## **APPENDIX**

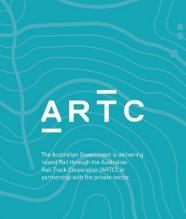




# Surface Water Quality Technical Report

Appendices A to B

NORTH STAR TO NSW/QUEENSLAND BORDER ENVIRONMENTAL IMPACT STATEMENT



## **APPENDIX**

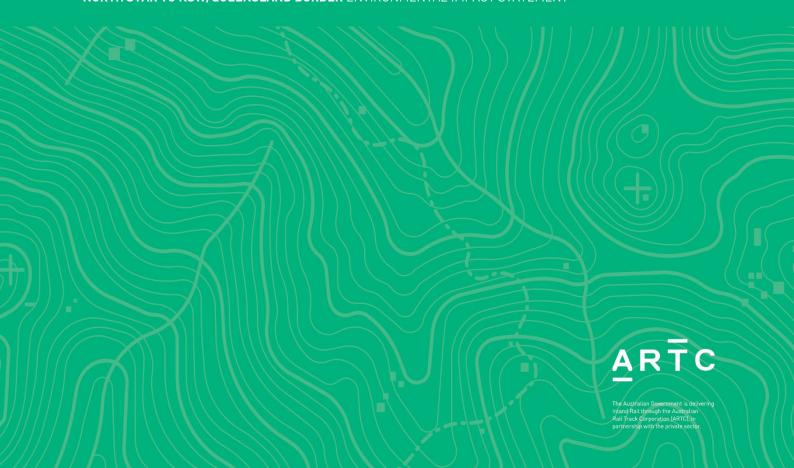




Surface Water Quality Technical Report

**Appendix A** Surface Water Quality Site Investigation Results

NORTH STAR TO NSW/QUEENSLAND BORDER ENVIRONMENTAL IMPACT STATEMENT



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													ail VI_ARTCInlandRai	
										NS2B-SITE 5	NS2B-SITE 11	NS2B-SITE 12	NS2B-SITE 16	DUPLICATE
									Location_Code		NS2B-SITE 11	NS2B-SITE 12	NS2B-SITE 16	DUPLICATE
										M18-Au34579	M18-Au34581	M18-Au34578	M18-Au34580	M18-Au34582
	Ta			ANZECC 2000 - Irrigation LTV	ANZECC 2000 - Irrigation STV	ANZECC 2000 - Livestock Drinking Water Quality	ANZECC 2000 - Slightly-Moderately Disturbed Freshwater Systems		NHMRC 2008 - g Guidelines for Managing Risks in Recreational Waters					
Chem_Group		output unit				_	Оузістіз							
Physio-Chemical Parame			0.1	6-8.5	6-8.5				6.5-8.5	7.7	8.3	8.2	8.6	8.3
	Total Suspended Solids	mg/L	1							65	14	9.1	56	16
Polynuclear Aromatic Hy		μg/L	1				16			<1	<1	<1	<1	<1
		μg/L	1							<1	<1	<1	<1	<1
		µg/L	1							<1	<1	<1	<1	<1
		μg/L	1							<1	<1	<1	<1	<1
		μg/L	1							<1	<1	<1	<1	<1
		μg/L	1							<1	<1	<1	<1	<1
		μg/L	1							<1	<1	<1	<1	<1
		μg/L	1							<1	<1	<1	<1	<1
		μg/L	1							<1	<1	<1	<1	<1
		μg/L	1							<1	<1	<1	<1	<1
		μg/L	1					0.01	0.1 <sup>#1</sup>	<1	<1	<1	<1	<1
		μg/L	1							<1	<1	<1	<1	<1
		μg/L	1							<1	<1	<1	<1	<1
	Benzo(g,h,i)perylene	μg/L	1							<1	<1	<1	<1	<1
		μg/L	1							<1	<1	<1	<1	<1
	Indeno(1,2,3-cd)pyrene	μg/L	1							<1	<1	<1	<1	<1
	Sum of PAHs	μg/L	1							<1	<1	<1	<1	<1
Metals	Arsenic (Filtered)	ug/L	1	100	2000	500-5000 <sup>#2</sup>	13 <sup>#3</sup>	10	100 <sup>#1</sup>	<1	1	8	1	1
	Cadmium (Filtered)	ug/L	0.2	10	50	10	0.2	2	20 <sup>#1</sup>	<0.2	<0.2	<0.2	<0.2	<0.2
	Chromium (Filtered)	ug/L	1	100	1000	1000			500 <sup>#1</sup>	<1	<1	2	<1	<1
	Copper (Filtered)	ug/L	1	200	5000	400#4	1.4	2000	20000#1	<1	<1	2	3	<1
	Lead (Filtered)	ug/L	1	2000	5000	100	3.4	10	100 <sup>#1</sup>	<1	<1	<1	<1	<1
	Mercury (Filtered)	ug/L	0.1	2	2	2	0.06	1	10 <sup>#1</sup>	<0.1	<0.1	<0.1	<0.1	<0.1
	Nickel (Filtered)	ug/L	1	200	2000	1000	11	20	200 <sup>#1</sup>	4	3	12	7	3
		ug/L	5	2000	5000	20000	8		_00	<5	<5	5	<5	<5
Physico-Chemical Param	Electrical conductivity (lab)	μS/cm	1							320	520	490	630	510
Alkalinity	Bicarbonate Alkalinity as CaCO3	mg/L	20							130	200	200	260	200
•		mg/L	10							<10	<10	<10	18	<10
Nutrients			0.01							0.11	0.03	0.03	0.05	0.04
	Nitrate (as N)	mg/L	0.02			90#5	0.158 <sup>#6</sup>			0.11	<0.02	0.03	<0.02	<0.02
			0.02			9.1 <sup>#5</sup>	0.100			<0.02	<0.02	<0.02	<0.02	<0.02
			0.2			0.1				0.6	0.5	0.4	1	0.5
	AUG C AUG II ( AU)	mg/L	0.05							0.11	<0.05	<0.05	<0.05	<0.05
		mg/L	0.2	5	25-125					0.7	0.5	0.4	1	0.5
			0.2							0.49	0.47	0.37	0.95	0.46
			0.05							<0.05	<0.05	<0.05	<0.05	<0.05
			0.05							0.15	0.08	0.06	0.1	0.07
Major Ions		mg/L	1							14	36	50	29	37
Major 10113		mg/L	5							<5	<5	<5	17	<5
			0.01							8.5	9.2	9.3	9.2	9.2
Field	IDO	11114/L	0.01							0.0			₹.∠	
Field		NTU	1							71	6.8	4.1	40	7.8

#### **Env Stds Comments**

#1:ADWG x10 (March 2015)
#2:5mg/L may be tolerated if food additive
#3:Arsenic (AsV) value adopted
#4:Conserv value for sheep adopted
#5:Anion calculated
#6:Ion conversion calculation



#### CHAIN OF CUSTODY RECORD

Sydney Laboratory
Unit F3 Bld F 16 Mars Pd Lane Cove West NSW 2064
02 9900 8400 Environmental Sydney Control of Sydney Con

Unit 1, 21 Smallwood PJ. Murama, OLD 4172 07 3902 4600 EnviroSampleOLD@euroSins.com Perth Laboratory
Unit 2 91 Leach Highway I revelate WA 5105
08 9251 9600 Enviro SampleWA@eurolins.com

Melbourne Laboratory

\* Engelon Love Close Cathleys VIC 1165

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Соп	npany	A A	200	M	Pr	oject N2	0	PR	7	)				t Manager	L	BA	SA	Te	ithbr note	idge	Sa	mpler(s	)	D	I .	(evae	A
Add	dress				Proj	ect Name	1	25	52	B			EDD (ESda Cu	Format it, EQuIS, stom)	35	Hor		\	ngte	27	Hand	led ove	r by	V	٨	()	
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1	152B	5- SITE	= 12	23/8	N	×	7		X	X	X	X	X	×	X	×	×	X			1	2	*			839	(医院) 24.40.50
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4	41	i)	il.	ч	N	X	×	×	X	X	X	X	×	×	X	×	X	×			.(	2				*1	34
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	offins   mgt ory Use Only	Received By	SECRETARY OF THE PARTY OF THE P	314Nd			JR 949 98 A)		ADL   NTL	SUM I	TO LABOR.	ature	4	4			THE PARTY OF	Date	24.18		400	Time		0	00 An	Temperature	. 4,97
Submission	of samples to ti	100000		cceptance of Eurofins	mgt Standard T				ADL   NTL		Sign Eurofins   m	ature of Standard	Terms and	d Condition	s is availabl	e on reque	Add to the	ate				Time		1	CX.	Report No	图 2. 多种





Accredited for compliance with ISO/IEC 17025 – Testing The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

NATA Accredited Accreditation Number 1261 Site Number 1254

Certificate of Analysis





Attention: Jonathan Billington

Collins Square, Tower 2, Level 11, 727 Collins Street

614408-W Report Project name FFJV Project ID NS2B Received Date Aug 24, 2018

**AECOM Aust Pty Ltd Melbourne** 

**Docklands** VIC 3008

Client Sample ID			NS2B-SITE 12	NS2B-SITE 5	NS2B-SITE 16	NS2B-SITE 11
Sample Matrix			Water	Water	Water	Water
Eurofins   mgt Sample No.			M18-Au34578	M18-Au34579	M18-Au34580	M18-Au34581
Date Sampled			Aug 23, 2018	Aug 23, 2018	Aug 23, 2018	Aug 23, 2018
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene <sup>N07</sup>	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	69	80	59	55
p-Terphenyl-d14 (surr.)	1	%	86	106	87	82
Ammonia (as N)	0.01	mg/L	0.03	0.11	0.05	0.03
Chloride	1	mg/L	50	14	29	36
Chlorophyll a	5	ug/L	< 5	7.5	41	< 5
Conductivity (at 25°C)	1	uS/cm	490	320	630	520
Dissolved Oxygen	0.01	mg/L	9.3	8.5	9.2	9.2
Dissolved Oxygen (% Saturation)		%	100	92	100	100
Nitrate & Nitrite (as N)	0.05	mg/L	< 0.05	0.11	< 0.05	< 0.05
Nitrate (as N)	0.02	mg/L	0.03	0.11	< 0.02	< 0.02
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Organic Nitrogen (as N)	0.2	mg/L	0.37	0.49	0.95	0.47
pH (at 25°C)	0.1	pH Units	8.2	7.7	8.6	8.3
Phosphate total (as P)	0.05	mg/L	0.06	0.15	0.10	0.08
Phosphorus reactive (as P)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Sulphate (as S)	5	mg/L	< 5	< 5	17	< 5
Suspended Solids	1	mg/L	9.1	65	56	14



Client Sample ID			NS2B-SITE 12 Water	NS2B-SITE 5 Water	NS2B-SITE 16 Water	NS2B-SITE 11 Water
Sample Matrix						1
Eurofins   mgt Sample No.			M18-Au34578	M18-Au34579	M18-Au34580	M18-Au34581
Date Sampled			Aug 23, 2018	Aug 23, 2018	Aug 23, 2018	Aug 23, 2018
Test/Reference	LOR	Unit				
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	0.4	0.6	1.0	0.5
Total Nitrogen (as N)	0.2	mg/L	0.4	0.7	1.0	0.5
Turbidity	1	NTU	4.1	71	40	6.8
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	200	130	260	200
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	18	< 10
Heavy Metals						
Arsenic (filtered)	0.001	mg/L	0.008	< 0.001	0.001	0.001
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Chromium (filtered)	0.001	mg/L	0.002	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	0.002	< 0.001	0.003	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	0.012	0.004	0.007	0.003
Zinc (filtered)	0.005	mg/L	0.005	< 0.005	< 0.005	< 0.005

Client Sample ID			DUPLICATE
Sample Matrix			Water
Eurofins   mgt Sample No.			M18-Au34582
Date Sampled			Aug 23, 2018
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons	·	•	
Acenaphthene	0.001	mg/L	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001
Anthracene	0.001	mg/L	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001
Benzo(b&j)fluorantheneN07	0.001	mg/L	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001
Chrysene	0.001	mg/L	< 0.001
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001
Fluoranthene	0.001	mg/L	< 0.001
Fluorene	0.001	mg/L	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001
Naphthalene	0.001	mg/L	< 0.001
Phenanthrene	0.001	mg/L	< 0.001
Pyrene	0.001	mg/L	< 0.001
Total PAH*	0.001	mg/L	< 0.001
2-Fluorobiphenyl (surr.)	1	%	89
p-Terphenyl-d14 (surr.)	1	%	105
Ammonio (ac NI)	0.04	ma/l	0.04
Ammonia (as N)	0.01	mg/L	0.04 37
Chloraphyllo	-	mg/L	
Chlorophyll a	5	ug/L uS/cm	< 5 510
Conductivity (at 25°C)	0.01		9.2
Dissolved Oxygen	0.01	mg/L	1
Dissolved Oxygen (% Saturation)		%	100



Client Sample ID Sample Matrix			DUPLICATE Water
Eurofins   mgt Sample No.			M18-Au34582
Date Sampled			Aug 23, 2018
Test/Reference	LOR	Unit	
Nitrate & Nitrite (as N)	0.05	mg/L	< 0.05
Nitrate (as N)	0.02	mg/L	< 0.02
Nitrite (as N)	0.02	mg/L	< 0.02
Organic Nitrogen (as N)	0.2	mg/L	0.46
pH (at 25°C)	0.1	pH Units	8.3
Phosphate total (as P)	0.05	mg/L	0.07
Phosphorus reactive (as P)	0.05	mg/L	< 0.05
Sulphate (as S)	5	mg/L	< 5
Suspended Solids	1	mg/L	16
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	0.5
Total Nitrogen (as N)	0.2	mg/L	0.5
Turbidity	1	NTU	7.8
Alkalinity (speciated)			
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	200
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10
Heavy Metals			
Arsenic (filtered)	0.001	mg/L	0.001
Cadmium (filtered)	0.0002	mg/L	< 0.0002
Chromium (filtered)	0.001	mg/L	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001
Nickel (filtered)	0.001	mg/L	0.003
Zinc (filtered)	0.005	mg/L	< 0.005



#### Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Melbourne	Aug 30, 2018	7 Day
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water	Malhaurna	A.v. 20 2040	2 Day
Chlorophyll a	Melbourne	Aug 29, 2018	2 Day
- Method: LTM-INO-4340 Chlorophyll a in Waters	Malhaurna	A.v. 20 2040	20 Day
Conductivity (at 25°C)	Melbourne	Aug 29, 2018	28 Day
- Method: LTM-INO-4030 Conductivity	Malhaurna	A.v. 20, 2010	1 Dov
Dissolved Oxygen	Melbourne	Aug 29, 2018	1 Day
- Method: LTM-INO-4130 Determination of Dissolved Oxygen using a DO meter	Malhaurna	Aug 20, 2019	1 Dov
Dissolved Oxygen (% Saturation)	Melbourne	Aug 29, 2018	1 Day
- Method: LTM-INO-4130 Determination of Dissolved Oxygen using a DO meter	Malhaurna	Aug 20, 2019	0 Hours
pH (at 25°C)	Melbourne	Aug 29, 2018	0 Hours
- Method: LTM-GEN-7090 pH in water by ISE	Malhaurna	Aug 20, 2019	29 Dov
Phosphate total (as P)	Melbourne	Aug 29, 2018	28 Day
- Method: APHA 4500-P E. Phosphorous	Malhaurna	Aug 20, 2019	2 Day
Phosphorus reactive (as P)	Melbourne	Aug 29, 2018	2 Day
- Method: APHA4500-PO4	Malhaurna	A.v. 20, 2010	7 Davis
Suspended Solids	Melbourne	Aug 29, 2018	7 Days
- Method: LTM-INO-4070 Analysis of Suspended Solids in Water by Gravimetry	Malhaurna	A.v. 20, 2010	2 Day
Turbidity	Melbourne	Aug 29, 2018	2 Day
- Method: Turbidity by classical using APHA 2130B (LTM-INO-4140)  Metals M8 filtered	Malhaurna	A.v. 20, 2010	20 Day
	Melbourne	Aug 29, 2018	28 Day
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Nitrogens (speciated)	Malhaurna	A.v. 20 2040	20 Day
Ammonia (as N)	Melbourne	Aug 29, 2018	28 Day
- Method: APHA 4500-NH3 Ammonia Nitrogen by FIA	Malhaurna	A.v. 20 2040	20 Day
Nitrate & Nitrite (as N)	Melbourne	Aug 29, 2018	28 Day
- Method: APHA 4500-NO3/NO2 Nitrate-Nitrite Nitrogen by FIA	Malhaurna	A.v. 20 2040	20 Day
Nitrate (as N)	Melbourne	Aug 29, 2018	28 Day
- Method: APHA 4500-NO3 Nitrate Nitrogen by FIA	Malhaurna	A.v. 20 2040	2 Day
Nitrite (as N)	Melbourne	Aug 29, 2018	2 Day
- Method: APHA 4500-NO2 Nitrite Nitrogen by FIA	Melbourne	Aug 20, 2010	7 Dov
Organic Nitrogen (as N)	Melbourne	Aug 28, 2018	7 Day
- Method: APHA 4500 Organic Nitrogen (N)	Melbourne	Aug 20, 2019	7 Dov
Total Kjeldahl Nitrogen (as N)	Melbourne	Aug 29, 2018	7 Day
- Method: LTM-INO-4310 TKN in Waters & Soils by FIA			
Major Anions Chlorida	Malhaurna	A.v. 20, 2010	20 Day
Chloride	Melbourne	Aug 29, 2018	28 Day
- Method: LTM-INO-4090 Chloride by Discrete Analyser	Malhaurr	A 20. 2040	20 Dov
Sulphate (as S)	Melbourne	Aug 29, 2018	28 Day
- Method: LTM-INO-4110 Sulfate by Discrete Analyser	Malhaurr	A 20. 2040	14 Dov
Alkalinity (speciated)	Melbourne	Aug 29, 2018	14 Day
- Method: APHA 2320 Alkalinity by Titration			



ABN- 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au Melbourne 2-5 Kingston Town Close Oakleigh VIC 3166 Phone: +61 3 8564 5000 NATA # 1261 Site # 1254 & 14271 Sydney Unit F3, Building F 16 Mars Road Lane Cove West NSW 2066 Phone: +61 2 9900 8400 NATA # 1261 Site # 18217 Brisbane 1/21 Smallwood Place Murarrie QLD 4172 Phone : +61 7 3902 4600 NATA # 1261 Site # 20794

Received:

**Contact Name:** 

Priority:

Due:

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone: +61 8 9251 9600
NATA # 1261
Site # 23736

Aug 24, 2018 9:00 AM

Aug 31, 2018

- ALL INVOICES

5 Day

Company Name: AECOM Aust Pty Ltd Melbourne

Address: Collins Square, Tower 2, Level 11, 727 Collins Street

Docklands

VIC 3008

Project Name: FFJV Project ID: NS2B Order No.:

Report #:

614408

**Phone:** 03 9653 1234

**Fax:** 03 9654 7117

Eurofins | mgt Analytical Services Manager : Natalie Krasselt

		Sa	mple Detail			Chlorophyll a	Conductivity (at 25°C)	Dissolved Oxygen	Dissolved Oxygen (% Saturation)	pH (at 25°C)	Phosphate total (as P)	Phosphorus reactive (as P)	Suspended Solids	Turbidity	Polycyclic Aromatic Hydrocarbons	Metals M8 filtered	Major Anions	Nitrogens (speciated)
Melb	ourne Laborato	ory - NATA Site	# 1254 & 142	71		Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х
Sydr	ey Laboratory	- NATA Site # 1	8217															
Bris	oane Laboratory	y - NATA Site #	20794															
Perti	Laboratory - N	IATA Site # 237	36															
Exte	rnal Laboratory	,		1														
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID													
1	NS2B-SITE 12	Aug 23, 2018		Water	M18-Au34578	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х
2	NS2B-SITE 5	Aug 23, 2018		Water	M18-Au34579	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х
3	NS2B-SITE 16	Aug 23, 2018		Water	M18-Au34580	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х
4	NS2B-SITE 11	Aug 23, 2018		Water	M18-Au34581	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х
5	DUPLICATE	Aug 23, 2018		Water	M18-Au34582	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х
Test	Counts					5	5	5	5	5	5	5	5	5	5	5	5	5

Eurofins | mgt 2-5 Kingston Town Close, Oakleigh, Victoria, Australia, 3166

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Date Reported:Sep 03, 2018

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#### **Internal Quality Control Review and Glossary**

#### General

- 1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
- 2. All soil results are reported on a dry basis, unless otherwise stated.
- 3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
- 4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences
- 5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds
- 6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- 7. Samples were analysed on an 'as received' basis
- 8. This report replaces any interim results previously issued.

#### **Holding Times**

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

\*\*NOTE: pH duplicates are reported as a range NOT as RPD

#### Units

mg/kg: milligrams per kilogram mg/L: milligrams per litre ug/L: micrograms per litre

**ppm:** Parts per million **ppb:** Parts per billion
%: Percentage

org/100mL: Organisms per 100 millilitres NTU: Nephelometric Turbidity Units MPN/100mL: Most Probable Number of organisms per 100 millilitres

#### **Terms**

Dry Where a moisture has been determined on a solid sample the result is expressed on a dry basis.

LOR Limit of Reporting

SPIKE Addition of the analyte to the sample and reported as percentage recovery RPD Relative Percent Difference between two Duplicate pieces of analysis.

LCS Laboratory Control Sample - reported as percent recovery.

CRM Certified Reference Material - reported as percent recovery.

Method Blank In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.

Surr - Surrogate The addition of a like compound to the analyte target and reported as percentage recovery

**Duplicate** A second piece of analysis from the same sample and reported in the same units as the result to show comparison.

**USEPA** United States Environmental Protection Agency

APHA American Public Health Association
TCLP Toxicity Characteristic Leaching Procedure

COC Chain of Custody

SRA Sample Receipt Advice

**QSM** Quality Systems Manual ver 5.1 US Department of Defense

CP Client Parent - QC was performed on samples pertaining to this report

NCP Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.

TEQ Toxic Equivalency Quotient

#### QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

#### **QC Data General Comments**

- 1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
- 2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
- 3. Organochlorine Pesticide analysis where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
- 4. Organochlorine Pesticide analysis where reporting Spike data, Toxaphene is not added to the Spike.
- Total Recoverable Hydrocarbons where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported
  in the C10-C14 cell of the Report.
- 6. pH and Free Chlorine analysed in the laboratory Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time.

  Analysis will begin as soon as possible after sample receipt.
- 7. Recovery Data (Spikes & Surrogates) where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
- 8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS
- 9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
- 10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.



#### **Quality Control Results**

Test	Units	Result 1	Accept Lim		Qualifying Code
Method Blank					
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	mg/L	< 0.001	0.00	01 Pass	
Acenaphthylene	mg/L	< 0.001	0.00	01 Pass	
Anthracene	mg/L	< 0.001	0.00	01 Pass	
Benz(a)anthracene	mg/L	< 0.001	0.00	01 Pass	
Benzo(a)pyrene	mg/L	< 0.001	0.00	01 Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001	0.00	01 Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001	0.00	01 Pass	
Benzo(k)fluoranthene	mg/L	< 0.001	0.00	01 Pass	
Chrysene	mg/L	< 0.001	0.00	01 Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001	0.00	01 Pass	
Fluoranthene	mg/L	< 0.001	0.00	01 Pass	
Fluorene	mg/L	< 0.001	0.00	01 Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001	0.00	01 Pass	
Naphthalene	mg/L	< 0.001	0.00	01 Pass	
Phenanthrene	mg/L	< 0.001	0.00		
Pyrene	mg/L	< 0.001	0.00		
Method Blank	g/ =		3.16		
Ammonia (as N)	mg/L	< 0.01	0.0	1 Pass	
Chloride	mg/L	< 1	1	Pass	
Nitrate & Nitrite (as N)	mg/L	< 0.05	0.0		
Nitrate (as N)	mg/L	< 0.02	0.0		
Nitrite (as N)	mg/L	< 0.02	0.0		
Phosphate total (as P)	mg/L	< 0.02	0.0		
Phosphorus reactive (as P)	mg/L	< 0.05	0.0		
Sulphate (as S)	mg/L	< 5	5		
Suspended Solids	mg/L	<1	1		
Total Kjeldahl Nitrogen (as N)	mg/L	< 0.2	0.2		
Turbidity	NTU	< 1	1	Pass	
Method Blank	INIU			Fass	
		Т			
Alkalinity (speciated)	/I	. 20			
Bicarbonate Alkalinity (as CaCO3)	mg/L	< 20	20		
Carbonate Alkalinity (as CaCO3)	mg/L	< 10		) Pass	
Method Blank					
Heavy Metals		0.004			-
Arsenic (filtered)	mg/L	< 0.001	0.00		
Cadmium (filtered)	mg/L	< 0.0002	0.00		
Chromium (filtered)	mg/L	< 0.001	0.00		
Copper (filtered)	mg/L	< 0.001	0.00		
Lead (filtered)	mg/L	< 0.001	0.00		
Mercury (filtered)	mg/L	< 0.0001	0.00		
Nickel (filtered)	mg/L	< 0.001	0.00		
Zinc (filtered)	mg/L	< 0.005	0.00	D5 Pass	
LCS - % Recovery					
Polycyclic Aromatic Hydrocarbons	1				
Acenaphthene	%	120	70-1		
Acenaphthylene	%	124	70-1	30 Pass	
Anthracene	%	129	70-1	30 Pass	
Benz(a)anthracene	%	86	70-1	30 Pass	
Benzo(a)pyrene	%	124	70-1	30 Pass	
Benzo(b&j)fluoranthene	%	117	70-1	30 Pass	



Test			Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Benzo(g.h.i)perylene			%	116		70-130	Pass	
Benzo(k)fluoranthene			%	123		70-130	Pass	
Chrysene			%	96		70-130	Pass	
Dibenz(a.h)anthracene			%	102		70-130	Pass	
Fluoranthene			%	121		70-130	Pass	
Fluorene			%	124		70-130	Pass	
Indeno(1.2.3-cd)pyrene			%	99		70-130	Pass	
Naphthalene			%	109		70-130	Pass	
Phenanthrene			%	130		70-130	Pass	
Pyrene			%	122		70-130	Pass	
LCS - % Recovery			,,,				. 455	
Ammonia (as N)			%	99		70-130	Pass	
Chloride			%	100		70-130	Pass	
Nitrate & Nitrite (as N)			<del>%</del>	109		70-130	Pass	
Nitrate (as N)			%	100		70-130	Pass	
Nitrite (as N)			<del>%</del>	105		70-130	Pass	
Phosphate total (as P)			<del>%</del>	103		70-130	Pass	
Phosphorus reactive (as P)			<del>%</del>	102		70-130	Pass	
•			<del>%</del>	100		70-130	Pass	
Sulphate (as S)								
Suspended Solids			%	101		70-130	Pass	
Total Kjeldahl Nitrogen (as N)			%	100		70-130	Pass	
LCS - % Recovery				I	T T	I		
Alkalinity (speciated)							_	
Carbonate Alkalinity (as CaCO3)			%	97		70-130	Pass	
LCS - % Recovery					l I			
Heavy Metals								
Arsenic (filtered)			%	98		80-120	Pass	
Cadmium (filtered)			%	105		80-120	Pass	
Chromium (filtered)			%	102		80-120	Pass	
Copper (filtered)			%	98		80-120	Pass	
Lead (filtered)			%	104		80-120	Pass	
Mercury (filtered)			%	104		70-130	Pass	
Nickel (filtered)			%	98		80-120	Pass	
Zinc (filtered)			%	99		80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery								
				1				
Polycyclic Aromatic Hydrocarbons				Result 1				
Polycyclic Aromatic Hydrocarbons Acenaphthene	B18-Au28943	NCP	%	Result 1 103		70-130	Pass	
		NCP NCP	%	1		70-130 70-130	Pass Pass	
Acenaphthene	B18-Au28943	1		103				
Acenaphthene Acenaphthylene	B18-Au28943 B18-Au28943	NCP	%	103 109		70-130	Pass	
Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene	B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943	NCP NCP	% %	103 109 113		70-130 70-130	Pass Pass	
Acenaphthene Acenaphthylene Anthracene	B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943	NCP NCP NCP	% % %	103 109 113 120		70-130 70-130 70-130	Pass Pass Pass	
Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene Benzo(a)pyrene Benzo(b&j)fluoranthene	B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943	NCP NCP NCP	% % % %	103 109 113 120 121		70-130 70-130 70-130 70-130	Pass Pass Pass Pass	
Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene Benzo(a)pyrene	B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943	NCP NCP NCP NCP NCP	% % % % %	103 109 113 120 121 113 124		70-130 70-130 70-130 70-130 70-130	Pass Pass Pass Pass Pass	
Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene Benzo(a)pyrene Benzo(b&j)fluoranthene Benzo(g.h.i)perylene Benzo(k)fluoranthene	B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943	NCP NCP NCP NCP NCP NCP	% % % % %	103 109 113 120 121 113 124 129		70-130 70-130 70-130 70-130 70-130 70-130 70-130	Pass Pass Pass Pass Pass Pass Pass	
Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene Benzo(a)pyrene Benzo(b&j)fluoranthene Benzo(g.h.i)perylene Benzo(k)ffluoranthene Chrysene	B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943	NCP NCP NCP NCP NCP NCP NCP	% % % % % %	103 109 113 120 121 113 124 129 123		70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130	Pass Pass Pass Pass Pass Pass Pass Pass	
Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene Benzo(a)pyrene Benzo(b&j)fluoranthene Benzo(g.h.i)perylene Benzo(k)fluoranthene Chrysene Dibenz(a.h)anthracene	B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943 B18-Au28943	NCP NCP NCP NCP NCP NCP NCP NCP	% % % % % % %	103 109 113 120 121 113 124 129 123 97		70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130	Pass Pass Pass Pass Pass Pass Pass Pass	
Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene Benzo(a)pyrene Benzo(b&j)fluoranthene Benzo(g.h.i)perylene Benzo(k)fluoranthene Chrysene Dibenz(a.h)anthracene Fluoranthene	B18-Au28943	NCP NCP NCP NCP NCP NCP NCP NCP NCP	% % % % % % %	103 109 113 120 121 113 124 129 123 97 127		70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130	Pass Pass Pass Pass Pass Pass Pass Pass	
Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene Benzo(b&j)fluoranthene Benzo(g.h.i)perylene Benzo(k)fluoranthene Chrysene Dibenz(a.h)anthracene Fluoranthene Fluorene	B18-Au28943	NCP	% % % % % % % % % % %	103 109 113 120 121 113 124 129 123 97 127 111		70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130	Pass Pass Pass Pass Pass Pass Pass Pass	
Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene Benzo(b&j)fluoranthene Benzo(g.h.i)perylene Benzo(k)fluoranthene Chrysene Dibenz(a.h)anthracene Fluoranthene Fluorene Indeno(1.2.3-cd)pyrene	B18-Au28943	NCP	% % % % % % % % % % % % %	103 109 113 120 121 113 124 129 123 97 127 111		70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130	Pass Pass Pass Pass Pass Pass Pass Pass	
Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene Benzo(b&j)fluoranthene Benzo(g.h.i)perylene Benzo(k)ffluoranthene Chrysene Dibenz(a.h)anthracene Fluoranthene Fluorene Indeno(1.2.3-cd)pyrene Naphthalene	B18-Au28943	NCP	% % % % % % % % % % % % % % %	103 109 113 120 121 113 124 129 123 97 127 111 111		70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130	Pass Pass Pass Pass Pass Pass Pass Pass	
Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene Benzo(b&j)fluoranthene Benzo(g.h.i)perylene Benzo(k)fluoranthene Chrysene Dibenz(a.h)anthracene Fluoranthene Fluorene Indeno(1.2.3-cd)pyrene	B18-Au28943	NCP	% % % % % % % % % % % % %	103 109 113 120 121 113 124 129 123 97 127 111		70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130 70-130	Pass Pass Pass Pass Pass Pass Pass Pass	



Chloride Phosphate total (as P)	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
				Result 1					
Phosphate total (as P)	M18-Au36593	NCP	%	76			70-130	Pass	
	M18-Au36599	NCP	%	114			70-130	Pass	
Sulphate (as S)	M18-Au36593	NCP	%	87			70-130	Pass	
Spike - % Recovery									
Alkalinity (speciated)				Result 1					
Bicarbonate Alkalinity (as CaCO3)	M18-Au32486	NCP	%	95			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic (filtered)	M18-Au34716	NCP	%	100			70-130	Pass	
Cadmium (filtered)	M18-Au34716	NCP	%	98			70-130	Pass	
Chromium (filtered)	M18-Au34716	NCP	%	99			70-130	Pass	
Copper (filtered)	M18-Au34716	NCP	%	93			70-130	Pass	
Lead (filtered)	M18-Au34716	NCP	%	93			70-130	Pass	
Mercury (filtered)	M18-Au34716	NCP	%	93			70-130	Pass	
Nickel (filtered)	M18-Au34716	NCP	%	94			70-130	Pass	
Zinc (filtered)	M18-Au34716	NCP	%	95			70-130	Pass	
Spike - % Recovery	1111071001710		,,,					. 455	
- p				Result 1					
Ammonia (as N)	M18-Au34582	СР	%	95			70-130	Pass	
Nitrate & Nitrite (as N)	M18-Au34582	CP	%	98			70-130	Pass	
Nitrate (as N)	M18-Au34582	CP	%	98			70-130	Pass	
Nitrite (as N)	M18-Au34582	CP	%	102			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Polycyclic Aromatic Hydrocarbons	s			Result 1	Result 2	RPD			
Acenaphthene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(a)pyrene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(b&j)fluoranthene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(g.h.i)perylene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(k)fluoranthene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chrysene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Dibenz(a.h)anthracene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluorene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
- tapitalaiono	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	Z18-Au29814	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene Pyrene			<u>.</u>					7 0.00	
Pyrene					Describ 0	DDD			
				Result 1	i Resuit∠ i	KPU			
Pyrene Duplicate	M18-Au36414	NCP	ma/l	17000	Result 2 17000	3.0	30%	Pass	
Pyrene  Duplicate  Chloride	M18-Au36414 S18-Au33928	NCP NCP	mg/L mg/L	17000	17000	3.0	30%	Pass Pass	
Pyrene  Duplicate  Chloride  Dissolved Oxygen	S18-Au33928	NCP	mg/L	17000 9.3	17000 9.2	3.0 1.0	30%	Pass	
Pyrene  Duplicate  Chloride  Dissolved Oxygen  Phosphate total (as P)	S18-Au33928 M18-Au32667	NCP NCP	mg/L mg/L	17000 9.3 0.26	17000 9.2 0.30	3.0 1.0 14	30% 30%	Pass Pass	
Pyrene  Duplicate  Chloride  Dissolved Oxygen	S18-Au33928	NCP	mg/L	17000 9.3	17000 9.2	3.0 1.0	30%	Pass	



Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic (filtered)	M18-Au34716	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	M18-Au34716	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium (filtered)	M18-Au34716	NCP	mg/L	0.002	0.001	9.0	30%	Pass	
Copper (filtered)	M18-Au34716	NCP	mg/L	0.002	0.002	5.0	30%	Pass	
Lead (filtered)	M18-Au34716	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury (filtered)	M18-Au34716	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	M18-Au34716	NCP	mg/L	0.002	0.001	9.0	30%	Pass	
Zinc (filtered)	M18-Au34716	NCP	mg/L	0.020	0.020	3.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Dissolved Oxygen (% Saturation)	M18-Au34579	CP	%	92	93	1.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Conductivity (at 25°C)	M18-Au34581	CP	uS/cm	520	520	<1	30%	Pass	
pH (at 25°C)	M18-Au34581	CP	pH Units	8.3	8.3	pass	30%	Pass	
Duplicate									
Alkalinity (speciated)				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as CaCO3)	M18-Au34581	CP	mg/L	200	210	6.0	30%	Pass	
Carbonate Alkalinity (as CaCO3)	M18-Au34581	CP	mg/L	< 10	< 10	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M18-Au34582	CP	mg/L	0.04	0.03	16	30%	Pass	
Chlorophyll a	M18-Au34582	CP	ug/L	< 5	< 5	<1	30%	Pass	
Nitrate & Nitrite (as N)	M18-Au34582	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Nitrate (as N)	M18-Au34582	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Nitrite (as N)	M18-Au34582	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Suspended Solids	M18-Au34582	CP	mg/L	16	15	9.0	30%	Pass	



#### Comments

#### Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

#### **Qualifier Codes/Comments**

Code Description

Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

#### **Authorised By**

 Natalie Krasselt
 Analytical Services Manager

 Alex Petridis
 Senior Analyst-Metal (VIC)

 Joseph Edouard
 Senior Analyst-Organic (VIC)

 Michael Brancati
 Senior Analyst-Inorganic (VIC)



#### Glenn Jackson

#### **National Operations Manager**

Final report - this Report replaces any previously issued Report

- Indicates Not Requested
- \* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Eurofine; Implication or interpretation given in this report, In on case shall Eurofine; Implication or interpretation given in this report, In on case shall Eurofine; Implication or interpretation given in this report, In on case shall Eurofine; Implication in the report of the report of the report of sent entered in contrast or feature to meet decidines and lost per performed on the samples as required.

## **APPENDIX**

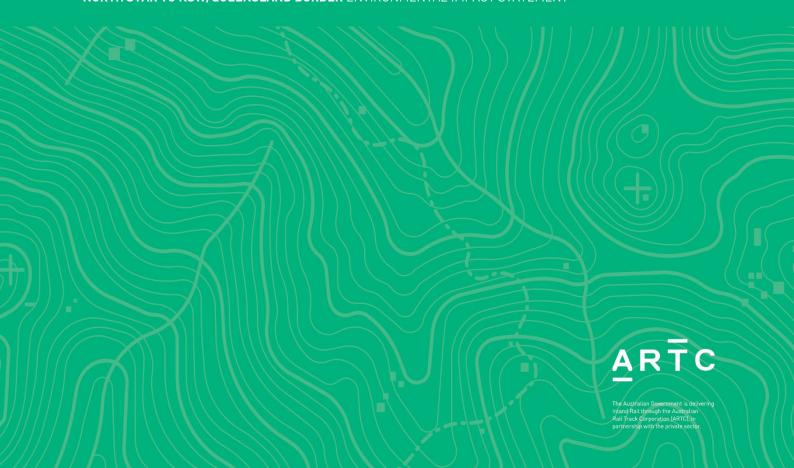




Surface Water Quality Technical Report

**Appendix B** Field Data Sheets

NORTH STAR TO NSW/QUEENSLAND BORDER ENVIRONMENTAL IMPACT STATEMENT



AUSRIVAS Physical Assessment Protocol Field Data Sheets	Page 1 Site No. # Do1 Date 21-8-18
Date 21-8-18 Site No. * Time 113* River Name Mossingry Creek Location Lot 93	
Weather Rain in last week? Y [ ] N [×] Ph	otograph numbers and details
Latitude: 28,869823 Longitude: 150,401801	) U/5-1+2 , CONTRE 3+4, D/C-5+6.
	0/5) U/5-1+2, CONTRE 3-4, D/5-5-6
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplait Left bank is facing downstream.  From  Process  Pro	LENGTH OF SAMPLING SITE  Bankfull width
JN	BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

BASIC WATER CHEMISTRY	Units	Valley shape Choose one category only	Local impacts on streams Choose one or more categories and	d describe the detail of each
Temperature OP	°c	Steep valley	Sand or gravel mining	Sewage effluent
Conductivity		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Other mining	Channel straightening
Dissolved Oxygen	mg l <sup>-1</sup>	Shallow valley	Road	River improvement wor
Dissolved Oxygen Sat.	%		Bridge / culvert / wharf	Water extraction
pH		Broad valley	Ford / ramp	Dredging
Turbidity			Discharge pipe	
Total phosphorus 🔲 🗒 ⊱		Gorge	Forestry activities	Litter
Total phosphorus		¥ 🗍	Sugar mill	Recreation
ALKALINITY		Symmetrical	Irrigation run-off or	Other
Amount of water	ml	floodplain	pipe outlet	
Amount of H <sub>2</sub> SO <sub>4</sub>	ml	Asymmetrical	Description	
Alkalinity	mg ſ⁻¹	floodplain		
	3	Jellich.	Local landuse	i.
Floodplain width		Average (m)	Choose one category for each bar Left Right	IK.
Floodplain features	(6) < P(p)	NOT BE DETREMENTO	Native forest	
Choose one or more features when present			Native grassland (no	ot grazed)
Sampling site has no distinct floodplain		oll systems	Grazing (native or no	n-native pasture)
Oxbows / billabongs Body of water occupying a former river		rt, crescentic strips or patches formed ig the inner bank of a stream meander	Exotic grassland (lav	wns etc., no grazing)
meander, isolated by a shift in the stream	Spl		Forestry Native [ ]	[ ] Pine [ ][ ]
channel		all alluvial fan formed where an rloaded stream breaks through a levee	Cropped Rainfed [	][ ] Irrigated [ ][ ]
Remnant channels Formed during a previous hydrological	and	deposits material on the floodplain	Urban residential	
regime. May be infilled with sediment		odplain scours our holes formed by the concentrated	Commercial	
Flood channels A channel that distributes water onto the		aring and digging action of flowing water	Industrial or intensiv	e agricultural
floodplain and off the floodplain during	⊠ No	floodplain features present	Recreation	
floods	Floo	odplain present at the sampling site but is not contain any of the above features	Other	

Riparian zone composition Assess for whole sampling site	% Cover	Vegetation D	Description	Longitudinal exte Choose one category include ground layer e native grassland.		Left Right bank bank
Trees (>10m in height)	15	e ELTC. TUT . CR	IGALOW LEUC POP	None	1	
Trees (<10m in height)	16	E PS ABOUT		Isolated / scattered	dy	
Shrubs	1	May total more than 100% Hearing & ABOUT - ARACIN SP		Regularly spaced	24.24	
Grasses / ferns / sedges	80'	LINATIVE CHAIS		Occasional clump	s street	THH
Chading of channel				Semi-continuous	States to make the	
Shading of channel  < 5% 6 - 25%	≥ 26 – 50%	51 – 75%		Continuous	· presentation of the land	166
slight exte	derate ensive nce rating	% Exotic J	al 100%	Y [ ] N [ > ]  If no, record regeneration category	Abundant (>5% coveresent Very limited (<1% co	er) and healthy
Choose one category only. Site category. Words within the draw	vings summarise the	detailed text about the state of	the riparian and valle	ey vegetation for each c	ategory.	gn disturbance
Extreme disturbance		High disturbance		Low disturbance		
dominated by exotic spare or completely abs	s extremely disturbed (ie. pecies with native species ent) griculture and/or cleared nts present are virtually all	disturb stock or through the ir although some native valley vegetation - land ONE side, native	agriculture and/or cleared vegetation on the other or with a high percentage	or minor on BOT condition disturbs  Valley v  Ripanan BOTH's	n vegetation – native vegetation p H sides of the river and in relatively n with few exotic species present, nce present is relatively minor. egetation – native vegetation presides of the river, with a virtually intended few exotic species	y good Any sent on

### Very high disturbance



Riparian vegetation - some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and

Valley vegetation - agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)



#### Moderate disturbance



Riparian vegetation - native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

Valley vegetation - agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state



#### Very low disturbance



Riparian vegetation - native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

Valley vegetation - native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

USRIVAS P	hysical Assessme	ent Protocol Fie	ld Data Sheets		Page 4	Site No. 2 00	Date	21-8 18
	riers to local fish ategory for each flow	condition	Type of bars Choose one or mo	ore categories	Extent of % of stream	bars ambed forming a ba	ar of any typ	pe5_ %
67	No passage	Base Low High flow flow flow	$\sim$	Bars absent	The second control of the second	sediment particle	[ ] Gra	vel [ ]
Q d	No passage			Side/point bars VEGETATED	Sand Channel	[ ] Silt/clay		mm more categories
8	Very restricted passage			Side/point bars UNVEGETATED		No modifications		Reinforced
8	Moderately restricted passage			Mid-channel bars VEGETATED		Desnagged		Revegetated
8	Partly restricted passage			Mid-channel bars UNVEGETATED  Bars around		Dams and diversions	00	Infilled
8	Good passage		0 0	Braided channel	1	Resectioned	00	Berms or embankments
8	Unrestricted passage			Infilled channel	N.X.	Straightened	Signs of work still	Recently channelised
ype and heig	tht of barrier(s)	NIV		High flow deposits	J.	Realigned	Works old and revegetated	Channelised in the past
Channel sha	pe Choose one ca	tegory only			1	2		
			~	4~		7	1	
	U shaped	Flat U shaped	Deepened I	U shape Wide	ened or infilled	Two s	stage	Multi stag
7	- 47			4		~	4	
	Box	Wide box	v v	shaped	Trapezoid	Concre	ete V	Pipe or culver

Bank shap Choose one	category for each	bank t Right k bank	Bank slope Choose one category for	or each bank  Left Right  bank bank	Sediment oils  absent light moderate profuse
	Concave		Vertical 80 - 90°		Water oils  ☑ none ☐ flecks ☐ globs ☐ sheen ☐ slick
	Convex	$\boxtimes$	Steep 60 - 80°		Sediment odours    normal/none   sewage   petroleum   chemical
2	Stepped		Moderate 30 - 60°		anaerobic other
	Wide lower bench		Low 10 - 30°		normal/none sewage petroleum chemical other
2	Undercut		Flat <10°		Turbidity (visual assessment)  Clear Slight Turbid Opaque
Choose one None Mining Runoff	Irriga draw-	red % b tation tion Arti chown Cho	Prock outcrops ess % of each bank covered edrock outcrops Left bank Right I ficial bank protection nose one or more categories	ank O Bank O Ban	Is water clarity reduced by:  Suspended material (e.g mud, clay, organics)  Water level at the time of sampling  Dry  No flow  Low  Baseflow or near baseflow  High  Flood (don't sample)
Stock access Human access	Seep	ses 🔲	None Fence structures Levee banks Rock or wall layer	Fenced stock watering points  Vegetation plantings  Logs strapped	Artificial features at the sampling site Choose one or more categories  Major Minor Ford Bridge Culvert Other weir  Description

	form features	and the same of th	Macrophyte cover Assess	% cover of the sa	ampling site by each category.
Total % compos	sition for all feature	es must equal 100%	Overall % cover of macrophy	tee 5	% cover of emergent macrophytes
Height >1m	Waterfall	% of site	Overall 78 cover of macrophry		
Gradient >60°	_	Est. Av. Length (m)		DE	% cover of floating macrophytes
		Est. Av. Height (m) Est. Av. Gradient (°)			% cover of submerged macrophytes
Step Height <1m	Cascade _	% of site	Macrophyte composition		
Gradient 5-60° Strong currents	-	Est. Av. Length (m)	Use a macrophyte field guide (i		acobs, 1994) to aid identification.
Silving currents		Est. Av. Height (m) Est. Av. Gradient (°)	Listed macrophytes can be cha N denotes a native taxa and I d		he common taxa present in each State or Territo luced taxa.
Gradient 3-5° Strong currents	Rapid	% of site	Emergent macrophytes	%	Submerged macrophytes %
Rocks break surface	Ba	Est. Av. Length (m)	P	resent cover	Present cover
surface	-	Est. Av. Depth (m) Est. Av. Width (m)	Brachiaria (Para Grass) I		Ceratophyllum (Hornwort) N
			Crassula (Crassula) N		Chara (Stonewart) N
Gradient 1-3° loderate currents	Riffle _	% of site	Cyperus (Sedge) I/N		Elodea (Canadian Pondweed) I
Surface unbroken but unsmooth		Est. Av. Length (m) Est. Av. Depth (m)	Eleocharis (Spikerush) N		Myriophyllum (Water Milfoil) I/N
out drismooth		Est. Av. Width (m)	Juncus (Rush) I/N		Nitella (Stonewart) N
Gradient 1-3°	Glide	% of site	Paspalum (Water Couch) N		Potamogeton (Pondweed) N
Small currents Surface unbroken		Est. Av. Length (m)	Phragmites (Common Reed) N		Triglochin (Water Ribbon) N
and smooth	_	Est. Av. Depth (m)	Ranunculus (Buttercup) I		Vallisneria (Ribbonweed) N
		Est. Av. Width (m)	Scirpus (Clubrush) N		Other
Gradient 1-3° Small but distinct	1 -	% of site	Triglochin (Water Ribbon) N		Other
& uniform current Surface unbroken	100	Est. Av. Length (m) Est. Av. Depth (m)	Typha (Cumbungi) N		Other
Surface unbrokerr		Est. Av. Width (m)	Other CALEX	5	Floating macrophytes
Area where	Pool		Other		Present
stream widens or	-	% of site Est. Av. Length (m)	Other		Azolla (Azolla) N
deepens and current declines	hononon	Est. Av. Depth (m)			Callitriche (Starwart) I
		Est. Av. Width (m)			Other
reasonable sized	Backwater	% of site			Other
(>20% of channel		Est. Av. Length (m)			Other
width) cut-off section away from	-	Est. Av. Depth (m)	Overall % sever of native ma	aranhuta tawa	160
	E7 _	Est. Av. Width (m)	Overall % cover of native ma	acrophyte taxa	Total should equal overall % cover

Note: An additional response variable planform channel pattern is measured in the office

Overall % cover of native macrophyte taxa 150 Total should equal overall % cover of macrophytes from above Overall % cover of native macrophyte taxa \_

#### Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes, overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1)

Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2)

Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily DRY

#### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

32-60% fine sediment, low availability of interstitial spaces

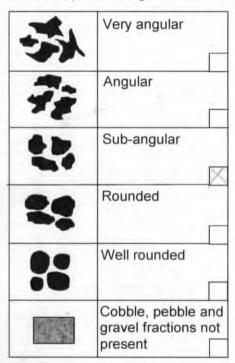


Matrix dominated

>60% fine sediment, interstitial spaces virtually absent

#### Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

- Stable

Unstable - depositing

#### Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.

#### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

#### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.

#### Moderate deposition

Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.

#### Severe deposition

Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.

<b>AUSRIVAS Physical</b>	and Chemical	Assessment Protocol	Field Data	Sheets	Page 8
Site No.	Date	1			

#### HIGH GRADIENT STREAMS

Page 1 of 2

Habitat								C	ondi	tion	cate	gon	1								
parameter		E	celle	nt		Good							Fair					Po	or		
1. Epifaunal substrate <i>l</i> available cover	subs epifa fish i subn bank stabi to all pote that	trate frame of cover; nergeous, cobie habitottial (i.e., contrate)	an 70% avours olonisi mix of i logs, ible or tat and colon e logs t new nt).	able for stion a snag: under other d at sti isation	age	habi full of pote habi of po of ac the i not	tat; with colonist and for copulate didition form of colonist and colo	adequi main ions; p ial sub f new epared	ate tenancoreser ostrate fall, bu i for ay rate	ce nce e in	hab avai desi freq	20-40% mix of stable habitat, habitat availability less than desirable, substrate frequently disturbed or removed.					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
2. Embeddedness	Gravel, cobble and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.						Gravel, cobble and boulder particles are 25- 50% surrounded by fine sediment.				50u 75%	der p	obble article ounde	s are		mo	ulder ore th	cobb parti- an 75 ided b	cles a	are	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
3. Velocity / depth regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).						Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).				Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep)					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.					from sedi botte	Some new increase in bar formation, mostly from gravel, sand or fine sediment, 5-30% of the bottom affected; slight deposition in pools.				new sedi new bott sedi obsi con- mod	grav ment bars om af ment truction striction	depo el, sar on old 30-5 fected depor ons, ons ar depo valent	nd or to d and 0% of t; sits at and ber sition	the	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently, pools almost absent due to substantial sediment deposition.					r an ue
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
5. Channel flow status	both	lower mal an mel su	thes b banks nount bstrat	, and		Water fills >75% of the available channel; or <25% of channel substrate is exposed.				avai	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.						Some channelization present, usually in areas of bridge abutments, evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not			or s pres and read	horing sent of 40 to	zation ; emb g struc n both 80% annelia	ankm ctures bank of str	ents s; eam	Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.						
SCORE	20	19	18	17	16	pres 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	T

<b>AUSRIVAS</b>	Physical and Chemical Assessment Protocol Field Data Sheets	Page 9
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#### HIGH GRADIENT STREAMS

Page 2 of 2

Habitat								(	cond	ition	cate	go	У								
parameter		Ex	celle	ent			-	Good	1				Fair					Po	or		
7. Frequency of riffles (or bends)	riffles divided by width of the stream <7.1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.						elatively frequent; ratio distance between fiftes divided by width of the stream 47.1 variety 1 habitat is key. In reams where riffles are ontinuous, placement boulders or other rge, natural obstruction								Occasional riffle or bend, bottom contours provide some habitat, distance between riffles divided by the width of the stream is between 15 to 25.						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
8. Bank stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal, little potential for future problems <5% of bank affected.						Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable, 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable, many eroded areas, 'raw' areas frequent along straight sections and bends; obvious bank sloughing, 60-100% of bank has erosional scars.				
SCORE	Left	bank		10	9	8		7	10	6	5	1	4		3		2	1	1	0	
SCORE	Righ	t bar	k	10	9	8		7	1	6	5		4		3	-3	2	- 1	1	0	
9. Vegetative protection (score each bank)	More than 90% of the streambank surfaces and immediate nparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident, almost all plaints allowed					stre cove vegi of pi repr evid full i to ai mon the	70-90% of the streambark surfaces covered by native vegefation, but one class of plants is not well-represented, disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height				50-70% of the streambank surfaces covered by vegetation; disruption obvious, patches of bare soil or closely cropped vegetation common, less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE		ow na bank	T	10	9	8	1	7		6	5	T	4		3	3	2		1	0	
SCORE	Righ	t bar	ik.	10	9	8		7		6	5		4		3	1	2		1	0	
10. Riparian zone score (score each bank)	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					12-1 activ	Width of ripanan zone 12-18 metres, human activities have impacted the ripanan zone only minimally				Width of riparian zone 6- 12 metres, human activities have impacted the riparian zone a great deal.					Width of riparian zone <5 metres; little or no riparian vegetation is present because of human activities.					
SCORE		-		10	9	8		7		6	5	T	4		3	1	2		1	0	
SCORE	Left bank 10 9					8		7	1	6	5	-	4	+	3		2		1	0	

TOTAL HIGH GRADIENT HABITAT SCORE



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#### LOW GRADIENT STREAMS

Page 1 of 2

Habitat									Cond	lition	cat	ego	ry								
parameter		E	xcell	ent				Goo	d				Fai	r		Т		P	oor		
1. Epifaunal substrate / available cover	sub epit and sna und or c and cold (i.e not	eater to ostrate faunal d fish d ags, su dercut other s d at sta onisati logs/ new f nsient)	favou colon cover, ubmer banks stable age to on po snags all and	irable isation mix or ged to s, cob habita allow tential that	for f d ogs. ble at full	hab full pote hab of p of a the not colo	coloni ential, itat fo opula ddition form yet pronisati	vell-su isation adequations; tions; nal su of new repare	uate ntenan preser bstrati vfall, b d for ay rate	ce nce e in ut	hab ava des freq	itat, h ilabilit irable	y less sub dist	stable t sthan strate urbed		ha	bitat	lack s; su	0% s of h bstra lackii	abita te	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	X	3	2	1	0
2. Pool substrate characterization	mail and roof sub	ture of lerials, firm s mats merge	with sand p and	grave preval	ent,	be o	d or cl domina s and	ant, so	ud ma ome ro erged		bott		ttle or ubme	or sa no ro erged		be		k, no	ay or root	mat	or
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	×	4	3	2	1	To
3. Pool variability	sha sma	n mix llow, la all-sha p pool	arge-d	leep, small-					s large shallo		mon		valent	much					ools		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	of is and bott	e or no slands less t om aff iment	or po han 2 fected	int bar 0% of by	rs	from sedi botte	forma grav ment, om aft	tion, n el, sar 20-50	nd or f 0% of sligh	ne the	new sedi new botto sedi obst cons mod	grave ment bars om af ment ruction striction	on old 50-8 fected depoins ons ar depo	sits at nd ber sition	the nds;	ma der 80° cha por to s	velop % of angin	the to most tantia	sits orease t mo pottor equen t abse	ed bare then tly, ent d	an ue
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	8	5	4	3	2	1	0
5. Channel flow status	both mini char	ler rea lower mal ar nnel si osed	r bank mount	s, and		avail	able of	>759 channe channe is exp	el	0	avail and/	able (	chann le sub	strate		cha	anne	and	most tandi	tly	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	dred	nneliz Iging a mal s nal pa	absent tream	or		pres of br evide char dred 20 y but r char	ent, unidge attence of inelization (in may recent inelization)	abutmof pasi ation, i greate y be p	in are ents, t e er than resent		or sh presi and reach	nsive noring ent or 40 to	struct both 80%	may bankme tures bank of streed an	ents s:	gat 80° cha disi	oion o % of annel rupte oitat (	the s ized id Ir	nstrea ly alte	ove n rea	ch
SCORE	20	19	18	17	16	pres 15	14	13	12	11	10	9	8	7	6	5	4	3	2	4	0
		1				10	1.4	10	12	4.1	10	9	0	,	0	9	4	3	2	1	0

DRY.

Continued over

AUSRIVAS Physical and	Chemical	Assessment	Protocol I	Field Data	Sheets	Page 11
Site No. DO I	Date	21.8.18	*			

#### LOW GRADIENT STREAMS

Page 2 of 2

Habitat						(	Conditi	on c	categ	ory						
parameter	Ex	celle	ent			Good	1			Fair				Po	or	
7. Channel sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).			increas length 2	e the str 2 to 3 tim han if it		1	The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.				Channel straight: waterway has been channelized for a long distance.				
SCORE	20 19	18	17	16	15 1	4 13	12 1	1 1	10 9	8	7	6	5 4	3	2	1 (
8. Bank stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.				of erosi	-30% of as areas	Il areas ly healed bank in	1	Moderately unstable, 30- 60% of bank in reach has areas of erosion, high erosion potential during floods.			10-	Unstable; many eroded areas; 'raw' areas fraquent along straight sections and bends; obvious bank sloughing. 60-100% of bank has erosional scars.			
SCORE	Left bank	1	10	9	8	X	6		5	4	1	3	2			0
SCORE	Right ban	k 1	10	9	8	- 7	6		5	4	1	3	2		1	0
9. Vegetative protection (score each bank)	More than streamban and immec zone cover vegetation, trees, und shrubs, or macrophyt disruption grazing or minimal or almost all to grow na	k surfitate ri red by inclu- erston non v es; ve throughout not en plants	faces pania nati ding ey wood egeta gh ng vider allow	s an ve y ative	covered vegetat of plant represe evident full plan to any g more th	bank sur d by nativition, but as is not a ented; dist but not at growth great extraon one to ential plate height	ve one class well- sruption affecting potential ent; nalf of	S C C C C C C C C C C C C C C C C C C C	stream! covered disrupti patches closely vegetat than on potentia	of the bank surfa d by veget ion obvious s of bare's cropped ion comm re-half of t al plant storemaining.	ation, s; oil or on, le		Less th stream covered disrupti vegetat remove centime average	bank some of lon is lon had to 5 setres of	surface egetati stream very hi as been or less	es on; ibank igh; in
SCORE	Left bank	1	10	9	>8	7	6		5	4	1	3	2		1	0
SCORE	Right ban	k 1	10	9	8	7	6		5	4	1	3	2		1	0
10. Riparian zone score (score each bank)	Width of n >18 metres activities (i lawns, cro not impact zone.	e roa	nan ads,	ave	Width of riparian z 12-18 metres; hun activities have imp the riparian zone o minimally.		numan mpacted	i i	12 met	of riparian res, huma es have im arian zone	n pacte	d	Vidth of 6 met riparian present human	res, lit vege beca	tle or r tation i use of	10 S
SCORE	Left bank	1	10	9	8	7	6		5	>4	1	3	2	1	1	0
SCORE	Right ban	6	10	9	8	7	6		5	>4		3	2		1	0

TOTAL LOW GRADIENT HABITAT SCORE



Site No. 5001

Date 21. 8.18

#### Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

_	Cross-section sketch	as	Cros	s-section number of _2
	7	CANIL FALL		bedform at the cross-section  □ Run □ Pool □ Cascade □ Other □
Bank height (m)	The channel sketch should show in cross	s-section the shape of the channel and include the location of ill points. Also show other features such as bars, rocky ross section.		Bankfull channel width (m) (=total of boxes A+B+C)  am width at the water mark (m)  width at the water surface (m)
Bank width (m)  Vertical distance between the water surface and the water mark (m)  Riparian zone width	Horizontal dis		rement	Bank width (m)  Vertical distance between the water surface and the water mark (m)
Bank material Assess  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm)	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m ethe cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm)	Total 100%	Assess in the area 5m either side of the cross section    <10%
Fines (silt and clay, <0.06mm	Total 100% each	Fines (silt and clay <0.06mm)	00	<b>Detritus cover</b>

<b>AUSRIVAS Physical</b>	and	Chemical	Accesement	Protocol	Field	Data Shoote	Page 1	3
AUSKIVAS FILYSICAL	anu	Chemicai	Assessment	Protocol	rieid	Data Sneets	rage i	J

Site No.

Date 21.8.18

#### Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

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Bank height (m)	The channel sketch should show in cross	section the shape of the channel and include the location of li points. Also show other features such as bars, rocky	Type of Riffle	Bankfull channel width (m)  (=total of boxes A+B+C)  am width at the water mark (m)  width at the water surface (m)
Bank width (m)  Vertical distance between the water surface and the water mark (m)  Riparian zone width	Vertical water	3 4 5 6	rement	Bank width (m)  Vertical distance between the water surface and the water mark (m)
Left bank (m) R Bank material Assess  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay, <0.06mm)	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m ei the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	ither side of %001 lead 1	Assess in the area 5m either side of the cross section    <10%

Detailed instructions on the m Two cross-sections are required at ho	nogeneous sampling sites (generally low mpling is at or near the water mark level,	ections are provided in the	protocol manua	on  II. Be familiar with these before proceeding ous sampling sites (generally upland streams). am width at the water mark. In this case, vertical dista	7
Cro	ss-section sketch		Type of	ss-section number  bedform at the cross-section  Run Pool Cascade Oth  Bankfull channel width (m)  (=total of boxes A+B+C)	
the wa	Horizontal distances (m)  Vertical water depths (cm)	ow other features such as bars, rocky	Stream	width at the water mark (m) width at the water surface (m)	Vertical distance between the water surface and the water mark (m)
Riparian zone width  Left bank (m) Right b		n cross-section measu	irement		
Bank material Assess % com Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay, <0.06mm)	Assess % continue   Asse	>256mm)	Total 100%	Asses   Filamentous algae cover     <10%     10–35%     35-65%	

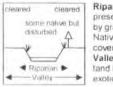
AUSRIVAS Physical Assessment Protocol Field Data Sheets Pag	e 1 Site No. 2002 Date 21 8 18
Date 21.8.18 Site No. 002 Time 1310	Recorder's Name Second Copper
River Name MOBBIADRY CREEK Location 15 LOT 6	OP 75 60 10
Weather <u>CLEAC+ SWAY</u> Rain in last week? Y [ ] N [X] Photograp	h numbers and details
deg min sec deg min sec	41, Thirt 2.4. 07 5-6
	1-4
20	-
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  Left bank is facing downstream.	LENGTH OF SAMPLING SITE  Bankfull width (m)  x 10  Length of sampling site (m)
The same of the sa	Notes
	BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a). AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998)

BASIC WATER CHEMISTRY	Units	Valley shape Choose one cate	gory only		pacts on streams ne or more categories ar	nd describe the detail of each
Temperature Di-	°c	1	Steep valley	Sar	nd or gravel mining	Sewage effluent
Conductivity	/			Oth	er mining	Channel straightening
Dissolved Oxygen	mg l <sup>-1</sup>		Shallow valley	Ro	ad	River improvement work
Dissolved Oxygen Sat.	%			Brid	dge / culvert / wharf	Water extraction
оH			Broad valley	For	rd / ramp	Dredging
Turbidity				Dis	charge pipe	Grazing
Total phosphorus 🔲 🗒		175	Gorge	For	restry activities	Litter
Total nitrogen		A		Sug	gar mill	Recreation
ALKALINITY		-v-	Symmetrical floodplain		gation run-off or e outlet	Other
Amount of water	ml	_ P			tion	
Amount of H <sub>2</sub> SO <sub>4</sub>	ml		Asymmetrical floodplain			
Alkalinity	mg l <sup>-1</sup>		Посаріані	1.50	SUSSE III	
- 1979-2-5-17				Local la Choose d	nduse one category for each ba	ink
Floodplain width		Average	_ , ,	Left Rig		
Floodplain features	Y 1, p.1	in total	44477		Native forest	
Choose one or more features when present		T + 13-10			Native grassland (n	ot grazed)
Sampling site has no distinct floodplain		oll systems t, crescentic strips	or patches formed		Grazing (native or ne	on-native pasture)
Oxbows / billabongs Body of water occupying a former river	alon	g the inner bank of	a stream meander		Exotic grassland (la	awns etc., no grazing)
meander, isolated by a shift in the stream channel	Spla	ays all alluvial fan forme	nd whom on		Forestry Native [	][ ] Pine [ ][ ]
Remnant channels	over	loaded stream brea	aks through a levee		Cropped Rainfed	[ ][ ] Irrigated [ ][ ]
Formed during a previous hydrological		deposits material o	in the floodplain		Urban residential	
regime. May be infilled with sediment Flood channels	Sco	odplain scours ur holes formed by			Commercial	
A channel that distributes water onto the			ction of flowing water		Industrial or intensi	ve agricultural
floodplain and off the floodplain during floods	No floodplain features present Floodplain present at the sampling site but			Recreation		
			f the above features		Other	

Riparian zone composition Assess for whole sampling site % Co	ver Vegetation Description	Longitudinal extent Choose one category for include ground layer exce native grassland.	each bank. Do not	Left Rigi bank ban
Trees (>10m in height)	e Lut TUR & ACACIA IP	None	~~	
Trees (<10m in height)	ENO WILDE - HORROR WE	Isolated / scattered	ハン	
Shrubs	than 100% than 1	Regularly spaced	×	
Grasses / ferns / sedges	May have the state of the state	Occasional clumps	95 10 10	
Shading of channel		Semi-continuous	spends to make	XF
< 5% 6 - 25% 26 - 5	0%	Continuous	Strate Canadan Strate Con	
Extent of trailing bank vegetation  nil moderate  slight extensive  Overall vegetation disturbance rating Choose one category only. Sites with valle category. Words within the drawings summ	Native and exotic riparian vegetation  % Native  % Exotic  Total 100%  y vegetation cleared on BOTH sides, but with riparian vegetation the detailed text about the state of the riparian and	If no, record regeneration category	Abundant (>5% coveresent Very limited (<1% could be scored in the high	et? er) and healt over)
Extreme disturbance	High disturbance	Low disturbance		
Riparian vegetation – absent or severeduced. Vegetation is extremely dist dominated by exotic species with nativare or completely absent)  Valley vegetation – agriculture and/o land BOTH sides. Plants present are exotic species (willows, pines etc.)	disturb stock or through the infrusion of exotic species although some native species remain  Valley vegetation – agriculture and/or cleared land ONE side, native vegetation on the other	or minor on BOTH's condition with disturbance valley veg BOTH side	egetation – native vegetation p sides of the river and in relatively with few exotic species present e present is relatively minor. etation – native vegetation preses sof the river, with a virtually into	good Any sent on

#### Very high disturbance



Riparian vegetation - some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and

Valley vegetation - agriculture and/or cleared fand BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)



#### Moderate disturbance



Riparian vegetation - native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

Valley vegetation - agriculture and/or cleared land on ONE side native vegetation on the other in reasonably undisturbed state



#### Very low disturbance



Riparian vegetation - native vegetation present on BOTH sides of the river and in an undisturbed state Exotic species are absent or rare. Representative of natural vegetation in excellent condition

Valley vegetation - native vegetation present on BOTH sides of the river with an intact canopy Exotic species are absent or rare. Representative of natural vegetation in excellent condition

	rriers to local fish ategory for each flow			Type of bars Choose one or	more categories	S	Extent of I	oars mbed forming a ba	ar of any ty	pe1%
		Base	Low High		Bars absent		All The Land of the State of th	sediment particle		
59	No passage				Side/point b		Sand	bble [ ] Pebble [ ] Silt/clay nodifications Cho	/ [=] or	mr
G S	Very restricted passage			1	Side/point b	ars		No modifications		Reinforced
8	Moderately restricted passage	×			Mid-channe VEGETATE	D	Take .	Desnagged	¥ 9°	Revegetated
S	Partly restricted passage				Mid-channel UNVEGETA Bars around	TED 🔀		Dams and diversions	00	Infilled
\$	Good passage				obstructions Braided cha	A	7	Resectioned	00	Berms or embankment
5	Unrestricted passage				Infilled chan		7.7	Straightened	Signs of work still	Recently channelised
e and heigh	ght of barrier(s)	-1		000	High flow de	posits	J.	Realigned	Works old and revegetated	Channelised in the past
annel sha	ape Choose one ca	ategory	only							
			5	-5					7	
	U shaped	Fla	t U shape	d Deepened	d U shape	Widen	ed or infilled	Two s	stage	Multi s
	- 47			1	Ц-			1		
	Box		Wide bo	×	V shaped		Trapezoid	Concre	te V	Pipe or cu

Bank shape	Bank slope	Sediment oils
Choose one category for each bank	Choose one category for each bank	absent light moderate profuse
Left Right	Left Right	
Concave 🖂	Vertical	Water oils
Convex	Steep 60 - 80°	Sediment odours  normal/none sewage petroleum chemical
	Moderate	normal/none sewage petroleum chemical anaerobic other
Stepped	30 - 60°	Water odours
Wide lower bench	Low 10 - 30°	other sewage petroleum chemical
Undercut	Flat <10°	Turbidity (visual assessment)  Clear Slight Turbid Opaque
Factors affecting bank stability Choose one or more categories	Bedrock outcrops Assess % of each bank covered by bedrock outcrops % bedrock outcrops Left bank	Is water clarity reduced by:  Suspended material (e.g mud, clay, organics)  Dissolved material (e.g plant leachates)
None Cleared vegetation	Right Bank	Water level at the time of sampling
Runoff Irrigation draw-down	Artificial bank protection measures Choose one or more categories	Dry No flow Low Baseflow or near baseflow  High Flood (don't sample)
Stock Reservoir releases Human Seepage	None Fenced stock watering points	Artificial features at the sampling site Choose one or more categories
access Seepage Ford, culvert Flow and	Levee banks Vegetation plantings	Major Minor Ford Bridge Culvert Other weir
or bridge waves	Rock or wall layer Logs strapped	Description
Feral animals Drainpipes	Rip rap to bank	
7.00	Fenced human Concrete channel	Large woody debris
Other	access lining	

<b>AUSRIVAS Physical</b>	Assessment Protoco	Field Data Sheets
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USRIVAS Ph	ysical Assess	sment Protocol Field Data	Sheets	Page	6	Site No Date _	2118	0	
	form features		Macrophyte cover Asses	ss % cove	er of the s	sampling site by each category.			
Total % composition for all features must equal 100%		Overall % cover of macrophytes			% cover of emergent macrophytes				
Height >1m Gradient >60°  Waterfall	% of site Est. Av. Length (m)		% cover of floating macron	er of floating macrophytes					
		Est. Av. Height (m) Est. Av. Gradient (°)				% cover of submerged ma		s	
Step Height <1m Gradient 5-60° Strong currents	Cascade	% of site Est. Av. Length (m)	Macrophyte composition Use a macrophyte field guide Listed macrophytes can be of N denotes a native taxa and	e (i.e. Sai hanged to	o reflect t	lacobs, 1994) to aid identification the common taxa present in each duced taxa.	State or	Territor	
Gradient 3-5° Strong currents Rocks break surface	Rapid	% of site	Emergent macrophytes			Submerged macrophytes			
	FILE	Est. Av. Length (m)		Present	% cover	<u>Gusmorgea macrophytes</u>	Present	% cover	
	Est. Av. Depth (m) Est. Av. Width (m)	Brachiaria (Para Grass) I			Ceratophyllum (Hornwort) N				
			Crassula (Crassula) N			Chara (Stonewart) N			
Gradient 1-3° Moderate currents Surface unbroken but unsmooth	Riffle	% of site	Cyperus (Sedge) I/N			Elodea (Canadian Pondweed)			
	Est. Av. Length (m) Est. Av. Depth (m)	Eleocharis (Spikerush) N			Myriophyllum (Water Milfoil) 1/1				
	The same of the sa	Est. Av. Width (m)	Juncus (Rush) I/N			Nitella (Stonewart) N			
Gradient 1-3° Small currents Surface unbroken and smooth	Glide	% of site	Paspalum (Water Couch) N			Potamogeton (Pondweed) N			
		Est. Av. Length (m)	Phragmites (Common Reed) N			Triglochin (Water Ribbon) N			
	Est. Av. Depth (m)	Ranunculus (Buttercup) I			Vallisneria (Ribbonweed) N				
		Est. Av. Width (m)	Scirpus (Clubrush) N			Other			
Gradient 1-3° Small but distinct & uniform current Surface unbroken	Run	% of site	Triglochin (Water Ribbon) N			Other			
		Est. Av. Length (m) Est. Av. Depth (m)	Typha (Cumbungi) N			Other			
	(iiii)	Est. Av. Width (m)	Other		ji.	Flantier engage			
Area where	Pool		Other			Floating macrophytes	Present	%	
stream widens or		% of site Est. Av. Length (m)	Other			Azolla (Azolla) N	riesent		
deepens and current declines	( <u>\$2222</u> )	Est. Av. Depth (m)				Callitriche (Starwart) I			
		Est. Av. Width (m)				Other	H		
reasonable sized (>20% of channel width) cut-off section away from	Backwater	Backwater % of site Est. Av. Length (m)				Other			
						Other			
	6555	Est. Av. Depth (m)	b wat a second		7.5				
	B	Est. Av. Width (m)	Overall % cover of native r	macroph	yte taxa	Total should equal ov	erall % co	ver	
ata. An additional separate with the start with the			Overall % cover of native macrophyte taxa						

Note: An additional response variable planform channel pattern is measured in the office

## Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes. overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1)

Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2)

Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily

### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

32-60% fine sediment, low availability of interstitial spaces

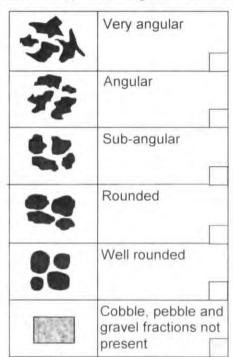


Matrix dominated

>60% fine sediment, interstitial spaces virtually absent

## Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

Stable -

Unstable - depositing

## Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening Bare, severely eroded banks Erosion heads. Steep streambed caused by erosion

### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size Banks stable Streambed comprised of consolidated (tightly arranged and packed) material

## Moderate deposition

Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow

### Severe deposition

Extensive build up of fine sediments to form a flat bed. Channel blocked but wide and shallow Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material

AUSRIVAS Physical and	Chemical	Assessment	Protocol Field	Data Sheets	Page 8
Site No.	Date		_		

# HIGH GRADIENT STREAMS

Page 1 of 2

Habitat								C	ondi	tion	cate	gor	1								
parameter		E	xcelle	nt				Good					Fair					Po	oor		
1. Epifaunal substrate / available cover	subsepifation substant stab to all potes that	ster the strate to aunal cover, merged ss, cot le hab low ful are no transie	favour colonis mix o d logs oble or itat an I color e log ot new	able for ation a f snag under other d at st disation s/snag	and s, rout age	pote hab of p of a the not colo	tat water tat for tat form of the property of	sation adequations; lions; lions sub and sub of new epared	ted for ate tenancoreser ostrate fall, bu d for ay rate	ce ice in	habi avai desi freq	tat h labilit rable	nix of abitat y less subs y distu	than trate		ha	bitat	lack s; sub e or l	of ha	bitat e	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
2. Embeddedness	25% sedi	vel, co der pa surro ment. ole pro che sp	unded Layer vides	are 0 by fin	е	50%	der p	ounde	and s are 2 d by fi		boul 75%	lder p	obble article ounde	s are		m st	ore th	parti lan 7: nded i	cles	are	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Velocity / depth regime	regir deep deep	mes procession sions (ast- ) 3m/s im).	esent shallo	(slow- ow fas w) S	st-	pres miss than	ent (i				regi	mes p	the 4 preser r slow ng so	t (if fa	st-	VE	locity	dept /dept / slow	h reg		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	less affec	e or no eds or than s cted by osition	point to 5% of sedir	ars ar	nd	from sedi bott	forma grav ment om af	tion, n el sar 5-30	d or f	ne ie	new bott sedi obsi	grav ment bars om af iment truction striction	depo el sar on old 30-5 fected depo ons ar depo valent	nd or to t and 0% of t; sits at	the ands	m de 50 ct po to	atena evelop l% of nangu	deposition in the bond free timest tantia	mo lottor quen absi	ed bare the tily.	ar ian
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	(
5. Channel flow status	both	er read lower mal an anel su ased	banks nount	and of		avai <25	lable of	>75% chann chann is exp	el	е	avai	lable for rift	s 25-7 chann fle sub y expo	el strate		pr	anne	le wa and as s	mos	tiy	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	dred	nneliza Iging a mal_s nal_pat	bsent tream	Or		Some channelization present usually in areas of bridge abutments evidence of past channelization. Fe dredging (greater than 20 yr) may be present but recent channelization is not				1	Channelization may be extensive embankments or shoring structures present on both banks and 40 to 80% of stream reach channelized and disrupted					80% of the stream reach channelized and					
						pres		mercan) i v													

USRIVAS F	Physical and	Chemical	Assessment	Protocol	Field	Data	Sheets	Page 9	
ite No.		Date							

# HIGH GRADIENT STREAMS

Page 2 of 2

Habitat								(	ond	itio	cate	gory								
parameter		Ex	celle	ent			-	Good	1			Fa	ir				Po	or		
7. Frequency of riffles (or bends)	relation of dispersion of has stream control of bollarge	stances divided a stream was well abitat a stream will abitat a stream will a stream	reque e betv led by 5 to 7 5 key here s, plans s or oural of	veen veen vidt vidt nffles ceme	n of riety are nt	betw by th	equent veen r	ce of r t, dista riffles of the of t between	ince divided the		botton some between	sional ri n conto habitat en riffle width n is bel	urs pro distant s divide of the	vide ce ed	sha ha be by	allow bitat; tweer the v	riffles dista n riffle vidth	flat was poor proces divided the atio of	ded	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9 8	1	6	5	4	3	2	1	(
8. Bank stability (score each bank)	of er abse	ks sta osion ent or ntial follems cted	or ba minim or futi	nk fai nal, lit ire	lure tie	of er	rosion 5-3 th has	y stab sma most 0% of areas	l area y heal bank	ed	60% has a bigh a	of bank eas of	nstable; 30- in reach erosion; potential		fre sei ob	eas; 'i quen ctions vious	raw' a t alon s and bank % of t	any en areas ig stra bend s sloug bank h	ight s;	
SCORE	Left	bank	1	10	9	8		7	1	6	5	-	1	3	_	2	1	1	1	0
SCORE	Righ	nt bar	ık	10	9	8		1		6	5	1	1	3		2		1	10	0
9. Vegetative protection (score each bank)	strea and zone vege trees shru maci disru graz minin almo	than ambar imme a cove atation s, und abs. or rophy uption ing or mal or ost all row na	diate red by includerstor non tes, votes, votes not explants	riparia y national y national y national rey woods egeta ghors ing evidents allow	an ve	strey cover vege of pl reprievid full p to ar more the p	ered betation lants in esent but olant going green to be than to be the to be than to be the to be	nk sur y nation, but is not is ed, dis at not is growth at extinone to tial pla aight	ve one cla well- sruption affection potent and of	n ng	stream cover disrup patch close veget than of poten	% of the order of the control of the	surface egetation vious, are soil ed ed emmon, of the it stubb	or less	str co dis ver ver rer cer	eamt vered ruption getation getation nume	bank to bottom is don had to 5 stres in	o% of surface egeta stream very as been or less oble he	es tion; mba nigh en	ink
SCORE	Left	bank	T	10	9	8		7		6	5	1		3		2		1		0
SCORE	Righ	nt bar	nk	10	9	8		7	16	6	5		1	3		2		1		0
10. Riparian zone score (score each bank)	>18 activ	th of r metre rities ( s. cro mpact	s; hu e ro ps et	man ads, c) ha	ve	Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only			12 me activit	of ripa etres; h ies hav panan z	uman e impa	cted	<6 metres; little or no riparian vegetation is							
SCORE	-	bank		10	9	8		7	1	6	5	1	1	3	1	2		1	- 1	0
SCORE	Diek	nt bar	i.	10	9	8		7	1	6	5			3		2		1		0

TOTAL HIGH GRADIENT HABITAT SCORE

<b>AUSRIVAS Physical and</b>	Chemical	Assessment	Protocol	Field Data	Sheets	Page 10
Site No.	Date	28 71-6	1.80			

# LOW GRADIENT STREAMS

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Habitat										itior	cat	ego	ry								
parameter		Excellent Greater than 50% of						Good	d				Fai	r.				P	oor		
1. Epifaunal substrate / available cover	subsepifa and snag unde or of and color (i.e. not i	strate aunal fish c gs, su ercut ther s at sta nisation	favou coloni cover; bmen banks table l ige to on pot snags all and	rable sation mix of ged lo cobt habita allow ential	gs, ole t full	habi full of pote habi of pot of a the not colo	itat: w colonis ential; itat for opulat dditior form o yet pro- nisation	sation adequate main ions, p nal sub of new epared	ted for late tenand preser postrate fall, bid of for ay rate	ce nce e in	habi avai desi freq	itat, h labilit rable	y less subs distr	than		ha	bitat vious	lack s, sut			
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	X	6	5	4	3	2	1	0
2. Pool substrate characterization	and root subr	firm s mats	subs with and p and and ed veg	gravel revale	ent.	muc be d mat	or cli domina s and	ant, so	ud ma ome ro erged	ot	botte	om, li	ttle or	or sa no ro rged		be				mat o	or
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	shall sma	low la	of large-d	leep, small-					s large shallo		mon		valent							smal	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	of is	lands less tom aff	o enla or po han 2 fected depos	int bai 0% of by	S	from sedi bott	forma n grav ment om aft	tion, n el, sar 20-50	nd or f 0% of sligh	ine the	new botte sedi obst cons	grav ment bars om al ment truction striction	on of 50-8 ffected depo ons ons a	sits at nd ber	the ids.	de 80 ch po to	atena velop % of angir ols a	the incomen the ing free imos	t mo cottor equen t abs		an lue
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	both	lowe mai a nnel s	r bank moun ubstra	s, an		avai <25	lable of	>759 chann channe is exp	el	е	avai	lable for rif	chann	ostrate		ch	anne	dinid	ater y mos	tiy	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	dred	iging i	ation absen stream attern	tor		pres of bi evid chai dred 20 y	sent undge i ence i nneliza iging i ir) ma	abutm of pas ation great y be p	in are ents	y	or si pres and read	honn sent o	g stru g stru on bott anneli	may interest the contract of street are contr	ents (s,	ga 80 ch dis ha	bion % of anne srupti bitat	or ce the s sized ed (	and natre	m res	acty
								ation i	s not												

<b>AUSRIVAS Phys</b>	sical and Chemical	Assessment	Protocol Field Da	ta Sheets	Page 11
Site No. 50 1	Date	21.8.18	-0		

# LOW GRADIENT STREAMS

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Habitat						Conditio	on cate	gor	У						
parameter	Exc	ellen	t		Goo	d			Fair				Po	ог	
7. Channel sinuosity	The bends increase the length 3 to longer than straight line channel bruconsidered coastal plai low-lying ar parameter parameter in the	e strea 4 times if it wa (Note aiding is norma ns and eas. T s not e	s in a	increas	se the st 2 to 3 tir than if it		incre 2 tim	es lo	s in the he stre nger th straight	am an if	t to	Chann waterw chann distant	ay ha	s bee	
SCORE	20 19	18	7 16	15	14 13	12 1	10	9	8	7	6	6 4	3	2	1 (
8. Bank stability (score each bank)	Banks stab of erosion of absent or in potential for problems, affected.	r bank ninimal future	failure little	of eros	sion mos 5-30% o has area	all areas tly healed f bank in	60% has high	of ba	ly unstrank in resort end on potential	each sion,	1	Unstate areas; freque section obviou 60-100 erosion	'raw' a nt alor ns and s bank )% of i	areas ng stra bend k slou bank l	aight is; ghing:
SCORE	Left bank	10	9	8	7	6	5	0	4	T	3	2		1	0
SCORE	Right bank	10	9	8	7	6	- 6		4	T	3	2		1	0
9. Vegetative protection (score each bank)	More than streambani and immed zone cover vegetation, trees, unde shrubs, or macrophylic disruption to grazing or minimal or almost all p to grow nat	surfai late ripi led by rincludi rstorey non wo les; veg through mowing not evid	ces arian lative ng ody etative	stream covered vegetal of plan repress evident full plat to any more to the por	its is not ented; d t but not int growt great ex han one tential pla e height	one class well- sruption affecting h potential tent; half of	cover disrupator close vege than pote	red b uption hes o ely cre etation one-l ntial p	f the nk surf y vege obviou f bare opped n comm half of blant st naining	tatio is, soil o non, the ubbl	or less	Less ti stream covere disrupt vegeta vegeta removi centim averag	bank d by v ion of tion is tion had to 5 etres	surface regetal stream very as been or less	tion; mbank high; en
SCORE	Left bank	10	9	8	7	6	5		4		3	2		1	0
SCORE	Right bank	10	9	8	7	6	5		4	1	3	2		1	0
10. Riparian zone score (score each bank)	Width of rip >18 metres activities (i. lawns, crop not impacte zone.	huma e road s etc.)	n s, have	12-18 activiti	of riparia metres; es have arian zon ally	12 m activ	ities i	riparian s, huma nave im in zone	an ipac	ted	Width <6 me ripariai presen human	res, li i vege it beca	ttle or station ause o	no is	
SCORE	Left bank	10	9	8	7	6	>6	5	4		3	2		1	0
SCORE	Right bani	10	9	8	7	6	5		4	13	3	2		1	0

TOTAL LOW GRADIENT HABITAT SCORE



AUSRIVAS Physical and	Chemical	Assessment Proto	col Field Data	Sheets	Page 1	12
MUSICIONAS FILIVISIDAI AITU	Chemical A	Maacaaillelli i loll	COI I ICIU Data	Oliceta	1 age	

Site No. 002 Date 21.8 18

# Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

	Cross-section sketch		Cros	s-section number of
	LB CANE	FULL LE		bedform at the cross-section  Run Pool Cascade Other
Bank height (m)	The channel sketch should show in cross the water surface, watermark and bankfu outcrops and snags encountered at the c	s-section the shape of the channel and include the location of ill points. Also show other features such as bars, rocky ross section.		Bankfull channel width (m) (=total of boxes A+B+C)  m width at the water mark (m)  width at the water surface (m)
Bank width (m)	Horizontal dis	tances (m)	9 15	Bank width (m)
Vertical distance between the water surface and the water mark (m)	Vertical wate	r depths (cm)		Vertical distance between the water surface and the water mark (m)
Riparian zone width		Notes on cross-section measur	rement	
Left bank (m) F	Right bank (m)			
Bank material Assess		Substrate composition Assess % composition in the area of bed 5m ei the cross-section.	ither side of	Assess in the area 5m either side of the cross section  Assess in the area 5m either side of the cross section    <10%
Bedrock		Bedrock	)	Periphyton cover
Boulder (>256mm)		Boulder (>256mm)		<10%  10-35%  35-65%  65-90%  >90%
Cobble (64-256mm)		Cobble (64-256mm)		10% 10% 35-65% 05-90% 290%
Pebble (16-64mm)		Pebble (16-64mm)	Total 100%	Moss cover
Gravel (2-16mm)		Gravel (2-16mm)	to	<10% 10-35% 35-65% 65-90% >90%
Sand (0.06-2mm)	100 100	Sand (0.06-2mm)		
Fines (silt and clay, <0.06mn	1)	Fines (silt and clay <0.06mm)	00	Detritus cover
	Total 100% each			<10% 10-35% 35-65% 65-90% >90%

<b>AUSRIVAS Phys</b>	sical and	Chemical	Assessment	Protocol	Field Data	Sheets	Page 1	13
	nous assu	Olioninou,	100000IIICIIL	1 1000001	I ICIG Dutu	Olicera	I ugo I	

Site No. 952

Date 21-8-18

### Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

Bank height (m)		e-section the shape of the channel and include the location of ill points. Also show other features such as bars, rocky	Type of Riffle	Bankfull channel width (m) (=total of boxes A+B+C) am width at the water mark (m) width at the water surface (m)
Bank width (m)  Vertical distance between the water surface and the water mark (m)  Riparian zone width	Vertical wate		rement	Vertical distance between the water surface and the water mark (m)
Left bank (m) F Bank material Assess  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay, <0.06mm)	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m eit the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	ther side of	Assess in the area 5m either side of the cross section    <10%

Detailed instructions of Two cross-sections are requi	n the measurement of chann red at homogeneous sampling sites ime of sampling is at or near the wat	(generally lowland streams) and three cross-sections	at heterogeneo	I. Be familiar with these before proceeding.				
Bank height (m)		-section the shape of the channel and include the location of il points. Also show other features such as bars, rocky	Type of bedform at the cross-section  Riffle Run Pool Cascade Other  Bankfull channel width (m) (=total of boxes A+B+C)  Stream width at the water mark (m)  Stream width at the water surface (m)					
Bank width (m)  Vertical distance between the water surface and the water mark (m)	Horizontal dis		nent	Vertical dista between the surface and t water mark (r				
Riparian zone width	1							
Left bank (m)	Right bank (m)	-						
Bank material Asses	ss % composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either the cross-section.	side of	Assess in the area 5m either side of the cross section  Assess in the area 5m either side of the cross section    <10%				
Bedrock		Bedrock	_ )	Berinbuten sever				
Boulder (>256mm)		Boulder (>256mm)		Periphyton cover				
Cobble (64-256mm)		Cobble (64-256mm)	%	<10% 10–35% 35-65% 65-90% >90%				
Pebble (16-64mm)		Pebble (16-64mm)	}=	Moss cover				
Gravel (2-16mm)		Gravel (2-16mm)	Total 100%	<10% 10–35% 35-65% 65-90% >90%				
Sand (0.06-2mm)		Sand (0.06-2mm)						
Fines (silt and clay, <0.06m	Total 100% each	Fines (silt and clay <0.06mm)	_ )	Detritus cover <10% 10–35% 35-65% 65-90% >90%				

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AUSRIVAS Physical Assessment Protocol Field	Data Sheets	Page 1	Site No. 3 Da	te 218-18
Date 21 8 18 Site No. # 3	Time	1000	Recorder's Name	
River Name _ MOBBINDRY CROK	Location	LOT 31 DE	756010	
Weather CLIAR SUNKY Rain in las	st week? Y [ ] N [>>]	Photograph numb	pers and details	and the second
Latitude: 2 8 8 7 3 6 Longitude: 1 3	g min sec		+ P14-51479	
GPS Name and Datum	STORY STREET, STREET OF STREET, STREET	(0024/5)1-2 U	15 , NO CONTENTS	
	Scroll Marketin			
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landm	arks and natural or artificial channel o	r floodplain features.	LENGTH OF SAMPLING	SITE
Left bank is facing downstream.			Bankfull width	(m)
73 -				x 10
100	MELL DAY		Length of sampling site	(m
Trade.			Notes	
200		3		
P	3/			
/				
- th				
		T.		
82.2				
			BEFORE LEAVING TH	E
			SITE, CHECK DATA	
			SHEETS TO ENSURE	Y
			THAT ALL VARIABLES	The second secon

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson 1993a) ACP JUMA The Indicated Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998)

Units

mg I<sup>-1</sup>

%

m

ml

mg 1-1

does not contain any of the above features

BASIC WATER CHEMISTRY

Temperature

Conductivity

рН

Turbidity

Dissolved Oxygen

Total phosphorus

Total nitrogen

ALKALINITY

Alkalinity

Amount of water

Amount of H2SO4

Floodplain width

channel

floods

Floodplain features

Oxbows / billabongs

Remnant channels

Flood channels

Choose one or more features when present

Body of water occupying a former river

Formed during a previous hydrological regime. May be infilled with sediment

A channel that distributes water onto the floodplain and off the floodplain during

meander, isolated by a shift in the stream

Sampling site has no distinct floodplain

Dissolved Oxygen Sat.

Other

Page 2

Bits No. Date

AUSRIVAS Physical Assessn	nent Protocol Fi	eld Data Shee	ts Page 3	Site No.	3	Date 21- 3 1		-
Riparian zone composition Assess for whole sampling site	% Cover		Vegetation Description	Longitudinal ex Choose one categorinclude ground layinative grassland.	ory for each b	oank. Do not	tion Left bank	Righ
Trees (>10m in height)	15		NATURE EUC. TERT	None		~		
Trees (<10m in height)	1	May total more than 100%	ARL MATINE TREE + PERSON	Isolated / scatt	tered ,	12		
Shrubs	1	an 1	ACINA SASMUDIAN	Regularly space	ced ••	4.124	1 🗖	N
Grasses / ferns / sedges	35	May ≤∞	as a married and	Occasional clu	ımps 🤲	~ ~	15	
Shading of channel				Semi-continuo	us year	the tot the same	16	П
< 5% 6 - 25% 5	26 – 50%	51 – 75%	> 76%	Continuous	22220	To be designed to the Popularies		
overall vegetation disturbant Choose one category only. Sites category. Words within the drawing	nsive  ice rating with valley vegeta	% Native % Exotic ation cleared on a detailed text a	BOTH sides, but with riparian vegetal bout the state of the riparian and valle	Y[]N[]  If no, record regeneration category	Prese Very I	imited (<1% co	over)	
Extreme disturbance		High disturba		Low disturbance				
Riparian vegetation – reduced Vegetation is dominated by exotic sperare or completely abservaled Valley vegetation – agriand BOTH sides. Plant exotic species (willows.	extremely disturbed (ie cies with native species nt) iculture and/or cleared is present are virtually all	cleared mod disturb minor disturb Ripanan Valley	Riparian vegetation – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain  Valley vegetation – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present	or minor on cor dis	BOTH sides of the ndition with few esturbance present the vegetation -	n – native vegetation pi he river and in relatively exotic species present t is relatively minor. – native vegetation pres river, with a virtually inta tic species.	good Any ent on	
Very high disturbance		Moderate dist	urbance	Very low disturba	ince			
by grazing or the intrusic Native species severely cover Valley vegetation – ag	ly modified BOTH sides on of evalue species reduced an number and neuthini and/or climited its present are virtually all	cleared undisturbed or minor undisturbed or minor or mino	Riparian vegetation – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate valley vegetation – agriculture and/or cleared land on ONE side native vegetation on the other in reasonably undisturbed state.	pristine BO Exc nat Val BO Spir	OTH sides of the rootic species are a tural vegetation in the vegetation of the rootic sides of the rootic	n – native vegetation priver and in an undisturilabsent or rare. Repressin excellent condition.  I native vegetation presider with an intact cancorrare. Representative ent condition.	entative of entative of ent on opy Exotic	

	rriers to local fish ategory for each flow	condition	Type of bars Choose one or more categori	ies Extent of % of stream	bars mbed forming a bar o	f any type %
F	No second	Base Low High flow flow flow	Bars abse	nt Dominant Boulder/co	sediment particle siz	re on bars
gg	No passage		Side/point VEGETAT		[ ] Silt/clay [	ormin
8	Very restricted passage		Side/point UNVEGET		No modifications	Reinforced
3	Moderately restricted passage		Mid-chann VEGETAT	TED T	Desnagged	Revegetated
\$	Partly restricted passage		Mid-chann UNVEGET Bars arour	TATED Ind	Dams and diversions	Infilled
\$	Good passage		obstruction  Braided ch	7	Resectioned	Berms or embankments
5	Unrestricted passage		Infilled cha	annel		Signs of work still Recently channelised
e and heig	ht of barrier(s)	pole	High flow o	deposits		Works old and in the past
annel sha	ape Choose one ca	itegory only				
					7	
	U shaped	Flat U shaped	Deepened U shape	Widened or infilled	Two stag	ge Multi st
	- 47					
,	Box	Wide box	V V shaped	Trapezoid	Concrete	V Pipe or cu

Bank shap Choose one	category for ea		Bank slope Choose one category		Sediment oils  absent light moderate profuse
		Left Right bank bank		Left Right bank	Water oils
1	Concave		Vertica 80 - 90°		none flecks globs sheen slick
	Convex		Steep 60 - 80°		Sediment odours  normal/none sewage petroleum chemical
~	Stepped		Moder	The state of the s	anaerobic other
	17		30 - 60°		Water odours
	Wide lower bench		Low 10 - 30°		othersewage petroleum chemical
2	Undercut		Flat <10°		Turbidity (visual assessment)  Clear Slight Turbid Opaque
Choose one	ecting bank st	es	Bedrock outcrops Assess % of each bank cove % bedrock outcrops Left		Is water clarity reduced by:  Suspended material (e.g mud, clay, organics)  Dissolved material (e.g plant leachates)
None		eared getation		nt Bank	Water level at the time of sampling
Mining Runoff	Irri dra	gation aw-down	Artificial bank protection Choose one or more categor	measures	Dry No flow Low Baseflow or near baseflow High Flood (don't sample)
Stock access Human	rel	servoir eases	None Fence structures	Fenced stock watering points	Artificial features at the sampling site Choose one or more categories
access Ford, c		epage ow and	Levee banks	Vegetation plantings	Major Minor Ford Bridge Culvert Othe weir
or bridg		ves	Rock or wall layer	Logs strapped	Description
Feral a	nimals Dr	ainpipes	Rip rap	to bank	
Other			Fenced human	Concrete channel lining	Large woody debris
Description			access	9	Overall % cover of logs and branches greater than 10cm in diameter

- 944				6
- 107	-	n	$\mathbf{r}$	
	-	м	62	u
-	mn	.,	700	-

Site No. 003

Date

	- 17		

Extent of bedform features Total % composition for all features must equal 100%.		Macrophyte cover Assess % cover of the sampling site by each category.								
Total % compos	sition for all fea		Overall % cover of macrop	hytes	05	% cover of emergent macro	ophytes			
Height >1m Gradient >60*	Waterfall	% of site Est. Av. Length (m)				% cover of floating macrop	hytes			
	4	Est. Av. Height (m) Est. Av. Gradient (°)				% cover of submerged made		es		
Step Height <1m Gradient 5-60* Strong currents	Cascade	% of site Est. Av. Length (m) Est. Av. Height (m) Est. Av. Gradient (°)		e (i.e. Sa hanged t	o reflect the	cobs, 1994) to aid identification e common taxa present in each iced taxa.		Territory		
Gradient 3-5° Strong currents Rocks break	Rapid	% of site 8st. Av. Length (m)	Emergent macrophytes	Description	%	Submerged macrophytes	Dranaut	%		
surface	E TO	Est. Av. Depth (m) Est. Av. Width (m)	Brachiaria (Para Grass) I	Present	cover	Ceratophyllum (Hornwort) N	Present	cover		
	-7.2		Crassula (Crassula) N			Chara (Stonewart) N				
Gradient 1-3° Moderate currents	Riffle	% of site	Cyperus (Sedge) I/N			Elodea (Canadian Pondweed)				
Surface unbroken	Sall Sandania	Est. Av. Length (m) Est. Av. Depth (m)	Eleocharis (Spikerush) N			Myriophyllum (Water Milfoil) I/N	1			
but unsmooth		Est. Av. Width (m)	Juncus (Rush) I/N			Nitella (Stonewart) N				
Gradient 1-3°	Glide	% of site	Paspalum (Water Couch) N			Potamogeton (Pondweed) N				
Small currents Surface unbroken		Est. Av. Length (m)	Phragmites (Common Reed) N			Triglochin (Water Ribbon) N				
and smooth		Est. Av. Depth (m)	Ranunculus (Buttercup) I			Vallisneria (Ribbonweed) N				
		Est. Av. Width (m)	Scirpus (Clubrush) N			Other				
Gradient 1-3° Small but distinct	Run	% of site	Triglochin (Water Ribbon) N			Other				
& uniform current		Est. Av. Length (m) Est. Av. Depth (m)	Typha (Cumbungi) N			Other				
Surface unbroken		Est. Av. Width (m)	Other		-	Floating macrophytes		%		
Area where stream widens or	Pool	% of site Est. Av. Length (m)	Other			Azolla (Azolla) N	Present			
deepens and current declines	(\$3333)	Est. Av. Depth (m)				Callitriche (Starwart) I				
		Est, Av. Width (m)				Other				
A reasonable sized	Backwater	% of site				Other				
(>20% of channel		Est. Av. Length (m)				Other				
width) cut-off section away from	77	Est. Av. Depth (m)	Overall % cover of native	macronk	vite tava	4				
	B	Est. Av. Width (m)		,		Total should equal ov of macrophytes from		over		
			Overall % cover of native	macroph	ivte taxa	of macrophytes from	andve			

Note An additional response variable <u>planform channel pattern</u> is measured in the office

# Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes. overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction

Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1)

Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2)

Loose array of fine sediments. no overlapping, no packing and structure and can be dislodged very easily

### Sediment matrix

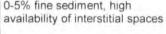
Choose one category only



Bedrock



Open framework 0-5% fine sediment, high





Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

32-60% fine sediment, low availability of interstitial spaces

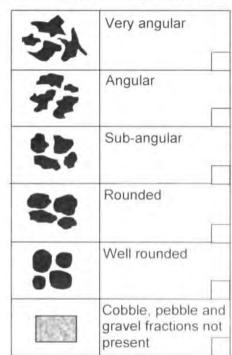


Matrix dominated

>60% fine sediment, interstitial spaces virtually absent

## Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

- Stable -

Unstable - depositing

### Severe erosion

Streambed scoured of fine sediments Signs of channel deepening. Bare, severely eroded banks Erosion heads Steep streambed caused by erosion

### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

### Bed stable

A range of sediment sizes present in the streambed Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size Banks stable Streambed comprised of consolidated (tightly arranged and packed) material

## Moderate deposition

Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow

### Severe deposition

Extensive build up of fine sediments to form a flat bed. Channel blocked. but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material

1 1 N N N N N N N N N N N N N N N N N N								5.0				-	1								
USEPA Habitat Circle a score for		~~~			Н	IIG	H (	GR/	AD	IEN	IT :	ST	RE	AN	IS			P	age	of	2
Habitat	12	_				Condition category															
parameter		E	xcell	ent		Good					Fair							P	oor		
1. Epifaunal substrate / available cover	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (Le logs/snags that are not new fall and not transient).				habitat well-suited for full colonisation potential, adequate habitat for maintenance					hab avai desi freq	20-40% mix of stable habitat, habitat availability less than desirable, substrate frequently disturbed or removed.				Less than 20% stable habitat. lack of habitat is obvious; substrate unstable or lacking						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	15	1	L
2. Embeddedness	Gravel, cobble and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space					Gravel, cobble and boulder particles are 25- 50% surrounded by fine sediment.				Gravel cobble and boulder particles are 50- 75% surrounded by fine sediment					Gravel cobble and boulder particles are more than 75% surrounded by fine sediment						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	D
3. Velocity / depth regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3 m/s, deep is >0.5 m).				Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).				Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low)				ast-	Dominated by 1 velocity/depth regime (usually slow-deep)							
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition					from sedi bott	Some new increase in bar formation mostly from gravel, sand or fine sediment, 5-30% of the bottom affected, slight deposition in pools.			Moderate deposition of new gravel, sand or fine sediment on old and new bars, 30-50% of the bottom affected, sediment deposits at obstructions, constrictions and bends, moderate deposition in pools prevalent				the ads.	Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently, pools almost absent due to substantial sediment deposition.						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.				avai	lable of	>75% channe channe is exp	el	e	avai and/	able or riff	s 25 7 chann le sub y expo	el strate		Very little water in channel and mostly present as standing pools						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal stream with normal pattern				Some channelization present usually in areas of bridge abulments evidence of past				Channelization may be extensive embankments or shoring structures present on both banks.				ents	Banks shored with gabino or cement over 80% of the stream reach channelized and							

channelization, i.e.

but recent channelization is not present

dredging (greater than 20 yr) may be present

SCORE

Continued over

removed entirely

disrupted instream

habital greatly altered or

and 40 to 80% of stream

reach channelized and

disrupted

20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

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USEPA	\ Hab	itat	Ass	essment
Circle a	score	for	each	parameter

# HIGH GRADIENT STREAMS

Page 2 of 2

Habitat			1					(	Cond	itior	cate	gory	1								
parameter		Ex	cell	ent				Good	i				Fair					Po	oor		_
7. Frequency of riffles (or bends)	relation of distribution of the streat continuous c	vely fi stances divident erally abitat ims wanuous oulden	reque e betv ted by 5 to 5 to s key here s, pla s or o	7) var In inffles	h of nety are	betv by t	equent veen r	ce of r t, dista riffles of the of t between	ance divided the		Occasional riffle or bend; bottom contours provide some habitat, distance between riffles divided by the width of the stream is between 15 to 25				sha hai bel by	Generally all flat wate shallow riffles, poor habitat, bistance between riffles divided by the width of the stream is a ratio of >2			or ided		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	(
8. Bank stability (score each bank)	of ero abse poter	nt or ntial fo	or ba minin or futi	viden ink fai nal: litt ure of ba	lure tie	infrequent, small areas, of erosion mostly healed byer 5-30% of bank in reach has areas of erosion, high erosion potential section reach has areas of during floods obvious.				60% of bank in reach has areas of erosion, high erosion potential			quen ctions vious	able, many eroded s, 'raw' areas lent along straight ons and bends ous bank sloughing, 00% of bank has							
SCORE	Left	bank	T	10	9	8	1	7		6	5 4 3			-	2	-	1	Ti	0		
SCORE	Righ	t bar	ık	10	9	8		7		6	5		4	T	3	-	2		1		0
9. Vegetative protection (score each bank)	strea and i zone vegei trees shrut macr disru grazii minin	mbar mme cove tation und bs. or rophyl ption ng or nal or st all	diate red b inclinersto non tes, v throu mow not e plants	wood egeta igh ing eviden s allov	ian ve y tive	stre cover vege of pi repri avid full pi to an more the stub	ered betation lants in esenticent but olant green, and	nk sur y nation to but of s not of ed dis- sit not of growth eat extra to one it to all pla- eight	ve one cli well- sruptio affecti poter ent, nalf of	ng ntial	strea cover disru patch close veget than poter	ption les of ly cro tation one-h itial pi	the k surf y vege obvious bare opped committed for land straining	tatio is soil i	n or less	str co dis ver ver rer	eamt vered ruptii getati getati nove ntime	bank by won of on is on his d to stres	No of surface regeta strea very as been or les oble h	ces ation mba high en s in	arık )
SCORE	Left		1	10	9	8		7		6	5		4		3	1 8	2		1		0
SCORE	Righ	t bar	ık	10	9	8		7		6	5	T	4	t	3	V	2		1		0
10. Riparian zone score (score each bank)	>18 r activi	metre ities ( s. cro npaci	s: hu e ro ps et	ads	IVE.	12-1 activ	8 me	npanai fres, h nave ir in zoni	uman npact	ed	Width of nparian zone 6- 12 metres, human activities have impacted the ripanian zone a great deal			Width of riparian zone <6 metres little or no riparian vegetation is present because of human activities							
SCORE	Left	bank		10	9	8		7		6	5		4		3	1 6	2		1		0
SCORE	Righ		-6	10	9	8		7		6	5		4	+	3		2		1		0

TOTAL HIGH GRADIENT HABITAT SCORE

<b>AUSRIVAS</b>	Physical and	Chemical	Assessment	Protocol	Field	Data	Sheets	Page 10
Site No.	003	Date		6				

# LOW GRADIENT STREAMS

Page 1 of 2

Habitat								(	Conc	lition	cat	ego	ry								
parameter		E	cell	ent			Good Fair							P	oor						
1. Epifaunal substrate / available cover	epif, and sna und or o and colo (i.e. not	strate aunal fish c gs, su ercut ther s at sta onisatio	than 50 favou coloni cover, ubmen banks itable i age to on pot snags all and	rable sation mix of ged lo cobt habita allow ential	gs, ple t full	30-50% mix of stable habitat, well-suited for full colonisation potential, adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale)					availability less than desirable substrate frequently disturbed or			of ha	habitat is ate						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	(
2. Pool substrate characterization	mat and root sub	enals, firm s mats	with sand p and and ed veg	gravel revale	ent.	mud or clay, mud may be dominant; some root				All mud or clay or sand bottom; little or no root mat, no submerged vegetation.					be		an cli k no ion		mat	or	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	shal	llow, la	of large-d	eep.		Majority of pools large- deep, very few shallow			mor	Shallow pools much more prevalent than deep pools.				Majority of pools small- shallow or pools absent							
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	(
4. Sediment deposition	of is	lands less to om aft	o enlar or por han 2 fected depos	nt bar 0% of by	5	from sedi botti	formal gravi ment, om aff	tion, n el, sar 20-50	nd or f 0% of sligh	ine the	Moderate deposition of new gravel, sand or fine sediment on old and new bars, 50-80% of the bottom affected, sediment deposits at obstructions, constrictions and bends, moderate deposition in			Heavy deposits of fine material, increased bar development, more than 80% of the bottom changing frequently pools almost absent due to substantial sediment deposition.							
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	valent 8	7	6	5	4	3	2	1	0
5. Channel flow status	mini char	lower mal a	ches bank mount ubstra	s, and		avail <25	lable of	>759 channe channe is exp	el	ė	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed					Very little water in channel and mostly present as standing pools					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	drec	ging a	ation ( absen stream stern	or		pres of bi evid char dred 20 y but i	ent unage a ence o nneliza iging ( r) man recent	abutm of pas ation, greate y be p	in are ents t e er than resen	,	Channelization may be extensive embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted			Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted instream habitat greatly altered or removed entirely							
						channelization is not present. 15 14 13 12 11 10 9 8 7															

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# LOW GRADIENT STREAMS

Page 2 of 2

Habitat					(	Conditio	on cat	ego	ry						
parameter	Exc	Excellent Good Fair							1	P	oor				
7. Channel sinuosity	The bends increase the length 3 to longer than straight line channel bra considered coastal plair low-lying an parameter is rated in the	times if it wa (Note iding is normal as and eas. T	s in a in other his asily	increase length 2	e the str to 3 tin han if it		inci 2 ti	The bends in the stream increase the stream 1 to 2 times longer than if if was in a straight line				Channel straight, waterway has been channelized for a long distance.			
SCORE	20 19	18 1	7 16	15 1	1 13	12 1	1 10	9	8	7	6	5	4 3	2	1
8. Bank stability (score each bank)	Banks stable of erosion of absent or impotential for problems affected	r bank inimal, future	failure little	of erosi	ent sma on most -30% of as areas	Il areas ly healed bank in	609 has	Moderately unstable, 30- 60% of bank in reach has areas of erosion, high erosion potential during floods.				Unstable many eroded areas 'raw' areas frequent along straight sections and bends obvious bank sloughing 60-100% of bank has erosional scars			
SCORE	Left bank	10	9	8	7	6		5	4		3	2		1	0
SCORE	Right bank	10	9	8	7	6		5	4		3	2		1	0
9. Vegetative protection (score each bank)	More than s streambank and immedia zone covere vegetation, trees unde shrubs, or r macrophyte disruption ti grazing or r minimal or r almost all pl to grow nati	surface ate ripade by nucludirestorey non woods, vegenough nowing anot evidents all	ces arian attive ng ody etative	covered vegetati of plant represe evident	bank sur i by nati- ion but is is not nted di- but not t growth great ext an one i ential pla height	ve one class well- sruption affecting potential ent nalf of	stre cov disr pati clos veg that pote	ered ruptio ches sely c etation one ential	of the ank sur by vego n obvio of bare ropped on commendation of plants maining	soil o	or less	strea cover disru vege vege remo- centi	than 5 mbank red by ption of tation i tation i ved to metres age sti-	vegeta vegeta of strea s very ras be 5 or les	ces ation ambani high en
SCORE	Left bank	10	9	8	7.	6		5	4		3	2		1	0
SCORE	Right bank	10	9	8	7	6		5	4		3	2		1	0
10. Riparian zone score (score each bank)	Width of rip >18 metres activities (i lawns crop not impacte zone	huma road: s etc.)	n s, have		netres f s have i nan zon	numan mpacted	12 acti	Width of nparian zone 6- 12 metres, human activities have impacted the ripanan zone a great deal			Width of riparian zone <6 metres little or no riparian vegetation is present because of human activities				
SCORE	Left bank	10	9	8	7	6		5	4	1	3	2		1	0
SCORE	Right bank	10	9	8	7	6			4	1	3	2		1	0

TOTAL LOW GRADIENT HABITAT SCORE



Site No.

Date A 8

### Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

	Cross-section sketch		Type of	s-section number of bedform at the cross-section Run Pool Cascade Other  Bankfull channel width (m)
Bank height (m)		e-section the shape of the channel and include the location of Il points. Also show other features such as bars, rocky ross section.	1 2 12 7	(=total of boxes A+B+C)  Bank height ( am width at the water mark (m)  width at the water surface (m)
Bank width (m)  Vertical distance between the water surface and the water mark (m)  Riparian zone width	Horizontal dis		rement	Vertical distance between the was surface and the water mark (m)
Left bank (m) F Bank material Assess Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm)		Substrate composition Assess % composition in the area of bed 5m ei the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0 06-2mm)	ther side of	Assess in the area 5m either side of the cross section  <10%

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ite No. Date 21 8 7

### Channel cross-sections and variables to be measured in the area around a cross section

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Bank height (m)	Cross-section sketch	FOLL RE	Type of	bedform at the cross-section  Run Pool Cascade Other  Bankfull channel width (m) (=total of boxes A+B+C)  Bank height (m)
1.8.		s-section the shape of the channel and include the location of ill points. Also show other features such as bars, rocky ross section.		width at the water mark (m) A width at the water surface (m)
Bank width (m)	Horizontal dis	stances (m)	1 .	Bank width (m)
Vertical distance between the water surface and the water mark (m)	Vertical wate	r depths (cm)		Vertical distance between the wate surface and the water mark (m)
Riparian zone width		Notes on cross-section measurem	ent	
Left bank (m) R	ight bank(m)			
Bank material Assess	% composition for each bank Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either s the cross-section	side of	Assess in the area 5m either side of the cross section  Assess in the area 5m either side of the cross section  4 < 10%
Bedrock		Bedrock	_ )	
Boulder (>256mm)		Boulder (>256mm)	-5.71	Periphyton cover
Cobble (64-256mm)		Cobble (64-256mm)	%	<10% 10-35% 35-65% 65-90% >90%
Pebble (16-64mm)		Pebble (16-64mm)		Moss cover
Gravel (2-16mm)		Gravel (2-16mm)	Total	
Sand (0.06-2mm)		Sand (0.06-2mm)		<10% <u>10-35%</u> 35-65% <u>65-90%</u> >90%
Fines (silt and clay, <0.06mm)	Total 100% each	Fines (sill and clay <0 06mm)	_ )	Detritus cover <10% 10-35% 35-65% 65-90% >90%

Detailed instructions on the me Two cross-sections are required at home	easurement of chann nogeneous sampling sites appling is at or near the wat	e measured in the area around a cross rel cross-sections are provided in the protoc (generally lowland streams) and three cross-sections at ler mark level, stream width at the water surface will be e	ol manua	I. Be familiar with these before proceeding	between the
nk height (m)  The char the water	nnel sketch should show in cross r surface, watermark and bankful and snags encountered at the ci	-section the shape of the channel and include the location of points. Also show other features such as bars, rocky oss section.	Type of Riffle	Bankfull channel width (m) (=total of boxes A+B+C)	of
Vertical distance stween the water surface and the water mark (m)	Vertical water	depths (cm)  Notes on cross-section measurement	nt		Vertical d between t surface ar water man
eft bank (m) Right ba	ank (m)				
Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Gand (0.06-2mm)	osition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either side the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm)	Total 100%	Filamentous algae cover    <10%	
Sand (0.06-2mm) Fines (sill and clay <0.06mm)	Total 100% each		Tot	Detri	10%

AUSRIVAS Physical Assessment Protocol Field Data Sheets Page 1	Site No. 004 Date 21.8 //
Date 71-8-18 Site No Time Time	
River Name BACK CROOK Location Lot 18 DP756	0 11
	pers and details
Latitude: D. S. L. C. Z. opgitude: L. C. L	, 5-8 galette, 16, 0/5, 2 cmb -
GPS Name and Datum	
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  Left bank is facing downstream.	LENGTH OF SAMPLING SITE  Bankfull width(m)  x 10  Length of sampling site(m)  Notes
	BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

BASIC WATER CHEMISTRY	<u>Units</u>	Valley shape Choose one categor	y only		npacts on streams one or more categories an	nd describe the detail of each
Temperature	°c		Steep valley	Sa	nd or gravel mining	Sewage effluent
Conductivity		V		Ot	her mining	Channel straightening
Dissolved Oxygen	mg l <sup>-1</sup>		Shallow valley	Ro	oad	River improvement wor
Dissolved Oxygen Sat.	%	¥		Bri	dge / culvert / wharf	Water extraction
pH		I E	Broad valley	Fo	rd / ramp	Dredging
Turbidity				Dis	scharge pipe	Grazing
Total phosphorus 🔲 🗒 🛌			Gorge	Fo	restry activities	Litter
Total phosphorus Total nitrogen		A L		Su	gar mill	Recreation
ALKALINITY			Symmetrical floodplain		gation run-off or	Other
Amount of water	ml	X	пооцріант	Descrip	pe outlet	
Amount of H <sub>2</sub> SO <sub>4</sub>	ml	1 1 1	Asymmetrical floodplain	Descrip	, ion	
Alkalinity	mg l <sup>-1</sup>			Local la	anduse one category for each bar	nk
Floodplain width		Average(	m)	Left Rig		
Floodplain features	CAR	Diene Peri	S 10 + to - 00		Native forest	
Choose one or more features when present					Native grassland (no	ot grazed)
Sampling site has no distinct floodplain		roll systems ort, crescentic strips or p	natches formed		Grazing (native or no	on-native pasture)
Oxbows / billabongs Body of water occupying a former river		ng the inner bank of a s			Exotic grassland (la	wns etc., no grazing)
meander, isolated by a shift in the stream		lays	Test on		Forestry Native [	][ ] Pine [ ][ ]
channel  Remnant channels		all alluvial fan formed verloaded stream breaks			Cropped Rainfed [	][ ] Irrigated [ ][ ]
Formed during a previous hydrological	and	deposits material on the			Urban residential	
regime. May be infilled with sediment		odplain scours our holes formed by the	concentrated		Commercial	
Flood channels  A channel that distributes water onto the		aring and digging action			Industrial or intensiv	ve agricultural
floodplain and off the floodplain during	No	floodplain features p	resent		Recreation	

No floodplain features present Floodplain present at the sampling site but does not contain any of the above features

floods

Other

AUSRIVAS Physical Assess	ment Protocol Fi	ield Data Shee	ets Page	3 Site No.	004	Date 21 8	18	-3
Riparian zone composition Assess for whole sampling site	% Cover		Vegetation Description	Choose one ca	tegory for e layer excep	of riparian vegeta each bank. Do not pt where site is in	tion Left bank	Righ
Trees (>10m in height)	95	_ ) e	. TER. T BEIGHTON	None		$\sim$		П
Trees (<10m in height)	20:	_ ( E 00 _	4	Isolated / s	cattered	22	1 1	П
Shrubs	10	an 1	Mist topy a trends to colle	Regularly s	paced	×	1 1	П
Grasses / ferns / sedges	65	May total more than 100%	Arms + Santa Assur	Occasional	clumps	9° 4 "	1 🗇	П
Shading of channel				Semi-contin	nuous	suspens on marin	15	П
< 5% 6 - 25%	26 – 50%	51 – 75%	> 76%	Continuous		Physical Company of the same o		V
Overall vegetation disturba Choose one category only. Site	s with valley vegeta	% Native % Exotic ation cleared on e detailed text a	≻ Total 100%	Y[]N[  If no, recorregeneration categor  tation in good conditation for	A P	Abundant (>5% coveresent /ery limited (<1% co	over)	
dominated by exotic sprare or completely abs	s extremely disturbed (ie becies with native species ient) griculture and/or cleared ints present are virtually all	Cleared mod disturb minor disturb Cleared Ripanan Valley	Riparian vegetation – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain  Valley vegetation – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present	Low disturban undisturb or minor  undisturb  Riparian  Valley	Riparian version BOTH side condition wit disturbance Valley veget BOTH sides	getation – native vegetation p des of the river and in relatively th few exotic species present present is relatively minor tation – native vegetation pres of the river, with a virtually into few exotic species.	y good Any sent on	
Very high disturbance		Moderate dist	urbance	Very low distu	rbance			
some native but disturbed A Native species severe cover Valley vegetation – a	ly reduced in number and igriculture and/or cleared ants present are virtually all	cleared undisturbed or minor undisturbed or minor & O Ripanan > Valley	Riparian vegetation – native vegetation on BOT sides with canopy intact or with native species widespread and common in the riparian zone. Trintrusion of exotic species is minor and of moder Valley vegetation – agriculture and/or cleared to none side, native vegetation on the other in reasonably undisturbed state.	he ate postine	BOTH sides Exotic specie natural veger Valley veger BOTH sides species are	getation – native vegetation p. of the river and in an undisturi- es are absent or rare. Representation in excellent condition tation – native vegetation present the river with an intact cand absent or rare. Representative excellent condition	bed state entative of sent on opy Exctic	

	rriers to local fish ategory for each flow			Type of bars Choose one or r	nore catego	ories	Extent of % of stream	bars mbed forming a b	ar of any ty	oe 5 %
60	No necession	Base Low flow flow	High flow	~	Bars abs	ent	Dominant	sediment particle	e size on ba	ars
	No passage			SE SE	Side/poir VEGETA		Sand		y [×] or	mr
S	Very restricted passage			1	Side/poir UNVEGE			No modifications	1	Reinforced
S	Moderately restricted passage				Mid-char VEGETA	TED	1	Desnagged		Revegetated
S	Partly restricted passage			200	Mid-chan UNVEGE Bars arou	TATED Ind		Dams and diversions	00	Infilled
\$	Good passage			62.69	obstruction Braided of		77	Resectioned	00	Berms or embankments
5	Unrestricted passage		Y	w .	Infilled ch	nannel	7.7.	Straightened	Signs of work still	Recently channelised
e and heig	ght of barrier(s)	KITL-		000	High flow	deposits	F	Realigned	Works old and revegetated	Channelised in the past
annel sha	ape Choose one ca	tegory only								
	- 4			75		~		7	4	\
	U shaped	Flat U sh	aped	Deepened	U shape	Widen	ed or infilled	Two	stage	Multi s
	- 47							>		
	Box	Wide	e box	V	V shaped		Trapezoid	Concre	ete V	Pipe or cu

Bank shape Choose one category for each bank	Bank slope Choose one category for each hank	Sediment oils
Concave  Convex  Conve	Bank slope Choose one category for each bank  Vertical 80 - 90° Steep 60 - 80° Moderate 30 - 60° Low 10 - 30° Flat <10° Bedrock outcrops Assess % of each bank covered by bedrock outcrops % bedrock outcrops Left bank Right Bank Right Bank	Sediment oils    absent   light   moderate   profuse     Water oils   none   flecks   globs   sheen   slick     Sediment odours   normal/none   sewage   petroleum   chemical   anaerobic   other     Water odours   normal/none   sewage   petroleum   chemical   other     Turbidity (visual assessment)   Clear   Slight   Turbid   Opaque   Is water clarity reduced by:   Suspended material   Dissolved material (e.g mud, clay, organics)   (e.g plant leachates)     Water level at the time of sampling   Dry   No flow   Low   Baseflow or near baseflow     Dry   No flow   Low   Baseflow or near baseflow   No flow   Low   Baseflow   No flow   Low   Baseflow   No flow   Low   Baseflow   No flow   Low   No flow   Low   Dow   No flow   Low   Dow   No flow   Low   Low   No flow   Low   Low   Low   Low   Low   Low
Runoff draw-down  Stock Reservoir releases Human Seepage access Ford, culvert or bridge Waves Feral animals Drainpipes Other  Description	Artificial bank protection measures Choose one or more categories  None Fence structures Levee banks Rock or wall layer Rip rap Fenced human access Other	High Flood (don't sample)  Artificial features at the sampling site Choose one or more categories  Major Minor Ford Bridge Culvert Other weir  Description  Large woody debris Overall % cover of logs and branches greater than 10cm in diameter % Notes on visibility

	form features		Macrophyte cover Asses	s % cove	er of the s	ampling site by each category.		
Total % compo		es must equal 100%	Overall % cover of macrop	hytes	0	% cover of emergent macro	phytes	
Height >1m Gradient >60°	Waterfall _	% of site				% cover of floating macrop	hytes	
Studient 99		Est. Av. Length (m) Est. Av. Height (m) Est. Av. Gradient (°)				% cover of submerged made		s
Step Height <1m Gradient 5-60° Strong currents	Cascade	% of site Est. Av. Length (m) Est. Av. Height (m) Est. Av. Gradient (°)		e (i.e. Sai hanged to	reflect th	acobs, 1994) to aid identification. he common taxa present in each luced taxa.	State or	Territor
Gradient 3-5° Strong currents	Rapid	% of site	Emergent macrophytes		%	Submerged macrophytes		%
Rocks break surface	Blom	Est. Av. Length (m)		Present	cover		Present	cover
surface	-	Est. Av. Depth (m) Est. Av. Width (m)	Brachiaria (Para Grass) I			Ceratophyllum (Hornwort) N		
			Crassula (Crassula) N			Chara (Stonewart) N		
Gradient 1-3° Moderate currents	Riffle _	% of site	Cyperus (Sedge) I/N			Elodea (Canadian Pondweed)		
Surface unbroken but unsmooth	- The state of the	Est. Av. Length (m) Est. Av. Depth (m)	Eleocharis (Spikerush) N			Myriophyllum (Water Milfoil) I/N		
out dristriootri		Est. Av. Width (m)	Juncus (Rush) I/N			Nitella (Stonewart) N		
Gradient 1-3°	Glide	% of site	Paspalum (Water Couch) N			Potamogeton (Pondweed) N		
Small currents Surface unbroken		Est. Av. Length (m)	Phragmites (Common Reed) N			Triglochin (Water Ribbon) N		
and smooth	_	Est. Av. Depth (m)	Ranunculus (Buttercup) I			Vallisneria (Ribbonweed) N		
	-	Est. Av. Width (m)	Scirpus (Clubrush) N			Other		
Gradient 1-3° Small but distinct	Run	% of site	Triglochin (Water Ribbon) N			Other		
& uniform current Surface unbroken		Est. Av. Length (m) Est. Av. Depth (m)	Typha (Cumbungi) N			Other		
odriade diforokeri		Est. Av. Width (m)	Other			Floating macrophytes		- 3
Area where	Pool	% of site	Other			- rouning macrophytos	Present	%
stream widens or deepens and		Est. Av. Length (m)	Other			Azolla (Azolla) N		
current declines		Est. Av. Depth (m)				Callitriche (Starwart) I		
	_	Est. Av. Width (m)				Other		
A reasonable sized	Backwater	% of site				Other		_
(>20% of channel width) cut-off		Est. Av. Length (m)				Other		
section away from	C. C. C.	Est. Av. Depth (m)				Total should equal out	-	

Overall % cover of native macrophyte taxa

Note: An additional response variable planform channel pattern is measured in the office

## Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes, overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1)

Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2)

Loose array of fine sediments. no overlapping, no packing and structure and can be dislodged very easily

### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

32-60% fine sediment, low availability of interstitial spaces

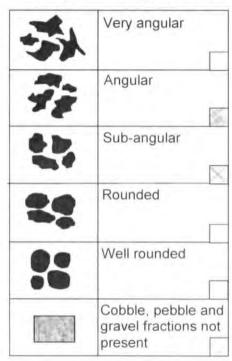


Matrix dominated

>60% fine sediment, interstitial spaces virtually absent

## Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

Stable -

Unstable - depositing

### Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening. Bare severely eroded banks. Erosion heads. Steep streambed caused by erosion.

### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size Banks stable Streambed comprised of consolidated (tightly arranged and packed) material

## Moderate deposition

Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform Channel wide and shallow.

## Severe deposition

Extensive build up of fine sediments to form a flat bed Channel blocked but wide and shallow Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material

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# HIGH GRADIENT STREAMS

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Habitat								C	ondi	tion	cate	gon	/								
parameter		E	xcell	ent				Good	d				Fair			Т		Po	oor		
1. Epifaunal substrate / available cover	sub epif fish sub ban stab to a pote that	aler the strate aunal ( cover- merge ks, colole hab llow fu are no transie	favour colonis mix o d logs oble or ital an il color e log of new	able for sation of snag under other od at si nisation is/snag	and ps, rcut tage n	hab full pote hab of p of a the not cold	coloni ential, itat fo opula idditio form yet pro- possati	rell-su isation adequations tions nal su of new repare	late tenand present bstrate fall, bit d for ay rate	ce nce e in ut	hab ava des freq	itat, h ilabilit irable	nix of abitat y less subs y distu	than trate		ha	ess th abitat ovious establ	lack sub	of ha	bitat e	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
2. Embeddedness	25% sedi	vel, co lder pa surro ment ble pro iche si	unded Layer	are 0 by fir	ie	509	lder p	ounde	and s are 2 d by fi		75%	lder p	obble article ounde	s are		m su	avel, oulder ore th irrour	parti an 7:	cles	are	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
3. Velocity / depth regime	region deep	our vermes proposed postorio (1975) (	resent -shallo shallo	(slow ow, fa: w) S	st-	mis than	sent (	f fast- score ssing			regi	mes p	the 4 present slowing, so	it (if ta	st- ow	Ve	omina locity sually	/dept	h reg		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	islar less affec	e or no ids or than i cted by osition	point to 5% of y sedir	pars a	nd	tron sed bott	forma grav ment om af	ition, n rel sar 5-30	nd or f	ne le	new sedi new bott sedi obsi con: mod	grave ment bars om af ment truction striction	ons ar depos	nd or fi t and 0% of l, sits at	the ds.	de 50 ch po to	eavy ( aterial velop % of angin ols al subs positi	ment the b g fre most tantia	more otton quen abse	d ba re than tly, ent d	er an
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
5. Channel flow status	both mini char	er real lower mal an nnel su	banks	s, and		avai <25	lable % of	s >75% chann chann is exp	el	е	avai	lable of	25-7 chann le sub y expo	el strate		pr	ery litt annel esent ols	and	most	fy	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	dred	nneliza Iging a mal; si nal pat	bsent tream	or		pres of b evid chai dred 20 y	sent i ndge ence nneliz iging	abutm of pas ation (greati y be p	in are ents t		or si pres and read	nsive hanna ent a 40 ta	emba emba struc both 80% enneliz	ankme tures bank of stre	ents s am	ga BC ch de ha	bion of work annel srupte bitat moves	the s ized id in great	ment tream and istres y alte	ove rea	ach
							nneliz	ation o	s not												

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# HIGH GRADIENT STREAMS

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Habitat								(	ond	ition	cat	ego	ry								П
parameter		Ex	cell	ent			(	Good	i				Fai					Po	or		
7. Frequency of riffles (or bends)	riffles divided by width of the stream <7.1 (generally 5 to 7): variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.				n of nety are nt	betw by th	quent veen r ne wid	ith of I	nce divided		som betw by th	e ha veen ne w	nal riffl contour ibitat, o nffles idth of s betw	s providistant divide the	ide e d	hall bet by	allow bitat, tweer the v	lly all fi riffles distant riffles vidth o is a ra	poor ice divid	led	
SCORE	(generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.  20 19 18 17 16  Banks stable, evidence of erosion or bank failure absent or minimal, little potential for future problems <5% of bank affected.  Left bank 10 9  Right bank 10 9  More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation including trees, understorey shrubs, or non woody macrophytes. Vegetative disruption through grazing or moving-minimal or not evident.		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			
8. Bank stability (score each bank)	Banks stable, evidence of erosion or bank failure absent or minimal, little potential for future problems <5% of bank affected.  Left bank 10 9  Right bank 10 9				lure lie	Moderately stable; infrequent, small areas of erosion mostly healed over 5-30% of bank in reach has areas of erosion					60% has high	of to	ely uns pank in as of er sion po bods	reach		are fre ser ob	ctions vious	e mai raw and t along s and t bank % of bi al scar	eas y strai bends sloug ank h	ght	
SCORE	Left	bank		10	9	8		7	10	6	5		4	Т	3	-	2	1	T	(	)
SCORE	Right bank 10 9			8		7	1	6	5		4		3		2	1		0	)		
9. Vegetative protection (score each bank)	stres and zone vege trees shru mac disru graz minii almo	ambar imme a cove etation s. und ibs, or rophy uption ing or mal or est all	diate red b incluers to non tes, v throughout not a plants	faces nparia y national rey wood egeta igh ing evidents allow	an ve ve tve	stress cove vege of pi repri evide full p to ar more the p stub	ered betation ants is esention betation betation of the control of	nk sur y nativ but o s not i sed dis it not a growth all exter i one h trai pla eight	ve one cla well- sruptio affection potent ent; half of	n ng	disni pato closi vege than	amb ered uption hes ely contration	of the ank su by veg in obvious of bare cropper on come half of plant:	petation ous e soil of d mon f the stubble	or less	str dis ver ver rer cer	eamb vered ruptic getati getati nove ntime	an 50% bank s by ve on of s on is v on has d to 5 etres o	urface getati stream very h s been	es on bar igh	
SCORE	-	bank		10	9	8		7	16	6	5		4	Т	3		2	1	1	0	)
SCORE	Righ	nt bar	nk	10	9	8		7	1	6	5		4		3		2	1		0	)
10. Riparian zone score (score each bank)	>18 activ lawn not it		s hu i e ro ips et	man ads, c)ha	ve	12-1 activ	8 me	tres, h	n zone luman mpacte e only		12 ms activit		have	npanan zone 6- s. human have impacted an zone a great		<6 np	metr arian esent	of ripar res, litt veget, becau activiti	abon ase of	5	
SCORE				10	9	8		7	1	6	5	11	4		3		2	1		(	1
SCORE	not impacted the ripanan zone  Left bank 10 9  Right bank 10 9													-	2	1			)		

TOTAL HIGH GRADIENT HABITAT SCORE



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# LOW GRADIENT STREAMS

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Habitat								(	Conc	litior	cat	ego	ry								
parameter		E	cell	ent			- 1	Goo	d				Fai					P	oor		
1. Epifaunal substrate / available cover	sub epif and sna und or o and colo (i.e not	eater the strate aunal in fish or gs. sufercut other state onisation logs/snew fisient)	favou coloni cover ibmen banks table i age to on pot snags all and	irable isation mix of ged lo is, cobb habita allow ential that a	gs, ple t	hab full of pote hab of p of a the not colo	colonis ential, itat for opulat ddittor form o yet pro	ell-sui sation adequ main ions: nal sul of new epare on (ma	ted for	ce nce e in ut	habi avai desi freq	itat, h labilit rable	mix of abitat y less subs y distu	than trate		hat	oitat,	lack lack s, sub le or l	of ha	abitat e	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	mat and root sub	ture of erials, firm s mats merge	with pand pand	gravel	ent;	be o	iomina	ay; mo ant; so subm	ud ma ome ro erged	ot	botte	om; li	r clay ttle or ubme	no ro		bed		an cla k; no ion.		mat	or
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	sha	n mix flow, la all-sha p pool	arge-d	leep, small-		deep; very few shallow.			mon		oools r valent					y of p					
SCORE	20	19	18	17	16					10	9	8	7	6	5	4	3	2	1	0	
4. Sediment deposition	of is	e or no slands less t om aff iment	or po han 2 fected	int bar 0% of by	s	Some new increase in bar formation, mostly from gravel, sand or fine sediment, 20-50% of the bottom affected, slight, deposition in pools.			new botto sedi obst cons	grav ment bars om af ment truction striction	depo el, sar on old 50-8 fected depo ons, ons ar depo valent	nd or d and 0% o d; sits at and be sition	fine f the	ma dev 80° cha poo to s	teria relop % of angir ols a	deposition in the transfer in	rease t; mo oottor quen absi	ed bare then netty; ent d	r an ue		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	6	4	3	2	1	0
5. Channel flow status	both mini char	ter rea lower imal a nnel s osed	r bank mount	s, and		Water fills >75% of the available channel; or <25% of channel substrate is exposed.			avail and/	lable or riff	s 25-7 chann le sub y expo	el, strati		cha	inne sent	le wa and as s	mos	tly			
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	drec	enneliz dging i imal; s mal pa	absen stream	t or		Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not				or si pres and reac	nsive horing ent o 40 to	emb g struct n both 80% annelia	ankm tures bani of str	ents ks; eam	gab 80° cha disi	ion 6 of inne rupte itat	shore or ce the s lized ed. In great d ent	ment trear and nstreat ty alt	n rea	ich	
20005	-	1	44	17	but recent channelization is not present			40	9	8	7	6	5	4	3	2	1	0			
SCORE	20	19	18																		

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# LOW GRADIENT STREAMS

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Habitat					(	onditio	n cate	gory							
parameter	Exc	ellent			Good	1		Fa	ir			P	oor		_
7. Channel sinuosity	The bends increase the length 3 to longer than straight line channel braconsidered coastal plai low-lying ar parameter in rated in the	times fit was (Note iding is normal as and eas. The	in a in a in other his asily	increas	e the str 2 to 3 tim han if it	es	incre 2 tim	pends in ase the s es longe n a strai	tream than i	1 to	water	nel stra way ha nelized nce.	as bee		
SCORE	20 19	18 1	7 16	15 1	4 13	12 11	10	9 8	7	6	5 4	3	2	1	0
8. Bank stability (score each bank)	Banks stab of erosion of absent or in potential for problems affected	r bank inimal, future	failure little	of erosi	-30% of las areas	l areas y healed bank in	60% has a high	erately un of bank areas of a erosion p g floods	in react		areas freque section obviou 60-10	ble, m 'raw' ent alor ns and us ban 0% of nal sc	areas ng stra d bend k slou bank	aight is; ghing	
SCORE	Left bank	10	9	8	X	6	5	4	=	3	2	T	1	0	)
SCORE	Right bank	10	9	38	7	6	5	4		3	2		1	0	)
9. Vegetative protection (score each bank)	More than streambaniand immed zone cover vegetation, trees, unde shrubs, or imacrophyte disruption to grazing or mainimal or in almost all p to grow nat	surfac ate ripa ad by na including storey non woods, vege arrough nowing not evid ants all	es inan ative ig ody stative ent;	covered vegetat of plant represe evident full plan to any of more th	bank sur d by nativition, but of s is not vitented; dis but not a but not a the growth great extra lan one frential pla height	one class well- truption affecting potential ent, half of	strea cover disru patch close veget than poter	ow of the mbank s red by ve ption ob- nes of ba ly cropp- tation co- one-half tial plant it remain	urface: egetation re soil ed mmon; of the	n; or less	strear cover disrup veget veget remov centin	than 50 nbank ed by o tion of ation is ation h yed to netres ge stul	surface vegeta s strea s very las bed 5 or les	ces ation, mbar high; en	nk
SCORE	Left bank	10	9	8	7	6	5	4		3	2		1	0	)
SCORE	Right bank	10	9	38	7	6	5	4		3	2		1	0	)
10. Riparian zone score (score each bank)	Width of rip >18 metres activities (i. lawns, crop not impacte zone	human e roads s etc.)	n s, have	12-18 r activitie	of ripariar netres, h is have in rian zone lly	uman npacted	12 m activi	n of ripar etres, hu ties have parian zo	iman e impac	ted	<6 me	of ripa etres. I an vege nt becan activ	ittle or etation ause o	no is	
SCORE	Left bank	10	9	8	7	36	5	4		3	2		1	0	)
SCORE		10	9	8	7	6	55	-	_	-	2	-		_	0

TOTAL LOW GRADIENT HABITAT SCORE



<b>AUSRIVAS Physica</b>	and Cher	nical Assessmen	t Protocol Field	Data Sheets	Page 12
ACCITIVACT HYSICA	and one	ilicai Assessifici	t i lotocoi i leiu	Data Silects	rage 12

Site No. 004

Date 21 8 18

# Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

Cross-section sk	PANE FRU D.C.	Type of	ss-section number of  bedform at the cross-section  Run Pool Cascade Other  Bankfull channel width (m)
	in cross-section the shape of the channel and include the location of bankfuli points. Also show other features such as bars, rocky at the cross section.		Bankfull channel width (m) (=total of boxes A+B+C)  Bank height (n)  width at the water mark (m)  width at the water surface (m)
Vertical distance between the water surface and the water mark (m)  Riparian zone width	Notes on cross-section measurement	nt	Vertical distance between the water mark (m)
Left bank (m) Right bank (m)  Bank material Assess % composition for each bar Left bank Right !  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay, <0.06mm)	Substrate composition Assess % composition in the area of bed 5m either side the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	Total 100%	Assess in the area 5m either side of the cross section    <10%

<b>AUSRIVAS Physi</b>	cal and	Chemical	Assessment	Protocol	Field	Data	Sheets	Page '	13
ACCITIVACT HYSI	cai anu	Officialical	ASSESSINCILL	TOLOCOL	LICIU	Data	Olicera	rage	

Site No. Date Date

### Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

Cross-	section sketch	7.0	Cros	s-section number	of
	Δ <i>p</i> (-p)	Forth B. A.		bedform at the cross-section  Run Pool Cascade Other	
the water sun		s-section the shape of the channel and include the location of ill points. Also show other features such as bars, rocky ross section.		Bankfull channel width (m) (=total of boxes A+B+C)  m width at the water mark (m)  width at the water surface (m)	Bank height
Bank width (m)  Vertical distance etween the water surface and the water mark (m)  Riparian zone width	Horizontal dis		nt		Vertical distanted between the water mark (m. 1997)
Left bank (m) Right bank  Bank material Assess % composit Left Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm)		Substrate composition Assess % composition in the area of bed 5m either side the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0 06-2mm)	Total 100%	Filamentous algae cover the	

Detailed instructions of Two cross-sections are requivilent the water level at the	on the measurement of chan- uired at homogeneous sampling sites	be measured in the area around a cross- nel cross-sections are provided in the protoco is (generally lowland streams) and three cross-sections at hater mark level, stream width at the water surface will be ed	ol manual neterogeneo	Be familiar with these before proceeding us sampling sites (generally upland streams).	e between the		
	Cross-section sketch		Cross-section number of				
				bedform at the cross-section  Run Pool Cascade Other			
Bank height (m)			Stron	Bankfull channel width (m) (=total of boxes A+B+C)  m width at the water mark (m)	Bank height (		
		is-section the shape of the channel and include the location of ull points. Also show other features such as bars, rocky cross section.		width at the water surface (m)	Â		
Bank width (m)	Horizontal dis	stances (m)			Bank c width (n		
Vertical distance between the water surface and the water mark (m)	Vertical water	er depths (cm)			Vertical distance between the was surface and the water mark (m)		
Discolor social		Notes on cross-section measuremen	nt				
Riparian zone widt	Right bank (m)						
	ess % composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either side the cross-section.	e of	Filamentous algae cover	the area 5m either side of the cross section >90%		
Bedrock		Bedrock	- )		_00 00 70 00 70		
Boulder (>256mm)		Boulder (>256mm)	_	Periphyton cover	7		
Cobble (64-256mm)		Cobble (64-256mm)	%6	<10% 10–35% 35-65%	65-90% >90%		
		Pebble (16-64mm)	Total 100%	Moss cover			
Pebble (16-64mm)							
Pebble (16-64mm) Gravel (2-16mm)		Gravel (2-16mm)	100		65-90% >90%		
Pebble (16-64mm)		Gravel (2-16mm)	- Tot	<10% 10–35% 35-65% Detritus cover	65-90% >90%		

AUSRIVAS Physical Assessment Protocol Field Data Sheets	Page 1	Site No. Date Date
Date 22 - 3 - 18 Site No Tim	e 0700	Recorder's Name
River Name CACK CLOCK Location	crown Lord	TSIL
Weather Rain in last week? Y [ ] N [	[] Photograph num	bers and details OOS
Latitude: 2 8 5 6 4 4 Longitude: deg min sec Longitude: 1 5 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		u/s _ 4
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landmarks and natural or artificial chan Left bank is facing downstream.	nel or floodplain features.	LENGTH OF SAMPLING SITE  Bankfull width  x 10  Length of sampling site
	Ť	Notes
		· William a
		A rue
		BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a). AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

BASIC WATER CHEMISTRY	Units	Valley shape Choose one category only	Local impacts on streams Choose one or more categories and	d describe the detail of each
Temperature 8-3	°c	Steep valley	Sand or gravel mining	Sewage effluent
Conductivity 177-5 pages 36-1 paster	Spic	V	Other mining	Channel straightening
Dissolved Oxygen	mg l <sup>-1</sup>	Shallow valley	Road	River improvement work
Dissolved Oxygen Sat. 34-2	%		Bridge / culvert / wharf	Water extraction
pH 7-21		Broad valley	Ford / ramp	Dredging
Turbidity			Discharge pipe	Grazing
Total phosphorus 🗸 👸 🛌		Gorge	Forestry activities	Litter
Total nitrogen		A L	Sugar mill	Recreation
≥ ALKALINITY		Symmetrical floodplain	Irrigation run-off or	Other
Amount of water	ml	Пообран	pipe outlet  Description	
Amount of H <sub>2</sub> SO <sub>4</sub>	ml	Asymmetrical	Description	
Alkalinity	mg I <sup>-1</sup>	floodplain		
Source College			Local landuse Choose one category for each ban	i.
Floodplain width		Average (m)	Left Right	K
Floodplain features	100	WATER TO BE BORREY TO THE	Native forest	
Choose one or more features when present			Native grassland (no	t grazed)
Sampling site has no distinct floodplain		oll systems	Grazing (native or not	n-native pasture)
Oxbows / billabongs	alor	ort, crescentic strips or patches formed ag the inner bank of a stream meander	Exotic grassland (lav	vns etc., no grazing)
Body of water occupying a former river meander, isolated by a shift in the stream		ays	Forestry Native [ ]	[ ] Pine [ ][ ]
channel		all alluvial fan formed where an rloaded stream breaks through a levee	Cropped Rainfed [	][ ] Irrigated [ ][ ]
Remnant channels Formed during a previous hydrological		deposits material on the floodplain	Urban residential	
regime. May be infilled with sediment		odplain scours our holes formed by the concentrated	Commercial	
Flood channels A channel that distributes water onto the		aring and digging action of flowing water	Industrial or intensive	e agricultural
floodplain and off the floodplain during		floodplain features present	Recreation	
floods		odplain present at the sampling site but as not contain any of the above features	Other	

AUSRIVAS Physical Assessment Protoc	col Field Data Sheets	Page 3 Site No.	Date
Riparian zone composition Assess for whole sampling site % Cover		Choose one category f	
Trees (>10m in height)	E total Brigator	None	
Trees (<10m in height)	m m m m m m m m m m m m m m m m m	Isolated / scattere	dy
Shrubs	May total more than 100%	Regularly spaced	×
Grasses / ferns / sedges	M May be been been	Occasional clump	s m
Chadina of shared	Pro 17- 155	Semi-continuous	proved the second
Shading of channel < 5% 6 - 25% 26 - 50%	51 – 75%  > 76%	Continuous	Street or Commence of the Party
nil moderate slight extensive  Overall vegetation disturbance rating Choose one category only. Sites with valley very category. Words within the drawings summariant.	% Native Total 100% % Exotic Total 100% regetation cleared on BOTH sides, but with rips	If no, record regeneration category	Abundant (>5% cover) and health Present Very limited (<1% cover)
Cleared cleared Riparian vegetation – absent or severely reduced. Vegetation is extremely disturbed dominated by exotic species with native sprare or completely absent)  Valley vegetation – agriculture and/or clear land BOTH sides. Plants present are virtue exotic species (willows, pines etc.)	d (ie. lecies ared	Low disturbance    Self disturbed by exotic species.   Undisturb or minor   On BOT	n vegetation – native vegetation present H sides of the river and in relatively good in with few exotic species present. Any nice present is relatively minor.  egetation – native vegetation present on ides of the river, with a virtually intact and few exotic species.
Very high disturbance	Moderate disturbance	Very low disturbance	
Riparian vegetation – some native vegetation – some native vegetation – some native vegetation is severely modified BOTH some native but by grazing or the intrusion of exotic species Native species severely reduced in number cover valley vegetation – agriculture and/or cle land BOTH sides. Plants present are virtue exotic species (willows, pines etc.)	sides sides with canopy intact or with n widespread and common in the nintrusion of exotic species is min	adive species ipanan zone The or and of moderate and/or cleared land in the other in BOTH'S Exotic's naturally Valley with BOTH'S species	n vegetation – native vegetation present on ides of the river and in an undisturbed state becies are absent or rare. Representative of regetation in excellent condition egetation – native vegetation present on ides of the river with an intact canopy. Exotic are absent or rare. Representative of natural on in excellent condition.

	riers to local fish ategory for each flow			Type of bars Choose one or r	more categories	Extent of str	of bars eambed forming a b	ar of any ty	pe _ 5 _ %
67	No passage	Base flow	Low Hig flow flow		Bars absent	and the second second second	nt sediment particle cobble [ ] Pebble		
9	No passage			The state of the s	Side/point bars VEGETATED	Sand Channe	[ ] Silt/cla		mn more categories
98	Very restricted passage				Side/point bars UNVEGETATED		No modifications		Reinforced
8	Moderately restricted passage				Mid-channel bars VEGETATED	78.2	Desnagged		Revegetated
S	Partly restricted passage				Mid-channel bars UNVEGETATED Bars around		Dams and diversions	00	Infilled
3	Good passage	X			obstructions  Braided channel	7	Resectioned	00	Berms or embankments
5	Unrestricted passage				Infilled channel	7/2	' Straightened	Signs of work still	Recently channelised
e and heig	ht of barrier(s)	14		000	High flow deposits		Realigned	Works old and revegetated	Channelised in the past
annel sha	pe Choose one ca	ategory	only						
			5		4~		-	7	
7 /	U shaped	Fla	t U shape	ed Deepened	U shape Wid	ened or infille	Two	stage	Multi st
	Вох		) Wide b	ox V	V shaped	Trapezoi	d	ete V	Pipe or cu

Bank shape Choose one category for each bank	Bank slope Choose one category for each bank	Sediment oils
Left Right bank bank	Left Right bank bank	water oils moderate profuse
Concave	80 - 90°	none flecks globs sheen slick
Convex	Steep 60 - 80°	Sediment odours  normal/none sewage petroleum chemical
Stepped	Moderate 30 - 60°	Water odours other
Wide lower bench	Low 10 - 30°	normal/none sewage petroleum chemical other
Undercut	Flat <10°	Turbidity (visual assessment)  Clear Slight Turbid Opaque
choose one or more categories	Bedrock outcrops Assess % of each bank covered by bedrock outcrops % bedrock outcrops Left bank	Is water clarity reduced by:  Suspended material Dissolved material (e.g mud, clay, organics) (e.g plant leachates)
None Cleared vegetation	Right Bank	Water level at the time of sampling
Mining   Irrigation   draw-down	Artificial bank protection measures Choose one or more categories	Dry No flow Low Baseflow or near baseflo  High Flood (don't sample)
Stock Reservoir releases	None Fenced stock watering points	Artificial features at the sampling site Choose one or more categories
access Seepage Ford culvert Flow and	Levee banks Vegetation plantings	Major Minor Ford Bridge Culvert Other
Ford, culvert Flow and or bridge waves	Rock or wall layer Logs strapped	Description
Feral animals Drainpipes	Rip rap to bank	\$ 1.7 m
Other	Fenced human Concrete channel lining	Large woody debris
	access	

Extent of bedf		es must equal 100%	Macrophyte cover Asses	s % cove	er of the s	ampling site by each category.		
_	And her a contractor.		Overall % cover of macrop	hytes	15	% cover of emergent macrop	ohytes	
Height >1m Gradient >60°	Waterfall	% of site Est. Av. Length (m)				% cover of floating macrophy		-
		Est. Av. Height (m) Est. Av. Gradient (°)				% cover of submerged macr		s
Step Height <1m Gradient 5-60° Strong currents	Cascade	% of site Est. Av. Length (m) Est. Av. Height (m) Est. Av. Gradient (°)	Macrophyte composition Use a macrophyte field guide Listed macrophytes can be c N denotes a native taxa and	e (i.e. Sai hanged to	o reflect t	acobs, 1994) to aid identification. he common taxa present in each S duced taxa.	State or	Territor
Gradient 3-5° Strong currents	Rapid	% of site	Emergent macrophytes		%	Submerged macrophytes		%
Rocks break surface	=	Est. Av. Length (m) Est. Av. Depth (m)	Brachiaria (Para Grass) I	Present	cover	Ceratophyllum (Hornwort) N	Present	cover
		Est. Av. Width (m)	Crassula (Crassula) N			Chara (Stonewart) N		
Gradient 1-3° Moderate currents	Riffle _	% of site	Cyperus (Sedge) I/N			Elodea (Canadian Pondweed)		
Surface unbroken	-	Est. Av. Length (m) Est. Av. Depth (m)	Eleocharis (Spikerush) N			Myriophyllum (Water Milfoil) I/N		
but unsmooth		Est. Av. Width (m)	Juncus (Rush) I/N	10		Nitella (Stonewart) N		
Gradient 1-3°	Glide	% of site	Paspalum (Water Couch) N	同		Potamogeton (Pondweed) N		
Small currents Surface unbroken		Est. Av. Length (m)	Phragmites (Common Reed) N			Triglochin (Water Ribbon) N		
and smooth	_	Est. Av. Depth (m)	Ranunculus (Buttercup) I			Vallisneria (Ribbonweed) N		
		Est. Av. Width (m)	Scirpus (Clubrush) N			Other		
Gradient 1-3° Small but distinct	Run	% of site	Triglochin (Water Ribbon) N			Other		
& uniform current	19 -	Est. Av. Length (m)	Typha (Cumbungi) N			Other		
Surface unbroken		Est. Av. Depth (m) Est. Av. Width (m)	Other		150	FIG. do		
Areawhare	Pool		Other			Floating macrophytes	Present	%
Area where stream widens or	- 000	% of site	Other			Azolla (Azolla) N	resent	
deepens and current declines		Est. Av. Length (m) Est. Av. Depth (m)				Callitriche (Starwart) I		
		Est. Av. Width (m)				Other	H	
reasonable sized	Backwater	% of site				Other		
(>20% of channel	A -	Est. Av. Length (m)				Other		
width) cut-off section away from		Est. Av. Depth (m)	0					
	100	Est. Av. Width (m)	Overall % cover of native r	nacroph	vie iaxa	Total should equal over	-11 0/	Control Control

Overall % cover of native macrophyte taxa

Note: An additional response variable planform channel pattern is measured in the office

### Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes. overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1)

Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2)

Loose array of fine sediments. no overlapping, no packing and structure and can be dislodged very easily

#### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

32-60% fine sediment. low availability of interstitial spaces

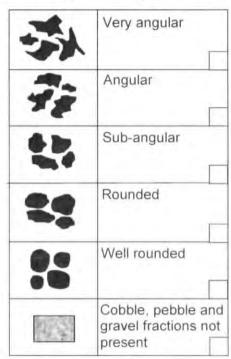


Matrix dominated

>60% fine sediment, interstitial spaces virtually absent

### Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

- Stable -

Unstable - depositing

#### Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion

#### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

#### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size Banks stable Streambed comprised of consolidated (tightly arranged and packed) material

### Moderate deposition

Moderate build-up of fine sediments at obstructions and bars Streambed flat and uniform. Channel wide and shallow.

#### Severe deposition

Extensive build up of fine sediments to form a flat bed. Channel blocked but wide and shallow. Bars large and covering most of the bed or banks Streambed comprised of unconsolidated (loosely arranged and unpacked) material

AUSRIVAS Physical and	Chemical Assessment Protocol Field Data Sheets	Page 8
Site No.	Date	

# HIGH GRADIENT STREAMS

Habitat								C	ondi	tion	cate	gor	1										
parameter		E	xcelle	ent				Good	i				Fair			Т		P	oor				
1. Epifaunal substrate / available cover	sub epif fish sub ban stat to a pote that	ater the strate aunal of cover; merge ks, col ble hab flow fu are no transie	favour colonis mix o d logs oble or itat an il color e log ot new	rable for sation a of snag under other od at st nisation s/snag	and s, rout age	hab full pote hab of p of a the not cold	40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations, presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale)					20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed						Less than 20% stable habitat; lack of habitat is obvious, substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	19		
2. Embeddedness	25% sed cob	vel, co lder pa surro ment ble pro iche si	unded Layer vides	are 0- d by fin	e	Gravel, cobble and boulder particles are 25- 50% surrounded by fine sediment.					50u 75%	lder p	obble article ounde	s are		m	ravel. oulder ore th irrour idime	parti an 7	cles	are			
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1		
3. Velocity / depth regime	dee dee	our vei mes pi p slow p fast 0 3m/s	resent -shallo shallo	(slow- ow fas w) Si	st-	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)					Only regi sha are	st- ow	Dominated by 1 velocity/depth regime (usually slow-deep)										
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	(		
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition					bar formation, mostly					Moderate deposition of new gravel, sand or fine sediment on old and new bars, 30-50% of the bottom affected, sediment deposits at obstructions, constrictions and bends, moderate deposition in pools prevalent.						Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently, pools almost absent due to substantial sediment deposition						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1			
5. Channel flow status	mini char	er real lower mal an nnel su osed	banks	s, and of		avai <25	lable i	s >75% channe channe is exp	el or	e	Wat avai and are		Very little water in channel and mostly present as standing pools										
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1		
6, Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments evidence of past channelization, i.e. dredging (greater than 20 yr) may be present but recent channelization is not					Channelization may be extensive embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted						Banks shored with gation or cement, over 80% of the stream reach channelized and disrupted instream habitat greatly attered or removed entirely						
	_			-		pres	ent	_															

AUSRIVAS Physical and	Chemical Assessment Protocol Field Data Sheets	Page 9
Site No.	Date	

# HIGH GRADIENT STREAMS

Page 2 of 2

Habitat								C	ond	itior	cate	go	У								
parameter		Ex	celle	ent			- (	Good	1				Fair					Po	or		
7. Frequency of riffles (or bends)	Occur relativ of dist riffles the str (generation of hab stream continuof bour large, is imp	rely fr tance divid ream rally ! bitat is ms whous ulders natu	eque bety ed by <7 1 5 to 7 s key here pla s or o ral of	ween y widt 7), var in riffles cementher	nety are	betw by th	quent veen r	ce of ri dista iffles d lth of the	nce fivided he		Occa botto some betw by the streat 25	Generally all flat water or shallow riffles poor habitat, distance between riffles divided by the width of the stream is a ratio of >25									
SCORE	20	19	18	17	16	15	14	13	12	11	10	8	6	5	4	3	2	1	0		
8. Bank stability (score each bank)	Banks of eros absen potent proble affects	sion in it or r tial fo	or ba	ink fai nal lit ure	lure	Moderately stable; infraquent small areas of erosion mostly healed over 5-30% of bank in reach has areas of erosion					60% has high	Moderately unstable: 30- 50% of bank in reach has areas of erosion; high erosion potential during floods					eas, in quen ctions vious -100°	e, ma raw a t alon s and bank 6 of t	g stra bend slou ank	aight s ghin	
SCORE	Left b	ank		10	9	8		7	X	6	5	T	4	T	3	-	2	1		-	0
SCORE	Right	ban	k	10	9	8		7/		6	5		4		3		2	1	1	- 1	0
9. Vegetative protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation. including trees, understorey shrubs, or non woody macrophytes, vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed.					mbank surfaces mmediate riparian covered by native tation, including understorey cob, or non woody ophytes, vegetative pition through nail or not evident.							50-70% of the streambank surfaces covered by vegetation disruption obvious patches of bare soil or closely cropped vegetation common, let than one-half of the potential plant stubble height remaining					an 50 pank son of on is on had to 5 tres of stub	surfacegeta strea very is bei	tion mba high en	ink
SCORE	Left b		- 1	10	9	8		7		6	5		4		3	1	2			1	0
SCORE	Right	ban	k	10	9	8		7		6	5	1	4		3	13	2			-	0
10. Riparian zone score (score each bank)	Width >18 m activiti lawns not im zone	etres les (i	e ro	man ads, c) ha	ve	12-1 activ	8 me	ipanar tres, h nave in n zone	uman npacte		12 m activ	ities	s hun have	an zon nan mpac ne a gr	ted	Width of riparian zone <6 metres, little or no riparian vegetation is present because of human activities					
SCORE	Left b	ank		10	9	8	1	7		6	5		4		3	- 2	2			-	0
SCORE	Right	brank.		10	9	8	-	7		6	5	-	4		3		2				0

TOTAL HIGH GRADIENT HABITAT SCORE

<b>AUSRIVAS Physical</b>	and Chemical	Assessment	Protocol	Field Data	Sheets	Page 1	10
Site No.	Date	22 -8-12	100				

# LOW GRADIENT STREAMS

Habitat										litior	cat	egoi										
parameter		Ex	cell	ent				Good	d				Fair					Po	oor			
1. Epifaunal substrate / available cover	epifi and snaj undi or or and colo (i e not	ater the strate aunal fish cogs, su ercut ther state at state logs/snew fasient).	favou coloni cover; bones; banks table I ige to on pot snags all and	rable sation mix of ged to cobi habita allow rential that a	of ligs, ble it full	pote hab of p of a the not	itat, w colonia ential, itat for opular ddition form of yet pronisation	nix of self-suit sation adequate main subof new epared on (main sof scale)	ted for	ce nce e in ut	habi avai desi freq	itat. h labilit irable	mix of abitat y less subs y distu	than trate		Less than 10% stable habitat lack of habitat is obvious, substrate unstable or lacking.						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
2. Pool substrate characterization	mate and root subi	ture of erials, firm s mats merge mon	with or and pand	gravel	ant.	be o	d or cl domina s and	soft s ay; mi ant; so subm pres	ud ma ome ro erged	tool	bott	om: li	ttle or ubme		be		an cla k; no lion		mat	or		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
3. Pool variability	shal	n mix low, la ill-sha p pool	arge-d	leep, small-			fajority of pools large- eep; very few shallow.			Sha mor deep		Majority of pools small- shallow or pools absent										
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition					islands or point bars had less than 20% of the ottom affected by bar formation, mostly from gravel, sand or fine sediment 20-50% of the new bars, 50-80						nd or I d and 0% of I sits at ad ber sition	the ands	ma de 80 ch po to	atena velop % of angii ols a	deposition in the transfer in	mo cottor quer abs	ed bare the	ar ian			
SCORE	20	19	18	17	16	15	14	13	12	H.	10	9	8	7	6	5	4	3	2	1	0	
5. Channel flow status	both mini char	ler real lower mai ar nnel si osed	r bank mount	s an		avai	lable i	>75% channe channe is exp	el, or el	ie	avai	lable for rift	s 25-7 chann le sut y expo	el. estrate		ch	anne	tle wa land tas s	mos	tiy		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
6. Channel alteration	dred	nneliz iging a mal, s nal pa	absen tream	t or		Some channelization present usually in areas of bridge abutments avidence of past channelization, i.e. dredging (greater than 20 yr) may be present but recent channelization is not				Channelization may be extensive embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted						Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted instream habitat greatly altered or removed entirely						
						but	recen	t		t.	distr	upted				76	nove	ent ent	irety			

<b>AUSRIVAS Physical an</b>	d Chemical	Assessment Protocol Field Data Sheets	Page 11
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# LOW GRADIENT STREAMS

Page 2 of 2

Habitat	Condition category													
parameter	Exc	ellent			Good			Fair			Poor			
7. Channel sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas)			increase length 2	nds in the e the stre to 3 time han if it w line	es	increase 2 times	nds in the the str longer to a straigh	ream than it	1 to	water	nel strai way has elized f ce	been	g
SCORE	20 19	18 17	16	15 1	4 13	12 11	10 9	8	7	6	5 4	3	2 1	(
8. Bank stability (score each bank)	Banks stable, evidence of erosion or bank failure absent or minimal, little potential for future problems <5% of bank affected.		of erosion or bank failure absent or minimal little potential for future problems <5% of bank		60% of has are	tely uns bank in eas of en osion po floods	react	1	freque section obviou 60-10	ble, ma 'raw' a ent along ns and is bank 0% of b nal sca	reas g straig bends slough ank ha	ht		
SCORE	Left bank	10	9	8	7	6	5	4	1	3	2	1		0
SCORE	Right bank	10	9	8	7	6	5	4		3	2	1		0
9. Vegetative protection (score each bank)	More than 90% of the streambank surfaces and immediate ripanian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes, vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally		covered vegetati of plant represe evident full plan to any g more th	pank surf i by nativi ion, but o is is not w inted, disi but not a it growth great exter an one he ential plant height	e one class vell- ruption offecting potential ent. alf of	disruption patches closely vegetate than on potentia	of the bank suit of by veg on obvious of bare cropped ion com- e-half of al plant s emainin	etatio	n or less	stream covern disrup vegeta vegeta remov centin	han 50 hbank s ad by ve trion of s ation is ation ha ed to 5 hetres of ge stubi	surfaces egetation streamb very high s been or less in	s on, pank gh:	
SCORE	Left bank	10	9	8	7	6	5	4		3	2	1		0
SCORE	Right bank	10	9	8	7	6	5	4		3	2	1		0
10. Riparian zone score (score each bank)	Width of ripanan zone >18 metres, human activities (i.e. roads, lawns, crops etc.) have not impacted the ripanan zone.		12-18 metres, human activities have impacted have the ripanan zone only		12 metractivitie	of riparia res, hum s have i man zon	nan mpac	tea	<6 me riparia prese	of ripar stres, lit in veget nt beca n activit	tie or ne lation is use of	0		
SCORE	Left bank	10	9	8	7	6	5	4	1	3	2	1	-	0
SCORE	Right bank	10	9	8	7	6	5	4		3	2	1		0

TOTAL LOW GRADIENT HABITAT SCORE

Channel cross-sections and variables to b				
Detailed instructions on the measurement of channel Two cross-sections are required at homogeneous sampling sites Where the water level at the time of sampling is at or near the water surface and the water mark should be entered as 0.	(generally lowland streams) and three cross-sections a	heterogeneo	ous sampling sites (generally upland streams).	
Cross-section sketch	RL		s-section number	of
8	€		bedform at the cross-section	
		Riffle	Run Pool Cascade Othe	er
- Extrat	CACA			
ank height (m)			Bankfull channel width (m) (=total of boxes A+B+C)	Bank height (
ank neight (m)		Strea	m width at the water mark (m)	A Bank neight (
	is-section the shape of the channel and include the location of ull points. Also show other features such as bars, rocky cross section.		width at the water surface (m)	
Bank width (m) B Horizontal dia	stances (m)			Bank c width (m
Vertical distance petween the water surface and the	er depths (cm)	Ĭ		Vertical distance between the wat surface and the
water mark (m)				water mark (m)
Lating Table	Notes on cross-section measureme	ent		
Riparian zone width				
Left bank (m) Right bank (m)	-			
Bank material Assess % composition for each bank Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either si the cross-section.	de of	Filamentous algae cover	the cross section
Bedrock	Bedrock	1	<10% 10–35% 35-65%	65-90% >90%
Boulder (>256mm)	Boulder (>256mm)	- 1	Periphyton cover	
Cobble (64-256mm)	Cobble (64-256mm)	_	<10% 10-35% 35-65%	65-90% >90%
Pebble (16-64mm)	Pebble (16-64mm)	- (%001		_
Gravel (2-16mm)	Gravel (2-16mm)	Total 100%	Moss cover	
			<10% 10–35% 35-65%	65-90% >90%

Fines (silt and clay <0.06mm)

Total 100% each

Detritus cover

<10% 10-35% 35-65% 65-90% >90%

Fines (silf and clay, <0.06mm)

Detailed instructions on the measurement of Two cross-sections are required at homogeneous sampli	ng sites (generally lowland streams) and three cross-section	cross section  tocol manual. Be familiar with these before proceeding is at heterogeneous sampling sites (generally upland streams), be equal to stream width at the water mark. In this case, vertical distance.	
Cross-section s	ketch	Cross-section number	of
	WATER PURE	Type of bedform at the cross-section  Riffle Run Pool Cascade Other	
	CMF == =	Bankfull channel width (m) (=total of boxes A+B+C)	Bank height (n
The channel sketch should sho	w in cross-section the shape of the channel and include the location of nd bankfull points. Also show other features such as bars, rocky d at the cross section	Stream width at the water mark (m)  Stream width at the water surface (m)	A J J J
Bank width (m) B Horiz	ontal distances (m)		Bank width (m
Vertical distance between the water surface and the water mark (m)	al water depths (cm)		Vertical distance between the wate surface and the water mark (m)
Riparian zone width	Notes on cross-section measurer	ment	
water mark (m)	Notes on cross-section measurer		

#### Assess % composition in the area of bed 5m either side of Left bank Right bank 10-35% 35-65% 65-90% the cross-section. Bedrock Bedrock Periphyton cover Boulder (>256mm) Boulder (>256mm) <10% 35-65% 65-90% Cobble (64-256mm) 10-35% Cobble (64-256mm) Total 100% Pebble (16-64mm) Pebble (16-64mm) Moss cover Gravel (2-16mm) Gravel (2-16mm) <10% 10-35% 35-65% 65-90% Sand (0.06-2mm) Sand (0.06-2mm) Fines (silt and clay, <0.06mm) Detritus cover Fines (silt and clay <0.06mm) 35-65% 65-90% >90% 10-35% Total 100% each

Detailed instructions or Two cross-sections are requir	n the measurement of channed at homogeneous sampling sites me of sampling is at or near the wal	e measured in the area around a cro nel cross-sections are provided in the protoc (generally lowland streams) and three cross-sections at ter mark level, stream width at the water surface will be e	ol manua	Be familiar with these before proceedings sampling sites (generally upland streams)	7.7
ank height (m)	The channel sketch should show in cross the water surface, watermark and bankful outcrops and snags encountered at the co	section the shape of the channel and include the location of if points. Also show other features such as bars, rocky	Type of Riffle	bedform at the cross-section  Run Pool Cascade Ot  Bankfull channel width (m) (=total of boxes A+B+C)  am width at the water mark (m) width at the water surface (m)	herBank height
Width (m)  Vertical distance petween the water surface and the water mark (m)  Riparian zone width	Horizontal dis		nt		Vertical distant between the water mark (m)
Left bank (m)					
	s % composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either side the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm)	Total 100%	Filamentous algae cover    <10%	65-90% >90%

AUSRIVAS Physical Assessment Protocol Field Data Sheets Page 1	Site No. 006 Date 21-8-18
Date 18 Site No. 006- Time 15 30	Recorder's Name SARAM GLAULAT
River Name BACK CREEK Location LOT 7 DP 75	
Weather Rain in last week? Y [ ] N [⋉] Photograph numl	bers and details
deg min sec deg min sec could be a constitude:	us, 344 comes, 5.60/5 1000 a/5
	15 9 = 16
SPS Name and Datum	2. 2.4 come, 5.6 0/5
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  Left bank is facing downstream.	LENGTH OF SAMPLING SITE  Bankfull width (m)
	BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

Units

mg l<sup>-1</sup>

%

ml

ml

UNDETERMINED !

mg [1

Splays

Floodplain present at the sampling site but

does not contain any of the above features

BASIC WATER CHEMISTRY

Temperature

Conductivity

Hq

Turbidity

Dissolved Oxygen

Total phosphorus

Total nitrogen

ALKALINITY

Alkalinity

Amount of water

Amount of H2SO4

Floodplain width

channel

floods

Floodplain features

Oxbows / billabongs

Remnant channels

Flood channels

Choose one or more features when present

Sampling site has no distinct floodplain

Body of water occupying a former river meander, isolated by a shift in the stream

Formed during a previous hydrological

regime. May be infilled with sediment

A channel that distributes water onto the floodplain and off the floodplain during

Dissolved Oxygen Sat.

Other

AUSRIVAS Physical Assessment Pr	rotocol Field Data She	ets Page 3	Site No. 006	Date _21.8.	18
Riparian zone composition Assess for whole sampling site % 0	Cover	Vegetation Description	Longitudinal extent Choose one category for include ground layer exc native grassland.	each bank. Do not	Left Right
Trees (>10m in height)	9 9	AE TEN	None	~~	
Trees (<10m in height)	tal mol	a	Isolated / scattered	ハン	155
Shrubs	May total more than 100%	MARIOL GUSE.	Regularly spaced	×	
Grasses / ferns / sedges	May Way	ATTUS + Stone Vet-	Occasional clumps	200	
Shading of shannel			Semi-continuous	Secretary on many	1百百
Shading of channel	50% 51 – 75%	> 76%	Continuous	State of the last	
Overall vegetation disturbance ration Choose one category only. Sites with vacategory. Words within the drawings sun	lley vegetation cleared or	Total 100%  Total 100%  BOTH sides, but with riparian vegetation about the state of the riparian and valle	If no, record regeneration category	Abundant (>5% cov Present Very limited (<1% could be scored in the his	over)
cleared cleared exotic only A Riparian vegetation – absent or so reduced. Vegetation is extremely of dominated by exotic species with no rare or completely absent)  Valley vegetation – agriculture and land BOTH sides. Plants present a exotic species (willows, pines etc.)	disturbed (ie. ative species disturb disturb disturb disturb.)	Riparian vegetation – moderately disturbed by	or minor on BOTH scondition with disturbanc  Valley veg  Riparian	egetation – native vegetation posides of the river and in relativel with few exotic species present is relatively minor.  etation – native vegetation preses of the river, with a virtually interest of the river.	y good Any sent on
Very high disturbance	Moderate dis	sturbance	Very low disturbance		
cleared cleared some native but disturbed A Riparian Vegetation – some native but disturbed A Native species severely reduced in cover.  Valley vegetation – some native present, but it is severely modified by grazing or the intrusion of exotic Native species severely reduced in cover.  Valley vegetation – some native present, but it is severely modified by grazing or the intrusion of exotic species severely reduced in cover.	BOTH sides or mino undisturbed or minor or o	sides with canopy intact or with native species	pristine Exotic species and a Ripanan ▶ BOTH side Exotic species and a Ripanan ▶ BOTH side species and species are species and species and species are species and species and species are species ar	egetation – native vegetation per softhe river and in an undisturcies are absent or rare. Representation in excellent condition pretation – native vegetation press of the river with an intact cance absent or rare. Representativin excellent condition	rbed state. sentative of sent on opy. Exotic

AUSRIVAS P	hysical Assessme	ent Protocol F	ield Data Sheets		P	age 4	Site No. 006	Date	21.8.18
	rriers to local fish ategory for each flow	condition	Type of bars Choose one or n	nore categories		Extent of	bars mbed forming a ba	ar of any typ	ne %
600	No wasses	Base Low High		Bars absent		Dominant Boulder/co	sediment particle	size on ba	
G	No passage			Side/point ba		Sand		/[] or	mm
8	Very restricted passage			Side/point ba		~	No modifications	-	Reinforced
8	Moderately restricted passage			Mid-channel VEGETATED		Jar.	Desnagged	¥ 9°	Revegetated
8	Partly restricted passage			Mid-channel to UNVEGETAT Bars around		7	Dams and diversions	00	Infilled
3	Good passage			obstructions Braided chan	nel	77	Resectioned	00	Berms or embankments
8	Unrestricted passage			Infilled chann		N. N. S.	Straightened	Signs of work still	Recently channelised
Type and heig	ht of barrier(s)			High flow dep	osits	J.	Realigned	Works old and revegetated	Channelised in the past
Channel sha	ape Choose one ca	tegory only							
						_	7	1	
	U shaped	Flat U shape	ed Deepened	U shape	Widene	d or infilled	Two s	tage	Multi stage
						- L	<b>\</b>		
	Box	Wide b	ox \	√ shaped		Trapezoid	Concre	te V	Pipe or culvert

Bank shape Choose one category for each bank	Bank slope Choose one category for each bank	Sediment oils
Left Right bank bank	Vertical 80 - 90°	water oils  Ight moderate profuse  Water oils  Ight sheen slick
Convex	Steep 60 - 80°	Sediment odours  normal/none sewage petroleum chemical
Stepped	Moderate 30 - 60°	anaerobic other
Wide lower bench	Low 10 - 30°	normal/none sewage petroleum chemical other
Undercut	Flat <10°	Turbidity (visual assessment)  Clear Slight Turbid Opaque
Factors affecting bank stability Choose one or more categories	Bedrock outcrops Assess % of each bank covered by bedrock outcrops % bedrock outcrops Left bank	Is water clarity reduced by:  Suspended material (e.g mud, clay, organics)  Dissolved material (e.g plant leachates)
None Cleared vegetation  Runoff draw-down	Right Bank   Artificial bank protection measures Choose one or more categories	Water level at the time of sampling  Dry No flow Low Baseflow or near baseflow  High Flood (don't sample)
Stock Reservoir releases  Human Seepage access  Ford, culvert Flow and	<ul> <li>None</li> <li>Fence structures</li> <li>Levee banks</li> <li>Fenced stock watering points</li> <li>Vegetation plantings</li> </ul>	Artificial features at the sampling site Choose one or more categories  Major Minor Ford Bridge Culvert Other weir
or bridge waves  Feral animals Drainpipes  Other	Rock or wall layer Rip rap  Fenced human access  Logs strapped to bank Concrete channel lining	Large woody debris Overall % cover of logs and branches greater than 10cm in diameter

AUSRIVAS	Physical	Assessment	Protocol	Field	Data	Sheets

% of site

Est. Av. Length (m) Est. Av. Height (m) Est. Av. Gradient (°)

Est. Av. Length (m)

Est. Av. Height (m) Est. Av. Gradient (°)

Est. Av. Length (m)

Est. Av. Depth (m) Est. Av. Width (m)

Est. Av. Length (m)

Est. Av. Depth (m)

Est. Av. Width (m)

Est. Av. Length (m)

Est. Av. Depth (m)

Est. Av. Width (m)

Est. Av. Length (m)

Est. Av. Depth (m)

Est. Av. Width (m)

Est. Av. Length (m)

Est. Av. Depth (m)

Est. Av. Width (m)

Est. Av. Length (m)

Est. Av Depth (m)

Est. Av. Width (m)

Total % composition for all features must equal 100%

Waterfall

Cascade

Rapid

Riffle

Glide

Run

Pool

Extent of bedform features

Height >1m

Gradient >60°

Step Height <1m

Gradient 5-60°

Strong currents

Gradient 3-5°

Rocks break surface

Gradient 1-3°

but unsmooth

Gradient 1-3°

Small currents

and smooth

Gradient 1-3°

Area where

deepens and

Small but distinct

& uniform current

Surface unbroken

stream widens or

current declines

width) cut-off

A reasonable sized (>20% of channel

section away from

Surface unbroken

Moderate currents

Surface unbroken

Strong currents

Macrophyte cover Assess % cover of the sampling site by each category.  Overall % cover of macrophytes  % cover of emergent macrophytes  % cover of floating macrophytes  % cover of submerged macrophytes  % cover	heets	Page	6 5	Site No. 506 Date 3	1 - 7 - 1	8
### Cover of floating macrophytes  ### Cover of submerged macrophytes  ### Listed macrophyte can be changed to reflect the common taxa present in each State or Territory  ### No denotes a native taxa and I denotes an introduced taxa.  ### Emergent macrophytes  ### Present cover	Macrophyte cover Assess	% cove	r of the sa	ampling site by each category.		
Macrophyte composition Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification. Listed macrophytes can be changed to reflect the common taxa present in each State or Territory N denotes a native taxa and I denotes an introduced taxa.  Emergent macrophytes  Present   Submerged macrophytes   Present   Cover	Overall % cover of macroph	ytes	W65	% cover of emergent macro	ophytes	5
Macrophyte composition Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification. Listed macrophytes can be changed to reflect the common taxa present in each State or Territory N denotes a native taxa and I denotes an introduced taxa.  Emergent macrophytes  Present   Submerged macrophytes   Present   Cover				% cover of floating macrop	hytes	77
Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification. Listed macrophytes can be changed to reflect the common taxa present in each State or Territory N denotes a native taxa and I denotes an introduced taxa.  Emergent macrophytes    Present   Pres						eses
Brachiaria (Para Grass) I	Use a macrophyte field guide Listed macrophytes can be ch	anged to	reflect th	e common taxa present in each		Territory
Brachiaria (Para Grass) I				Submerged macrophytes	200	100
Crassula (Crassula) N  Cyperus (Sedge) I/N  Eleocharis (Spikerush) N  Juncus (Rush) I/N  Paspalum (Water Couch) N  Phragmites (Common Reed) N  Ranunculus (Buttercup) I  Scirpus (Clubrush) N  Triglochin (Water Ribbon) N  Triglochin (Water Ribbon) N  Other		Present	cover	4.00.00	Present	cover
Cyperus (Sedge) I/N  Eleocharis (Spikerush) N  Juncus (Rush) I/N  Paspalum (Water Couch) N  Phragmites (Common Reed) N  Ranunculus (Buttercup) I  Scirpus (Clubrush) N  Triglochin (Water Ribbon) N  Triglochin (Water Ribbon) N  Other  Other  Other  Other  Other  Other  Azolla (Azolla) N  Callitriche (Starwart) I						
Eleocharis (Spikerush) N  Juncus (Rush) I/N  Paspalum (Water Couch) N  Phragmites (Common Reed) N  Ranunculus (Buttercup) I  Scirpus (Clubrush) N  Triglochin (Water Ribbon) N  Triglochin (Water Ribbon) N  Other  Other  Other  Other  Azolla (Azolla) N  Callitriche (Starwart) I  Other  Other	Crassula (Crassula) N			TALL TO MERCHANIST CONTRACTOR		
Juncus (Rush) I/N  Paspalum (Water Couch) N  Phragmites (Common Reed) N  Ranunculus (Buttercup) I  Scirpus (Clubrush) N  Triglochin (Water Ribbon) N  Triglochin (Water Ribbon) N  Other  Typha (Cumbungi) N  Other  Other  Other  Other  Azolla (Azolla) N  Callitriche (Starwart) I  Other	Cyperus (Sedge) I/N			Elodea (Canadian Pondweed) I		
Paspalum (Water Couch) N  Phragmites (Common Reed) N  Ranunculus (Buttercup) I  Scirpus (Clubrush) N  Triglochin (Water Ribbon) N  Other  Typha (Cumbungi) N  Other	Eleocharis (Spikerush) N			Myriophyllum (Water Milfoil) I/N		
Phragmites (Common Reed) N  Ranunculus (Buttercup) I  Scirpus (Clubrush) N  Triglochin (Water Ribbon) N  Other  Typha (Cumbungi) N  Other	Juncus (Rush) I/N			Nitella (Stonewart) N		
Ranunculus (Buttercup) I	Paspalum (Water Couch) N			Potamogeton (Pondweed) N		
Scirpus (Clubrush) N         Other	Phragmites (Common Reed) N			Triglochin (Water Ribbon) N		
Triglochin (Water Ribbon) N         Other	Ranunculus (Buttercup) I			Vallisneria (Ribbonweed) N		
Triglochin (Water Ribbon) N         Other	Scirpus (Clubrush) N			Other		
Other Other Other Azolla (Azolla) N Callitriche (Starwart) I Other	Triglochin (Water Ribbon) N					
Other	Typha (Cumbungi) N			Other		
Other Azolla (Azolla) N Callitriche (Starwart) I	Other	190	15	Election managements		
Other Azolla (Azolla) N  Callitriche (Starwart) I  Other	Other			Floating macrophytes	Present	%
Callitriche (Starwart)   Other				Azolla (Azolla) N		
Other						

Other

Total should equal overall % cover of macrophytes from above

Overall % cover of native macrophyte taxa

Overall % cover of native macrophyte taxa

Note: An additional response variable <u>planform channel pattern</u> is measured in the office

Backwater

### Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes, overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1)

Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2)

Loose array of fine sediments. no overlapping, no packing and structure and can be dislodged very easily

#### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

32-60% fine sediment, low availability of interstitial spaces

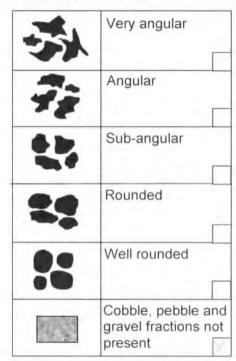


Matrix dominated

>60% fine sediment, interstitial spaces virtually absent

### Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

Stable -

Unstable - depositing

### Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening. Bare severely eroded banks Erosion heads Steep streambed caused by erosion

#### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

#### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material

### Moderate deposition

Moderate build-up of fine sediments at obstructions and bars Streambed flat and uniform Channel wide and shallow.

### Severe deposition

Extensive build up of fine sediments to form a flat bed Channel blocked but wide and shallow Bars large and covering most of the bed or banks Streambed comprised of unconsolidated (loosely arranged and unpacked) material

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# HIGH GRADIENT STREAMS

Habitat								C	ondi	tion	cate	gor	У								
parameter		E	xcelle	ent				Good	t				Fair			T		P	oor		
1. Epifaunal substrate / available cover	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					hab full i pote hab of p of a the not colo	itat w coloni ential itat fo opular ddition form o yet pr inisati	rell-su sation adequations tions nal sul of new epare	tenand present bstrate fall, bit d for ay rate	ce nce e in ut	hab avai des freq	itat, h ilabilit irable	mix of abitat y less subs y distu	than trate		ha ob	ess thabitat, ovious astab	lack sub	of ha	abitat e	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
2. Embeddedness	25% sedi	vel, co der pa surro ment ble pro	unded Layer vides	are 0-	ie	50%	lder p	ounde	and s are : d by fi		50u 75%	ider p	obble article ounde	s are		m su	ravel oulder ore th irrour edime	parti an 7	cles 5%	are	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
3. Velocity / depth regime	regii deep deep	our vei mes pro- p. slow p. fast- com/s	esent -shallo shallo	(slow- ow fas w) S	st-	miss than	sent (i				regi	mes p	the 4 preser r slow ng, so	t (if fa	ast- ow	Ve	omina locity sually	/dept	h reg		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
4. Sediment deposition	islan less affec	e or no ids or than t cted by osition	point to % of the seding	ars ar	nd	bar from sedi bott	forma grav ment om af	tion n el sar 5-30	ease in nostly nd or f % of th sligh ols	ne ie	new sedi new botte sedi obst cons	grav ment bars om af ment truction striction	depo el sar on old 30-5 fected depor ons ons ar depor valent	nd or indicated and of and of and of and of and of and bernstein at the second of and bernstein and	the nds	de 50 ch po to	eavy eatena evelop 1% of langing los a subseposit	the b importantial tantia	mo otton quen abse	ed ba re th n itly ent d	ar iari
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
5. Channel flow status	both	er real lower mai an mei su	banks	s, and of		avail <25	lable of	>759 chann chann is exp	el	e:	avai	lable for rift	s 25-7 chann le sub y expo	el strate		ch	anne esent ols	and	most	tiy	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
6. Channel alteration	Channelization or dradging absent or minimal, stream with normal pattern					Son pres of bit evid char dred 20 y but char	Cha exte or si pres and reac disn	ents is eam	Banks shored with gabion or cement over 80% of the stream reach channelized and disrupted Instream nabitat greatly attered or removed entirely.												
						pres		augit i	1707												

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USEPA	Habitat	Asse	essment
Circle a	score for	each	parameter

# HIGH GRADIENT STREAMS

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Habitat								C	ond	tior	cate	gon	1							
parameter		Exc	elle	ent				Good	1				Fair					Poor		
7. Frequency of riffles (or bends)	Occum relative of dista riffles of the stre (general of habit stream continu- of boul large, r is impo	nt raveen width  ); var in iffles cementher	n of nety are nt	infre betw by th	quent veen r	ith of t	nce livided		some between	habi en ri	ntour tat, d ffles th of	s prov listand divide	nde te d	Generally all flat water or shallow infles, poor habitat distance between rifles divided by the width of the stream is a ratio of >25						
SCORE	20 1	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3 2	1	0
8. Bank stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal, little potential for future problems. <5% of bank affected.					of er	osion 5-3 h has	most	l areas y heald bank ii	60	60%	of bar reas erosio	nk in of en on po	reach osion: tential		are free sec obv	duent ctions vious 100°	e, many aw area t along si s and ber bank sic of bank al scars	s raigh nds, lughir	t ng.
SCORE	Left bank 10 9				8	1	7	1	i	5		4		3	-	2	1		0	
SCORE	Right	bank		10	9	8	/	7	1	5	5		4		3		2	10		0
9. Vegetative protection (score each bank)	More the stream and im zone covegetal trees, is shrubs macrop disrupt grazing minima almost to grow	ibank imedia overe ition, ii under ii, or n phytes tion th g or m ai or n	surface of the state of the sta	faces iparia y nativi iding ey woody egeta ah ng eviden allow	streambank surfaces covered by native vegetation, but one class of plants is not weil- represented, disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant						close veget than	veg obvio bare pped comi alf of	etation ous, o soil o mon; I the stubble	or less	stre cov dis veg veg ren cer	eamb vered ruption getation getation nove intime	an 50% of lank surf by vege on of stre on is ver- on has b d to 5 tres or le stubble	aces tation tamba amba y high een	arik	
SCORE	Left ba	ánk		10	9	8		7	1	3	5		4		3		2	1		0
SCORE	Right	bank		10	9	8		7	1	;	5		4		3	1	2	1	10	0
10. Riparian zone score (score each bank)	Width of riparian zone >18 metres, human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.					12-18 metres, human activities have impacted ive the ripanan zone only						hun ave i		ted.	Width of nparian zone <6 metres, little or no riparian vegetation is present because of human activities					
SCORE	Left ba	ank		10	9	8		7	1	,	5	1	4	1	3		2	1		0
SCORE	Right	hank		10	q	8		7	1		5	+	4		3		2	1	1	0

TOTAL HIGH GRADIENT HABITAT SCORE



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# LOW GRADIENT STREAMS

Habitat									Conc	litior	cat	ego	ry								
parameter		Excellent Freater than 50% of						Good	d				Fai	r				P	oor		
1. Epifaunal substrate / available cover	substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient)				habitul of pote habit of pote the line in not color	itat w colonis ential; itat for opulat ddittor form o yet pro- nisatio	nix of self-sur- sation adequir main ions; p nal sub- of new epared on (main of scale	ted for	ce nce e in ut	hab ava des freq	itat: h labilit irable	y less , subs y disti	than		hai	bitat vious	lack	0% s of ha ostrat lackin	e e		
SCORE	20	1	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	and root subs	enals, firm s mats	subs with g and p and ed veg	gravel revale	ent;	be d	or cla domina s and	soft s ay: mu ant, so subm prese	id ma ome ro erged	ot	bott mat	om, li	ttle or	or sa no ro erged		be			root	mat	or
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	shall	low, la	of large-d liow, s	eep.				f paois y few :			mor		valent						ools a		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	of is and botto	lands less to om aff	o enlar or poi han 2 lected depos	nt bar 0% of by	8	from sedi botto	forma gravi ment om aff	v incre tion, m el, san 20-50 fected i in po	nostly nd or f 0% of sligh	ine the	new bott sedi obsi cons	grav ment bars om at ment truction striction	on ol- 50-8 fected depo ons ons a	sits at nd be	the	ma der 80° chi por to	tena velop % of angir ols a	the to most tanta	sits orease t: mo pottor equen t abse	ed bare the n tly ent d	an ue
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	both	lower mal ar	ches bank mount ubstra	s, and		avail	lable of	>75% channe channe is exp	el; or	е	avai	lable for rifl	chann	bstrate	200	cha	anne	and	mos tandi	tly	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	dred	ging a	ation dabsenders at the same stream of the same str	or		pres of br evide char dred 20 y but r	ent, undge a ence o nneliza Iging ( r) ma recent	e channelization ent, usually in areas dge abutments, nce of past nelization, i e ging (greater than i) may be present, enelization is not				Channelization may be extensive, embankments or shoring structures present on both banks and 40 to 80% of stream reach channelized and disrupted				Banks shored with gabion or cement, over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
						pres		artoli is	s not												

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# LOW GRADIENT STREAMS

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Habitat			Condition category  Excellent Good Fair Poor																		
parameter		Ex	celle	ent			(	3000	1				Fair					Po	or		
7. Channel sinuosity	lengi longi strai char cons coas low-	was i	The be increal length longer straigh	se th 2 to than	ne stre 3 tim n if it v	eam les		incre Z tim	ase es lo	is in the stronger to straigh	ream than if	1 to	wat	erwa	ized	ight s bee for a l					
SCORE	20	19	18	17	16	15 1	14	13	12	11	10	5	4	3	2	1	0				
8. Bank stability (score each bank)	Banks stable, evidence of erosion or bank failure absent or minimal, little potential for future problems <5% of bank affected.				Moder infrequ of eros over reach erosion	ient sion 5-30 has	smail mosti 0% of	l areas y heale bank i	ed	60% has a	of b reas	ely uns ank in s of en ion po ods	react osion	1	fred sec obv 60-	as, 'i	t alor and bani	any ar areas ng stra bend c slou bank ars	aight is		
SCORE	Left	bank		10	9	8		7	1	6	5		4		3		2		1	(	0
SCORE	Right bank 10 9				9	8		7	- 1	3	5	T	4		3	1	2		1	(	0
9. Vegetative protection (score each bank)	stres and zone vege trees shru mac disru graz minii almo	e than amban immed a cover station s. undi ibs, or rophyt uption ing or mai or ost all prow na	red by includerstor non tes, vithrou mow not epiants	rfaces nparia y nati- uding rey wood egeta igh ing evider s allow	y tive	70-90° stream covere vegeta of plan repres eviden full pla to any more t the pol stubble remain	disru patch close veget than poter	mba red to ption les d ly cri tatio one- itial	of the link sur- by veg n obvior for bare copped n com- half of plant s mainin	etation ous. e soil of mon; f the stubble	n; or less	stre cov dist veg veg ren cer	eamt rered ruption jetati jetati nove stime	oank by von of on is on hi d to s	0% of surface egeta strea very as been or less oble he	ces tion, mba high en	nk				
SCORE	Left	bank		10	9	8		7	1	3	5.		4		3	1	2	1	1	(	0
SCORE	Righ	nt ban	ık	10	9	8		7	1	3	>5	7	4		3	- 3	2		1	(	0
10. Riparian zone score (score each bank)	>18 activ lawn not it	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone				Width of riparian zone 12-18 metres, human activities have impacted the riparian zone only minimally				12 m activi	etre ties	riparia s; hum have i an zon	nan mpac	ted	<6 rips pre	metr anan sent	es li vege	ttle or tation tuse of ties	10 15		
SCORE	Left	bank	T	10	9	- 8		7		5	5		4		3	1	2	1	1	(	0
SCORE	- Dist	Right bank 10 9				8		7		5	5	-	4	100	3		2		1	-	0

TOTAL LOW GRADIENT HABITAT SCORE



	tions and variables to be measured in the area around a	
wo cross-sections are requi Where the water level at the	n the measurement of channel cross-sections are provided in the prized at homogeneous sampling sites (generally lowland streams) and three cross-sectionime of sampling is at or near the water mark level, stream width at the water surface will mark should be entered as 0.	otocol manual. Be familiar with these before proceeding.  In at heterogeneous sampling sites (generally upland streams).  If be equal to stream width at the water mark. In this case, vertical distance between the
	Cross-section sketch	Cross-section number of
	BANK FUIL	Type of bedform at the cross-section
	THE PARTY	Riffle Run Pool Cascade Other
		Bankfull channel width (m)
nk height (m)		(=total of boxes A+B+C)
6.3		Stream width at the water mark (m) Bank heigh
1	The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.	Stream width at the water mark (iii) Stream width at the water surface (m)
Bank vidth (m)	Horizontal distances (m)	9 0 Bank width
/ertical distance	<b>▼</b>	Vertical dieter
tween the water		Vertical distant
surface and the	Vertical water depths (cm)	surface and the

outcrops and snags encountered at the o	cross section.	Stream	width at the water surface (m)
Bank width (m) B Horizontal dis	stances (m)	10	Bank width (m
Vertical distance between the water surface and the water mark (m)	r depths (cm)		Vertical distance between the wat surface and the water mark (m)
Riparian zone width	Notes on cross-section measuremen	nt	Dan Orient of other
Left bank (m) Right bank (m)			
Bank material Assess % composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either side the cross-section.	of	Filamentous algae cover  Assess in the area 5m either side of the cross section
Bedrock	Bedrock		<10% 10-35% 35-65% 65-90% >90%
Boulder (>256mm)	Boulder (>256mm)		Periphyton cover
Cobble (64-256mm)	Cobble (64-256mm)	%	<10% 10–35% 35-65% 65-90% >90%
Pebble (16-64mm)	Pebble (16-64mm)	Total 100%	Magagaguer
Gravel (2-16mm)	Gravel (2-16mm)	otal	Moss cover
Sand (0.06-2mm)	Sand (0.06-2mm)		<10% 10–35% 35-65% 65-90% >90%
Fines (silt and clay, <0.06mm)	Fines (silt and clay <0.06mm)		Detritus cover
Total 100% each			<10%

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Site No. 266

Date 21-8-18

### Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

Bank height (m)		s-section the shape of the channel and include the location of ill points. Also show other features such as bars, rocky	Type of Riffle	bedform at the cross-section  Run Pool Cascade Other  Bankfull channel width (m) (=total of boxes A+B+C)  m width at the water mark (m) width at the water surface (m)
Bank width (m)  Vertical distance between the water surface and the water mark (m)  Riparian zone width	Horizontal dis		ent	Vertical distance between the water surface and the water mark (m)
Bank material Assess  Bedrock  Boulder (>256mm)  Cobble (64-256mm)  Pebble (16-64mm)  Gravel (2-16mm)  Sand (0.06-2mm)  Fines (silt and clay, <0.06mm)	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either side the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	Total 100%	Assess in the area 5m either side of the cross section  <10% 10-35% 35-65% 65-90% >90% Periphyton cover <10% 10-35% 35-65% 65-90% >90% Moss cover <10% 10-35% 35-65% 65-90% >90% Detritus cover <10% 10-35% 35-65% 65-90% >90% >90% Detritus cover <10% 10-35% 35-65% 65-90% >90% >90%

		e measured in the area around a cross			1
Two cross-sections are rec Where the water level at th	quired at homogeneous sampling sites	nel cross-sections are provided in the protoco (generally lowland streams) and three cross-sections at he ster mark level, stream width at the water surface will be equ	eterogeneo	us sampling sites (generally upland streams).	between the
	Cross-section sketch			s-section number	_ of
				Run Pool Cascade Other	
ank height (m)		s-section the shape of the channel and include the location of ull points. Also show other features such as bars, rocky cross section		Bankfull channel width (m) (=total of boxes A+B+C) m width at the water mark (m) width at the water surface (m)	Bank height (r
Bank width (m)  Vertical distance petween the water surface and the water mark (m)		stances (m)			Vertical distance between the wat surface and the water mark (m)
Riparian zone wid	lth	Notes on cross-section measuremen	t		
	Right bank (m)				
Bank material Ass	sess % composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either side	of	Filamentous algae cover th	he area 5m either side of e cross section
	Tight sain	the cross-section.  Bedrock	1	<10% 10–35% 35-65%	65-90% \>90%
Bedrock		Boulder (>256mm)		Periphyton cover	
Boulder (>256mm)				<10% 10–35% 35-65%	65-90% >90%
Boulder (>256mm) Cobble (64-256mm)		Cobble (64-256mm)	%00	<10% 10–35% 35-65%	65-90% >90%
Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm)		Cobble (64-256mm) Pebble (16-64mm)	otal 100%	Moss cover	
Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm)		Cobble (64-256mm)  Pebble (16-64mm)  Gravel (2-16mm)	Total 100%	Moss cover	65-90% >90% 65-90% >90%
Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay, <0.06	Smm)	Cobble (64-256mm) Pebble (16-64mm)	Total 100%	Moss cover	

AUSRIVAS Physical Assessment Protocol Field Data Sheets	Page 1	Site No. 007 Date 22.8 /8
Date 22-8-18 Site No. 007 Time	1523	Recorder's Name SARAH 65AURS
Weather CLINAL + SUNNY Rain in last week? Y [ ] N [>]	Photograph nu	mbers and details
deg min sec deg min sec atitude: 2 8 4 6 4 5 Longitude: 1 5 6 2 4 5 3		U/S, 3+4-mar, 5+6 0/5
GPS Name and Datum	(002 RAL) -	112 LOW JAM ON BAR BROOK
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or eft bank is facing downstream.	r floodplain features.	LENGTH OF SAMPLING SITE  Bankfull width
Foxe		Notes  SET PREFILED FROM BOND SHIP  FACEL WATER TO SERVE CHEE
Fair Plansing Reserved		BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

Riparian zone composition			Longitudinal extent	of riparian vegeta	tion	
Assess for whole sampling site			Choose one category for			
% Cove	er	Vegetation Description	include ground layer exce native grassland.	ept where site is in	Left bank	Right
rees (>10m in height)		EVC. TOR. + ACACIA	None	~~		
rees (<10m in height)	May total more than 100%	W *	Isolated / scattered	ハン		$\overline{\Box}$
Shrubs	ay tota		Regularly spaced	, · · · · · · ·		Ī
Grasses / ferns / sedges	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	NATIVET FROTH GRASSES	Occasional clumps	9		
Shading of channel			Semi-continuous	States to Marie	X	$\times$
	6 51 – 75%	> 76%	Continuous	Sherry Contraction of the Party		
Z .0%			Demonstration of ma	41	41	
Extent of trailing bank vegetation	Native and e	xotic riparian vegetation	Regeneration of na Is the sampling site			
	% Native	to a contract regulation	is the sampling site	in undisturbed fores	Str	
il moderate	% Native _	Total 100%	Y[ ] N [X]			
slight extensive	% Exotic	40 Cruss Bases AN		Abundant (>5% cov	or) and h	noalth
	_	Contract Con			er) and n	lealu
		V/Crn before a first	It no record	Drocont		
		VISTAN FRONT BOX	componentian	Present	ovor)	
		VISTA-1 FROM TOX	componentian	Present Very limited (<1% c	over)	
Overall vegetation disturbance rating			regeneration category	Very limited (<1% c		
Choose one category only. Sites with valley	vegetation cleared o	n BOTH sides, but with riparian vegetation	regeneration category on in good condition shou	Very limited (<1% c		oance
	vegetation cleared o rise the detailed text	n BOTH sides, but with riparian vegetation	regeneration category on in good condition shou	Very limited (<1% c		ance
Choose one category only. Sites with valley	vegetation cleared o rise the detailed text <u>High disturb</u>	n BOTH sides, but with riparian vegetation about the state of the riparian and valle	regeneration category on in good condition shou	Very limited (<1% c		ance
Choose one category only. Sites with valley category. Words within the drawings summare Extreme disturbance  Cleared cleared Riparian vegetation – absent or severely	rise the detailed text  High disturb	on BOTH sides, but with riparian vegetation about the state of the riparian and valley bance	on in good condition show y vegetation for each cate	Very limited (<1% could be scored in the hiegory.	gh disturb	oance
Choose one category only. Sites with valley category. Words within the drawings summare Extreme disturbance  Cleared cleared Riparian vegetation – absent or severely reduced. Vegetation is extremely disturbed dominated by exotic species with native secrees with nati	High disturb	about the state of the riparian and valled about the state of the riparian vegetation – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain	on in good condition show y vegetation for each cate  Low disturbance  undisturb undisturb or minor undisturb on BOTH s	Very limited (<1% could be scored in the hiegory.  egetation – native vegetation pides of the river and in relatively	gh disturb	pance
Choose one category only. Sites with valley category. Words within the drawings summare Extreme disturbance    Cleared   Cleared   Riparian vegetation – absent or severely reduced. Vegetation is extremely disturbed dominated by exotic species with native surface or completely absent)	High disturb	n BOTH sides, but with riparian vegetation about the state of the riparian and valled and an another state of the riparian and valled and another state of the riparian vegetation – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain valley vegetation – agriculture and/or cleared	on in good condition show y vegetation for each cate Low disturbance  Low disturbance  Undisturb undisturb or minor on BOTH secondition was condition with the condition with the condition was condition with the condition was condition with the condition was condition with the condition with the condition was conditionally conditionally conditions with the condition was conditionally conditionally conditions with the conditional conditions was conditionally conditiona	Very limited (<1% could be scored in the hiegory.	gh disturb	pance
Choose one category only. Sites with valley of category. Words within the drawings summare Extreme disturbance  Cleared cleared exotic only only only only only only only valley vegetation – absent or severely described dominated by exotic species with native severely reaction on the second of the second only only only valley vegetation – agriculture and/or cleared BOTH sides. Plants present are virtued.	High disturb	n BOTH sides, but with riparian vegetation about the state of the riparian and valled by stock or through the intrusion of exotic species, although some native species remain  Valley vegetation – agriculture and/or cleared land ONE side, native vegetation on the other	on in good condition show y vegetation for each cate Low disturbance  Low disturbance  Undisturb undisturb or minor on BOTH secondition we disturbance Valley veg	Very limited (<1% could be scored in the hiegory.  egetation – native vegetation pides of the river and in relatively in the west of the species present is relatively minor.  etation – native vegetation pre-	gh disturb	pance
Choose one category only. Sites with valley category. Words within the drawings summare Extreme disturbance    Cleared   Cleared   Riparian vegetation – absent or severely reduced. Vegetation is extremely disturbed dominated by exotic species with native surface or completely absent)	High disturb	n BOTH sides, but with riparian vegetation about the state of the riparian and valled and an another state of the riparian and valled and another state of the riparian vegetation – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain valley vegetation – agriculture and/or cleared	on in good condition show y vegetation for each cate undisturb or minor on BOTHs condition with disturbance Valley vegetation for each cate vegetation for each cate vegetation for each cate vegetation with the condition with disturbance valley vegetation with the condition with	Very limited (<1% could be scored in the histogory.  egetation – native vegetation purides of the river and in relatively in the few exotic species present a present is relatively minor.	gh disturb	pance
Choose one category only. Sites with valley category. Words within the drawings summare Extreme disturbance  Riparian vegetation – absent or severely reduced. Vegetation is extremely disturbed dominated by exotic species with native some or completely absent)  Valley vegetation – agriculture and/or cleaned BOTH sides. Plants present are virtuated in the process of	High disturb	n BOTH sides, but with riparian vegetation about the state of the riparian and valled about the state of the riparian and valled by stock or through the intrusion of exotic species, although some native species remain  Valley vegetation – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present	on in good condition show y vegetation for each cate undisturb or minor undisturb or minor undisturb or minor undisturb condition we disturbance Valley vegenoths side	Very limited (<1% could be scored in the hiegory.  egetation – native vegetation prices of the river and in relative in the experies present is relatively minor.  etation – native vegetation press of the river, with a virtually interest of the river, with a virtually interest of the river.	gh disturb	pance
Choose one category only. Sites with valley category. Words within the drawings summare Extreme disturbance  Riparian vegetation – absent or severely reduced. Vegetation is extremely disturbed dominated by exotic species with native surface or completely absent)  Valley vegetation – agriculture and/or cleaned BOTH sides. Plants present are virtue exotic species (willows, pines etc.)  Very high disturbance  Riparian vegetation – some native ve	High disturb  cleared modisturb  cleared disturb  cleared disturb  cleared wally all  Moderate di  cleared undisturb  cleared undisturb  cleared undisturb	Riparian vegetation – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain  Valley vegetation – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present  Sturbance	on in good condition show y vegetation for each cate undisturb or minor undisturb or minor undisturb or minor undisturb condition will sturbance Valley vegetation will be undisturbance very low disturbance	Very limited (<1% could be scored in the higher of the river and in relatively minor.  etation – native vegetation processes a present is relatively minor.  etation – native vegetation press of the river, with a virtually into the exotic species.	gh disturb oresent y good Any sent on lact	pance
Choose one category only. Sites with valley category. Words within the drawings summare Extreme disturbance  Riparian vegetation – absent or severely reduced. Vegetation is extremely disturbed dominated by exotic species with native surface or completely absent)  Valley vegetation – agriculture and/or cle land BOTH sides. Plants present are virtue exotic species (willows, pines etc.)  Very high disturbance  Riparian vegetation – some native veget present, but it is severely modified BOTH by grazing or the intrusion of exotic species.	High disturb  y ed (ie. pecies eared ually all Ripanan Valley  Moderate di  cleared undisturb or min sides es undisturbed	n BOTH sides, but with riparian vegetation about the state of the riparian and valled by stock or through the intrusion of exotic species, although some native species remain  Valley vegetation – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present  Sturbance  Riparian vegetation – native vegetation on BOTH sides with canopy intact or with native species. The	on in good condition show y vegetation for each cate to y vegetation with the property of BOTH side canopy and to y very low disturbance with the property of the property	Very limited (<1% could be scored in the hiegory.  egetation – native vegetation processed in the hiegory.  egetation – native vegetation present is relatively minor.  etation – native vegetation present is relatively minor.  etation – native vegetation present is relatively minor.  etation – native vegetation present is of the river, with a virtually interpretation present is of the river and in an undisture is of the river and in an undisture.	gh disturb  oresent y good Any  sent on lact	pance
Choose one category only. Sites with valley category. Words within the drawings summare Extreme disturbance  Riparian vegetation – absent or severely reduced. Vegetation is extremely disturbed dominated by exotic species with native surface or completely absent)  Valley vegetation – agriculture and/or cleared some native but disturbed some native but disturbed of Some native but disturbed of Native species severely modified BOTH by grazing or the intrusion of exotic species Native species severely reduced in number 2.	High disturb  yed (ie. pecies eared ually all  Moderate di  cleared undisturb or min or min undisturbed	n BOTH sides, but with riparian vegetation about the state of the riparian and valled by stock or through the intrusion of exotic species, although some native species remain  Valley vegetation – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present  Sturbance  Riparian vegetation – native vegetation on BOTH sides with canopy intact or with native species. The	regeneration category  on in good condition should be reach category  vegetation for each category  Low disturbance  undisturb undisturb or minor on BOTHs condition with disturbance walley vegetation for each category  Riparian vegetation for each category  Valley vegetation for each category  Riparian vegetation for each category  Valley vegetation for each category  Riparian vegetation for each category	Very limited (<1% could be scored in the highest of the river and in relatively lith few exotic species present a present is relatively minor.  etation – native vegetation present is relatively minor.  etation – native vegetation present is relatively minor.	gh disturb  oresent y good Any  sent on lact	pance
Choose one category only. Sites with valley of category. Words within the drawings summal Extreme disturbance  Riparian vegetation – absent or severely reduced. Vegetation is extremely disturbed dominated by exotic species with native so rare or completely absent)  Valley vegetation – agriculture and/or cle land BOTH sides. Plants present are virtue exotic species (willows, pines etc.)  Very high disturbance  Riparian vegetation – some native vegetation – some native vegetation is severely modified BOTH by grazing or the intrusion of exotic species.	High disturb  cleared modisturb  cleared disturb  cleared disturb  cleared wally all  Ripanian Valley  Moderate di  cleared undisturb  or min  undisturb  or min  or min  or min  or min  or min  or minor  or	Riparian vegetation – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain  Valley vegetation – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present  Riparian vegetation – native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The	regeneration category  on in good condition shouly vegetation for each cate vegetation for each cate of the condition with the	very limited (<1% could be scored in the hiegory.  egetation – native vegetation produces of the river and in relative in the exercise present is relatively minor.  etation – native vegetation press of the river, with a virtually into the exercise present is relatively minor.  etation – native vegetation press of the river, with a virtually into the exercise series are absent or rare. Repressives are absent or rare.	gh disturb	pance

	rriers to local fish ategory for each flow	condition		more categories	Extent of % of stream	bars imbed forming a ba	r of any typ	pe _2_%
S	No passage		ligh ow	Bars absent Side/point bars VEGETATED	Boulder/co	sediment particle	size on ba [ ] Gra	ars vel [ ] mn
S	Very restricted passage			Side/point bars UNVEGETATED		No modifications	-	Reinforced
8	Moderately restricted passage			Mid-channel bars VEGETATED	The state of the s	Desnagged	~ >	Revegetated
\$	Partly restricted passage			Mid-channel bars UNVEGETATED  Bars around	7	Dams and diversions	00	Infilled
\$	Good passage			obstructions  Braided channel	77	Resectioned	00	Berms or embankment
5	Unrestricted passage			Infilled channel	7/4	Straightened	Signs of work still	Recently channelised
	ght of barrier(s) Received to the second to			High flow deposits	J.	Realigned	Works old and revegetated	Channelised in the past
innel sha	ape Choose one ca	ategory only						
			45	4~		7	4	
	U shaped	Flat U shap	ped Deepene	d U shape Wide	ned or infilled	Two s	tage	Multi s
1	- 47		4	4		<b>\</b>	4	
	Box	Wide	box	V shaped	Trapezoid	Concre	te V	Pipe or c

Bank shape Choose one category for each bank	Bank slope Choose one category for each bank	Sediment oils  absent light moderate profuse
Left Right	Left Right	
Concave	Vertical 80 - 90°	Water oils  none flecks globs sheen slick
Convex 🛛 🖂	Steep 60 - 80°	Sediment odours  normal/none sewage petroleum chemical
	Noderate	anaerobic other
Stepped	30 - 60°	Water odours
Wide lower bench	Low 10 - 30°	normal/none sewage petroleum chemical other
Undercut	Flat <10°	Turbidity (visual assessment)  Clear Slight Turbid Opaque
Factors affecting bank stability Choose one or more categories  None Cleared vegetation Mining Irrigation draw-down	Bedrock outcrops Assess % of each bank covered by bedrock outcrops % bedrock outcrops	Is water clarity reduced by:  Suspended material Dissolved material (e.g mud, clay, organics) (e.g plant leachates)  Water level at the time of sampling  Dry No flow Low Baseflow or near baseflow  High Flood (don't sample)
Stock Reservoir releases Human Seepage access Ford, culvert Flow and waves Feral animals Drainpipes Other  Sespring Plow and waves Drainpipes Description	None Fence structures Levee banks Rock or wall layer Rip rap Fenced human access Other Fenced stock watering points Vegetation plantings Logs strapped to bank Concrete channel lining	Artificial features at the sampling site Choose one or more categories  Major Minor Ford Bridge Culvert Other weir  Description  Large woody debris Overall % cover of logs and branches greater than 10cm in diameter

	orm features	on must asset 1000/	Macrophyte cover Assess % cover of the sampling site by each category.									
otal % compos		es must equal 100%	Overall % cover of macrophytes	% cover of emergent macrophytes								
Height >1m Gradient >60°	Waterfall _	% of site		% cover of floating macrophytes								
		Est. Av. Length (m) Est. Av. Height (m)										
		Est. Av. Gradient (°)		% cover of submerged macrophytes								
Step Height <1m	Cascade _	% of site	Macrophyte composition									
Gradient 5-60° Strong currents	-	Est. Av. Length (m) Est. Av. Height (m)	Use a macrophyte field guide (i.e. Sainty	and Jacobs, 1994) to aid identification.								
	-	Est. Av. Gradient (°)	Listed macrophytes can be changed to reflect the common taxa present in each State or Territory. N denotes a native taxa and I denotes an introduced taxa.									
Gradient 3-5°	Rapid											
Strong currents Rocks break	Kapiu –	% of site	Emergent macrophytes	% Submerged macrophytes %								
surface	-	Est. Av. Length (m) Est. Av. Depth (m)		over Present cover								
		Est. Av. Width (m)	Brachiaria (Para Grass) I	Ceratophyllum (Hornwort) N								
Gradient 1-3°	Riffle	% of site	Crassula (Crassula) N	Chara (Stonewart) N								
derate currents		Est. Av. Length (m)	Cyperus (Sedge) I/N	Elodea (Canadian Pondweed) I								
Surface unbroken but unsmooth	Est. Av. Depth (m)	Eleocharis (Spikerush) N	Myriophyllum (Water Milfoil) 1/N									
		Est. Av. Width (m)	Juncus (Rush) I/N	Nitella (Stonewart) N								
Gradient 1-3° Small currents	Glide _	% of site	Paspalum (Water Couch) N	Potamogeton (Pondweed) N								
urface unbroken and smooth	-	Est. Av. Length (m) Est. Av. Depth (m)	Phragmites (Common Reed) N	Triglochin (Water Ribbon) N								
and smooth		Est. Av. Width (m)	Ranunculus (Buttercup) I	Vallisneria (Ribbonweed) N								
Gradient 1-3°	Run	% of site	Scirpus (Clubrush) N	Other								
small but distinct uniform current	-	Est. Av. Length (m)	Triglochin (Water Ribbon) N	Other								
urface unbroken		Est. Av. Depth (m)	Typha (Cumbungi) N	Other								
		Est. Av. Width (m)	Other	Floating macrophytes %								
Area where stream widens or	Pool	% of site	Other	Present								
deepens and		Est. Av. Length (m)	Other	Azolla (Azolla) N								
current declines		Est. Av. Depth (m) Est. Av. Width (m)		Callitriche (Starwart) I								
	_			Other								
easonable sized 20% of channel	Backwater -	% of site		Other								
width) cut-off	(   -	Est. Av. Length (m) Est. Av. Depth (m)		Other								
ection away from		Est. Av. Width (m)	Overall % cover of native macrophyte	e taxa Total should equal overall % cover								

is measured in the office

#### Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes. overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1)

Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2)

Loose array of fine sediments. no overlapping, no packing and structure and can be dislodged very easily

#### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

32-60% fine sediment, low availability of interstitial spaces

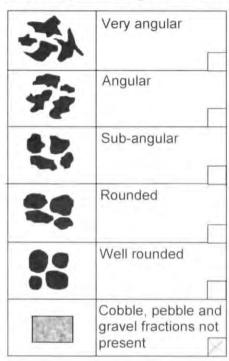


Matrix dominated

>60% fine sediment, interstitial spaces virtually absent

### Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

Stable ·

Unstable - depositing

### Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.

#### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

#### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material

### Moderate deposition

Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform Channel wide and shallow.

### Severe deposition

Extensive build up of fine sediments to form a flat bed. Channel blocked. but wide and shallow Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material

AUSRIVAS Physical a	nd Chemical	Assessment Proto	col Field	Data She	ets Page 8
Site No.	Date				

# HIGH GRADIENT STREAMS

Habitat parameter								C	ondi	tion	cate	gon	1								
parameter		E	xcelle	ent				Good	1				Fair					P	oor		
1. Epifaunal substrate / available cover	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover, mix of snags, submerged logs, undercut banks, coibble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).					40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).				20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 20% stable habitat lack of habitat is obvious, substrate unstable or lacking.						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
2. Embeddedness	Gravel, cobble and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.					50%	lder p	ounde	and s are 2 d by fi		Gravel, cobble and boulder particles are 50- 75% surrounded by fine sediment					Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Velocity / depth regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).				pres mis than	sent (i sing, s				Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime (usually slow-deep)						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	(
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition			ars and bar formation, mostly new gravel, sand or fine bottom from gravel, sand or fine sediment on old and					the	Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently, pools almost absent due to substantial sediment deposition.											
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed				avai	lable of	>759 channi channi is exp	el	е	avai	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.  Very little water in channel and mostly present as standing pools.					tly					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern					pres of b evid chai dred 20 y but chai	ent, undge : ence nnelizi Iging : r) ma recen nnelizi	abutm of pas ation, greate y be p	in are ents; t e er thar resent		Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.				ents s; iam	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted instream habitat greatly altered or removed entirely					
						pres	etil.														_

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# HIGH GRADIENT STREAMS

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Habitat								C	ondi	tion	cate	egor	У							
parameter		Ex	celle	ent			(	Good	1				Fair					Poo	r	
7. Frequency of riffles (or bends)	of dis riffles the si (gene of ha strea contii of bo	vely fi stance dividence tream erally bitati ms we nuous ulder natu	reque e betv ded by 5 to 7 5 to 7 is key here s, plais s or o ural of	ent, ra ween y widt 7). var in riffles cemei	h of riety are nt	betw by th	quent veen r ne wid	ce of rit, dista iffles d itth of the between	nce livided he		some betw by th	e hab veen i	al riffle ontour pitat d riffles dth of between	s provi distant divide the	ride d	sha hall bet by	allow bitat weer the v	ly all fla riffles, distance riffles vidth of is a rati	noor e divide the	d
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3 2	1	0
8. Bank stability (score each bank)	of ero abser poter	nt or ntial for ems	or ba minim or futi	videni ink fai nal, litt ure o of ba	lure tle	of er	osion 5-3 h has	y stab smal mostly 0% of areas	l areas y heale bank ii	d y	60% has high	of ba	ly uns ank in s of en ion po ods.	react osion		are free sec obv	duen ctions nous 100	e; many raw' are t along s and be bank s 6 of bar al scars	as straigh ends loughi nk has	ht.
SCORE	Left	bank		10	9	8		1/			5	1	4	T	3		2	1		0
SCORE	Righ	t bar	ık	10	9	8		17	6		5		4		3		2	1		0
9. Vegetative protection (score each bank)	strea and in zone vegel trees shrut macr disru grazii minin	mbar mme cove tation und os or ophy ption ng or nal or st all	diate red by inclusion red by inclusion restorates, vithrous most explants	woody egeta igh ing eviden s allov	y y trive	strey cove vege of pl repri evid full p to ar more the p	ered betation ants i esent but blant grant	nk surfly native to but of some the control as growth that extended the control and plant and pl	re cla vell- ruption affection potent ent; all of	g	strea cove disru patci close vege than poter	amba ered b uption hes c ely cr etation one- ntial (	of the nk suit by veg n obvious opped n com half of plant s mainin	etations: e soil of mon f the stubble	or less	stri cov dis veg veg ren cer	eamb vered ruptii getati getati nove ntime	an 50% bank suit by vegon of stroon is ve on has d to 5 d to 5 stubble	rtaces etation reamb iry hig been less in	n: oank h
SCORE	Left	bank		10	9	8		7			5		4		3		2	1		0
SCORE	Righ	t bar	ık	10	9	8		7	6		5		4		3	1	2	1		0
10. Riparian zone score (score each bank)	>18 r activi lawns	metre ties ( s, cro npact	s hu e ro ps et		ive	12-1 activ	8 me	npanar tres, h nave in in zone	uman npacte	d	12 m activ	netres rities iparia	npana s. hum have i an zon	nan mpac	ted	<6 npa pre	metr anan esent	f riparia es, little vegetat becaus activitie	or no ion is e of	)
SCORE	Left			10	9	8		7			5		4		3	3	2	1		0
SCORE	-	t bar		10	9	8	-	7			5	-	4	-	3		2	1	-	0

TOTAL HIGH GRADIENT HABITAT SCORE



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# LOW GRADIENT STREAMS

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Habitat									Cond	itior	cat	ego	y								
parameter		Ex	celle	ent			(	Good	1				Fair	r				Po	oor		
1. Epifaunal substrate / available cover	subi epifa and snaj undi or o and colo (i.e.	ater the strate aunal in fish cogs, su ercut the ther sta at sta inisation logs/s new fa- sient)	favou coloni over, bmen banks table to ge to on pot snags	rable sation mix of ged lo cobt habita allow ential that a	gs, ole t full	habi full of pote habi of po of ac the f not y	tat for opulation form o	ell-sur sation adequi main ions p ial sub if new epared on (ma	ate tenancoreser ostrate fall, but if for ay rate	ce ice in	habi avai desi freq	tat, h labilit rable	mix of abitat y less subs y distu	than		hai	bitat. vious	lack sub	0% st of ha ostrat ackin	bitat e	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	mate and root subi	ture of erials, firm s mats merge	with g and p and	gravel revale	ent.	mud be d	lomina	ay mu ant, so subm	id may ime ro erged	ot	bott	om; li	r clay ttle or ubme	no ro		be			root	mat	or
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	shall	n mix llow, la all-shal	arge-d	eep, mall-					s large shallov		mor		ools r valent						ools a		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	of is and botte	e or no lands less ti om aff iment	or poi han 2 ected	nt bar 0% of by	5	trom sedil botto	format grave ment	ion, mal, san 20-50 ected	or fi % of the slight	ne the	new botto sedi obst cons	grav ment bars om at ment ruction striction	depo el, sar on old ; 50-8 fected depo ons, ons ar depo valent	nd or of and 0% of 1, sits at the sition	the	ma der 80° chu poo	teria velop % of angin ols al	ment the to g fre most tantia	rease t. mo pottor quen abse al sed	ed bare the n tly ent d	an ue
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	both mini char	ler rea lower mal ar nnel si osed	r bank mount	s, and	900	avail	er fills lable of % of c strate	hanne	ef	е	avai and/	able or rift	s 25-7 chann le sub y expo	el. ostrate		cha	anne	and	most tandi	lly	
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	X	3	2	1	0
SCORE				or				sually	in are	as	exte	nsive	ation	ankm	ents	gat	noic	or ce	d wit	ove	
SCORE 6. Channel alteration	dred	nneliz Iging a mal; s nal pa	absen tream			char dred 20 y but r	r) may ecent neliza	of pas ation, greate be p	e er than resent		pres and reac	ent o	n both 80% annelia	of str	eam	dis hal	rupte outat	ized ed li	nstrea ly alte	am	

AUSRIVAS	Physical and	d Chemical	Assessment	Protocol	Field	Data	Sheets	Page	11
Site No.	06.5	Date	22 8 18	Para				-	

# LOW GRADIENT STREAMS

Page 2 of 2

Habitat					C	onditio	n cate	gory						
parameter	Exce	ellent			Good	1		Fair				Poo	r	
7. Channel sinuosity	The bends in increase the length 3 to 4 longer than i straight line channel brai considered in coastal plain low-lying are parameter is rated in thes	times it was (Note- ding is normal is and of as. The not ear	in a n other is sily	increase length 2	the stre to 3 hm	es	increa 2 time	ends in th ise the str is longer t i a straigh	eam han if	1 to	waterw	el straigh ay has b elized for e	een	ĺ
SCORE	20 19 1	8 17	16	15 14	1 13	12 11	10	9 8	7	6	5 4	3 2	1	0
8. Bank stability (score each bank)	Banks stable of erosion or absent or mi potential for problems < affected	bank fi nimal, I future	ailure ittle	of erosic over 5	tely stab ant, small on mostli -30% of as areas	l areas y healed bank in	60% i has a high a	rately uns of bank in reas of en rosion po rosions	reach		frequer section obvious 60-100	le many raw are at along s and be s bank s % of bar al scars	as straigh ends oughir ik has	nd:
SCORE	Left bank	10	9	8	7	6	5	4		3	2	1		0
SCORE	Right bank	10	9	8	7	6	5	4		3	2	1		0
9. Vegetative protection (score each bank)	More than 90 streambank and immedia zone covere vegetation. It trees, under shrubs, or macrophytes disruption th grazing or minimal or n almost all pla to grow nature.	surface the ripar d by na ncluding storey on wood s veget rough owing ot evide ants allo	es nan tive d dy ative	vegetati of plants represe evident full plan to any g more th	pank sur by native on but of s is not we nted, dis- but not a l growth great exter an one he ential plat height	re one class vell- ruption affecting potential ent; all of	stream coven disrup patch closel veget: than o poten	% of the nbank sured by vegotion obvious of bare y cropped ation coming plant is remaining.	soil o	or less	covered disrupti vegetati vegetati remove centime	lan 50% bank suid by veg on of stribon is ve ion has kd to 5 etres or a stubble	faces étation eamb ry high been ess in	ank
SCORE	Left bank	10	9	8	7	6	5	4		3	2	-1		0
SCORE	Right bank	10	9	8	7	6	5	4		3	2	1		0
10. Riparian zone score (score each bank)	Width of ripa >18 metres activities (i e lawns, crops not impacted zone	human roads etc.) fi	ave	12-18 m activities	nan zone	uman npacted	12 me activit	of riparia stres hum les have li parian zon	nan mpac	ted	<6 met ripariar present	of riparia res little i vegetal i becaus activitie	or no ion is e of	
SCORE	Left bank	10	9	8	7	6	>5	4		3	2	1		0
SCORE	Right bank	10	9	8	7	6	- 5	4		3	2	1	-	0

TOTAL LOW GRADIENT HABITAT SCORE

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Site No. 007 Date 22.8 18

# Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

Bank height (m)	The channel sketch should show in cross	s-section the shape of the channel and include the location of ill points. Also show other features such as bars, rocky	Type of Riffle	Bankfull channel width (m)  (=total of boxes A+B+C)  am width at the water mark (m)  width at the water surface (m)
Bank width (m)  Vertical distance between the water surface and the water mark (m)  Riparian zone width	Horizontal dis	depths (cm)  Notes on cross-section measure		Vertical distance between the water mark (m)
Left bank (m) R  Bank material Assess  Bedrock  Boulder (>256mm)  Cobble (64-256mm)  Pebble (16-64mm)  Gravel (2-16mm)  Sand (0.06-2mm)  Fines (silt and clay, <0.06mm)	% composition for each bank  Left bank Right bank	Jana (0.00-2000)	ner side of	Assess in the area 5m either side of the cross section    <10%

Detailed instructions on the me Two cross-sections are required at hom	asurement of chann ogeneous sampling sites opling is at or near the water	e measured in the area around a cel cross-sections are provided in the pro- igenerally lowland streams) and three cross-sections or mark level, stream width at the water surface will be	ocol manua at heterogeneo	al. Be familiar with these before propus sampling sites (generally upland streams)	).
Cros	s-section sketch		Type of	s-section number bedform at the cross-section Run Pool Cascade Bankfull channel width (m)	Other
the water		section the shape of the channel and include the location of points. Also show other features such as bars, rocky oss section.		(=total of boxes A+B+C) am width at the water mark (m width at the water surface (m	Bank height (h
Vertical distance between the water surface and the water mark (m)  Riparian zone width	Vertical water	depths (cm)  Notes on cross-section measurer	nent		Vertical distance between the water mark (m)
Left bank (m) Right bank material Assess % compositions of the composition of the c	77	Substrate composition Assess % composition in the area of bed 5m either the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	side of	Filamentous algae cover    <10%	6-65% 65-90% >90% 6-65% 65-90% >90%

Detailed instructions on the measurement of cha wo cross-sections are required at homogeneous sampling sit	tes (generally lowland streams) and three cross-sections at I	ol manua	I. Be familiar with these before proceeding.	
	ross-section the shape of the channel and include the location of	Type of Riffle	bedform at the cross-section  Bankfull channel width (m)  (=total of boxes A+B+C)  am width at the water mark (m)  Width at the water surface (m)	
/ertical distance tween the water	Notes on cross-section measurement	l	betw surfa	Bar c wide ical dist veen the ace and er mark
Bank material Assess % composition for each bank Left bank Right bank edrock coulder (>256mm) cobble (64-256mm) cebble (16-64mm) cand (0.06-2mm) cobs (silt and clay, <0.06mm)	Substrate composition Assess % composition in the area of bed 5m either side the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	Total 100%	Assess in the area 5m er the cross section  <10%	

AUSRIVAS Physical Assessment Protocol Field Data Sheets Page 1	Site No. 009 Date 138 18
Date 23.8-18 Site No. 009 Time #635	Recorder's Name SARAH CLANIZI
River Name WHALLAN CREEK Location CROWN	haw o
	umbers and details
GPS Name and Datum	
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  Left bank is facing downstream.	LENGTH OF SAMPLING SITE  Bankfull width  x 10  Length of sampling site  (m)
	Notes
3. Sur	ACCESS BLOCKED.
Printe Point N	BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White. 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998)

Valley shape

Units

mg I<sup>-1</sup>

°C

%

Choose one category only

BASIC WATER CHEMISTRY

Temperature

Conductivity

pH

Turbidity

Dissolved Oxygen

Total phosphorus

Total nitrogen

Dissolved Oxygen Sat.

ory only	Local impacts on streams  Choose one or more categories and describe the detail of each
Steep valley	Sand or gravel mining Sewage effluent
Shallow valley	Other mining Channel straightening  Road River improvement works  Bridge / culvert / wharf Water extraction
Broad valley	Ford / ramp Dredging  Discharge pipe Grazing
Gorge	Forestry activities  Recreation
Symmetrical floodplain	Sugar mill  Irrigation run-off or pipe outlet  Other
Asymmetrical floodplain	Description Chown LAND + CREEK HATE
(m)	Local landuse Choose one category for each bank  Left Right  Native forest  Native grassland (not grazed)
patches formed stream meander	Grazing (native or non-native pasture)  Exotic grassland (lawns etc., no grazing)

Forestry Native [ ][ ] Pine [ ][ ]

Industrial or intensive agricultural

Urban residential

Commercial

Recreation

Other

Cropped Rainfed [>][ ] Irrigated [ ][ ]

ALKALINITY  Amount of water  Amount of H <sub>2</sub> SO <sub>4</sub> Alkalinity	ml ml mg   mg   ml mg   mg   mg   mg   m
Floodplain width	Average (m)
Choose one or more features when present  Sampling site has no distinct floodplain Oxbows / billabongs Body of water occupying a former river meander, isolated by a shift in the stream channel  Remnant channels Formed during a previous hydrological regime. May be infilled with sediment  Flood channels A channel that distributes water onto the floodplain and off the floodplain during floods	Scroll systems Short, crescentic strips or patches formed along the inner bank of a stream meander  Splays Small alluvial fan formed where an overloaded stream breaks through a levee and deposits material on the floodplain  Floodplain scours Scour holes formed by the concentrated clearing and digging action of flowing water  No floodplain features present Floodplain present at the sampling site but does not contain any of the above features

Site No. 009 Date 23 8 18

Riparian zone composition Assess for whole sampling site	% Cover		Vegeta	ation Description	Choose one cate	gory for	of riparian vegetat each bank. Do not ept where site is in	Left bank	Right
Trees (>10m in height)	20	ore	EUC. THE.	+ ACALIA SALISE	None		~~		
Trees (<10m in height)	5	tal more	b "	. 16.	Isolated / sca	ttered	~ ~		
Shrubs	30	5 5	NEWO ACA	CIA (MIMOGA)	Regularly spa	aced	×**	16	
Grasses / ferns / sedges	25	May	NATIUE		Occasional c	umps	gri or or	X	
Shading of channel					Semi-continu	ous	States to see the		X
Extent of trailing bank vegetal mode		% Native	exotic ripari	an vegetation			tive woody vegetatin undisturbed fores		
slight exten		% Exotic	50	J 10tal 100%	If no, record regeneration category		Abundant (>5% cove Present Very limited (<1% co		healthy
Choose one category only. Sites category. Words within the drawin	with valley veget	ation cleared ne detailed te	on BOTH side	es, but with riparian veget ate of the riparian and va	ation in good condition lley vegetation for ea	on shou ch cate	ld be scored in the hig gory.	h distur	bance
Extreme disturbance		High distu	rbance		Low disturbance				
cleared cleared Riparian vegetation – a reduced Vegetation is e		mimmi mm		getation – moderately disturbed by ugh the intrusion of exotic species.			egetation - native vegetation produces of the river and in relatively		



dominated by exotic species with native species rare or completely absent)

Valley vegetation - agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

# Very high disturbance X



Riparian vegetation - some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species Native species severely reduced in number and

Valley vegetation - agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)



although some native species remain

Valley vegetation - agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

## Moderate disturbance



Riparian vegetation - native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

Valley vegetation - agriculture and/or cleared land on ONE side native vegetation on the other in reasonably undisturbed state



condition with few exotic species present. Any disturbance present is relatively minor.

Valley vegetation - native vegetation present on BOTH sides of the river with a virtually intact canopy and few exotic species

## Very low disturbance



Riparian vegetation - native vegetation present on BOTH sides of the river and in an undisturbed state Exotic species are absent or rare. Representative of natural vegetation in excellent condition

Valley vegetation - native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

	riers to local fish		Type of bars Choose one or more ca	ategories	Extent of			
		Base Low High flow flow flow		absent	Dominant	mbed forming a basediment particle bble [ ] Pebble	e size on ba	ars
59	No passage			/point bars ETATED	Sand	Silt/cla	y [ ] or	mn
S	Very restricted passage		Side/	/point bars EGETATED		No modifications		Reinforced
8	Moderately restricted passage		VEG	channel bars ETATED	The state of the s	Desnagged		Revegetated
S	Partly restricted passage		UNVE Bars	channel bars EGETATED around		Dams and diversions	10 O	Infilled
\$	Good passage			ded channel	77	Resectioned	20	Berms or embankments
5	Unrestricted passage		Infille	ed channel	1	Straightened	Signs of work still	Recently channelised
e and heig	ht of barrier(s)F	oko.	High	flow deposits	J.	Realigned	Works old and revegetated	Channelised in the past
annel sha	pe Choose one ca	tegory only						
				4~		7 /	X	\
7 7 11	U shaped	Flat U shape	d Deepened U sha	ape Widen	ed or infilled	Two	stage	Multi st
	- 47					~		
	Box	Wide bo	x V shap	ped	Trapezoid	Concre	ete V	Pipe or cu

Bank shape	Bank slope	Sediment oils
Choose one category for each bank  Left Right bank bank	Choose one category for each bank  Left Right bank bank	
Concave	Vertical 80 - 90°	water oils
Convex	Steep 60 - 80°	Sediment odours  normal/none sewage petroleum chemical
Stepped	Moderate 30 - 60°	water odours other
Wide lower bench	Low 10 - 30°	normal/none sewage petroleum chemical other
Undercut	Flat <10°	Turbidity (visual assessment)  Clear Slight Turbid Opaque
Factors affecting bank stability Choose one or more categories	Bedrock outcrops Assess % of each bank covered by bedrock outcrops % bedrock outcrops Left bank	Is water clarity reduced by:  Suspended material (e.g mud, clay, organics)  Dissolved material (e.g plant leachates)
None       ✓ Cleared vegetation         Mining       Irrigation draw-down	Right Bank  Artificial bank protection measures Choose one or more categories	Water level at the time of sampling    Dry
X Stock Reservoir releases Human access Seepage	None Fenced stock watering points  Vegetation	Artificial features at the sampling site Choose one or more categories  Major Minor Ford Bridge Culvert Other
Ford, culvert Flow and waves  Feral animals Drainpipes	Levee banks plantings  Rock or wall layer Logs strapped to bank	weir  Description  TOTAL BY  TRANSPORT  TRAN
Other  Description	Fenced human Concrete channel lining Other	Large woody debris Overall % cover of logs and branches greater than 10cm in diameter

Height >1m Gradient >60°  Step Height <1m Gradient 5-60° Strong currents  Gradient 3-5° Strong currents  Rocks break surface  Gradient 1-3° Moderate currents  Surface unbroken  Waterfall  Step Height <1m (Est. Av. Length (m) (Est. Av. Length (m) (Est. Av. Height (m) (Est. Av. Height (m) (Est. Av. Gradient (°))  Waterfall  St. Av. Length (m) (Est. Av. Height (m) (Est. Av. Gradient (°))  Waterfall  St. Av. Length (m) (Est. Av. Length (m) (Est. Av. Depth (m) (Est. Av. Width (m))  Waterfall  St. Av. Length (m) (Est. Av. Length (m) (Est. Av. Depth (m) (Est. Av. Dep	cover of macrophytes
Height >1m Gradient >60°  Step Height <1m Gradient 5-60° Strong currents  Gradient 3-5° Strong currents  Rocks break surface  Gradient 1-3° Gradient 1-3° Moderate currents  Waterfall  Step Height <1m Est. Av. Length (m) Est. Av. Length (m) Est. Av. Height (m) Est. Av. Gradient (°)  Wacrophy Use a mac Listed mac N denotes  Emergent  Strong currents  Rapid  Wacrophy Use a mac Listed mac N denotes  Est. Av. Gradient (°)  Wacrophy Use a mac Listed mac N denotes  Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Depth (m) Est. Av. Width (m)  Brachiaria (Crassula (Corporus (Set. Av. Width (m))  Crassula (Corporus (Set. Av. Corporus (Set. Av. Width (m))  Crassula (Corporus (Set. Av. Corporus (Set.	% cover of floating macrophytes 5 % cover of submerged macrophytes 5 yte composition
Step Height <1m	% cover of submerged macrophytes
Step Height <1m Gradient 5-60° Strong currents  Gradient 3-5° Strong currents  Gradient 3-5° Strong currents  Rocks break surface  Gradient 1-3° Gradient 1-3° Gradient 1-3° Gradient 1-3° Riffle  Est. Av. Gradient (°)  Water the strong currents  Est. Av. Height (m) Est. Av. Gradient (°)  Water the strong currents  Est. Av. Length (m) Est. Av. Length (m) Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Depth (m) Est. Av. Width (m)  Brachiaria (Crassula (Constitution)  Crassula (Constitution)  Crassula (Constitution)  Crassula (Constitution)  Crassula (Constitution)  Crassula (Constitution)  Crassula (Constitution)	yte composition
Gradient 5-60° Strong currents  Gradient 3-5° Strong currents  Gradient 3-5° Strong currents  Rocks break surface  Gradient 1-3° Gradient 1-3° Gradient 1-3° Riffle  Est. Av. Length (m) Est. Av. Gradient (°)  Water Oph.  Use a made Listed made N denotes  Emergent  Est. Av. Length (m) Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Depth (m) Est. Av. Width (m)  Brachiaria (Crassula (Concrete currents)  Gradient 1-3° Riffle  Water Oph.  Water Oph.  Use a made Listed made N denotes  Capacitation  Riffle  Water Oph.  Use a made Listed made N denotes  Emergent  Crassula (Concrete currents)	
Strong currents  Strong currents  Gradient 3-5° Strong currents Rocks break surface  Gradient 1-3° Gradient 3-5° Strong currents Rocks break surface  Rapid  Est. Av. Length (m) Est. Av. Gradient (°)  We of site Emergent Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Depth (m) Est. Av. Width (m)  Brachiaria (Crassula (Constitution))  Crassula (Constitution)  Gradient 1-3° Riffle  We of site  Cyperus (Set. Av. Deptus (Set. Av. D	
Gradient 3-5° Strong currents Rocks break surface  Gradient 1-3° Gradient (°) Grad	
Strong currents Rocks break surface  Strong currents Rocks break surface  Strong currents Rocks break surface  Strong currents Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Width (m)  Strong currents Fig. 2  Strong currents Strong curre	crophytes can be changed to reflect the common taxa present in each State or Territor a native taxa and I denotes an introduced taxa.
Surface Est. Av. Depth (m) Est. Av. Width (m)  Gradient 1-3° Riffle % of site  Cyperus (Section 1)	macrophytes % Submerged macrophytes %
Gradient 1-3° Riffle % of site Cyperus (Si	Present cover
Gradient 1-3° Riffle % of site Cyperus (Si	Para Grass) I Ceratophyllum (Hornwort) N
Cyperus (Si	Crassula) N Chara (Stonewart) N
Surface unbroken Est. Av. Lengtn (m)  Est. Av. Denth (m)  Eleocharis (	edge) I/N Elodea (Canadian Pondweed) I
but unemooth Lot, AV. DCDIII (III)	(Spikerush) N Myriophyllum (Water Milfoil) I/N
but unsmooth Est. Av. Depth (m)  Listantia (m)  Listantia (m)  Juncus (Ru	sh) I/N Nitella (Stonewart) N
Gradient 1-3° Glide % of site Paspalum (	Water Couch) N Potamogeton (Pondweed) N
Small currents Surface unbroken  Est. Av. Length (m) Phragmites	(Common Reed) N Triglochin (Water Ribbon) N
and smooth Est. Av. Depth (m)	s (Buttercup) 1 Vallisneria (Ribbonweed) N
Est. Av. Width (m) Scirpus (Clu	ubrush) N Other
Gradient 1-3° Small but distinct Run / 00 % of site Triglochin (\)	Water Ribbon) N Other
8 uniform current Surface unbroken Surface unbroken	nbungi) N Other
Est. Av. Width (m) Other	Floating macrophytes
Other	Present
stream widens orOther	Azolla (Azolla) N
deepens and current declines Est. Av. Length (m)	Callitriche (Starwart) 1
Est. Av. Width (m)	Other
reasonable sized Backwater % of site	Other
>20% of channel Section Est. Av. Length (m)	(36.51.161
width) cut-off Est. Av. Depth (m) Est. Av. Width (m) Overall %	Other

Note: An additional response variable planform channel pattern is measured in the office

Overall % cover of native macrophyte taxa Total should equal overall % cover of macrophytes from above Overall % cover of native macrophyte taxa

## Bed compaction

Choose one category only



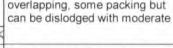
Tightly packed, armoured Array of sediment sizes, overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but





Low compaction (1) Limited range of sediment sizes, little overlapping, some packing and structure but can



Low compaction (2)

be dislodged very easily

Loose array of fine sediments. no overlapping, no packing and structure and can be dislodged very easily

#### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high

availability of interstitial spaces



Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

32-60% fine sediment, low availability of interstitial spaces

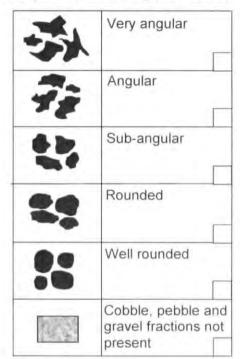


Matrix dominated

>60% fine sediment, interstitial spaces virtually absent

## Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

Stable •

Unstable - depositing

### Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.

#### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

#### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled) Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material

## Moderate deposition

Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow

## Severe deposition

Extensive build up of fine sediments to form a flat bed Channel blocked but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material



AUSRIVAS PI	nysical and Chemical	Assessment Prote	ocol Field Data Sh	eets Page 8
Site No	Date			

# HIGH GRADIENT STREAMS

Page 1 of 2

Habitat								C	ondi	tion	cate	gon	/									
parameter		E	xcelle	ent				Good	i				Fair			П		P	oor			
1. Epifaunal substrate / available cover	substant stable to all pole that	ater the strate is aunal cover; merger cs, cot le hab low ful are no ransie	avours colonis mix or d logs, oble or itat an I color e log of new	able for ation a f snag under other d at st hisation s/snag	and s, rcut age	habi full of pote habi of p of a the not colo	itat: w coloni ential itat fo opular ddition form ( yet pr nisati	ell-sui sation adequ main tions nal sui of new epare	tenand preser ostrate fall, but d for ay rate	ce ice in	20-40% mix of stable habitat, habitat availability less than destrable, substrate frequently disturbed or removed						Less than 20% stable habitat tack of habitat is obvious, substrate unstable or lacking					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	(	
2. Embeddedness	25% sedi	vel, co der pa surro ment. ole pro che sp	rticles unded Layer vides	by fin	e	50%	der p		and s are 2 d by fi		75%	lder p	obble article ounde	s are		m	oulder ore th arroun	part an 7 ided	cles	are		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1	
3. Velocity / depth regime	regir deep deep	our vel mes pro slow (ast- ) 3m/s	esent shallo	(slow- ow fas w) Si	il-	pres miss than	ent (i				regi	mes p	the 4 preser r slow ng. sc	t (if fa	st-	Ve	omina docity sually	/dept	h reg			
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
4. Sediment deposition	less affec	e or no ids or than 5 cted by osition	point t	ars ar	nd -	from sedi bott	forma grav ment, om af	tion n el sar 5-30	ease in nostly nd or fi % of th slight ols	ne. ie	new sedi new bott sedi obst	grave ment bars om af ment truction striction denate	ons ar	of or find or	the ids.	m. de 50 ch po to	eavy of ateria evelop )% of langing look all subsepositi	the to most tantia	rease t mo otton quen abse	ed bare the months of the mont	ar nam due	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	valent 8	7	6	5	4	3	2	1		
5. Channel flow status	both	er read lower mal an mel su ised	banks	and of		avail <25	lable i	>759 chann channe is exp	el	e	avai	lable for riff	thann te sub	el strate		ch pr	ery litt lanne esent lols	and	most	tly		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1	
6. Channel alteration	dred	Channelization or redging absent or inimal, stream with ormal pattern			Some channelization present, usually in areas of bridge abutments evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent						Channelization may be extensive embankments or shoring structures present on both banks and 40 to 80% of stream reach channelized and disrupted						Banks shored with gabion or cament over 80% of the stream reach channelized and disrupted (instream habitat greatly altered or removed entirely					
						char		ation is	s not													

<b>AUSRIVAS</b>	Physical and Chemical Assessment Protocol Field Data She	ets Page 9
Site No.	Date	

# HIGH GRADIENT STREAMS

Page 2 of 2

Habitat								(	Cond	ition	cate	egor	У										
parameter		Exc	elle	ent			-	Good	1				Fair					Pod	r				
7. Frequency of riffles (or bends)	Occurr relative of dista riffles of the stri (gener- of habi stream continu- of boul large, it	ely fre ance divide eam ally 5 itat is ns wh uous, iders natura	eque between between to 7 to 7 key ere place or o	nt, ra veen vidt (); var in riffles cement ther	n of nety are nt	betw by th	quent veen r ne wic	ce of r dista iffles of the of the	nce fivided the		som betw by th	e hab veen r	ontour oitat c riffles ofth of	e or b s pro- distance divide the een 15	vide ce ed	Generally all flat water or shallow riffles, poor habitat, distance between riffles divided by the width of the afream is a ratio of >25							
SCORE	20 1	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2 1	0			
8. Bank stability (score each bank)	Banks stable, evidence of erosion or bank failure absent or minimal, little potential for future problems <5% of bank affected					of er over reac	Moderately stable, infrequent, small areas of erosion mostly healed over 5-30% of bank in reach has areas of erosion						Moderately unstable, 30- 60% of bank in reach has areas of erosion high erosion potential during floods					Unstable, many eroded areas, 'raw' areas frequent along straight sections and bends obvious bank stoughing 60-100% of bank has erosional scars					
SCORE	Left ba	ank		10	9	8		1		6	5		4		3	-	2	1		0			
SCORE	Right	bank		10	9	8	1	7		6	5		4		3		2	1	T	0			
9. Vegetative protection (score each bank)	More that stream and im and im arone of vegeta trees where the street of	covere covere tition under s, or r phyte tion to g or n al or r	sur ade i ad by inclu rstor non, i s vi nou now not e	faces inparia y national wood egeta gh ing evident allow	y ttive	stress covered of pl representations full p to ar more the p	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble neight					ered buption hes o ely or etation one- ntial p	nk su by veg obvious opped opped opped half o	e soil of mon f the stubbl	or less	dis ver ver rer cer	eamb vered ruptki getati getati nove ntime	an 50% pank suby version of so on is version has d to 5 dres or stubb	rface getation tream ery his been less	s on bank gh			
SCORE	Left b	ank		10	9	8		7		6	5		4		3		2	1		0			
SCORE	Right	bank		10	9	8	1	7		6	5		4		3	1	2	1		0			
10. Riparian zone score (score each bank)	Width >18 m activitie lawns not imp zone	etres es (i e crop	hui e ro	man ads, c) ha	ve	12-1 activ	8 me	ripanar tres, h nave in an zoni	uman npact		12 n	netres nties i	hun have	an zon nan mpac ne a gi	ted	Width of riparian zone <6 metres, little or no riparian vegetation is present because of human activities							
SCORE	Left b	ank		10	9	8		7	1	6	5		4		3	- 2	2	1		0			
SCORE	Dinks	Right bank 10 9									5 4 3					2 1 0							

TOTAL HIGH GRADIENT HABITAT SCORE

# LOW GRADIENT STREAMS

Page 1 of 2

Habitat								(	Conc	lition	cat	ego	ry								
parameter		E	celle	ent			-	Good	d				Fair					P	oor		
1. Epifaunal substrate / available cover	epifa and snag undo or or and colo (i.e.	strate aunal fish c gs, su ercut ther s at sta logs/s	colonicover; bmery banks table to age to on pot snags all and	rable sation mix of ged lo cobb habita allow ential that a	gs, ole t full	pote habi of pi of a the not	tat w colonis ential, itat for opulat ddition form o yet pro	ell-sui sation adequ main ions nal sui of new eparei on (ma	tenani preser ostrate fall bi d for ay rate	ce nce e in ut	habi avai desi freq	itat; h labilit rable	mix of abitat y less subs y distu	than trate		ha ob	bitat vious	lack sub	0% si of ha ostrat lackin	abital e	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	86	7	6	5	4	3	2	1	0
2. Pool substrate characterization	and root subi	firm s mats	and p	trate gravel revale etatio	ent.	muc be o	lomina	ay mi ant so subm	id ma ome ro erged	lot.	botte mat.	om li	r clay title or subme	no ro		be			ay or root	mat	or
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	9<	5	4	3	2	1	0
3. Pool variability	shal	low la	of large-d ligw, s s pres	leep, small-					s large shallo		mon		oools r valent Is						ools a		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	X
4. Sediment deposition	of is	ittle or no enlargement f islands or point bars nd less than 20% of the ottom affected by ediment deposition			bar from sedi bott	forma i grav ment.	tion, n el, sar 20-50 fected	ease in nostly nd or f 0% of sligh ols	ine the	new sedi new batte sedi obst cons	grav ment bars om af ment truction striction	deported sar on old sar on one ar deported sar old sar	d and 0% of l, sits at ad ber	the	de 80 ch po to	velop % of angir ols a	the to impose impose tantia	sits or rease t mo pottor equen t absi al sec	ed bare the nation of the nati	an ue	
SCORE	20	19	18	17	16	15	14	13	12	X	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	mini char	lowe mal a				avai <25	er fills lable of % of o	hann	el	е	avai	lable for rift	s 25-7 chann fle sub y expo	el, strate		ch	anne	and	ater ir mas tandi	tly	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	d
6. Channel alteration	dred	innelization or tging absent or imal, stream with mai pattern				Some channelization present, usually in areas of bridge abulments evidence of past channelization, i e dredging (greater than 20 yr) may be present but recent					Channelization may be extensive embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted						Banks shored with gabion or cament over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.				
						but	neliz				aron	inproce				100	11040	NA (511)	in say		

AUSRIVA	S Physical	and Chemical Date	Assessment	Protocol	Field Data	Sheets	Page 1	11
Site No.	00 9	Date	23.8 18	4				

# LOW GRADIENT STREAMS

Page 2 of 2

Habitat						Cond	itio	cate	gory											
parameter	Ex	celler	nt	T	God	bd				Fair					Poor					
7. Channel sinuosity	The bends increase the length 3 to longer than straight linchannel broconsidered coastal plates of the low-lying a parameter rated in the	4 time 4 time if it w (Not aiding normains and reas is not	am es as in a e - is al in d other This easily	increa length	ends in the second seco	tream imes		The bincrea 2 time was in	se th	e str ger t	eam han if	1 to	Channel straight, waterway has been channelized for a long distance							
SCORE	20 19	18	17 16	15	14 13	12	11	10	9	8	7	6	Ϋ́	4 3	3 2	1	0			
8. Bank stability (score each bank)	Banks state of erosion absent or repotential for problems affected	or bani minima r futur	k failure I, little e	of eros	ately sta ent sm sion mos 5-30% i has are	all area stly hea of bank	Mode 60% i has a high e during	of bar reas	nk in of ero n pot	reach		Unstable, many eroded areas: 'raw areas frequent along straight sections and bends obvious bank sloughing, 60-100% of bank has erosional scars.								
SCORE	Left bank	1	0 9	×	7		6	5		4		3	2		1	1	0			
SCORE	Right ban	k 1	0 ><	8	7		6	5		4		3	2		1	-	0			
9. Vegetative protection (score each bank)	More than streamban and immed zone cover vegetation trees, und shrubs, or macrophyt disruption grazing or minimal or almost all to grow na	k surfa liate rip led by includerstore non wies. veg through mowin not ev- blants:	aces parian native ling y poody getative n g	stream covered vegeta of plar represe eviden full plat to any more to the po	% of the ibank side by na ition, but its is no ented of the but no interest of the but no interest ented in the but no its is no enterest	urfaces five t one cli t well- fisruptic t affecti th poter xtent a half of lant	in ng	50-70 stream cover disrup patch closel veget. than o poten height	mbani ed by otion des of y crop ation one-h	k sur vege bare pped comi alt of ant s	etation lus soil of mon the	n or less	stres cove disru vege vege remo	red by iption tation tation oved to metre	50% on k surfar y veget of stre is very has be of sorte ubble	aces ation amba high een	arik.			
SCORE	Left bank	1	0 9	8	7		6	5		4	1	3	2		1	1	0			
SCORE	Right ban	k 1	0 9	8	7		6	5		4	>	X.	2		1		0			
10. Riparian zone score (score each bank)	Width of n >18 metre: activities (i lawns, croj not impact zone	e road	an ds. ) have	12-18 activiti the rip	of ripan metres es have anan zo ally	human		Width 12 me activit the rip deal	etres. les h	hum ave in	nan mpac	ted	<6 metres little or riparian vegetation			n no n is				
SCORE	Left bank	1	0 9	8	7		6	5		4	1	2	2		1	-	0			
SCORE	Right ban	k 1	0 9	8	7		6	5		4	-	~	2		1		0			

TOTAL LOW GRADIENT HABITAT SCORE



Site No. 009

Date 23 8.18

#### Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

Cross-section	SANK FALL	Type of	ss-section number of f bedform at the cross-section  Run Pool Cascade Other
	show in cross-section the shape of the channel and include the location of rk and bankfull points. Also show other features such as bars, rocky itered at the cross section.		Bankfull channel width (m) (=total of boxes A+B+C)  am width at the water mark (m)  width at the water surface (m)
Vertical distance between the water surface and the water mark (m)  Riparian zone width	Prizontal distances (m)  Notes on cross-section measure  Prizontal distances (m)  Notes on cross-section measure  Prizontal distances (m)	ement Ouc	Vertical distance between the wat surface and the water mark (m)
Bank material Assess % composition for each Left bank Ri Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay. <0.06mm)	Substrate composition	Total 100%	Assess in the area 5m either side of the cross section    ✓ <10%

Channel cross-sections and variables to Detailed instructions on the measurement of char Two cross-sections are required at homogeneous sampling site Where the water level at the time of sampling is at or near the water surface and the water mark should be entered as 0.	nnel cross-sections are provided in the protoces (generally lowland streams) and three cross-sections at	ol manual heterogeneo	Be familiar with these before proceeding us sampling sites (generally upland streams).	between the
Cross-section sketc	h	Cros	s-section number	_ of
			bedform at the cross-section  Run Pool Cascade Other	
	oss-section the shape of the channel and include the location of full points. Also show other features such as bars, rocky e cross section		Bankfull channel width (m) (=total of boxes A+B+C)  m width at the water mark (m)  width at the water surface (m)	Bank height
Vertical distance etween the water	distances (m)			Vertical distant between the water mark (m
	Notes on cross-section measureme	nt		water mark (m
Riparian zone width	1			
Left bank (m) Right bank (m)  Bank material Assess % composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either sid the cross-section.	e of	Filamentous algae cover	the area 5m either side of the cross section >90%
Bedrock	Bedrock	_ )		300 00 10
Boulder (>256mm)	Boulder (>256mm)		Periphyton cover	
Cobble (64-256mm)	Cobble (64-256mm)	_ %	<10% 10–35% 35-65%	65-90% >90%
Pebble (16-64mm)	Pebble (16-64mm)	_ \ e	Moss cover	
Gravel (2-16mm)	Gravel (2-16mm)	Total 100		Ter 000/ []-000/
Sand (0.06-2mm)	Sand (0.06-2mm)		<10% 10–35% 35-65%	65-90% >90%
Fines (silt and clay. <0 06mm)  Total 100% each	Fines (silt and clay <0.06mm)	_ )	Detritus cover <10% 10-35% 35-65%	65-90% >90%

<10% 10-35% 35-65% 65-90% >90%

Detailed instructions on the measur Two cross-sections are required at homogeneous	ariables to be measured in the area a ement of channel cross-sections are provide ous sampling sites (generally lowland streams) and three is at or near the water mark level, stream width at the water intered as 0.	d in the protocol manual cross-sections at heterogene	al. Be familiar with these before proceedir	
Cross-se	ection sketch	Type o	f bedform at the cross-section e Run Pool Cascade Ot  Bankfull channel width (m) (=total of boxes A+B+C)  am width at the water mark (m)	herBank height (
the water surface	tch should show in cross-section the shape of the channel and include the event was an experience of the channel and include the event was a specific and the cross section.  Horizontal distances (m)  Vertical water depths (cm)  Notes on cross-section	Stream	n width at the water surface (m)	Vertical distance between the wat surface and the water mark (m)
Riparian zone width  Left bank (m) Right bank		measurement		
Bank material Assess % composition Left to Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0 06-2mm) Fines (silt and clay, <0 06mm)	Cubatrata hamanatika	f bed 5m either side of	Filamentous algae cover <pre> &lt;10%</pre>	65-90% >90%   >90%

Date	No. OII	me 0900	Recorder's Name SARAM	
ever Name MACHITERE RIVER		PUBLIC ACCESS		
Veather CLARK SUNNY	Rain in last week? Y [ ] N [	Photograph numb	pers and details	
deg min sec	deg min sec	The state of the s	,3+4 curas, 5-6 D	li .
atitude: 28 40 60 Lo	ingitude: 1 5 0 3 0 3 1			
PS Name and Datum				
LANFORM OVETOU OF CITE				
	access points, landmarks and natural or artificial cha-	innel or floodplain features.	LENGTH OF SAMPLING SIT	E
eft bank is facing downstream.		26	Bankfull width	(m)
				x 10
	PENNIC.		Length of sampling site	(m)
CAN K	0 000	Alberton KS	Notes	
7		Algeria	SITE IS WESTMANN - OF	SENT MARKET
	-		DUMAR PLAN KINEL +	
		7100		
	OF PRICE IT		- DAY I Pho	
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		7.64	· b · fair To one con	
	720			
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	60 m		- PUR SHOSCIPIE SAP	2.011 (T)

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

HAVE BEEN RECORDED

Diff.	No. 01 Time 09	Recorder's Name SARAM GEABLERT
River Name MACHITALE LIVER	Location Public	A CLESS
Weather CLARK SUNNY	Rain in last week? Y [ ] N [ ] PI	hotograph numbers and details
deg min sec	deg min sec	11) 1+2us, 3+4 currer, 5-6 0/5
	ngitude: 1 5 0 3 0 3 1	
GPS Name and Datum	-	
PLANFORM SKETCH OF SITE		LENGTH OF SAMPLING SITE
Including bedform types, location of cross-sections, a Left bank is facing downstream.	access points, landmarks and natural or artificial channel or floodpla	ain features.  Bankfull width (m)
		x 10
		Length of sampling site (m)
V COU	0 000 Herman	Notes
76	-	SITE IS UPSTREAM OF CONFUNCICE
	The state of the s	DUMAR ESCH RIVER + PARTER
	of the state of	row niver.
	or parcet The	FAIR LINE STATE
	0000	- SITT REGISSIO IRDM ROME WITH
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		Y ALL STATE OF THE
	(61)	- DUPLICATE SAMPLE FROM

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

HAVE BEEN RECORDED

AUSRIVAS PH	nysical Assessme	ent Protocol Fie	ld Data Sheets
-------------	------------------	------------------	----------------

Units Valley shape Choose one category only	Local impacts on streams  Choose one or more categories and describe the detail of each
°c Steep va	
mg I <sup>-1</sup> Shallow	
Broad va	
Gorge	Discharge pipe  Forestry activities  Sugar mill  Grazing  Litter  Recreation
ml Symmet floodpla	trical Irrigation run-off or Description Description
mg I <sup>-1</sup>	Local landuse Choose one category for each bank Left Right
(III)	Native grassland (not grazed)
Scroll systems Short, crescentic strips or patches falong the inner bank of a stream m Splays Small alluvial fan formed where an overloaded stream breaks through and deposits material on the floodp Floodplain scours	Grazing (native or non-native pasture)  Exotic grassland (lawns etc., no grazing)  Forestry Native [ ][ ] Pine [ ][ ]  a levee Cropped Rainfed [ ][ ] Irrigated [ ][ ]
	Units  c Steep vi  mg I¹ Shallow  Broad vi  Gorge  Symmet floodpla  Asymmet floodpla  Asymmet floodpla  Asymmet floodpla  Asymmet floodpla  Scroll systems  Short, crescentic strips or patches falong the inner bank of a stream m  Splays  Small alluvial fan formed where an overloaded stream breaks through and deposits material on the floodpla

Riparian zone composition Assess for whole sampling site %	Cover	Vegetation Description	Choose one category for include ground layer extractive grassland.		tion Left bank	Right bank
Trees (>10m in height)	May total more than 100%	telet, Couringhorn Melo	None	~~		
Trees (<10m in height)	tal mor	1 1	Isolated / scattered	1		
Shrubs	ay tot	Mimosa	Regularly spaced	, · · · · · ·		
Grasses / ferns / sedges	Way (	Phisymhes counch prolings	Occasional clumps	92 10		
Shading of channel			Semi-continuous	States to states from		
	50% 51 – 75%	> 76%	Continuous	Share to the state of the last of the last	X	$\times$
Extent of trailing bank vegetation  nil moderate  slight extensive  Overall vegetation disturbance rate Choose one category only. Sites with variations	% Native _ % Exotic _  ng  lley vegetation cleared of	on BOTH sides, but with riparian vegetat	Y[]N[]  If no, record regeneration category	Abundant (>5% cov Present Very limited (<1% could be scored in the high	er) and over)	
category. Words within the drawings sur  Extreme disturbance	nmarise the detailed text High disturb		Low disturbance	tegory.		
cleared cleared exotic only Arrange and a Riparian vegetation – absent or streduced. Vegetation is extremely dominated by exotic species with rare or completely absent)  Valley vegetation – agriculture an land BOTH sides. Plants present exotic species (willows, pines etc.)  Very high disturbance	everely cleared minor disturbed (ie. ative species d/or cleared	Riparian vegetation – moderately disturbed by stock or through the intrusion of exotic species, although some native species remain  Valley vegetation – agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present	undisturb. undisturb or minor on BOTH condition disturban	vegetation – native vegetation p sides of the river and in relativel with few exotic species present ce present is relatively minor getation – native vegetation pre- des of the river, with a virtually intend few exotic species	y good Any sent on	

cleared cleared some native but disturbed

◀ Riparian ►

-Valley-

Riparian vegetation - some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and

Valley vegetation - agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

## Moderate disturbance



Riparian vegetation - native vegetation on BOTH sides with canopy intact or with native species widespread and common in the nparian zone. The intrusion of exotic species is minor and of moderate

Valley vegetation - agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state

## Very low disturbance



Riparian vegetation - native vegetation present on BOTH sides of the river and in an undisturbed state Exotic species are absent or rare Representative of natural vegetation in excellent condition

Valley vegetation - native vegetation present on BOTH sides of the river with an intact canopy Exotic species are absent or rare. Representative of natural vegetation in excellent condition

AUSRIVAS	hysical Assessm	ent Protocol Fie	eld Data Sheets	Page	4 Site No.	Date	23.8.18
Physical ba Choose one of	rriers to local fish category for each flow	v condition	Type of bars Choose one or more cate	nories	tent of bars of streambed forming a	par of any ty	pe IO %
P	No passage	Base Low High flow flow flow	Bars ab	Dor Bou	minant sediment partic ulder/cobble [ ] Pebb	le size on ba	ars
9			Side/po VEGET	oint bars San	annel modifications C	ay [ ] or	mm
	Very restricted passage			oint bars GETATED	No modifications		Reinforced
8	Moderately restricted passage		VEGET		Desnagged	× Y %	Revegetated
8	Partly restricted passage			ennel bars ETATED Dund	Dams and diversions	10 O	Infilled
3	Good passage		obstruct  Braided	channel	Resectioned	20	Berms or embankments
8	Unrestricted passage		Infilled o	channel	Straightened	Signs of work still	Recently channelised
Гуре and heig	ht of barrier(s)		High flow	w deposits	Realigned	Works old and revegetated	Channelised in the past
Channel sha	pe Choose one car	tegory only					
			75	-	47	K Z	
	U shaped	Flat U shaped	Deepened U shape	Widened or in	nfilled Two	stage	Multi stage
					-		Width stage
	Box	Wide box	V V shaped	Trape	ezoid Concre	ete V	Pipe or culvert

ALLERTWANT PROVIDED A COLOROL FURTH FLALM STREET

Pipe or culvert

Bank shape Choose one category for each bank	Bank slope	Sediment oils
Left Right		Right
Concave	Vertical 80 - 90°	Water oils  none flecks globs sheen slick
Convex	Steep 60 - 80°	Sediment odours      normal/none   sewage   petroleum   chemical
Stepped	Moderate 30 - 60°	anaerobic other  Water odours
Wide lower bench	Low 10 - 30°	normal/none sewage petroleum chemical other
Undercut	Flat <10°	Turbidity (visual assessment)  Clear Slight Turbid Opaque
Factors affecting bank stability Choose one or more categories	Bedrock outcrops Assess % of each bank covered by bed % bedrock outcrops Left bank	Suspended material   Dissolved material
None Cleared vegetation	Right Bank	(og plant loadilates)
Runoff Irrigation draw-down	Artificial bank protection measure Choose one or more categories	Dry No flow No low Baseflow or near baseflow
Stock Reservoir releases Human Seepage	1110110	d stock ng points  Artificial features at the sampling site Choose one or more categories
access	Levee banks Veget	Major   Marie   Tota   Bhage   Calvert   Care
Ford, culvert Flow and waves	Rock or wall layer Logs s	trapped Description On Force
Feral animals Drainpipes	Rip rap to ban	ete channel ———————————————————————————————————
Other Description	Fenced human Concrete lining Other	Large woody debris

Extent of bedfor Total % composit		es must equal 100%		7	ampling site by each category.	0
Height >1m	Waterfall	% of site	Overall % cover of macroph	ytes	% cover of emergent macrophyte	
Gradient >60°	_	Est. Av. Length (m)	0300		% cover of floating macrophytes	
		Est. Av. Height (m) Est. Av. Gradient (°)			% cover of submerged macrophy	ytes
Step Height <1m	Cascade _	% of site	Macrophyte composition			
Gradient 5-60° Strong currents	-	Est. Av. Length (m)	Use a macrophyte field guide		acobs, 1994) to aid identification.	
3.000	-	Est. Av. Height (m) Est. Av. Gradient (°)			he common taxa present in each State	or Territ
	) –	Lst. Av. Gradient ( )	N denotes a native taxa and I	denotes an introd	duced taxa.	
Gradient 3-5° Strong currents	Rapid	% of site	<b>Emergent macrophytes</b>	%	Submerged macrophytes	%
Rocks break surface	Da	Est. Av. Length (m)		Present cover	Prese	
surface	-	Est. Av. Depth (m) Est. Av. Width (m)	Brachiaria (Para Grass) 1		Ceratophyllum (Hornwort) N	
			Crassula (Crassula) N		Chara (Stonewart) N	
Gradient 1-3°  Moderate currents	Riffle _	% of site	Cyperus (Sedge) I/N		Elodea (Canadian Pondweed) I	
Surface unbroken but unsmooth	-	Est. Av. Length (m) Est. Av. Depth (m)	Eleocharis (Spikerush) N		Myriophyllum (Water Milfoil) I/N	
out unsmooth		Est. Av. Width (m)	Juncus (Rush) I/N		Nitella (Stonewart) N	
Gradient 1-3°	Glide	% of site	Paspalum (Water Couch) N		Potamogeton (Pondweed) N	
Small currents Surface unbroken		Est. Av. Length (m)	Phragmites (Common Reed) N	X 2	Triglochin (Water Ribbon) N	
and smooth		Est. Av. Depth (m)	Ranunculus (Buttercup) I		Vallisneria (Ribbonweed) N	
		Est. Av. Width (m)	Scirpus (Clubrush) N		Other	
Gradient 1-3° Small but distinct	Run	○○ % of site	Triglochin (Water Ribbon) N		Other	
& uniform current	5	Est. Av. Length (m)	Typha (Cumbungi) N		Other	
Surface unbroken	TTTT	Est. Av. Depth (m) Est. Av. Width (m)	Other To see 1 2 55	× 0-01		

Other

Note: An additional response variable <u>planform channel pattern</u> is measured in the office

Backwater

Pool

% of site

% of site

Est. Av. Length (m)

Est. Av. Depth (m)
Est. Av. Width (m)

Est. Av. Length (m) Est. Av. Depth (m)

Est. Av. Width (m)

Area where

deepens and

stream widens or

current declines

A reasonable sized (>20% of channel

width) cut-off section away from

Overall % cover of native macrophyte taxa

Overall % cover of native macrophyte taxa

Total should equal overall % cover of macrophytes from above

Azolla (Azolla) N

Other

Other

Callitriche (Starwart) I

Present

## Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes. overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1)

Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2)

Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily

### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

32-60% fine sediment, low availability of interstitial spaces

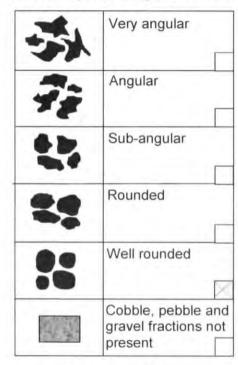


Matrix dominated

>60% fine sediment, interstitial spaces virtually absent

## Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

- Stable -

Unstable - depositing

## Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.

#### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material Publicar Descriptions

#### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled) Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material

## Moderate deposition

Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.

### Severe deposition

Extensive build up of fine sediments to form a flat bed. Channel blocked but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.

<b>AUSRIVAS</b>	Physical and Chemical Assessment Protocol Field Data Sheets	Page 8
Site No	Date	

# HIGH GRADIENT STREAMS

Page 1 of 2

Habitat								C	ondi	tion	cate	gor	y .								
parameter		E	xcelle	ent				Good	1				Fair					Po	or		
1. Epifaunal substrate / available cover	subtepifal high subtepifal subtep	cover, nerges is, cot le hab low ful ntial ()	avour colonis mix o d logs, oble or itat an l color e log it new	% of able fo ation a f snag under other d at st hisation s/snag fall an	and s. rcut age	habi full of pote habi of pi of ai the not colo	tat, w colonia intial itat for opulat ddition form o yet pro- nisation	mainions; pal sub from new eparec	led for late tenanc presen postrate fall, bu if for lay rate	ce nce nn nt	hab avai des freq	tat, h labilit rable	abitat y less subs y distu	than		habi	tat, I	ack sub	% st of ha strati ackin	bitat	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	1	6	5	4	3	2	1	0
2. Embeddedness	25% sedii cobb	surro ment.	rticles unded Layer vides	are 0-	е	boul 50%	der pa		and s are 2 d by fi		75%	der p	ounde	and es are ed by f		boul	der i	partion an 75 ded b	le an cles a 5% by fin	are	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Velocity / depth regime	regir deep deep	, slow , fast- ).3m/s	esent -shallo shallo	(slow- ow, fas w) S	st-	pres miss than	ent (it				regi	mes p	reser	habita nt (if fa r-shall core lo	st-	velo	city/		y 1 n reg -dee		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	islan less affec	ds or	point to % of sedir	gemen pars ar the bo ment	nd /	bar from sedi bott	forma grav ment, om aff	tion, m el, sar 5-309	of the	ine ne	new sed new bott sed obs con mox	grav ment bars om at ment truction striction	on oli 30-5 fected depo ons ons ar	0% of fi sits at and ber sition	the ids	mate deve 50% char pool	enal, elopr of t nging s alr	incr ment he b g free most antia	ease more otton quen abse sed	d bare that the that the that ant do	r an ue
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	both	lower mai an mei su	banks nount			avai <25	lable of	>759 channe channe is exp	el	е	avai	lable for rif	chann	ostrate		char	nnei ent	and	ter in most tandi	ly	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	dred	nneliza ging a mal; si nal pat	bsent tream	or		pres of bi evid chai dred 20 y but chai	ient, i. ridge i ence nnelizi Iging i rr) ma recent nnelizi	abutm of pas ation, greate y be p	in are ents t Le er than	1	or s pres and read	horing ent o	g strui g strui n both 80% anneli	may be ankmore tures of sank of street and ankmore tures of street ankmore tures o	ents s:	gabi 80% char disru habi	on of tonelli	he sized a	strea y alte	ove rea	ich
SCORE	20	19	40	17	46	pres		40	40		40		8	-							
	20	19	18	11	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

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Site No.	Date	

USEPA	Habitat	Assessme	ent
Circle a	score for	each param	eter

# HIGH GRADIENT STREAMS

Page 2 of 2

Habitat								C	ond	tior	n cat	ego	ry								
parameter		Exce	elle	nt			-	Good					Fair	•				Po	or		
7. Frequency of riffles (or bends)	relatively frequent, ratio of distance between riffles divided by width of the stream <7.1 (generally 5 to 7); variety of habitat is key in streams where riffles are continuous, placement of boulders or other large, natural obstruction is important  20 19 18 17 16 15 14					of distance between riffles divided by the width of the stream ref. 1 (generally 5 to 7); variety of habitat is key in streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.						s provided the	vide shallow riffles poor ce habitat distance between riffles divide by the width of the						1		
SCORE	20 1	9 1	8	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8. Bank stability (score each bank)	Banks of eros absent potentia problen affected	ion or or mi al for t	bar nim futu	nk fail al litt re	lure le	of er over	quent osion 5-3 h has	y stable, small mostly 0% of areas	areas y heald bank i	be	60% has high	of to	ely uns pank in as of er sion po pods	reach osion	1	are free sec obv	quent ctions vious	e ma raw' a t along s and bank % of b	reas g stra bend sloup ank h	ight s. ghin	
SCORE	Left ba	ank	1	10	9	8		7	1	5	5		4		3		2	1		- (	0
SCORE	Right h	bank	1	10	9	8		1		5	5		4		3	14	2	1		(	0
9. Vegetative protection (score each bank)	More the stream and imit and i	media overection, ir unders i, or no phytes tion thi g or ma all pla	surf ite n d by nclu- stori on w s, ve roug own ot ev	faces ipania nativi ding ey voody egetat gh ng viden allow	tive	strei cove vege of pl repri evide full p to ar more the p stub	ered betation ants i esent betation betation betation of the control of the contr	nk surf y nativ n but d s not v ed; dis it not a growth eat exter i one h hal plar eight	e one cla vell- ruption affectir potent ent, alf of	n Ig	clos vege than	amba ered uptio ches ely c etation one ential	of the ank su by veg in obvice of bare cropped on come half or plant semaining	etation ous; e soil of mon; f the stubble	or less	stri cov dis veg veg ren cer	eamb vered ruptio getati getati nove ntime	an 50° bank s by ve on of s on is on had to 5° lires of stubi	surfacegeta stream very in s been	es tion mba nigh in	nk
SCORE	Left ba	ank	1	10	9	8		7	1	3	5		4		3		2	1		(	0
SCORE	Right t	bank	1	10	9	8		7	1	3	5		4		3		2	1		(	0
10. Riparian zone score (score each bank)	Vidth of >18 me activities lawns, not important activities activities activities lawns, not important activities activiti	etres, es (i e crops	ros etc	nan ads,	ve	12-1 activ	8 me	ipanar tres, hi nave in n zone	uman npacte		12 n	netre vities ripari	npana es, hun have i ian zon	nan mpac	ted	<6 rips pre	metr enan sent	f ripar es liti veget becar activit	tle or tation use o	no is	
SCORE	Left ba	ank	1	10	9	8		7		3	5		4		3	1	2	1		(	0
SCORE	Right t	bank	1	10	9	8		7	1	3	5		4	1	3		2	1		-	0

TOTAL HIGH GRADIENT HABITAT SCORE





<b>AUSRIVAS Physica</b>	l and Chemical	Assessment	Protocol Field D	ata Sheets	Page 10
Site No. O11	Date	33.8.	18.		

# LOW GRADIENT STREAMS

Page 1 of 2

Habitat								(	ond	ition	cate	egor	У								
parameter		Ex	celle	ent			(	Good	1				Fair					Po	or		
1. Epifaunal substrate / available cover	subsepifa and snag unde or of and color () e	ater the strate aunal of fish cogs, su ercut ther standard at standard togs/snew fasient).	favou coloni over, bmen banks table i ige to on pot snags all and	rable sation mix of ged lo , cobb nabita allow ential that a	gs. ole t	habit full of pote habit of pote of act the to colo	tat, we colonis ntial; tat for opulat ddition form of yet pro- nisation	nix of sell-suit sation adequir main ions, pal sub of new epared on (ma of scal	ate tenandoreser ostrate fall, bu i for ay rate	ce nce e in	habi avail desi freq	tat, h lability rable	abitat less subs			hal	vious	an 10 lack sub e or la	of ha	bitat e	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Pool substrate characterization	and root subs	firm s mats merge	with g and p and	gravel prevale	ent;	be d	or cla lomina s and	soft s ay; mu ant, so subm prese	nd ma me ro erged	ot	botte mat	om; li	ttle or	or sa no ro rged		be		an cla c; no ion		mat o	or
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	shal	n mix llow, la all-sha p pool	arge-d	leep. small-			Majority of pools large- deep, very few shallow Shallow pools much more prevalent than deep pools.								Majority of pools small- shallow or pools absent						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	of is	e or no slands less t om aff iment	or po than 2 fected	int ba 0% of 1 by	rs	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools				Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected, sediment deposits at obstructions. constrictions and bends, moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently, pools almost absent due to substantial sediment deposition.						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	both mini cha	ter rea lowe imal a nnel s osed	r bank moun	ks, an		Water fills >75% of the available channel, or <25% of channel substrate is exposed				Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern			of b evid cha dred	sent, i ridge lence nneliz dging yr) ma	anneliz usually abutm of pas ation, (great ay be p	in an	n	extensive, embankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and habitat				shored with or cement over the stream reach elized and ed Instream greatly altered or ed entirely								
						cha	recen nneliz sent	t ation	s not		F					ľ					

Continued over

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ite No.	011	Date	23 8 18	

# LOW GRADIENT STREAMS

Page 2 of 2

Habitat						Cond	lition	cate	gory								
parameter	Exc	ellent			Goo	d			Fa	r			Po	or			
7. Channel sinuosity	The bends in increase the length 3 to 4 longer than in straight line, channel braiconsidered in coastal plain low-lying are parameter is rated in these	stream times if it was (Note- ding is normal it is and deas. The not eas	in a	increas	nds in the the street to 3 tin than if it line.	ream nes		increa 2 time	ends in l ase the s es longer n a straig	tream than i	1 to f it	Channel straight; waterway has been channelized for a long distance.					
SCORE	20 19	18 17	16	15 1	4 13	12	11	10	9 8	7	6	5 4	3	2	1		
8. Bank stability (score each bank)	Banks stable of erosion or absent or m potential for problems < affected.	bank fa inimal, l future	ailure Ittle	of eros	tely statent, sma on most -30% of as areas	ill area ly hea bank	led	60% of has a high e	rately un of bank in reas of e erosion p g floods	reach	1	Unstab areas frequer section obvious 60-100 erosion	raw a nt alon is and s bank 1% of i	areas ng str bend k slou bank	raight ds, ughing		
SCORE	Left bank	10	9	8	7		6	5	4		3	2		1	0		
SCORE	Right bank	10	9	8	7		6	5	4		3	2		1	0		
9. Vegetative protection (score each bank)	More than 9 streambank and immedia zone covere vegetation, i trees, under shrubs, or n macrophytes disruption th grazing or m nilmost all pix to grow nature.	surface ate ripar d by na ncluding storey on wood s, veget irough lowing of evide ants allo	is ian tive d dy ative	covered vegetal of plant represe evident full plant to any more th	bank suit d by natii ion but is is not inted, die but not it growth great ext ian one ential pla height	ve one cl well- sruptic affecti poter ent half of	ass on ing ntial	stream covered disrup patch closel vegets than of poten	% of the nbank si ed by ve otion obv es of bar y croppe ation cor one-half trainini	getatio ious e soil i d nmon of the stubbl	n; or less	Less the stream covered disrupt vegetal vegetal remove centime average	bank d by v ion of tion is tion ha ed to 5 etres	surfa egeta strea very as be or les	ices ation; amban high; een		
SCORE	Left bank	10	9	8	N		6	5	4		3	2		1	0		
SCORE	Right bank	10	9	8	7		6	5	4		3	2	1	1	0		
10. Riparian zone score (score each bank)	Width of ripa >18 metres, activities (i.e. lawns, crops not impacted zone	human roads etc ) h	ave	12-18 r activitie	of riparia netres, i s have i irian zon	numan	ed	12 me activit	of ripari etres, hu ies have parian zo	man impac	ted	Width <6 met npanar presen human	res li vege t beca	ttle or tation	r no		
SCORE	Left bank	10	9	8	7		6	5	4		3	2	-	1	0		
SCORE	Right bank	10	9	В	7		6	5	4		3	2		1	0		

TOTAL LOW GRADIENT HABITAT SCORE

Detailed instructions or Two cross-sections are requir	the measurement of changed at homogeneous sampling sites me of sampling is at or near the wa	(generally lowland streams) and three cross-se	protocol manua ections at heterogene	al. Be familiar with these before proceeding.
	Cross-section sketch	IL FRILL - SIV	Type of	ss-section number of
Bank height (m)	The channel sketch should show in cross	s-section the shape of the channel and include the location of a lipoints. Also show other features such as bars, rocky ross section.	Stream	Bankfull channel width (m) (=total of boxes A+B+C)  am width at the water mark (m)  width at the water surface (m)
Vertical distance between the water surface and the water mark (m)		r depths (cm)  Notes on cross-section measurements		Vertical distance between the was surface and the water mark (m)
Left bank (m)			- s Sept Fil	Complete the second
	s % composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm)	either side of	Assess in the area 5m either side of the cross section  <10%

AUSRIVAS Physical and Chemical Assessment Protocol Field Data Sheets Page 13	Site No.	Date _23-8-18
Channel cross-sections and variables to be measured in the area around a cross section	on	

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

Cross-section number of Cross-section sketch Type of bedform at the cross-section Riffle Run Pool Cascade Other Bankfull channel width (m) (=total of boxes A+B+C) Bank height (m) Bank height (m) Stream width at the water mark (m) The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky Stream width at the water surface (m) outcrops and snags encountered at the cross section. Bank Horizontal distances (m) Bank width (m) c width (m) Vertical distance Vertical distance between the water between the water surface and the surface and the Vertical water depths (cm) water mark (m) water mark (m) Notes on cross-section measurement Riparian zone width Left bank (m) Right bank (m) Assess in the area 5m either side of Substrate composition Bank material Assess % composition for each bank Filamentous algae cover the cross section Assess % composition in the area of bed 5m either side of Left bank Right bank <10% 10-35% the cross-section. 65-90% 35-65% Bedrock Bedrock Periphyton cover Boulder (>256mm) Boulder (>256mm) 10-35% 35-65% 65-90% Cobble (64-256mm) Cobble (64-256mm) Total 100% Pebble (16-64mm) Pebble (16-64mm) Moss cover Gravel (2-16mm) Gravel (2-16mm) 10-35% 35-65% 65-90% Sand (0.06-2mm) Sand (0.06-2mm) Fines (silt and clay, <0.06mm) Detritus cover Fines (silt and clay < 0.06mm) 10-35% 35-65% 65-90% Total 100% each

Detailed instructions on the measurement of char Two cross-sections are required at homogeneous sampling site Where the water level at the time of sampling is at or near the w water surface and the water mark should be entered as 0.	s (generally lowland streams) and three cross-sections at he	l manua eterogeneo	Be familiar with these before proceeding.     bus sampling sites (generally upland streams).	between the
the water surface, watermark and bank outcrops and snags encountered at the	iss-section the shape of the channel and include the location of	ype of Riffle	Bankfull channel width (m) (=total of boxes A+B+C)  am width at the water surface (m)	Bank height (r
Vertical distance petween the water	ver depths (cm)  Notes on cross-section measuremen			Vertical distance between the water mark (m)
Riparian zone width	Total on cross section measurement			
Left bank (m) Right bank (m)				
Bank material Assess % composition for each bank Left bank Right bank Bedrock	Substrate composition Assess % composition in the area of bed 5m either side the cross-section.  Bedrock Boulder (>256mm)	of	Filamentous algae cover	the area 5m either side of the cross section    65-90%   >90%

AUSRIVAS Physical Assessment Protocol Field Data Sheets	Page 1 Site No. 012 Date 13-8-18
Date 29.8.18 Site No Time	
River Name MACINTY RE RIVER Location PUBLIC	ACTS & BOCKABILLA
Weather CLOAL + SWARY Rain in last week? Y [ ] N [ ] Photo	graph numbers and details
III I langitude: 1 C langitude:	1+2 WE, 3+400WE, 5+6 ONE, 7+ P LOTHE 1
SPS Name and Datum	SAMPLE POINTS 1+2 WS, 3+4 ENVIRE, 5+6 D/S
PLANFORM SKETCH OF SITE ncluding bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.	LENGTH OF SAMPLING SITE
eft bank is facing downstream.	Bankfull width (m)
3037	x 10
The second have been second	Length of sampling site(m)
100 100 100 100 100 100 100 100 100 100	Notes
The state of the s	Strate plante to
Sup Me	ueg on lot- one U
	State a days earler, rudus
A X A	ansot a free
	TOP -THE WAY
	- Exit TRAPS X4 . IDR 21 - NO F
	THER CONVINE SHOKE (1)
A - Yere	BEFORE LEAVING THE SITE, CHECK DATA
THE THEFT THE	SHEETS TO ENSURE THAT ALL VARIABLES
	HAVE BEEN RECORDED

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

BASIC WATER CHEMISTRY	Units	Valley shape Choose one category only	Local impacts on streams Choose one or more categories and describe the detail of each
Temperature 12-0	°c	Steep valley	Sand or gravel mining Sewage effluent
Conductivity 308-1 410 *3	500	V	Other mining Channel straightening
Dissolved Oxygen San 9	mg I <sup>-1</sup>	Shallow valley	Road River improvement wo
Dissolved Oxygen Sat. 83.5	%		Bridge / culvert / wharf Water extraction
HC Ho		Broad valley	Ford / ramp Dredging
Turbidity <u>12-5</u>	Other		Discharge pipe Grazing
Total nitrogen		Gorge	Forestry activities Litter
Total nitrogen		A	Sugar mill Recreation
S ALKALINITY		Symmetrical floodplain	☐ Irrigation run-off or ☑ Other
Amount of water	ml	пообрын	pipe outlet  Description
Amount of H <sub>2</sub> SO <sub>4</sub>	ml	Asymmetrical floodplain	Stude, 43se femore
Alkalinity	mg l <sup>-1</sup>	Пообрын	
Salary 0.2 pp			Local landuse Choose one category for each bank
Floodplain width	250	Average (m)	Left Right
Floodplain features			Native forest
Choose one or more features when present			Native grassland (not grazed)
Sampling site has no distinct floodplain		oll systems rt, crescentic strips or patches formed	Grazing (native or non-native pasture)
Oxbows / billabongs Body of water occupying a former river	alon	g the inner bank of a stream meander	Exotic grassland (lawns etc., no grazing)
meander, isolated by a shift in the stream	Spla		Forestry Native [ ][ ] Pine [ ][ ]
channel Remnant channels		all alluvial fan formed where an rloaded stream breaks through a levee	Cropped Rainfed [ ] [ ] Irrigated [ ] [ ]
Formed during a previous hydrological		deposits material on the floodplain	Urban residential
regime. May be infilled with sediment		odplain scours ur holes formed by the concentrated	Commercial
Flood channels A channel that distributes water onto the		ring and digging action of flowing water	Industrial or intensive agricultural
floodplain and off the floodplain during		floodplain features present odplain present at the sampling site but	Recreation
THE PARTY OF PROPERTY AND PROPERTY OF THE PARTY OF THE PA		s not contain any of the above features	Other

iparian zone composition ssess for whole sampling site % Co	over Vegetation Description	Choose one category for each bank. Do not include ground layer except where site is in native grassland.	
rees (>10m in height)	De FAC TEL + MONTH	None None	
rees (<10m in height)	100%	Isolated / scattered	i
hrubs5s	May total more than 100%	Regularly spaced	i
rasses / ferns / sedges	May Name a likely gar	Occasional clumps	i H
Shading of shannel		Semi-continuous	i E
Shading of channel  6 - 25% 26 - 56	0%	Continuous	38
il moderate slight extensive	Native and exotic riparian vegetation % Native % Exotic  Total 100%	Regeneration of native woody vegetation Is the sampling site in undisturbed forest?  Y[]N[]  Abundant (>5% cover) and Present Very limited (<1% cover)	d health
Overall vegetation disturbance rating Choose one category only. Sites with valle attegory. Words within the drawings summer the disturbance.		rian vegetation in good condition should be scored in the high distuant and valley vegetation for each category.  Low disturbance	urbance
cleared cleared Riparian vegetation – absent or sever reduced. Vegetation is extremely districted dominated by exotic species with native rare or completely absent)  Valley vegetation – agriculture and/or land BOTH sides. Plants present are	cleared mod disturb stock or through the intrusion of exception of exc	disturbed by undisturb or minor on BOTH sides of the river and in relatively good condition with few exotic species present Apy disturbance present is relatively minor.  Valley vegetation – native vegetation present or BOTH sides of the river and in relatively good condition with few exotic species present Apy disturbance present is relatively minor.	

# Very high disturbance



◀ Ripanan ▶

**←**Valley — ▶

Riparian vegetation - some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and

exotic species (willows, pines etc.)

Valley vegetation - agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)



side clearly disturbed or with a high percentage of introduced species present

## Moderate disturbance



Riparian vegetation - native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

Valley vegetation - agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state



BOTH sides of the river, with a virtually intact canopy and few exotic species

### Very low disturbance



Riparian vegetation - native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare Representative of natural vegetation in excellent condition

Valley vegetation - native vegetation present on BOTH sides of the river with an intact canopy Exotic species are absent or rare. Representative of natural vegetation in excellent condition

	rriers to local fish ategory for each flow		Type of bars Choose one or more categori	Extent of ies % of stres	bars ambed forming a ba	ar of any tyr	96
F		Base Low High flow flow flow	Bars abser	nt Dominant	sediment particle	size on ba	irs
d's	No passage		Side/point VEGETAT		[>] Silt/clay		
98	Very restricted passage		Side/point UNVEGET	bars	No modifications		Reinforced
B	Moderately restricted passage		Mid-chann VEGETAT	ED	Desnagged	¥ 9°	Revegetated
8	Partly restricted passage		Mid-chann UNVEGET Bars arour	TATED Ind	Dams and diversions	00	Infilled
\$	Good passage		obstruction  Braided ch	7	Resectioned	00	Berms or embankments
5	Unrestricted passage		Infilled cha	annel	Straightened	Signs of work still	Recently channelised
pe and heig	ght of barrier(s)		High flow o	deposits	Realigned	Works old and revegetated	Channelised in the past
annel sha	ape Choose one ca	tegory only					
					7	-	(
12-12-Ti	U shaped	Flat U shaped	Deepened U shape	Widened or infilled	Two s	stage	Multi st
	a Chadhas and						$]\bigcirc$
	Box	Wide bo	x V shaped	Trapezoid	Concre	ete V	Pipe or cu

AURBIVAS Physical Assessment

Pipe or culvert

Bank shape Choose one category for each bank  Left Right bank bank	Bank slope Choose one category for each bank  Left Right bank bank	Sediment oils  absent light moderate profuse
Concave	Vertical 80 - 90°	Water oils  ☑ none ☐ flecks ☐ globs ☐ sheen ☐ slick
Convex	Steep 60 - 80°	Sediment odours  normal/none sewage petroleum chemical
Stepped 🖂	Moderate 30 - 60°	anaerobic other Water odours
Wide lower bench	Low 10 - 30°	normal/none sewage petroleum chemical other
Undercut	Flat <10°	Turbidity (visual assessment)  Clear Slight Turbid Opaque
Factors affecting bank stability Choose one or more categories	Bedrock outcrops Assess % of each bank covered by bedrock outcro % bedrock outcrops Left bank	Is water clarity reduced by:  Suspended material (e.g mud, clay, organics)  Dissolved material (e.g plant leachates)
None Cleared vegetation	Right Bank	Water level at the time of sampling
Runoff Irrigation draw-down	Artificial bank protection measures Choose one or more categories	Dry No flow Low Baseflow or near baseflow High Flood (don't sample)
Stock Reservoir access releases Human Seepage	None Fenced stock watering points	Artificial features at the sampling site Choose one or more categories
access Seepage Ford, culvert Flow and	Levee banks Vegetation plantings	Major Minor Ford Bridge Culvert Other weir
or bridge waves  Feral animals Drainpipes	Rock or wall layer Logs strapped to bank	Description
Other	Fenced human Concrete channel	
Description	access lining Other	Large woody debris Overall % cover of logs and branches greater than 10cm in diameter  % Notes on visibility

Extent of bedfo	rm features		Macrophyte cover Asses	s % cove	r of the s	ampling site by each category.		
Total % composition	on for all feature	es must equal 100%			1			1
Height >1m	Waterfall	% of site	Overall % cover of macrop	nytes	-	% cover of emergent mag		-
Gradient >60°		Est. Av. Length (m)				% cover of floating macro	phytes	- 0
		Est. Av. Height (m) Est. Av. Gradient (°)				% cover of submerged m	acrophyte	s
Step Height <1m Gradient 5-60° Strong currents	Cascade		Macrophyte composition Use a macrophyte field guide Listed macrophytes can be o N denotes a native taxa and	e (i.e. Sai hanged to	reflect t	acobs, 1994) to aid identification he common taxa present in each	on. ch State or	Territory
Gradient 3-5° Strong currents	Rapid	% of site	Emergent macrophytes		%	Submerged macrophytes		%
Rocks break surface	-	Est. Av. Length (m) Est. Av. Depth (m)		Present	cover		Present	cover
	-	Est. Av. Width (m)	Brachiaria (Para Grass) I			Ceratophyllum (Hornwort) N		
Gradient 1-3°	Riffle		Crassula (Crassula) N			Chara (Stonewart) N		
Moderate currents	Kille	% of site Est. Av. Length (m)	Cyperus (Sedge) I/N			Elodea (Canadian Pondweed		
Surface unbroken but unsmooth	A STATE OF THE PARTY OF THE PAR	Est. Av. Depth (m)	Eleocharis (Spikerush) N			Myriophyllum (Water Milfoil)	I/N	
		Est. Av. Width (m)	Juncus (Rush) I/N			Nitella (Stonewart) N		
Gradient 1-3°	Glide	% of site	Paspalum (Water Couch) N			Potamogeton (Pondweed) N		
Small currents Surface unbroken	_	Est. Av. Length (m)	Phragmites (Common Reed) N	P	1	Triglochin (Water Ribbon) N		
and smooth	_	Est. Av. Depth (m)	Ranunculus (Buttercup) I			Vallisneria (Ribbonweed) N		
		Est. Av. Width (m)	Scirpus (Clubrush) N			Other		
Gradient 1-3° Small but distinct	Run	% of site	Triglochin (Water Ribbon) N			Other		
& uniform current Surface unbroken		Est. Av. Length (m) Est. Av. Depth (m)	Typha (Cumbungi) N			Other		
Surface unbroken		Est. Av. Width (m)	Other			Fig. 40 and a second but the		
	Pool		Other			Floating macrophytes	Present	%
Area where stream widens or	-	% of site	Other			Azolla (Azolla) N	riesein	
deepens and current declines		Est. Av. Length (m) Est. Av. Depth (m)				Callitriche (Starwart) I		
		Est. Av. Width (m)				Other		
	Backwater	% of site				Other		
reasonable sized (>20% of channel	A  -	Est. Av. Length (m)				200		_
width) cut-off {		Est. Av. Depth (m)	0			Other		_

Note: An additional response variable planform channel pattern is measured in the utilize:

# **Bed compaction**

Choose one category only



Tightly packed, armoured Array of sediment sizes. overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1)

Limited range of sediment sizes. little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2)

Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily

### Sediment matrix

Choose one category only



Bedrock

Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

32-60% fine sediment, low availability of interstitial spaces

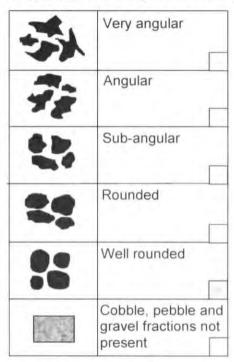


Matrix dominated

>60% fine sediment, interstitial spaces virtually absent

# Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

- Stable -

Unstable - depositing

### Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion

### Moderate erosion

Little fine sediment present. Signs of channel deepening Eroded banks. Streambed deep and narrow Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.

### Moderate deposition

Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow

### Severe deposition

Extensive build up of fine sediments to form a flat bed. Channel blocked but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material

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# HIGH GRADIENT STREAMS

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Habitat								C	ondi	tion	cate	gory	1								
parameter		E	xcelle	ent			77	Good	1				Fair					Po	oor		
1. Epifaunal substrate / available cover	epifa fish subr bani stab to al pote that	ater the strate to aunal cover, mergecks, cot le hab low ful are no transie	avour colonis mix o d logs oble or itat an Il color e log ot new	able for ation a f snag under other d at st disation s/snag	and s, rcut age	habi full of pote habi of pi of ai the not colo	tat w colonii ential; tat for opulat ddition form of yet pro- nisation	sation adequations; pal nal sub of new epared	ted for tenance present ostrate fall, build for ay rate	ce ice in	habi avai desi freq	tat h lability rable	nix of abitat less subs distu	than trate		ha	ss the bitat vious stable	lack sub	of ha	bital e	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Embeddedness	25% sedi	vel col der pa surro ment ble pro	unded Layer vides	are 0 by fin	e	50%	der p		and s are 2 d by fi		75%	der p	article ounde	s are		mo su	avel, ulder ore th rroun dimer	parti an 7. ded	cles : 5%	are	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Velocity / depth regime	regii deep deep	mes proposition of slow p. fast- 0,3m/s	esent shallo	(slow- ow, fas w). S	st-	pres miss than	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes)					2 of mes p low o	ow ow	Dominated by I velocity/depth regime (usually slow-deep)							
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition						forma grav ment om at	tion n el sar 5-30°	of the	ne ie	new sedi new bott sedi obsi cons	grave ment bars om af ment truction striction	deposed san on old 30-5 fected deposens ar deposed dep	id or if and 0% of its at	the nds	de 50 ch po to	eavy caterial velop welop welop welop angin ols all subsi	menthe to menthe to g free most	rease l mo ottor quen abse	ed bare the tily ent o	ar nan
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	both mini char	er read lower mai an nnel su osed	banks	and of		avai	lable i	>75% channi channi is exp	ei	e	avai	lable i	25-7 chann le sub y expo	el strate		ch	ery litt anne esent ols	and	most	tty	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	dred	nnelizz Iging a mal si nal pat	bsent tream	or		Some channelization present usually in area of bridge abutments, evidence of past channelization, i.e. dredging (greater than 20 yr) may be present but recent channelization is not				1	or s pres and read	nsive horing ent o 40 to	ation emba struct both 80%	tures bank of str	ents i is eam	80% of the stream reach channelized and					ach
						pres		ation is	s not												

Continued over

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USEPA	Habitat	Asse	essment
Circle a	score for	each	paramete

# HIGH GRADIENT STREAMS

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Habitat	-							C	ondi	tion	cate	go	У									
parameter		Ex	cell	ent			-	Good	1				Fair					Poo	r			
7. Frequency of riffles (or bends)	relation of different the signal of has stread continuous continuo	vely fi stances divide tream erally abitat i ims w nuous sulden	ce of integration of the control of	nt, ra veen veen veen veen veen veen veen vee	h of nety are nt	betw by If	quent veen r	th of t	nce livided		some betw by th	e hat een een	al riffle ontour bitat, d riffles dth of between	s provistance divide the	nde e d	Generally all flat water or shallow riffles: poor habitat, distance between riffles divided by the width of the stream is a ratio of >25						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2 1	0		
8. Bank stability (score each bank)	of ero	nt or ntial for	ble, e or ba minim or futti <5%	nk fai lat lit ire	lure tje	of er over reac	Moderately stable; infrequent, small areas of erosion mostly healed over 5-30% of bank in reach has areas of erosion					of b	ly uns ank in a of en ion po ods	reach		are free sec obv	quen tions nous	e, man raw' are along and b bank s of ba al scars	straigh ends loughi nk has	nt ng		
SCORE	Left	bank		10	9	8		7	6		5	T	4	T	3	_	2	1		0		
SCORE	Righ	t bar	ik	10	9	8		7	6		5		4		3	- 6	2	1	1	0		
9. Vegetative protection (score each bank)	strea and i zone vege trees shrut macr disru grazii minin	mban mmed cove tation und os, or rophyt ption ng or nal or st all	non tes; v throu mow not e plants	faces riparia y natividing rey wood egeta gh ing rividen allov	an ve	stress cove vege of pl reprieviding to ar more the p stub	ered betation ants i esenti ent bu plant g ny gre e than	nk surfly native y native but of s not ved; dis- surf not a growth eat exten- tione had plan- eight	ne class vell- ruption affection potenti ant; alf of	9	strea cove disru patch close vege than poter	mba red b iption hes c ely cr tation one- ntial i	of the nk sure oy veg n obvious of bare copped n common half of plant some	soil of mon the	n. Iess	stre cov dis veg veg ren cer	eamb vered ruptio getati getati novembrine	an 50% iank su by veg on of st on is vion has if to 5 tres or stubble	rfaces letation reamb ary hig been less in	ank h;		
SCORE	Left			10	9	8	-	7	6		5		4		3	1	2	1		0		
SCORE	Righ	t bar	ık	10	9	8		7	6		5		4		3		2	1		0		
10. Riparian zone score (score each bank)	Width > 18 r active lawns not in zone	metre ties (i s, cro npact	s, hu e ro ps et	man ads, ; ) ha	ve	12-1 activ	8 me	ipanar tres, h nave in in zone	uman npacte	1	12 m activ	etres	npana hum have ii an zon	ian mpaci	ed	<6 rips	metr arian sent	ripania es little vegeta becaus activitie	or no tion is se of			
SCORE				10	9	8		7	6		5	1	4	1	3	13	2	1		0		
SCORE					Right bank 10 9 8 7 6 5 4						+	3	1	2	1	-	0					

TOTAL HIGH GRADIENT HABITAT SCORE

<b>AUSRIVAS Physic</b>	al and Chemical	Assessment	Protocol	Field Data	Sheets	Page 10
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# LOW GRADIENT STREAMS

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Habitat									ond	ition	cat	egor	У									
parameter		Ex	celle	ent			(	Good	i				Fair					Po	or			
1. Epifaunal substrate / available cover	subs epifa and snag unde or of and color (i e	ater that strate aunal of fish co gs, sui ercut t ther st at sta nisatio logs/s new fa sient)	favour colonic over bmerg banks sable h ge to on pot snags	rable to sation mix of ged lo cobb abital allow ential that a	gs, ole t full	habit full of pote habit of pot of act the finot	tat; we colonis ntial; tat for opulati iddition form of yet pre- nisation	adequi maint	ate tenandoreser ostrate fall, but if for ay rate	ce ice in	habi avai desi freq	tat, h lability rable	nix of abitat y less subs y distu	than trate		Less than 10% stable habitat, lack of habitat is obvious; substrate unstable or lacking						
SCORE	20	19	18	17	16	15	14	13	12	11	10	6	5	4	3	2	1	(				
2. Pool substrate characterization	and root subr	ure of enals, firm s mats merge mon	with ( and p and	gravel revale	ent:	mud or clay; mud may be dominant; some root					bott	om li	r clay ttle or ubme	noro		be			root	mat «	or	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	(	
3. Pool variability	shal	low, la	arge-d	eep. mall-		Majority of pools large- deep, very few shallow				Sha mor dee		Majority of pools small- shallow or pools absent										
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	(	
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition					from sedi bott	forma grav ment om aft	v incre tion, n el, sar 20-50 fected i in po	nastly na or f 0% of sligh	ine the	new sed new bott sed obs con mod	grav ment bars om al ment truction striction	depo el, sar on ol 50-8 fectes depo ons ons a depo valent	nd or d and 0% o i sits at and be sition	fine f the nds	ma de 80 ch po to	velop % of angir ols a	the to most the to most lantia	sits o rease t mo oottor quen absoluted	ed bare the	ar an	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1	
5. Channel flow status	both mini chai	ter rea lower mal a nnel s	r bank moun	s, an		avai	lable of of	>75% chann chann is exp	el, or el	ne	ava	lable for rit	s 25-1 chanr fle sul	nel. ostrat		ch	anne	and	mos tand	tly .		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1	
6. Channel alteration	drec	inneliz iging imai s mai pa	absen stream	t or		Some channelization present usually in areas of bridge abutments evidence of past channelization, i.e. dredging (greater than 20 yr) may be present but recent channelization is not				or s pre- and read	nonn sent o	zation emit g stru on boti o 80% anneli	ankm ctures to ban of str	ks.	Banks shored with gabion or cement over 80% of the stream reach channelized and disrupted instream habitat greatly altered or removed entirely							
						cha			s not													

Continued over

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# LOW GRADIENT STREAMS

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Habitat								Cond	tior	1 categ	ory											
parameter	Excellent		Good Fair			ir	Poor															
7. Channel sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line (Note – channel brading is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).		increase the stream length 3 to 4 times longer than if it was in a straight line (Note – channel bradding is considered normal in coastal plains and other low-lying areas. This parameter is not easily		increase the stream length 3 to 4 times longer than if it was in a straight line (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily		increase the stream length 3 to 4 times longer than if it was in straight line. (Note channel braiding is considered normal in coastal plains and oth low-lying areas. This parameter is not easily		increase the stream in length 3 to 4 times longer than if it was in a straight line. (Note channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily		increase the stream length 3 to 4 times longer than if it was in a straight line (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily			tream mes		The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.			Channel straight, waterway has been channelized for a long distance			1
SCORE	20	19	18	17	16	15 1	4 13	12	11	10 9	8	7	6	5	4	3 3	1	0				
8. Bank stability (score each bank)	Banks stable, evidence of erosion or bank failure absent or minimal, little potential for future problems <5% of bank affected			of eros	ent sm ion mos 5-30% d nas area	all areas tly heals of bank i	ed	Moderately unstable. 30-60% of bank in reach has areas of erosion, high erosion potential during floods			n	Unstable, many eroded areas; 'raw' areas frequent along straight sections and bends, obvious bank sloughing, 60-100% of bank has erosional scars.										
SCORE	Left	bank		10	9	8	7		3	5	4		3		2	1		0				
SCORE	Right	t bank		10	9	8	7	1	5	5	4	5	3		2	1		0				
9. Vegetative protection (score each bank)	stream and in zone veget trees shrub macri disrup grazin minim almos	than s mbank mmedi covern lation under as, or i ophyte ption the ng or i nal or i st all pow nati	sur late red by inclu- rator non ves, ve hroughout e hroughout e lants	facer ripan y nat iding ey wood egeta gh ing vider allo	s an ive l dy atrive	of plant represe evident	bank so d by na- dion, but is is not ented; d but no nt growing great en an one ential p	urfaces tive one cla well- isruption affection the potent dent; half of lant	g	stream covere disrupt patche closely vegeta than or potenti	of the bank side of the bank side of bar cropper tion corne-half remaining	urfaces getations re soil of ed mmon of the stubble	or less	cov distress veg veg ren cer	eamb vered ruptio getati getati nove ntime	an 50% bank su by veg on of st on is ve on has a to 5 tres or stubble	rfaces etation reamb ry higi been less in	n, ank h				
SCORE	Left t	bank	1 8	10	9	8	7	1	6	5	4		3	4	2	1		0				
SCORE	Right	t bank		10	9	8	7		3	5	4		3	1	2	1		0				
10. Riparian zone score (score each bank)	Width of riparian zone >18 metres, human activities (i.e. roads lawns, crops etc.) have not impacted the riparian zone.		12-18 /	netres is have anan zo	an zone human impacte ne only		12 met activitie	of ripan tres, hu es have arian zo	man Impac	ted	<6 ripa pre	metr arian sent	f ripana es little vegeta becaus activitie	or no ion is e of								
SCORE	Left t	bank	1	10	9	8	7	- 1	3	5	4		3	1.3	2	1		0				
SCORE	Right		-	10	9	8	7		3	5	4		3		2	1		0				

TOTAL LOW GRADIENT HABITAT SCORE



AUSRIVAS Physical and	Chemical Assessment	Protocol Field Data	Sheets Page 12
Accidit Ac i flysical alle	Olicilical Assessinelli	FIULUCUI I ICIU Data	Silects laye IL

Site No. OlZ Date 73

# Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

	Cross-section sketch		Cros	ss-section number of
	1	- LANCE MALL	1 1 2 2	of bedform at the cross-section le Run Pool Cascade Other
Bank height (m)		s-section the shape of the channel and include the location Il points. Also show other features such as bars, rocky ross section.	of	Bankfull channel width (m) (=total of boxes A+B+C)  eam width at the water mark (m)  m width at the water surface (m)
Bank width (m)  Vertical distance between the water surface and the water mark (m)  Riparian zone width	Horizontal dis		urement	Bank width (m)  Vertical distance between the war surface and the water mark (m)
Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm)		Substrate composition Assess % composition in the area of bed 5m the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm)	n either side of	Assess in the area 5m either side of the cross section    <10%
Sand (0.06.20m) Lines (silt and Jay +0.06mm)	Total 100% each	Gravel (2-16mm)  Sand (0 06-2mm)  Fines (silt and clay < 0 06mm)		<pre></pre>

AUSRIVAS Physical and	Chemical A	ssessment	Protocol	Field	Data	Sheets	Page '	13
			, , , , , , , , ,				21 -	

Site No. \_\_\_\_ Date \_\_\_\_ Date

### Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

	Cross-section sketch		Cros	s-section number of
	Tr.	ya an en a Trade		bedform at the cross-section  Run Pool Cascade Other
nk height (m)		-section the shape of the channel and include the location of il points. Also show other features such as bars, rocky ross section.		Bankfull channel width (m) (=total of boxes A+B+C)  am width at the water mark (m)  width at the water surface (m)
Bank width (m)  Vertical distance etween the water surface and the water mark (m)	Horizontal dis			Vertical dis between the surface and
Riparian zone width		Notes on cross-section measure	ement	water mark
eft bank (m) F	Right bank (m)	THE PER TOWN		SOUNDED TO SOURCE SOURC
Bank material Assess	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m eith the cross-section.	ner side of	Assess in the area 5m either side the cross section    Assess in the area 5m either side the cross section
edrock		Bedrock		
oulder (>256mm)		Boulder (>256mm)		Periphyton cover
obble (64-256mm)		Cobble (64-256mm)		<10% 10-35% 35-65% 65-90% >90
ebble (16-64mm)		Pebble (16-64mm)	Total 100%	Moss cover
ravel (2-16mm) and (0.06-2mm)	0 7	Gravel (2-16mm)	F	<10% 10–35% 35-65% 65-90% >9
nes (silt and clay, <0.06mm	Total 100% each	Sand (0.06-2mm)  Fines (silt and clay < 0.06mm)		Detritus cover   <10%   10–35%   35-65%   65-90%   >90

hannel cross-section	ons and variables to b	e measured in the area around a cr	oss section	on	
vo cross-sections are require	d at homogeneous sampling sites e of sampling is at or near the wat	(generally lowland streams) and three cross-sections	at heterogeneo	I. Be familiar with these before proceeding us sampling sites (generally upland streams). m width at the water mark. In this case, vertical distance to	petween the
	Cross-section sketch		Cros	s-section number	_ of
			Type of	bedform at the cross-section	
			100000000000000000000000000000000000000	Run Pool Cascade Other	
k height (m)				Bankfull channel width (m) (=total of boxes A+B+C)	Bank height
( neight (m)			Strea	m width at the water mark (m)	Dank neigh
		-section the shape of the channel and include the location of Il points. Also show other features such as bars, rocky ross section.	Stream	width at the water surface (m)	1/ -
Bank	. Harinantal dia	Annes (m)			Bank
dth (m) B	Horizontal dis	lances (III)			c width
ertical distance			000000		▼ Vertical distar
een the water urface and the	Vertical water	r depths (cm)			between the surface and t
ater mark (m)			olda-		water mark (r
parian zone width		Notes on cross-section measuren	nent		
	Right bank (m)				
	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either the cross-section	side of	Filamentous algae cover	the area 5m either side of the cross section
drock		Bedrock	)	<10% 10–35% 35-65%	65-90% >90%
ulder (>256mm)		Boulder (>256mm)		Periphyton cover	
bble (64-256mm)		Cobble (64-256mm)		<10% 10–35% 35-65%	65-90% >90%
Oble (10.04mm)		Pebble (16-64mm)	1000	Mana cover	
vel (2 mom)		Gravel (2-16mm)	Total 100	Moss cover	Tes 000/ 17-00/
neve neur b		Sand (0.06-2mm)		<10% 10-35% 35-65%	65-90% >90
row (a) Capatrian - Cotions		Fines (silt and clay <0.06mm)		Detritus cover	
		the second of an architecture of the second of		<10% 10–35% 35-65%	65-90% >909

<10% 10-35% 35-65% 65-90% >90%

AUSRIVAS Physical Assessment Protocol Field Data Sheets Page 1	Site No. <u>014</u> Date <u>23.818</u>
Date 23.8.18 Site No. 014 Time 14.30.  River Name 14.30 CARRL Location 10.7 24 P	
Weather CLIME ► SUMMIT Rain in last week? Y [ ] N M Photograph numb	
1 49 4 7 9 8 8 9 10 7   Longitudo: 1 5 6 6 1 1 1 7	3+4 LENTRE, S+6 D/S B CHLUCKTS UNDER TRACK
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodplain features.  Left bank is facing downstream.	LENGTH OF SAMPLING SITE  Bankfull width
Scoures Low FLOW MANNEL	Notes  SITE MICHAY MODIFICO  CREEK IN AGRICULTURE:
PLOW OF PRIMARY LOVERD BY NATIVE CRASS	CROPPING LAND SCAPE
	BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a). AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

BASIC WATER CHEMISTRY	Units	Valley shape Choose one category only	Local impacts on streams Choose one or more categories and describe the detail of each
Temperature Conductivity	°C	Steep valley	Sand or gravel mining  Sewage effluent  Other mining  Channel straightening
Dissolved Oxygen	mg l <sup>-1</sup>	Shallow valley	Road River improvement work
Dissolved Oxygen Sat	%		Bridge / culvert / wharf Water extraction
pH		Broad valley	Ford / ramp Dredging
Turbidity			Discharge pipe Grazing
Total nitrogen		Gorge	Forestry activities Litter
Total nitrogen	-	A	Sugar mill Recreation
ALKALINITY		Symmetrical floodplain	Irrigation run-off or Other
Amount of water	ml		Description LEVEE - CONSTRUCTED ACON
Amount of H <sub>2</sub> SO <sub>4</sub>	ml	Asymmetrical floodplain	BOTH BAMILS
Alkalinity	mg l <sup>-1</sup>	Посаріан	
			Local landuse Choose one category for each bank
Floodplain width		Average (m)	Left Right
Floodplain features	EXTENS	INE TO BROAD TO	Native forest
Choose one or more features when present			Native grassland (not grazed)
Sampling site has no distinct floodplain		oll systems	Grazing (native or non-native pasture)
Oxbows / billabongs		ort, crescentic strips or patches formed ng the inner bank of a stream meander	Exotic grassland (lawns etc., no grazing)
Body of water occupying a former river meander, isolated by a shift in the stream		ays	Forestry Native [ ][ ] Pine [ ][ ]
channel		all alluvial fan formed where an rloaded stream breaks through a levee	Cropped Rainfed [ ] [ ]
Remnant channels Formed during a previous hydrological		deposits material on the floodplain	Urban residential
regime. May be infilled with sediment		odplain scours our holes formed by the concentrated	Commercial
Flood channels A channel that distributes water onto the		aring and digging action of flowing water	Industrial or intensive agricultural
floodplain and off the floodplain during		floodplain features present	Recreation
floods		odplain present at the sampling site but	Other

#### Site No. 614 Date 23 8-18 Longitudinal extent of riparian vegetation Riparian zone composition Choose one category for each bank. Do not Assess for whole sampling site include ground layer except where site is in % Cover Left Right Vegetation Description native grassland. bank bank Trees (>10m in height) 0 тоге None 100% 0 Trees (<10m in height) Isolated / scattered May total Shrubs than ROLLY POBLY. Regularly spaced 90 Grasses / ferns / sedges GRASS NATIUE Occasional clumps Semi-continuous Shading of channel Continuous - 25% 26 - 50%51 - 75%> 76% Regeneration of native woody vegetation Extent of trailing bank vegetation Native and exotic riparian vegetation Is the sampling site in undisturbed forest? % Native 30 moderate YIINM Total 100% % Exotic 10 extensive slight Abundant (>5% cover) and healthy If no, record Present regeneration Very limited (<1% cover) category Overall vegetation disturbance rating Choose one category only. Sites with valley vegetation cleared on BOTH sides, but with riparian vegetation in good condition should be scored in the high disturbance category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

### Extreme disturbance X cleared cleared exotic only A

Riparian vegetation - absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)

Valley vegetation - agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

# Very high disturbance



◀ Riparian ▶

✓—Valley——▶

Riparian vegetation - some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species Native species severely reduced in number and

Valley vegetation - agriculture and/or cleared land BOTH sides Plants present are virtually all exotic species (willows, pines etc.)

### High disturbance



Riparian vegetation - moderately disturbed by stock or through the intrusion of exotic species. although some native species remain

Valley vegetation - agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

# Moderate disturbance



Riparian vegetation - native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

Valley vegetation - agriculture and/or cleared land on ONE side native vegetation on the other in reasonably undisturbed state

### Low disturbance



Riparian vegetation - native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor.

Valley vegetation - native vegetation present on BOTH sides of the river with a virtually intact canopy and few exotic species

### Very low disturbance

undisturb	undisturb
coco pri	com
III)*	***************************************
◀ Ripa	man 🕨
✓ Val	

Riparian vegetation - native vegetation present on BOTH sides of the river and in an undisturbed state Exotic species are absent or rare. Representative of natural vegetation in excellent condition

Valley vegetation - native vegetation present on BOTH sides of the river with an intact canopy. Exphc. species are absent or rare. Representative of national vegetation in excellent condition.

	riers to local fish ategory for each flow		Type of bars Choose one of	r more categories	Extent of	bars mbed forming a b	ar of any bu	pe 80 %
60		Base Low I	High How	Bars absent	Dominant	sediment particle	e size on ba	ars
9	No passage	$\boxtimes$		Side/point bars VEGETATED	Sand Channel n	Silt/cla	ny [ ] or	
S	Very restricted passage			Side/point bars UNVEGETATED		No modifications		Reinforced
8	Moderately restricted passage			Mid-channel bars VEGETATED	74.45	Desnagged	4 %	Revegetated
	Partly restricted passage			Mid-channel bars UNVEGETATED  Bars around		Dams and diversions	00	Infilled
3	Good passage			obstructions  Braided channel		Resectioned	00	Berms or embankments
5	Unrestricted passage			Infilled channel	× ZZ	Straightened	Signs of work still	Recently channelised
pe and heig	ht of barrier(s)	J	- 5	High flow deposits	J.	Realigned	Works old and revegetated	Channelised in the past
nannel sha	ipe Choose one ca	tegory only						
V			×			7	1	
	U shaped	Flat U sha	ped Deepen	ed U shape Wide	ened or infilled	Two	stage	Multi st
1						~		
	Box	Wide	box	V shaped	Trapezoid	Concr	ete V	Pipe or cu

Bank shape Choose one category for each bank	Bank slope Choose one category for each bank	Sediment oils
Left Right bank bank	Left Right bank bank	
Concave	Vertical 80 - 90°	none flecks globs sheen slick
Convex	Steep 60 - 80°	Sediment odours  in normal/none sewage petroleum chemical
Stepped	Moderate 30 - 60°	anaerobic other
Wide lower bench	Low 10 - 30°	normal/none sewage petroleum chemical other
Undercut	Flat <10°	Turbidity (visual assessment)  Clear Slight Turbid Opaque
Factors affecting bank stability Choose one or more categories  None	Bedrock outcrops Assess % of each bank covered by bedrock outcrops % bedrock outcrops Left bank	Is water clarity reduced by:  Suspended material (e.g mud, clay, organics)  Dissolved material (e.g plant leachates)
Mining Vegetation  Runoff Irrigation draw-down  Stock Reservoir	Right Bank  Artificial bank protection measures Choose one or more categories	Water level at the time of sampling  Dry No flow Low Baseflow or near baseflo  High Flood (don't sample)
access releases Human Seepage	None Fenced stock watering points	Artificial features at the sampling site Choose one or more categories
Ford, culvert Flow and	Levee banks Vegetation plantings	Major Minor Ford Bridge Culvert Other weir
or bridge waves  Feral animals Drainpipes	Rock or wall layer Logs strapped to bank	Description Cue vent 2 V 2 V 1 V 1 V 1 V 1 V 1 V 1 V 1 V 1 V
Other Description	Fenced human Concrete channel lining	Large woody debris
Description	Other Livet ellereth and	Overall % cover of logs and branches greater than 10cm in diameter

<b>AUSRIVAS Physical</b>	Assessment Protoco	I Field	Data	Sheets
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Extent of bedform features Macrophyte cover Assess % cover of the sampling site by each category. Total % composition for all features must equal 100% % cover of emergent macrophytes Overall % cover of macrophytes Waterfall % of site Height >1m % cover of floating macrophytes Gradient >60° Est. Av. Length (m) Est. Av. Height (m) % cover of submerged macrophytes Est. Av. Gradient (°) % of site Step Height <1m Cascade Macrophyte composition Gradient 5-60° Est. Av. Length (m) Use a macrophyte field guide (i.e. Sainty and Jacobs, 1994) to aid identification. Strong currents Est. Av. Height (m) Listed macrophytes can be changed to reflect the common taxa present in each State or Territory Est. Av. Gradient (°) N denotes a native taxa and I denotes an introduced taxa. Gradient 3-5° Rapid % of site Emergent macrophytes Submerged macrophytes Strong currents Rocks break Est. Av. Length (m) Present cover Present cover surface Est. Av. Depth (m) Ceratophyllum (Hornwort) N Brachiaria (Para Grass) I Est. Av. Width (m) Chara (Stonewart) N Crassula (Crassula) N Riffle Gradient 1-3° % of site Cyperus (Sedge) I/N Elodea (Canadian Pondweed) I Moderate currents Est. Av. Length (m) Surface unbroken Eleocharis (Spikerush) N Myriophyllum (Water Milfoil) I/N Est. Av. Depth (m) but unsmooth Est. Av. Width (m) Juncus (Rush) I/N Nitella (Stonewart) N Paspalum (Water Couch) N Potamogeton (Pondweed) N Glide Gradient 1-3° % of site Small currents Est. Av. Length (m) Phragmites (Common Reed) N Triglochin (Water Ribbon) N Surface unbroken Est. Av. Depth (m) and smooth Ranunculus (Buttercup) I Vallisneria (Ribbonweed) N Est. Av. Width (m) Scirpus (Clubrush) N Other Run Gradient 1-3° % of site Triglochin (Water Ribbon) N Other Small but distinct Est. Av. Length (m) & uniform current Typha (Cumbungi) N Est. Av. Depth (m) Surface unbroken Est. Av. Width (m) Other Floating macrophytes Pool Present Area where % of site stream widens or Other Azolla (Azolla) N Est. Av. Length (m) deepens and Est. Av. Depth (m) current declines Callitriche (Starwart) | Est. Av. Width (m) Backwater % of site A reasonable sized 1-20% of channel Est. Av. Length (m) Other width) and off Est. Av. Depth (m) unicition awary from Overall % cover of native macrophyte taxa Est. Av Width (m) Total should equal overall % cover of macrophytes from above Overall % cover of native macrophyte taxa

Moles. An artiflingral response variable planform channel pattern. by interestation in the office.

Site No. 014 Date 23 8 14

Page 6

# Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes, overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1)

Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2)

Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily

### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

32-60% fine sediment, low availability of interstitial spaces

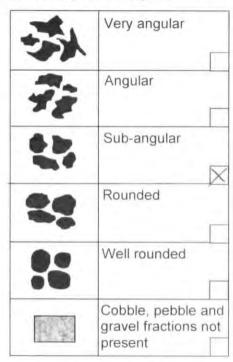


Matrix dominated

>60% fine sediment, interstitial spaces virtually absent

# Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

Stable

Unstable - depositing

### Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening Bare, severely eroded banks Erosion heads. Steep streambed caused by erosion

#### Moderate erosion

Little fine sediment present Signs of channel deepening. Eroded banks Streambed deep and narrow Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

#### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material

### Moderate deposition

Moderate build-up of fine sediments at obstructions and bars Streambed flat and uniform Channel wide and shallow

# Severe deposition

Extensive build up of fine sediments to form a flat bed Channel blocked but wide and shallow Bars large and covering most of the bed or banks Streambed comprised of unconsolidated (loosely arranged and unpacked) material

AUSRIVAS Physical	and Chemical Assessment Protocol Field Data	Sheets Page 8
Site No.	Date	

# HIGH GRADIENT STREAMS

Page 1 of 2

Habitat	-							C	ondi	tion	cate	gon	1										
parameter		E	xcelle	nt				Good	1				Fair					P	oor				
1. Epifaunal substrate / available cover	Greater than 70% of substrate favourable for epifaunal colonisation and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habital and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).  20 19 18 17 16					habit full of pote habit of pot of act the f not y	tat, we colonis ntial, tat for opulat ddition form of yet pro- nisation	ell-sur sation adequi main ions, p ial sub if new epared	tenand preser pstrate fall bit d for ay rate	ce nce a in ut	habi avai desi freq	tat; h labilit rable	abitat y less subs			Less than 20% stable habitat, lack of habitat is obvious; substrate unstable or lacking.							
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1			
2. Embeddedness	tiness boulder particles are 0- 25% surrounded by fine boulder particles are 25- 50% surrounded by fine 75					boul 75%	der p	ounde	and is are at by t		me Su	ulder ore th	part part an 7 nded nt	cles 5%	are								
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	T		
3. Velocity / depth regime	regir deep deep	slaw fast- 3m/s	esent shallo	(slow- ow fas w) SI	st-	pres miss than	ent (if				regir	nes p	reser	habita nt (if fa shall core to	ist- ow	Dominated by 1 velocity/depth regime (usually slow-deep)							
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1			
4. Sediment deposition	islan less affec	ids or	point to 6% of y sedir	gemen pars ar the bot nent	id	from sedi	format gravi ment om aff	tion, n el sar 5-30°	d or f	ine ne	new sedi new botto sedi obst cons mod	grav ment bars om at ment ruction striction	on old 30-5 fected depo ons	0% of 1, sits at nd ber sition	the	mi de 50 ch po to	ateria ivelop i% of angir iols a	deporting incoment the transfer incoment incomen	mo nottor quen absi	ed ba re th n tly ent d	an		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1			
5. Channel flow status	both	lower mai an mei su	banks	of .		<25	able of	>75% channi channi is exp	el	е	avail and/	able or rif	chanr	strate		Very little water in channel and mostly present as standing pools							
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1			
6. Channel alteration						Channelization or Some channelization or dredging absent or present usually in areas of bridge abutments			Chamielization may be extensive empankments or shoring structures present on both banks, and 40 to 80% of stream reach channelized and disrupted.					80% of the stream reach channelized and									
						20 y	r) ma recent	y be p	resen		disri	upted			1.4								

AUSRIVAS Physical	and Chemical Assessment Protocol Field Data Sheets	Page 9
Site No.	Date	

# HIGH GRADIENT STREAMS

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Habitat								(	Cond	itio	n cate	ego	ry							
parameter		Exc	elle	ent			-	Good	1				Fair					Pod	or	
7. Frequency of riffles (or bends)	relative of dista riffles of the stri- (general of habit stream continu- of boul	Occurrence of riffles relatively frequent, ratio of distance between riffles divided by width of the stream < 7.1 (generally 5 to 7); variety of habitat is key in streams where riffles are continuous, placement of boulders or other large, natural obstruction									nerally all flat water or allow riffles, poor itat, distance ween riffles divided the width of the earn is a ratio of >25									
SCORE	20 1	9 1	18	17	16	15	14	13	12	11	10	9	.6	7	6	5	4	3	2	1 (
8. Bank stability (score each bank)	Banks stable, evidence of erosion or bank failure absent or minimal, little potential for future problems <5% of bank affected				of er	quent osion 5-3 h has	y stab sma mosti 0% of areas	l area y heal bank	ed	60% has a high	Moderately unstable, 30- 60% of bank in reach has areas of erosion, high erosion potential during floods.				are free sec obs	as, in quen tions vious 1001	e, man aw an along and b bank s to of ba	eas stran ends sloug ink h	ght	
SCORE	Left ba	ank	T	10	9	8		1	T	6	5		4	T	3	_	2	1	T	0
SCORE	Right	bank		10	9	8	1	7		6	5		4		3		2	1	1	0
9. Vegetative protection (score each bank)	stream and im zone ci vegetal trees, i shrubs macrop disrupt grazing minima	More than 90% of the streambank surfaces and immediate ripanan zone covered by native vegetation including trees, understorey shrubs or non,woody macrophytes vegetative disruption through grazing or mowing minimal or not evident, almost all plants allowed				ore than 90% of the reambank surfaces in immediate ripanan in covered by native gelation, including gelation including rubs, or non,woody acrophytes vegetative full plant growth potential to any great extent, more than one half of the potential plant stubble neight.					50-70% of the streambank surfaces covered by vegetation disruption obvious, patches of bare soil or closely cropped vegetation common less than one-half of the potential plant stubble height remaining					Less than 50% of the streambank surfaces covered by vegetation, disruption of streambank vegetation is very high, vegetation has been removed to 5 centimetres or less in average stubble height				
SCORE	Left ba	ank		10	9	8		7		6	5		4	1	3	3	2	1	1	0
SCORE /	Right I	bank		10	9	8		7		6	5		4	1	3	1	2	1		0
10. Riparian zone score (score each bank)	Width in >18 me activities lawns not implicated and implications.	etres es (i e crops	hun roi etc	nan ads. : ) hav	ve	12-1 activ	B met	ipariar tres, h tave in n zone	uman npacti		12 m activi	etre	npana s hum have ir an zoni	an npaci	ed	Width of riparian zone <6 metres, little or no riparian vegetation is present because of human activities				
SCORE	Left ba	ank	1	10	9	8		7		6	5		4	T	3		2	1		0
			_	_					-											

TOTAL HIGH GRADIENT HABITAT SCORE

# LOW GRADIENT STREAMS

Page 1 of 2

Habitat								(	Conc	litio	n cat	ego	ry								
parameter		E	cell	ent			- 1	Goo	d			-	Fai	-				P	oor		
1. Epifaunal substrate / available cover	sub epiti and snai und or o and colo (i e not	eater the strate aunal fish of gs. su ercut other s at standard for the st	colonicover banks table age to on pot snags	irable sation mix or ged lo cobi habita allow ential that a	f ligs ble st full	hab full pote hab of p of a the not	itat; w colonii antial; itat foi opulat ddition form o yet pro- priisatii	rell-sui sation adequations tions nal sul of new eparei	tenani preser bstrate fall, be d for ay rate	ce nce a in ut	hab avai desi freq	itat h labilit irable	mix of labitat y less subs y distu	than		Less than 10% stath habitat, lack of habit obvious, substrate unstable or lacking.				habitat is rate	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	1
2. Pool substrate characterization	and root subs	firm s firm s mats merge	with and pand	gravel irevale	ant.	be c	or classification of the communication of the commu	ant, so	ud ma ome ro erged	tot	bott	om li	r clay ttle or ubme	no ro		be		an cla k. no ion.		mat	or
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	×	5	4	3	2	1	0
3. Pool variability	shall sma	n mix llow, la all-sha p pool	erge-d	leep, mail-					s large shallor		mon		valent					y of p			
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	of is	e or no lands less t om aft ment	or po han 2 lected	nt bar 0% of by	rs	from sedi botti	forma grav ment, om aff	tion n el sar 20-50	ease in nostly nd or f 0% of sligh ols	ine the	new botto sedi obst cons	gravi ment bars om af ment cruction striction	depo el sar on ok 50-8 fected depo ons ons ar depo valent	nd or following and of the control o	the ids	de 80 ch po	ateria velop % of angir ols a	deposition in the transfer in	mo ottor quen abse	ed bare the	ar ian
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	X	0
5. Channel flow status	both	er rea lower mal ar nnel si osed	bank mount	s and		avail <25	lable of	>75% channe channe is exp	BÍ	е	avail and/	able or nff	25-7 chann le sub y expo	el strate		ch	anne	le wa l and l as s	mos	tly	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	D
6. Channel alteration	dred	nneliz Iging a mal, s nal pa	absen tream	t or		pres of br evide char dred 20 y	ent u ridge a ence i nneliza Iging ( r) ma	abutmof pasi ation, i greate y be p	in are ents	1	extension of street and reac	nsive nonng ent o 40 to	ation emb struc n both 80% inneliz	ankme tures bank of stre	ants s eam	gai 80 chi dis	bion % of anne rupte bitat	shore or ce the s lized ad tr great d ent	ment tream and astrea ly alle	oye n rez	ach.
								ation is	s not												

Continued over

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AUSRIVAS	Physical	and Chemical	Assessment	Protocol	Field Data	Sheets	Page 11	į
Site No.	014	Date	23.8.18					

# LOW GRADIENT STREAMS

Page 2 of 2

Habitat						C	onditio	n cate	gory							
parameter		Exce	llent			Good	1		F	air			Po	oor		
7. Channel sinuosity	The be increas length longer straigh channe considi coastal low-lyir parame rated in	se the : 3 to 4 than if it line is braid ered no i plains ng area eter is	stream times if was (Note ling is ormal and is and in not ea	in a	The ben increase length 2 longer th straight	the stre to 3 tim an if it	es	increa 2 time	ase the	the stream stream er than ight line	1 to	chann	waterway has been channelized for a long distance			
SCORE	20 1	19 1	8 1	7 16	15 14	13	12 11	10	9 8	7	34	5 4	3	2	1 0	
8. Bank stability (score each bank)	Banks of eros absent potentia probler affecte	or mir al for f	bank l nimal, uture	ailure little	Moderatinfrequer of erosion over 5-reach has erosion	nt small on mostl 30% of	l areas y healed bank in	60% has a high i	of bank reas of	nstable in reac erosion potentia	h	freque section obviou 60-10		areas ng str i bend k slou bank	aight is.	
SCORE	Left ba	ank	10	9	8	7	6	5	1	M	3	2		1	0	
SCORE	Right I	bank	10	9	>8<	7	6	5		4	3	2		1	0	
9. Vegetative protection (score each bank)	More the stream and important trees, to shrubs macropy disrupt grazing minima almost to grow	bank s medial overed tion, in unders i, or no phytes tion thr g or mo all or no all pla	surface te ripal by na cludin torey in woo vege ough owing at evid- ints all	es nan ative g ady tative	of plants represer evident t	ank sur by nation on but of is not vo- ited dis- but not a growth reat extean one in intial plan- height	one class well- truption affecting potential ent half of	stream cover disruit patch close veget than it poten	ed by votion ob es of body by cropp ation co one-hab	surface egetation vious are soil and mmon of the	or less	stream covered disrup vegeta vegeta remov centin	han 50 nbank ed by viton of ation is ation hi ed to: netres ge stuf	surfa vegeta strea very as be or les	ces ation ambank high en	
SCORE	Left ba	ank	10	9	>	7	6	5	1	4	3	2		1	0	
SCORE	Right I	bank	10	194	8	7	6	5		1	3	2		1	0	
10. Riparian zone score (score each bank)	VVidth ( >18 me activities lawns not important)	etres, les (i.e. crops	roads etc.   )	lave	Width of 12-18 m activities the ripar minimal	etres, h have in ian zone	uman npacted	12 m	atres, h	rian zor uman e impac one a g	ited	npana	atres la in vege	ittle or etation ause	1 IS	
SCORE	Left ba	ank.	10	9	8	7	6	5		1	3	2		1	>0<	
SCORE	Right I	Bank.	10	9	8	7	6	5		1	3	2	-	1	-	

TOTAL LOW GRADIENT HABITAT SCORE



Site No. 014

Date \_23.8.18

# Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams). Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

Bank height (m)	The channel sketch should show in cross	section the shape of the channel and include the location of	Type of Riffle	bedform at the cross-section  Bankfull channel width (m)  (=total of boxes A+B+C)  mm width at the water mark (m)  width at the water surface (m)
Bank width (m)  Vertical distance between the water surface and the water mark (m)  Riparian zone width	Horizontal dis		urement	Bank width (m)  Vertical distance between the water water mark (m)
Bank material Assess  Bedrock  Boulder (>256mm)  Cobble (64-256mm)  Pebble (16-64mm)  Gravel (2-16mm)  Sand (0-00-20m)  Limes (oill and clay =0.060m)	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m of the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	either side of	Assess in the area 5m either side of the cross section    <10%

<b>AUSRIVAS Physical</b>	and Chemical	<b>Assessment Protoco</b>	I Field Data Sheets	Page 13
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Site No. 014

Date 23.8.18

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	Cross-section sketch	BAME FULL RE	Type of	s-section number of bedform at the cross-section  Run
				Bankfull channel width (m) (=total of boxes A+B+C)
Bank height (m)			Strea	m width at the water mark (m)
1-2		s-section the shape of the channel and include the location of ill points. Also show other features such as bars, rocky cross section.		width at the water surface (m)
Bank width (m)	Horizontal dis	stances (m)		Bank width (m)
Vertical distance between the water surface and the water mark (m)	3 Vertical water	r depths (cm)  Notes on cross-section measu	rement	Vertical distance between the water surface and the water mark (m)
Riparian zone width				
Left bank _ (m) R	Right bank 4 (m)			
Bank material Assess	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m ethe cross-section	ither side of	Assess in the area 5m either side of the cross section  Assess in the area 5m either side of the cross section  35-65% 65-90% >90%
Bedrock		Bedrock	)	Parinhutan sausa
Boulder (>256mm)		Boulder (>256mm)		Periphyton cover
Cobble (64-256mm)		Cobble (64-256mm)	3%	X <10% 10–35% 35-65% 65-90% >90%
Pebble (16-64mm)		Pebble (16-64mm)	5 Z & Yout lead 100%	Moss cover
Gravel (2-16mm)	70 11	Gravel (2-16mm)		<10% 10-35% 35-65% 65-90% >90%
Sand (0.06-2mm)		Sand (0.06-2mm)	30	A 10 % 10 - 55 % 35-05 % 35 50 % 1 50 %
Fines (silt and clay, <0.06mm		Fines (silt and clay <0.06mm)	45	Detritus cover
	Total 100% each			X <10% 10-35% 35 65% (65 00 ) - 90

ank height (m)	Cross-section sketch		Type of	bedform at the cross-section Run Pool Cascade Other Bankfull channel width (m)	of
1	he change sketch should show in excess			Bankfull channel width (m)	1
1 1		-section the shape of the channel and include the location of il points. Also show other features such as bars, rocky ross section		(=total of boxes A+B+C)  am width at the water mark (m)  width at the water surface (m)	Bank height
Bank width (m)  Vertical distance etween the water surface and the water mark (m)	Horizontal dis				Vertical distant between the was surface and the water mark (m)
Riparian zone width		Notes on cross-section measuren	ient		mater man (m)
Left bank (m) Rig Bank material Assess % Bedrock Boulder (>256mm)		Substrate composition Assess % composition in the area of bed 5m either the cross-section.  Bedrock Boulder (>256mm)	side of	Filamentous algae cover the cro  <10% 10-35% 35-65% 65- Periphyton cover	rea 5m either side of oss section 90% >90%
obble (64 256mm) ebble (16 04mm) fravel (2 16mm) atril (9 0) 2mm) frass (without) by >0 06mm)		Cobble (64-256mm)  Pebble (16-64mm)  Gravel (2-16mm)  Sand (0.06-2mm)  Fines (silt and clay < 0.06mm)	Total 100%	<10%	-90%>90% -90%>90%

AUSRIVAS Physical Assessment Protocol Field Data Sheets	Page 1	Site No. 915 Date _22.8 (8.
Date 22-8-18 Site No. 015 Time 0  River Name & Name ONAINACE LINE Location Lot		
Weather CLERGE + SARRY Rain in last week? Y [ ] N [X]	Photograph numl	bers and details  3+4 counce \$+6 0/5  WS , 3+4 counce , 5+6 0/5
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or flood Left bank is facing downstream.	dplain features.	LENGTH OF SAMPLING SITE  Bankfull width (m)  x 10  Length of sampling site (m)
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	N	Notes  DRAWAGE UNE IN PARRICE  DIM FISH MAGITAT VALUE  THIS SITE LOCATED DE OF  SITE 14. SITE 13 NOT SAMPLE  SEE COLLECTOR NOTES FOR  MORE DETAIL.
RICHT BA-16-		BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

BASIC WATER CHEMISTRY	Linita	Valley shape	Local impacts on streams
Temperature	<u>Units</u> °c	Choose one category only	Choose one or more categories and describe the detail of each
Conductivity		Steep valley	Sand or gravel mining Sewage effluent  Other mining Channel straightening
Dissolved Oxygen	mg l <sup>-1</sup>	Shallow valley	
Dissolved Oxygen Sat.	%	Shallow Valley	
pH		Proof wells	Bridge / culvert / wharf Water extraction
Turbidity		Broad valley	Ford / ramp Dredging
Total phosphorus	•	Come	Discharge pipe Grazing  Forestry activities Litter
Total phosphorus Total nitrogen		Gorge	Decreeties
ALKALINITY		Symmetrical floodplain	Irrigation run-off or Other
Amount of water	ml		pipe outlet  Description on Social Option
Amount of H₂SO₄ Alkalinity	ml mg l <sup>-1</sup>	Asymmetrical floodplain	Description
Floodplain width		Average (m) ALEH FLOOR PLANT	Local landuse Choose one category for each bank Left Right
loodplain features	. On billy the	HECH FCOOD FLATURE	Native forest
choose one or more features when present			Native grassland (not grazed)
Sampling site has no distinct floodplain Oxbows / billabongs	Scro	oll systems t, crescentic strips or patches formed	Grazing (native or non-native pasture)
Body of water occupying a former river	alon	g the inner bank of a stream meander	Exotic grassland (lawns etc., no grazing)
meander, isolated by a shift in the stream channel	Spla Sma	ays all alluvial fan formed where an	Forestry Native [ ][ ] Pine [ ][ ]
Remnant channels	over	loaded stream breaks through a levee	Cropped Rainfed [ ] [ ] Irrigated [ ] [ ]
Formed during a previous hydrological regime. May be infilled with sediment		deposits material on the floodplain	Urban residential
Flood channels	Scoi	ur holes formed by the concentrated	Commercial
A channel that distributes water onto the floodplain and off the floodplain during	<del></del>	ring and digging action of flowing wate	Industrial or intensive agricultural
floods	No 1 Floo	floodplain features present dplain present at the sampling site but	Recreation
	does	s not contain any of the above features	Other

AUSRIVAS Physical Assessment Protocol Field	d Data Sheets

Page	3
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Riparian zone composition			Longitudinal extent	of riparian vegetati	ion	
Assess for whole sampling site	% Cover	Vegetation Description	Choose one category for include ground layer excenative grassland.		Left bank	Right bank
Trees (>10m in height)			None	~~		$ \times $
Trees (<10m in height)	<u> </u>	100% 100%	Isolated / scattered	~ ~		
Shrubs	<u> </u>	May total  than 10  than 10  white charts / thousand more \$  consider the property of the prop	Regularly spaced	····	1 🗂	$\Box$
Grasses / ferns / sedges	<u> </u>	NATIVE CRASS/MOSTER WEEDS	Occasional clumps	950		Ħ
Shading of channel			Semi-continuous	Section in the same		Ħ
	26 – 50%	51 – 75% > 76%	Continuous	Shranger destruction of the state of the sta		
Extent of trailing bank vege	etation derate	Native and exotic riparian vegetation  % Native		ative woody vegetat in undisturbed forest		
slight exte	ensive	% Exotic \int \text{Total 100%}	If no, record	Abundant (>5% cove Present Very limited (<1% co		nealthy
Overall vegetation disturba Choose one category only. Site	_	etation cleared on BOTH sides, but with riparian vegetatio	n in good condition shou	ald be scored in the hig	h disturt	oance

category. Words within the drawings summarise the detailed text about the state of the riparian and valley vegetation for each category.

# Extreme disturbance



Riparian vegetation - absent or severely reduced. Vegetation is extremely disturbed (ie. dominated by exotic species with native species rare or completely absent)

Valley vegetation - agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

# High disturbance



Riparian vegetation - moderately disturbed by stock or through the intrusion of exotic species. although some native species remain

Valley vegetation - agriculture and/or cleared land ONE side, native vegetation on the other side clearly disturbed or with a high percentage of introduced species present

# Low disturbance



Riparian vegetation - native vegetation present on BOTH sides of the river and in relatively good condition with few exotic species present. Any disturbance present is relatively minor.

Valley vegetation - native vegetation present on BOTH sides of the river, with a virtually intact canopy and few exotic species

# Very high disturbance



Riparian vegetation - some native vegetation present, but it is severely modified BOTH sides by grazing or the intrusion of exotic species. Native species severely reduced in number and

Valley vegetation - agriculture and/or cleared land BOTH sides. Plants present are virtually all exotic species (willows, pines etc.)

### Moderate disturbance



Riparian vegetation - native vegetation on BOTH sides with canopy intact or with native species widespread and common in the riparian zone. The intrusion of exotic species is minor and of moderate

Valley vegetation - agriculture and/or cleared land on ONE side, native vegetation on the other in reasonably undisturbed state

### Very low disturbance



Riparian vegetation - native vegetation present on BOTH sides of the river and in an undisturbed state. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

Valley vegetation - native vegetation present on BOTH sides of the river with an intact canopy. Exotic species are absent or rare. Representative of natural vegetation in excellent condition

AUSRIVAS P	hysical Assessme	ent Protoco	l Field	d Data Sheets		Page 4	Site No. 615	Date	22.8.68.
Physical bar Choose one ca	rriers to local fish ategory for each flow	condition		Type of bars Choose one or more ca	ategories			ar of any typ	De
	No second	flow flow	flow	Bars	absent	Dominan	t sediment particle	size on ba	ars
G	No passage					Sand	[ ] Silt/cla	y [່ $\!$	mm
	Very restricted passage			Side	/point bars	Channel	No	oose one or i	Reinforced
	Moderately restricted			Mid-	channel bars		Desnagged		Revegetated
	passage Partly restricted		LJ	Mid-c	channel bars	78.55			
	passage			Bars	around		Dams and diversions	<b>D</b>	Infilled
\$	Good passage					7	Resectioned		Berms or embankments
5	Unrestricted passage		$\boxtimes$	Infille	d channel	212-27	Straightened	Signs of work still	Recently channelised
Type and heig	ht of barrier(s)			High	flow deposits		Realigned	Works old and revegetated	Channelised in the past
Physical barriers to local fish passage Choose one category for each flow condition    Base   Low flow flow flow flow flow flow flow fl									
							7		
	U shaped	Flat U sha	aped	Deepened U sha	ipe Widene	ed or infilled	Two s	tage	Multi stage
						_			
	Box	Wide	box	V shap	ed	Trapezoid	Concre	te V	Pipe or culvert

AUSRIVAS Physical Assessment P	rotocol Field Data Sheets	Page 5 Site No. <u>015</u> Date <u>22 8 · 18</u>
Bank shape Choose one category for each bank Left Right	Bank slope Choose one category for each bank Left Right	Sediment oils  absent light moderate profuse
Concave bank bank	Vertical 80 - 90°	Water oils
Convex	Steep 60 - 80°	Sediment odours  normal/none sewage petroleum chemical
Stepped	Moderate 30 - 60°	water odours
Wide lower bench	Low 10 - 30°	normal/none sewage petroleum chemical other
Undercut	Flat <10°	Turbidity (visual assessment)  ☐ Clear ☐ Slight ☐ Turbid ☐ Opaque
Factors affecting bank stability Choose one or more categories  None Cleared vegetation Irrigation draw-down Stock access Human access Ford, culvert or bridge Feral animals Other  Description	Assess % of each bank covered by bedrock outcrops % bedrock outcrops	ls water clarity reduced by:

JSRIVAS Physical Assessment Protocol Field Data	Sheets Page (	6 Site No. <u>015</u> Date <u>22.8-15</u>
xtent of bedform features otal % composition for all features must equal 100%	Macrophyte cover Assess % cove	r of the sampling site by each category.
Height >1m	Overall % cover of macrophytes	% cover of emergent macrophytes % cover of floating macrophytes % cover of submerged macrophytes
Step Height <1m Gradient 5-60° Strong currents  Cascade  ———————————————————————————————————	Macrophyte composition Use a macrophyte field guide (i.e. Sair Listed macrophytes can be changed to N denotes a native taxa and I denotes	nty and Jacobs, 1994) to aid identification.  o reflect the common taxa present in each State or Territory.  an introduced taxa
Gradient 3-5° Strong currents Rocks break surface Surf	Emergent macrophytes Present	% Submerged macrophytes
surface Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Width (m)	Brachiaria (Para Grass) I Crassula (Crassula) N	Ceratophyllum (Hornwort) N
Gradient 1-3° oderate currents urface unbroken but unsmooth but unsmooth	Cyperus (Sedge) I/N	Chara (Stonewart) N Elodea (Canadian Pondweed) I
Est. Av. Width (m)	Eleocharis (Spikerush) N  Juncus (Rush) I/N	Myriophyllum (Water Milfoil) I/N  Nitella (Stonewart) N
Gradient 1-3° Small currents surface unbroken  Glide  ———————————————————————————————————	Paspalum (Water Couch) N  Phragmites (Common Reed) N	Potamogeton (Pondweed) N
and smooth Est. Av. Depth (m) Est. Av. Width (m)  Gradient 1-3°  Run  9/ of air	Ranunculus (Buttercup) I Scirpus (Clubrush) N	Vallisneria (Ribbonweed) N Other
Gradient 1-3° Small but distinct a uniform current urface unbroken urface unbroken suniform current urface unbroken urface	Triglochin (Water Ribbon) N Typha (Cumbungi) N	Other Other
Est. Av. Width (m)	Other	Floating macrophytes %
tream widens or deepens and current declines Current declines Est. Av. Depth (m)	Other	Azolla (Azolla) N  Callitriche (Starwart)
Est. Av. Width (m)  Backwater  or of site		Other
20% of channel width) cut-off ction away from Est. Av. Length (m) Est. Av. Depth (m)		Other

### Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes, overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1) Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2) Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily

### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework 5-32% fine sediment, moderate availability of interstitial spaces



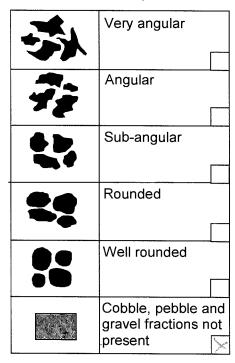
Framework dilated 32-60% fine sediment, low availability of interstitial spaces



Matrix dominated >60% fine sediment, interstitial spaces virtually absent

# Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding ◀

- Stable ·

Unstable - depositing

### Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.

### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.

# Moderate deposition

Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.

### Severe deposition

Extensive build up of fine sediments to form a flat bed. Channel blocked. but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.

AUSRIVAS Physical and Chemica Site No Date	Assessment Protocol Field Data Sheets	Page 8
USEPA Habitat Assessment	HIGH GRADIENT STREAMS	Page 1 of 2

Excellent   Good   Fair   Poor	Circle a score for	each	para	mete	er								311	-						age		_
Excellent   Cood   Fair   Poor   Po	Habitat								(	Cond	ition	cate	gory	,								
Epifaunal substrate / substrate favournable for epifaunal colonisation of shower; mix of snags, substrate favournable for epifaunal colonisation and fish cover; mix of snags, substrate favournable for epifaunal colonisation and fish cover; mix of snags, substrate favournable for epifaunal colonisation and fish cover; mix of snags, substrate favournable for epifaunal colonisation and fish cover; mix of snags, substrate favournable for epifaunal colonisation and fish cover; mix of snags, substrate favournable for epifaunal colonisation and fish cover; mix of snags, substrate favournable for epifaunal colonisation and fish cover; mix of snags, substrate favournable for epifaunal colonisation and the fish of scale).  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment. Layengg of cobble provides diversity of niche space.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Only 3 of the 4 regimes present (saw-deep, fast-shallow), fast-deep, fast-shallow, fast-deep, stat-shallow, fast-deep, stat-shallow, fast-deep, fast-shallow, fast-deep, fas	parameter		E	xcell	ent		1	Good				Τ		Fair			Т.		P	oor		
20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Caravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.  SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  All four velocity/depth regime present (slow-depension) is <0.3m/s, deep is >0.5m).  SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  All four velocity/depth regime present (slow-depension) is <0.3m/s, deep is >0.5m).  SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.  SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Little or no enlargement of elast than 5% of the bottom affected by sediment deposition in pools.  SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Water reaches/base of botth lower barks, and minimal apridunt of channel status  SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Water reaches/base of botth lower barks, and minimal apridunt of channel, substrate is exposed.  SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Water reaches/base of botth lower barks, and minimal apridunt of channel, substrate is exposed.  SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel atteration minimal apridunt of channel substrate is exposed.  SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel atteration or dredging absent or minimal; stream with normal pattern.  Some channelization persent, elevation, i.e. dredging (greater than 200 of stream reach channelized and disrupted. Instream reach channelized and disrupted.	Epifaunal substrate / available cover	substrate favourable for epifaunal colonisation and fish cover; mix of snags, submerged logs, undercut banks, cobile or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).			hab full pote hab of p of a the not	habitat: well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at				habitat; habitat availability less than desirable; substrate frequently disturbed or					habitat; lack of habitat is obvious; substrate							
Embeddedness  boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  All four velocity/depth regimes present (slow-deep, isow-shallow, fast-deep, fast-shallow). Siow is <0.3m/s, deep is <0.5m/s.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  All four velocity/depth regimes present (slow-deep, isow-shallow, fast-deep, fast-shallow). Siow is <0.3m/s, deep is <0.5m/s.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  All title or no enlargement of islands or point bars and deposition  Embeddedness  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Little or no enlargement of islands or point bars and deposition.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Water reachey/base of both lower barks, and minimal agriount of channel substrate is exposed.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Water reachey/base of both lower barks, and minimal agriount of channel substrate is exposed.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Water reachey/base of both lower barks, and minimal agriount of channel substrate is exposed.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Water reachey/base of both lower barks, and minimal agriount of channel substrate is exposed.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel allowers the control of provides and mostly present as standing pools.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channelization or creachey/base of both lower barks, and or fine sediment on old and sold most provident deposition.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channelization or creachey/base or both lower barks, and or fine sediment on old and sold most provident deposition.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channelization or creachey/base or both lower barks, and or fine sediment on old and sol	SCORE	10 10 11			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
All four velocity/depth regime present (slow-deep, slow-shallow), fast-deep, fast-shallow). Slow is <0.3m/s, deep is <0.5m).  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Dominated by 1 velocity/depth regimes present (if fast-shallow is 50.3m/s, deep is <0.5m).  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Dominated by 1 velocity/depth regime present (if fast-shallow is 50.3m/s, deep is <0.5m).  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Moderate deposition of less than 5% of the bottom affected by sediment deposition in pools.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Embeddedness	boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity				509	Gravel, cobble and boulder particles are 25-50% surrounded by fine				boul 75%	Gravel, cobble and boulder particles are 50-75% surrounded by fine					ulder ore th	parti an 7: ided l	cles : 5%	are		
All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow), fast-deep, fast-shallow, fast-deep, fast-shallow, fast-deep, fast-shallow is missing, score low-mark regimes present (if fast-shallow is missing, score low).   SCORE   20   19   18   17   16   15   14   13   12   11   10   9   8   7   6   5   4   3   2   1   0   10   10   10   10   10	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  4. Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.  Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Water reaches/base of both lower barks, and minimal aprount of channel, substrate is exposed.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Water fills >75% of the available channel, and minimal aprount of channel, substrate is exposed.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Water fills >25-75% of the available channel, and before fifte substrates are mostly exposed.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel flow status  Channel gravel, sand or fine sediment old and new bars; 30-50% of the bottom affected; sight deposition in pools.  Water fills >25-75% of the available channel, and before fifte substrates are mostly exposed.  Channel gravel, sand or fine sediment old and new bars; 30-50% of the bottom affected; sight deposition in pools.  Water fills >25-75% of the available channel, and before fifte substrates are mostly exposed.  Channel gravel, sand or fine sediment old and new bars; 30-50% of the bottom affected; sight development; more than 10 over than 10	Velocity / depth	regimes present (slow- deep, slow-shallow, fast- deep, fast-shallow). Slow is <0.3m/s, deep is				present (if fast-shallow is missing, score lower than if missing other				regimes present (if fast- shallow or slow-shallow					velocity/depth regime							
4. Sediment deposition  Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.  Score 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel flow status  Score 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel substrate is exposed.  Score 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel substrate is exposed.  Score 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel substrate is exposed.  Score 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel substrate is exposed.  Score 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel substrate is exposed.  Score 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel substrate is exposed.  Score 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel substrate is exposed.  Score 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel substrate is exposed.  Score 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel substrate is exposed.  Score channelization or dredging absent or minimal; stream with normal pattern.  Score channelization, i.e. dredging (greater than correct of past channelized and 20 yr) may be present, usually in areas of bridge abutments; evidence of past channelized and disrupted. Instream habitat greatly altered or remembers and stream of some present, usually in areas of bridge abutments; evidence of past channelized and disrupted. Instream habitat greatly altered or removed entirely rem	SCORE	-		18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	4	•
SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  5.	Sediment deposition	islan less affec	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment			bar from sedi bott	bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight				new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment						
Score  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel alteration  Channel alteration  Water reaches/base of both lower banks, and minimal aprount of channels, and minimal aprount of channels, and minimal stream with normal pattern.  Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.  Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.  Score  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Channel alteration or dredging absent or minimal; stream with normal pattern.  Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, disrupted.  Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.  Channel available channel, and/or riffle substrates are mostly exposed.  Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely removed entirely.	SCORE	20	19	18	<b>17</b>	16	15	14	13	12	11				7	6	5	4	3	2	1	0
6. Channelization or dredging absent or minimal; stream with normal pattern.  Channel alteration  Channelization or dredging absent or minimal; stream with normal pattern.  Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, usually in areas of bridge abutments; evidence of past channelized and disrupted. Instream habitat greatly altered or removed entirely	Channel flow status	both minir chan	lower nal an nel su	banks lount o	, and of	***	avai <25	Water fills >75% of the available channel; or <25% of channel				avail and/	able c or riffl	hanne subs	el, strates		Very little water in channel and mostly present as standing					
Channel alteration dredging absent or minimal; stream with normal pattern.  dredging absent or may be greater than a stream with normal pattern.  dredging absent or may be greater than a stream with normal pattern.  dredging absent or may be greater than a stream with normal pat	SCORE	20/	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
but recent channelization is not present.	Channel	dred minir	Channelization or dredging absent or minimal; stream with normal pattern.				pres of br evide char dred 20 y but r char	present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not			extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and					gabion or cement; over 80% of the stream reach channelized and disrupted. Instream						
SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	SCORE	20	19	18	17	16			13	12	11	10	9	8	7	6	5	4	3	2	1	0

Site No Dat	e	rage 3
USEPA Habitat Assessment Circle a score for each parameter	HIGH GRADIENT STREAMS	Page 2 of 2

Habitat			•					C	ond	ition	cate	jory										
parameter		Ex	celle	ent				Good				F	air			Poor						
7. Frequency of riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.				Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.				Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.								
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
8. Bank stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.				infred of erd over. reach	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.				Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.							
SCORE	Left	bank		10	9	8		7/		6	5		4		3	_	2		1	(	D	
SCORE	Righ	nt bar	ık	10	9	8		7	T	6	5	$\top$	4		3	7	2	1	1	(	0	
9. Vegetative protection (score each bank)	strea and zone vege trees shru maci disn. graz minii almo	e than ambar imme cove etation s, und bs, or rophy uption ing or mal or ost all cow na	nk sur diate red b , incluerstor non tes; v through not e plants	faces riparia y nativ uding rey woody egeta gh ing eviden s allow	in ve / tive	cover vege of pla repre evide full p to an more the p	70-90% of the streambank surfaces , covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble helght remaining.						Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.				
SCORE	Left	bank	: [	10	9	8		7		6	5		4		3	:	2		1	(	D	
SCORE	Righ	nt bai	ık	10	9	8		7		6	5		4		3	:	2		1	(	0	
10. Riparian zone score (score each bank)	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.			12-1 activi	Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.				Width of riparian zone 6- 12 metres; human activities have impacted the riparian zone a great deal.					Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.								
SCORE	Left	bank		10	9	8	T	7	T	6	5		4		3	:	2		1	-	0	
SCORE	Rial	nt ba	٦k	10	9	8		7	T	6	5	$\top$	4	1	3	:	2		1	_	0	

TOTAL HIGH GRADIENT HABITAT SCORE

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# LOW GRADIENT STREAMS

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Habitat									Cond	litio	n cat	ego	ry								
parameter			xcell				Good					Fai	r			Poor					
1. Epifaunal substrate / available cover	Greater than 50% of substrate favourable for epifaunal colonisation and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonisation potential (i.e. logs/snags that are not new fall and not transient).				30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).			10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.				h:	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.								
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	DK	0
2. Pool substrate characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.				be o	d or cla domina s and	soft say; mu ant; so subm pres	id ma ome ro erged	ot	bott mat	nud o om; lit ; no s etation	tle or ubme	no ro		be		an cl k; no tion.			or	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	K	10
3. Pool variability	Even mix of large- shallow, large-deep, small-shallow, small- deep pools present.			Majority of pools large- deep; very few shallow.			Shallow pools much more prevalent than deep pools.				Majority of pools small- shallow or pools absent.										
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.			Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.			Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent,				Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.										
SCORE	20	19	18	17	<b>)6</b> (	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	both minir	lower mal an mel su	ches I bank mount ubstra	s, and of		avail. <259	able c % of c	>75% hanne hanne s expe	i; or	Э	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.				Very little water in channel and mostly present as standing pools,						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.			Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not			Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.				Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.										
							neliza	tion is	not												

Continued over

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### LOW GRADIENT STREAMS

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Habitat						С	onditio	on cat	category								
parameter		Exce	ellent			Good				Fair					Po	or	
7. Channel sinuosity	increa lengti longe straig chan consi coast low-ly parar	ase the h 3 to 4 er than in the line. nel braidered ratal plain ying are meter is	ands in the stream se the stream 3 to 4 times than if it was in a the line. (Note — el braiding is lered normal in al plains and other ng areas. This eter is not easily n these areas).				am es	incr 2 tir	The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.					Channel straight; waterway has been channelized for a long distance.			
SCORE	20	19 1	18 1	7 16	15 1	4 13	12 1	10	9	8	7	<b>)</b> 6<	5	4	3	2	1 0
8. Bank stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.  Moderately stable; infrequent, small ar of erosion mostly his problems. <5% of bank affected.					areas healed bank in	60% has high	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.				
SCORE	Left	bank	10	9	8	<b>&gt;</b> <	6	5	;	4	T.	3	2		1	T	0
SCORE	Righ	t bank	10	9	8	><	6	5	;	4		3	2		1		0
9. Vegetative protection (score each bank)	More than 90% of the streambank surfaces and immediate ripanian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed			bank surficion, but of the control o	e ne class rell- ruption ffecting potential nt; alf of	stre cov disr pate clos veg than	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.				Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.						
SCORE	Left	bank	10	9	8	7	6	5	;	4	>	<b>3</b> (	2		1		0
SCORE	Righ	t bank	10	9	8	7	6	5	i	4	1	3.	2		1		0
10. Riparian zone score (score each bank)	>18 r activi lawns	h of ripa metres; ities (i.e s, crops mpacted	humar . roads : etc.) h	n , nave	12-18 activities	Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.				f ripariar es; hum s have in ian zone	an npact	ed	Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.				
SCORE	Left	bank	10	9	8	7	6		;	4		3	2		1		್ರಾಂ<
SCORE	Righ	t bank	10	9	8	7	6			4	$\top$	3	2		1		>0<

TOTAL LOW GRADIENT HABITAT SCORE

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# Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

Cross-	section sketch	1 CAMINE PACE. RB.	Cros	ss-section number 2 of 2
		WATERWAY IL		f bedform at the cross-section e Run Pool Cascade Other
Bank height (m)	1234 -	12 3225 ja		Bankfull channel width (m) (=total of boxes A+B+C) Bank height (n
the water sum	ketch should show in cros ace, watermark and bankfi snags encountered at the c	s-section the shape of the channel and include the location of ill points. Also show other features such as bars, rocky cross section.		am width at the water mark (m)
Bank width (m)	Horizontal dis	stances (m)  2 4 5 14 12 13 [	4	Bank width (m
Vertical distance between the water surface and the water mark (m)	∑⊘ [₄⊙] Vertical wate	40 20 0 0 0 50 C		Vertical distance between the wat surface and the
Riparian zone width  Left bank (m) Right bank	<u>€</u> (m)	Notes on cross-section measuren	nent	water mark (m)
Bank material Assess % compositi		Substrate composition Assess % composition in the area of bed 5m either the cross-section.  Bedrock	side of	Assess in the area 5m either side of the cross section  Assess in the area 5m either side of the cross section  >10%
Boulder (>256mm)		Boulder (>256mm)  Cobble (64-256mm)	— —   %0	Periphyton cover <a></a> <10%
Gravel (2-16mm)		Pebble (16-64mm)  Gravel (2-16mm)  Sand (0.06-2mm)	Total 100%	<b>Moss cover</b>
Fines (silt and clay, <0.06mm)	Total 100% each	Fines (silt and clay <0.06mm)		<b>Detritus cover</b>

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Site No. 015 Date 22.8.15

#### Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

	Cross-section sketch		Cros	s-section number of
		R.B.		bedform at the cross-section  ⊠ Run □ Pool □ Cascade □ Other □
Bank height (m)				Bankfull channel width (m) (=total of boxes A+B+C) Bank height
0.3		-section the shape of the channel and include the location of Il points. Also show other features such as bars, rocky ross section.		width at the water mark (m) 3 A O-/
Bank S B	Horizontal dis	tances (m)		Bank width (r
Vertical distance between the water surface and the water mark (m)	Vertical water	depths (cm)		Vertical distance between the was surface and the water mark (m)
Riparian zone width	_	Notes on cross-section measurem	ent	DOPTH OF CAMBREL
	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either the cross-section.	side of	Assess in the area 5m either side of the cross section  Assess in the area 5m either side of the cross section  35-65% 65-90% >90%
Boulder (>256mm) Cobble (64-256mm)		Bedrock  Boulder (>256mm)  Cobble (64-256mm)	   %	Periphyton cover
Pebble (16-64mm)  Gravel (2-16mm)  Sand (0.06-2mm)		Pebble (16-64mm)  Gravel (2-16mm)  Sand (0.06-2mm)		Moss cover   35-65% 65-90% >90%
Fines (silt and clay, <0.06mm	n) 100 100 Total 100% each	Fines (silt and clay <0.06mm)		Detritus cover <a href="#">  &lt;10%</a>

AUSRIVAS Physical	and Chemical Assess	ment Protocol Field Data Sheets	Page 14	Site No Date	
Detailed instructions on Two cross-sections are required	the measurement of chans d at homogeneous sampling sites e of sampling is at or near the wa	te measured in the area around nel cross-sections are provided in the (generally lowland streams) and three cross-secter mark level, stream width at the water surface	protocol manua	1 <b>5</b> f 22 10 10 11	ng.
,	Cross-section sketch	1	Cros	s-section number	of
		<u>.</u>		f bedform at the cross-section  Run Pool Cascade Otl  Bankfull channel width (m)	ner
Bank height (m)	The channel sketch should show in cross the water surface, watermark and bankfu outcrops and snags encountered at the control of the control	s-section the shape of the channel and include the location of ill points. Also show other features such as bars, rocky ross section.		(=total of boxes A+B+C)  am width at the water mark (m)  width at the water surface (m)	Bank height (r
Bank width (m)  Vertical distance between the water surface and the water mark (m)	Horizontal dis	depths (cm)			Vertical distance between the water mark (m)
Riparian zone width		Notes on cross-section measu	rement 5		
Left bank (m) Ri  Bank material Assess S  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay, <0.06mm)	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m ei the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	ther side of	Filamentous algae cover	65-90%>90%

USRIVAS Physical Assessment Protocol Field Data Sheets	Page 1	Site No. <u>○ 1 6</u> Date <u>22 8 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8</u>
Date 22 8 17 Site No. Oolb. Time _	1140	O:0- IERVAS  Recorder's Name SARAH GLAUERT
tiver Name FOREST CREEK Location Loc	7 PP	756011.
eather <u>เมลน + รูแลงป่า</u> Rain in last week? Y [ ] N [※]	Photograph numb	
titude: 2 8 4 4 3	Total Control of the	15,2+4 CONTRES 5+6 D/S
PS Name and Datum		
ANFORM SKETCH OF SITE		LENGTH OF CAMPLING SITE
iding bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or fl bank is facing downstream.	oodplain features.	LENGTH OF SAMPLING SITE  Bankfull width (m)
	1	x 10
Li choem more		Length of sampling site(m)
		Notes
	, N 2	MANY DETAILS NOT RECEDED
		AS SITE DOES NOT HAVEH &
The busic bong.		C MAN COLOR
Tool cum wan .	that Thoom H	167-NO CROSS SECTION COLLEC
- Orm		BEFORE LEAVING THE
		SITE, CHECK DATA SHEETS TO ENSURE
= = 1,00= 360 m		THAT ALL VARIABLES HAVE BEEN RECORDED

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

74.5

Units

mg l<sup>-1</sup>

\* NJEW

ml

ml

mg l<sup>-1</sup>

23/600

%

°c

BASIC WATER CHEMISTRY

0.25 PPT

SAL

Hq

Turbidity

Temperature

Conductivity

Dissolved Oxygen

Total phosphorus

Total nitrogen

**ALKALINITY** 

Alkalinity

Amount of water

Amount of H<sub>2</sub>SO<sub>4</sub>

Floodplain width

channel

floods

Floodplain features

Oxbows / billabongs

Remnant channels

Flood channels

Choose one or more features when present

Sampling site has no distinct floodplain

Body of water occupying a former river meander, isolated by a shift in the stream

Formed during a previous hydrological regime. May be infilled with sediment

A channel that distributes water onto the floodplain and off the floodplain during

COMP WETHTY

Dissolved Oxygen Sat.

Data Sheets	Page 2 Site No. <u>alla Date 22 de 18 de la </u>
Valley shape Choose one category only	Local impacts on streams  Choose one or more categories and describe the detail of each
Steep valle	
□ Shallow val	ey Road River improvement works Bridge / culvert / wharf Water extraction
Broad valle	y Ford / ramp Dredging  Discharge pipe Srazing
Gorge	Forestry activities Litter  Sugar mill Recreation
Symmetrica floodplain	Irrigation run-off or Other pipe outlet
Asymmetric floodplain	Description DIVERSIBL OF CASOC.
Average (m)	Local landuse Choose one category for each bank  Left Right  Native forest  Native grassland (not grazed)
Scroll systems Short, crescentic strips or patches form along the inner bank of a stream mean	ed Grazing (native or non-native pasture)
Splays Small alluvial fan formed where an overloaded stream breaks through a le and deposits material on the floodplain	Forestry Native [ ][ ] Pine [ ][ ]  vee Cropped Rainfed [ ][ ] Irrigated [ ][ ]
Floodplain scours Scour holes formed by the concentrate clearing and digging action of flowing was a second	d Commercial

Recreation

Other

CHSULLINIA

D/S OF DAM OVER FLOW LARGE

No floodplain features present

FREDWAL FAN

Floodplain present at the sampling site but

does not contain any of the above features

AUSRIVAS Physical Asses	ssment Protocol Fi	eld Data Sh	eets	Page 3	Site No.	016	Date 💷 👌	18	_
Riparian zone composition Assess for whole sampling site	% Cover		Vegetation [	Description	Choose one cat	egory for e layer excep	of riparian vege each bank. Do not ot where site is in	tation Left bank	Right
Trees (>10m in height)	75	) e	CASURINA	CHNMINCHEM!	None		$\overline{\wedge}$		
Trees (<10m in height)	1	_   m m = 000%	Le	٠/	Isolated / so	attered	~ <u>`</u>	ᅴ님	Ħ
Shrubs	2	tots			Regularly sp	paced	· · · · · · · · · · · · · · · · · · ·		
Grasses / ferns / sedges		May total more than 100%	NATIVE + Exc	7) (	Occasional	clumps	92		
Shading of channel					Semi-contin	uous	2 m 2 m 2 m 2 m 2 m 2 m 2 m 2 m 2 m 2 m		
Shading of channel 6 – 25%	<b>26 – 50%</b>	∑ 51 – 75%	> 76%		Continuous		District		П
	oderate xtensive	% Native _ % Exotic _	~ > 100	al 100%	Y [ ] N [>	A P	n undisturbed for sbundant (>5% co Present Very limited (<1%	over) and	health
Overall vegetation disturb Choose one category only. S category. Words within the di	ites with valley vegeta	ation cleared c e detailed text	on BOTH sides, but t about the state of	with riparian vegetation the riparian and valle	on in good condity vegetation for e	tion should	d be scored in the gory.	high distu	rbance
Extreme disturbance	on – absent or severely	High disturt		<ul> <li>moderately disturbed by</li> </ul>	Low disturband				
exotic only A reduced. Vegetatic dominated by exoti rare or completely valley vegetation	on is extremely disturbed (ie. c species with native species absent)  – agniculture and/or cleared Plants present are virtually all	disturb. All	stock or through the in although some native  Valley vegetation — land ONE side, native	trusion of exotic species, species remain agriculture and/or cleared vegetation on the other or with a high percentage	or minor  undisturb.  Riparian ▶  Valley	on BOTH sid condition wit disturbance Valley veget BOTH sides	getation — native vegetatic des of the river and in relation th few exotic species prese present is relatively minor. tation — native vegetation of the river, with a virtually few exotic species	vely good ent. Any present on	
Very high disturbance		Moderate d	isturbance		Very low distur	bance			
some native but disturbed by grazing or the in	on – some native vegetation everely modified BOTH sides attrusion of exotic species.	cleared undisturb or min undisturbed Q or minor QQ	sides with canopy inta	- native vegetation on BOTH ct or with native species non in the riparian zone. The	undisturb. undisturb.	BOTH sides	getation – native vegetation of the river and in an undiverse are absent or rare. Rep	sturbed state.	

intrusion of exotic species is minor and of moderate

Valley vegetation - agriculture and/or cleared land

on ONE side, native vegetation on the other in

reasonably undisturbed state

natural vegetation in excellent condition Valley vegetation - native vegetation present on

vegetation in excellent condition

◀ Riparian ▶

-Valley-

BOTH sides of the river with an intact canopy. Exotic

species are absent or rare. Representative of natural

O or minor O

◀ Riparian ▶

✓—Valley —

Native species severely reduced in number and

Valley vegetation - agriculture and/or cleared

exotic species (willows, pines etc.)

land BOTH sides. Plants present are virtually all

◄ Riparian ►

-Valley

AUSRIVAS P	hysical Assessmo	ent Pr	rotocol	Field	d Data Sheets			Pag	e <b>4</b>	Site No. <u>Ol</u>	/ <u> </u>	_ Date	22.5.12
Physical bar Choose one ca	rriers to local fish ategory for each flow	condi	ition		Type of bars Choose one or n	nore catego	ories		xtent of to	pars mbed forming a	bar of	anv tvp	ne 30%
	No passage	Base flow		ligh low	$\sim$	Bars abs	ent	<b>D</b> o	ominant : oulder/col	sediment partic	le siz	e on ba	rs
						Side/poir VEGETA		Sa	and	[ ] Silt/c	ay [>	<] or _	mm
	Very restricted passage			Ž		Side/poir UNVEGE			<u></u>	No modifications	_	_	Reinforced
	Moderately restricted passage					Mid-char VEGETA	TED _		A ST	Desnagged		<b>9</b>	Revegetated
B	Partly restricted passage					Mid-chan UNVEGE Bars arou	TATED Ind			Dams and diversions	V.	A.O	Infilled
\$	Good passage					obstruction Braided of				Resectioned	<b>80</b>	I	Berms or embankments
5	Unrestricted passage					Infilled ch			12.12	Straightened		igns of ork still	Recently channelised
Гуре and heig	ht of barrier(s)					High flow	deposits		Ţ,	Realigned		orks old and egetated	Channelised in the past
Channel sha	ipe Choose one ca	tegory	only					<u> </u>					
			5		<b>\</b>				_ 🔀	7		7	
	U shaped	Fla	t U shap	ed	Deepened	U shape	Widene	ed or	infilled	Two	stage	)	Multi stage
	Box		√ Wido I	hov		/ abana d		- 					
L	DUX		Wide b	DOX		/ shaped		Tra	pezoid	Conc	rete V		Pipe or culvert

AUSRIVAS Physical Assessment F	Protocol Field Data Sheets	Page 5 Site No. <u>016</u> Date <u>22.8.18</u>
Bank shape Choose one category for each bank  Concave  Convex  Stepped  Wide lower bench  Undercut	Bank slope Choose one category for each bank  Left Right bank bank  Vertical 80 - 90°  Steep 60 - 80°  Moderate 30 - 60°  Low 10 - 30°  Flat <10°  Flat <10°	Sediment oils   absent   light   moderate   profuse     Water oils   none   flecks   globs   sheen   slick     Sediment odours   normal/none   sewage   petroleum   chemical   anaerobic   other     Water odours   mormal/none   sewage   petroleum   chemical   other     Turbidity (visual assessment)   Clear   Slight   Turbid   Opaque
Factors affecting bank stability Choose one or more categories  None Cleared vegetation Irrigation draw-down Stock Reservoir releases Human Seepage access Ford, culvert or bridge Feral animals Other  Description  Particles	Bedrock outcrops  Assess % of each bank covered by bedrock outcrops  % bedrock outcrops	ls water clarity roduced by:

AUSRIVAS PI	nysical Asses	ssment Protocol Field Data	Sheets	Page 6	Site No. <u>016</u> Date _	22.8.12.
Extent of bed Total % compo		es atures must equal 100%	Macrophyte cover Asse	ess % cover of the	sampling site by each category.	
Height >1m		_ &! A	Overall % cover of macro	phytes	% cover of emergent macro	ophytes
Gradient >60°	waterrali	Est. Av. Length (m)			% cover of floating macrop	-
		Est. Av. Height (m) Est. Av. Gradient (°)			% cover of submerged made	
Step Height <1m Gradient 5-60° Strong currents		% of site Est. Av. Length (m) Est. Av. Height (m) Est. Av. Gradient (°)	Macrophyte composition Use a macrophyte field guide Listed macrophytes can be N denotes a native taxa and	de (i.e. Sainty and o changed to reflect	Jacobs, 1994) to aid identification. the common taxa present in each duced taxa.	State or Territory
Gradient 3-5° Strong currents Rocks break	Rapid	% of site Est. Av. Length (m)	Emergent macrophytes	%	Submerged macrophytes	%
surface	The state of	Est. Av. Depth (m)		Present cover		Present cover
	- C.V	Est. Av. Width (m)	Brachiaria (Para Grass) I		Ceratophyllum (Hornwort) N	
Gradient 1-3°	Riffle	% of site	Crassula (Crassula) N		Chara (Stonewart) N	
Moderate currents Surface unbroken		Est. Av. Length (m)	Cyperus (Sedge) I/N		Elodea (Canadian Pondweed) I	
but unsmooth	Carl Branch	Est. Av. Depth (m)	Eleocharis (Spikerush) N		Myriophyllum (Water Milfoil) I/N	
		Est. Av. Width (m)	Juncus (Rush) I/N		Nitella (Stonewart) N	
Gradient 1-3°	Glide	% of site	Paspalum (Water Couch) N		Potamogeton (Pondweed) N	
Small currents Surface unbroken		Est. Av. Length (m)	Phragmites (Common Reed)	N -	Triglochin (Water Ribbon) N	
and smooth		Est. Av. Depth (m)	Ranunculus (Buttercup) I		Vallisneria (Ribbonweed) N	
		Est. Av. Width (m)	Scirpus (Clubrush) N		Other	
Gradient 1-3° Small but distinct	Run	% of site	Triglochin (Water Ribbon) N		Other	
& uniform current		Est. Av. Length (m)	Typha (Cumbungi) N			<u> </u>
Surface unbroken	<del>THE</del>	Est. Av. Depth (m)	Other		Other	
	النابا	Est. Av. Width (m)	<del></del>		Floating macrophytes	%
Area where stream widens or	Pool	% of site	Other			Present
deepens and		Est. Av. Length (m)	Other		<i>Azolla</i> (Azolla) N	
current declines		Est. Av. Depth (m)			Callitriche (Starwart) I	
		Est. Av. Width (m)			Other	
A reasonable sized	Backwater	% of site			Other	
(>20% of channel width) cut-off		Est. Av. Length (m)			Other	
section away from		Est. Av. Depth (m)	Overall 9/ sever of			
	<i>≦</i>	Est. Av. Width (m)	Overall % cover of native	macropnyte taxa	Total should equal over	vrall 0/ navor

Note: An additional response variable <u>planform channel pattern</u> is measured in the office

Overall % cover of native macrophyte taxa

Total should equal overall % cover of macrophytes

#### **Bed compaction**

Choose one category only



Tightly packed, armoured Array of sediment sizes. overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1) Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2) Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily

#### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework 5-32% fine sediment, moderate availability of interstitial spaces



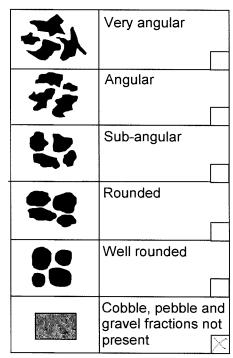
Framework dilated 32-60% fine sediment, low availability of interstitial spaces



Matrix dominated >60% fine sediment, interstitial spaces virtually absent

#### Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

- Stable -

Unstable - depositing

#### Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.

#### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.

#### Moderate deposition

Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.

#### Severe deposition

Extensive build up of fine sediments to form a flat bed. Channel blocked. but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.



	Il Assessment Protocol Field Data Sheets	Page 8
USEPA Habitat Assessment Circle a score for each parameter	HIGH GRADIENT STREAMS	Page 1 of 2

			mete																		
Habitat						· · · · · · · · · · · · · · · · · · ·		C	ond	ition	cate	gory	,								
parameter		Е	xcell	ent				Goo	d		T		Fair			$\overline{}$		Р	oor		
1. Epifaunal substrate / available cover	sub- epifa fish sub- bani stab to al pote that	ater the strate aunal cover; merge ks, colole habiliow ful are no transie	favour colonis mix o d logs oble or itat ar il color .e. log ot new	able for ation of snag under other od at so nisation	and is, rcut tage n gs	full pote hab of p of a the not cold	itat; w coloni ential; itat fo opula ddition form yet pr pnisati	vell-su isation adequations; tions; nal su of new epare	uate ntenan prese bstrat- rfall, b d for ay rate	ce nce e in ut	hab avai desi freq	40% ri itat; ha lability irable; uently oved.	abitat less subs	than trate		ha ob	bitat viou	an 2 lack	0% s of ha ostrat lackin	abitat e	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Embeddedness	25% sedi	vel, co der pa surro ment. ole pro che sp	rticles undec Layer vides	are 0 by fir ing of	е	50%	ider p	ounde	and s are: d by f	25- ne	boul 75%	Gravel, cobble and coulder particles are 50-75% surrounded by fine sediment.					avel, uide ore th	cobb parti an 7 ded	ile an	d are	L
SCORE	20	19	18	17	16	15	14	13	12	11	10	9 🍻	8	7	6	5	4	3	2	1	0
3. Velocity / depth regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					pres miss than	ent (in sing, s	f fast- score ssing			Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).						mina	ted b /dept		ime	
SCORE	>0.5m).					15	14	13	/12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	islan less affec	or no ds or p than 5 ted by sition.	ooint b % of t sedin	ars ar he bol	ıd	from sedi botto	forma grávi ment; om aff	tľon, n el, sar 5-30°	lease in nostly nd or f. % of th ; slight ols.	ne ie	new sedin botto sedin obstr cons mode	erate of grave ment of bars; om afforment of cuction triction erate of previous prev	l, sandon old 30-50 ected; deposins, ns and depos	d or fi and )% of its at	ne the	He ma de 50 ch po to	avy of angir	deposition increment the big free most tantia	its of ease; mor ottom quent abse	fine d bar e tha ly; nt du	in ie
SCORE	20	19	18	ЛT	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	both minin	er read lower nal am nel sul sed.	bańks iount d	, and of		avail	able o % of c	>75% hanne hanne is exp	el	е	availa and/	er fills able cl or riffle nostly	hanne subs	el, strates	- 1	cha	annel sent	e wa and	ter in most andir	y y	_
SCORE	20/	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	dredging absent or minimal; stream with normal pattern.					preson of bring evide chan dredge 20 yr but re	ent, usidge a ence of neliza ging (si of) may ecent neliza	butme of past ution, i greate of be po	in are ents; : .e. er than resent		or sh prese and 4 reach	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					oion of of annel rupte oitat o	r cer the st zed a d. In	strea , alte	over read	h

AUSRIVAS Physical and Chemics Site No Date	al Assessment Protocol Field Data Sheets Pa le	ge 9
USEPA Habitat Assessment Circle a score for each parameter	HIGH GRADIENT STREAMS	Page 2 of 2

Habitat							C	onditi	on	catego	ory					
parameter		Excel	ent				Good		$\neg$		Fair			Poor		
7. Frequency of riffles (or bends)	Occurre relativel of distal riffles di the stree (genera of habit streams continue of bould large, n is impor	y frequence befivided beam <7: ally 5 to at is keen ous, pladers or atural of atural o	ent; racween by widt 1 7); var y, In e riffles aceme other	h of niety are nt	infreq betwee by the	uent en r e wic	ce of riff t; distan iffles di dth of th betwee	ce vided e		some had between by the w	nal riffle o contours ; abitat; dist n riffles div vidth of th s between	orovide ance vided e	shallow habitat; betwee by the	lly all flat or riffles; po distance on riffles di width of the is a ratio of the control of the	or vided e	i
SCORE	20 19	9 18	17	16	15	14	13	12 1	11	10 9	8	7 6	5 4	3 2	1	0
8. Bank stability (score each bank)	Banks sof erosical absent potential problem affected	infred of ero over.	uent sion 5-3 has	ly stable t, small mostly 0% of b	areas healed ank in	1	60% of has area	tely unsta bank in re as of eros sion pote oods.	ach ion;	areas; frequer section obvious 60-100	le, many of raw' areas it along st is and ben is bank slo is of bank al scars.	s raigh ds; ughir	t			
SCORE	Left ba	ınk	10	9	8 7 6					5	4	3	2	1		0
SCORE	Right t	ank	10	9	8 7 6					5	4	3	2	1		0
9. Vegetative protection (score each bank)	More the stream and immage and immage and immage and trees, using macrop disrupting grazing minimal almost to grow	pank somediate overed lion, incommending or nor hytes, on three or monitor not all plan	urfaces riparia by nati luding brey wood wegeta ugh wing evider ts allow	an en	cover veget of pla repre evide full pl to an more	mba red b ration ints i sent nt bi ant of ant of than oten	nk surfa by native in, but on is not we ed; disr ut not af growth p eat exter n one ha tial plant eight	ell- uption fecting ootentiant; alf of		covered disruption patches closely of vegetation than one potentia	ank surfa by veget on obvious of bare s	ation; s; oil or on; less ne lbble	stream covered disrupt vegetal vegetal remove centime	an 50% of pank surfated by veget on of street on is very ion has been do 5 etres or less stubble i	aces ation amba high een ss in	ank n;
SCORE	Left ba	ınk	10	9	8		7	6		5	4	3	2	1		0
SCORE	Right t	ank	10	9	8	T	7	6		5	4	3	2	1		0
10. Riparian zone score (score each bank)	Width of >18 me activitie lawns, on timp zone.	ve	12-18 activi the n	Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.				12 metr activities	f riparian es; huma s have im rian zone	n pacted	<6 met npanar presen	of riparian res; little of vegetation because activities.	r no n is			
SCORE	Left ba	ınk	10	9	8		7	6		5	4	3	2	1		0
SCORE	<del></del>	Right bank 10 9											1	1		

TOTAL HIGH GRADIENT HABITAT SCORE

#### **LOW GRADIENT STREAMS**

Page 1 of 2

Habitat									Cond	ditio	n cat	ego	rv								
parameter	Condition category						r				Р	oor									
1. Epifaunal substrate / available cover	sub epir and sna und or d and coli (i.e	eater to ostrate faunal difish di ags, si dercut other si di at sti onisati logs/ new fi nsient)	e favor color cover, ubmer banks stable age to ion po snags all and	urable isation mix or ged los, cob habita allow tentials that	for f gs, ble at full	full pote hab of potential the not cold	citat; w coloni ential; citat fo copular ddition form of yet pr	vell-su isation adeq or mair tions; nal su of nev epare on (m	ited for uate ntenan prese bstrativifall, b id for ay ratio	ce nce e in ut	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					ha ob	bitat: vious	lack s; su	0% s of hat ostrat	abitat e	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	10.
2. Pool substrate characterization	and root sub	ture o terials i firm : t mats mergi nmon.	, with sand p and ed veg	grave oreval	ent;	be o	domin	ay; m ant; s subm	ud ma ome ro nerged	oot	bott	om; li	r clay ttle or ubme	no ro		be		k; no	ay or root	mat o	1, ,
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	sha sma	en mix illow, l all-sha p poo	arge-d	ieep, small-	•	Majority of pools large- deep; very few shallow. Shallow pools much more prevalent than deep pools.							more prevalent than						ools s		-
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	of is and bott	e or no slands less tom af iment	or po han 2 fected	int bai 0% of I by	's	bar from sedi bott	forma n grav iment;	tion, r el, sai 20-50 fected	ease in nostly nd or f 0% of ; sligh ols.	ine the	new sedii new botto sedii obst cons mod	grave ment bars; om af ment ruction striction erate	deposed, san on old 50-81 fected deposed ons an deposed	id or f l and 0% of ; its at d ber	the	ma dev 80° cha poo to s	terial velop % of angin ols al	l, inc men the k g fre most antia	sits of rease t; mor oottom quent abse	d ba e tha i tiy; ent do	re an
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	both mini chai	ter rea lowe imal a nnel s osed.	r bank mount	s, and		avai <25	er fills lable of % of o strate	hann hann	el	e	avail and/	able of	25-7: channe le sub expo	el, strate		cha	innel sent	and	ter in most tandir	ly	
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	)O(
6. Channel alteration	dred mini	inneliz Iging a Imal; s nal pa	absen tream	t or		pres of br evide char dred 20 yr but r	ndge a ence o nneliza ging ( r) may recent nneliza	sually abutm of pas ation, i greate be p	in are ents; t i.e. er thar resent		exter or sh prese and a reach	nsive; noring ent or 40 to	ation rembal embal structor both 80% onneliza	inkme tures bank of stre	ents s; eam	gab 80% cha disr hab	ion of the control of	or cei the s ized d. Ir	strea y alte	over read	ch
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

NO BANKS HIGHLY ALTERED :

Continued over

<b>AUSRIVA</b>	S Physical and	Chemical	Asses	sment	Protocol	Field Data	Sheets	Page 11
Site No.	017	Date	27	N. 1	i,			•

#### LOW GRADIENT STREAMS

Page 2 of 2

Habitat								C	ond	ition	cate	go	ry						:	
parameter	Excellent Good The bends in the stream The bends in the stream												Fair					Po	or	
7. Channel sinuosity	incre lengt longe straig chan cons coas low-l	increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).  20 19 18 17 16 15 14 13 12 11 10 9 8 7								to	wate	rwa neli:	zed f	ght; beer or a li						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1 0
8. Bank stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.  Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion; high erosion potential during floods.							30-	area frequence sect obvide 60-1	s; 'n uent ions ous 00%	aw' a along and bank	g stra bend sloug ank h	aight s; ghing;							
SCORE	Left	bank	1	10	9	8	T	7		6	5		4		3	2		1		0
SCORE	Righ	nt ban	k ·	10	9	8	1	7		6	5		4		3	2		1		0
9. Vegetative protection (score each bank)	strea and i zone vege trees shrui maci disru grazi minir almo	e than amban immed cover station, s, unde bs, or rophyte ing or mal or est all p ow nat	k sur diate r red by incluserstor non v es; ve through mowinot e plants	faces iparia inparia iding ey wood egeta gh ing ivider allov	an ve y ttive	cover veget of pla repre evide full pl to any more	mba ed b ation nts i sent nt bi ant g than than oten	nk surfa by native n, but on is not we ed; disr ut not a growth peat exten one hat tial plan eight	e ne cli ell- ruptio ffecti poter nt;	n ng	streation cover dism. patciose vege than pote	red iptiones ely c tatione one	of the ank surfactory vegets of obvious of bare suropped on comme-half of the plant sturmaining.	ation s; oil oi on; li ne ubble	ess	strea cove disra vege vege remo cent aver	embi ered uptio etatio etatio oveo imet age	ank s by ve on of s on is on ha i to 5 tres o	very I s bee or less	ces tion; mbank high; en
SCORE	Left	bank		10	9	8		7		6	5		4		3	>2		1		0
SCORE	Righ	nt ban	k	10	9	8		7		6	5		4		3	>2		1		0
10. Riparian zone score (score each bank)	>18 activ lawn	th of rip metres ities (i. s, crop mpacto s.	s; hur .e. ro os etc	man ads, c.) ha	ve	12-18 activit	8 me ties pania	riparian etres; hu have im an zone	ıman pact		12 m activ	etre ities ipar	f riparian es; huma s have im ian zone	n pact	ed	<6 n ripar pres	netre nan : ent	es; lit vegel	rian z tle or tation use o ies.	no is
SCORE	Left	bank		10	9	8		7		6	5		4		3	2		1		<u>&gt;</u> o<
SCORE	Right bank 10 9 8 7 6							5 4 3					1							

ARTIFICIAL.
NO IBENIOS

NO BANKS

TOTAL LOW GRADIENT HABITAT SCORE

Channel cross-sections on Two cross-sections are required.	ions and variables to be the measurement of changed at homogeneous sampling sites the of sampling is at or near the wa	nent Protocol Field Data Sheets Pare measured in the area around a conel cross-sections are provided in the pro (generally lowland streams) and three cross-sections ter mark level, stream width at the water surface will be considered to the control of the contr	ross secti tocol manua	On al. Be familiar with these before proceed	ling.
	Cross-section sketch	1	Cros	s-section number	of
			Type of	bedform at the cross-section	Other
Bank height (m)				Bankfull channel width (m) (=total of boxes A+B+C)	Bank height (m
	The channel sketch should show in cross the water surface, watermark and bankfu outcrops and snags encountered at the o	s-section the shape of the channel and include the location of Il points. Also show other features such as bars, rocky ross section.		width at the water mark (m) width at the water surface (m)	A
Bank width (m)  Vertical distance between the water surface and the water mark (m)	Horizontal dis		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		Bank width (m)  Vertical distance between the wate surface and the
Riparian zone width		Notes on cross-section measuren	nent		water mark (m)
Left bank (m) F  Bank material Assess  Bedrock  Boulder (>256mm)  Cobble (64-256mm)  Pebble (16-64mm)  Gravel (2-16mm)  Sand (0.06-2mm)  Fines (silt and clay, <0.06mm)	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	Side of Lotal 100%	Filamentous algae cover    <10%	

AUSRIVAS Physical and Chemical Assessment Protocol Field Data Sheets Page 12

AUSRIVAS Physical	and Chemical Assessr	nent Protocol Field Data Sheets	Page 13	Site No Da	nte
Detailed instructions on Two cross-sections are require	the measurement of channed at homogeneous sampling sites ne of sampling is at or near the wat	(generally lowland streams) and three cross-sect	orotocol manual	. Be familiar with these before proceed	_
	Cross-section sketch			s-section number	of
				Run Pool Cascade	Other
T				Bankfull channel width (m) (=total of boxes A+B+C)	<b>│</b>
ank height (m)			Stroo	· <del></del>	Bank height (r
	The channel sketch should show in cross	-section the shape of the channel and include the location of Il points. Also show other features such as bars, rocky	Silea	m width at the water mark (m)	A /
	outcrops and snags encountered at the c		Stream	width at the water surface (m)	/
Bank width (m)  Vertical distance between the water surface and the water mark (m)	Horizontal dis				Vertical distance between the wat surface and the water mark (m)
Riparian zone width		Notes of Cross-Section measur	remem		
Left bank (m) F	Right bank (m)				
Bank material Assess Bedrock		Substrate composition Assess % composition in the area of bed 5m ei the cross-section.  Bedrock	ither side of	Filamentous algae cover	ssess in the area 5m either side of the cross section  65-90%
Boulder (>256mm)		Boulder (>256mm)		Periphyton cover	
Cobble (64-256mm)		Cobble (64-256mm)	%0	<10% <u>10</u> –35% <u>35-65</u>	%65-90%>90%
Pebble (16-64mm) Gravel (2-16mm)		Pebble (16-64mm)		Moss cover	
Sand (0.06-2mm)		Gravel (2-16mm)	T	<10%	%  65-90% >90%
Fines (silt and clay, <0.06mm	<u> </u>	Sand (0.06-2mm)			
(and and only) -0.00mm	<del></del>	Fines (silt and clay <0.06mm)	<del></del> J	Detritus cover	., [
	Total 100% each			<10%	% <u>65-90%</u> >90%

C	cross-section sketch		Cros	s-section number	of				
				f bedform at the cross-section  Pool Cascade Other					
ank height (m)				Bankfull channel width (m) (=total of boxes A+B+C)	Bank hei				
\   th	ne channel sketch should show in cross e water surface, watermark and bankfu pitcrops and snags encountered at the c	-section the shape of the channel and include the location of II points. Also show other features such as bars, rocky ross section.		Stream width at the water mark (m)  Stream width at the water surface (m)					
Bank width (m)	Horizontal dis	tances (m)			Bar c wid				
Vertical distance petween the water surface and the water mark (m)	Vertical water	depths (cm)			Vertical dis between the surface and				
Riparian zone width		Notes on cross-section measurer	nent		water mark				
Left bank (m) Rigi	ht bank (m)								
Bank material Assess %	composition for each bank Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either the cross-section.	side of	Filamentous algae cover	the area 5m either side the cross section				
Bedrock Boulder (>256mm)		Bedrock	)		]00-90% [_]>90				
Cobble (64-256mm)		Boulder (>256mm)		Periphyton cover	]os 000/ []				
Pebble (16-64mm)		Cobble (64-256mm)	<u> </u>	<10%	<u> </u> 65-90% <u> </u>  >90				
Gravel (2-16mm)		Pebble (16-64mm)  Gravel (2-16mm)		Moss cover					
Sand (0.06-2mm)		Sand (0.06-2mm)	<u> </u>	<10% 10–35% 35-65%	65-90% >90				
Carra (0.00 Emm)		Jana (0.00-2000)	1						
Fines (silt and clay, <0.06mm)		Fines (silt and clay <0.06mm)		Detritus cover					

Site No.

Date \_\_\_\_\_

AUSRIVAS Physical and Chemical Assessment Protocol Field Data Sheets Page 14

AUSRIVAS Physical Assessment Protocol Field Data Sheets	Page 1	Site No. <u>017</u> Date <u>22 8 18 </u>
	300	Recorder's Name
River Name FOREST CROIC Location Location	7 00	756011
Weather CLEAR 4 Sun in last week? Y [ ] N [X]	Photograph numbe	ers and details
Latitude: 2 8 4 5 Longitude: \( \) \	7- DEBRUS	NS, 3+4 COTRE; 546 0/5
GPS Name and Datum		
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or flood	plain features.	LENGTH OF SAMPLING SITE
Left bank is facing downstream.		Bankfull width (m)
		Length of sampling site x 10 (m)
EN: (1)		Notes
	pear	- WIDE BROAD SHALLOW FLOOD
South of the second of the sec	L	- ONL & ONE Chass will trovid
Political Control of the Control of		UNIFORM SMALLOW DOTE SSEN
40%		BANKS POORLY DUPINED.
CAGRINA CC C	SR. NA.	YEND LOW GRADIENT
PHOTO POINT		BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN RECORDED

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

AUSRIVAS Physical Assessment Protoco	l Field Data Sheets	Page	2 Site No. <u>017</u> Date <u>22</u> <u>8</u> 1 8
BASIC WATER CHEMISTRY	Valley shape Choose one category	y only	Local impacts on streams Choose one or more categories and describe the detail of each
Temperature Conductivity	°c {	Steep valley	Sand or gravel mining  Sewage effluent  Other mining  Channel straightening
Dissolved Oxygen Sat.	mg I <sup>-1</sup>	Shallow valley	Road River improvement wo
pH Turbidity		Broad valley	Ford / ramp  Discharge pipe  Grazing
Total phosphorus Total nitrogen		Gorge	Forestry activities Litter
ALKALINITY Amount of water	, , <del>, ,</del> ,	Symmetrical loodplain	Sugar mill  Irrigation run-off or pipe outlet
Amount of H <sub>2</sub> SO <sub>4</sub>	ml   A	Asymmetrical loodplain	Description
Floodplain width	 Average (n	n)	Local landuse Choose one category for each bank Left Right
Floodplain features Choose one or more features when present  Sampling site has no distinct floodplain  Oxbows / billabongs Body of water occupying a former river meander, isolated by a shift in the stream channel  Remnant channels Formed during a previous hydrological regime. May be infilled with sediment  Flood channels A channel that distributes water onto the floodplain and off the floodplain during floods	Scroll systems Short, crescentic strips or p along the inner bank of a st  Splays Small alluvial fan formed w overloaded stream breaks t and deposits material on the  Floodplain scours Scour holes formed by the c clearing and digging action  No floodplain features pr Floodplain present at the sa does not contain any of the	atches formed ream meander there an chrough a levee e floodplain concentrated of flowing water resent ampling site but	Native forest Native grassland (not grazed) Grazing (native or non-native pasture) Exotic grassland (lawns etc., no grazing) Forestry Native [ ] [ ] Pine [ ] [ ] Cropped Rainfed [ ] [ ] Irrigated [ ] [ ] Urban residential Commercial Industrial or intensive agricultural Recreation Other

AUSRIVAS Physical Assessm	ent Protocol Field Data	Sheets	Page 3 Site N	40. <u>617</u>	Date <u>22 - &amp;</u>	18	
Riparian zone composition Assess for whole sampling site	% Cover	Vegetation Description	Choose one include area	e category for ea und layer except	f riparian vegetat ch bank. Do not where site is in	ion Left bank	Right
Trees (>10m in height)		CASULINA POPESAL	None		$\sim$		
Trees (<10m in height)		) H	Isolated	/ scattered	<u>~</u> ~		
Shrubs			Regulari	y spaced	·····		
Grasses / ferns / sedges	May total more	NATIVE + EXOTIC	Occasio Occasio	nal clumps	95000		$\overline{A}$
Chading of shapped			Semi-co	ntinuous	serve on marie some		
Shading of channel  5% 6-25%	26 – 50% 51 –	75%	Continuo	ous	Desta contrate de la		
Extent of trailing bank vegetary in mode slight extends	erate % Nativ	nd exotic riparian vegetation ve	Is the sa Y[]N	mpling site in  Ab ecord Pro	ve woody vegeta undisturbed fores oundant (>5% cove esent ery limited (<1% co	et? er) and h	าealth <sup>։</sup>
Overall vegetation disturban Choose one category only. Sites		red on ROTH sides, but with ring	rian vegetation in good co	andition should	he scored in the hir	nh dieturk	nance
category. Words within the drawi						gir alotait	,ancc
Extreme disturbance	High di	sturbance	Low disturb				
Riparian vegetation – a reduced. Vegetation is e dominated by exotic sperare or completely abser Valley vegetation – agriland BOTH sides. Plant exotic species (willows, part of the second species)	extremely disturbed (ie. cies with native species 1t) ioulture and/or cleared s present are virtually all		or minor ain  or minor undisturb. or undisturb. or the other	on BOTH side condition with disturbance pr	etation – native vegetation p is of the river and in relatively few exotic species present, resent is relatively minor, ition – native vegetation pres if the river, with a virtually into w exotic species	good Any sent on	
Very high disturbance	<u>Modera</u>	te disturbance	Very low di	sturbance			
cleared cleared some native but disturbed a grazing or the intrusion	y modified BOTH sides	ndisturbed or minor sides with canopy intact or with na widespread and common in the rip	ive species	BOTH sides o	etation – native vegetation p of the river and in an undistur of are absent or rare. Repres	bed state.	

intrusion of exotic species is minor and of moderate

Valley vegetation - agriculture and/or cleared land

on ONE side, native vegetation on the other in

reasonably undisturbed state

◀ Riparian ►

natural vegetation in excellent condition Valley vegetation – native vegetation present on

vegetation in excellent condition

BOTH sides of the river with an intact canopy. Exotic

species are absent or rare. Representative of natural

disturbed

◀ Riparian ►

–Valley-

Native species severely reduced in number and

Valley vegetation - agriculture and/or cleared

exotic species (willows, pines etc.)

land BOTH sides. Plants present are virtually all

◀ Riparian ►

---Valley----

AUSRIVAS P	Physical Assessme	ent Pr	otoc	ol Field	d Data Sheets			Р	age 4	Site No. 📿	フ	Date	22-8-18
Physical bar Choose one ca	rriers to local fish ategory for each flow	condit / Base	tion Low	High	Type of bars Choose one or r	nore categ	ories			mbed forming a			
	No passage	flow	flow	flow		Bars abs	sent	e de la companya del companya de la companya del companya de la co	Boulder/co	<b>sediment part</b> ibble [ ] Peb	ble	[ ] Grav	vel [ ]
						Side/poi			Sand	[ ] Silt/onodifications	clay	[ ] or _	mm
	Very restricted passage					Side/poi	nt bars			No modifications		se one or r	Reinforced
	Moderately restricted passage		X			VEGETA	X	<u></u>	78 24	Desnagged	X	Y B	Revegetated
	Partly restricted passage			X		Mid-chan UNVEGE Bars arou	ETATED			Dams and diversions			Infilled
3	Good passage					Obstruction			7	Resectioned			Berms or embankments
8	Unrestricted passage					Infilled ch			77.77	Straightened		9 1	Recently channelised
Type and heig	ht of barrier(s) ਉੱਧਰ ਅਸਟ ਫਿਲ੍ਹ	THET	BAS	SACÉ		High flow	deposits		J.	Realigned	ı	Works old and revegetated	Channelised in the past
Channel sha	pe Choose one cat	tegory	only			-							
	Lisbanad		<i></i>										
	U shaped	Flat	U sha	aped	Deepened	U shape	Widen	ned	l or infilled	Two	o sta	ge	Multi stage
	Box		Wide	₃ box		/ shaped		_ 1	Trapezoid	Cond	rete	V	Pipe or culvert

AUSRIVAS Physical Assessment P	rotocol Field Data Sheets	Page 5 Site No. Old Date 22-8-18
Bank shape Choose one category for each bank Left Right	Bank slope Choose one category for each bank Left Right	Sediment oils  Sediment oils  Iight moderate profuse
· ·	Vertical 80 - 90° Steep 60 - 80° Moderate 30 - 60° Low 10 - 30° Flat <10° Flat <10°  Bedrock outcrops Assess % of each bank covered by bedrock outcrops % bedrock outcrops Left bank Right Bank  Right Bank  Artificial bank protection measures	Water oils  none
Stock cleases  Human ccess  Ford, culvert or bridge  Feral animals  Other  Description  Reservoir releases  Reservoir releases  Flow and waves  Drainpipes	Choose one or more categories  None Fence structures Levee banks Rock or wall layer Rip rap Fenced human access Other  Choose one or more categories Fenced stock watering points Vegetation plantings Logs strapped to bank Concrete channel lining	Artificial features at the sampling site Choose one or more categories  Major Minor Ford Bridge Culvert Other weir  Description  Large woody debris Overall % cover of logs and branches greater than 10cm in diameter  % Notes on visibility

AUSRIVAS P	hysical Asse	ssment Protocol Field Data	Sheets	Page 6	Site No Date	22 · 8	.18
Extent of be Total % compo		es eatures must equal 100%		ess % cover of the s	sampling site by each category		
Height >1m Gradient >60°		% of site Est. Av. Length (m) Est. Av. Height (m) Est. Av. Gradient (°)	Overall % cover of macro	ohytes <u></u>	<ul><li>% cover of emergent ma</li><li>% cover of floating macr</li><li>% cover of submerged n</li></ul>	ophytes	2
Step Height <1m Gradient 5-60° Strong currents		% of site Est. Av. Length (m) Est. Av. Height (m) Est. Av. Gradient (°)	Macrophyte compositio Use a macrophyte field guid Listed macrophytes can be on the composition of the compos	le (i.e. Sainty and Jo Changed to reflect t	acobs, 1994) to aid identificati he common taxa present in ea luced taxa.	on. ich State or	Territory
Gradient 3-5° Strong currents Rocks break surface	ph.	% of site Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Width (m)	Emergent macrophytes  Brachiaria (Para Grass) I	% Present cover	Submerged macrophytes  Ceratophyllum (Hornwort) N	Present	% cover
Gradient 1-3° Moderate currents Surface unbroken but unsmooth	Riffle	% of site Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Width (m)	Crassula (Crassula) N Cyperus (Sedge) I/N Eleocharis (Spikerush) N Juncus (Rush) I/N		Chara (Stonewart) N Elodea (Canadian Pondweed Myriophyllum (Water Milfoil)	1)	
Gradient 1-3° Small currents Surface unbroken and smooth	Glide	% of site Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Width (m)	Paspalum (Water Couch) N Phragmites (Common Reed) N Ranunculus (Buttercup) I		Nitella (Stonewart) N Potamogeton (Pondweed) N Triglochin (Water Ribbon) N Vallisneria (Ribbonweed) N		
Gradient 1-3° Small but distinct & uniform current Surface unbroken	Run	% of site  400 Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Width (m)	Scirpus (Clubrush) N Triglochin (Water Ribbon) N Typha (Cumbungi) N Other		OtherOther	_	
Area where stream widens or deepens and current declines	Pool	% of site Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Width (m)	Other		Azolla (Azolla) N Callitriche (Starwart) I	Present	<b>%</b>
A reasonable sized (>20% of channel width) cut-off section away from	Backwater	% of site Est. Av. Length (m) Est. Av. Depth (m) Est. Av. Width (m)	Overall % cover of native r	macrophyte taxa	Other Other  Other  Other  Total should equal of	Dyerall % assu	

Overall % cover of native macrophyte taxa

Total should equal overall % cover of macrophytes

Total should equal overall % cover of macrophytes from above

Note: An additional response variable <u>planform channel pattern</u> is measured in the office

#### Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes. overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes, overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1) Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2) Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily

#### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework

5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated

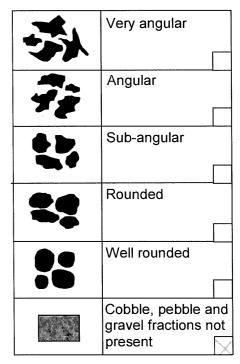
32-60% fine sediment. low availability of interstitial spaces



Matrix dominated >60% fine sediment, interstitial spaces virtually absent

#### Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only



In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams

Bed stability rating Choose one category only

Unstable - eroding

- Stable ---

Unstable - depositing

#### Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.

#### Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

#### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.

#### Moderate deposition

Moderate build-up of fine sediments lat obstructions and bars. Streambed flat and uniform. Channel wide and shallow.

#### Severe deposition

Extensive build up of fine sediments to form a flat bed. Channel blocked. but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.

AUSRIVAS Physical and Che	emical Assessment Protocol Field Data Sheets	Dago Q
Site No	Date	rage o

## HIGH GRADIENT STREAMS

Page 1 of 2

Habitat	T								Cond	itior	ı cat	egor	v								
parameter	-		Excel	lent		T		Goo			T	-3	Fa	r					oor		
1. Epifaunal substrate / available cover	Grisul epi fish sul bar sta to a pot than not	hal full pot hai of a the not	40-70% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).				20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					h	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.								
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2. Embeddedness	Gra bou 25% sed cob of n	509	avel, c ilder p 6 surr liment	article	and s are :	25- ne	50u	avel, coller p der p surr iment	obble article ound		50m	G bo m su	ravel oulde ore ti	cob r part nan 7 nded	ble ar	nd are	10				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9 /	V 8	7	6	5	4	3	2	1	0
3. Velocity / depth regime	regi dee dee is <	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is <0.5m/s.								the 4 preser	habitant (if fa	at ast- ow	omina	minated by 1 ocity/depth regime ually slow-deep).							
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	islar less affe	e or no nds or than cted b osition	point 5% of y sedi	bars a the bo	nd	from sedi botta	forma grav ment;	tion, n el, sar 5-309 ected	d or fi 6 of th slight	ne e	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in				Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.						
SCORE	20	19	18	17	16	15	14	13	12	11	10	s prev	alent.	7	6	5	4	3	2	1	0
5. Channel flow status	both mini	er read lower mal an nnel so sed.	banks jount	s, and of		avail	er fills able o % of c strate	hanne hanne	ĺ	9	Wate avail and/	er fills able c	25-7 hann e sub	5% of el, strate	the	Ve	y litt annel sent	e wa and	ter in most andir	y	Ų
SCORE	20/	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6. Channel alteration	dred minir	nneliza ging ai nal; st nal pati	bsent ream	or		preson of brown evide chan dredge 20 yr but re	dredging (greater than				present on both banks; and 40 to 80% of stream reach channelized and					Bar gab 80% cha disr	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
													_		-		7	٦	4	'	0

<b>AUSRIVAS Physi</b>	ical and Chemical Assessment Protocol Field Data She	ets Page 🤅
Site No.	Date	

USEPA Habitat Assessment
Circle a score for each parameter

#### **HIGH GRADIENT STREAMS**

Page 2 of 2

Habitat						(	oc	ndition	catego	ry								
parameter		Excel	lent			Good Fair							Poor					
7. Frequency of riffles (or bends)	relative of dist. riffles the str (gener of hab stream contin of boul	latively frequent; ratio distance between distance between fiffles divided by width of e stream <7:1 stream is between 7 to lenerally 5 to 7); variety latin frequent; distance between fiffles divided by the width of the stream is between 7 to lenerally 5 to 7); variety latin frequent; distance between fiffles divided by the width of the stream is between 7 to lenerally 5 to 7); variety latin frequent; distance between fiffles divided by the width of the stream is between 7 to lenerally 5 to 7); variety latin frequent; distance between fiffles divided by the width of the stream is between 7 to lenerally 5 to 7); variety latin frequent; distance between fiffles divided by the width of the stream is between 7 to lenerally 5 to 7); variety latin frequent; distance between fiffles divided by the width of the stream is between 7 to lenerally 5 to 7); variety latin frequent; distance between fiffles divided by the width of the stream is between 7 to lenerally 5 to 7); variety latin frequent fre					bottom of some had between by the w	nal riffle o contours p abitat; dist i riffles div ridth of the s between	Generally all flat water or shallow riffles; poor habitat_distance between riffles divided by the width of the stream is a ratio of >25.									
SCORE	20	19 18	17	16	15	14 13	1:	2 11	10/9	8	7 6	5	4	3	2	1	1	
8. Bank stability (score each bank)	of eros absen potent	s stable; sion or to to or min tial for fu ems. <5 ed.	ank fa imal; lit iture	ilure tle	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.				60% of l	ely unstal bank in re as of erosi sion poter oods.	Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.							
SCORE	Left b	ank	10	9	8	7		6	5	4	3	2	-	1			0	
SCORE	Right	bank	10	9	8	7	1	6	5	4	3	2		1			0	
9. Vegetative protection (score each bank)	stream and in zone of vegeta trees, shrub macro disrup grazin minim almos	than 90 mbank s mmediat covered ation, in- unders es, or no ophytes; otion the ng or mo nal or no st all plan own natur	urfaces e ripari by naticluding torey n wood vegeta bugh wing t evide nts allo	s an ive ly ative	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.				covered disruption patches closely of vegetati than one potentia	eank surfa by vegeta on obvious of bare s	ation; s; oil or on; less ne	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.						
SCORE	Left b	oank	10	9	8	7		6	5	4	3	2		1	1		0	
SCORE	Right	t bank	10	9	8	7	1	6	5	4	3	2		1	1		0	
10. Riparian zone score (score each bank)	>18 m activit lawns	n of ripa netres; I ties (i.e. s, crops npacted	numan roads, etc.) h	ave	12-18 activit the rip	Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.			12 metr	of riparian es; huma s have im nan zone	Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.							
SCORE	Left b		10	9	8	7		6	5	4	3	2		1	1		0	
SCORE	Right	t bank	10	9	8	7	7	6	5	4	3	2	!		1		0	

TOTAL HIGH GRADIENT HABITAT SCORE

## LOW GRADIENT STREAMS

Page 1 of 2

Habitat			Condition ca								n cat	category									
parameter		E	xcel	ent				Goo	d		T	-3-	Fai	r		$\top$		Р	oor		
1. Epifaunal substrate / available cover	sul epi and sna und or o and col (i.e	eater t bstrate ifaunal d fish c ags, si dercut other s d at sta onisati . logs/: new f nsient)	e favor colon cover, ubmer banks stable age to on po snags all and	urable isation mix or ged los, cob habita allow tentials that a	for f ogs, ble at full	30-50% mix of stable habitat; well-suited for full colonisation potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonisation (may rate at high end of scale).				10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.				h	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	Tak	0
2. Pool substrate characterization	and roo	ture of terials, firm s t mats omerge nmon.	with sand p and	gravel orevale	ent;	Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present.				All mud or clay or sand bottom; little or no root mat; no submerged vegetation.				H	Hard-pan clay or bedrock; no root mat or vegetation.						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	<b>6</b>	5	4	3	2	1	0
3. Pool variability	sha	en mix illow, la all-shai p pool:	arge-d	leep, small-	<u></u>	Majority of pools large- deep; very few shallow.			Shallow pools much more prevalent than deep pools.			Ma	Majority of pools small- shallow or pools absent.								
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	of is and bott	e or no slands less tl om aff iment o	or poi han 20 ected	nt bar 0% of by	bar formation, mo of the from gravel, sand sediment: 20-509			ostly d or fi % of t slight	ne he	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.				ine the ds;	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.						
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	both mini	er read lower mal an nnel su osed.	bank: nount	s, and of	of 	Water fills >75% of the available channel; or <25% of channel			Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.				cha pre	Very little water in channel and mostly present as standing pools.							
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	ò
6. Channel alteration	dred minir	redging absent or inimal; stream with ormal pattern.				Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not			Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.				gab 80% cha disr hab	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.							
SCORE					- 1	prese		101110	HOL												

Continued over

#### LOW GRADIENT STREAMS

Page 2 of 2

Habitat					Condition category													
parameter	Ex	cell	ent			Good	l				Fair					Pod	or	
7. Channel sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas).				The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.			The bends in the stream increase the stream 1 to 2 times longer than if it was in a straight line.				Channel straight; waterway has been channelized for a long distance.						
SCORE	20 19	18	17	16	15 1	4 13	12	11	10	9	8	7	6	5	4	3	2	1 00
8. Bank stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.			of eros over. reach	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.			60% has a high	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.				Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left bank		10	9	8	7		6	5		4		3	2	2	1		0
SCORE	Right bar	nk	10	9	8	7		6	5		4		3	2	2	1		0
9. Vegetative protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understorey shrubs, or non woody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.			70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one half of the potential plant stubble height remaining.			50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.				Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.							
SCORE	Left bank	:	10	9	8	7		6	5		4		3	:	2	>1	1	0
SCORE	Right bar	nk	10	9	8	7		6	5		4		3	2	2	$\searrow$	<	0
10. Riparian zone score (score each bank)	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.			Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.			Width of riparian zone 6- 12 metres; human activities have impacted the riparian zone a great deal.				Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.							
SCORE	Left bank	,	10	9	8	7		6	5		4		3	-	2	->1	4	0
SCORE	Right bar	nk	10	9	8	7		6	5		4		3	:	2	7	peth.	0

BROAD STACLOW

NO TRUE BANKS

TOTAL LOW GRADIENT HABITAT SCORE

Channel cross-sections and Detailed instructions on the meas Two cross-sections are required at homogon Where the water level at the time of sampling water surface and the water mark should be	variables to be measured in urement of channel cross-sections eneous sampling sites (generally lowland strong is at or near the water mark level, stream	n the area around a cros	S section Il manual. Be familiar wi	th these before proceeding. enerally upland streams). mark. In this case, vertical distance	
Cross-	section sketch	10.15	「ype of bedform at th ☐ Riffle ☐ Run ☐ Po	ool Cascade Other	
outcrops and	GRAZING IMPROVED THE SHAPE OF THE CLARKETH SHOW IN CROSS-Section the shape of the clace, watermark and bankfull points. Also show other fisnags encountered at the cross section.	hannel and include the location of	Stream width at the	` ′	Bank height (m
Bank width (m)  Vertical distance between the water surface and the water mark (m)	Horizontal distances (m)  Vertical water depths (cm)				Vertical distance between the water mark (m)
Riparian zone width  Left bank (m) Right bank		ss-section measurement	t		water mark (m)
Bank material Assess % compositi	on for each hank Substrate coi	ion in the area of bed 5m either side of the side of t	Periphyton of 10%	algae cover t ]10–35%	 ]65-90%

Total 100% each

<b>AUSRIVAS Physical and</b>	<b>Chemical Assessment</b>	Protocol Field Data	Sheets	Page 1	13
				9 -	

Site No. 0 17 Date 22-8-18-

#### Channel cross-sections and variables to be measured in the area around a cross section

Detailed instructions on the measurement of channel cross-sections are provided in the protocol manual. Be familiar with these before proceeding.

Two cross-sections are required at homogeneous sampling sites (generally lowland streams) and three cross-sections at heterogeneous sampling sites (generally upland streams).

Where the water level at the time of sampling is at or near the water mark level, stream width at the water surface will be equal to stream width at the water mark. In this case, vertical distance between the water surface and the water mark should be entered as 0.

	Cross-section sketch	I WATER MARIL +	Cros	s-section number of
	1.5	· * * * * * * * * * * * * * * * * * * *	Type of	bedform at the cross-section
				Run Pool Cascade Other
Bank height (m)	31 M			Bankfull channel width (m) (=total of boxes A+B+C) Bank height (m
		section the shape of the channel and include the location of points. Also show other features such as bars, rocky oss section.		width at the water mark (m) 39 A width at the water surface (m)
Bank width (m)	Horizontal dis	tances (m)		Bank width (m)
Vertical distance between the water surface and the water mark (m)	Vertical water	depths (cm)		Vertical distance between the wate surface and the water mark (m)
		Notes on cross-section measure	ment	
Riparian zone width	. ab	<u> </u>	til A	LL SMALLOW FLOOD WAY WITH
Left bank <u>32</u> (m) F	Right bank(m)	rookly officio cha	MH CL	P. THIS OUR
Bank material Assess	s % composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either the cross-section.	er side of	Assess in the area 5m either side of the cross section  Assess in the area 5m either side of the cross section  5 10 10 35% 35-65% 65-90% 90%
Bedrock		Bedrock	)	
Boulder (>256mm)		Boulder (>256mm)		Periphyton cover
Cobble (64-256mm)		Cobble (64-256mm)	%	<10% 10-35% 35-65% 65-90% >90%
Pebble (16-64mm)		Pebble (16-64mm)	Total 100%	Moss cover
Gravel (2-16mm)		Gravel (2-16mm)		<10% 10–35% 35-65% 65-90% >90%
Sand (0.06-2mm)		Sand (0.06-2mm)		
Fines (silt and clay, <0.06mn	m) 100 100	Fines (silt and clay <0.06mm)	<u> </u>	Detritus cover
	Total 100% each		-	<10% 10-35% 35-65% 65-90% >90%

AUSRIVAS Physical	and Chemical Assess	ment Protocol Field Data Sheets	Page 14	Site No Date
Two cross-sections are require	the measurement of changed at homogeneous sampling sites	be measured in the area around a nel cross-sections are provided in the p (generally lowland streams) and three cross-section ter mark level, stream width at the water surface w	rotocol manu	
	Cross-section sketch	1	Cros	ss-section number of
			Type o	of bedform at the cross-section
Bank height (m)	The channel sketch should show in cross	s-section the shape of the channel and include the location of	Stre	Bankfull channel width (m) (=total of boxes A+B+C)  am width at the water mark (m)  Bank height
Bank width (m)	the water surface, watermark and bankfi, outcrops and snags encountered at the c	iii points. Also snow other features such as bars, rocky ross section.		n width at the water surface (m)
Vertical distance between the water surface and the water mark (m)	Vertical water	depths (cm)	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Vertical distante between the wasurface and the
Riparian zone width		Notes on cross-section measure	ement	water mark (m
Left bank (m) R	light bank (m)			
Bank material Assess Bedrock	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m eith the cross-section.	er side of	Assess in the area 5m either side of the cross section  Assess in the area 5m either side of the cross section    <10%
Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm)		Bedrock Boulder (>256mm) Cobble (64-256mm)		Periphyton cover  <10% 10-35% 35-65% 65-90% >90%
Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay, <0.06mm)		Pebble (16-64mm)  Gravel (2-16mm)  Sand (0.06-2mm)		Moss cover
,	Total 100% each	Fines (silt and clay <0.06mm)	<i>)</i>	<b>Detritus cover</b> ☐ <10% ☐ 10–35% ☐ 35-65% ☐ 65-90% ☐ >90%

AUSRIVAS Physical Assessment Protocol Field Data Sheets	Page 1 Site No. OF Date 22.8-18
Date 22.8.18 Site No. 018 Time 14:	20 Recorder's Name SARAH CHAUERT
River Name Folist Classic Location Road	AD RESOLUE
	Photograph numbers and details
Latitude: $28460$ Longitude: $150$ $24$ $27$	018) 1+2 4/5, 3-4 REATRE, SAG D/5
GPS Name and Datum	
PLANFORM SKETCH OF SITE Including bedform types, location of cross-sections, access points, landmarks and natural or artificial channel or floodpl Left bank is facing downstream.  CASURINA  SOME ARUBANIC  SPECIES YEONCARE  IN DICATE  CHARLELD  HYDROLO GY:  MYDROLO GY:  CULVENT	Bankfull width  x 10  Length of sampling site(m)  Notes  BROAD UNDEFINED FLOODGAY  NO CLOSS SICTION E AND SOME DATING NOT COLLECTED
X X	BEFORE LEAVING THE SITE, CHECK DATA SHEETS TO ENSURE THAT ALL VARIABLES HAVE BEEN BECORDED

Acknowledgments - The content and layout of these data sheets are derived from the sheets used in the River Habitat Audit Procedure (Anderson, 1993a), AUSRIVAS, the Index of Stream Condition (Ladson and White, 1999 and DNRE Victoria) and the River Habitat Survey (Raven et al., 1998).

<b>AUSRIVAS Physical A</b>	Assessment Protocol Field Data Sheets
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Temperature

Conductivity

рΗ

Turbidity

Dissolved Oxygen

Total phosphorus

Total nitrogen

**ALKALINITY** 

Alkalinity

Amount of water

Amount of H2SO4

Floodplain width

channel

floods

Flood channels

BASIC WATER CHEMISTRY Valley shape Local impacts on streams **Units** Choose one category only °c Steep valley mg l<sup>-1</sup> Shallow valley Dissolved Oxygen Sat. % Broad valley Gorge Symmetrical floodplain ml Asymmetrical ml floodplain mg l<sup>-1</sup> Local landuse BROARD Floodplain features Choose one or more features when present Sampling site has no distinct floodplain Scroll systems Short, crescentic strips or patches formed Oxbows / billabongs along the inner bank of a stream meander Body of water occupying a former river meander, isolated by a shift in the stream Splays Small alluvial fan formed where an overloaded stream breaks through a levee Remnant channels and deposits material on the floodplain Formed during a previous hydrological regime. May be infilled with sediment Floodplain scours Scour holes formed by the concentrated clearing and digging action of flowing water A channel that distributes water onto the floodplain and off the floodplain during No floodplain features present Floodplain present at the sampling site but does not contain any of the above features

Choose one or more categories	s and describe the detail of ea	ach

Site No. <u>918</u> Date <u>22-8-18</u>

Sand or gravel mining	Sewage effluent
Other mining	Channel straightening
Road	River improvement works
Bridge / culvert / wharf	Water extraction
Ford / ramp	Dredging
Discharge pipe	
Forestry activities	Litter
Sugar mill	Recreation
Irrigation run-off or pipe outlet	Other
Description LEVEE C	RMATED BY ROAD.

Choose one category for each bank

Page 2

Left	Right
	Native forest
	Native grassland (not grazed)
$\times$	Grazing (native or non-native pasture)
	Exotic grassland (lawns etc., no grazing)
	Forestry Native [ ][ ] Pine [ ][ ]
	Cropped Rainfed [ ][ ] Irrigated [ ][ ]
	Urban residential
	Commercial
	Industrial or intensive agricultural
	Recreation

<b>AUSRIVAS Physical Assessm</b>	ent Protocol Fie	eld Data She	ets	Page 3	Site No.	018	Date <u>_</u>	2 - 8 - 18		
Riparian zone composition Assess for whole sampling site	AS \$55500 M	ARE 1201	CA750: 124		Longitudina Choose one cat	tegory for e	each bank. Do	not هما		_ UN DOY
· · · · · · · · · · · · · · · · · · ·	% Cover		Vegetation Description		include ground native grassland		pt where site is			Right bank
Trees (>10m in height)	10 ·		CASURINA-	······································	None		~	$\sim$		
Trees (<10m in height)	1	_ \	U		Isolated / so	cattered	× >		Ħ	Ħ
Shrubs	D'	May total mo than 100%	<del></del>		Regularly s	paced	·····	٠٠٠.	$\Box$	$\Box$
Grasses / ferns / sedges	50		ative + EDLOTIL GR	ASSUS,	Occasional	clumps	9500	~	Ħ	Ħ
Shading of channel					Semi-contin	nuous	350.000 00 100.00	-	$\overline{\Box}$	$\Box$
5.5% 6 - 25%	26 – 50%	<ul><li>≤ 51 – 75%</li></ul>	= > 76% ~ A		Continuous		33.00 to the Cartestaning	*****		
Extent of trailing bank vegeta  in in mode  slight exten		lative and ex % Native % Exotic	otic riparian vegetation		_	ling site i	tive woody von undisturbe	d forest?		ealth)
Overall vegetation disturband Choose one category only. Sites category. Words within the drawing	with valley vegetat	tion cleared one detailed text a	BOTH sides, but with riparia	an vegetatic n and vallev	If no, record regeneration category on in good condition for each of the condition for each of t	tion shoul	Present Presen	<1% cove	r)	·
Extreme disturbance		High disturba			Low disturban	_	<i>,</i>			
cleared cleared reduced. Vegetation – al reduced. Vegetation is e dominated by exotic speciare or completely absent Valley vegetation – agric land BOTH sides. Plants exotic species (willows, p	extremely disturbed (ie. ies with native species di) culture and/or cleared present are virtually all	cleared mod disturb minor disturb.		isturbed by ic species, n /or cleared the other	undisturb. undisturb. or minor undisturb.	Riparian ve on BOTH sid condition wit disturbance Valley vege BOTH sides	getation – native ve des of the river and i th few exotic species present is relatively tation – native vege of the river, with a v few exotic species	in relatively goo s present. Any minor. etation present o	d	
Very high disturbance		Moderate dis	turbance	,	Very low distur	rbance [				
Riparian vegetation – s present, but it is severely by grazing or the intrusion Native species severely r cover.  ✓ Riparian ➤ Valley vegetation – agri land BOTH sides. Plants exotic species (willows, processor)	modified BOTH sides n of exotic species. educed in number and culture and/or cleared s present are virtually all	cleared undisturbed or minor or minor or Riparian Valley	sides with canopy intact or with native	e species ian zone. The nd of moderate or cleared land	undisturb. undisturb.  pristine  Riparian	BOTH sides Exotic speci- natural vege Valley vege BOTH sides species are	getation – native ve of the river and in a es are absent or rare tation in excellent co tation – native vege of the river with an ia	in undisturbed se. Representate ondition present dintact canopy. Interesent contests of the contest of the cont	tate. ive of in Exotic	

—Valley——

vegetation in excellent condition

AUSRIVAS P	hysical Assessme	ent Pr	otoc	ol Fiel	d Data Sheets			Page 4		Site No	8	Date	22-8-18
Physical bar Choose one ca	rriers to local fish ategory for each flow	condit	ion		Type of bars Choose one or r	nore categ	ories	Extent		a <b>rs</b> nbed forming a l	bar of	anv tvp	pe ♡ %
		Base flow	Low flow	High flow		Bars abs	sent			sediment partic			
	No passage							Boulde Sand	r/cob	oble [ ] Pebbl	le [	] Gra	vel [ ]
B						Side/poi						] or _	
	Very restricted	]						Chanr		odifications C	hoose	one or r	nore categories
G	passage		$\times$			Side/poi	nt bars ETATED  ┌──			No modifications	-		Reinforced
	Moderately					-	nnel bars				X_		
	restricted					VEGETA				Desnagged	876	<b>₩</b>	Revegetated
	passage					Mid-chan	nel bars				$\dashv$ $\checkmark$		
	Partly restricted passage			$\boxtimes$		UNVEGE				Dams and			Infilled
	,					Bars arou				diversions			
1	Good passage		$\Box$			Obstruction	5116			Resectioned			Berms or
						Braided	channel		]	г	_		embankments
57	Unrestricted	]				Infilled ch	annol		y	Straightened			Recently
	passage					milled Ci	larinei			otraighteneu -		igns of ork still	channelised
Type and heig	ht of barrier(s)	<b>.</b>				High flow	deposits		.~	Doolianad			<u> </u>
UATER I	DEPTHY WILL PASSAGE	REST	C129	<del></del>				نئے۔ 🏻 🔻	<i>7.</i>	Realigned		orks old and	Channelised in the past
Channel sha	<b>pe</b> Choose one cat	egony	only	·· <del>·····</del>				<u> </u>			reve	egetated	
		egory	Offig						<u> </u>			<del></del>	
			$\int$	L		L					L	12	حمر
	U shaped	Flat	U sh	aped	Deepened	U shape	Widene	ed or infill	ed	Two	stage	, \	
			$\overline{\Gamma}$			L	¬	_	<u> </u>	1			ivialli stage
			)										
	Box		Wide	e box		/ shaped		Trapezo	oid	Concr	ete V		Pipe or culvert

AUSRIVAS Physical Assessme	nt Protocol Field Data Sheets	Page 5 Site No. <u>○18</u> Date <u>22-8-18</u>
Bank shape Choose one category for each bank Left Rightal	ht Left Rig	int inderate profuse
Concave	Vertical 80 - 90°	Water oils  ☑ none ☐ flecks ☐ globs ☐ sheen ☐ slick
Convex	Steep 60 - 80°	Sediment odours  normal/none sewage petroleum chemical
Stepped	Moderate 30 - 60°	anaerobic other  Water odours
Wide lower bench	Low 10 - 30°	normal/none sewage petroleum chemical other
Undercut	Flat <10°	Turbidity (visual assessment)  Clear Slight Turbid Opaque
Factors affecting bank stability Choose one or more categories  None  Mining  Runoff  Stock access Human access Ford, culvert or bridge Feral animals Other  Description  Cleared vegetatio Irrigation draw-dow Reservoir releases Flow and waves  Drainpipe	Artificial bank protection measures Choose one or more categories  None Fence structures Levee banks Rock or wall layer  Artificial bank protection measures watering production watering production plantings Logs strap	Suspended material (e.g mud, clay, organics)  Water level at the time of sampling  Dry No flow Low Baseflow or near basefle High Flood (don't sample)  Artificial features at the sampling site Choose one or more categories  Major Minor Ford Bridge Culvert Other weir  Description CULVERT AT DOUGH STREAM

Gradient 3-60*  Stac Height can Gradient 5-60*  Cascade Gradient 5-60* Gradient 1-3* Gra	AUSRIVAS PI	hysical Assess	sment Protocol Field Data	Sheets	Page 6	Site No	Date	
A reasonable sized Carsarder 1-3°   Sinal but distinct soft Surface unbroken and smooth of Site   St. Av. Length (m)   Est. Av. Le				Macrophyte cover Asses	s % cover of the	sampling site by	each category.	
Est. Av. Length (m)   Est. Av. Height (m)   Est. Av. Height (m)   Est. Av. Height (m)   Est. Av. Gradient (*)   Est. Av. Gradient (*)   Est. Av. Gradient (*)   Est. Av. Height (m)   Est. Av. Heigh			ν.Λ	Overall % cover of macrop	hytes _2_	% cover of	emergent macrophyte	s 2
Est. Av. Height (m) Est. Av. Gradient (°) Strong currents Strong currents Gardient 3-5' Gradient 1-3' Strong currents Rocks break Surface unbroken Dut unsmooth Dist. Av. Depth (m) Dut unsmooth Dist. Av. Uength (m) Dist. Av		Waterian	Est. Av. Length (m)				· · · · · ·	<u>ව</u>
Est. Av. Length (m)   Est. Av. Depth (m)   E							· -	es
Strong currents   Rapid   Strong currents   Rocks break   Est. Av. Length (m)   Est. Av. Length (m)   Est. Av. Depth (m)   Est. Av. Width (m)   Est. Av. Width (m)   Est. Av. Depth (m)   Est. Av. D	Gradient 5-60°		Est. Av. Length (m) Est. Av. Height (m)	Use a macrophyte field guide Listed macrophytes can be c	e (i.e. Sainty and hanged to reflec	t the common tax	aid identification. a present in each State o	r Territory
Est. Av. Depth (m) Est. Av. Width (m) Est. Av. Length (m) Est. Av. Useth (m) Est. Av. Useth (m) Est. Av. Length (m) Est. Av. Length (m) Est. Av. Useth (m) Est. Est. Est. Est. Est. Est. Est. Est.	Strong currents	1					l macrophytes	
Areasonable sized cyrents Surface unbroken and smooth  Areasonable sized cyrent Surface unbroken and smooth  A reasonable sized (>20% of channel width) cut-off section area for facility and find the cyrent decimes width) cut-off section area from the cyrent source and smooth of the cyrent source and success and succe			Est. Av. Depth (m)	•			Present	
Surface unbroken but unsmooth b		Riffle	% of site			•	<i>'</i>	
Gradient 1-3° Small currents Surface unbroken and smooth  Gradient 1-3° Small but distinct & uniform current Surface unbroken stream widens or deepens and current declines  A reasonable sized (>20% of channel width) cut-off section away from section away fro				- ·			·	
Gradient 1-3° Small currents Surface unbroken and smooth  Gradient 1-3° Small but distinct a uniform current Surface unbroken  Area where stream widens or deepens and current declines  A reasonable sized (>20% of channel width) cut-off section away from s	but unsmooth	1.44		• • • •				
Small currents Surface unbroken and smooth  Gradient 1-3° Small but distinct uniform current Surface unbroken  Area where stream widens or deepens and current declines  A reasonable sized (>20% of channel width) cut-off section away from set on and smooth  Est. Av. Length (m) Cother  Other	Gradient 1.3°	Clida	, ,			•	· —	
## Surface unbroken    Fist. Av. Depth (m)	Small currents	Glide		•	<u> </u>		· / —	
Gradient 1-3° Small but distinct & uniform current Surface unbroken  Area where stream widens or deepens and current declines  A reasonable sized (>20% of channel width) cu-off section away from section away fr		200	Est. Av. Depth (m)				=	
Sralle tot distinct & uniform current Surface unbroken  Area where stream widens or deepens and current declines  A reasonable sized (>20% of channel width) cut-off section away from section a							· —	
Suniform current Surface unbroken  Surface unbroken  Area where stream widens or deepens and current declines  A reasonable sized (>20% of channel width) cut-off section away from section away		Run	% of site	· · · · · · · · · · · · · · · · · · ·		Other		
Surface unbroken  Area where stream widens or deepens and current declines  A reasonable sized (>20% of channel width) cut-off section away from section awa				•	<u> </u>	Other		
Area where stream widens or deepens and current declines  A reasonable sized (>20% of channel width) cut-off section away from section awa			Est. Av. Depth (m)	• • •		Other		
Area where stream widens or deepens and current declines  A reasonable sized (>20% of channel width) cut-off section away from section away from stream widens or deepens and current declines  A reasonable sized (>20% of channel width) cut-off section away from stream widens or deepens and current declines  M of site  Other			Est. Av. Width (m)			Floating m	acronhytes	
Est. Av. Length (m)   Callitriche (Starwart)		Pool	% of site					
Current declines  Little Est. Av. Depth (m) Est. Av. Width (m)  A reasonable sized (>20% of channel width) cut-off section away from section away from Est. Av. Depth (m)  Est. Av. Depth (m)  Callitriche (Starwart)    Other MAN Doo  Other Other  Est. Av. Depth (m)  Other Other  Est. Av. Depth (m)				Other		Azolla (Azolia	<del></del>	
A reasonable sized (>20% of channel width) cut-off section away from section away fr	current declines		Est. Av. Depth (m)			·	′ <u>-</u>	
A reasonable sized (>20% of channel width) cut-off section away from section away fr			Est. Av. Width (m)				· —	7.
width) cut-off section away from  Est. Av. Length (m)  Cother  Est. Av. Depth (m)		Backwater	% of site					
section away from Est. Av. Depth (m)								
😂   Est. Av. Wigth (m)	,		Est. Av. Depth (m) Est. Av. Width (m)	Overall % cover of native n	nacrophyte tax	2 2		
Note: An additional response variable planform channel pattern  Overall % cover of native macrophyte taxa   Total should equal overall % cover of native macrophyte taxa   of macrophytes from above	Noto: An eddition it		, ,				al should equal overall % co	over

Note: An additional response variable <u>planform channel pattern</u> is measured in the office

## Bed compaction

Choose one category only



Tightly packed, armoured Array of sediment sizes, overlapping, tightly packed and very hard to dislodge



Packed, unarmoured Array of sediment sizes. overlapping, tightly packed but can be dislodged with moderate



Moderate compaction Array of sediment sizes, little overlapping, some packing but can be dislodged with moderate



Low compaction (1) Limited range of sediment sizes, little overlapping, some packing and structure but can be dislodged very easily



Low compaction (2)

Loose array of fine sediments, no overlapping, no packing and structure and can be dislodged very easily

Bed stability rating Choose one category only

#### Sediment matrix

Choose one category only



Bedrock



Open framework 0-5% fine sediment, high availability of interstitial spaces



Matrix filled contact framework 5-32% fine sediment, moderate availability of interstitial spaces



Framework dilated 32-60% fine sediment, low availability of interstitial spaces



Matrix dominated >60% fine sediment, interstitial spaces virtually absent

## Sediment angularity

Choose one category only Assess cobble, pebble and gravel fractions only

松	Very angular	
77	Angular	
	Sub-angular	
23	Rounded	
::	Well rounded	
	Cobble, pebble an gravel fractions no present	

In the USEPA Habitat Assessment on the following pages, be sure to use the correct form for high or low gradient streams



Unstable - eroding

- Stable -

Unstable - depositing

# Severe erosion

Streambed scoured of fine sediments. Signs of channel deepening. Bare, severely eroded banks. Erosion heads. Steep streambed caused by erosion.

## Moderate erosion

Little fine sediment present. Signs of channel deepening. Eroded banks. Streambed deep and narrow. Steep streambed comprised of unconsolidated (loosely arranged and unpacked) material

#### Bed stable

A range of sediment sizes present in the streambed. Channel is in a 'relatively natural' state (not deepened or infilled). Bed and bar sediments are roughly the same size. Banks stable. Streambed comprised of consolidated (tightly arranged and packed) material.

# Moderate deposition

Moderate build-up of fine sediments at obstructions and bars. Streambed flat and uniform. Channel wide and shallow.

## Severe deposition

Extensive build up of fine sediments to form a flat bed. Channel blocked, but wide and shallow. Bars large and covering most of the bed or banks. Streambed comprised of unconsolidated (loosely arranged and unpacked) material.

AUSRIVAS Physical and Chemical Site No Date	Assessment Protocol Field Data Sheets	Page 8	
USEPA Habitat Assessment	HIGH GRADIENT STREAMS	 }	Page 1 of 2

	-,-	·	amet																			
Habitat parameter								-	Conc	litior	cat	egor	у									
parameter		E	xcel	lent		T		God	d		1		Fai	r		Poor						
1. Epifaunal substrate / available cover	sub epir fish sub bar sta to a pot tha	faunal cover merge iks, co ble hal illow fu ential	favou coloni mix ed logs obble o bitat a ull colo (i.e. log ot nev	1% of rable for sation of snager other other of at some of snager other	and gs, ercut r tage in gs	ha ful po ha of of the no	bitat; v I color tential bitat fo popula addition form t yet p	well-si isatio ; adec or mai ations; of ne repard ion (n	uate ntenar prese ubstrat wfall, b ed for nay rat	nce ence e in	hat ava des	oitat; h ilabilit sirable	mix of nabitat y less ; subs y distr	stable		Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.						
SCORE	20	19	18	17	16	15		_	7	11	10	9	8	7	6	5	4	3	2	1	0	
2. Embeddedness	Gravel, cobble and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.						avel, c ulder p % suri diment	article ound	and es are ed by	25-	Gra bou 75%	ivel, c	obble article ounde		50-	Gr bo mo	avel, ulder ore th	cob part an 7	ble ar	nd are	10	
SCORE	20	19	18	.17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
3. Velocity / depth regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is <0.3m/s, deep is >0.5m).					pre mis tha	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).						reser r slow	habita nt (if fa s-shall ore lo	ist- ow	Dominated by 1 velocity/depth regime (usually slow-deep).						
SCORE	20	19	18,	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
4. Sediment deposition	islar less affe dep	than than the ted by sition	point 5% of y sedii		nd ttom	bar fror sec bot dep	forma m grav liment tom af	ition, i el, sa ; 5-30 fected n in po	ease in mostly nd or to % of to	îne 1e	new sedi new bott sedi obst cons	grave iment bars; om af ment truction striction	el, sar on old 30-5 fected depos ins, ons ar depos	0% of its at id ben sition i	of ine the	He ma dev 50% cha poor to s	avy o tena velop % of angin	deporting free most	sits o rease t; mo ootton quen abse	f fine ed ba re than n tly; ent d	r en	
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
5. Channel flow status	both mini	lower mal an mel su	banks	of		ava <25	ilable of	hann		е	avail and/	able o	hann e sub	strate		cha	innel sent	and	ter in most tandi	ly		
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
6. Channel alteration	Channelization or dredging absent or minimal; stream with normal pattern.						Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. a dredging (greater than					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	pres 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

AUSRIVAS Physical and Chemica Site No Date	Assessment Protocol Field Data Sheets	Page 9
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Habitat .							Co	ondition	catego	ory				-			
parameter		Ex	celle	ent			Good			Fair		Poor					
7. Frequency of riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream < 7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.  20 19 18 17 16  Banks stable; evidence					infreque between by the v	ence of riff ent; distan n riffles div vidth of th is between	ce ⁄ided e	bottom of some had between by the w	onal riffle of contours pabitat; dist n riffles div vidth of th is between	provide tance vided e	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE	20	19	18	17	16	15 1	1 13	12 11	10 9	8	7 6	5 4	3 2	1	0		
8. Bank stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.				ilure tle	infreque of erosi over. 5	tely stable ent, small on mostly -30% of b as areas o	areas healed ank in	60% of has area	tely unsta bank in re as of eros ssion pote loods.	each ion;	Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE	Left	bank		10	9	8	7	6	5 4 3			2	1		0		
SCORE	Righ	t ban	k	10	9	8	7	6	5	4	3	2	1		0		
9. Vegetative protection (score each bank)	strea and i zone vege trees shrul macr disru grazi minir almo to gra	than amban cover tation, under the cover tation, in the cover tation in the cover table in tabl	k sur diate i red by inclu- erstor non v es; vo throu mowinot e blants	faces ripania y nati y nati uding rey wood egeta gh ing vider s allow	y titive	covered vegetati of plant represe evident full plan to any g more th	pank surfa l by native ion, but or is is not we nted; disri- but not aff t growth p preat exter an one ha ential plant height	ne class ell- uption fecting ootential at;	covered disruption patches closely of vegetation than one potentia	eank surfa by vegeta on obvious of bare s	ation; s; oil or on; less ne	Less than 50% of the streambank surfaces covered by vegetation; disruption of streamban vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.					
SCORE	Left	bank	$\perp$	10	9	8	7	6	5	4	3	2	1		0		
SCORE/	Righ	t ban	k	10	9	8	7	6	5	4	3	2	1		0		
10. / Riparian zone score (score each bank)	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.				ıve	12-18 n activitie	f riparian : netres; hu s have imp rian zone ly.	man pacted	12 metr activities	f riparian es; humai s have imp nan zone	n pacted	Width of riparian zone <6 metres; little or no riparian vegetation is present because of human activities.					
SCORE	Left	bank		10	9	8	7	6	5	4	3	2	1		0		

TOTAL HIGH GRADIENT HABITAT SCORE

AUSRIVAS Phy Site No.	sical	and	l Ch	emio Da	cal A ite _	sses	ssm	ent	Prot —	ocol	Fiel	ld Da	ata S	Shee	ets	Pag	ge 1	0			
USEPA Habitat						LO	W	GR	RAE	ΙE	NT	ST	RE	A	ИS				Pag	e 1 c	of 2
Habitat					-				Cond	litio	n cat	egor	v								
parameter		E	ccell	ent				Goo	d			<u>-3</u>	Fair	-		Poor					
1. Epifaunal substrate / available cover	sub epif and sna und or c and cold (i.e. not	ater ti strate aunal fish o gs, su ercut ther s at sta nisatio logs/s new fa sient)	favou coloni cover; ibmer banks table age to on pot snags all and	irable isation mix or ged los, coblination allow tential that a	for f ggs, ble at full	habifull of potes habi of potes the notical	itat; w colonial; itat for opulat ddition form of yet pr nisation	rell-su sation adequ r main tions; nal su of new epare	uate itenan prese bstrati fall, b d for ay rati	ce nce e in ut	hab avai desi freq	30% n itat; h: ilability irable; uently oved.	abitat less subs	than trate		Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	YK.	٥
2. Pool substrate characterization	mat and root sub	ture of erials, firm s mats merge imon.	with sand pand	gravel prevale	ent;	Mixt muc be d mat	ure of l or cla lomina s and	soft s ay; mu ant; so	sand, ud ma ome ro erged	y	All n botto mat;	nud or om; lit ; no su etation	clay tle or ubmer	or sai	nd	Hard-pan clay or bedrock; no root mat o vegetation.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool variability	shal sma	n mix low, la ill-sha o pool	arge-d	leep, small-					s large shallo		more	llow pools	alent		<u></u>	Majority of pools small- shallow or pools absent.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4. Sediment deposition	of is and botte	e or no lands less ti om aff ment	or poi han 20 ected	int bar 0% of by	's	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions and bends; moderate deposition in pools prevalent.					Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.					in Je
SCORE	20	19	<b>718</b> ~	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5. Channel flow status	both mini	er rea lower mal ar nnel su sed.	bank nount	s, and	and available channel; or available channel, <25% of channel and/or riffle substrate							el, strate		cha	nnel sent	e war and as st	most	ly			
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0<
6. Channel alteration	dredging absent or minimal; stream with normal pattern.  present of bridg evident channe dredgin 20 yr) r					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent			Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.				Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.								

20 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

SCORE

Continued over

<b>AUSRIVA</b>	S Physical a	ind Chemical	Assessment Protocol Field Data Sheets	Page 11
Site No.	018	Date	22-8-18	•

USEPA Habitat Assessment Circle a score for each parameter

# LOW GRADIENT STREAMS

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Habitat	Condition category																	
parameter		Ex	celle	ent			Good				Fai	r		Poor				
7. Channel sinuosity	incre lengt longe strain chan cons coas low-l	bends ease that 3 to er that ght lin nnel brosidered stal plat lying a meter d in the	ne stro 4 tim n if it v e. (No raiding d norm ins an ireas. is no	eam nes was in ote – g is nal in nd otl This t easi	n a her s	increase length 2	nds in the e the stre ? to 3 tim han if it v line.	increas 2 times	ends in the se the st s longer a straig	ream than	1 to f it	Channel straight, waterway has been channelized for a long distance.						
SCORE	20 19 18 17 16  Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					15 14	1 13	12	11	10 9	5 4	3	2	1 0				
8. Bank stability (score each bank)						of erosion	tely stablent, small on mostly -30% of as areas	area heal bank	ed	60% o has ar high e	ately uns f bank in eas of er rosion po floods.	reac osion	n ;	Unstable; many eroded areas; 'raw' areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.				
SCORE	Left	bank		10	9	8	7		6	5	4		3	2		1	0	
SCORE	Righ	nt bar	ık :	10	9	8	7	5	4	3	2	T	1	0				
9. Vegetative protection (score each bank)	strea and zone vege trees shru maci disru grazi minir almo	e than ambar immed cove etation s, und abs, or rophyl uption ing or mal or ost all	ik sur diate r red by incluerstor non v tes; vot through mowing not e	faces inparia y nati y nati uding ey wood egeta gh ing evider s allow	y titive	covered vegetati of plants represe evident full plan to any g more th	pank surfl l by nativion, but on s is not vinted; dis but not a t growth great external plant an one hential plant height	stream coveredisrupt patched closely vegetad than of potenti	% of the ibank sud by veg tion obvises of barric cropper tion comne-half cial plant remaining	or less	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimetres or less in average stubble height.							
SCORE	Left	bank	_	10	9	8	7		6	5	4		3	2	7	1<	0	
SCORE	Righ	nt bar	ık	10	9	8	7		6	5	4		3	2	7	1	0	
10. Riparian zone score (score each bank)	Width of riparian zone >18 metres; human activities (i.e. roads, lawns, crops etc.) have not impacted the riparian zone.				ive	Width of riparian zone 12-18 metres; human activities have impacted the riparian zone only minimally.				12 me activiti	of riparia tres; hur es have arian zor	nan impad	ted	Width <6 me riparia prese huma	tres; li n vege nt bec	ittle or etation ause (	no is	
SCORE	Left	bank	T	10	9	8	7		6	5	4		3	2	T	1	0	
SCORE	Right bank 10 9					8	7	1	6	5	4	+	3	2	+-	1	0	

40 0EFINOD BANKS

UN OFFINOO.

TOTAL LOW GRADIENT HABITAT SCORE

AUSRIVAS Physical a	and Chemical Assessm	nent Protocol Field Data Sheets Pa	age <b>12</b>	Site No Date	
Detailed instructions on Two cross-sections are require	the measurement of changed at homogeneous sampling sites ne of sampling is at or near the wa	ne measured in the area around a conel cross-sections are provided in the pro- (generally lowland streams) and three cross-section ter mark level, stream width at the water surface will	tocol manua	I. Be familiar with these before proceedi	ng. cance between the
	Cross-section sketch		Type of	bedform at the cross-section Run Pool Cascade O	
Bank height (m)	The channel sketch should show in cross the water surface, watermark and bankfu outcrops and snags encountered at the c	s-section the shape of the channel and include the location of Il points. Also show other features such as bars, rocky ross section.	ĺ	Bankfull channel width (m) (=total of boxes A+B+C)  Im width at the water mark (m) width at the water surface (m)	Bank height (m
Bank width (m)  Vertical distance between the water surface and the water mark (m)  Riparian zone width	Horizontal dis		nent		Vertical distance between the water mark (m)
Left bank (m) R  Bank material Assess  Bedrock  Boulder (>256mm)  Cobble (64-256mm)  Pebble (16-64mm)  Gravel (2-16mm)  Sand (0.06-2mm)  Fines (silt and clay, <0.06mm)	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	side of	<10%	

AUSRIVAS Physical	and Chemical Assessn	nent Protocol Field Data Sheets P	age 13	Site No Da	ate
Detailed instructions on Two cross-sections are require	the measurement of channed at homogeneous sampling sites one of sampling is at or near the water	e measured in the area around a cel cross-sections are provided in the pro (generally lowland streams) and three cross-sections er mark level, stream width at the water surface will be a consequent to the consequence of th	tocol manual	I. Be familiar with these before procee	_
	Cross-section sketch			Cross-section number of _	
			1	bedform at the cross-section  Run Pool Cascade	Other
Bank height (m)		·		Bankfull channel width (m) (=total of boxes A+B+C)	Bank height (
	The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.		Stream width at the water mark (m)  Stream width at the water surface (m)		
Bank width (m)  Vertical distance between the water surface and the water mark (m)	Horizontal dist		ment		Vertical distance between the wat surface and the water mark (m)
Riparian zone width					
Bank material Assess Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay, <0.06mm)	% composition for each bank  Left bank Right bank	Substrate composition Assess % composition in the area of bed 5m either the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	r side of	Filamentous algae cover    <10%	

		ment Protocol Field Data Sheets F		Site No Date		
Two cross-sections are require	the measurement of chan- ed at homogeneous sampling sites ne of sampling is at or near the wa	nel cross-sections are provided in the pro	tocol manua	- L - B - C		
	Cross-section sketch			Cross-section number of		
				f bedform at the cross-section e Run Pool Cascade Other		
Bank height (m)			Bankfull channel width (m) (=total of boxes A+B+C)  Bank height			
	The channel sketch should show in cross-section the shape of the channel and include the location of the water surface, watermark and bankfull points. Also show other features such as bars, rocky outcrops and snags encountered at the cross section.		Stream width at the water mark (m)  Stream width at the water surface (m)			
Bank width (m)  Vertical distance between the water surface and the water mark (m)	Horizontal dis	rtances (m)		Bank width (r		
Riparian zone width  Left bank (m) Right bank (m)		Notes on cross-section measurement water mark (m)				
Bank material Assess  Bedrock  Boulder (>256mm)  Cobble (64-256mm)  Pebble (16-64mm)  Gravel (2-16mm)  Sand (0.06-2mm)  Fines (silt and clay, <0.06mm)	% composition for each bank  Left bank Right bank  ———————————————————————————————————	Substrate composition Assess % composition in the area of bed 5m either the cross-section.  Bedrock Boulder (>256mm) Cobble (64-256mm) Pebble (16-64mm) Gravel (2-16mm) Sand (0.06-2mm) Fines (silt and clay <0.06mm)	Total 100%	Assess in the area 5m either side of the cross section    <10%		

# **Henderson, Courtney**

**From:** Billington, Jonathan

Sent: Monday, 26 November 2018 5:44 PM

To: Henderson, Courtney
Cc: Monte, Anneke

**Subject:** Further information surface water quality

#### Hi Courtney

In response to your queries.

- There are no calibration certificates available for the water quality meter used to collect in-situ readings. This is Dion's personal unit and whilst he completes regular field calibrations. General parameters were collected using YSI pro Multi-parameter water quality meter and turbidity using a Hach 2100Q portable turbidimeter.
- Raw in-situ water quality is provided in our ecology technical report, this report details both terrestrial and aquatic investigations. I can provide you the initial spreadsheet taken off of the tablet but the data in the report is the same. Our report is saved on project-wise <a href="here">here</a>. Also of use may be the photos of the surveyed reach of each site. If you want the full size photos I can link you to these so let me know but probably easier to just use our report which has identified upstream and downstream photos.
- Descriptions of each site reach are provided in the above linked technical report. In speaking to Dion who completed the work I understand that there was no rainfall either immediately prior to or during the survey program but as he isn't based out there he can't provide a lot more intel than that. You'd need to look at BOM observations to get a better overall picture of preceding rainfall but most of the sites sampled are highly ephemeral and the region was considered to be in drought at the time of assessment.

I'll be around tomorrow so we can talk then.

Thanks
Jonathan Billington
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