under roads have been aligned to 90-degrees to each road as much as possible.

12. Apart from the weir low-flow pipes, no other additional culverts have been allowed for as compared to the DCP.
13. Culvert sizes are smaller than previously identified in the DCP costing.
14. It should be noted that there is a drop from the outfall of the Gordon Street culvert into the Main Storage.

To enable this review to take place, PGA undertook field survey and civil engineering design, collaborating with Water Technology for hydrologic modelling of the waterway as it currently exists.

Arising from the water quality modelling, changes from the CPG calculated areas to the Water Technology calculated areas are shown in Table 1.

Table 1

ELEMENT	STORAGE		WATER QUALITY (treatment area)	
	W-T	CPG	W-T	CPG
WR-02	40,100m <sup>3</sup>	30,000m <sup>3</sup>	5,000m <sup>2</sup>	7,500m <sup>2</sup>
WR-03 (CPG WR-01)	1,730m <sup>3</sup>	2500m <sup>3</sup>	1,700m <sup>2</sup>	1,500m <sup>2</sup>
WR-04	11,000m <sup>3</sup>	5,400m <sup>3</sup>	4,500m <sup>2</sup>	3,200m <sup>2</sup>

Other points arising from this work are –

1. There is a consequent change to the Net Developable Area.
2. The estimated costs of the construction differ from those presented in the DCP.
3. There is a need to identify strategy towards construction of the drainage works –
  - a. For coordination and logistics; and
  - b. Because the works are located on private land.

## **REPORT ON FINDINGS**

### **1. INTRODUCTION**

The Morwell North West Development Contributions Plan (“DCP”) covers an area between Latrobe Road and Maryvale Road as shown in **Appendix 1**. This includes a main drainage corridor described as –

- Upper reach – WR02/3 Existing Wetland and Pond System.
- Middle reaches – Open Drainage Channel Sections 1 & 2
- Lower reach – WR02 Basin
- Outfall beyond the limits of the DCP – Outfall from WR02 > culverts under Latrobe Road > downstream channel

It also includes –

- Matching into constructed wetlands/retarding basin WR\_02/3 and overland flows from the external catchment beyond WR\_02/3.
- Defining requirements for the main on-line retarding basin WR\_02 and its associated weir / low flow culvert at the downstream end.
- Defining requirements for major culvert structures –
  - Culvert Crossing 1 under English Street.
  - Culvert Crossing 2 under Gordon Street.
- Identifying stormwater treatment for low flows from the DCP area.

The focus of this design project is for the main drainage corridor upstream of the Latrobe Road culverts and the extent of drainage infrastructure that is required to manage drainage flows for a 1 in 100 year rainfall event. This will enable Council to control required levels of roads and lots along the length of the main drainage corridor.

Following a route survey along the length of the existing main drainage and matching into surrounding Lidar information for modelling purposes, initial concepts were able to be modelled and then finalised into the attached Functional Plans. In this work, PGA collaborated with Water Technology who carried out the specialised hydrologic modelling (refer to separate Water Technology report).

Section 2 provides comment on particular aspects of the Functional Layout Plans.

Section 3 identifies changes that are consequential for calculation of the Net Developable Area on which distribution of costs is based.

Section 4 identifies the costs of the drainage infrastructure identified in this report for updating of the DCP cost schedule.

### **2. FUNCTIONAL DESIGN**

#### **2.1. General**

In the set of Functional Layout Plans –

- Plan views identify the spatial extent of the required channel and retarding basin works; and notes on those works. In this respect separate linework is shown for –
  - The outline base features of channels and retarding basin on top of existing features and contours.
  - The extent of the water surface for the 1 in 100 year event.
  - The extent of the freeboard at 0.3m above the 1 in 100 year water surface.
  - The extent of temporary cut or fill batters to match the existing land surfaces from the freeboard line.
  - The proposed road reserves boundaries contained in the DCP.
- Longitudinal sections identify the vertical alignment along the design reference line of the –
  - Floors for the channels and retarding basin;
  - Flood level for the 1 in 100 year event;
  - Level of freeboard 0.3m above the level of the 1 in 100 year event.
  - Existing land surface levels.

- Cross-sections at various points are a vertical representation across the channels or retarding basin and similarly identify –
  - Floors for the channels and retarding basin;
  - Flood level for the 1 in 100 year event;
  - Level of freeboard 0.3m above the level of the 1 in 100 year event.
  - Existing land surface levels.
  - Permanent batters at the edges of channels and the retarding basin at 1 in 6 up to the freeboard line. This slope is suitable for mowing purposes.
  - How temporary batters extend upwards at 1 in 3 from the freeboard line. These batters are to be adjusted later for road and verge design.

Council will reference the levels for the water surface at the 1 in 100 year rainfall event for development control purposes.

## 2.2. Upper Reach

The outfall point for the constructed wetlands / retarding basin WR\_02/3 has overland flows also joining. The design matches into the existing weir structure and identifies filling of the temporary downstream pond at this location.

If a street connection is required across the channel immediately downstream of this filling work, a developer-funded culvert is envisaged as being of a similar size to the culverts specified for English Street.

## 2.3. Middle Reaches

The current drainage reserve set aside for Channel Section No.1 is 25m wide. The outcomes from the flood modelling recommend a channel width of 36m. Comments on this section are –

- Some reduction to the Gordon Street road reserve width could be made with footpath only on the northern side.
- Instead of the channel being on a straight line, with horizontal separation at English Street, the channel could be deviated in the same way that the Gordon Street road reserve moves across to achieve a cross-intersection either side of English Street. Alternatively a staggered Tee Intersection could be adopted.
- In addition the whole section of channel could be moved slightly to the south to enable the Gordon Street road reserve to be achieved, as this is a major link.
- The two short lengths of road reserve proposed on the south side of the channel and east of English Street should therefore be discontinued with part of the area given to enlarging the drainage reserve and part of the area given to developable lots. The mechanism suggested for alternative lot access is to form court heads where the north-south streets intersect the drainage reserve.
- An enlarged and relocated drainage reserve also affects the area of developable lots shown on the south side of the channel.
- Similar levels for a relocated channel would apply as shown in the Functional Layout Plans.
- With a relocated channel, the angle of the culverts at English Street should be changed to match the new alignment.

The increase in width of Channel Section No. 1 effectively means a change in the net developable area of 112.34 ha as defined in the DCP. Based on the encroachment of the drainage channel on Gordon Street and the parallel street to the south of the channel, the area involved is estimated to be approximately 0.34 ha (see also Table 1).

For Channel Section No. 2, the required downstream channel cross-section has been defined and is contained within the drainage channel area provided. Channel flows pass through culverts at English Street and then Gordon Street before discharging into the main retarding basin. Required culverts, having upstream and downstream concrete endwalls are –

- English Street (Crossing No.1) – 5 No. 2400mm x 1200mm Reinforced Concrete Box Culverts
- Gordon Street (Crossing No.2) – 1 No. 2400mm x 1200mm & 1 No. 1200mm x 1200mm RCBC.

The cost of the Gordons Street culverts has been minimised by adopting an alignment almost at right-angle to the road.

Rock beaching to be provided with the culvert structures in conjunction with the endwall treatments.

Current functional design plans (*see Appendix 4*) have included a corrected road alignment for Gordon St adjacent drainage channel section No. 2. As a result of the increased width of Gordon St road reserve the drainage channel and developable land parcels to the south will shift accordingly.

A proposed 2.5 metre wide shared pathway along Gordon St is to be accommodated within the Gordon Street road reserve (north side) and outside of the drainage channel due to restrictive batter slopes in the drainage reserve.

#### 2.4. Lower Reach

At the outfall of the Gordons Street culverts there is a drop into the main retarding basin area in order to achieve the volume of storage required, approximately 40,000m<sup>3</sup>. The general structure of this storage is as follows –

- Previously proposed offline channel CH02 has now been incorporated into the main storage basin in the form of a low flow channel.
- The first section of low-flow channel leads into a flat area on which the on-line wetlands can be established below the level of the channel gradient. It is envisaged that there will be a general movement of water through the wetland plants, largely driven by the head of incoming waters pushing through this area.
- The wetland may include siltation ponds and deeper ponds as well as shallow treatment areas. All of the wetland will be inundated by flood flows.
- In the design flow for the 1 in 100 year rainfall event, floodwaters will extend to the limits shown on the side of the retarding basin. The basin extends to the full width between the future road reserves to achieve the storage necessary for the contributing internal area of the DCP. The volume of 40,000 m<sup>3</sup> does not include any storage for external catchment inflows which will be allowed to pass through the system via the low flow culverts at the weir embankment.
- Side batters are 1 in 6 up to the proposed 100 year flood level. Batters have been shown on the plans to extend up in a temporary batter of 1 in 3 to match the existing ground surface. Final levels and shape will occur following detailed design of surrounding roads at a future time by others.
- The 100 year flood level is contained within the proposed drainage reserve, acceptable freeboard will need to be provided within the road reserve & to the future allotments.
- The existing drainage channel lies within the outline of the retarding basin and will be superseded by the basin construction.

The main retarding basin at its downstream end will have –

- An embankment through which a low flow multi-celled culvert is required, comprising 6 No 1050mm diameter reinforced concrete pipes and accompanying endwall structures.
- A concrete weir above the embankment to allow for any flows higher than the 1 in 100 year rainfall event to pass over the embankment. Detailed design must include scour protection.

#### 2.5. Outfall

Downstream of the embankment and outside the DCP area, the outflow channel to the Latrobe Road culverts has been identified in location and level. Culverts under the embankment will need to be matched into the outfall channel and some earthworks are required.

Downstream of the match-point the outflow levels have not been altered but some maintenance will be necessary to retain fall in the outflow channel and to manage the current reed infestation for hydraulic conductivity.

For Council and VicRoads information and reference, Latrobe Road has been identified as being overtopped in the 1 in 100 year rainfall event with the existing 3 x 1200mm dia pipe culverts. This matter is outside the scope of the DCP.

## 2.6. Public Open Space

Whilst part of the land previously set aside for unencumbered public open space (“POS”) has been utilised for the required channel into the main retarding basin WR\_02, this also assists in achieving the required storage volume for the retarding basin. The adjacent section of road on the west side of the POS as shown on the DCP plan has also been deleted as this is not required for road connection purposes and similarly assists with the channel entry into the retarding basin and achieving the required storage volume.

Whilst the amount of unencumbered POS has been reduced at this location, in practical terms the remaining unencumbered POS area is now able to link seamlessly with the encumbered eastern land within the retarding basin. This would enable paths to be constructed along and through this area, visiting the future wetland treatment area (a landscape feature) and linking back out to streets further north. Hence this loss of unencumbered space is thought to be an acceptable outcome of this design.

The combined area of this available space is –

- 2185 m<sup>2</sup> unencumbered POS remaining
  - 2665 m<sup>2</sup> former unencumbered POS, now encumbered POS in the retarding basin
  - 1300 m<sup>2</sup> former road reserve now encumbered POS in the retarding basin
  - 4340 m<sup>2</sup> adjacent encumbered land in the retarding basin
- 10,490 m<sup>2</sup> of useable POS (not in flood time)

Similar use of the western sections of the retarding basin with paths could also be made. The available areas are shown on PGA drawing 14166-301-3.

## 3. CHANGE TO NET DEVELOPMENT AREA

Alteration is required to the value of Net Developable Area (“NDA”) on which the DCP apportionment to owners is based. This is due to –

- The need to increase the site area available for Channel No. 1.
- The need to increase available land to achieve the volume of storage required for the main retarding basin and to site the connecting channel from the Gordon Street culverts.

These adjustments are shown in Table 2.

Table 2

NET DEVELOPABLE AREA ADJUSTMENT					
PGA AREA CALCULATION					
ITEM	DESCRIPTION	Total Site Area (ha)	Unencumbered Open Space (ha)	Encumbered Open Space (ha)	Estimated Net Developable Area (Lots + Roads) (ha)
1	Land Budget per DCP	124.12	1.61	10.17	112.34
2	Park land lost to retarding basin		-0.27	0.27	
3	Street reserve lost to retarding basin			0.13	-0.13
4	Drainage encroachment onto Gordon Street, east of English St			0.13	-0.13
5	Drainage encroachment onto land and streets south of channel, east of English Street			0.21	-0.21
6	ADJUSTED TOTALS	124.12	1.34	10.91	111.87

A review could be made of the need to show an additional road reserve crossing over the drainage channel immediately downstream of the constructed wetlands opposite the recreation reserve. If this was to be discontinued this would further reduce the NDA by 0.07ha, effectively increasing the encumbered drainage reserve area by the same amount.

Elements of this review, which could prompt wider change in layout between English Street and the recreation reserve, include –

- The substantial developer cost (not included in the DCP) for a culvert across Channel No. 1. This structure would be of a similar size to the culverts at English Street.



- Whilst the location of the street connection across Channel No. 1 is mid-distance east of English Street, the ultimate southerly destination is still English Street unless there is a connection to and through the recreation reserve.
- The desired access routes to the recreation reserve.
- The effect of drainage channel increase for Channel No. 1 which requires change to road and lot layout on the south side of the channel.

#### 4. CHANGE TO ESTIMATED COSTS

**Appendix 3** identifies the items in the DCP spreadsheet which have changed in cost as a result of the functional design. These are current estimates except for the main retarding basin WR-02 where the new volume of 40,100 has been used with the 2013 rate. The current adjusted 2016 rate for this item should be adopted.

Comments on costs are –

- The required size of the main retarding basin (WR\_02) has increased. As this is for the runoff from the contributing DCP area and not the external catchment the cost is borne by the DCP.
- The cost of the channels has continued to be split between Council (at 67% for external contributing flows) and the DCP (at 33% for contributing internal flows) as this reflects the ratio of contributing areas.
- Because the main retarding basin takes up the whole of the area that is available in between the street network, there is no room for a bypass channel to take the external catchment flows. However part of the size of the outfall culverts at the weir is sized to cater for the through external flows. Notionally the external flows therefore are represented by the top of the water in the retarding basin (i.e. over the top of the stored flows) as part of the 1 in 100 year flood height and these flows pass through the outfall culverts in the weir embankment.
- The cost for the outlet culverts identified as CV\_03, which are through the weir embankment, has been split 67%:33% in the same way as for channels. These culverts did not appear in the earlier DCP schedule.
- As the location of those outlet culverts cannot be maintained as the existing outfall channel location, the cost of the section of outfall channel downstream of the weir has been split 67%:33%.
- In the same way as for channels, the cost of culverts at English Street and Gordon Street has been split 67%:33%.

#### 5. CONCLUSIONS

The Functional Plans developed by PGA in conjunction with modelling carried out by Water Technology provide the basis for Latrobe City Council to confidently assess and control development activities in a coordinated way along the line of the main drainage corridor within the Morwell North Development Plan area.

Longitudinal sections show that grades on the channels and main retarding basin are relatively flat in the lower reaches of the main drainage corridor. This means that there is little room to move with levels in detailed design and that the control provided by these Functional Plans needs to be maintained and coordinated through the detailed designs developed by others for individual developments or for final design of drainage facilities necessary for the DCP area.

Council will need to identify a strategy to achieve the construction of the channels and main retarding basin as these are located on private land in fragmented ownership.

Changes to costs and Net Developable areas will need to be made to the DCP schedules as identified.



*Managing Director*  
*Paroissien Grant and Associates Pty Ltd*

**APPENDIX 1 – SITE CONTEXT PLAN**

SITE CONTEXT NOTES – MORWELL NORTH WEST DCP DRAINAGE

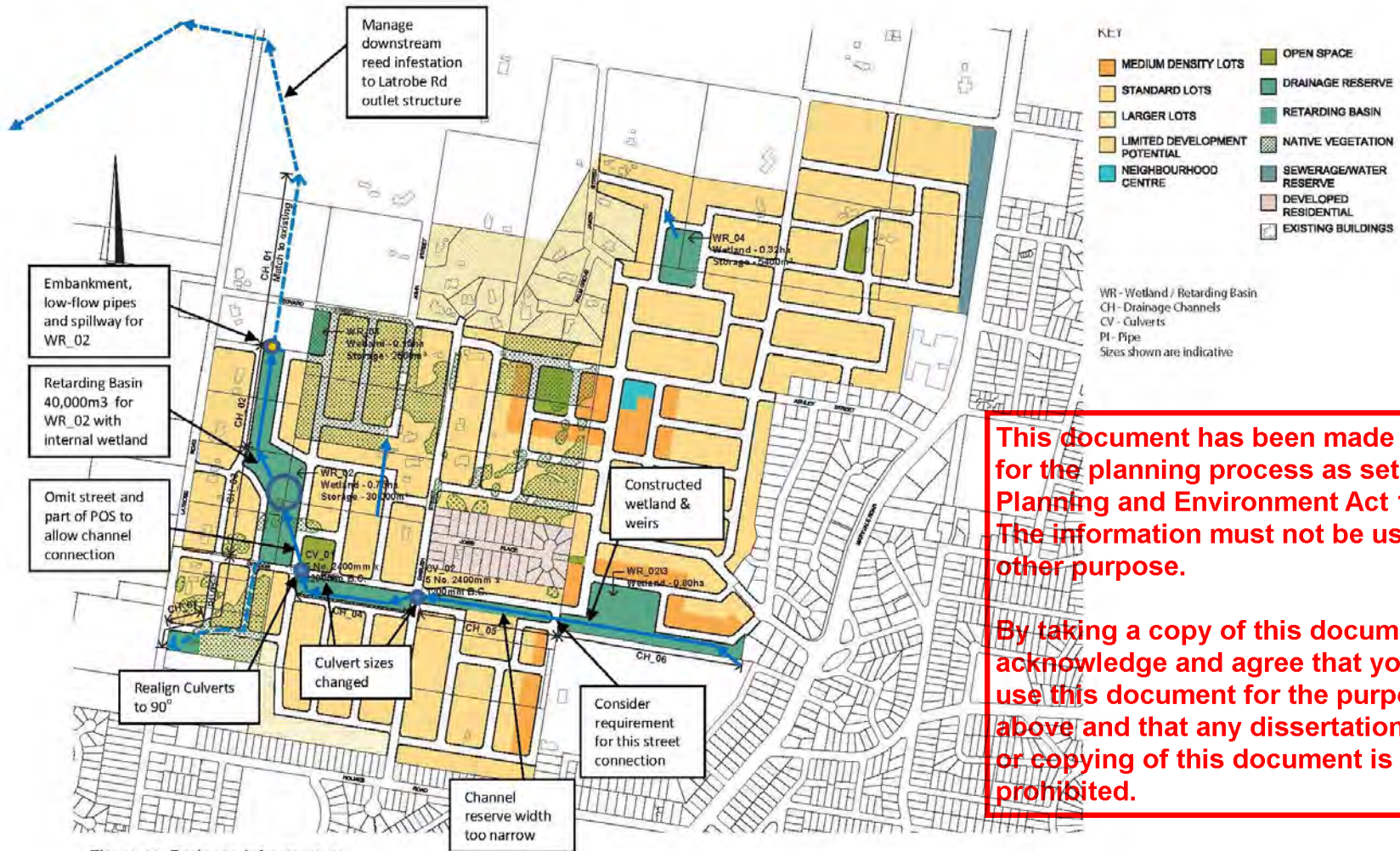


Figure 13: Drainage Infrastructure

**This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.**

**By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissertation, distribution or copying of this document is strictly prohibited.**

**APPENDIX 2 – SITE PHOTOS**



**This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.**

**By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissertation, distribution or copying of this document is strictly prohibited.**

### APPENDIX 3 – CHANGES IN DRAINAGE COSTS


#### MORWELL NORTH-WEST DEVELOPMENT PLAN

Table 3 - DEVELOPER CONTRIBUTIONS SCHEDULE - PROJECT CATEGORIES THAT HAVE CHANGED IN COST DUE TO FUNCTIONAL DESIGN 2016

Project Item	Project Category	Project Description	Estimated Project Cost April 2016				Estimated External Use %	Main Catchment Area Use % (6)	Main Catchment Area Contribution \$
			Quantity	Unit	Rate	Estimated Cost			
<b>DR</b>	<b>Drainage</b>								
<b>WR</b>	<b>Wetlands/ Retarding Basin</b>								
	WR_02 North of Gordon Street.	Treatment area approx 0.75ha. Typical profile as per DP fig 4		No change					
		Retardation storage approx 40,000cbm	40000	cbm	\$47	\$1,867,627	0%	100%	\$1,867,627
<b>CH</b>	<b>Drainage Channels</b>								
	CH_01 Outfall channel - match to existing north of DP area.	Channel Section A-A Refer PGA Typical Cross Sections Plan 14166-304. Assume match to existing 100m downstream. Cut Volume 1357m3.	1357	cbm	\$15	\$20,860	67%	33%	\$6,829.10
	CH_03 Low Flow Conveyance Channel through Basin WR02. Inlet and Outlet from Wetland.	Channel Section E-E Low Flow Channel. Refer PGA Typical Cross Sections Plan 14166-304. 10m wide, 1m deep, 320m long.	1750	cbm	\$15	\$26,901	67%	33%	\$8,806.88
	CH_04 Between Gordon Street and English Street (PGA Channel Section 2)	Channel Section G-G Refer PGA Typical Cross Sections Plan 14166-304. Cut Volume 18,520m3.	18520	cbm	\$15	\$284,689	67%	33%	\$93,201.90
	CH_05 East of English Street (PGA Channel Section 1)	Channel Section H-H Refer PGA Typical Cross Sections Plan 14166-304. Cut Volume 24,247m3. Fill Volume 1,042m3	24247	cbm	\$15	\$372,725	67%	33%	\$122,023.03
<b>CV</b>	<b>Culverts under existing Roads</b>								
	CV_01 At Gordon Street (Crossing No.2)	1No. 2400mm x 1200mm & 1No. 1200mm x 1200mm box culverts, allow 25Lm	1	Each	\$721,254	\$721,254	67%	33%	\$236,124.90
	CV_02 At English Street (Crossing No.1)	5No. 2400mm x 1200mm box culverts, allow 20Lm	1	Each	\$852,105	\$852,105	67%	33%	\$278,962.84
	CV_03 WR02 Outlet Culvert and Weir Structure	6No. 1050mm RCP, allow 14Lm	1	Each	\$172,166	\$172,166	67%	33%	\$56,364.00
Total Estimated Cost for the above items						\$4,318,327			\$2,669,939

#### Notes

- 1 Drainage infrastructure costs include 20% contingency allowance, 15% survey, design and project management, 3.25% Council plan checking & supervision fees.
- 2 Drainage Channels includes allowance for pilot channel rock work and aquatic planting.
- 3 The proposed drainage channels and road culverts will cater for an external catchment of 226ha and a Development Plan catchment of 100ha.
- 4 Costs exclude GST

Version: 3 (updated by PGA 09/06/2016)  
 PGA Amendments to DCP table.

**This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.**

**By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissertation, distribution or copying of this document is strictly prohibited.**



**APPENDIX 4 – FUNCTIONAL LAYOUT PLANS**

Refer to the drawing set.

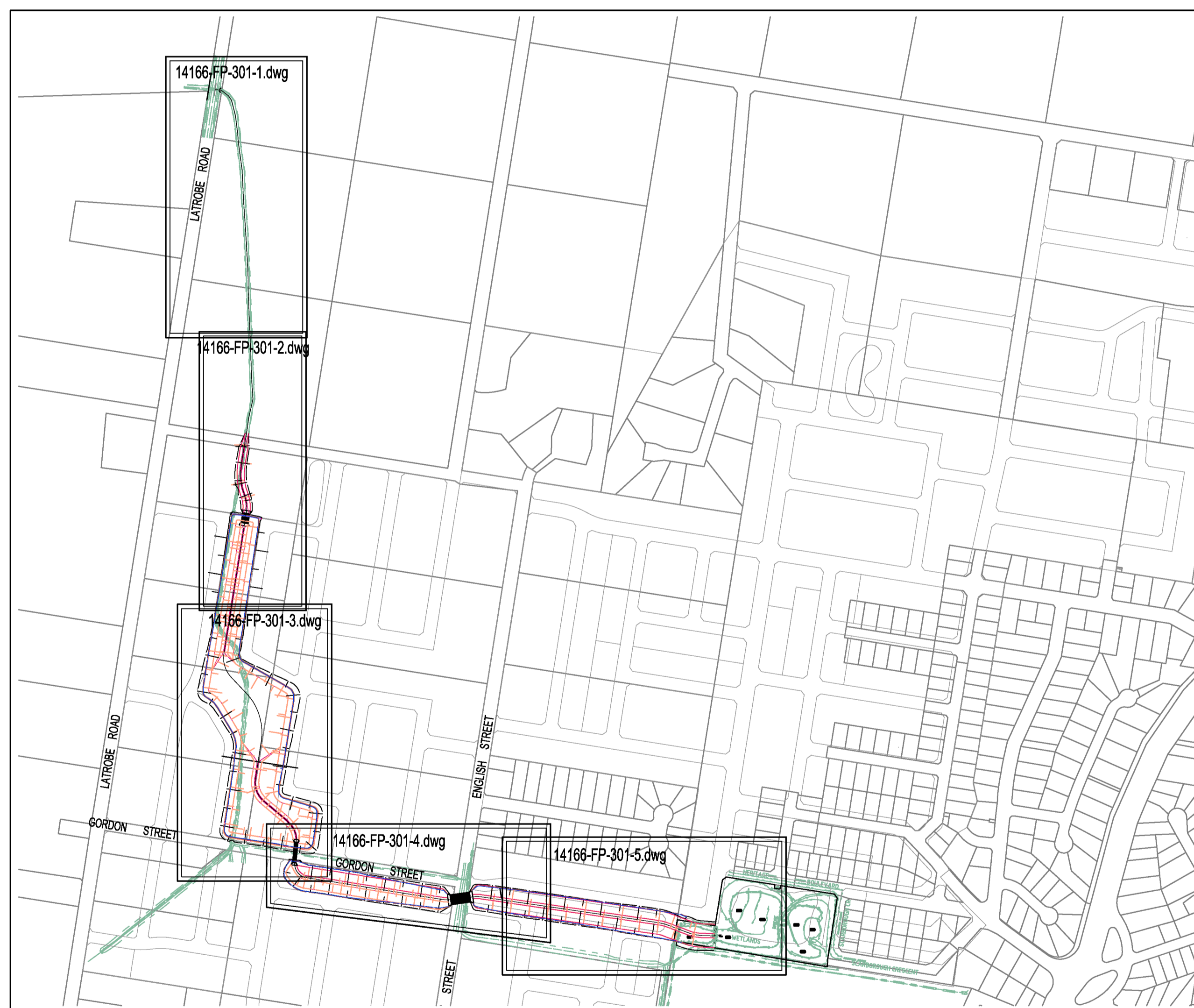
**This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.**

**By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissemination, distribution or copying of this document is strictly prohibited.**

# MORWELL NORTH-WEST DRAINAGE REVIEW FUNCTIONAL LAYOUT DRAWINGS

This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.

By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissemination, distribution or copying of this document is strictly prohibited.

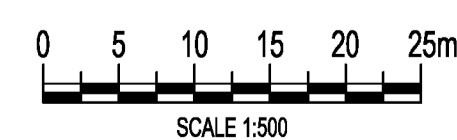
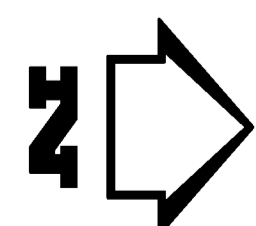


## DRAWING INDEX

14166 - FP-300	LOCALITY PLAN & DRAWING INDEX
14166 - FP- 301-1	LAYOUT PLAN - SHEET 1 OF 5
14166 - FP- 301-2	LAYOUT PLAN - SHEET 2 OF 5
14166 - FP- 301-3	LAYOUT PLAN - SHEET 3 OF 5
14166 - FP- 301-4	LAYOUT PLAN - SHEET 4 OF 5
14166 - FP- 301-5	LAYOUT PLAN - SHEET 5 OF 5
14166 - FP- 303-1	LONGITUDINAL SECTION - LOW FLOW CHANNEL - SHEET 1 OF 3
14166 - FP- 303-2	LONGITUDINAL SECTION - LOW FLOW CHANNEL - SHEET 2 OF 3
14166 - FP- 303-3	LONGITUDINAL SECTION - LOW FLOW CHANNEL - SHEET 3 OF 3
14166 - FP -304	TYPICAL CROSS SECTIONS

PRELIMINARY  
NOT FOR CONSTRUCTION

REV	DESCRIPTION	CHECKED	APPROVED	DATE
0	PRELIMINARY ISSUE-NOT FOR CONSTRUCTION			20.04.2016



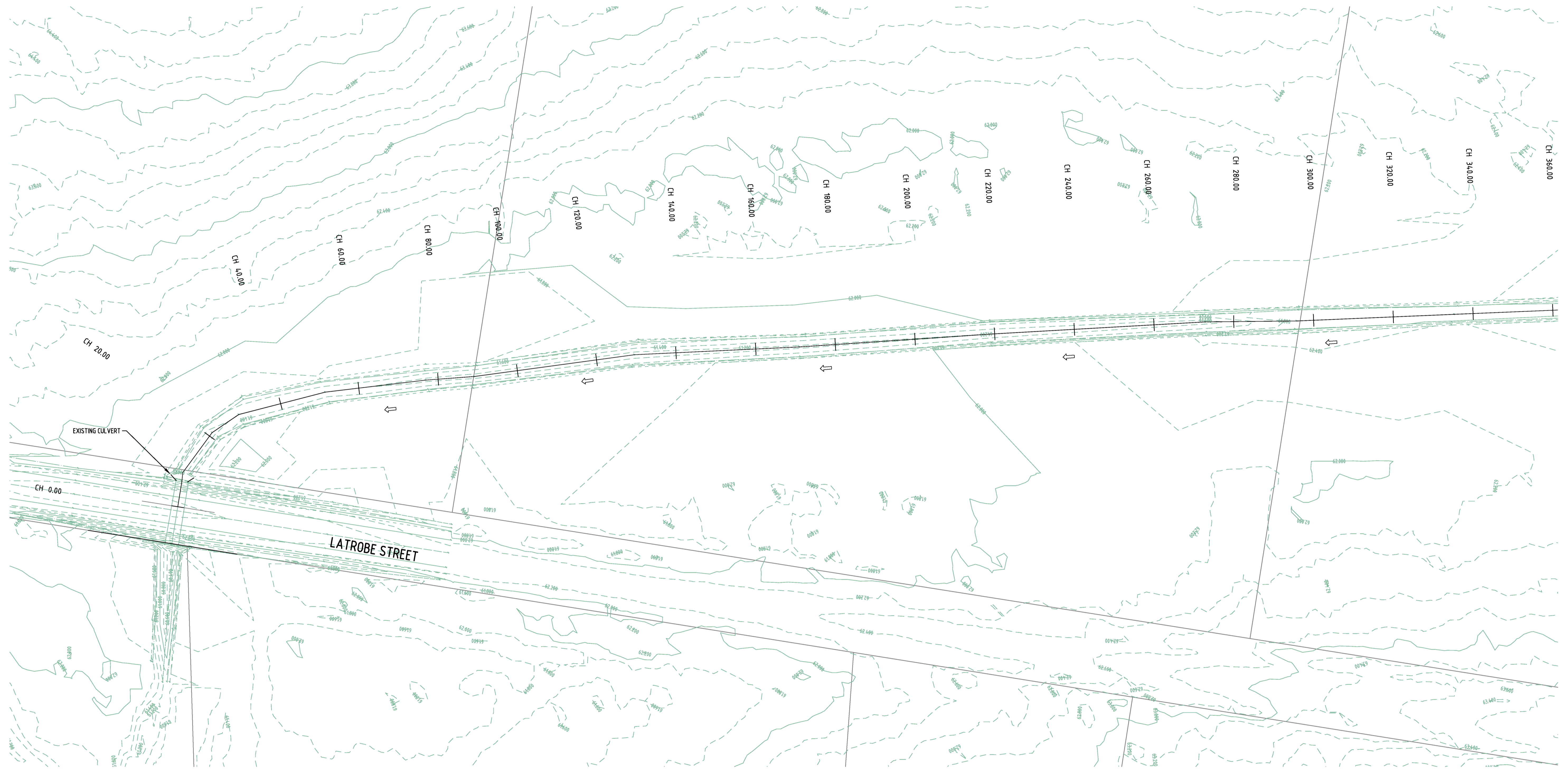
DESIGNED BY:	DESIGNED BY:
APPROVED FOR CONSTRUCTION BY:	APPROVED FOR CONSTRUCTION BY:
DRAWN DATE: MAR 2016	DRAWN DATE: -
SURVEY BY:	SURVEY BY:
APPROVED DATE:	APPROVED DATE:

**PGA** Paroissien Grant & Associates Pty. Ltd.  
Consulting Engineers & Surveyors  
ABN 53 123 888 326

MORWELL NORTH-WEST DRAINAGE REVIEW  
LATROBE CITY COUNCIL

LOCALITY PLAN & DRAWING INDEX

SCALE @ A1:	1:500	DRAWING NO.:	14166-300	REV:	0
-------------	-------	--------------	-----------	------	---



FOR CONTINUATION REFER TO DRAWING 14166-301-2

**LEGEND**

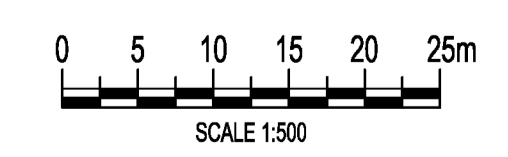
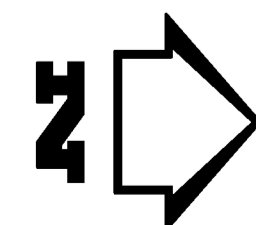
EARTHWORKS - CUT 1:3 BATTER		BASIN/WETLAND BOUNDARY	
EARTHWORKS - FILL 1:3 BATTER		PROPOSED 100YR FLOOD LEVEL	
WETLAND AREA		PROPOSED 300MM FREEBOARD	
ROCK BEACHING		ROAD RESERVE BOUNDARY	



This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.

By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissertation, distribution or copying of this document is strictly prohibited.

**PRELIMINARY  
NOT FOR CONSTRUCTION**

REV	DESCRIPTION	CHECKED	APPROVED	DATE
1	PRELIMINARY ISSUE-ADDRESSING COUNCIL COMMENTS			18.01.2016
0	PRELIMINARY ISSUE-NOT FOR CONSTRUCTION			



DRAWN BY: 	DRAWN DATE: MAR 2016
DESIGNED BY: 	SURVEY BY: -
APPROVED FOR CONSTRUCTION BY: -	APPROVED DATE: -

**PGA** Paroissien Grant & Associates Pty. Ltd.  
Consulting Engineers & Surveyors  
ABN 53 123 888 326

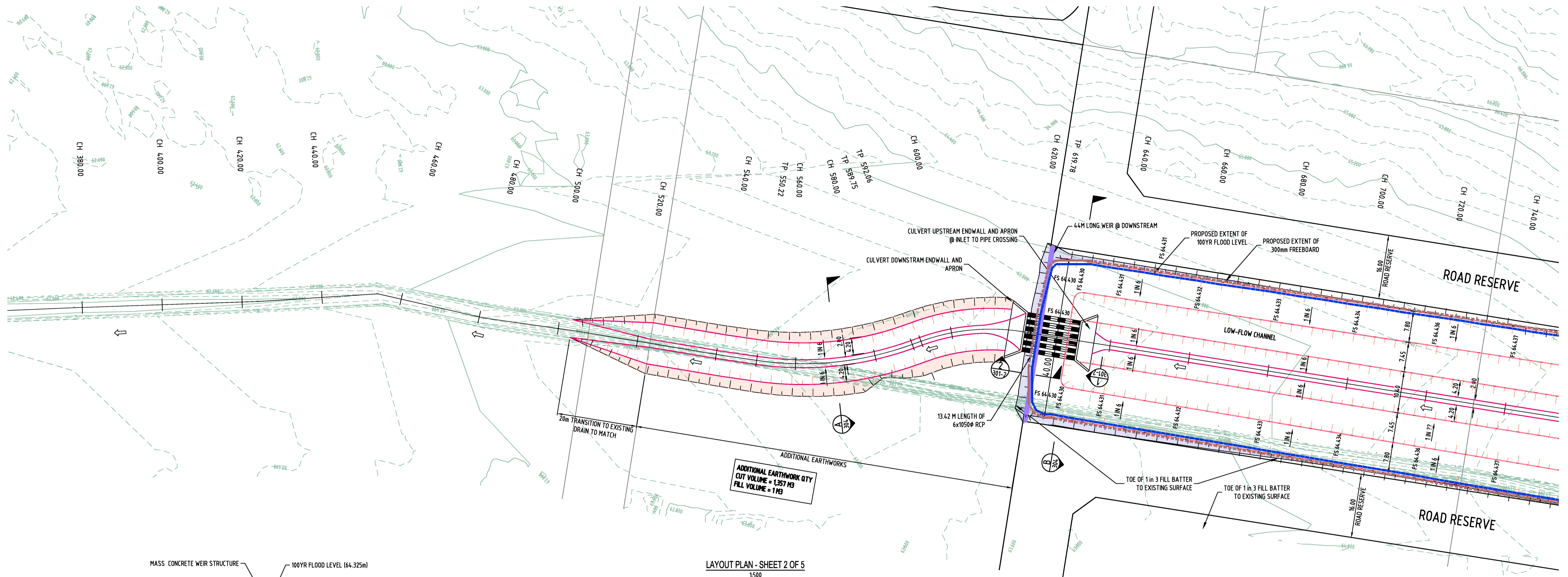
**MORWELL NORTH-WEST DRAINAGE REVIEW**  
LATROBE CITY COUNCIL

LAYOUT PLAN - SHEET 1 OF 5

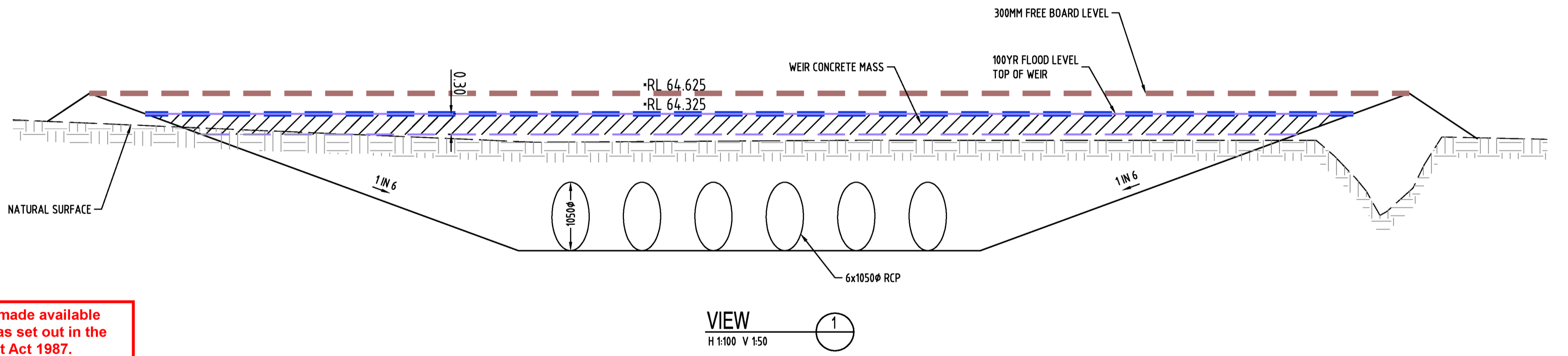
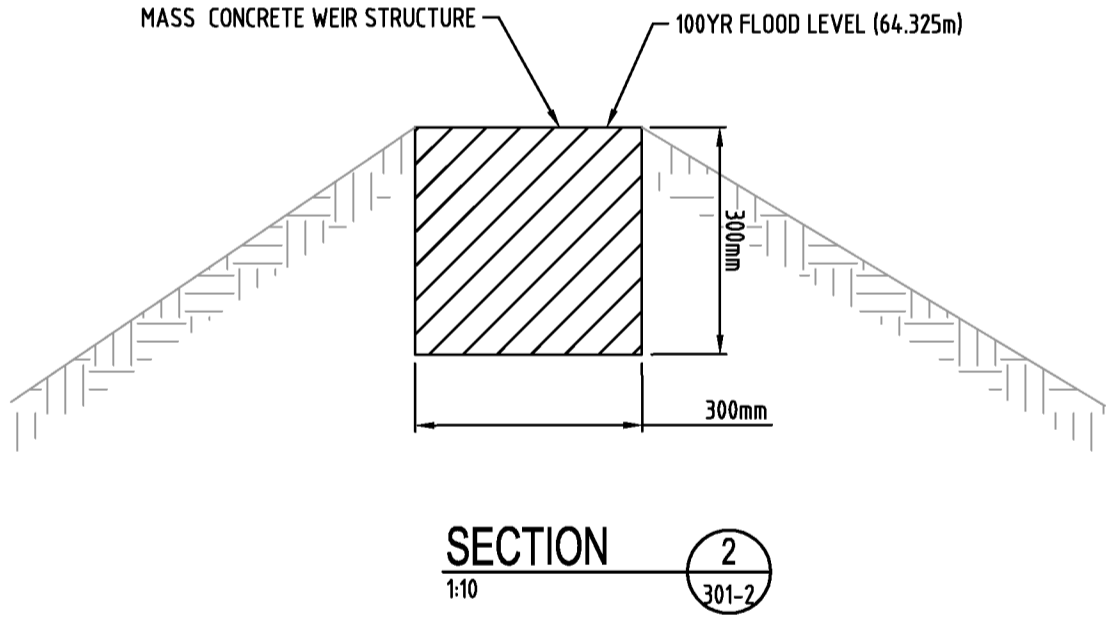
SCALE @ A1: 1:500	WATER TECHNOLOGY DRAWING NO: 14166-301-1	REV: 1
----------------------	--	-----------

CONTINUED FROM DRAWING 14-166-301-1

FOR CONTINUATION REFER TO DRAWING 14-166-301-3



LAYOUT PLAN - SHEET 2 OF 5  
1:500



**LEGEND**

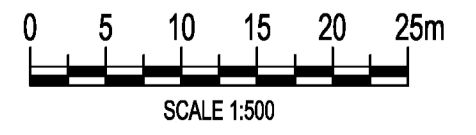
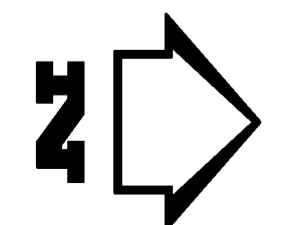
EARTHWORKS - CUT 1:3 BATTER		BASIN/WETLAND BOUNDARY	
EARTHWORKS - FILL 1:3 BATTER		PROPOSED 100YR FLOOD LEVEL	
WETLAND AREA		PROPOSED 300MM FREEBOARD	
PARK AREA		ROAD RESERVE BOUNDARY	
ROCK BEACHING			
WEIR CONCRETE MASS			

This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.

By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissertation, distribution or copying of this document is strictly prohibited.

PRELIMINARY  
NOT FOR CONSTRUCTION

REV	DESCRIPTION	CHECKED	APPROVED	DATE
2	PRELIMINARY ISSUE - ADDRESSING FLOOD MODELLING ADJENMENTS BY W.T.			01.04.2016
1	PRELIMINARY ISSUE-ADDRESSING COUNCIL COMMENTS			18.01.2016
0	PRELIMINARY ISSUE-NOT FOR CONSTRUCTION			



DRAWN BY:	DRAWN DATE:
DESIGNED BY:	SURVEY BY:
APPROVED FOR CONSTRUCTION BY:	APPROVED DATE:

**PGA** Paroissien Grant & Associates Pty. Ltd.  
Consulting Engineers & Surveyors  
ABN 53 123 888 326

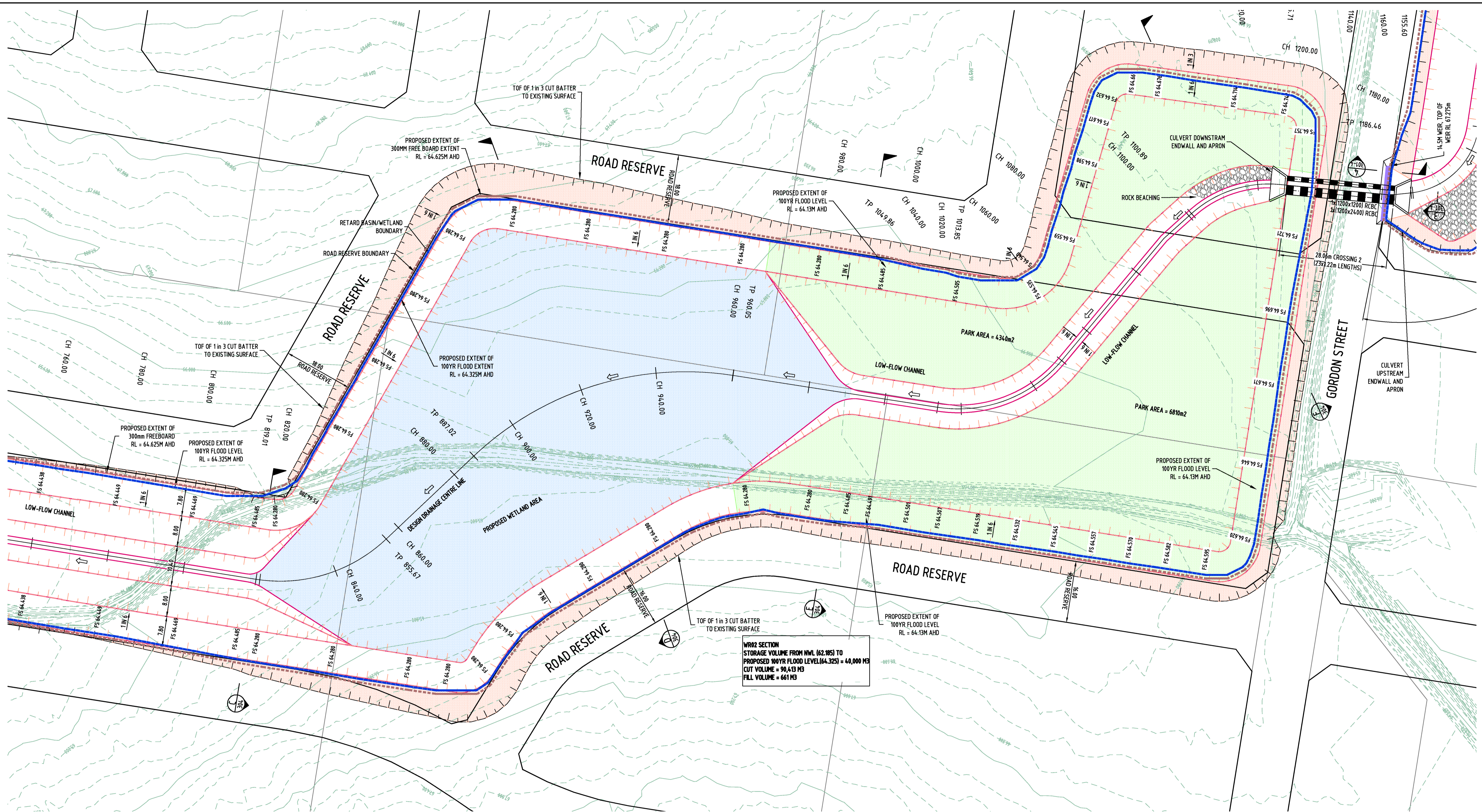
**MORWELL NORTH-WEST DRAINAGE REVIEW**  
LATROBE CITY COUNCIL  
LAYOUT PLAN - SHEET 2 OF 5

SCALE @ A1:	1:500	WATER TECHNOLOGY	DRAWING NO.:	14166-301-2	REV:	2
-------------	-------	------------------	--------------	-------------	------	---



CONTINUED FROM DRAWING 14-166-301-2

FOR CONTINUATION REFER TO DRAWING 14-166-301-4



**LEGEND**

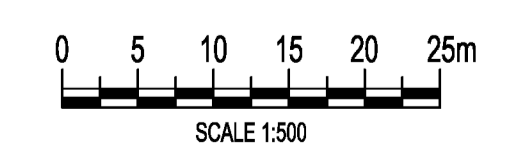
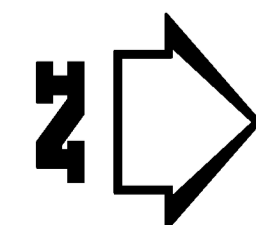
- EARTHWORKS - CUT 1:3 BATTER
- EARTHWORKS - FILL 1:3 BATTER
- WETLAND AREA
- PARK AREA
- ROCK BEACHING
- WEIR CONCRETE MASS
- BASIN/WETLAND BOUNDARY
- PROPOSED 100YR FLOOD LEVEL
- PROPOSED 300MM FREEBOARD
- ROAD RESERVE BOUNDARY

This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.

By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissemination, distribution or copying of this document is strictly prohibited.

WRR2 SECTION  
STORAGE VOLUME FROM MWL (62.185) TO  
PROPOSED 100YR FLOOD LEVEL (64.325) = 40,000 M<sup>3</sup>  
CUT VOLUME = 90,413 M<sup>3</sup>  
FILL VOLUME = 661 M<sup>3</sup>

REV	DESCRIPTION	CHECKED	APPROVED	DATE
3	PRELIMINARY ISSUE - AREAS ADDED			15.04.2016
2	PRELIMINARY ISSUE - ADDRESSING FLOOD MODELLING ADJENMENTS BY W.T.			01.04.2016
1	PRELIMINARY ISSUE-ADDRESSING COUNCIL COMMENTS			18.01.2016
0	PRELIMINARY ISSUE-NOT FOR CONSTRUCTION			



DRAWN BY:	DRAWN DATE:
DESIGNED BY:	SURVEY BY:
APPROVED FOR CONSTRUCTION BY:	APPROVED DATE:

**PGA** Paroissien Grant & Associates Pty. Ltd.  
Consulting Engineers & Surveyors  
ABN 53 123 888 326

MAR 2016

**MORWELL NORTH-WEST DRAINAGE REVIEW**  
LATROBE CITY COUNCIL

LAYOUT PLAN - SHEET 3 OF 5

SCALE @ A1: 1:500

WATER TECHNOLOGY

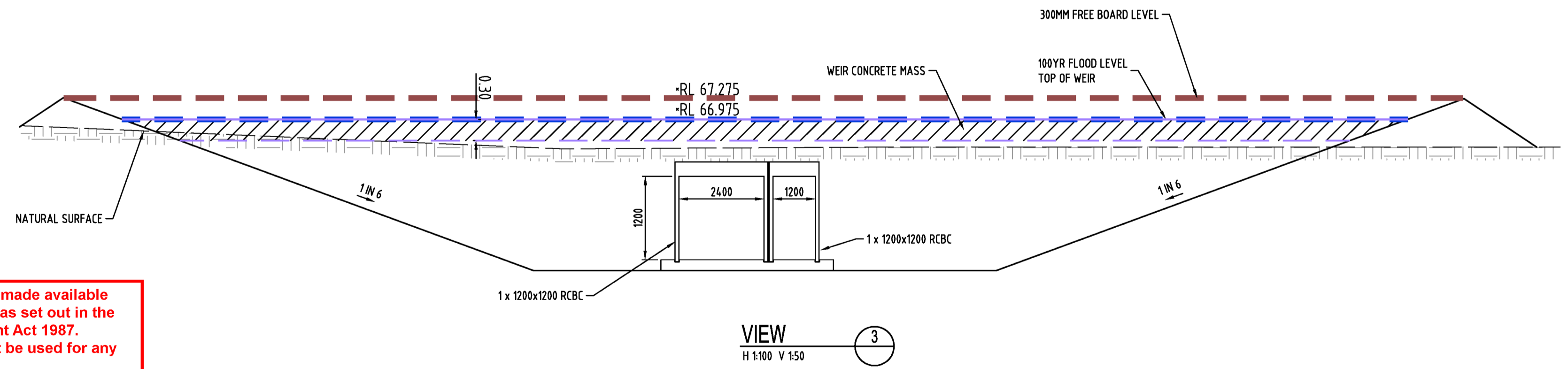
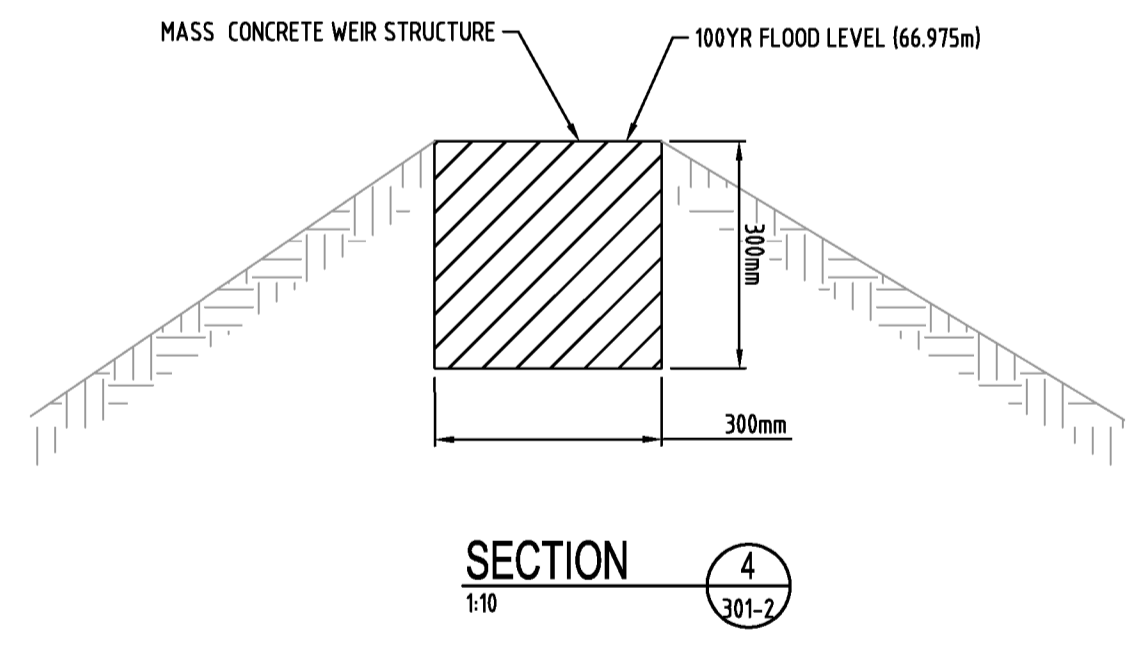
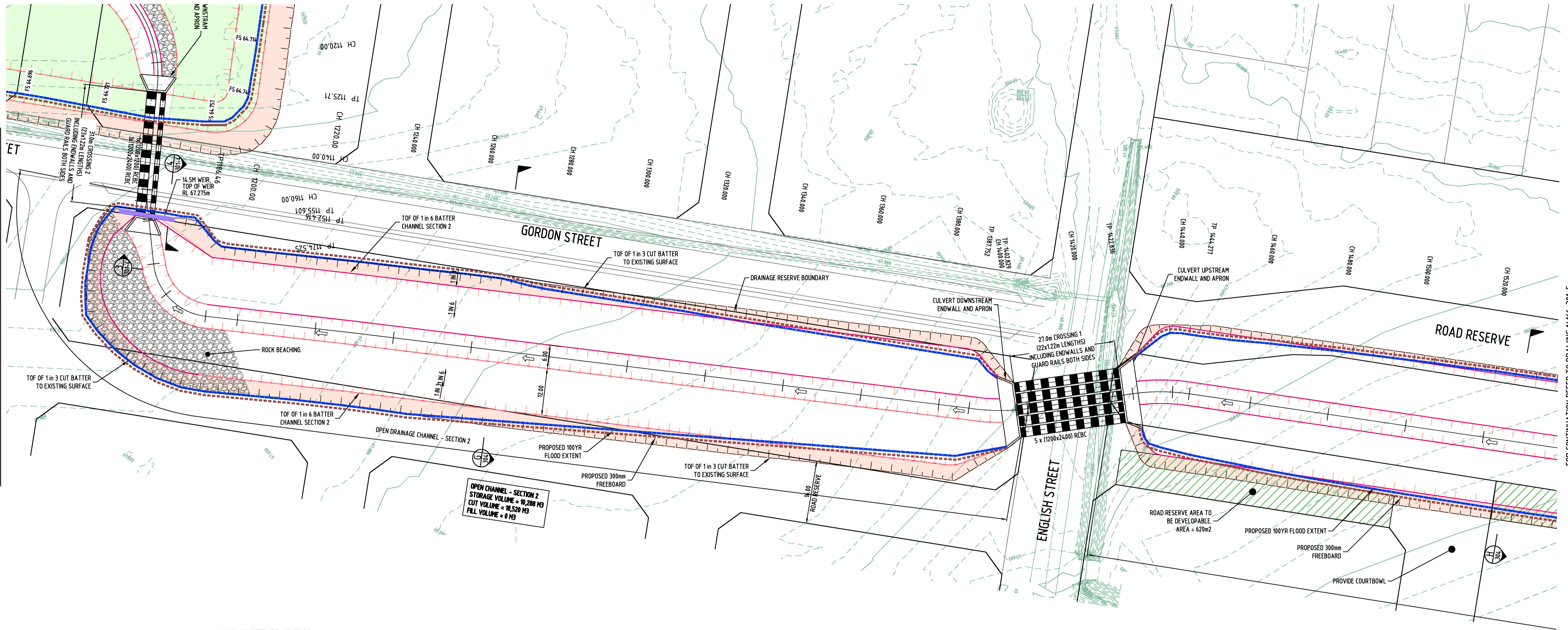
DRAWING NO.: 14166-301-3

REV: 3

**PRELIMINARY**  
NOT FOR CONSTRUCTION

CONTINUED FROM DRAWING 14166-301-3

FOR CONTINUATION REFER TO DRAWING 14166-301-5



**LEGEND**

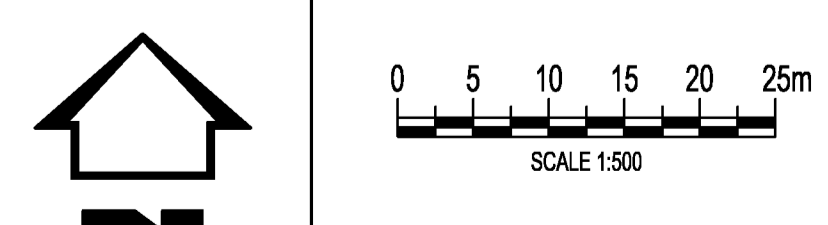
EARTHWORKS - CUT 1:3 BATTER		BASIN/WETLAND BOUNDARY	
EARTHWORKS - FILL 1:3 BATTER		PROPOSED 100YR FLOOD LEVEL	
WETLAND AREA		PROPOSED 300MM FREEBOARD	
PARK AREA		ROAD RESERVE BOUNDARY	
ROCK BEACHING			
WEIR CONCRETE MASS			

This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.

By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissertation, distribution or copying of this document is strictly prohibited.

**PRELIMINARY**  
NOT FOR CONSTRUCTION

REV	DESCRIPTION	CHECKED	APPROVED	DATE
4	PRELIMINARY ISSUE - CHANNEL ALIGNMENT AMENDED			09.06.2016
3	PRELIMINARY ISSUE - AREAS ADDED			15.04.2016
2	PRELIMINARY ISSUE - ADDRESSING FLOOD MODELLING ADJNMENTS BY W.T.			01.04.2016
1	PRELIMINARY ISSUE - ADDRESSING COUNCIL COMMENTS			18.01.2016
0	PRELIMINARY ISSUE - NOT FOR CONSTRUCTION			



DRAWN BY:	DRAWN DATE:
DESIGNED BY:	SURVEY BY:
APPROVED FOR CONSTRUCTION BY:	APPROVED DATE:

**PGA** Paroissien Grant & Associates Pty. Ltd.  
Consulting Engineers & Surveyors  
ABN 53 123 888 326



**MORWELL NORTH-WEST DRAINAGE REVIEW**  
LATROBE CITY COUNCIL  
LAYOUT PLAN - SHEET 4 OF 5

SCALE @ A1:	1:500	DRAWING No.:	14166-301-4	REV:	4
-------------	-------	--------------	-------------	------	---

CONTINUED FROM DRAWING 14.166-301-4



**LEGEND**

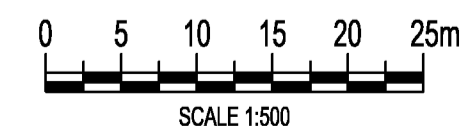
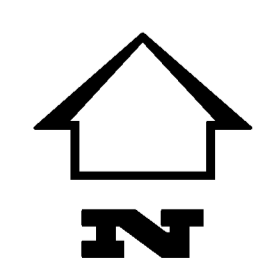
EARTHWORKS - CUT 1:3 BATTER		BASIN/WETLAND BOUNDARY	
EARTHWORKS - FILL 1:3 BATTER		PROPOSED 100YR FLOOD LEVEL	
WETLAND AREA		PROPOSED 300MM FREEBOARD	
ROCK BEACHING		ROAD RESERVE BOUNDARY	

This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.

By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissertation, distribution or copying of this document is strictly prohibited.

**PRELIMINARY  
NOT FOR CONSTRUCTION**

REV	DESCRIPTION	CHECKED	APPROVED	DATE
3	PRELIMINARY ISSUE - AREAS ADDED			15.04.2016
2	PRELIMINARY ISSUE - ADDRESSING FLOOD MODELLING ADJNMENTS BY W.T.			01.04.2016
1	PRELIMINARY ISSUE-ADDRESSING COUNCIL COMMENTS			18.01.2016
0	PRELIMINARY ISSUE-NOT FOR CONSTRUCTION			

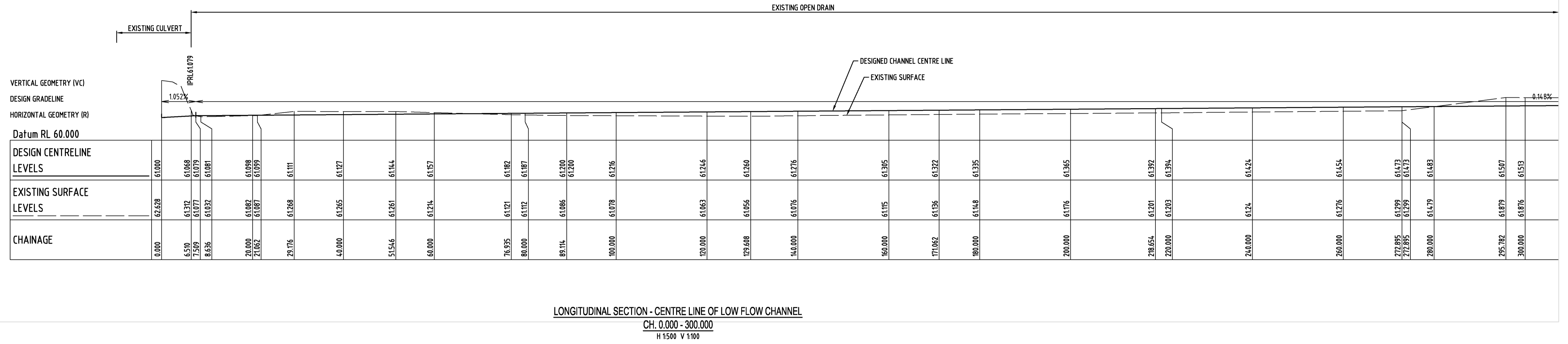


DRAWN BY:	DESIGNED BY:	APPROVED FOR CONSTRUCTION BY:
[Redacted]	[Redacted]	[Redacted]
DRAWN DATE:	SURVEY BY:	APPROVED DATE:
MAR 2016	-	-

**PGA** Paroissien Grant & Associates Pty. Ltd.  
Consulting Engineers & Surveyors  
ABN 53 123 888 326

**MORWELL NORTH-WEST DRAINAGE REVIEW**  
LATROBE CITY COUNCIL  
LAYOUT PLAN - SHEET 5 OF 5

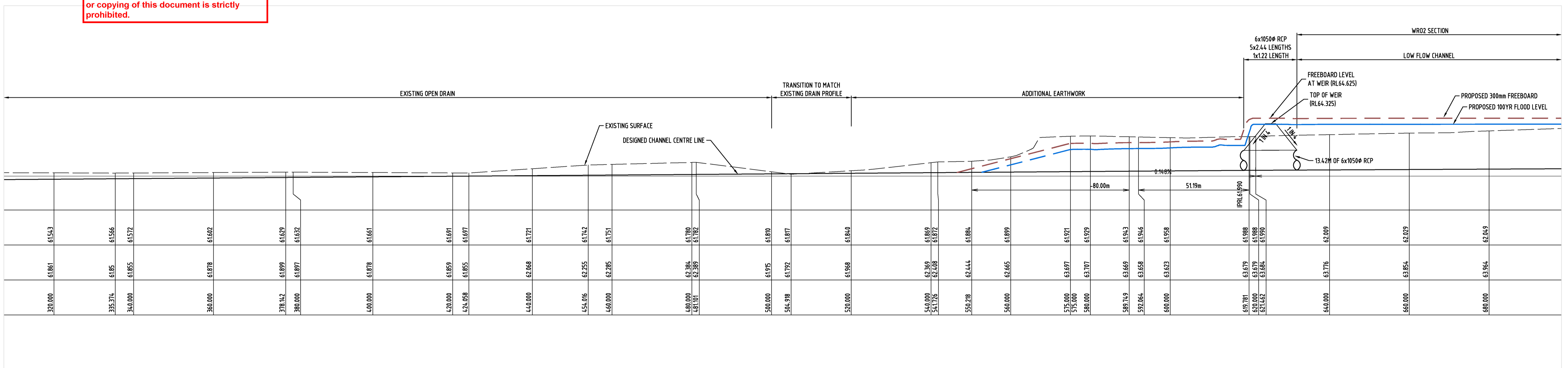
SCALE @ A1:	1:500	DRAWING NO.:	14166-301-5	REV:	3
-------------	-------	--------------	-------------	------	---



LONGITUDINAL SECTION - CENTRE LINE OF LOW FLOW CHANNEL  
CH. 0.000 - 300.000  
H 1:500 V 1:100

This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.

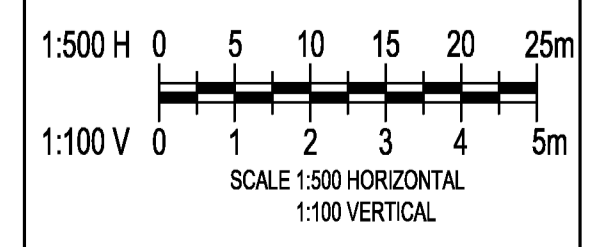
By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissertation, distribution or copying of this document is strictly prohibited.



LONGITUDINAL SECTION - CENTRE LINE OF LOW FLOW CHANNEL  
CH. 320.000 - 680.000  
H 1:500 V 1:100

**LEGEND**

TOP OF EXTENDED DETENTION	
PROPOSED 100YR FLOOD LEVEL	
PROPOSED 300MM FREEBOARD	



DRAWN BY:	DRAWN DATE:
DESIGNED BY:	MAR 2016
SURVEY BY:	
APPROVED FOR CONSTRUCTION BY:	APPROVED DATE:

**PGA** Paroissien Grant & Associates Pty. Ltd.  
Consulting Engineers & Surveyors  
ABN 53 123 888 326

**MORWELL NORTH-WEST DRAINAGE REVIEW**  
LATROBE CITY COUNCIL  
LONGITUDINAL SECTION - CENTRE LINE OF LOW FLOW CHANNEL  
SHEET 1 OF 3

SCALE @ A1:	H 1:500 V 1:100	DRAWING NO.:	14166-303-1	REV:	2
-------------	-----------------	--------------	-------------	------	---

CONTINUED FROM ABOVE

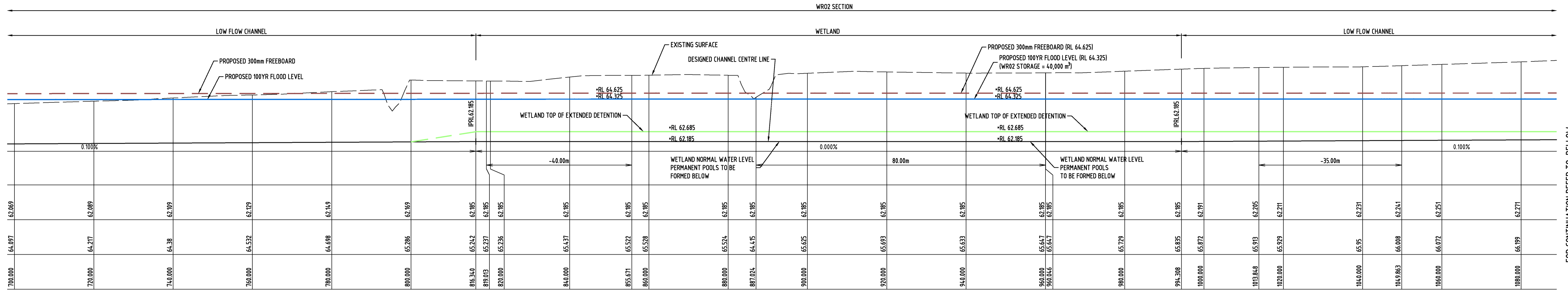
FOR CONTINUATION REFER TO DRAWING 14-166-303-2

FOR CONTINUATION REFER TO BELOW

**PRELIMINARY**  
NOT FOR CONSTRUCTION

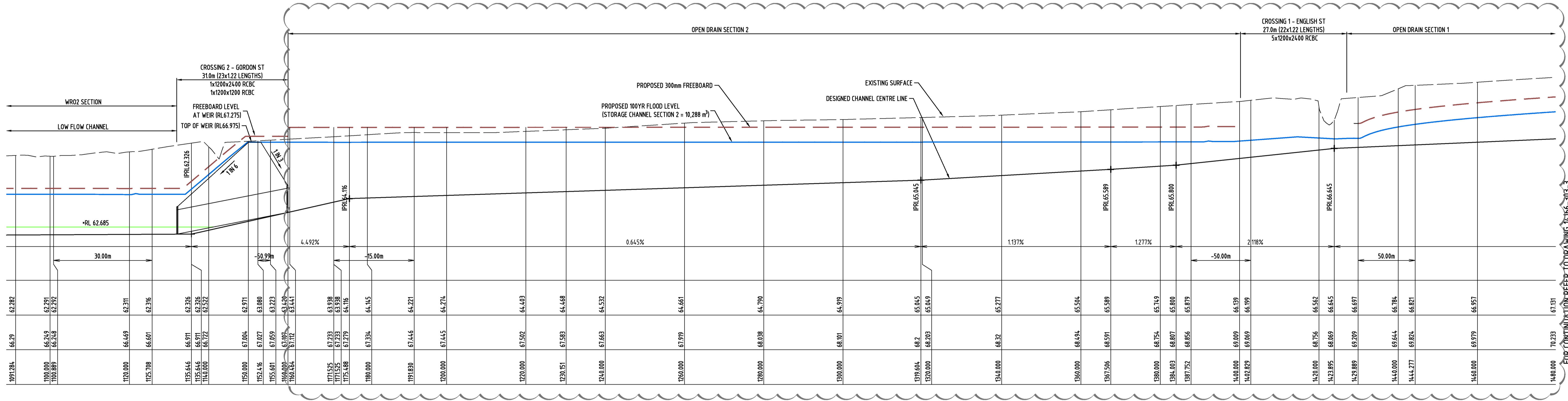
REV	DESCRIPTION	CHECKED	APPROVED	DATE
2	PRELIMINARY ISSUE - ADDRESSING FLOOD MODELLING ADJENMENTS BY W.T.			01.04.2016
1	PRELIMINARY ISSUE-ADDRESSING COUNCIL COMMENTS			18.01.2016
0	PRELIMINARY ISSUE-NOT FOR CONSTRUCTION			-

CONTINUED FROM DRAWING 14166-303-1



LONGITUDINAL SECTION - CENTRE LINE OF LOW FLOW CHANNEL  
CH. 700.000 - 1080.000  
H 1500 V 1:100

CONTINUED FROM ABOVE



LONGITUDINAL SECTION - CENTRE LINE OF LOW FLOW CHANNEL  
CH. 1091.000 - 1480.000  
H 1500 V 1:100

LEGEND

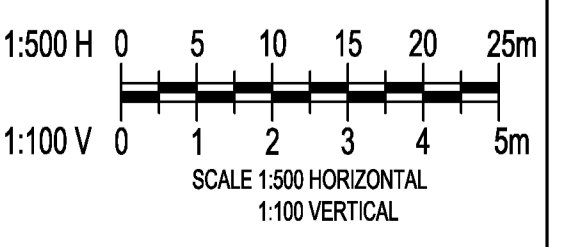
- TOP OF EXTENDED DETENTION
- PROPOSED 100YR FLOOD LEVEL
- PROPOSED 300MM FREEBOARD

This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.

By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissertation, distribution or copying of this document is strictly prohibited.

PRELIMINARY NOT FOR CONSTRUCTION

REV	DESCRIPTION	CHECKED	APPROVED	DATE
3	PRELIMINARY ISSUE - CHANNEL ALIGNMENT AMENDED SECTION UPDATED			09.06.2016
2	PRELIMINARY ISSUE - ADDRESSING FLOOD MODELLING ADJUSTMENTS BY W.T.			01.04.2016
1	PRELIMINARY ISSUE-ADDRESSING COUNCIL COMMENTS			18.01.2016
0	PRELIMINARY ISSUE - NOT FOR CONSTRUCTION			

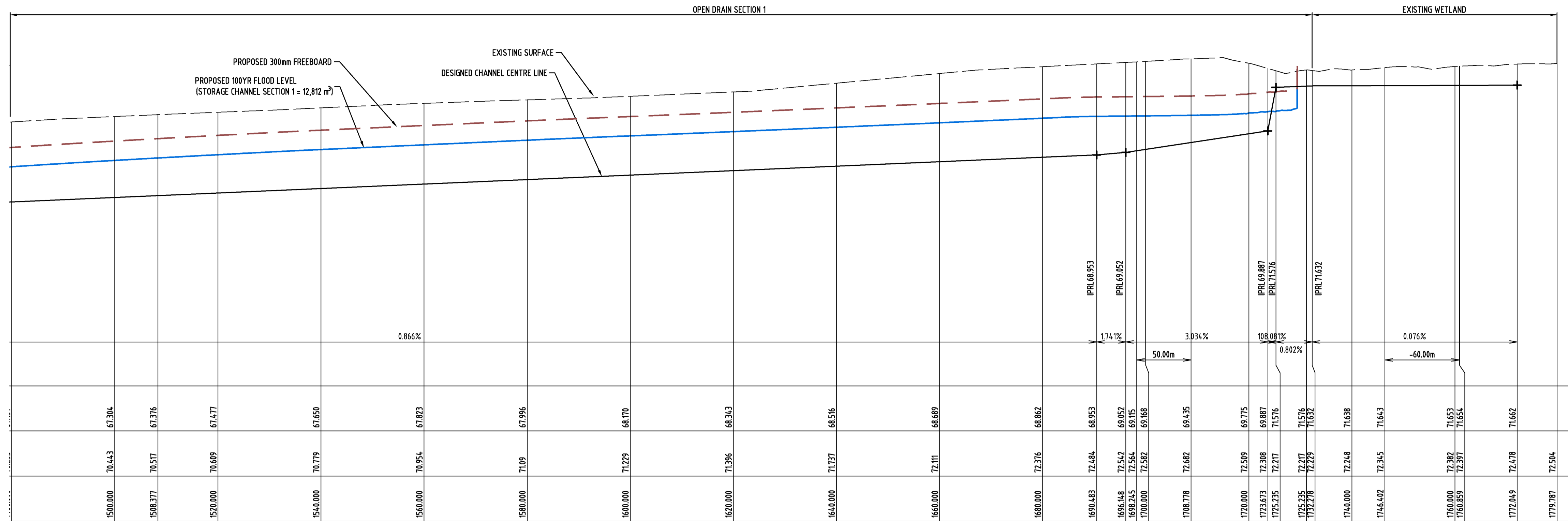


DESIGNED BY:	DRAWN DATE:
DESIGNED BY:	MAR 2016
APPROVED FOR CONSTRUCTION BY:	SURVEY BY:
	APPROVED DATE:

**PGA** Paroissien Grant & Associates Pty. Ltd.  
Consulting Engineers & Surveyors  
ABN 53 123 888 326

MORWELL NORTH-WEST DRAINAGE REVIEW  
LATROBE CITY COUNCIL  
LONGITUDINAL SECTION - CENTRE LINE OF LOW FLOW CHANNEL  
SHEET 2 OF 3

FOR CONTINUATION REFER TO DRAWING 14166-303-2



LONGITUDINAL SECTION - CENTRE LINE OF LOW FLOW CHANNEL  
 CH. 1500.000 - 1772.049  
 H 1:500 V 1:100

This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.

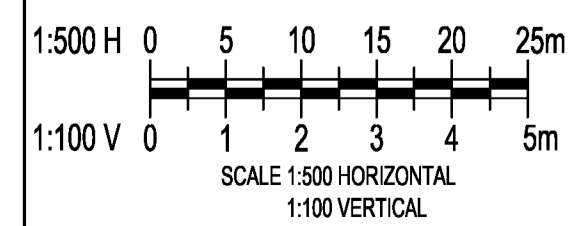
By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissemination, distribution or copying of this document is strictly prohibited.

**LEGEND**

- TOP OF EXTENDED DETENTION
- PROPOSED 100YR FLOOD LEVEL
- PROPOSED 300MM FREEBOARD

**PRELIMINARY  
NOT FOR CONSTRUCTION**

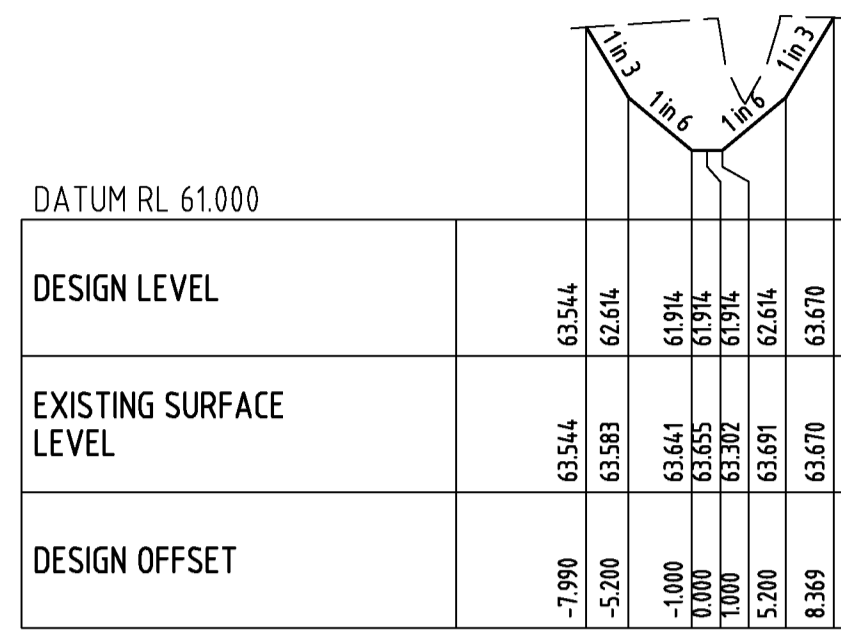
REV	DESCRIPTION	CHECKED	APPROVED	DATE
3	PRELIMINARY ISSUE - CHANNEL ALIGNMENT AMENDED SECTION UPDATED			09.06.2016
2	PRELIMINARY ISSUE - ADDRESSING FLOOD MODELLING ADJENMENTS BY W.T.			01.04.2016
1	PRELIMINARY ISSUE-ADDRESSING COUNCIL COMMENTS			18.01.2016
0	PRELIMINARY ISSUE-NOT FOR CONSTRUCTION			-



DRAWN BY: [Redacted]	DRAWN DATE: MAR 2016
DESIGNED BY: [Redacted]	SURVEY BY: -
APPROVED FOR CONSTRUCTION BY: -	APPROVED DATE: -

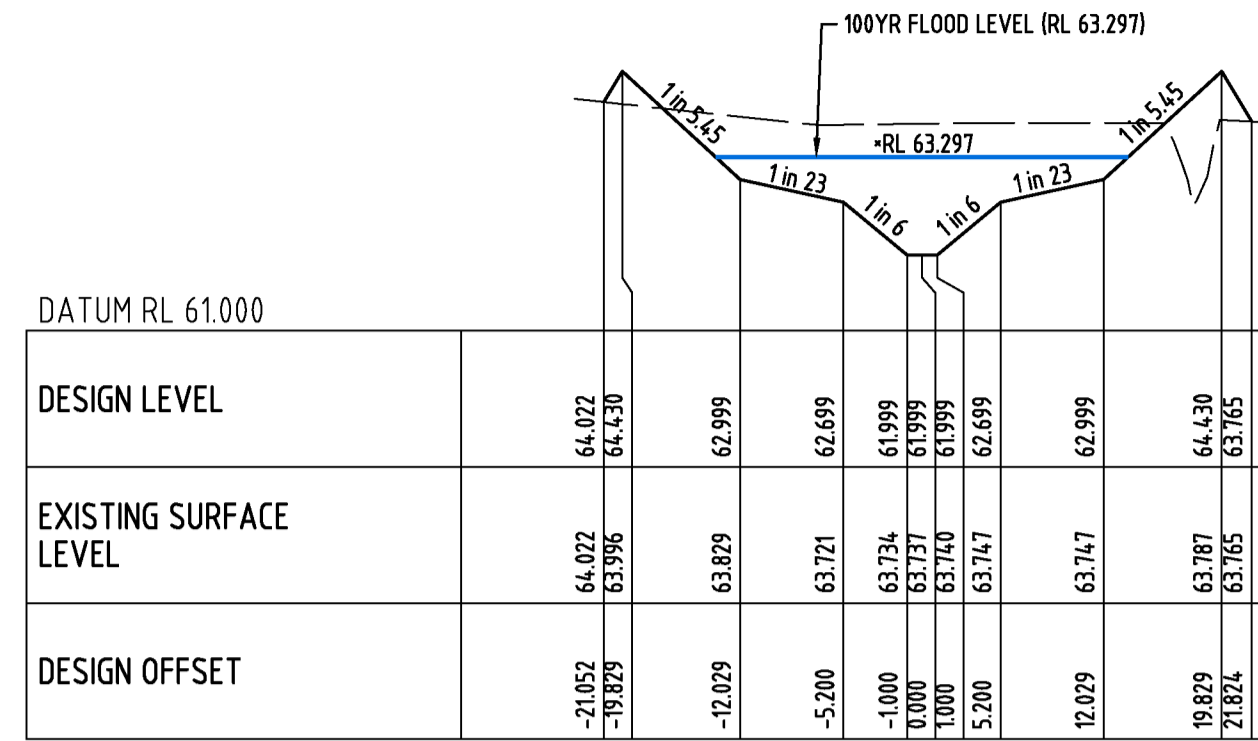
**PGA** Paroissien Grant & Associates Pty. Ltd.  
 Consulting Engineers & Surveyors  
 ABN 53 123 888 326

**MORWELL NORTH-WEST DRAINAGE REVIEW**  
 LATROBE CITY COUNCIL  
 LONGITUDINAL SECTION - CENTRE LINE OF LOW FLOW CHANNEL  
 SHEET 3 OF 3



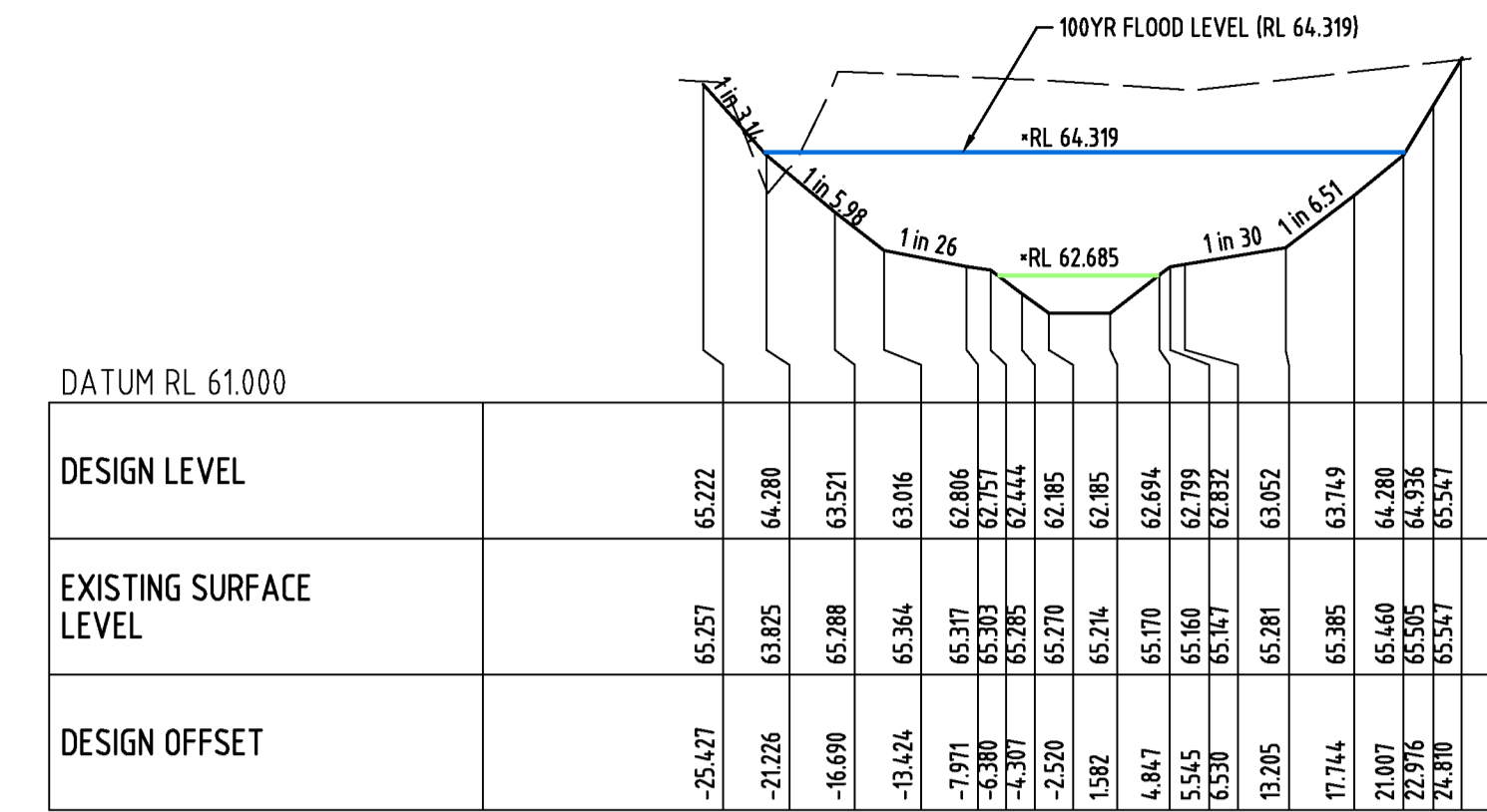
DATUM RL 61.000	
DESIGN LEVEL	63.544
EXISTING SURFACE LEVEL	63.544
DESIGN OFFSET	-7.990

SECTION A - CH 570.000  
H 1:500 V 1:100



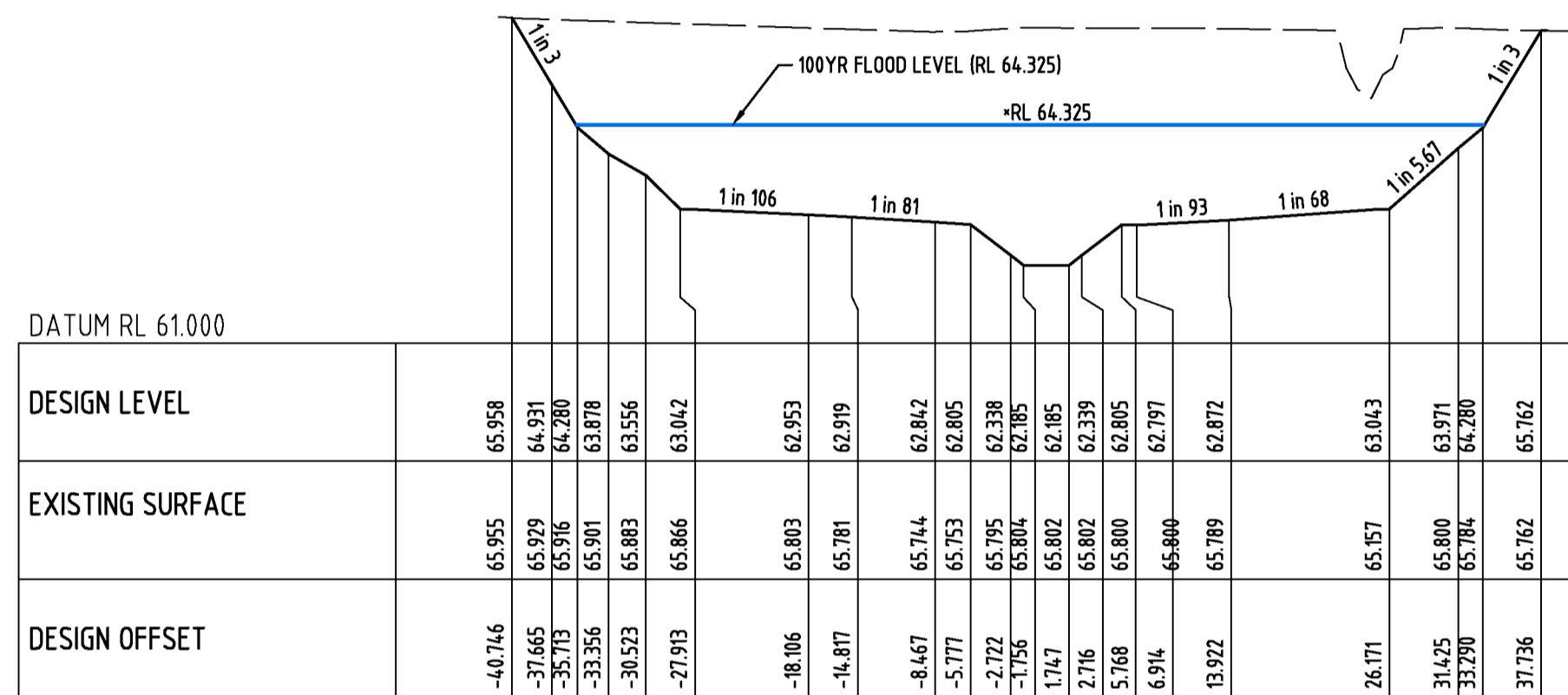
DATUM RL 61.000	
DESIGN LEVEL	64.022
EXISTING SURFACE LEVEL	64.022
DESIGN OFFSET	-21.052

SECTION B - CH 630.000  
H 1:500 V 1:100



DATUM RL 61.000	
DESIGN LEVEL	65.222
EXISTING SURFACE LEVEL	65.222
DESIGN OFFSET	-25.147

SECTION C - CH 820.000  
H 1:500 V 1:100

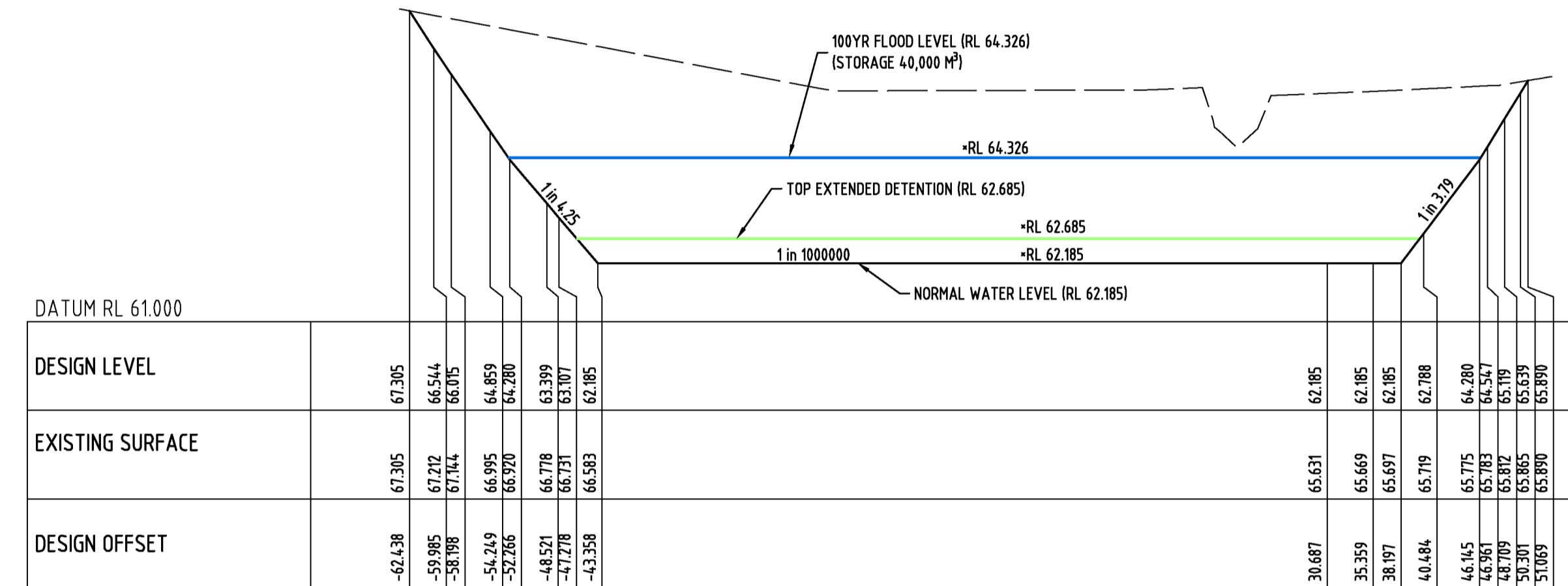


DATUM RL 61.000	
DESIGN LEVEL	65.958
EXISTING SURFACE LEVEL	65.958
DESIGN OFFSET	-40.746

SECTION E - CH 990.000  
H 1:500 V 1:100

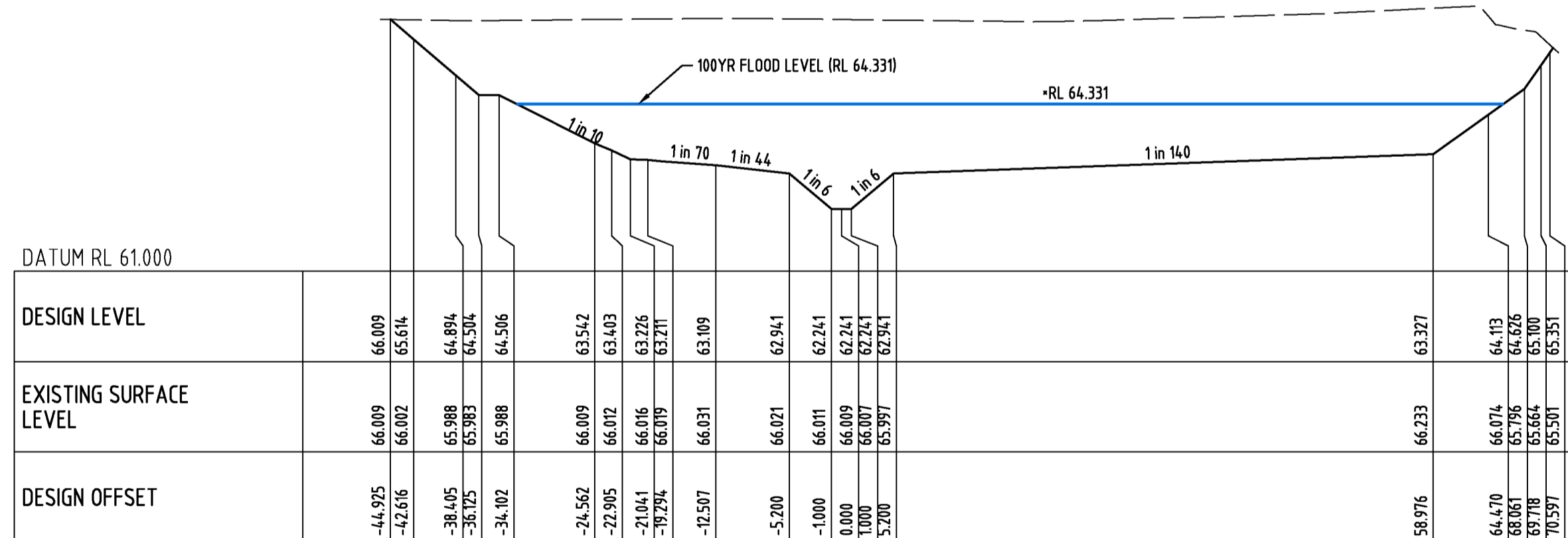
This document has been made available for the planning process as set out in the Planning and Environment Act 1987. The information must not be used for any other purpose.

By taking a copy of this document you acknowledge and agree that you will only use this document for the purpose specified above and that any dissemination, distribution or copying of this document is strictly prohibited.



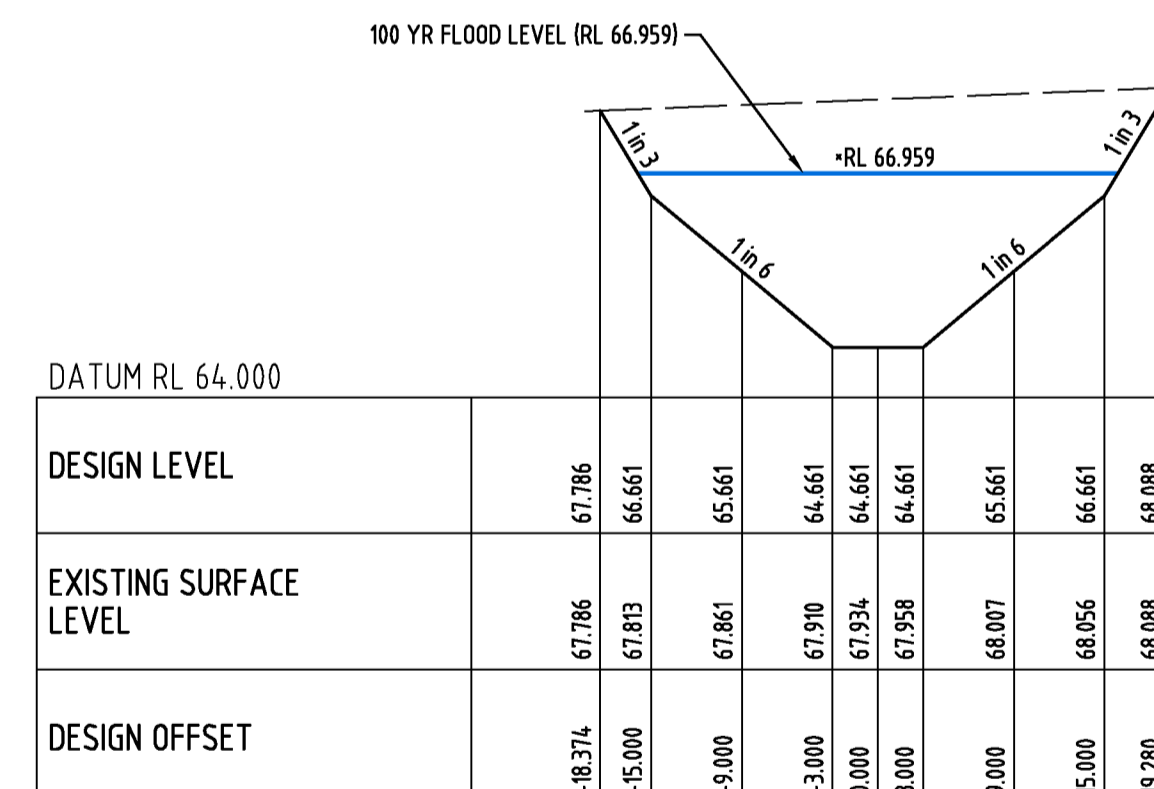
DATUM RL 61.000	
DESIGN LEVEL	67.305
EXISTING SURFACE LEVEL	67.305
DESIGN OFFSET	-62.238

SECTION D - CH 920.000  
H 1:500 V 1:100



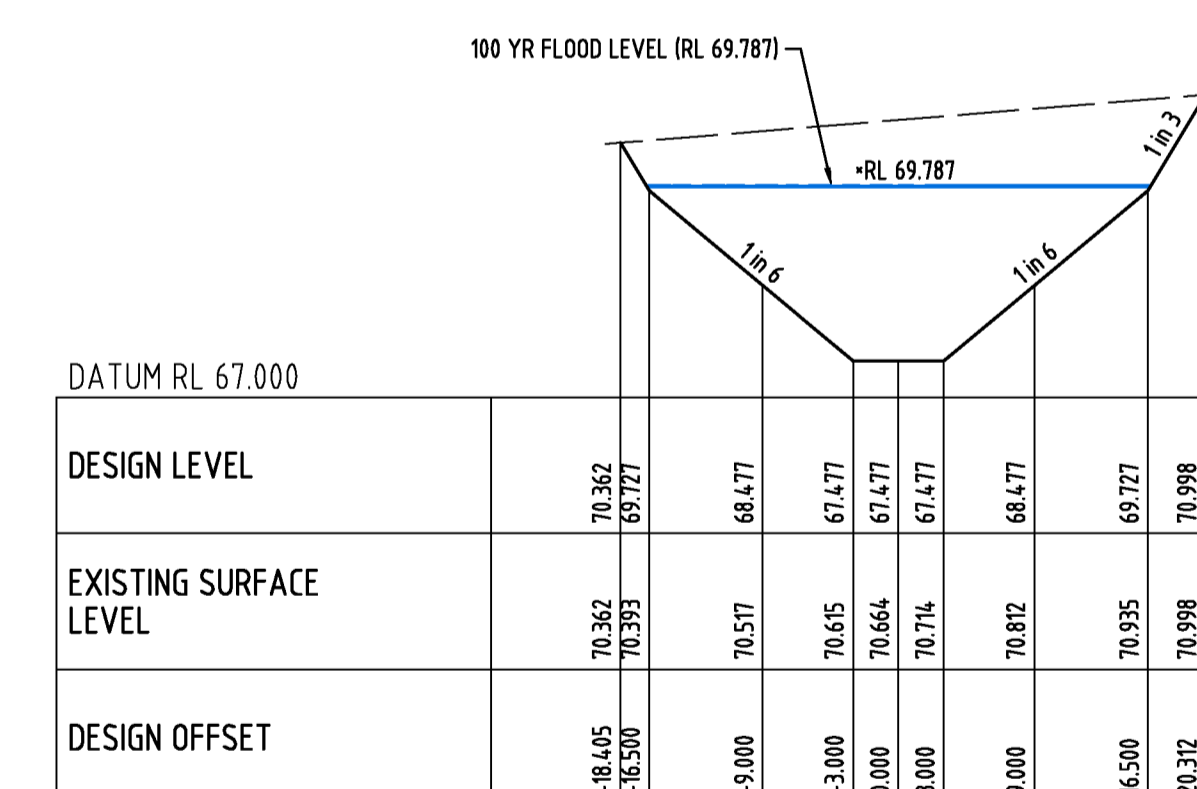
DATUM RL 61.000	
DESIGN LEVEL	66.009
EXISTING SURFACE LEVEL	66.009
DESIGN OFFSET	-44.925

SECTION F - CH 1110.000  
H 1:500 V 1:100



DATUM RL 64.000	
DESIGN LEVEL	67.786
EXISTING SURFACE LEVEL	67.786
DESIGN OFFSET	-18.374

SECTION G - CH 1260.000  
H 1:500 V 1:100



DATUM RL 67.000	
DESIGN LEVEL	70.382
EXISTING SURFACE LEVEL	70.382
DESIGN OFFSET	-18.405

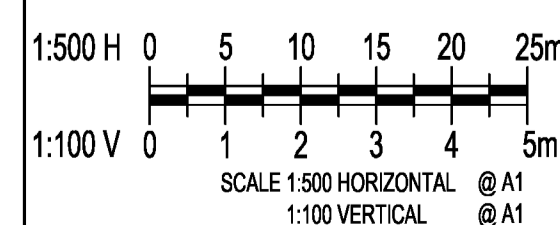
SECTION H - CH 1520.000  
H 1:500 V 1:100

LEGEND

- TOP OF EXTENDED DETENTION
- PROPOSED 100YR FLOOD LEVEL

PRELIMINARY  
NOT FOR CONSTRUCTION

REV	DESCRIPTION	CHECKED	APPROVED	DATE
2	PRELIMINARY ISSUE - ADDRESSING FLOOD MODELLING ADJENMENTS BY W.T.			01.04.2016
1	PRELIMINARY ISSUE-ADDRESSING COUNCIL COMMENTS			18.01.2016
0	PRELIMINARY ISSUE-NOT FOR CONSTRUCTION			



DRAWN BY:	DRAWN DATE:
DESIGNED BY:	SURVEY BY:
APPROVED FOR CONSTRUCTION BY:	APPROVED DATE:

**PGA** Paroissien Grant & Associates Pty. Ltd.  
Consulting Engineers & Surveyors  
ABN 53 123 888 326

**MORWELL NORTH-WEST DRAINAGE REVIEW**  
LATROBE CITY COUNCIL  
TYPICAL CROSS SECTIONS  
H 1:500 V 1:100  
WATER TECHNOLOGY  
SCALE @ A1: H 1:500 V 1:100  
DRAWING No.: 14166-304  
REV: 2