BEFORE THE CANTERBURY REGIONAL COUNCIL
AND THE ASHBURTON DISTRICT COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of resource consent applications by Rangitata Diversion Race Management Limited to the Canterbury Regional Council and Ashburton District Council for resource consents for the construction, operation and maintenance of the Klondyke Water Storage Facility, its associated water takes from and discharges to the Rangitata River, and all associated activities.

SUMMARY OF EVIDENCE AND SUPPLEMENTARY COMMENTS OF PAUL KELVIN MORGAN

DATED 23 APRIL 2018

Introduction

1. My name is Paul Kelvin Morgan. I prepared a statement of evidence for the Klondyke Storage Facility proposal dated 28 March 2018. My qualifications and experience are set out in that statement of evidence and I reiterate my confirmation of the Code of Conduct for Expert Witnesses in preparing this summary and supplementary comments.

2. This summary statement addresses:

   (a) The key points of my evidence which includes the figures from my evidence and drawings from Annexure A; and

   (b) My supplementary comments in response to the statements of evidence of Mr Martin Bonnett (Central South Island Fish and Game) and Dr Murray Hicks (Central South Island Fish and Game)

Summary of evidence

3. This summary of evidence provides an overview of the engineering work associated with the canal modifications, fish screen and kayak course. The key findings presented in the evidence are as follows.

Canal Modifications

4. The additional 10m^3/s flow increases water levels by approximately 0.5m which requires modification to parts of the canal between the intake and the Klondyke Storage Facility. The modifications will mostly require bank raising with a section of the canal also requiring widening. Three of the existing bridges will also require raising. The proposed rotary cylinder fish screens will also result in a further approximately 0.2m rise in water levels upstream of the fish screen (i.e. 0.7m in total upstream increase). However the existing bank levels between the intake and the location of the fish screen are already sufficiently high as to not require any modifications to accommodate the additional flows and fish screen.

5. An initial dam break assessment has been undertaken by RILEY for the canal between the intake and the Klondyke Storage Facility and indicated that there are three areas along the race that have been constructed in fill which require consideration. The assessment has indicated that the Potential Impact Category (PIC) is low. Compliance with the design standards that apply as a consequence of this PIC will ensure that any risk of an uncontrolled release from the modified sections of the canal will be low, and in accordance with the applicable guidelines. .

6. The main construction activity will be earthworks with a total of approximately 34,000m^3.

Fish Screen

7. The design shall take into consideration regional and national guidelines in relation to fish screens, and the most relevant document is NIWA: Good Practice Guidelines for Fish Screening in Canterbury[1]. The NIWA fish screen guidelines outline key design requirements for fish screens. The key aspects of the design are:

[1] Jamieson, D., Bonnett, M., Jellyman, D., & Unwin, M. (2005). Fish Screening: good practice guidelines for Canterbury. NIWA, Auckland, 70pp.

- Velocity of the flow into the screen (approach velocity), measured in front of the screen.
- Velocity of the flow past the screen (sweep velocity).
- Mesh size of screen.
- Fish bypass geometry and design.

8. In considering the fish screen location and fish screen type these key factors need to be considered. The other considerations in the selection relate to sediment, ease of operation/maintenance, construction costs and operating costs.

9. A number of locations and fish screen types were assessed before the preferred option was decided upon. The proposed new fish screen will comprise a rotary cylinder screen located upstream of the sand trap. The last rotary cylinder screen may be replaced with a flat screen of some kind depending on the available flows for the fish bypass. RILEY Dwg: 150975-3 (Annexure A) shows the location of the proposed fish screen. Figure 1 shows the type of rotary cylinder screen that is being proposed and Figure 2 shows a travelling flat screen which may be required to replace the last rotary screen if the velocity requirements for sediment management require it. Figure 3 shows a schematic of the general layout of the fish screen.

Figure 1: Cylinder screen design in United States (Intake Screens, Inc. Sacramento USA)

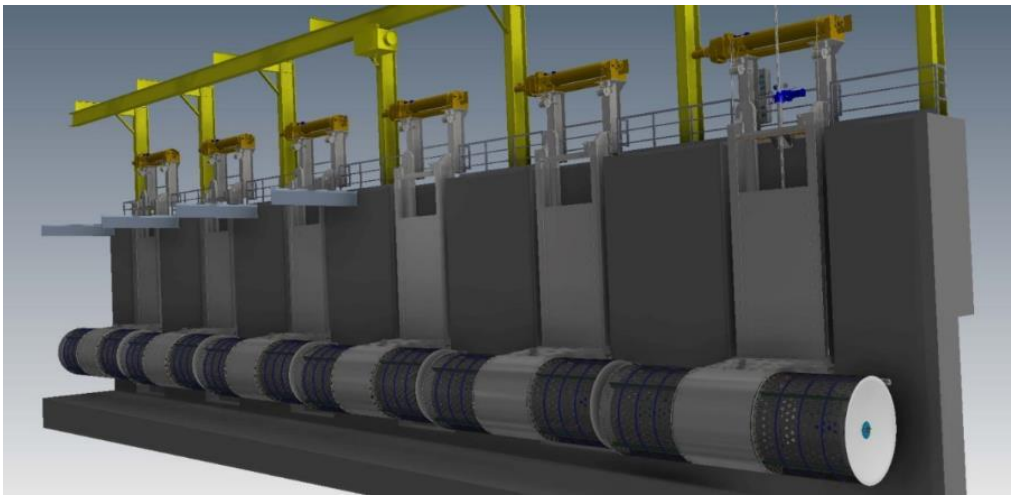


Figure 2: Example of travelling screen (Fall River, Hydolox screen)

Figure 3: Schematic layout of fish screen and bypass channel

10. Feedback from consultation with Central South Island Fish & Game (CSIFG), Department of Conservation (DOC), Te Runanga o Ngati Tahu (TRoNT), Te Runanga o Arowhenua (TRoA), and Environment Canterbury (ECan) was considered and changes to original concepts were then included.

11. The fish screen is designed based on the fish screen guidelines and on international practice, particularly the standards that apply in the USA. The design will achieve the guidelines in regard to approach velocity and the sweep velocity.

12. The fish bypass will meet the guidelines and follow the feedback from consultation. The outlet will be located upstream of the existing fish bypass.

13. Maintenance will be required periodically but can be undertaken while the scheme operates below maximum flow conditions when it will be possible to raise a screen out of the water for work to be undertaken.

14. The main construction activity will occur offline from the existing canal and will involve excavation of a new channel and construction of concrete walls and the fish screens.

White Water Course

15. It is proposed to construct a White Water Course (WWC) at the outlet of the proposed Klondyke Storage Facility. The WWC is off-line from the MHIS race to allow the control of flows into the course, thereby maximising its potential usage. All flows above the design inflow will bypass the gate and continue as normal to the MHIS race.

16. The construction of the kayak course will include control gates, earthworks in the kayak course, a car park and toilet/change facilities.

Supplementary comments

Evidence of Mr Martin Bonnett

17. In Paragraph 26 Approach Velocity. Mr Bonnett comments on the need for the criteria of the approach velocity being less than 0.12m/s (+/- 10%) for the entire screen. The Draft

Conditions have the approach velocity criteria based on the average velocity. The fish screen will be designed to ensure that the average approach velocity is less than 0.12m/s (as per NIWA Guidelines and Draft Conditions) and during the design process the aim will be to achieve as close as possible to 100% of the screen meeting this criteria, but I do not consider it is practical to achieve 100% for the entire the screen. This is due to the geometry of the screens, the turbulence in some areas due to that geometry and fluctuations in water levels and flows during normal operation. In the very small percentage of area where the screen does not achieve this criteria the approach velocity will be close to this velocity criteria.

18. Paragraph 27 Sweep Velocity. Mr Bonnett comments on the travel time but it is important to note that the travel time criteria is not included in the NIWA Guidelines. I understand Dr Ryder will address travel time in his supplementary comments.

19. Paragraph 39 – 46 & 48 (d) Testing screen effectiveness to meet the NIWA Guidelines. The significant number of fish screen trials that has been undertaken on the RDR along with a recent trial at Barrhill Chertsey Irrigation Intake have all highlighted that this approach is very unreliable. I have not been involved with any of these trials but are aware of results from the trials. The Golder Report undertaken for Barrhill Chertsey Irrigation Ltd[2] resulted in a very low number of the fish released being trapped. The report indicates that CSIFG have undertaken many trials where many of the fish released were not caught downstream. The report also quotes recapture rates of 21% to 59% in recent Canterbury trials. The uncertainty and error in any measures of fish screen efficiency from these trials have only been able to provide a general indication of effectiveness. RDR is proposing that the testing of screen effectiveness will be based upon showing the screen meets all of the criteria of the NIWA Guidelines which can be more accurately and effectively measured.

Evidence of Dr Murray Hicks

20. In paragraph 48 and 49 Dr. Hicks comments on sediment effects associated with the fish bypass. It is unclear whether Dr. Hicks expects that sand will settle at the toe of the screens but he has commented that the sand will be flushed back to the river on a continual basis. Currently there is no evidence of sand settling in this area of the RDR race due to the velocity of the flow and the race being relatively straight in alignment. At the proposed fish screens

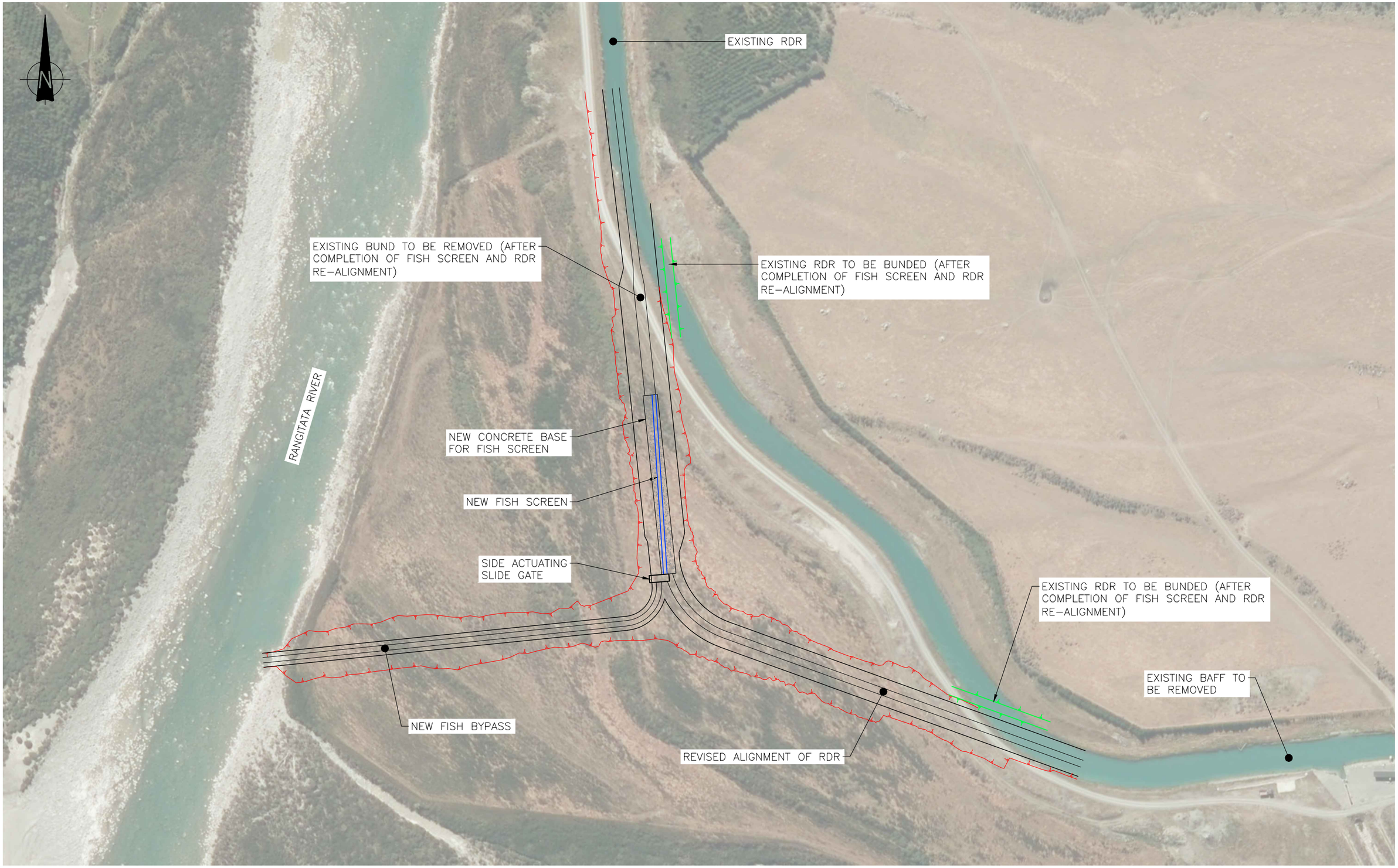
[2] Golder Associates. (2017) An Assessment of Fish Screen Effectiveness at the Barrhill Chertsey Irrigation Intake.

the canal will be concrete lined and the velocities will be at or greater than current velocities. Therefore this will reduce the risk of settlement of sand in this area. Dr. Hicks considers that sand and fine gravel discharged back to the river may form a transient fan-delta which could hinder fish connection with the main river channel. In paragraph 68 and 69 he recommends monitoring the connectivity of the proposed fish bypass channel with the Rangitata main channel at the discharge point and the use of earth-moving machinery to ensure connectivity. I agree with Dr. Hicks comments and the suggested monitoring conditions proposed to address this.

Paul Morgan

23 April 2018

Annexure A



20 0 40 80m

SCALE 1:2000

NOTES:

1. PHOTO SOURCED FROM LINZ (DEC 2011).

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	DATE
1	FOR INFORMATION		

DESIGN BEA | CHECKED
DRAWN PO | CHECKED
DATE DRAWN OCTOBER 2017

APPROVED FOR ISSUE: DRAFT
DATE: / /

RILEY CONSULTANTS
P.O.BOX 4355 CHRISTCHURCH
TEL. 03–3794402
FAX. 03–3794403

Rangitata Diversion Race Management Limited

TITLE

RANGITATA DIVERSION RACE MANAGEMENT LTD

RDR SAND TRAP AND FISH SCREEN

FISH SCREEN CONCEPT PLAN

CADFILE 150975–3
SCALES (A3) 1:2000
ACENZ
DRAWING No. 150975-3
REV. 1

KEY

TYPICAL CROSS–SECTION (1)

TYPICAL CROSS–SECTION (2)

TYPICAL CROSS–SECTION (3)

TYPICAL CROSS–SECTION (4)

TYPICAL CROSS–SECTION (5)

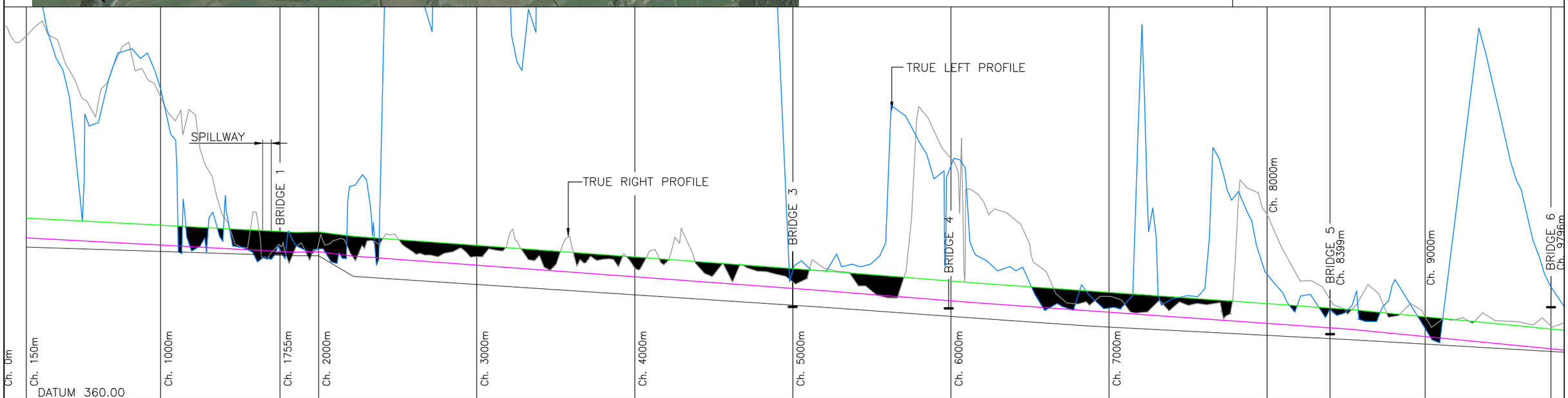
CH. 0.0m
CH. 1000m
CH. 1500m
BRIDGE 1
CH. 2000m
CH. 2500m
CH. 3000m
CH. 3500m
CH. 4000m
CH. 4500m
CH. 5000m
CH. 5500m
CH. 6000m
BRIDGE 4
DWG 11835/2-3
CH. 6500m
CH. 7000m
CH. 7500m
CH. 8000m
CH. 8500m
BRIDGE 5
DWG 11835/2-3
CH. 9000m
CH. 9500m
BRIDGE 6
BRIDGE 3
DWG 11835/2-3

LEGEND

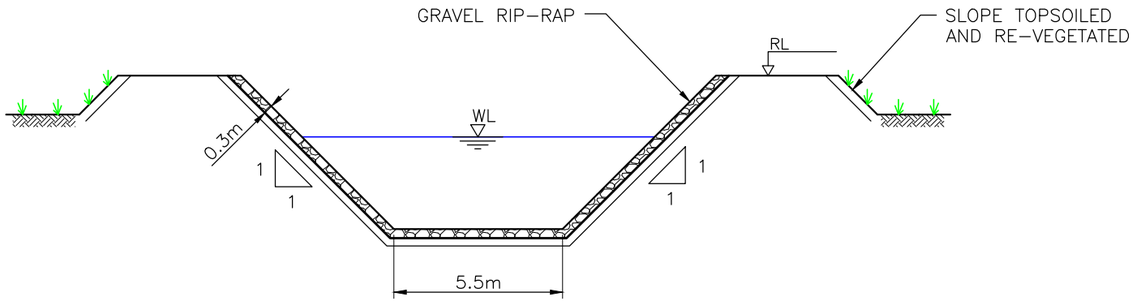
PROPOSED 0.5m FREEBOARD

PROPOSED MAXIMUM CANAL WATER LEVEL

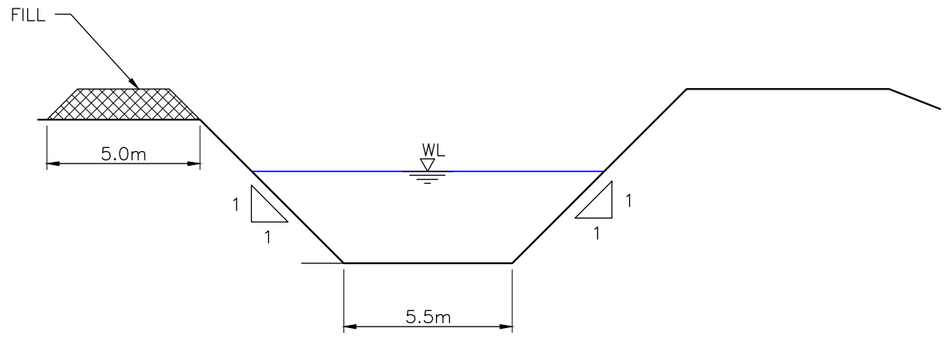
CURRENT MAXIMUM CANAL WATER LEVEL



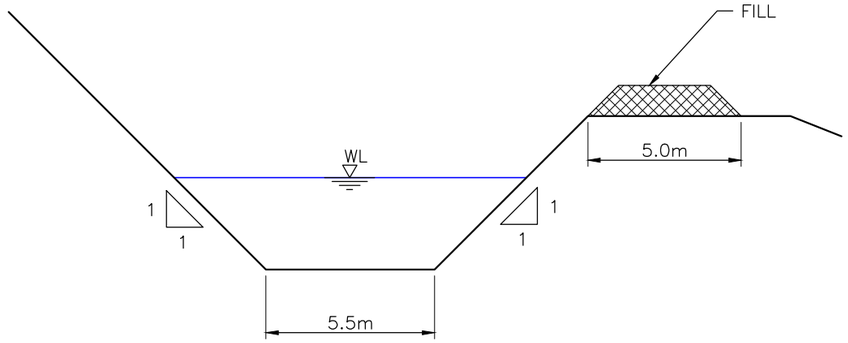
		DESIGN NS	CHECKED	APPROVED FOR ISSUE:	RILEY CONSULTANTS	TITLE	CADFILE 11835_2-1
		DRAWN HN	CHECKED	..... DATE: / /	P.O.BOX 4355 CHRISTCHURCH TEL. 03–3794402 FAX. 03–3794403	RANGITATA DIVERSION RACE MANAGEMENT LTD RANGITATA DIVERSION RACE (RDR) CANAL MODIFICATION - PLAN AND LONG SECTION	SCALES (A3) 1:2500
0	FIRST ISSUE			DATE DRAWN 27 AUG 2015			ACENZ DRAWING No. 11835/2-1 REV. 0
REV	DESCRIPTION	BY	DATE				



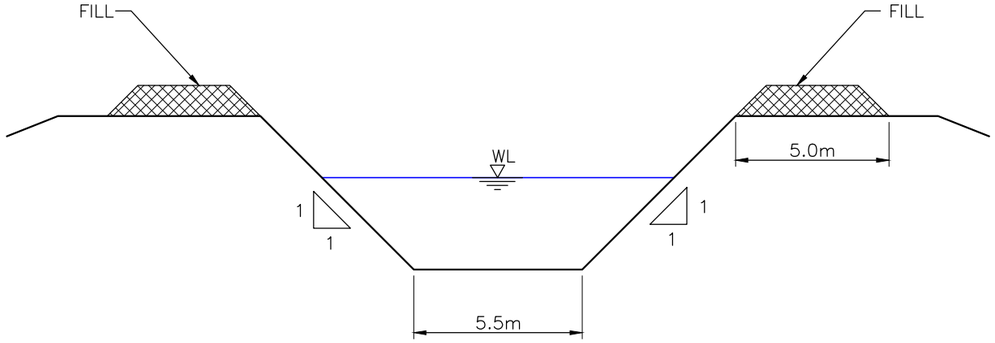
TYPICAL CROSS SECTION ①
SCALE 1:200



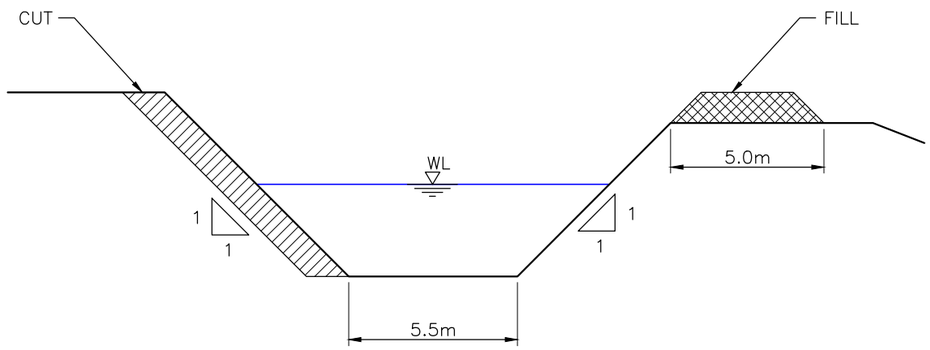
TYPICAL CROSS SECTION ②
SCALE 1:200



TYPICAL CROSS SECTION ③
SCALE 1:200



TYPICAL CROSS SECTION ④
SCALE 1:200



TYPICAL CROSS SECTION ⑤
SCALE 1:200

2 0 4 8m
SCALE 1:200

NOT FOR CONSTRUCTION

REV	DESCRIPTION	BY	DATE
0	FIRST ISSUE		

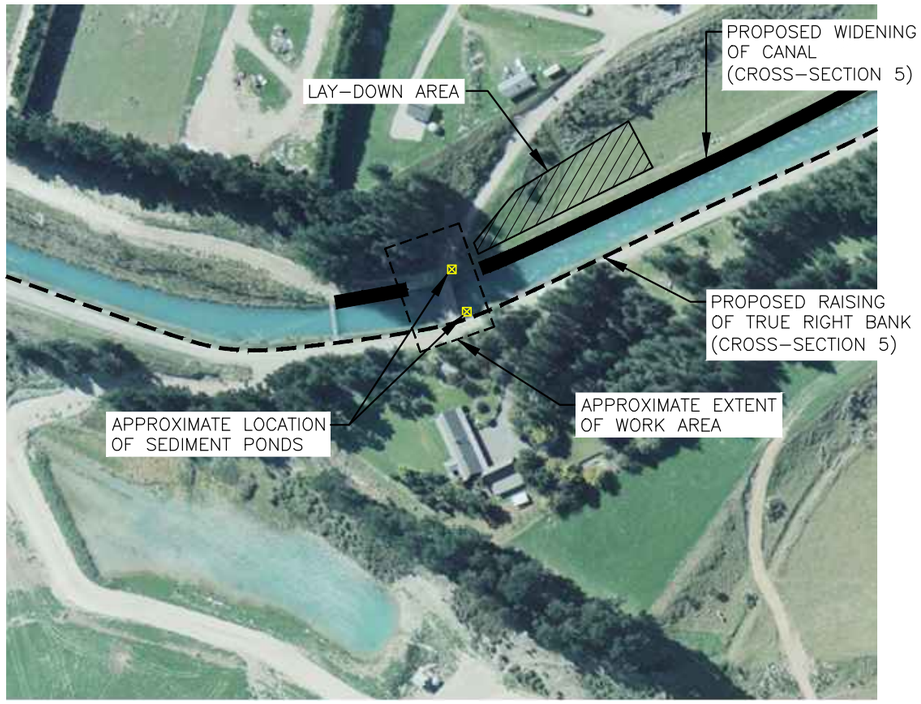
DESIGN NS | CHECKED
DRAWN HN | CHECKED
DATE DRAWN 27 AUG 2015

APPROVED FOR ISSUE: DRAFT
DATE: / /

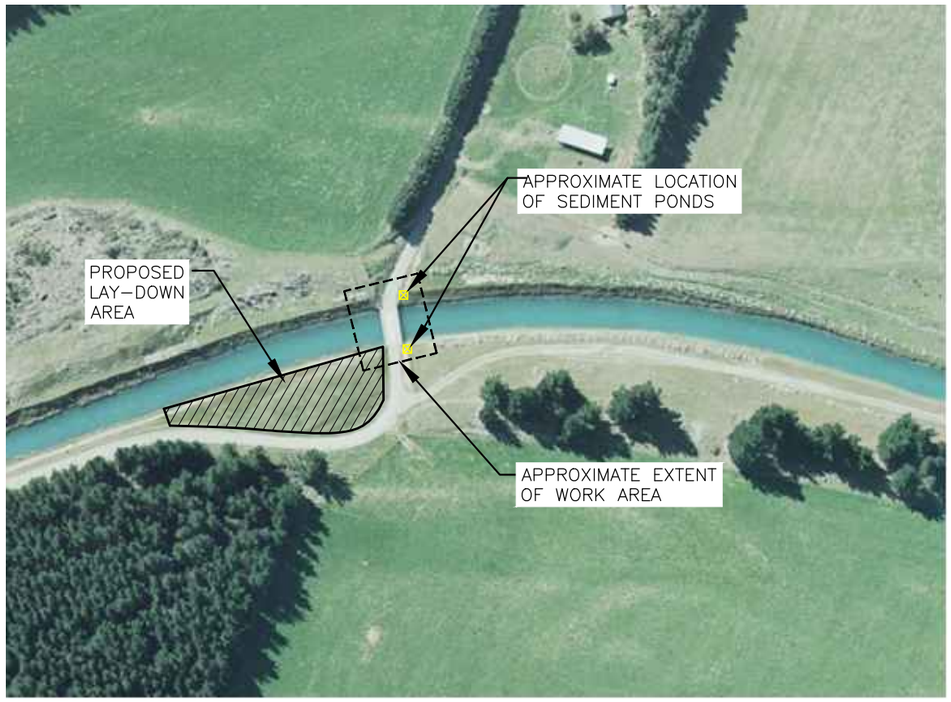
RILEY CONSULTANTS
P.O.BOX 4355 CHRISTCHURCH
TEL. 03–3794402
FAX. 03–3794403

TITLE
RDRML
RANGITATA DIVERSION RACE (RDR)
CANAL MODIFICATION - TYPICAL SECTIONS

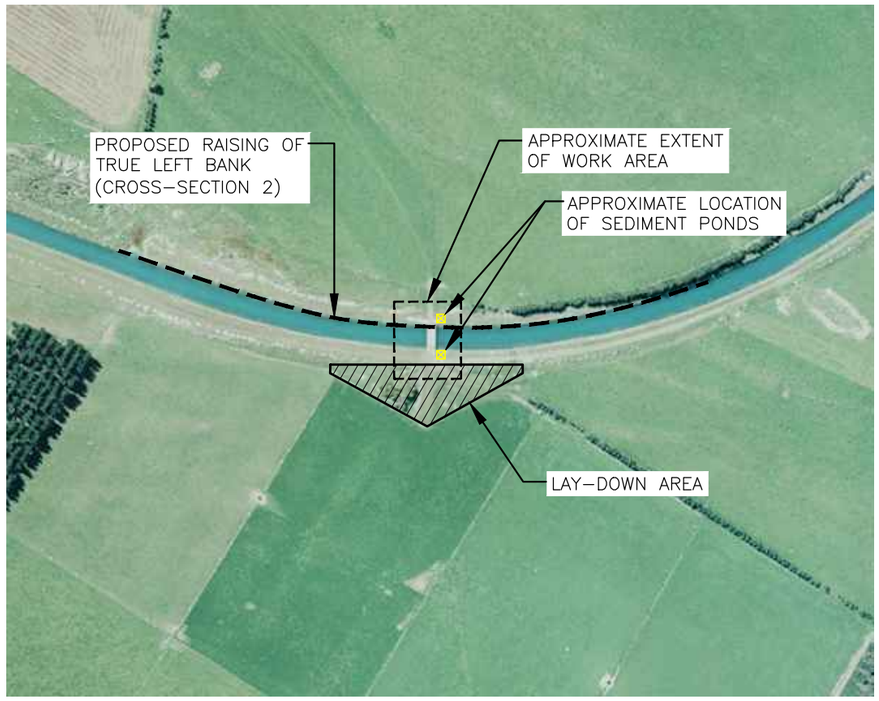
CADFILE 11835_2–2
SCALES (A3) AS SHOWN
ACENZ
DRAWING No. 11835/2-2
REV. 0



BRIDGE 3
SCALE N.T.S.



BRIDGE 4
SCALE N.T.S.



BRIDGE 5
SCALE N.T.S.

NOT FOR CONSTRUCTION

REV	DESCRIPTION	BY	DATE
1	SEDIMENT PONDS ADDED	HN	29.10.15
0	FIRST ISSUE		

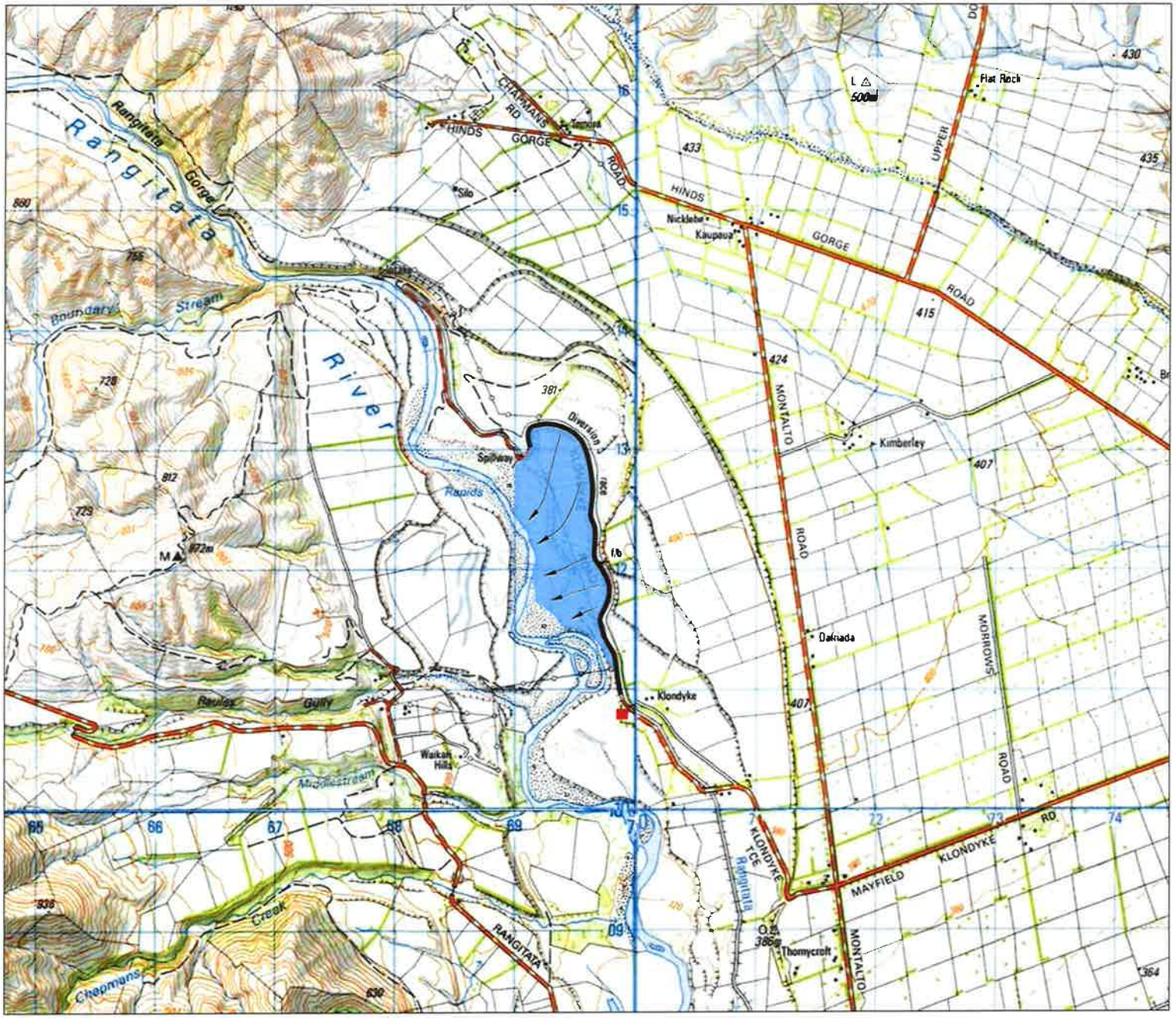
DESIGN NS | CHECKED
DRAWN HN | CHECKED
DATE DRAWN 4 SEPT 2015

APPROVED FOR ISSUE: DRAFT
DATE: / /

RILEY CONSULTANTS
P.O.BOX 4355
CHRISTCHURCH
TEL. 03–3794402
FAX. 03–3794403

TITLE
RANGITATA DIVERSION RACE MANAGEMENT LTD
RANGITATA DIVERSION RACE (RDR)
CANAL MODIFICATION AERIALS - BRIDGES 3, 4 AND 5

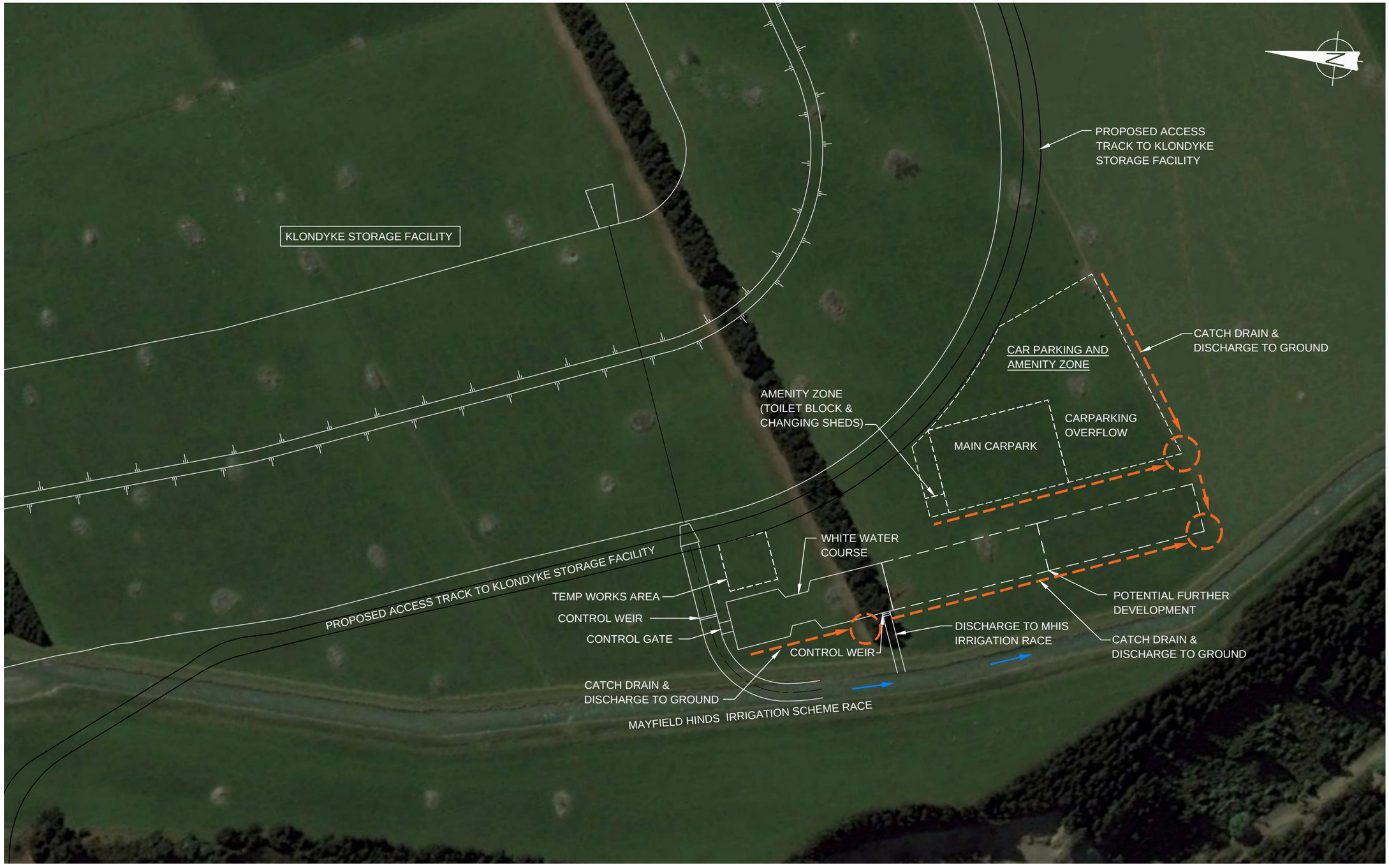
CADFILE 11835_2–3
SCALES (A3) AS SHOWN
ACENZ
DRAWING No. 11835/2-3
REV. 1



LEGEND

- POTENTIAL INUNDATION AREA (FROM MULTIPLE BREACHES)
- POTENTIAL FLOW PATHS
- DWELLING AT KLONDYKE
- RANGITATA DIVERSION RACE

DESIGNED PFR	RILEY CONSULTANTS ○ AUCKLAND ● CHRISTCHURCH	RANGITATA DIVERSION RACE MANAGEMENT LTD RANGITATA DIVERSION RACE (RDR) DAM-BREAK FLOOD HAZARD AND CONSEQUENCE ASSESSMENT	CADFILE 11835_2-5 DATE 14 OCT 2015 SCALES (A4) AS SHOWN ACENZ DRAWING No. 11835/2-5 REV. 0
DRAWN HN			
CHECKED			



20 0 40 80m

SCALE 1:2000

NOT FOR CONSTRUCTION

REV	DESCRIPTION	BY	DATE
0	FIRST ISSUE		

DESIGN: GML | CHECKED:
DRAWN: RBT | CHECKED:
DATE DRAWN: 20 NOV 2015

APPROVED FOR ISSUE: DRAFT
DATE: / /

RILEY CONSULTANTS
P.O.BOX 4355 CHRISTCHURCH
TEL. 03-3794402
FAX. 03-3794403

RDR Rangitata Diversion Race Management Limited

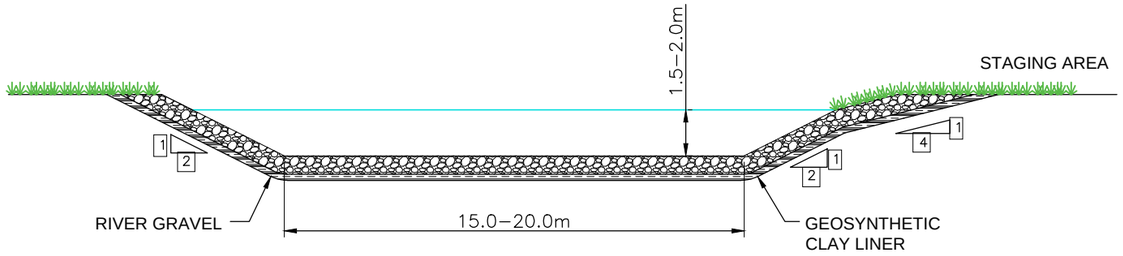
TITLE

RANGITATA DIVERSION RACE MANAGEMENT LTD

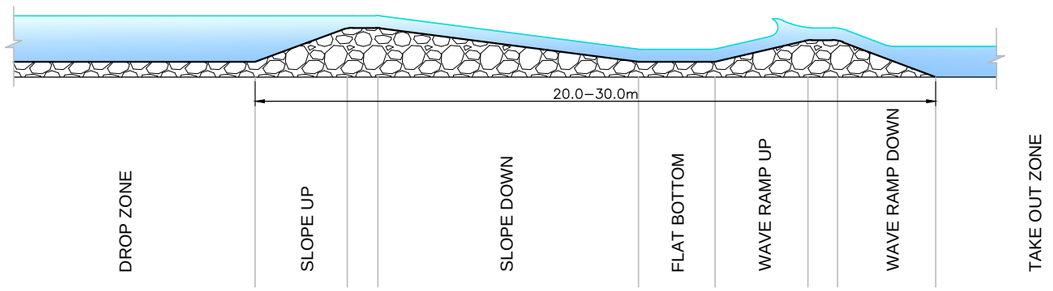
WHITE WATER COURSE

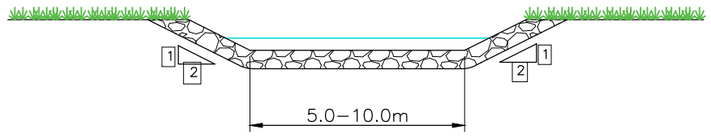
OVERALL LAYOUT

CADFILE: 11835/3-01
SCALES (A3): AS SHOWN
ACENZ
DRAWING No.: 11835/3-01
REV.: 0



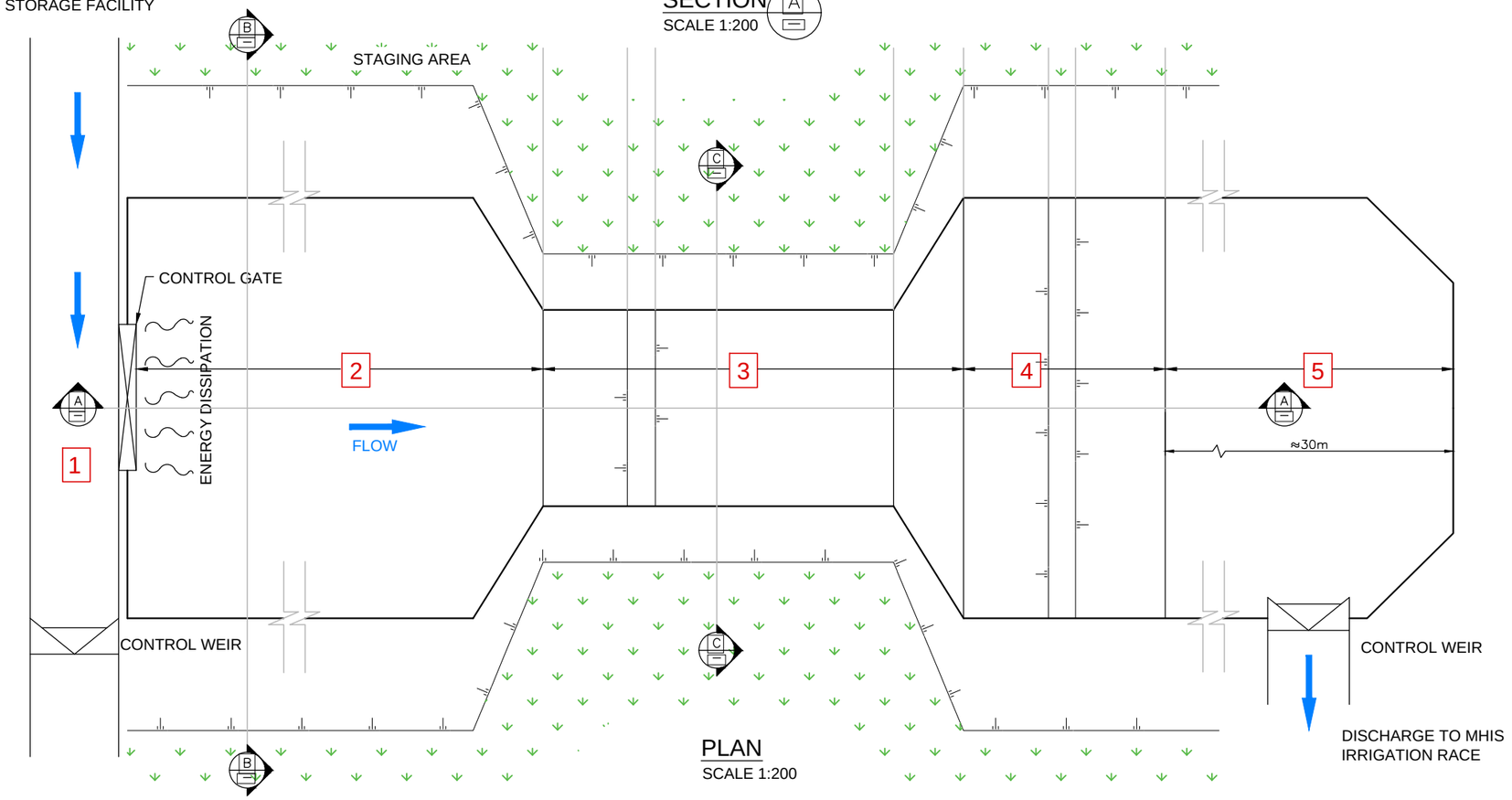
SECTION B
SCALE 1:200





SECTION C
SCALE 1:200

SECTION A
SCALE 1:200



PLAN
SCALE 1:200

NOTES:

- ALL DIMENSIONS SUBJECT TO SPECIFIC ENGINEERING DESIGN

1. CONTROL GATE AND WEIR
2. UPSTREAM STAGING AREA AND DROP-IN ZONE
3. TRANSITION TO WAVE
4. WAVE ZONE
5. DOWNSTREAM TAKE-OUT ZONE

2 0 4 8m
SCALE 1:200

NOT FOR CONSTRUCTION

REV	DESCRIPTION	BY	DATE
0	FIRST ISSUE		

DESIGN: GML | CHECKED:
DRAWN: RBT | CHECKED:
DATE DRAWN: 20 NOV 2015

APPROVED FOR ISSUE: DRAFT
DATE: / /

RILEY CONSULTANTS
P.O.BOX 4355
CHRISTCHURCH
TEL. 03–3794402
FAX. 03–3794403

RDR
Rangitata Diversion Race Management Limited

TITLE

RANGITATA DIVERSION RACE MANAGEMENT LTD
WHITE WATER COURSE
LAYOUT AND SECTIONS

CADFILE: T11835/3–02
SCALES (A3): AS SHOWN
ACENZ
DRAWING No.: 11835/3-02
REV.: 0