Ruahorehore Stream Tributary

Figure 4-7(a): *Ruahorehore stream forest reach upstream photograph. (RUA_Forest)*

Figure 4-7(b): *Ruahorehore stream forest reach downstream photograph. (RUA_forest)*

Figure 4-7(c): *Ruahorehore stream tributary upper reach upstream photograph (RUA_Upper)*

Figure 4-7(d): *Ruahorehore stream tributary upper reach (RUA_Upper)*

Ruahorehore Stream (lower catchment)

Figure 4-8(a): *Ruahorehore stream lower reach upstream photograph (RUA_Lower)*

Figure 4-8(b)*: Ruahorehore stream lower reach instream photograph (RUA_Lower)*

Figure 4-8(c): *Ruahorehore stream lower already partially revegetated site (RUA_Revegetated)*

Figure 4-8(d)*: Ruahorehore stream lower already partially revegetated site (RUA_Revegetated)*

Ruahorehore Stream (upper catchment)

Figure 4-9(a): *Ruahorehore 'At trig Road' stream tributary upper reach upstream photograph (RUA_Trig Road)*

Figure 4-9(b): *Ruahorehore 'At trig Road' stream tributary upper reach upstream photograph (RUA_Trig Road)*

Figure 4-9(c): *Ruahorehore Stream, near headwaters (TRN_RUA_Upper)*

Figure 4-9(d): *Ruahorehore Stream, near headwaters (TRN_RUA_Upper)*

Figure 4-9(e): *Tributary to Ruahorehore Stream, near headwaters (TRN_RUA_Up_Trib_US)*

Figure 4-9(f): *Tributary to Ruahorehore Stream, near headwaters (TRN_RUA_Up_Trib_US)*

Appendix 5: Macroinvertebrate and Stream Ecological Valuation Data

Waiharakeke Stream

***Table 5-1**: SEV attribute values for Waiharakeke Stream tributaries*

Function category	Function	Waiharakeke Stream tributary	Waiharakeke Stream right branch tributary
Hydraulic	Natural flow regime	0.97	1.00
	Floodplain effectiveness	0.92	1.00
	Connectivity to natural species migrations	1.00	1.00
	Natural connectivity to groundwater	0.99	1.00
Biogeochemical	Water temperature control	0.80	0.74
	Dissolved oxygen levels maintained	1.00	1.00
	Organic matter input	1.00	1.00
	In-stream particle retention	0.98	1.00
	Decontamination of pollutants	0.86	0.90
Habitat provision	Fish spawning habitat	1.00	1.00
	Habitat for aquatic fauna	0.98	0.96
Biodiversity provision	Fish fauna intact	1.00	1.00
	Invertebrate fauna intact	0.89	0.89
	Riparian vegetation intact	0.81	0.90
SEV score		**0.942**	**0.956**

Mataura Stream Tributary 2

***Table 5-2:** SEV attribute values for Mataura Stream Ttributary 1 and 2.*

Function category	Function	Tributary 1	Tributary 2
Hydraulic	Natural flow regime	0.76	0.75
	Floodplain effectiveness	0.18	0.29
	Connectivity to natural species migrations	1.00	1.00
	Natural connectivity to groundwater	0.79	0.83
Biogeochemical	Water temperature control	0.22	0.54
	Dissolved oxygen levels maintained	0.68	0.68
	Organic matter input	0.05	0.40
	In-stream particle retention	0.60	0.70
	Decontamination of pollutants	0.36	0.61
Habitat provision	Fish spawning habitat	0.23	0.63
	Habitat for aquatic fauna	0.60	0.66
Biodiversity provision	Fish fauna intact	0.33	0.33
	Invertebrate fauna intact	0.47	0.74
	Riparian vegetation intact	0.08	0.16
SEV score		**0.453**	**0.594**

Mataura Stream Tributary 3

***Table 5-2:** SEV attribute values for Mataura Stream Tributary 3.*

Function category	Function	Tributary 3		
		North Arm	South Arm (DS)	South Arm (US)
Hydraulic	Natural flow regime	0.95	0.94	0.95
	Floodplain effectiveness	0.22	0.47	0.49

	Connectivity to natural species migrations	0.30	1.00	1.00
	Natural connectivity to groundwater	0.89	0.88	0.91
Biogeochemical	Water temperature control	0.26	0.24	0.42
	Dissolved oxygen levels maintained	1.00	1.00	1.00
	Organic matter input	0.00	0.06	0.03
	In-stream particle retention	0.98	0.97	0.84
	Decontamination of pollutants	0.39	0.66	0.46
Habitat provision	Fish spawning habitat	0.50	0.50	0.50
	Habitat for aquatic fauna	0.59	0.74	0.80
Biodiversity provision	Fish fauna intact	-	-	-
	Invertebrate fauna intact	-	-	-
	Riparian vegetation intact	0.01	0.02	0.04
SEV score		**0.51**	**0.62**	**0.62**

Gladstone Stream

Table 5-3: *SEV attribute values from the Gladstone Stream*

Function	Gladstone
Natural Flow Regime	1.00
Floodplain Effectiveness	0.50
Connectivity for natural species migrations	1.00
Natural connectivity to groundwater	1.00
Hydraulic Functions	**0.88**
Water temperature control	0.50
Dissolved oxygen levels	1.00
Organic matter input	0.50
Instream particle retention	1.00
Decontamination of pollutants	0.61
Biogeochemical Functions	**0.72**
Fish Spawning Habitat	0.05
Habitat for aquatic fauna	0.58
Habitat Provisions Functions	**0.36**
Fish Fauna Intact	0.00
Invertebrate Fauna Intact	0.45
Riparian Vegetation Intact	0.35
Biodiversity Provision Functions	**0.27**
SEV Score	**0.617**

Ruahaorehore Stream

Table 5-4:*SEV attribute values for the Ruahorehore Stream.*

Function	RUA_ Revegetated	RUA_ lower	RUA_ upper	RUA_ forest	RUA_ Trig_Road
Natural Flow Regime	0.78	0.65	1.00	0.99	0.55
Floodplain Effectiveness	0.58	0.17	0.04	1.00	0.17
Connectivity for natural species migrations	1.00	1.00	1.00	1.00	1.00
Natural connectivity to groundwater	0.90	0.75	1.00	0.98	0.80
Hydraulic Functions	**0.81**	**0.64**	**0.76**	**0.99**	**0.63**
Water temperature control	0.20	0.16	0.28	0.62	0.24
Dissolved oxygen levels	0.68	0.68	1.00	1.00	0.40
Organic matter input	0.25	0.00	0.00	1.00	0.05
Instream particle retention	0.82	0.478	0.92	1.00	0.29
Decontamination of pollutants	0.65	0.37	0.24	0.80	0.44
Biogeochemical Functions	**0.52**	**0.34**	**0.49**	**0.88**	**0.28**
Fish Spawning Habitat	0.40	0.05	0.05	0.50	0.05
Habitat for aquatic fauna	0.49	0.58	0.55	0.88	0.46
Habitat Provisions Functions	**0.45**	**0.31**	**0.30**	**0.69**	**0.25**
Fish Fauna Intact	0.43	0.67	0.50	0.50	0.30
Invertebrate Fauna Intact	0.72	0.46	0.77	0.84	0.76
Riparian Vegetation Intact	0.15	0.08	0.10	0.80	0.13
Biodiversity Provision Functions	**0.43**	**0.40**	**0.46**	**0.71**	**0.40**
SEV Score	**0.575**	**0.435**	**0.532**	**0.850**	**0.403**

Northern Rock Stack – Stream TB1

Table 5-5: *SEV attribute values from sites TB1_lower and TB1_Upper.*

Function	TB1_lower	TB1_upper
Natural Flow Regime	0.77	0.68
Floodplain Effectiveness	0.55	0.12
Connectivity for natural species migrations	1.00	1.00
Natural connectivity to groundwater	0.68	0.80
Hydraulic Functions	**0.75**	**0.65**
Water temperature control	0.28	0.24
Dissolved oxygen levels	0.50	0.50
Organic matter input	0.50	0.00
Instream particle retention	0.56	0.76
Decontamination of pollutants	0.51	0.33
Biogeochemical Functions	**0.47**	**0.37**
Fish Spawning Habitat	0.05	0.05
Habitat for aquatic fauna	0.39	0.32
Habitat Provisions Functions	**0.22**	**0.18**
Fish Fauna Intact	0.30	0.30
Invertebrate Fauna Intact	0.61	0.54
Riparian Vegetation Intact	0.30	0.10
Biodiversity Provision Functions	**0.40**	**0.31**
SEV Score	**0.501**	**0.409**

Table 5-6: Oceanagold Waihi North Project - Survey Macroinvertebrate Data 2017 - 2020. *Note: italicised numbers for July 2020, August 2020 and Jan 2021 were processed using Coded Abundance. 1 = Rare 1-4, 5 = Common 5-19, 20 = Abundant 20-99, 100 = Very Abundant 100-499, 500 = Very Very Abundant 500+ .*

Sample Date		**June 2017**						**March 2019**		**July 2020**		**August 2020**		**Jan 2021**
Site		**TB1**	**TB1 - Upper Trib**	**Rua - Upper**	**Rua - Lower**	**Rua - Forest**	**Gladstone**	**RUA-Lower 2019**	**RUA-Trig Road**	**Willow – Tributary 1**	**Willow - Mataura Stream A**	**Waiharakeke Main A**	**Waiharakeke Right Branch A**	**Willow –Tributary 2**
ACARINA	ACARINA	2	3	3	1	12	80	8	24	*1*	*1*		*1*	*1*
OLIGOCHAETA	OLIGOCHAETA		19	10	28	2	96	102	38	*100*			*1*	*100*
ARACHNIDA	Dolomedes												*1*	*1*
Coleoptera	Dytiscidae, other									*1*				
Coleoptera	Elmidae							204	13		*20*	*1*	*5*	
Coleoptera	Hydraenidae Beetle									*1*				
Coleoptera	Hydrophilidae		1	1										
Coleoptera	Ptilodactylidae			2		2				*1*	*1*	*1*		
Coleoptera	Scirtidae						3							
Coleoptera	Staphylinidae					1			1					
Coleoptera	Enochrus tritus													
COLLEMBOLA	COLLEMBOLA		3	4	2	6	848	4	26	*20*		*1*	*1*	*5*
Crustacea	*Paracalliope*	159	2		380			350						
Crustacea	*Paraleptamphopus*							4	12					
Crustacea	*Paratya*													*1*
Crustacea	Talitridae			4		1	9		3	*1*				
Crustacea	Cladocera							40						
Crustacea	Copepoda	1			1			144	97					
Crustacea	Isopoda	3	3	1		3	7			*1*	*1*		*1*	
Crustacea	Ostracoda	4			2		48	36	7	*5*	*1*		*1*	*20*
Crustacea	*Paranephrops*	1		1										
Diptera	Aphrophila sp.								1			*5*	*5*	
Diptera	*Austrosimulium*	5	9	24	22					*100*	*1*			*1*

Diptera	Blephariceridae													
Diptera	Ceratopogonidae	1										*1*	*1*	
Diptera	Chironomidae									*1*			*1*	
Diptera	Chironomus zealandicus								13					
Diptera	*Corynoneura*			1										
Diptera	Empididae								1					*5*
Diptera	Ephydridae						5							
Diptera	Eriopterini, excl. Molophilus			2		2				*1*				
Diptera	*Harrisius*												*1*	
Diptera	Hexatomini						10							
Diptera	Maoridiamesa										*1*			
Diptera	Molophilus									*1*				
Diptera	Nothodixa									*1*				
Diptera	Orthocladiinae	4	15	8	10	6	1	41	119	*20*	*5*	*5*	*1*	*100*
Diptera	*Paradixa*	3		1			3		4					*5*
Diptera	*Paralimnophila*					1	1			*5*		*1*		*1*
Diptera	*Polypedilum*		3			16	368			*5*		*20*	*5*	*100*
Diptera	Psychodidae					1								
Diptera	Stratiomyidae						1							*1*
Diptera	Tabanidae										*1*			
Diptera	Tanypodinae						4	4	11	*1*		*1*		*20*
Diptera	Tanytarsini	1	1	1				86	14		*1*	*20*	*5*	
Ephemeroptera	Ameletopsis										*1*	*1*	*1*	
Ephemeroptera	*Arachnocolus*			6		27								
Ephemeroptera	*Austroclima*				3	2		1			*1*	*1*	*1*	
Ephemeroptera	*Coloburiscus*			6		26					*5*	*5*	*5*	
Ephemeroptera	Deleatidium								3		*5*	*1*	*1*	
Ephemeroptera	Neozephlebia													*5*
Ephemeroptera	Nesameletus sp.										*1*		*5*	
Ephemeroptera	*Zephlebia*	1			1			19		*20*	*1*	*20*	*20*	*100*
Hemiptera	*Mesovelia*													*1*
Hemiptera	*Microvelia*	1		1						*1*				*5*

Hemiptera	Microvelia macgregori							32	1					
Hemiptera	Sigara sp.								4					
HIRUDINEA	HIRUDINEA							9						
Hydrozoa	Hydra							16						*1*
Megaloptera	*Archichauliodes*					1					*20*	*5*	*1*	
Megaloptera	Archichauliodes diversus													
MOLLUSCA	Echyridella sp.							1						
MOLLUSCA	Ferrissia sp.							4	81					*1*
MOLLUSCA	Lymnaeidae	2												
MOLLUSCA	*Physella (Physa)*				29				30					
MOLLUSCA	*Potamopyrgus*	89	256		680	2		919	1046	*100*	*20*	*5*	*1*	*500*
MOLLUSCA	Pseudosuccinea columella							44						
MOLLUSCA	Sphaeriidae				3				5	*1*				
NEMATODA	NEMATODA									*1*				*1*
NEMERTEA	NEMERTEA	1						41	5					*5*
Odonata	Antipodochlora braueri													
Odonata	*Austrolestes*	3												
Odonata	Hemianax papuensis								3					
Odonata	*Xanthocnemis*	32	2		8			93	534					
Odonata	*Aeshna*													
Odonata	*Antipodochlora*					1								
Platyhelminthes	Rhabdocoela								1					
PLATYHELMINTHES	PLATYHELMINTHES	3	4		3			278	43	*5*	*1*	*5*	*1*	*1*
Plecoptera	*Acroperla*			20		33					*5*	*1*		
Plecoptera	Austroperla											*5*	*1*	
Plecoptera	Stenoperla											*1*		
Plecoptera	Taraperla												*1*	
Plecoptera	Zelandiobius										*5*		*5*	
Trichoptera	Alloecentrella												*1*	
Trichoptera	Costachorema									*1*				
Trichoptera	Helicopsyche												*1*	
Trichoptera	Hudsonema												*1*	

Trichoptera	Hudsonema amabile							43						
Trichoptera	*Hydrobiosella*			1								100	5	
Trichoptera	*Hydrobiosis*					3				1	1	1		
Trichoptera	Hydrobiosis copis													
Trichoptera	Hydrobiosis sp. (juveniles)													
Trichoptera	Hydrochorema												1	
Trichoptera	Hydropsyche-Aoteapsyche							54	3		20		1	
Trichoptera	Hydropsyche-Orthopsyche											5	20	
Trichoptera	Neurochorema forsteri								1					
Trichoptera	Neurochorema										1			
Trichoptera	*Oeconesidae*		4	2						1				
Trichoptera	*Olinga*													
Trichoptera	*Orthopsyche*			1		4								
Trichoptera	*Oxyethira*	4	1	6	5					5				1
Trichoptera	Oxyethira albiceps							2246	80					
Trichoptera	*Paroxyethira*							123	12					
Trichoptera	*Polyplectropus*	4	11		1	2		1	2			1		1
Trichoptera	*Psilochorema*		2	2										
Trichoptera	Pycnocentria sp.							34		1				
Trichoptera	Pycnocentrodes							39			5			1
Trichoptera	*Triplectides*	46						40	6		1			
Trichoptera	Zelolessica											1	5	
Number of Taxa		**22**	**17**	**23**	**17**	**22**	**15**	**32**	**34**	**29**	**26**	**26**	**34**	**27**
Total individuals		**370**	**339**	**108**	**1179**	**154**	**1484**	**5060**	**2244**	**403**	**126**	**214**	**108**	**984**
MCI		**85.5**	**90.6**	**110.4**	**87.1**	**114.5**	**90.6**	**89.0**	**82.0**	**96.6**	**109.2**	**130.0**	**122.4**	**84.4**
MCI-sb		**82.3**	**93.6**	**116.1**	**74.1**	**123.3**	**91.1**	**82.8**	**80.5**	**-**	**-**	**-**	**-**	**-**

Table 5-7: Oceanagold Waihi North Project - Survey Fish Data 2017 - 2020. Note: P = present.

Sample Date		**June 2017**						**March 2019**		**July 2020**		**August 2020**	
Site		**TB1**	**TB1 - Upper Trib**	**Rua - Upper**	**Rua - Lower**	**Rua - Forest**	**Gladstone**	**RUA-Lower Revegetation**	**RUA-Trig Road**	**Willow – Tributary 1**	**Willow - Mataura Stream A**	**Waiharakeke Main A**	**Waiharakeke Right Branch A**
Longfin eel	*Anguilla dieffenbachii*			1		1					-	-	-
Shortfin eel	*Anguilla australis*	P	P	3	30	1		P	1	3	-	-	-
Unidentified eel	*Anguilla spp.*									4	-	-	-
Common bully	*Gobiomorphus cotidianus*				1			90			-	-	-
Rainbow Trout	*Oncorhynchus mykiss*				1						-	-	-
Kōura	*Paranephrops planifrons*			5	P	60		P			-	-	-
Total Fish Species											**-**	**-**	**-**
Total Fish Abundance		**0**	**0**	**9**	**32**	**62**	**0**	**90**	**1**	**7**	**-**	**-**	**-**
Fish IBI Score		**18**	**18**	**30**	**40**	**30**	**0**	**26**	**18**	**20**	**-**	**-**	**-**
Fish IBI Score Rating		**Poor**	**Poor**	**Very Good**	**Excellent**	**Very Good**	**Poor**	**Good**	**Poor**	**Fair**	**-**	**-**	**-**

Appendix 6: Water Quality Criteria

Table 6-1: *WRC guidelines and standards used to assess water quality for ecological health*

Water quality variable (units)	Relevance		Categories	
		Excellent	Satisfactory	Unsatisfactory
Dissolved oxygen (% of saturation)	Oxygen for aquatic animals to breathe	>90	80–90	<80
pH (acidity)	Can affect plants and fish	7–8	6.5–7 or 8–9	<6.5 or >9
Turbidity (NTU)	Can restrict plant growth	<2	2–5	>5
Ammonia (g N/m^3)	Toxic to fish	<0.1	0.1–0.88	>0.88
Temperature (°C)	Fish spawning May-Sep	<10	10–12	>12
	Fish health Oct-Apr	<16	16–20	>20
Total phosphorus (g/m^3)	Causes nuisance plant growth	<0.01	0.01–0.04	>0.04
Total nitrogen (g/m^3)	Causes nuisance plant growth	<0.1	0.1–0.5	>0.5

Table 6-2:*Provisional biomass and cover guidelines for periphyton growing in gravel/cobble bed streams for three main instream values (AFDM = ash-free dry mass) (from Biggs 2000).*

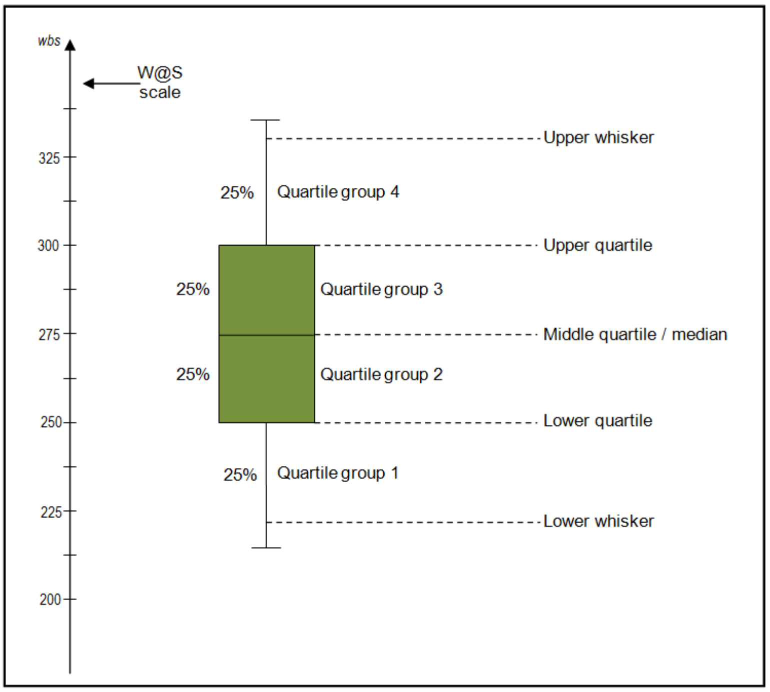
Instream value/variable	Diatoms/cyanobacteria	Filamentous algae
Aesthetics/recreation (1 November – 30 April)		
Maximum cover of visible stream bed	**60 % >0.3 cm thick**	**30 % >2 cm long**
Maximum AFDM (g/m^2)	**N/A**	**35**
Maximum chlorophyll *a* (mg/m^2)	**N/A**	**120**
Benthic biodiversity		
Mean monthly chlorophyll *a* (mg/m^2)	**15**	**15**
Maximum chlorophyll *a* (mg/m^2)	**50**	**50**
Trout habitat and angling		
Maximum cover of whole stream bed	**N/A**	**30 % >2 cm long**
Maximum AFDM (g/m^2)	**35**	**35**
Maximum chlorophyll *a* (mg/m^2)	**200**	**120**

Appendix 7: Interpretation of Boxplots

How to read a box plot/Introduction to box plots

(from: https://www.wellbeingatschool.org.nz/information-sheet/understanding-and-interpreting-box-plots).

Boxplots enable us to study the distributional characteristics of a group of scores as well as the level of the scores. To begin with, scores are sorted. Then four equal sized groups are made from the ordered scores. That is, 25% of all scores are placed in each group. The lines dividing the groups are called *quartiles*, and the groups are referred to as *quartile groups*. Usually we label these groups 1 to 4 starting at the bottom.

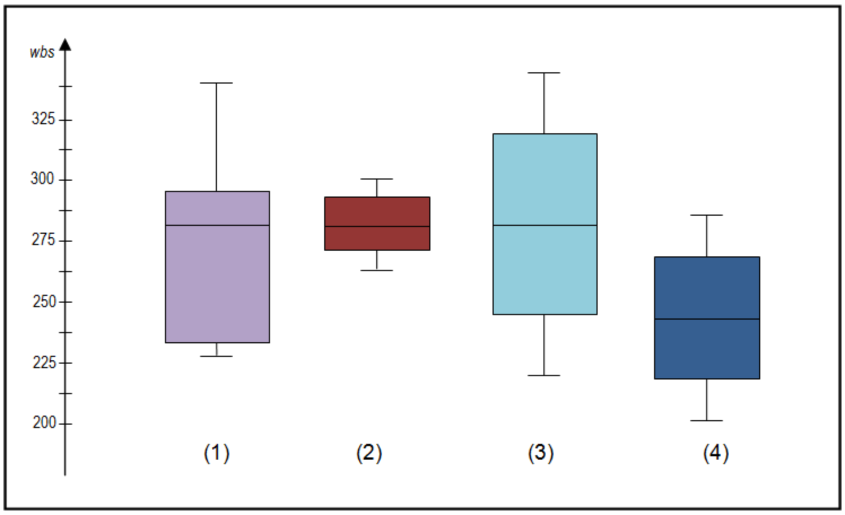


Definitions

- **Median**
  The median (middle quartile) marks the mid-point of the data and is shown by the line that divides the box into two parts. Half the scores are greater than or equal to this value and half are less.
- **Inter-quartile range**
  The middle "box" represents the middle 50% of scores for the group. The range of scores from lower to upper quartile is referred to as the inter-quartile range. The middle 50% of scores fall within the inter-quartile range.
- **Upper quartile**
  Seventy-five percent of the scores fall below the upper quartile.
- **Lower quartile**
  Twenty-five percent of scores fall below the lower quartile.
- **Whiskers**
  The upper and lower whiskers represent scores outside the middle 50%. Whiskers often (but not always) stretch over a wider range of scores than the middle quartile groups.

Interpreting box plots/Box plots in general

Box plots are used to show overall patterns of response for a group. They provide a useful way to visualise the range and other characteristics of responses for a large group. The diagram below shows a variety of **different box plot shapes and positions**.



Some general observations about box plots

- **The box plot is comparatively short** - see example (2). This suggests that overall students have a high level of agreement with each other.
- **The box plot is comparatively tall** - see examples (1) and (3). This suggests students hold quite different opinions about this aspect or sub-aspect.
- **One box plot is much higher or lower than another** - compare (3) and (4) - This could suggest a difference between groups. For example, the box plot for boys may be lower or higher than the equivalent plot for girls. Follow this up by looking at the *Items at a Glance* reports.
- **Obvious differences between box plots** - see examples (1) and (2), (1) and (3), or (2) and (4). Any obvious difference between box plots for comparative groups is worthy of further investigation in the *Items at a Glance* reports.
- Your school box plot is much higher or lower than the national reference group box plot. This also suggests an area of difference that could be explored further in the *Items in Detail* reports and through consultation.
- **The 4 sections of the box plot are uneven in size** - See example (1). This shows that many students have similar views at certain parts of the scale, but in other parts of the scale students are more variable in their views. The long upper whisker in the example means that students views are varied amongst the most positive quartile group, and very similar for the least positive quartile group. The *Items in Detail* reports can be used to explore this further.
- **Same median, different distribution** - See examples (1), (2), and (3). The medians (which generally will be close to the average) are all at the same level. However the box plots in these examples show very different distributions of views.
  It always important to consider the pattern of the whole distribution of responses in a box plot.

Appendix 8: SEV Assumptions

***Table 8-1**. Predicted SEV scores used within the mitigation calculations.*

	Willows Farm	Willows Farm	Willows Farm
	Willows_Trib 3 (Southern Headwaters)	Willows_Impact Site (Tributary 2)	Willows_Impact Site 2 (Tributary 1)
	Mitigation Site - Potential Value	Impact Site - Potential Value	Mitigation Site - Potential value
Vchann	No change	Removal of instream stucture	No change
Vlining	Reduction in silt/sand	No change	small reduction in silt/sand
Vpipe	No change	No change	No change
Vbank	No change	No change	No change
Vrough	Regenerating to 20m either side	Regenerating to 20m either side	Regenerating to 20m either side
Vbarr	No change	No change	No change
Vchanshape	Autopopulated	Autopopulated	Autopopulated
Vshade	Increase in shade to 71-90%	Increase in shade to 71-90%	Increase in shade to 71-90%
Vdod	No change	Assume optimal	Assume optimal
Vveloc	No change	No change	No change
Vdepth	No change	No change	No change
Vripar	Increase to 20m	Increase to 20m	Increase to 20m
Vdecid	No change	No change	No change
Vmacro	Assume almost no macrophyte due to shading	No change	No change
Vretain	Autopopulated	Autopopulated	Autopopulated
Vsurf	Increase leaf litter and woody debris. Small decrese SI/SA	Increase leaf litter and woody debris.	Increase leaf litter and woody debris.
Vripfilt	Increase to moderate	Increase to moderate	Increase to moderate
Vgalspwn	No change	No change	No change
Vgalqual	No change	No change	No change
Vgobspawn	Autopopulated	Autopopulated	Autopopulated
Vphyshab	Increase in channel shade and riparian integrity	Increase in channel shade and riparian integrity	Increase in channel shade and riparian integrity
Vwaterqual	Increase to well shaded	Increase to well shaded	Increase to well shaded
Vimperv	No change	No change	No change
Vfish	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vmci	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vept	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vinvert	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vripcond	Autopopulated	Autopopulated	Autopopulated

	Gladstone	Northern Rock Stack	
	Gladstone_Tributary	TB1_Lower	TB1_Upper
Vchann	No change	Reduction in macrophytes, increase in no modification	NO change
Vlining	No change	Reduction in loading of fine sediments	Reduction in loading of fine sediments
Vpipe	No change	No change	No change
Vbank	No change	No change	No change
Vrough	No change	Regenerating to 10m either side	Regenerating to 20m either side
Vbarr	No change	No change	No change
Vchanshape	Autopopulated	Autopopulated	Autopopulated
Vshade	Mix of moderate and high shading	Increase in shade to 71-90%	Increase in shade to 71-90%
Vdod	No change	Improvement to optimal	Improvement to optimal
Vveloc	No change	Slight increase in velocity due to reduction in macrophytes	No change
Vdepth	No change	No change	No change
Vripar	Increase to 20m	Riparian to 10m either side	Riparian to 20m either side
Vdecid	No deciduous	No deciduous	No deciduous
Vmacro	No change	Decrease in macrophytes	Decrease in macrophytes
Vretain	Autopopulated	Autopopulated	Autopopulated
Vsurf	No change	Reduction in macrophytes. Increase in woody debris.	increase in woody debris.
Vripfilt	Increase to moderate	Increase to moderate for rip. Very low for remainder.	Increase to moderate
Vgalspwn	No change	No change	No change
Vgalqual	No change	Increase	No change
Vgobspawn	Autopopulated	Autopopulated	Autopopulated
Vphyshab	Increase in channel shade and riparian integrity	Small increase in habitat diversity, abundance and hydrological heterogeneity. Increase in shade and riparian vegetation integrity.	Small increase in habitat diversity, abundance and hydrological heterogeneity. Increase in shade and riparian vegetation integrity.
Vwaterqual	No change	Increase	No change
Vimperv	Small increase to <10%	No change	No change
Vfish	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vmci	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vept	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vinvert	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vripcond	Autopopulated	Autopopulated	Autopopulated

	TSF3				
	RUA_Lower	RUA_Upper	RUA_Forest	RUA_Trig Road	RUA_Revegetated
Vchann	Assume small reduction in excessive macrophyte growth	No change.	No Change	Reduction in macrophytes	Reduction in macrophytes
Vlining	No change	Slight increase in sediment	No change	No change	No change
Vpipe	No Change	No change	No change	No change	No change
Vbank	No Change .	Reduction in channel incision	No change	No Change	No change
Vrough	Assume regenerating native bush to 20 m on one side.	Assume regenerating native bush to 10 m either side.	Assume regenerating native bush to 20 m either side.	Assume regenerating native bush to 20 m either side.	Increase plating to 20m on one side.
Vbarr	Assume no barriers	Assume no barriers	Assume no barriers	Assume no barriers	Assume no barriers
Vchanshape	Autopopulated	Autopopulated	Autopopulated	Autopopulated	Autopopulated
Vshade	Assume canopy species 71-90 % shade	Assume canopy species 71-90 % shade	Assume mixture of 71-90% and 51-70%	Assume canopy species 71-90 % shade	Assume small increase to 31-50% shading
Vdod	No change	No change	No change	Improvement to optimal	No change
Vveloc	No change	Assume slight increase in velocity	Assume slight increase	Slight increase owing to reduction in macrophyte	No change
Vdepth	Used median score	No Change	No Change	No Change	No Change
Vripar	Assume 20 m riparian on one side	Assume 10 m riparian	Assume 20 m riparian	Assume 20m riparian both sides	Assume 20 m riparian on one side
Vdecid	Assume no deciduous	Assume no deciduous	Assume no deciduous	Assume no deciduous	Assume no deciduous
Vmacro	Assume decrease in macrophyte present	No change	No change	Assume decrease in macrophyte present	No change
Vretain	Autopopulated	Autopopulated	Autopopulated	Autopopulated	Autopopulated
Vsurf	Assume decrease in macrophytes	Assume reduction in bedrock, increase in silt sand, increase in wood, increase in leaf litter.	No change	Assume decrease in macrophytes	No change
Vripfilt	Assume increase to moderate filtering	Assume increase to moderate filtering	No change	Assume increase to moderate filtering	Assume increase to moderate filtering activity for 50%.
Vgalspwn	No change	No change	No change	No change	No change
Vgalqual	No change	No change	No change	No change	No change
Vgobspawn	Autopopulated	Autopopulated	Autopopulated	Autopopulated	Autopopulated
Vphyshab	Increase to riparian vegetation integrity	Increase to channel shade and riparian vegetarian integrity	Increase to channel shade and riparian vegetarian integrity	Decrease in aquatic habitat abundance, decrease in hydrological heterogeneity, increase in shade and increase in riparian vegetation integrity.	Increase to channel shade
Vwaterqual	No change	Slight increase in shading	No change	Increase to partial	No change
Vimperv	No Change	No Change	No change	No change	No change
Vfish	No change – excluded from model	No change – excluded from model	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vmci	No change – excluded from model	No change – excluded from model	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vept	No change – excluded from model	No change – excluded from model	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vinvert	No change – excluded from model	No change – excluded from model	No change – excluded from model	No change – excluded from model	No change – excluded from model
Vripcond	Autopopulated	Autopopulated	Autopopulated	Autopopulated	Autopopulated

Trig Road North_ Upper Ruahorehore Headwaters		
	TRN_RUA_Upper	**TRN_RUA_Up Trib_US**
Vchann	No change	Assume not longer deepend, but still highly incised.
Vlining	No change	No change
Vpipe	No Change	No Change
Vbank	No Change	Assume no more deepening, but still unlikely to reach floodplain due to incision.
Vrough	Assume regenerating native bush to average of 20 m on both sides.	Assume regenerating native bush to average of 20 m on both sides.
Vbarr	No Change	No Change
Vchanshape	Autopopulated	Autopopulated
Vshade	Assume canopy species 71-90 % shade	Assume canopy species 71-90 % shade
Vdod	No change	No change
Vveloc	No Change	No Change
Vdepth	No Change	No Change
Vripar	Assume 20 m riparian on both sides	Assume 20 m riparian on both sides
Vdecid	Assume no deciduous	Assume no deciduous
Vmacro	Assume small decrease in macrophyte	Assume small decrease in macrophyte
Vretain	Autopopulated	Autopopulated
Vsurf	Small increase in leaf litter and woody debris.	Small increase in leaf litter and woody debris.
Vripfilt	Assume increase to moderate filtering	Assume increase to moderate filtering
Vgalspwn	No change	No change
Vgalqual	No change	No change
Vgobspawn	Autopopulated	Autopopulated
Vphyshab	Increase in channel shade & riparian integrity.	Increase in channel shade & riparian integrity. Small increase to habitat diversity
Vwaterqual	improvement to partial due to restoration planting	improvement to partial due to restoration planting
Vimperv	No Change	No Change
Vfish	No change – excluded from model	No change – excluded from model
Vmci	No change – excluded from model	No change – excluded from model
Vept	No change – excluded from model	No change – excluded from model
Vinvert	No change – excluded from model	No change – excluded from model
Vripcond	Autopopulated	Autopopulated

Appendix 9: Ecological Compensation Ratio (ECR) and mitigation quantum for streams

Table 9-1: Calculated mitigation quantum for proposed stream impacts within the project, as determined using the SEV and ECR methodology.

Impact Site		Mitigation Site	ECR	Length of impacted stream	Average width impacted stream	Length of compensation available	Average width of compensation stream	Proportion of impact reach compensated
Willows Farm	Tributary 2	Tributary 1	3.41	558	0.6	194.8	0.6	102%
		Tributary 3	5.68			1,800	0.97	
North Rock Stack	TB1 / OHE_T4	NRS DIVERSION	1.50	1,040	2.06	695.1	1.5	101%
		OHE_T4 & OHE_T5	5.40			293.6	0.745	
		RUA upstream planting (i.e. trig road)	2.96			940.2	2.216	
		RUA_T4	2.96			440.7	2.216	
		Willows Tributary 3	5.10			643.7	0.97	
		RUA_IMPACT (headwater planting)	5.40			128.1	1.52	
		RUA_(below div 10m each side)	5.97			475.4	2.45	
		TRN_RUA_Upper (US)	4.59			21	1.924	
		TRN_RUA_Up Trib_US	3.26			577	0.629	
	NRS Small Tributaries (OHE_T5, OHE_T6 and OHE_T7)	NRS_DIVERSION	1.55	349.5	0.745	270	1.5	100%
Gladstone Pit	Gladstone_Tributary	TRN_RUA_Upper (US)	5.39	47.2	1.682	224	1.924	100%
TSF3	Ruahorehore Impact Streams	RUA_DIVERSION	1.79	1,777	1.355	1,800	1.8	100%
		RUA_Downstream/revegetated (one side already planted)	10.58			2,947	2.216	
	Ruahorehore Stream (RUA)	RUA upstream planting (i.e. trig road)	2.53	341	2.45	955	2.216	100%

ECR calculations

ECR = [(SEVi-P – SEVi-I)/(SEVm-P – SEVm-C)] x 1.5																						
Impact Catchments	NORTH ROCK STACK												GLADSTONE PIT		TSF3					WILLOWS		
Impact Reaches	TB1 & OHE_T4										TB1 Small tribs (OHE_T5, T6, T7)		Gladstone Trib		Ruahorehore Impact			Ruahorehore (RUA)		Tributary 2		
Mitigation Sites		**NRS DIVERSION**	**OHE_T4 & OHE_T5**	**RUA upstream planting (i.e. trig road)**	**RUA_T4**	**Willows Tributary 3**	**RUA_IMPACT (headwater planting)**	**RUA_(beow div 10m each side)**	**TRN_RUA_Upper (US)**	**TRN_RUA_Up Trib_US**		**NRS DIVERSION**		**TRN_RUA_Upper (US)**		**RUA_DIVERSION**	**RUA_Downstream one side (already planted)**		**RUA upstream planting (i.e. trig road)**		**Tributary 1**	**Tributary 3**
Width (m)	2.06										0.745		1.682		1.355			2.45		0.6		
Length (m)	1040										349.5		47.2		1777			341		558		
Streambed area impact (m2)	2141										260.3775		79.3904		2407.835			835.45		334.8		
SEV Current (minus Fauna)	0.51										0.41		0.68		0.633			0.41		0.6		
SEVi-P	0.673										0.697		0.791		0.804			0.575		0.75		
SEVi-I	0										0		0		0			0		0		
SEVm-C		0	0.51	0.38	0.38	0.58	0.51	0.41	0.42	0.31		0		0.42		0	0.51		0.38		0.46	0.58
SEVm-P		0.673	0.697	0.721	0.721	0.778	0.697	0.579	0.64	0.62		0.673		0.64		0.673	0.624		0.721		0.79	0.778
ECR		**1.50**	**5.40**	**2.96**	**2.96**	**5.10**	**5.40**	**5.97**	**4.59**	**3.26**		**1.55**		**5.39**		**1.79**	**10.58**		**2.53**		**3.41**	**5.68**
Length available (m)		695.1	293.6	940.2	440.7	643.7	128.1	475.4	21	577		270		224		1799.8	2947.3		955		194.8	1800
Width at mitigation site (m)		1.5	0.745	2.216	2.216	0.97	1.52	2.45	1.924	0.629		1.5		1.924		1.8	2.216		2.216		0.6	0.97
Mitigation area avaliable (m2)		1043	218.7	2083	976.6	624.389	194.712	1164.73	40.404	362.933		405		430.98		3239.6	6531.22		2116.28		116.88	1746
Mitigation area required (m2)		3212	11560	7128	6339	10917.74	11559.9626	12791.2013	9826	6973.2678		404.494		428.17		4314.8	25472.4		2113.13		1141.36	1902.27
Mitigation length required (m)		2141	15517	3217	2861	11255.4	7605.23858	5220.89848	5107.1	11086.276		269.663		222.54		2397.1	11494.7		953.576		1902.27	1961.11
Percent of impact length mitigated		**32.46**	**1.892**	**29.23**	**15.41**	**5.71903**	**1.6843653**	**9.1057124**	**0.4112**	**5.204633**		**100.125**		**100.66**		**75.082**	**25.6404**		**100.149**		**10.2404**	**91.7849**
										101.1		***100.1***		***100.7***			***100.7***		***100.1***			***102.0***

Appendix 10: Comparison of Water Quality Criteria

Parameter	Consent Guideline g / m^3	99% 2018 DGVs g / m^3	95% 2018 DGVs g / m^3	99% 2000 ANZECC g / m^3	95% 2000 ANZECC g / m^3	Change from 2000 guidelines?
pH	6.5 to 9	20th Percentile = 7.2	80th Percentile = 7.8	6 to 9	6 to 9	Yes
Cyanide	0.09300	0.00400	0.00700	0.00400	0.00700	No
Iron	1.00000	ID	ID	ID	ID	No
Manganese	2.00000	1.20000	1.90000	1.20000	1.90000	No
Copper	0.01100	0.00100	0.00140	0.00100	0.00140	No
Nickel	0.16000	0.00800	0.01100	0.00800	0.01100	No
Zinc	0.10000	0.00240	0.00800	0.00240	0.00800	No
Silver	0.00240	0.00002	0.00005	0.00002	0.00005	No
Antimony	0.03000	0.00900	reliability unknown*	ID	ID	No
Arsenic (As III)	0.19000	0.00100	0.02400	0.00100	0.02400	No
Arsenic (As V)	0.19000	0.00080	0.01300	0.00080	0.01300	No
Selenium	0.00500	0.00500	0.01100	0.00500	0.01100	No
Mercury	0.00001	0.00006	0.00060	0.00006	0.00060	No
Cadmium	0.00100	0.00006	0.00020	0.00006	0.00020	No
Chromium (Cr III)	0.01000	ID	ID	ID	ID	No
Chromium (Cr VI)	0.01000	0.00001	0.00004	0.00001	0.00100	Yes
Lead	0.00250	0.00100	0.00340	0.00100	0.00340	No

ID = insufficient data

*Antimony guideline given with unknown reliability.

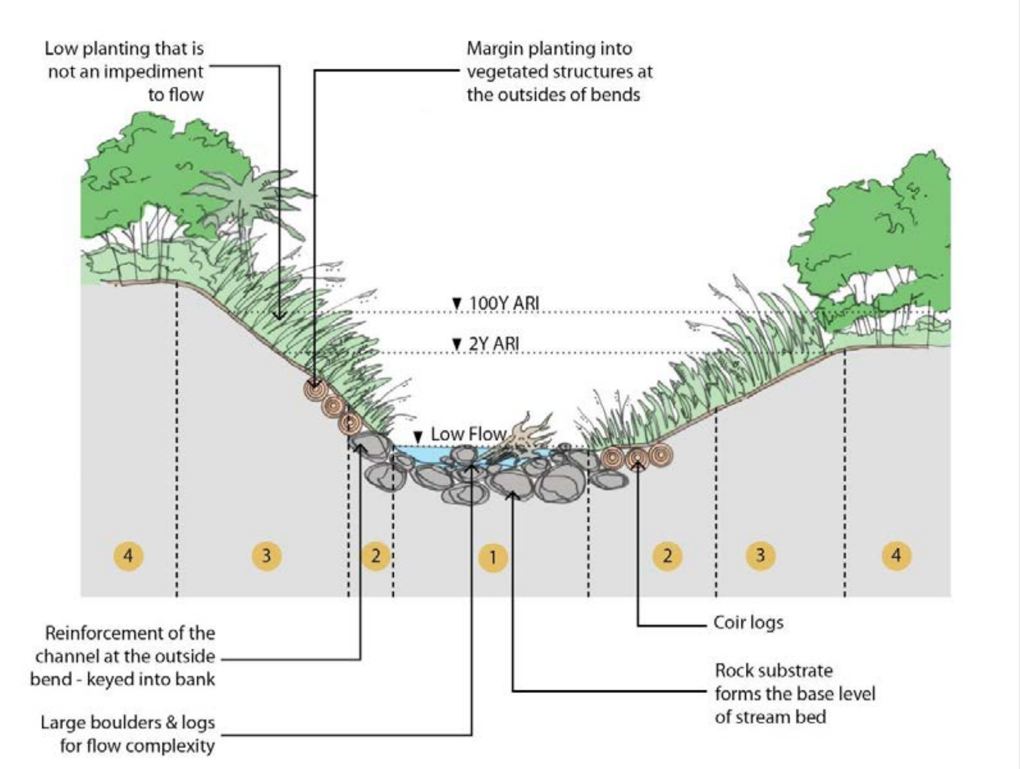
Parameter	Consent Guideline µg / L	99% 2018 DGVs µg / L	95% 2018 DGVs µg / L	99% 2000 ANZECC µg / L	95% 2000 ANZECC µg / L	Change from 2000 guidelines?
pH	6.5 to 9	20th Percentile = 7.2	80th Percentile = 7.8	6 to 9	6 to 9	Yes
Cyanide	93.00	4.00	7.00	4.00	7.00	No
Iron	1000.00	ID	ID	ID	ID	No
Manganese	2000.00	1200.00	1900.00	1200.00	1900.00	No
Copper	11.00	1.00	1.40	1.00	1.40	No
Nickel	160.00	8.00	11.00	8.00	11.00	No
Zinc	100.00	2.40	8.00	2.40	8.00	No
Silver	2.40	0.02	0.05	0.02	0.05	No
Antimony	30.00	9.00	reliability unknown	ID	ID	No
Arsenic (As III)	190.00	1.00	24.00	1.00	24.00	No
Arsenic (As V)	190.00	0.80	13.00	0.80	13.00	No
Selenium	5.00	5.00	11.00	5.00	11.00	No
Mercury	0.01	0.06	0.60	0.06	0.60	No
Cadmium	1.00	0.06	0.20	0.06	0.20	No
Chromium (Cr III)	10.00	ID	ID	ID	ID	No
Chromium (Cr VI)	10.00	0.01	0.04	0.01	1.00	Yes
Lead	2.50	1.00	3.40	1.00	3.40	No

ID = insufficient data

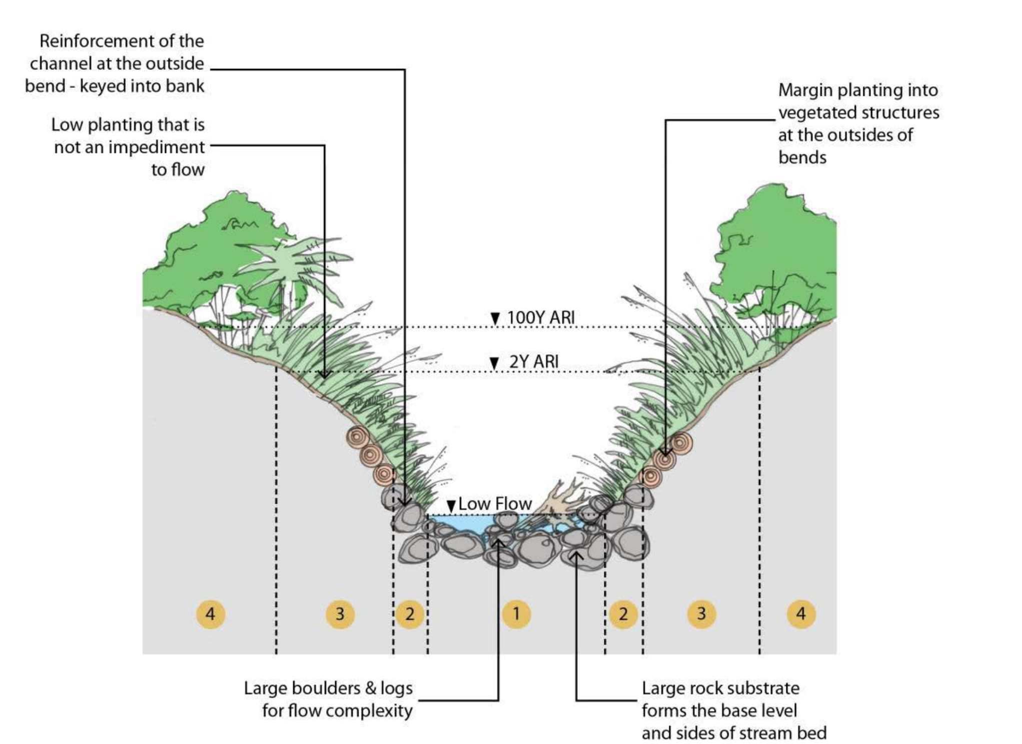
*Antimony guideline given with unknown reliability.

Appendix 11: Indicative Stream Channel Diversion Design

Indicative Stream Channel Diversion Design

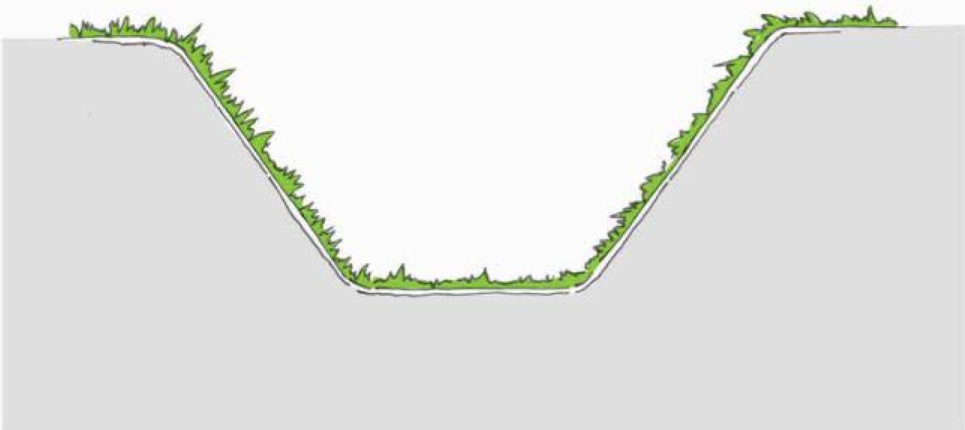


Stream Diversion Type 1 – Lowland stream cross section



Stream Diversion Type 2 – Steep stream cross section

Rock-Lined Flow Channel for High Flow and/or Steep Gradients



Grass-Lined Flow Channel for Low Flow and/or Flat Gradients

Stream Diversion Type 3 – Flow channel cross section

Appendix 12: NOF Environmental Limits for Attributes for Freshwater

Table 12-1: Environmental limits for ammonia toxicity (as ammoniacal-nitrogen) for ecosystem health values in freshwater in New Zealand (from NPS-FM 2020).

Ammonia (toxicity)

Value (and component)	Ecosystem health (Water	
Freshwater body type	Rivers and lakes	
Attribute unit	mg NH_4-N/L (milligrams ammoniacal-nitrogen per litre)	
Attribute band and description	**Numeric attribute state**	
	Annual median	Annual maximum
A 99% species protection level: No observed effect on any species tested.	≤0.03	≤0.05
B 95% species protection level: Starts impacting occasionally on the 5% most sensitive species.	>0.03 and ≤0.24	>0.05 and ≤0.40
National bottom line	**0.24**	**0.40**
C 80% species protection level: Starts impacting regularly on the 20% most sensitive species (reduced survival of most sensitive species).	>0.24 and ≤1.30	>0.40 and ≤2.20
D Starts approaching acute impact level (that is, risk of death) for sensitive species.	>1.30	>2.20
Numeric attribute state is based on pH 8 and temperature of 20°C. Compliance with the numeric attribute states should be undertaken after pH adjustment.		

Table 12-2: Environmental limits for nitrate toxicity (as nitrate-nitrogen) for ecosystem health values in freshwater in New Zealand (from NPS-FM 2020).

Table 6 – Nitrate (toxicity)

Value (and component)	Ecosystem health (Water quality)	
Freshwater body type	Rivers	
Attribute unit	mg NO_3 – I /L (milligrams nitrate-nitrogen per litre)	
Attribute band and description	**Numeric attribute state**	
	Annual median	Annual 95th percentile
A High conservation value system. Unlikely to be effects even on sensitive species.	≤1.0	≤1.5
B Some growth effect on up to 5% of species.	>1.C and ≤2.4	>1.5 and ≤3.5
National bottom line	**2.4**	**3.5**
C Growth effects on up to 20% of species (mainly sensitive species such as fish). No acute effects.	>2.4 and ≤6.9	>3.5 and ≤9.8
D Impacts on growth of multiple species, and starts approaching acute impact level (that is, risk of death) for sensitive species at higher concentrations (>20 mg/L).	>6.9	>9.8

This attribute measures the toxic effects of nitrate, not the trophic state. Where other attributes measure trophic state, for example periphyton, freshwater objectives, limits and/or methods for those attributes may be more stringent.

Table 12-3: Environmental limits for periphyton for ecosystem health values in freshwater in New Zealand (from NPS-FM 2020).

Value (and component)	Ecosystem health (Aquatic Life)	
Freshwater body type	Rivers	
Attribute unit	mg chl-*a*/m² (milligrams chlorophyll-*a* per square metre)	
Attribute band and description	**Numeric attribute state (default class)**	**Numeric attribute state (productive class)**
	Exceeded no more than 8% of samples	Exceeded no more than 17% of samples
A Rare blooms reflecting negligible nutrient enrichment and/or alteration of the natural flow regime or habitat.	≤50	≤50
B Occasional blooms reflecting low nutrient enrichment and/or alteration of the natural flow regime or habitat.	>50 and ≤120	>50 and ≤120
C Periodic short-duration nuisance blooms reflecting moderate nutrient enrichment and/or moderate alteration of the natural flow regime or habitat.	>120 and ≤200	>120 and ≤200
National bottom line	**200**	**200**
D Regular and/or extended-duration nuisance blooms reflecting high nutrient enrichment and/or significant alteration of the natural flow regime or habitat.	>200	>200

At low risk sites monitoring may be conducted using visual estimates of periphyton cover. Should monitoring based on visual cover estimates indicate that a site is approaching the relevant periphyton abundance threshold, monitoring should then be upgraded to include measurement of chlorophyll-*a*.

Classes are streams and rivers defined according to types in the River Environment Classification (REC). The Productive periphyton class is defined by the combination of REC "Dry" Climate categories (that is, Warm-Dry (WD) and Cool-Dry (CD)) and REC Geology categories that have naturally high levels of nutrient enrichment due to their catchment geology (that is, Soft-Sedimentary (SS), Volcanic Acidic (VA) and Volcanic Basic (VB)). Therefore the productive category is defined by the following REC defined types: WD/SS, WD/VB, WD/VA, CD/SS, CD/VB, CD/VA. The Default class includes all REC types not in the Productive class.

Based on a monthly monitoring regime. The minimum record length for grading a site based on periphyton (chlorophyll-*a*) is 3 years.

Table 12-4: Environmental limits for dissolved oxygen for ecosystem health values in freshwater in New Zealand (from NPS-FM 2020).

Table 7 – Dissolved oxygen

Value (and component)	Ecosystem health (Water quality)	
Freshwater body type	Rivers (below point sources only)	
Attribute unit	mg/L (milligrams per litre)	
Attribute band and description	**Numeric attribute state**	
	7-day mean minimum (summer period: 1 November to 30th April)	1-day minimum (summer period: 1 November to 30th April)
A No stress caused by low dissolved oxygen on any aquatic organisms that are present at matched reference (near-pristine) sites.	≥8.0	≥7.5
B Occasional minor stress on sensitive organisms caused by short periods (a few hours each day) of lower dissolved oxygen. Risk of reduced abundance of sensitive fish and macroinvertebrate species.	≥7.0 and <8.0	≥5.0 and <7.5
C Moderate stress on a number of aquatic organisms caused by dissolved oxygen levels exceeding preference levels for periods of several hours each day. Risk of sensitive fish and macroinvertebrate species being lost.	≥5.0 and <7.0	≥4.0 and <5.0
National bottom line	**5.0**	**4.0**
D Significant, persistent stress on a range of aquatic organisms caused by dissolved oxygen exceeding tolerance levels. Likelihood of local extinctions of keystone species and loss of ecological integrity.	<5.0	<4.0

The 7-day mean minimum is the mean value of seven consecutive daily minimum values.

The 1-day minimum is the lowest daily minimum across the whole summer period.

Table 12-5: Environmental limits for dissolved oxygen for ecosystem health values in freshwater in New Zealand (from NPS-FM 2020).

Table 14 – Macroinvertebrates (1 of 2)

Value (and component)	Ecosystem health (Aquatic life)	
Freshwater body type	Wadeable rivers	
Attribute unit	Macroinvertebrate Community Index (MCI) score; Quantitative Macroinvertebrate Community Index (QMCI) score	
Attribute band and description	**Numeric attribute states**	
	QMCI	MCI
A Macroinvertebrate community, indicative of pristine conditions with almost no organic pollution or nutrient enrichment.	≥6.5	≥130
B Macroinvertebrate community indicative of mild organic pollution or nutrient enrichment. Largely composed of taxa sensitive to organic pollution/nutrient enrichment.	≥5.5 and <6.5	≥110 and <130
C Macroinvertebrate community indicative of moderate organic pollution or nutrient enrichment. There is a mix of taxa sensitive and insensitive to organic pollution/nutrient enrichment.	≥4.5 and <5.5	≥90 and <110
National bottom line	**4.5**	**90**
D Macroinvertebrate community indicative of severe organic pollution or nutrient enrichment. Communities are largely composed of taxa insensitive to inorganic pollution/nutrient enrichment.	<4.5	<90

MCI and QMCI scores to be determined using annual samples taken between December and March (inclusive) with either fixed counts with at least 200 individuals, or full counts, and with current state calculated as the five-year median score. All sites for which the deposited sediment attribute does not apply, whether because they are in river environment classes shown in Table 25 in Appendix 2C or because they require alternate habitat monitoring under clause 3.25 are to use soft sediment sensitivity scores and taxonomic resolution as defined in table A1.1 in Clapcott et al. 2017 *Macroinvertebrate metrics for the National Policy Statement for Freshwater Management*. Cawthron Institute: Nelson, New Zealand. (*see* clause 1.8)

MCI and QMCI to be assessed using the method defined in Stark JD, and Maxted, JR. 2007 *A user guide for the Macroinvertebrate Community Index*. Cawthron Institute: Nelson, New Zealand (*See* Clause 1.8), except for sites for which the deposited sediment attribute does not apply, which require use of the soft-sediment sensitivity scores and taxonomic resolution defined in table A1.1 in Clapcott et al. 2017 *Macroinvertebrate metrics for the National Policy Statement for Freshwater Management*. Cawthron Institute: Nelson, New Zealand. (*see* clause 1.8)

Table 12-6: Environmental limits for dissolved reactive phosphorus for ecosystem health values in freshwater in New Zealand (from NPS-FM 2020).

Table 20 – Dissolved reactive phosphorus

Value (and component)	Ecosystem health (Water quality)	
Freshwater body type	Rivers	
Attribute unit	DRP mg/L (milligrams per litre)	
Attribute band and description	**Numeric attribute state**	
	Median	95th percentile
A Ecological communities and ecosystem processes are similar to those of natural reference conditions. No adverse effects attributable to dissolved reactive phosphorus (DRP) enrichment are expected.	≤ 0.006	≤ 0.021
B Ecological communities are slightly impacted by minor DRP elevation above natural reference conditions. If other conditions also favour eutrophication, sensitive ecosystems may experience additional algal and plant growth, loss of sensitive macroinvertebrate taxa, and higher respiration and decay rates.	> 0.006 and ≤0.010	> 0.021 and ≤0.030
C Ecological communities are impacted by moderate DRP elevation above natural reference conditions. If other conditions also favour eutrophication, DRP enrichment may cause increased algal and plant growth, loss of sensitive macro-invertebrate and fish taxa, and high rates of respiration and decay.	> 0.010 and ≤ 0.018	> 0.030 and ≤ 0.054
D Ecological communities impacted by substantial DRP elevation above natural reference conditions. In combination with other conditions favouring eutrophication, DRP enrichment drives excessive primary production and significant changes in macroinvertebrate and fish communities, as taxa sensitive to hypoxia are lost.	>0.018	>0.054
Numeric attribute state must be derived from the median of monthly monitoring over 5 years.		

Appendix 13: Service Trench Ecological Survey

Introduction

An inspection of the proposed survey trench route was undertaken on 11 November 2021 to identify prospective wetland features and watercourses. Rainfall during October had been above normal for Coromandel (120% - 149%) and ground conditions were moist to saturated. Photographs and brief descriptions of identified features is set out below.

Site 1:

The route intersects a recently excavated area containing standing water, estimated 0.5 m deep and 5 m wide (mounds of excavated soil were observed adjacent to the pond). A small of stand poplar and willow trees partly surround the pond. No water source or flow was observed, though a channel at one end drains excess water.

Aquatic macrophytes were present within the waterbody including water pepper, spearwort, and alligator weed. Water appeared stagnant and cloudy. Stock have access to the feature and margins are pugged and largely bare of vegetation.

Site 1 is a shallow water body with floating aquatic macrophytes. It meets the “rapid test” but is excluded as it is a constructed feature (an excavated pond).




Figure 13-1(a-e) *Site 1 of service trench route inspection.*

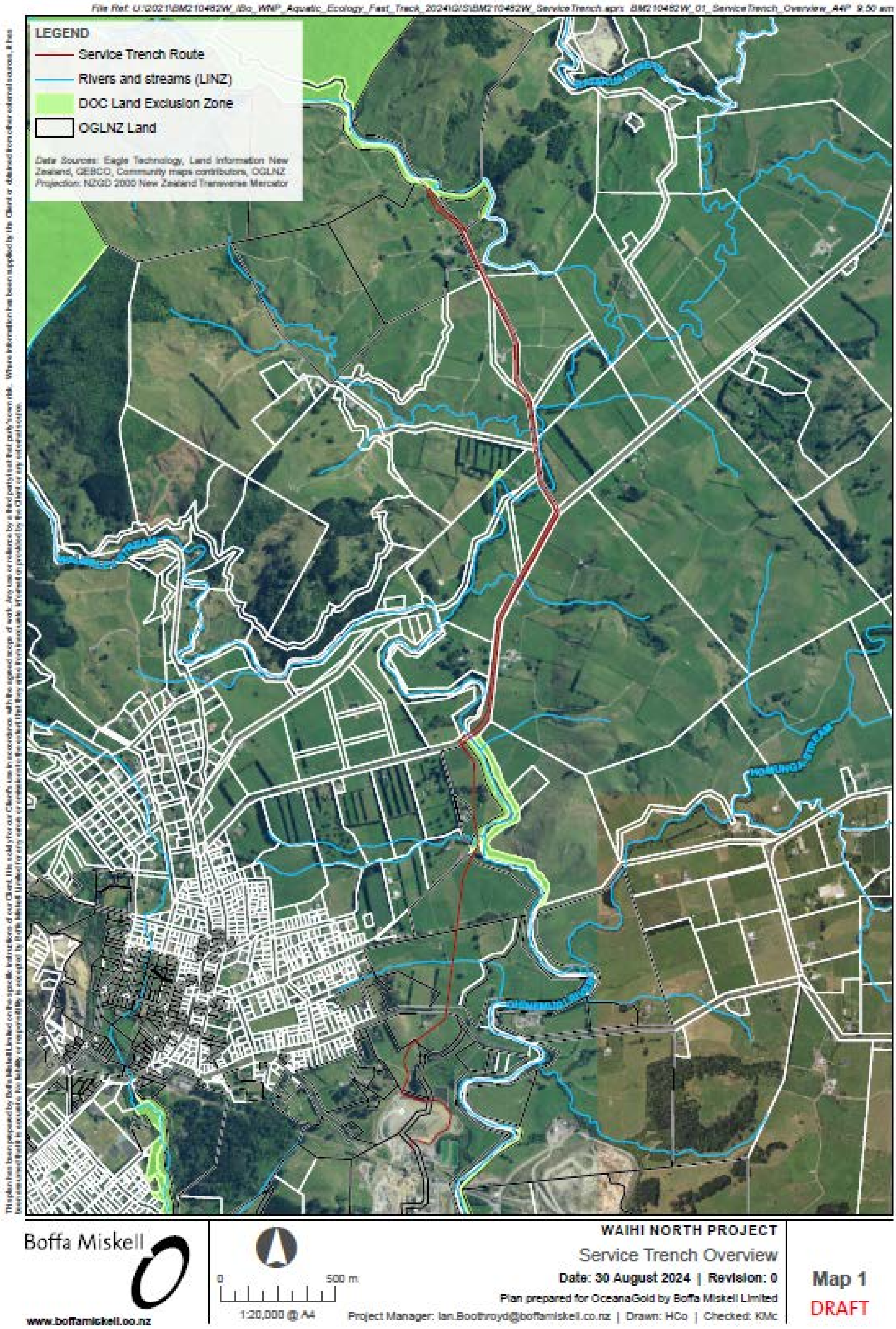

LEGEND
Service Trench Route
Rivers and streams (LINZ)
DOC Land Exclusion Zone
OGLNZ Land
Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors, OGLNZ
Projection: NZGD 2000 New Zealand Transverse Mercator
Boffa Miskell
www.boffamiskell.co.nz
0
500 m
1:20,000 @ A4
WAIHI NORTH PROJECT
Service Trench Overview
Date: 30 August 2024 | Revision: 0
Plan prepared for OceanaGold by Boffa Miskell Limited
Project Manager: Ian.Boothroyd@boffamiskell.co.nz | Drawn: HCo | Checked: KMc
Map 1
DRAFT

Figure 13-2:

Site 2:

Site 2 is an overland flowpath aligned NE – SW, roughly perpendicular to the proposed service trench alignment, which crosses it. Mercer grass (a FACW species) dominates the vegetation within a ~10 m wide swale down the length of the flowpath. A willow tree is present immediately eastward of the proposed trench alignment, beneath which vegetation cover is sparse. The flowpath crosses a shallow bund ~40 m downslope of the proposed trench alignment and deepens to form an area of shallow water with a relatively continuous cover of emergent Mercer grass and rushes (*Juncus canadensis, J. effusus,* FACW and OBL species respectively).

A built-up crossing of boulders and compacted clay with a short section of concrete culvert pipe across it is present on the eastern side of the willow tree.

A visual assessment was sufficient to confirm that the flowpath meets the “rapid test”, and does not meet any of the exclusions, and therefore meets the definition of a natural inland wetland.

The status of the pasture on the adjacent northern slope is less clear. This area evidently receives some groundwater seepage and is seasonally wet, with a patchy mix of ryegrass and wet-tolerant grasses and herbs (creeping bent, Mercer grass, buttercup, etc), and no distinct boundary between terrestrial and wetland communities. Yellow-brown pumice soils were sandy and free-draining, without definitive indications of gleying or hydric characteristics even in obviously saturated sites, so were not relied on for the evaluation. Hydrological observations undertaken in the May 2023 assessment were unhelpful for delineation due to saturated conditions, so a further assessment was undertaken in September 2023.

A series of vegetation plots were sampled, including within the currently proposed alignment, across the moisture gradient on the grassed slope northward of the flowpath, and within the flowpath adjacent to the existing culvert and crossing. Plot locations are shown in Appendix 1.

Plots sampled within grassland produced prevalence index (PI) scores between 2.1 and 3.3, with the highest scores (indicative of predominantly terrestrial vegetation) in plots furthest up the slope, and the lowest scores (indicative of a wet-tolerant plant community) in lower-lying areas closer to the flowpath. The proportion of ryegrass cover is the main determinant of the division between wetland and non-wetland vegetation and is fairly clear to the south and east of the feature, but less distinct at the head of the flowpath to the west, where the slope is shallow.

Following completion and review of plot data, the approximate extent of the Site 2 wetland feature was delineated during the September 2023 survey, using a visual assessment of the boundary between ryegrass-dominated pasture and grassland dominated by wet-tolerant species. This boundary was walked and recorded using a GPS track. Note that this line encompasses all plots with a PI score of 3 or below.

Figure 13-3(a-f) *Site 2 of service trench route inspection.*

WWLA (2023) have undertaken a review of the area, and based on the hydrology and soil substrate, concluded that the area through which the service trench will be excavated through is not a wetland; rather it is an overland flow path that conveys water down to the lower terrace adjacent to the Ohinemuri River. WWLA go on to state that any effects on the identified feature from excavating the trench through the already disturbed area will be less than minor with respect to the hydrologic and hydrogeological regime and will be of limited duration.

These assessments give conflicting views on whether it truly is a natural inland wetland. However, given inherent uncertainties and ambiguity of definitions we have taken a precautionary approach and have considered the feature to meet the definition of a natural inland wetland. We note that the highly pastoral nature of the feature means that we consider that ecological values of the feature are very low.

Site 3:

An area of shallow standing water is present in what appears to be an old excavation within an area of low relief. A group of mixed exotic trees is present on a relict mound of earth within the excavated pond. A closely cropped and heavily pugged pasture of creeping bent forms the main ground cover around the pond and throughout the low-lying topography. Patches of water pepper are interspersed through the standing water and around the margins of the pond. Water was brown and muddy. No water source or flow was observed, but an indent at one end of the pond feature allows water to drain to the nearby stream.

Site 3 is an area of standing water surrounded by creeping bent and interspersed with patches of water pepper (obligate). While vegetation cover was sparse, it met the “rapid test”, but is excluded as a constructed feature (a shallow excavated pond).

Figure 13-4(a-h) *Site 3 of service trench route inspection.*

Site 4:

The route intersects a tributary approximately 5 m wide. Thick floating mats of exotic grass completely cover the channel, mainly comprising Yorkshire fog, along with local swards of *Juncus canadensis,* meadow grass (*Poa trivialis*) and paspalum (*Paspalum dilatatum*). *Juncus effusus*, clover, creeping buttercup, dock and perennial ryegrass are also patchily interspersed throughout.

Site 4 is a well-defined channel containing standing or slowly flowing water. Vegetation cover at this site meets the pasture exclusion, while the channel itself meets the definition of an intermittent stream.

Fig 13-5(a-d): *Site 4 of service trench route inspection.*

Site 5:

The route intersects a tributary stream that follows the alignment of a barberry hedge with a ground cover of Montbretia overhanging the channel. Bank of around 500 mm tall.

Site 5 is a well-defined, deeply incised tributary with no hydrophilic vegetation, and does not meet any of the wetland delineation tests.

Figure 13-6(a-d) *Site 5 of service trench route inspection.*

Site 6:

The route intersects an overland flow path within an area of low relief approximately 50 m north of Golden Valley Rd. An intact sward of grazed pasture forms the dominant ground cover, containing an even mix of Yorkshire fog and perennial ryegrass, with creeping buttercup, dock, meadow grass, paspalum, creeping bent and water pepper in patches through the lowest-lying parts of the feature.

Site 6 is an area of grazed exotic grassland dominated by pasture species (including FAC and FACU species). Small patches of FACW and OBL species are locally present, but not dominant, in low-lying parts of the site. Vegetation comprises more than 50% pasture species and it does not meet the definition of a natural inland wetland.

Figure 13-7(a-d) *Site 6 of service trench route inspection.*

Site 2 Wetland delineation plot data

A total of 7 vegetation plots were undertaken to delineate the wetland feature at Site 2 along the Services Trench route. Plot data are set out below.

User Input											
Plot Number	1 (labelled 1 on map)										
6-letter code	% Cover	Dominant (50/20 rule) Y / N	Species Name	Common Name	Threat Status	Wetland Status	Pasture species	Dominant Species is OBL, FACW	Dominant Species is OBL, FACW, FAC	Score (Prevalence)	Points (Prevalence)
ranrep	35	y	*Ranunculus repens*	*Creeping Buttercup*		FAC			Yes	3	105.0
Pasdis	35	y	*Paspalum distichum*	*Mercer Grass*		FACW		Yes	Yes	2	70.0
perhyd	15	y	*Persicaria hydropiper*	*Water Pepper*		FACW		Yes	Yes	2	30.0
plamaj	1		*Plantago major*	*Broad-leaved Plantain*		FACU				4	4.0
poaann	1		*Poa annua*	*Annual Poa*		FACU				4	4.0
belper	1		*Bellis perennis*	*Bellis Daisy*		FACU				4	4.0
trirep	1		*Trifolium repens*	*White Clover*		FACU	Y			4	4.0
verser	1		*Veronica serpyllifolia*	*Turf Speedwell*		FAC				3	3.0
calsta	1		*Callitriche stagnalis*	*Water Starwort*		OBL				1	1.0
lolper	5		*Lolium perenne*	*Perennial Rye Grass*		FACU	Y			4	20.0
glydec	4		*Glyceria declinata*	*Blue Sweet Grass*		OBL				1	4.0
Number of species: 11	Percent vegetation cover: 100	Number of dominant species: 3		FAC-Neutral test: 44.4444444444444%							

OPTIONAL Indicators of wetland hydrology (1 = present, 0 = not present)					
Primary hydrology indicators				Secondary hydrology indicators	
1A. Surface water	0	2G. Inundation on aerial imagery	0	2K. Water-stained leaves	0
1B. Groundwater <30 cm	0	2H. Sparsely vegetated concave surface	0	2L. Drainage patterns	1
1C. Soil saturation <30 cm	1	2I. Salt crust	0	3E. Dry season water table	0
2A. Water marks	0	2J. Aquatic invertebrates	0	3F. Saturation in aerial imagery	0
2B. Sediment deposits	0	3A. Hydrogen sulfide odour	0	4B. Geomorphic position	0
2C. Drift deposits	0	3B. Oxidised rhizosphere on roots	1	4C. Shallow aquitard	0
2D. Algal mat/crust	0	3C. Reduced iron	0	4D. FAC neutral test	0
2E. Iron deposits	0	3D. Reduced iron in tilled soil	0	4E. Frost heave hummocks	0
2F. Surface soil cracks	0	4A. High water table stunted/stressed plants	0		
Hydric soil present	0				

Pasture exclusion test:	
Pasture cover	6
Vegetation cover	100
0.06	
This is not pasture	

Clarkson 2013			
Wetland vegetation determination			
1. Rapid test score:	0.67	Wetland if all dominant species across all strata rated OBL and/or FACW	*Fail*
2a. Dominance Test Score:	1.00	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule	*Pass*
2b. FAC dominants	0.33	Are all or most dominants FAC?	*Pass*
3. Indicators of wetland hydrology present?	TRUE	TRUE (Yes) / FALSE (No)	*Pass*
4. Prevalence Index Result:	2.5	Wetland if PI < 3.0, but values around 3.0 should be used alongside other wetland indicators	*Wetland*
Is it a wetland?	*It's wetland vegetation!*		

MFE 2021			
Wetland determination			
1. Rapid test score:	0.67	Wetland if all dominant species	*Fail*
2a. Dominance Test Score:	1	Wetland if more than 50% of dominant species across all strata are rated	*Pass*
2b. Prevalence Index Score:	2.49	Wetland if PI < 3.0, but values around 3.0 should be used alongside other	*Pass*
3. Dominance + Prevalence			*Pass*
4. Indicators of wetland hydrology present?	TRUE	TRUE (Yes) / FALSE (No)	*Pass*
Is it a wetland?	*It's a Wetland under the RMA!*		

User Input											
Plot Number	2 (labelled 2 on map)										
6-letter code	% Cover	Dominant (50/20 rule) Y / N	Species Name	Common Name	Threat Status	Wetland Status	Pasture species	Dominant Species is OBL, FACW	Dominant Species is OBL, FACW, FAC	Score (Prevalence)	Points (Prevalence)
Pasdis	30	y	*Paspalum distichum*	*Mercer Grass*		*FACW*		Yes	Yes	2	60.0
ranrep	20	y	*Ranunculus repens*	*Creeping Buttercup*		*FAC*			Yes	3	60.0
trirep	10		*Trifolium repens*	*White Clover*		*FACU*	Y			4	40.0
lolper	15	y	*Lolium perenne*	*Perennial Rye Grass*		*FACU*	Y			4	60.0
junart	10		*Juncus articulatus*	*Jointed Rush*		*FACW*				2	20.0
poaann	1		*Poa annua*	*Annual Poa*		*FACU*				4	4.0
rumobt	5		*Rumex obtusifolius*	*Broad-leaved Dock*		*FAC*				3	15.0
sphagn	1		*Sphagnum species*			*OBL*				1	1.0
pruvul	1		*Prunella vulgaris*	*Selfheal*		*FACU*				4	4.0
plamaj	1		*Plantago major*	*Broad-leaved Plantain*		*FACU*				4	4.0
perhyd	1		*Persicaria hydropiper*	*Water Pepper*		*FACW*				2	2.0
belper	5		*Bellis perennis*	*Bellis Daisy*		*FACU*				4	20.0
glydec	5		*Glyceria declinata*	*Blue Sweet Grass*		*OBL*				1	5.0
Number of species: 13	Percent vegetation cover: 105	Number of dominant species: 3			FAC-Neutral test: 45.4545454545455%						

OPTIONAL Indicators of wetland hydrology (1 = present, 0 = not present)					
Primary hydrology indicators				Secondary hydrology indicators	
1A. Surface water	0	2G. Inundation on aerial imagery	0	2K. Water stained leaves	0
1B. Groundwater <30 cm	0	2H. Sparsely vegetated concave surface	0	2L. Drainage patterns	0
1C. Soil saturation <30 cm	0	2I. Salt crust	0	3E. Dry season water table	0
2A. Water marks	0	2J. Aquatic invertebrates	0	3F. Saturation in aerial imagery	0
2B. Sediment deposits	0	3A. Hydrogen sulfide odour	0	4B. Geomorphic position	0
2C. Drift deposits	0	3B. Oxidised rhizosphere on roots	0	4C. Shallow aquitard	0
2D. Algal mat/crust	0	3C. Reduced iron	0	4D. FAC neutral test	0
2E. Iron deposits	0	3D. Reduced iron in tilled soil	0	4E. Frost-heave hummocks	0
2F. Surface soil cracks	0	4A. High water table stunted/stressed plants	0		
Hydric soil present	0				

Pasture exclusion test:	
Pasture cover	25
Vegetation cover	105
0.238095238	
This is not pasture	

Clarkson 2013			
Wetland vegetation determination			
1. Rapid test score:	0.33	Wetland if all dominant species across all strata rated OBL and/or FACW	*Fail*
2a. Dominance Test Score:	0.67	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule	*Pass*
2b. FAC dominants	0.33	Are all or most dominants FAC?	*Pass*
3. Indicators of wetland hydrology present?	FALSE	TRUE (Yes) / FALSE (No)	*Fail*
4. Prevalence Index Result:	2.8	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators	*Wetland, But Score is Borderline*
Is it a wetland?	*It's wetland vegetation!*		

MFE 2021			
Wetland determination			
1. Rapid test score:	0.33	Wetland if all dominant species	*Fail*
2a. Dominance Test Score:	0.666667	species across all strata are rated	*Pass*
2b. Prevalence Index Score:	2.81	3.0 should be used alongside other	*Pass*
3. Dominance + Prevalence			*Pass*
4. Indicators of wetland hydrology present?	FALSE	TRUE (Yes) / FALSE (No)	*Fail*
Is it a wetland?	*It's a Wetland under the RMA!*		

User Input											
Plot Number	3 (labelled 3 on map)										
6-letter code	% Cover	Dominant (50/20 rule) Y / N	Species Name	Common Name	Threat Status	Wetland Status	Pasture species	Dominant Species is OBL, FACW	Dominant Species is OBL, FACW, FAC	Score (Prevalence)	Points (Prevalence)
ranrep	25	y	*Ranunculus repens*	*Creeping Buttercup*		*FAC*			Yes	3	75.0
loiper	25	y	*Lolium perenne*	*Perennial Rye Grass*		*FACU*	Y			4	100.0
rumobt	1		*Rumex obtusifolius*	*Broad-leaved Dock*		*FAC*				3	3.0
hyprad	1		*Hypochoeris radicata*	*Catsear*		*FACU*				4	4.0
trirep	1		*Trifolium repens*	*White Clover*		*FACU*	Y			4	4.0
belper	5		*Bellis perennis*	*Bellis Daisy*		*FACU*				4	20.0
gnalut	1		*Pseudognaphalium luteoalbum*		*Not Threatened*					4	4.0
plamaj	5		*Plantago major*	*Broad-leaved Plantain*		*FACU*				4	20.0
pruvul	5		*Prunella vulgaris*	*Selfheal*		*FACU*				4	20.0
verser	1		*Veronica serpyllifolia*	*Turf Speedwell*		*FAC*				3	3.0
junart	2		*Juncus articulatus*	*Jointed Rush*		*FACW*				2	4.0
poaann	5		*Poa annua*	*Annual Poa*		*FACU*				4	20.0
glydec	1		*Glyceria declinata*	*Blue Sweet Grass*		*OBL*				1	1.0
cerglo	1		*Cerastium glomeratum*	*Annual Mouse-ear Chickweed*		*FACU*				4	4.0
pasdis	10		*Paspalum distichum*	*Mercer Grass*		*FACW*				2	20.0
sphagn	1		*Sphagnum species*			*OBL*				1	1.0
bare earth	10										
Number of species: 17	Percent vegetation cover: 100	Number of dominant species: 2			FAC-Neutral test: 33.3333333333333%						

OPTIONAL Indicators of wetland hydrology (1 = present, 0 = not present)					
Primary hydrology indicators				Secondary hydrology indicators	
1A. Surface water	0	2G. Inundation on aerial imagery	0	2K. Water-stained leaves	0
1B. Groundwater <30 cm	0	2H. Sparsely vegetated concave surface	0	2L. Drainage patterns	0
1C. Soil saturation <30 cm	0	2I. Salt crust	0	3E. Dry-season water table	0
2A. Water marks	0	2J. Aquatic invertebrates	0	3F. Saturation in aerial imagery	0
2B. Sediment deposits	0	3A. Hydrogen sulfide odour	0	4B. Geomorphic position	0
2C. Drift deposits	0	3B. Oxidised rhizosphere on roots	0	4C. Shallow aquitard	0
2D. Algal mat/crust	0	3C. Reduced iron	0	4D. FAC-neutral test	0
2E. Iron deposits	0	3D. Reduced iron in tilled soil	0	4E. Frost-heave hummocks	0
2F. Surface soil cracks	0	4A. High water table stunted/stressed plants	0		
Hydric soil present	0		0		

Pasture exclusion test:	
Pasture cover	26
Vegetation cover	100
0.26	
This is not pasture	

Clarkson 2013			
Wetland vegetation determination			
1. Rapid test score:	0.00	Wetland if all dominant species across all strata rated OBL and/or FACW	*Fail*
2a. Dominance Test Score:	0.50	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.	*Fail*
2b. FAC dominants	0.50	Are all or most dominants FAC?	*Fail*
3. Indicators of wetland hydrology present?	FALSE	TRUE (Yes) / FALSE (No)	*Fail*
4. Prevalence Index Result:	3.0	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.	*Not Wetland, But Score is Borderline*
Is it a wetland?	*Non-wetland vegetation*		

MFE 2021			
Wetland determination			
1. Rapid test score:	0.00	Wetland if all dominant species	*Fail*
2a. Dominance Test Score:	0.5	species across all strata are rated	*Fail*
2b. Prevalence Index Score:	3.03	3.0 should be used alongside other	*Fail*
3. Dominance + Prevalence			*Fail*
4. Indicators of wetland hydrology present?	FALSE	TRUE (Yes) / FALSE (No)	*Fail*
Is it a wetland?	*Non-wetland*		

User Input											
Plot Number	A (15/05/23) upslope in trench alignment (labelled 4 on map)										
6-letter code	% Cover	Dominant (50/20 rule) Y / N	Species Name	Common Name	Threat Status	Wetland Status	Pasture species	Dominant Species is OBL, FACW	Dominant Species is OBL, FACW, FAC	Score (Prevalence)	Points (Prevalence)
agrsto	35	y	*Agrostis stolonifera*	*Creeping Bent*		*FACW*		Yes	Yes	2	70.0
loiper	30	y	*Lolium perenne*	*Perennial Rye Grass*		*FACU*	Y			4	120.0
plalan	5		*Plantago lanceolata*	*Narrow leaved Plantain*		*FACU*	Y			4	20.0
trirep	10		*Trifolium repens*	*White Clover*		*FACU*	Y			4	40.0
pasdil	5		*Paspalum dilatatum*	*Paspalum*		*FACU*	Y			4	20.0
ranrep	5		*Ranunculus repens*	*Creeping Buttercup*		*FAC*				3	15.0
cerglo	1		*Cerastium glomeratum*	*Annual Mouse-ear Chickweed*		*FACU*				4	4.0
rumobt	1		*Rumex obtusifolius*	*Broad-leaved Dock*		*FAC*				3	3.0
bare ground	8										
Number of species: 9	Percent vegetation cover: 100	Number of dominant species: 2			FAC-Neutral test: 16.6666666666667%						

OPTIONAL Indicators of wetland hydrology (1 = present, 0 = not present)					
Primary hydrology indicators				Secondary hydrology indicators	
1A. Surface water	0	2G. Inundation on aerial imagery	0	2K. Water stained leaves	0
1B. Groundwater <30 cm	1	2H. Sparsely vegetated concave surface	0	2L. Drainage patterns	0
1C. Soil saturation <30 cm	1	2I. Salt crust	0	3E. Dry-season water table	0
2A. Water marks	0	2J. Aquatic invertebrates	0	3F. Saturation in aerial imagery	0
2B. Sediment deposits	0	3A. Hydrogen sulfide odour	0	4B. Geomorphic position	0
2C. Drift deposits	0	3B. Oxidised rhizosphere on roots	0	4C. Shallow aquitard	0
2D. Algal mat/crust	0	3C. Reduced iron	0	4D. FAC-neutral test	0
2E. Iron deposits	0	3D. Reduced iron in tilled soil	0	4E. Frost-heave hummocks	0
2F. Surface soil cracks	0	4A. High water table stunted/stressed plants	0		
Hydric soil present	0				

Pasture exclusion test:	
Pasture cover	50
Vegetation cover	100
0.5	
This is not pasture	

Clarkson 2013			
Wetland vegetation determination			
1. Rapid test score:	0.50	Wetland if all dominant species across all strata rated OBL and/or FACW	*Fail*
2a. Dominance Test Score:	0.50	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule	*Fail*
2b. FAC dominants	0.00	Are all or most dominants FAC?	*Pass*
3. Indicators of wetland hydrology present?	TRUE	TRUE (Yes) / FALSE (No)	*Pass*
4. Prevalence Index Result:	2.9	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.	*Wetland, But Score is Borderline*
Is it a wetland?	*It's probably wetland vegetation*		

MFE 2021			
Wetland determination			
1. Rapid test score:	0.50	Wetland if all dominant species	*Fail*
2a. Dominance Test Score:	0.5	species across all strata are rated	*Fail*
2b. Prevalence Index Score:	2.92	3.0 should be used alongside other	*Pass*
3. Dominance + Prevalence			*Next*
4. Indicators of wetland hydrology present?	TRUE	TRUE (Yes) / FALSE (No)	*Pass*
Is it a wetland?	*It's a Wetland under the RMA!*		

User Input		
Plot Number	B (15/05/23) mid slope in trench alignment - labelled 5 on map	

6-letter code	% Cover	Dominant (50/20 rule) Y / N	Species Name	Common Name	Threat Status	Wetland Status	Pasture species	Dominant Species is OBL, FACW	Dominant Species is OBL, FACW, FAC	Score (Prevalence)	Points (Prevalence)
agrsto	25	y	*Agrostis stolonifera*	*Creeping Bent*		*FACW*		Yes	Yes	2	50.0
pasdis	35	y	*Paspalum distichum*	*Mercer Grass*		*FACW*		Yes	Yes	2	70.0
pasdil	3		*Paspalum dilatatum*	*Paspalum*		*FACU*	Y			4	12.0
lolper	2		*Lolium perenne*	*Perennial Rye Grass*		*FACU*	Y			4	8.0
ranrep	20	y	*Ranunculus repens*	*Creeping Buttercup*		*FAC*			Yes	3	60.0
trirep	1		*Trifolium repens*	*White Clover*		*FACU*	Y			4	4.0
cerglo	1		*Cerastium glomeratum*	*Annual Mouse-ear Chickweed*		*FACU*				4	4.0
bare ground	13										
Number of species: 8	Percent vegetation cover: 100	Number of dominant species: 3				FAC-Neutral test: 33.3333333333333%					

OPTIONAL Indicators of wetland hydrology (1 = present, 0 = not present)

Primary hydrology indicators				Secondary hydrology indicators	
1A. Surface water	0	2G. Inundation on aerial imagery	0	2K. Water-stained leaves	0
1B. Groundwater <30 cm	1	2H. Sparsely vegetated concave surface	0	2L. Drainage patterns	0
1C. Soil saturation <30 cm	1	2I. Salt crust	0	3E. Dry season water table	0
2A. Water marks	0	2J. Aquatic invertebrates	0	3F. Saturation in aerial imagery	0
2B. Sediment deposits	0	3A. Hydrogen sulfide odour	0	4B. Geomorphic position	0
2C. Drift deposits	0	3B. Oxidised rhizosphere on roots	0	4C. Shallow aquitard	0
2D. Algal mat/crust	0	3C. Reduced iron	0	4D. FAC-neutral test	0
2E. Iron deposits	0	3D. Reduced iron in tilled soil	0	4E. Frost-heave hummocks	0
2F. Surface soil cracks	0	4A. High water table stunted/stressed plants	0		
Hydric soil present	0				

Pasture exclusion test:	
Pasture cover	6
Vegetation cover	100
0.06	
This is not pasture	

Clarkson 2013

Wetland vegetation determination			
1. Rapid test score:	0.67	Wetland if all dominant species across all strata rated OBL and/or FACW	*Fail*
2a. Dominance Test Score:	1.00	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.	*Pass*
2b. FAC dominants	0.33	Are all or most dominants FAC?	*Pass*
3. Indicators of wetland hydrology present?	TRUE	TRUE (Yes) / FALSE (No)	*Pass*
4. Prevalence Index Result:	2.1	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.	*Wetland*
Is it a wetland?	*It's wetland vegetation!*		

MFE 2021

Wetland determination			
1. Rapid test score:	0.67	Wetland if all dominant species	*Fail*
2a. Dominance Test Score:	1	species across all strata are rated	*Pass*
2b. Prevalence Index Score:	2.08	3.0 should be used alongside other	*Pass*
3. Dominance + Prevalence			*Pass*
4. Indicators of wetland hydrology present?	TRUE	TRUE (Yes) / FALSE (No)	*Pass*
Is it a wetland?	*It's a Wetland under the RMA!*		

User Input		
Plot Number	Control (15/05/23 pasture plot) Labelled 6 on map	

6-letter code	% Cover	Dominant (50/20 rule) Y / N	Species Name	Common Name	Threat Status	Wetland Status	Pasture species	Dominant Species is OBL, FACW	Dominant Species is OBL, FACW, FAC	Score (Prevalence)	Points (Prevalence)
Agrsto	25	y	*Agrostis stolonifera*	*Creeping Bent*		*FACW*		Yes	Yes	2	50.0
lolper	50	y	*Lolium perenne*	*Perennial Rye Grass*		*FACU*	Y			4	200.0
ranrep	20	y	*Ranunculus repens*	*Creeping Buttercup*		*FAC*			Yes	3	60.0
trirep	10		*Trifolium repens*	*White Clover*		*FACU*	Y			4	40.0
plalan	2		*Plantago lanceolata*	*Narrow-leaved Plantain*		*FACU*	Y			4	8.0
rumobt	1		*Rumex obtusifolius*	*Broad-leaved Dock*		*FAC*				3	3.0
pasdil	1		*Paspalum dilatatum*	*Paspalum*		*FACU*	Y			4	4.0
Number of species: 7	Percent vegetation cover: 109	Number of dominant species: 3				FAC-Neutral test: 20%					

OPTIONAL Indicators of wetland hydrology (1 = present, 0 = not present)

Primary hydrology indicators				Secondary hydrology indicators	
1A. Surface water	0	2G. Inundation on aerial imagery	0	2K. Water-stained leaves	0
1B. Groundwater <30 cm	1	2H. Sparsely vegetated concave surface	0	2L. Drainage patterns	0
1C. Soil saturation <30 cm	1	2I. Salt crust	0	3E. Dry season water table	0
2A. Water marks	0	2J. Aquatic invertebrates	0	3F. Saturation in aerial imagery	0
2B. Sediment deposits	0	3A. Hydrogen sulfide odour	0	4B. Geomorphic position	0
2C. Drift deposits	0	3B. Oxidised rhizosphere on roots	0	4C. Shallow aquitard	0
2D. Algal mat/crust	0	3C. Reduced iron	0	4D. FAC-neutral test	0
2E. Iron deposits	0	3D. Reduced iron in tilled soil	0	4E. Frost-heave hummocks	0
2F. Surface soil cracks	0	4A. High water table stunted/stressed plants	0		
Hydric soil present	0				

Pasture exclusion test:	
Pasture cover	63
Vegetation cover	109
0.577981651	
This is pasture	

Clarkson 2013

Wetland vegetation determination			
1. Rapid test score:	0.33	Wetland if all dominant species across all strata rated OBL and/or FACW	*Fail*
2a. Dominance Test Score:	0.67	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.	*Pass*
2b. FAC dominants	0.33	Are all or most dominants FAC?	*Pass*
3. Indicators of wetland hydrology present?	TRUE	TRUE (Yes) / FALSE (No)	*Pass*
4. Prevalence Index Result:	3.3	Wetland if PI ≤ 3.0, but values around 3.0 should be used alongside other wetland indicators.	*Not Wetland, But Score is Borderline*
Is it a wetland?	*It's wetland vegetation!*		

MFE 2021

Wetland determination			
1. Rapid test score:	0.33	Wetland if all dominant species	*Fail*
2a. Dominance Test Score:	0.666667	species across all strata are rated	*Pass*
2b. Prevalence Index Score:	3.36	3.0 should be used alongside other	*Fail*
3. Dominance + Prevalence			*Next*
4. Indicators of wetland hydrology present?	TRUE	TRUE (Yes) / FALSE (No)	*Pass*
Is it a wetland?	*It's a Wetland under the RMA!*		

User Input		
Plot Number	C (15/05/23) grassland adj to flowpath east of willow tree - labelled 7 on map	

6-letter code	% Cover	Dominant (50/20 rule) Y / N	Species Name	Common Name	Threat Status	Wetland Status	Pasture species	Dominant Species is OBL, FACW	Dominant Species is OBL, FACW, FAC	Score (Prevalence)	Points (Prevalence)
agrsto	35	y	*Agrostis stolonifera*	*Creeping Bent*		*FACW*		Yes	Yes	2	70.0
pasdis	20	y	*Paspalum distichum*	*Mercer Grass*		*FACW*		Yes	Yes	2	40.0
plalan	2		*Plantago lanceolata*	*Narrow-leaved Plantain*		*FACU*	Y			4	8.0
trirep	5		*Trifolium repens*	*White Clover*		*FACU*	Y			4	20.0
ranrep	10		*Ranunculus repens*	*Creeping Buttercup*		*FAC*				3	30.0
cerglo	2		*Cerastium glomeratum*	*Annual Mouse-ear Chickweed*		*FACU*				4	8.0
pasdil	1		*Paspalum dilatatum*	*Paspalum*		*FACU*	Y			4	4.0
perdec	2		*Persicaria decipiens*		*Not Threatened*	*OBL*				1	2.0
Number of species: 8	Percent vegetation cover: 77	Number of dominant species: 2				FAC-Neutral test: 42.8571428571429%					

OPTIONAL Indicators of wetland hydrology (1 = present, 0 = not present)

Primary hydrology indicators				Secondary hydrology indicators	
1A. Surface water	0	2G. Inundation on aerial imagery	0	2K. Water-stained leaves	0
1B. Groundwater <30 cm	1	2H. Sparsely vegetated concave surface	0	2L. Drainage patterns	1
1C. Soil saturation <30 cm	1	2I. Salt crust	0	3E. Dry season water table	0
2A. Water marks	0	2J. Aquatic invertebrates	0	3F. Saturation in aerial imagery	1
2B. Sediment deposits	0	3A. Hydrogen sulfide odour	0	4B. Geomorphic position	1
2C. Drift deposits	0	3B. Oxidised rhizosphere on roots	0	4C. Shallow aquitard	0
2D. Algal mat/crust	0	3C. Reduced iron	0	4D. FAC-neutral test	0
2E. Iron deposits	0	3D. Reduced iron in tilled soil	0	4E. Frost-heave hummocks	0
2F. Surface soil cracks	0	4A. High water table stunted/stressed plants	0		
Hydric soil present	0				

Pasture exclusion test:	
Pasture cover	8
Vegetation cover	77
0.103896104	
This is not pasture	

Clarkson 2013

Wetland vegetation determination			
1. Rapid test score:	1.00	Wetland if all dominant species across all strata rated OBL and/or FACW	*Pass*
2a. Dominance Test Score:	1.00	Wetland if more than 50% of dominant species across all strata are rated OBL, FACW, or FAC using the 50/20 rule.	*Pass*
2b. FAC dominants	0.00	Are all or most dominants FAC?	*Pass*
3. Indicators of wetland hydrology present?	TRUE	TRUE (Yes) / FALSE (No)	*Pass*
4. Prevalence Index Result:	2.4	Wetland if PI < 3.0, but values around 3.0 should be used alongside other wetland indicators.	*Wetland*
Is it a wetland?	*It's wetland vegetation!*		

MFE 2021

Wetland determination			
1. Rapid test score:	1.00	Wetland if all dominant species	*Pass*
2a. Dominance Test Score:	1	species across all strata are rated	*Pass*
2b. Prevalence Index Score:	2.36	3.0 should be used alongside other	*Pass*
3. Dominance + Prevalence			*Pass*
4. Indicators of wetland hydrology present?	TRUE	TRUE (Yes) / FALSE (No)	*Pass*
Is it a wetland?	*It's a Wetland under the RMA!*		

Figure 13-8(a-e): *Wetland delineation plot data.*

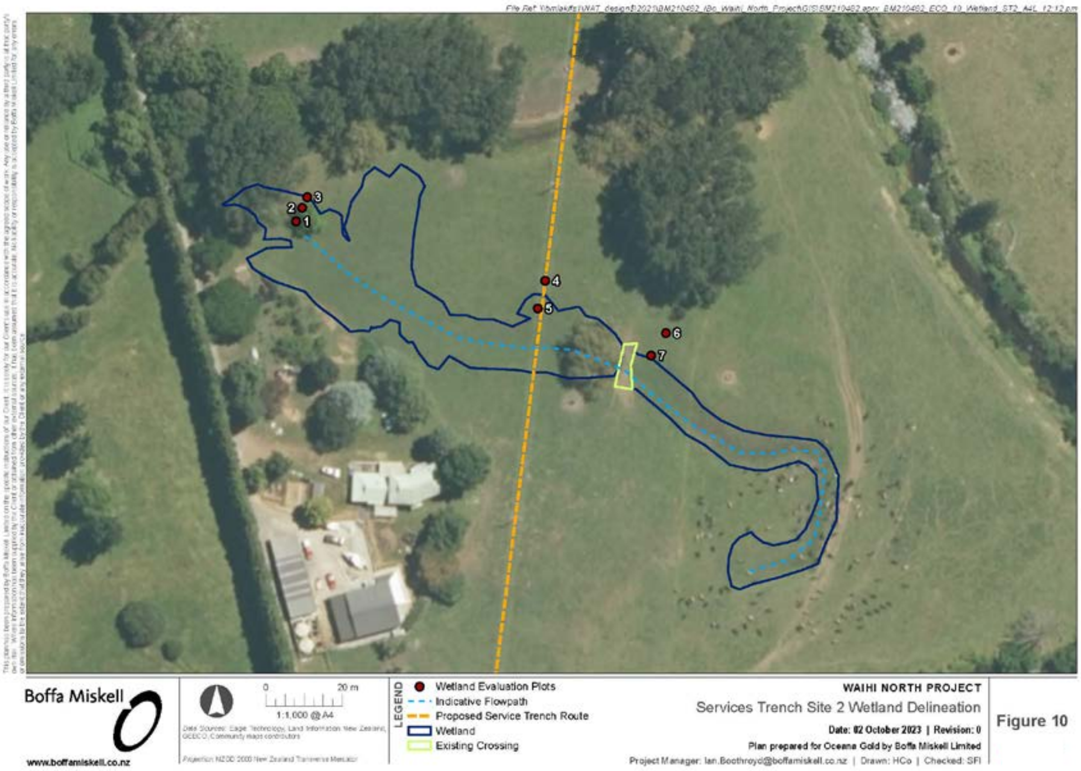


Figure 13-9(a-e): *Site 2 wetland showing location of wetland evaluation plots.*

Appendix 14: DRAFT Stream Diversion and Development Plan

Waihi North Project

DRAFT Stream Diversion and Development Plan
Prepared for Oceana Gold (NZ) Ltd

26 February 2025

Boffa Miskell is proudly a
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Cover photograph: Lower Stream TB1, a previous stream diversion © Boffa Miskell, 2019

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1.0 Introduction

1.1 Overview

The Waihi North Project (WNP; the Project) has identified opportunities to expand the Waihi operation by Oceana Gold (NZ) Ltd (OGNZL). The Project seeks to operate one new open pit, Gladstone Open Pit (GOP), and one new underground development (Wharekirauponga Underground Mine or WUG). To support these expansion operations a new tailings storage facility (TSF3), and two new rock stacks (the Northern Rock Stack, NRS and Willows Rock Stack) are required. All these facilities are proposed to be located over existing watercourses.

The impacts on some watercourses with the Project footprint is unavoidable. In order to offset a portion of the the impacts on, and loss of, watercourses two ecologically functional stream diversions will be created, totalling 2,765 m. The diversion channels primarily account for the loss of stream habitat on the unnamed ‘TB1’ stream within the Northern Rock Stack Area (NRS) and the Ruahorehore Stream and tributaries within the Tailings Storage Facility 3 Area (TSF3). However, the total of quantum of riparian planting and stream diversion is calculated as a ‘whole of project’ approach and is further detailed in the Freshwater Ecological Assessment (Boffa Miskell, 2024).

This Stream Diversion and Development Plan (SDDP) sets out the principals of the stream diversions and development. Detailed stream diversion drawings outlining detailed engineering details has not yet been prepared. However, they must be consistent with this plan.

This plan only applies to stream diversion channels and doesn’t include clean water diversion channels that are intended only to move water and have no ecological value.

1.2 Site Description

The OGNZL Waihi gold mines are located within and adjacent to the Waihi township, near the east coast of the North Island of New Zealand. The land surrounding the current surface mining operations (mainly zoned Martha Mineral zone in the Hauraki District Plan) is predominantly rural, except for the Martha Pit which is surrounded by low-density residential and town centre areas. The proposed footprint of the surface works for the WNP that require stream reclamation are located on rural land.

The existing mining site is located within the Ohinemuri River Catchment, a tributary of the Waihou River and within the Waihi Ecological District (ED). Waihi Ecological District includes the land from Whangamata south to Waihi Beach and encompasses the entire project area. With the exception of CFP land, much of the vegetation in Waihi ED has been modified through farming and urban development. Native forest within Waihi ED comprises tawa-dominated forest with emergent northern rata, rimu, totara, miro, pukatea and kauri.

Major tributaries of the Ohinemuri River include the Ruahorehore Stream, Mangatoetoe Stream and Mataura Stream, a number of smaller waterbodies draining into the river in the vicinity of Waihi; as well as the Waitawheta and Waitekauri Rivers lower in the catchment.

1.3 History of Diversions at Site

Oceana Gold (NZ) limited have previously diverted both ‘Eastern Stream’ and ‘TB1 Stream’ as part of earlier expansions to mining operations are Waihi. These two streams are of moderately-high value, given their location, and are successful examples of ecologically functioning stream diversions.

1.4 Proposed Stream Diversions

Two diversion channels are proposed; the NRS diversion (965 m) which discharges through a short section of an unnamed tributary and then into the Ohinemuri River. The TSF3 Diversion (1,800 m[1]) Channel flows into the Ruahorehore Stream and into the Ohinemuri River.

The two stream diversions, NRS Diversion and TSF3 Diversion, form part of a larger freshwater mitigation package across the Waihi North Project. However, in this report when reference is made to ‘the channel to be reclaimed’ it is referencing the main watercourse located under the relevant footprint of works and for which the diversion will be carrying water. For NRS Diversion this refers to Stream TB1 and for the TSF3 Diversion, this refers to the Ruahorehore Stream.

2.0 Existing Ecological Values

2.1 TB1 Stream / NRS Diversion

TB1 Stream is an existing formed diversion that was created from an earlier expansion of mining operations. The TB1 stream is located to the north of the Processing Plant and drains directly into the Ohinemuri River (Figure 1). There are several small tributaries to the east that flow in the TB1 stream that will also be reclaimed either in their entirety or within their lower reaches. The upstream source of water for TB1 will be unchanged for the NRS diversion, flowing from tributaries to the south-east and south.

[1] The full length of the TSF3 diversion channel is 2,503 m, however only the bottom 1,800 m is anticipated to be ecologically.

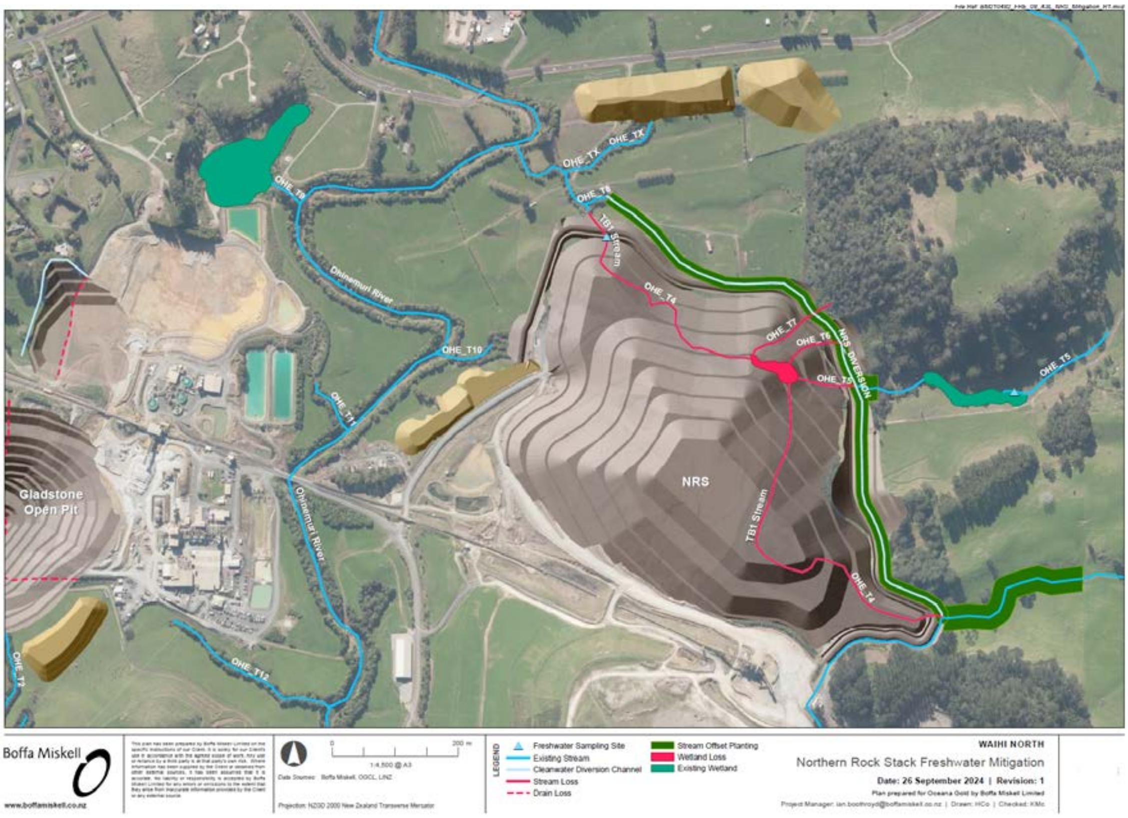

Figure 1:*Map of the existing TB1 Stream and proposed NRS Diversion.*

TB1 Stream has a reasonably wide (1.7 – 3.4 m) channel with a silt / sand substrate with the occasional small gravel present. Water flow was slow, with large and deep pools (up to 1.26 m deep) present along the reach and some areas of anoxic sediment. Riparian vegetation had been planted to approximately 10 m either side and fenced off from the surrounding grazed pasture. Native species such as flax, lemonwood, cabbage tree and mapou have been planted, amongst others. Giant umbrella sedge is abundant along the stream edge on both banks, with it extending out to several meters towards the downstream end of the reach. Small areas of active erosion were present with bank slumping more apparent at the downstream end of the reach. Macrophytes were rare along the survey reach, with small areas of *Nitella sp*. observed. Towards the lower reaches the stream channel shallowed and concentrated patches of watercress and water purslane (*Ludwigia palustris*) were present.

Macroinvertebrate communities were dominated by taxa pollution tolerant. However, a number of pollution sensitive EPT taxa were observed. The MCI-sb was indicative of ‘fair’ biotic function, with probable moderate pollution.

Fish taxa was poor, with only shortfin eel recorded (*Anguilla australis*).

TB1 Stream had an SEV score of 0.501, which is indicative of ‘moderate’ ecological functionality.

A wetland feature occurs within the TB1 stream corridor. This wetland has been formed from a former silt pond that was developed as part of the construction of the TSF2. This is not a ‘natural inland wetland’[2] because it is a deliberately constructed wetland as part of a re-routed

[2] NPS-FM Subpart 3, 3.21 Definitions relating to wetlands and rivers: natural inland wetland (b) a deliberately constructed wetland.

watercourse and arising from a former created silt pond. It will not be recreated as part of the NRS Diversion.

2.2 TSF3 Diversion / Ruahorehore Stream

The Ruahorehore Stream, associated tributaries and drainage canals are located to the east of the existing tailing storage facilities, south of the Processing Plant. The proposed TSF3 footprint will result in the loss of a section of the Ruahorehore Stream and associated tributaries, and a number of connected drainage canals (Figure 2). The headwaters of the Ruahorehore Tributary are located within a forested area and neighbouring grazing areas to the north. The flow from these headwaters will be maintained through the TSF3 diversion channel. A small area of the main stem of the Ruahorehore will be realigned at the downstream extent of the TSF3 diversion channel.

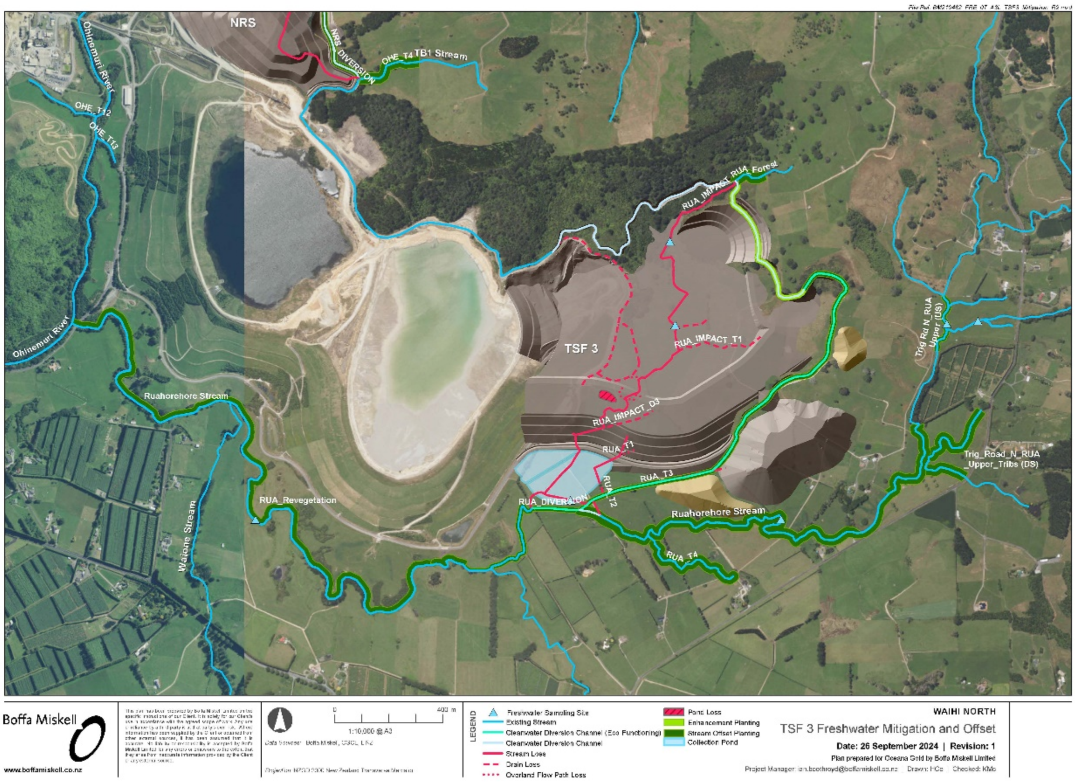

***Figure 2**:Map of the existing Ruahorehore Stream and Tributaries, and proposed TSF3 Diversion.*

The watercourses within the TSF3 footprint are generally characterised by an incised channel of varying width (0.17 - 3.3 m) and depth (0.2 - >1 m), and substrate comprised largely of silt / sand with occasional small gravels and bedrock present. Riparian vegetation is largely absent, with the occasional weedy shrub or hedging present. Bank slumping is evident along much of the stream length, with areas of pugging from stock also present. Macrophytes were often abundant, particularly along the stream edges including the emerged species willow weed and mercer grass (*Paspalum distichum*) and the submerged species *Elodea canadensis* and *Nitella sp*.

Macroinvertebrate communities were dominated by pollution tolerant species such as *Oxyethira* and the snail *Potamopyrgus antipodarum*. MCI-sb scores had a range of 74.1 – 110, with high scores seen at the upstream survey site.

Fish communities were comprised mainly of shortfin eel, with kōura, a common bully and a rainbow trout (*Oncorhynchus mykiss*) also recorded.

SEV-scores had a range of 0.435-0.532, which is indicative of ‘moderate’ ecological functionality.

3.0 Diversion Design Objectives

The proposed stream diversions, NRS and TSF3, are to be ecologically functioning diversions that replicate the habitat and ecological functioning of a stream. These two diversions have been included within stream offset calculations and have minimum ecological functionality (via a predicted SEV score) to achieve.

The design of the stream diversions must be fit for purpose and ensure that stream ecological functions are maintained or improved on from the stream to be lost. The new diversion channels must provide appropriate aquatic habitat for fish, macroinvertebrates and plants, while conveying water. The below are a guideline for the design and construction of the diversion. Final detail design has not been undertaken but is to be consistent with the principals of this Plan.

3.1 Stream Channel

3.1.1 Channel Meander

The two diversion channels should mimic and improve upon, as much as practicable, the natural meanders of the section of stream being reclaimed[3]. The addition of boulders, submerged logs, etc. will be used to aid meander development and increase flow heterogeneity.

3.1.2 Habitat Diversity and Channel Complexity

Hydrologic heterogeneity and instream habitat complexity can be improved upon through the creation of natural features such as runs, riffles and small and large pools. These features can be created utilising natural substrates such as rocks, logs and large boulders (See Figure 3 below). Both of the diversion channels are within catchments with a high loading of fine sediment, and these may become smothered with time. However, their presence increases stream heterogeneity and stability.

The extent of created habitat should be at a minimum consistent with the habitat present in the stream to be reclaimed and similar to neighbouring natural tributaries, with the final substrate present mimicking that naturally occurring in similar sized tributaries in the wider catchment.

[3] Stream TB1 and Rurahorehore Stream; the diversion mimicking the stream in the catchment it is within.

A visual survey of the existing stream should be undertaken prior to the design of the diversion channel by the Project Freshwater Ecologist and the relevant designer/engineer to ascertain the correct ratios for channel complexity and bed material[4]. The channel complexity and availability will 'naturalise' over time as the new diversion channel becomes established.

The channel design must create a low-flow, or baseflow, channel, a bank full channel and a floodplain area (Figure 3). A low flow channel aims to maintain flowing water as much as practicable during dry conditions. This provides a refuge for fish and for fish movement, at least to extend a period of habitat availability should dry conditions persist.

3.1.3 Stream depth, wetted width and velocity

Stream depth and wetted width affect the total area of habitat that can be utilised by aquatic biota, and the volume of water conveyed during normal flows. Stream width and depth should mimic that of the channel to be reclaimed. A survey of the existing stream should be undertaken prior to the design of the diversion channel by the Project Hydrologist to ascertain the stream depths, widths, velocities and capacity. The final design should mimic, where possible, these with some localised variation for the creation of large and small pools and meanders.

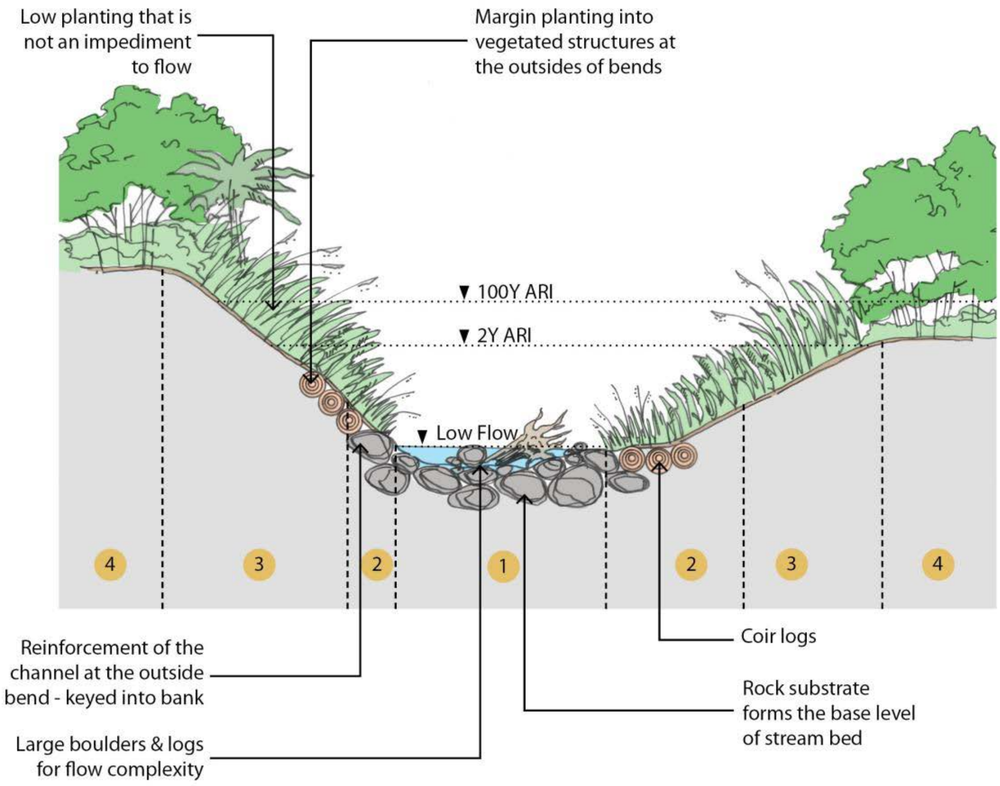

Figure 3: *Example of a channel design, illustrating a low flow channel and the use of rocky substrates and woody debris.*

[4] This include the ratios of riffe/run/pool/chute, and silt/sand/gravels/cobbles/boulders.

Water velocities can affect macroinvertebrates, fish and macrophyte establishment as individual species have different flow preferences. The diversion channel should initially seek to replicate base flow velocities present in the existing channels. The use of channel features such as cascades can be created to help maintain desired flow rates. These features must maintain the relevant fish passage.

3.2 Riparian Vegetation

Riparian vegetation is integral to the ecological success of the stream channel diversions. The stream profile must allow the planting of riparian vegetation close to and extending over the water surface to create ample stream edge habitat. This will provide shading to the water surface, detritus in the form of fallen leaves and potential habitat for fish and macroinvertebrate species.

All stream diversions are to be planted with a minimum of 10 m of riparian planting either side of the stream channel, with 20 m where surrounding land use allows. Exceptions to this occur where mine operation infrastructure or land ownership issues arise. Riparian planting for diversion channels is detailed in the Stream Enhancement and Riparian Planting Plan[5].

3.3 Assumed SEV Scores

The management of freshwater effects for the site is conceived as a wholly integrated ‘package’ that encompasses all aspects of mitigation. As part of this package the Stream Ecological Valuation (SEV) and associated Environmental Compensation Ratio (ECR) assessments were used to inform the mitigation package. Therefore stream diversions have an ‘assumed[6]’ SEV score that informs the overall quantum of stream mitigation (both diversion and riparian restoration) that is required. The SEV score incorporates a set of attributes that, overall, need to be met in order to achieve the predicted SEV score, and consequently the overall mitigation quantum. Further details of the SEV are given in Appendix 1.

Each site has an assumed SEV score, that should be met by 7 years post-livening. Other key attributes for the mitigation are the assumed wetted widths and proposed lengths of the diversions.

3.3.1 NRS Diversion

The assumed SEV score the NRS diversion is 0.673. Some other key scores used within the SEV ECR and overall quantum calculations, that must be met by the design include:

- Average wetted width of 1.5 m.
- Total diversion channel length of 965 m.
- Riparian planting to a minimum average of 10m width both sides.
- Shade from riparian planting to average of 71-90%.

The NRS diversion channel will have the same water source as it does currently and will continue to discharge into the lower reaches of TB1 Stream and out into the Ohinemuri River.

---

[5] Boffa Miskell, 2024. In preparation.

[6] SEVm-P score. As outlined in Storey et al (2011).

Existing tributaries to the east of the NRS diversion channel will discharge into the diversion channel. However, many will be significantly shorter in length.

3.3.2 TSF3 Diversion

The assumed SEV score the TSF3 diversion is 0.673. Some other key scores used within the SEV ECR and overall quantum calculations, that must be met by the design include:

- Average wetted width of 1.8 m.
- Total ecologically functional diversion channel length of 1,800 m.
- Riparian planting to a minimum average of 10m width both sides.
- Shade from riparian planting to average of 71-90%.

The TSF3 diversion channel will have the same water source as it does currently, originating from a neighbouring paddock and flowing through an area of regenerating native bush, maintain connection between the lower Ruahorehore Stream and the forested headwaters of its tributary. The diversion channel is not anticipated to be ‘ecologically functional’ in the upper reaches but will still enable fish passage for Anguilliforms and some climbers up into the upper reaches of the Ruahorehore Tributary.

4.0 Construction Methodology

4.1 Construction Principles

The final construction method will be subject to the final design of the diversion channels. Below are some general principles for construction.

- The stream diversion channel should be constructed offline and prior to any instream works within the channel to be reclaimed.
- Once the construction of the diversion channel is complete, it should be inspected by the Project Freshwater Ecologist to ensure ecological principals have been integrated.
- Prior to livening of the channel, a fish salvage shall be undertaken within the existing channel to be reclaimed. The details of the salvage are detailed in the Freshwater Fauna Salvage and Relocation Plan. Implementation will reduce any incidental mortality of native fish species.

5.0 Fish Passage

5.1 Objectives

The National Policy Statement for Freshwater Management (MfE, 2024; NPS-FM) sets out fish passage objectives, in particular specifying that *"The passage of fish is maintained, or is improved, by instream structures, except where it is desirable to prevent the passage of some fish species in order to protect desired fish species, their life stages, or their habitats."*

The stream diversion channels that are created must enable fish passage for native climbing and swimming species, where appropriate (Table 1). Fish communities were surveyed and were generally depauperate across all sites, with the below species identified:

- TB1 diversion: at a minimum it should enable passage of Anguilliforms along its length, with passage for climbers and swimmers within the lower reaches.
- TSF3 diversion: at a minimum the lower, ecologically functional, reaches need to enable the passage of swimming fish. The upper, steeper, reaches of the diversion should enable the passage of climbers and Anguilliforms.

Table 1. Swimming ability classification of some New Zealand Freshwater fish species (Boubée et al., 1999).

Swimming ability classification	Species
Anguilliforms: These fish are able to worm their way through interstices in stones or vegetation either in or out of water. They can respire atmospheric oxygen if their skin remains damp.	Shortfinned and longfinned eels, and to some extent juvenile kokopu and koaro. Torrentfish may also fit into this category, but they need to remain submerged at all times.
Climbers: These species climb the wetted margins of waterfalls, rapids and spillways. They adhere to the substrate using the surface tension and can have roughened "sucker like" pectoral and pelvic fins or even a sucking mouth (lamprey). The freshwater shrimp, a diadromous native crustacean, is an excellent climber.	Lamprey, elvers, juvenile kokopu, koaro and shrimp. To a limited extent juvenile common and redfinned bullies.
Jumpers: Able to leap using the waves at waterfalls and rapids. As water velocity increases it becomes energy saving for these fish to jump over the obstacle.	Trout, salmon, and possibly (on a scale of 20–50 mm) smelt and inanga.
Swimmers: Fish that usually swim around obstacles. They rely on areas of low velocity to rest and reduce lactic acid build-up with intermittent "burst" type anaerobic activity to get past high velocity areas.	Inanga, smelt, and grey mullet.

5.2 Trout Fishery

The Ohinemuri River is classified as a significant trout fishery and there are important trout spawning tributary streams (including the Mataura Stream) as well as streams providing habitat for juvenile trout populations (including the Ruahorehore Stream). A juvenile rainbow trout was captured

As stipulated above, the design of the TSF3 diversion must allow the passage of trout within the lower reaches. Trout are a swimming species and have no ability to climb, unlike many native species. The upper reaches of the Ruahorehore Stream naturally impeded the passage upstream of trout and the diversion channel should replicate this, with the passage of trout into the upper reaches considered undesirable.

6.0 Ecological Colonisation

The diversion channel is a new stream channel and as such, upon livening will be devoid of any aquatic life. Both the NRS and the TSF3 diversions have source populations of macroinvertebrate and fish species both upstream (within the forested reaches) and downstream. Colonisation of the diversion channels may occur at different rates, and it make take several weeks for aquatic communities to establish. Studies on recolonisation of New Zealand streams following flood events generally show that it takes some 4-8 weeks for macroinvertebrate communities to establish. The fauna and flora that establish in the diversion channels are expected to be similar to these source populations.

The exception being that juvenile trout have previously been captured in the lower reaches of the Ruahorehore, but these are not expected to populate the upper reaches of the TSF3 Diversion.

7.0 Monitoring

7.1 Pre-Livening Monitoring

Prior to the livening of the diversion channel an inspection should be undertaken by the Project Freshwater Ecologist and the relevant designer/engineer . The inspection must ensure that the stream and channel design meet the ecological objectives of this Plan.

7.2 Post-Livening Monitoring

Immediately following the livening of the diversion channel an inspection should be undertaken by the Project Freshwater Ecologist and the relevant designer/engineer. The inspection must ensure that the stream and channel design meet the ecological objectives of this Plan. In particular, fish passage along the length of the channel should be inspected. Any issues identified must be brought to the attention of the stream design and construction team, and a remedy found.

The diversion channels should undergo routine monitoring in the first year following construction to ensure stability of the channel.

7.3 Riparian Vegetation Monitoring

Riparian vegetation monitoring is to be undertaken to ensure the health and success of the riparian planting. The success of the planting directly impacts the success of the stream diversion. The details of the riparian planting monitoring are outlined in the Stream Enhancement and Riparian Planting Plan[7]

7.4 Stream Ecological Valuation Monitoring

Following completion of the stream diversion and associated riparian planting, the channel is to be monitored for ecological functionality to ensure it is meeting it's offset mitigation objectives. A Stream Ecologival Valuation (SEV) survey must be undertaken at each of the diversion channels. The SEV is to be carried out in approximately the middle of the diversion, with the same location surveyed each monitoring round.

The SEV surveys should be undertaken at the diversion sites at 1, 3 and 5 years following the completion of riparian planting. SEV scores should be no less than 80% of the predicted SEV Score by year 5 (SEVm-P). Monitoring shall continue until the target SEV score has been achieved, or until a maximum of 5 years. Regular monitoring prior to the 7-year target will allow any major issues to be identified and remedied earlier. If the SEV score has not been achieved by 5 years, then a Stream Enhancement and Riparian Remedial Plan shall be prepared outlining ways in which to achieve the predicted score. This should be submitted to Council for approval.

- NRS Diversion Target SEV: 0.673
- TSF3 Diversion Target SEV: 0.673

The monitoring should be undertaken by a suitably qualified and experienced freshwater ecologist who is experienced at undertaking SEV surveys.

8.0 Reporting

The consent holder must submit a report to the Consent Authority annually by 30 June each year, detailing the following:

- The extent and location, if any, of stream diversion channel construction in the previous 12 months.
    - This should include the final construction drawings of the diversion channel.

[7] Boffa Miskell (2024). In preparation.

- The extent and location, if any, of stream reclamation in the previous 12 months.
    - This should include the outcomes of any Freshwater Fauna Salvage undertaken.
- The results of the post-livening monitoring SEV surveys.
    - This should include any management actions that may have been identified following the surveys.

9.0 References

Boubée, J., Jowett, I., Nichols, S., and Williams, E (1999). Fish Passage at Culverts: A review, with possible solutions for New Zealand indigenous species. NIWA, Department of Conservation

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Appendix 1: SEV Method

Stream Ecological Valuation

The SEV is recommended by Auckland Council for providing an ecological valuation of streams and is increasingly being used outside of Auckland. The SEV uses a set of fourteen qualitative and quantitative variables to assess the integrity of stream ecological functions (Table 3-1). Field work consists of a comprehensive assessment of the in-stream and riparian environment. This includes a fish survey, aquatic macroinvertebrate sampling and cross-sections of the stream to measure width, depth and substrate, as well as using qualitative parameters for reach-scale attributes.

Table 3-1*: Summary of the 14 ecological functions used to calculate the SEV score.*

Hydraulic functions:	**Biogeochemical functions:**
Processes associated with water storage, movement and transport. • Natural flow regime • Floodplain effectiveness • Connectivity for species migrations • Natural connectivity to groundwater	Relates to the processing of minerals, particulates and water chemistry. • Water temperature control • Dissolved oxygen levels maintained • Organic matter input • In-stream particle retention • Decontamination of pollutants
Habitat provision:	**Biotic functions:**
The types, amount and quality of habitats that the stream reach provides for flora and fauna. • Fish spawning habitat • Habitat for aquatic fauna	The occurrences of diverse populations of native plants and animals that would normally be associated with the stream reach. • Fish fauna intact • Invertebrate fauna intact • Riparian vegetation intact

This data is analysed using a series of formulae in order to produce an SEV score of between 0-1, where a 0 is a stream with no ecological value and 1 is a pristine stream with maximum ecological value. Interpretation of SEV scores is given in Table 4 below.

Table 3-2*: Interpretation of SEV scores (Adopted from Golder Associates, 2009).*

Score	Category
0 - 0.40	Poor
0.41 – 0.60	Moderate
0.61 – 0.80	Good
0.81+	Excellent

Ecological Compensation Ratio

To calculate the amount of enhancement required to mitigate the impacts of streamworks an environmental compensation ratio (ECR) was calculated.

The environmental compensation ratio utilises the SEV score to calculate a ratio for the minimum area to be restored as mitigation for unavoidable stream loss. The ECR has the underlying principal of ‘not net loss’ and is based upon ‘no net loss of area-weight stream function’. A minimum ratio of compensation of 1:1 is required.

The formula for calculating the ECR is as below:

- *ECR = [(SEVi-P – SEVi-I)/(SEVm-P – SEVm-C)] x 1.5*
- *SEVi-C & SEVi-P are the current and potential SEV values respectively for the site to be impacted.*
- *SEVm-C & SEVm-P are the current and potential SEV values respectively for the site where environmental compensation is to be applied.*
- *SEVi-I is the predicted SEV value of the stream to be impacted, after impact.*
- *1.5 is a multiplier.*

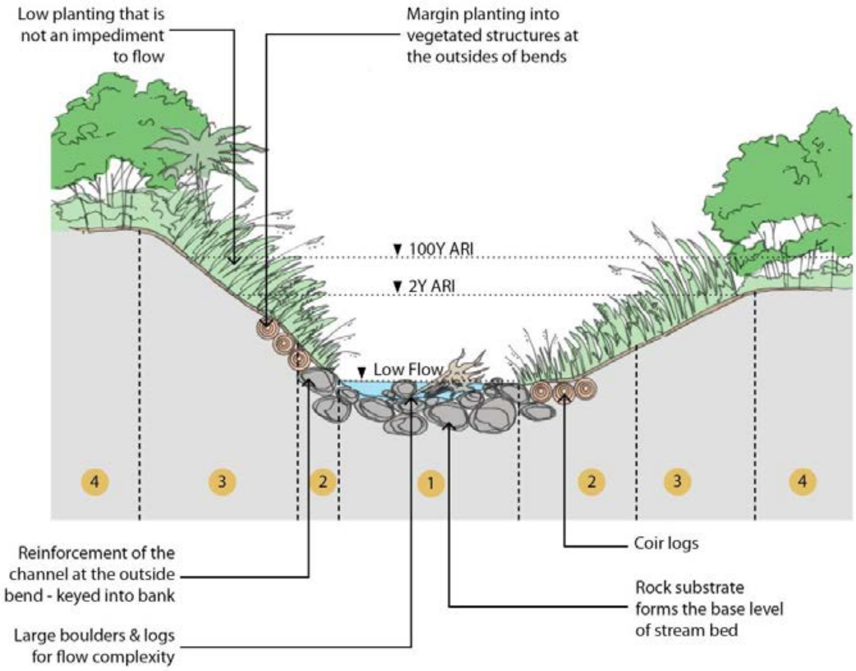
The ECR calculation requires the prediction of a ‘potential’ and ‘impact’ SEV scores. The potential scores for impact sites assume that best practise enhancement works have been undertaken. The prediction of the impact scores assume that the proposed streamworks have been undertaken. The generally accepted SEV score for culverts is 0.2. The predicted potential and impact scores do not include biotic functions (invertebrate fauna intact and fish fauna intact) as they are too difficult to predict.

The ECR considers that environmental compensation ratios greater than 1 are valid because of:

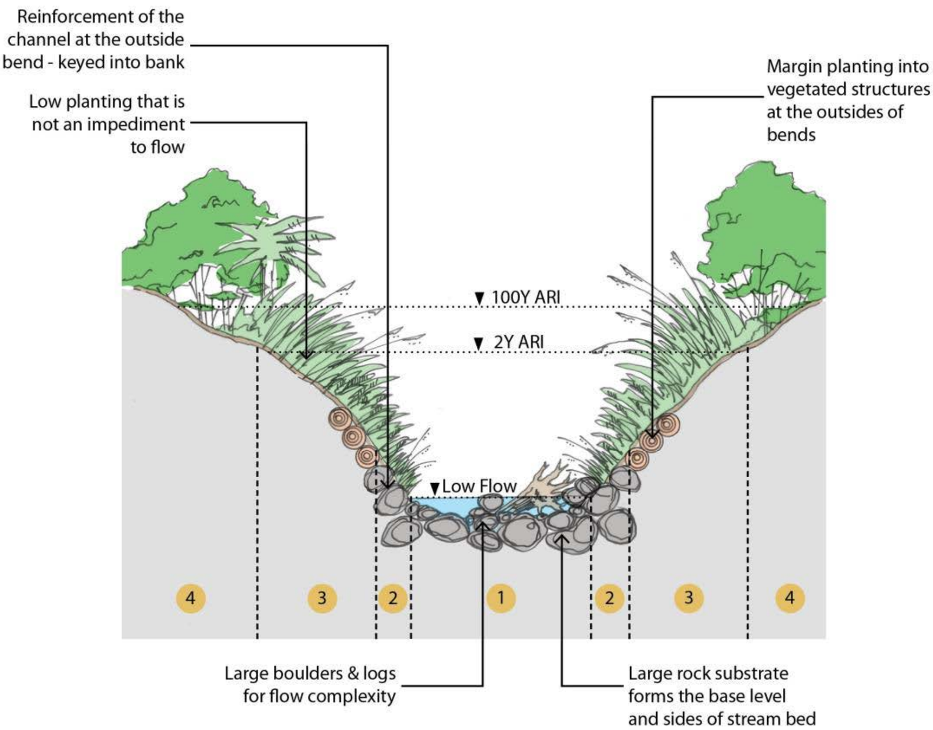
- The ecological risk factors associated with the cumulative loss of streams and the steady change in areal distribution of high-quality stream reaches;
- The long time-lag before full benefits of environment compensation (i.e. from riparian planting) accrue to the mitigated sites; and

The overall difference between the expected and actual success of stream restoration methods.

Appendix 2: Stream Chanel Design Examples

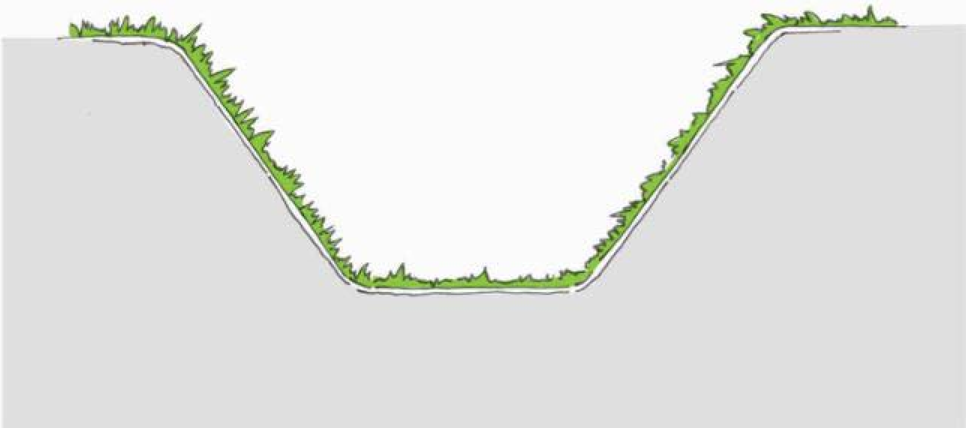


Stream Diversion Type 1 – Lowland stream cross section



Stream Diversion Type 2 – Steep stream cross section

Rock-Lined Flow Channel for High Flow and/or Steep Gradients



Grass-Lined Flow Channel for Low Flow and/or Flat Gradients

Stream Diversion Type 3 – Flow channel cross section

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Appendix 15: DRAFT Stream Enhancement Riparian Planting Plan

Boffa Miskell

Waihi North Project

DRAFT Stream Enhancement Riparian Planting Plan
Prepared for Oceana Gold (NZ) Ltd

24 February 2025

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CONTENTS

1.0 Introduction

1.1 Project Background

The Waihi North Project (WNP; the Project) has identified opportunities to expand the Waihi operation. The Project seeks to operate one new open pit, Gladstone Open Pit (GOP), and one new underground development (Wharekirauponga Underground Mine or WUG). To support these expansion operations a new tailings storage facility (TSF3), and two new rock stacks (the Northern Rock Stack, NRS and Willows Rock Stack) are required. All these facilities are proposed to be located over existing watercourses.

The impacts on some watercourses with the Project footprint is unavoidable. In order to mitigate the impacts on, and loss of, watercourses stream restoration by riparian planting is required along some 10,285 m of stream. This offset accounts for reclamation of stream from the 'hot spring' (WUG), Unnamed Tributary 2 (Willows), TB1 Stream (and tributaries) (NRS) and the Ruahorehore Stream (and tributaries) (TSF3). This offset has been informed by an Ecological Compensation Ratio (ECR) and, alongside the creation of stream diversion channels, will result in no net loss of freshwater ecological function.

This Stream Enhancement Riparian Planting Plan sets out the principals for riparian planting. Detailed planting schedules and specifications have not yet been prepared. However, they must be consistent with this Plan.

1.2 Site Description

The OGNZL Waihi gold mines are located within and adjacent to the Waihi township, near the east coast of the North Island of New Zealand. The land surrounding the current surface mining operations (mainly zoned Martha Mineral zone in the Hauraki District Plan) is predominantly rural, except for the Martha Pit which is surrounded by low-density residential and town centre areas. The proposed footprint of the surface works for the WNP requires unavoidable stream reclamation on rural land.

The existing mining site is located within the Ohinemuri River Catchment, a tributary of the Waihou River and within the Waihi Ecological District (ED). Waihi Ecological District includes the land from Whangamata south to Waihi Beach and encompasses the entire project area. With the exception of Coromandel Forest Park (CFP)- land, much of the vegetation in Waihi ED has been modified through farming and urban development. Native forest within Waihi ED comprises tawa-dominated forest with emergent northern rata, rimu, totara, miro, pukatea and kauri (Kessels & Associates, 2010).

Major tributaries of the Ohinemuri River include the Ruahorehore Stream, Mangatoetoe Stream and Mataura Stream, a number of smaller waterbodies draining into the river in the vicinity of Waihi; as well as the Waitawheta and Waitekauri Rivers lower in the catchment.

Streams on which enhancement riparian planting will be undertaken on are all located within the Ohinemuri River Catchment, predominantly on the Ruahorehore Stream, Matarua Stream and its tributaries, and other unnamed tributaries of the Ohinemuri River. Planting will be undertaken on streams in predominantly rural areas where the land is typically low-lying with some rolling hills and small ridges.

1.3 Restoration History

Considerable planting has been undertaken across the Oceana Gold (NZ) Ltd (OGNZL) Waihi site and surrounding areas by OGNZL (and the former Waihi Gold), with 455,400 plants planted between 1995-2016. Of these plants 206,541 were identified as ‘riparian’ plantings and a further 14,379 and 41,805 plants were identified as ‘swamp’ and ‘gully’ plantings respectively. These plantings totalled 35.31 ha of restoration plantings in and around the Waihi township.

The location of these plantings includes alongside the Ohinemuri River, TB1 Stream and Eastern Stream (both established as diversions and both now functioning watercourses) and a number of associated wetlands, and the lower reaches of the Ruahorehore Stream and tributaries. These plantings have improved the ecological value and function of these watercourses and wetlands.

2.0 Quantum Required

2.1 Length of Stream Riparian Planting

The impact on some watercourses within the footprint of works is unavoidable. The quantum of stream loss resulting from WNP at Willows Farm and at Waihi. Across the footprints of works for WNP there is an overall expected loss of some 4,122 m of low to high value stream loss as well as some 9 m^2 of warm spring. This is to be offset with the creation of 10,285 m of stream diversion channels[1] and stream restoration. With the exception of the warm spring, the offset has been informed by an Ecological Compensation Ratio (ECR) and the outcome equates to an approximate 3:1 offset ratio (gain:loss).

The total quantum of stream enhancement and riparian planting includes a ‘whole of project’ assessment. Where possible, riparian planting has been proposed as close to the stream loss as possible, but this has not always been feasible. The loss of the warm spring within the Wharekirauponga Stream catchment and the headwater stream within the GOP, are not able to be mitigated within their respective catchments. Therefore, stream and enhancement and riparian planting are presented as a project total, not broken down into individual areas of stream loss. Further details of the stream loss are presented in the Freshwater Ecological Assessment (Boffa Miskell, 2025).

The areas of stream enhancement and riparian planting are shown in Figure 1, Figure 2 and Figure 3 below.

[1] The details of the stream diversion channel design are detailed in the Stream Diversion and Development Plan (Boffa Miskell, 2025).

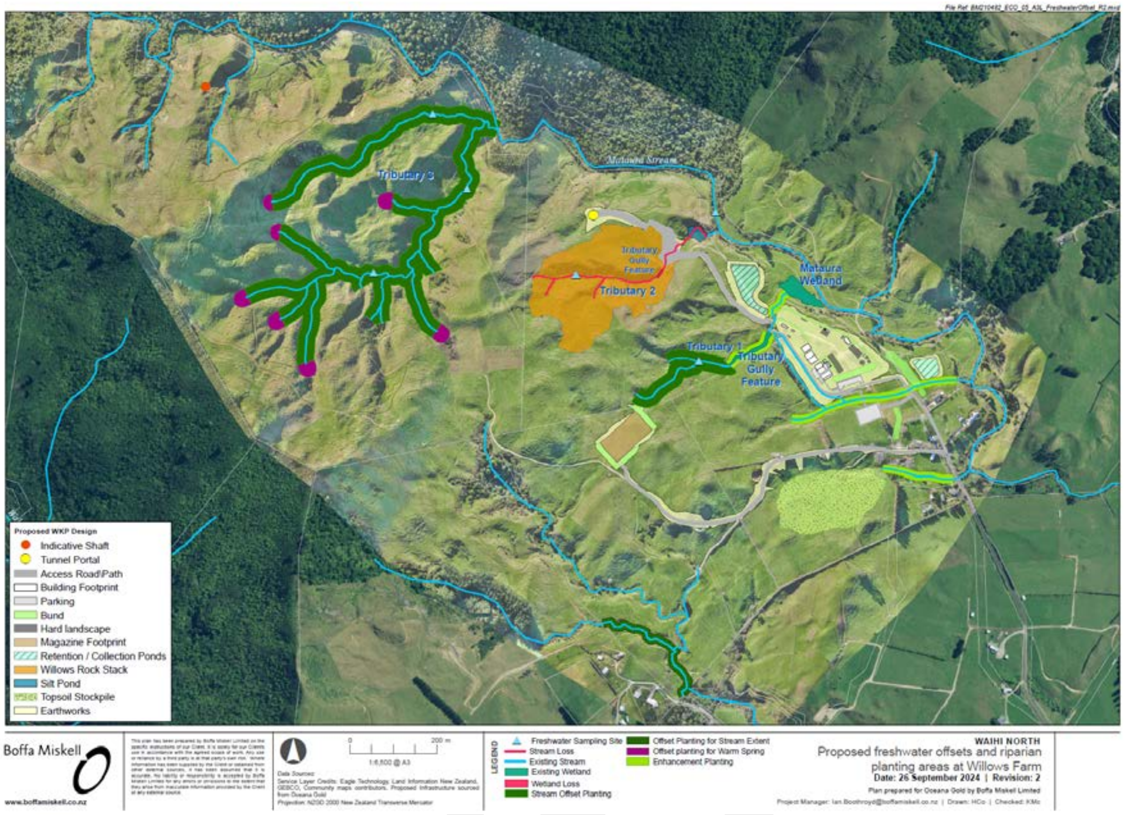

Figure 1 : Map of 'Willows Farm' showing areas of Riparian Planting (Offset Planting).

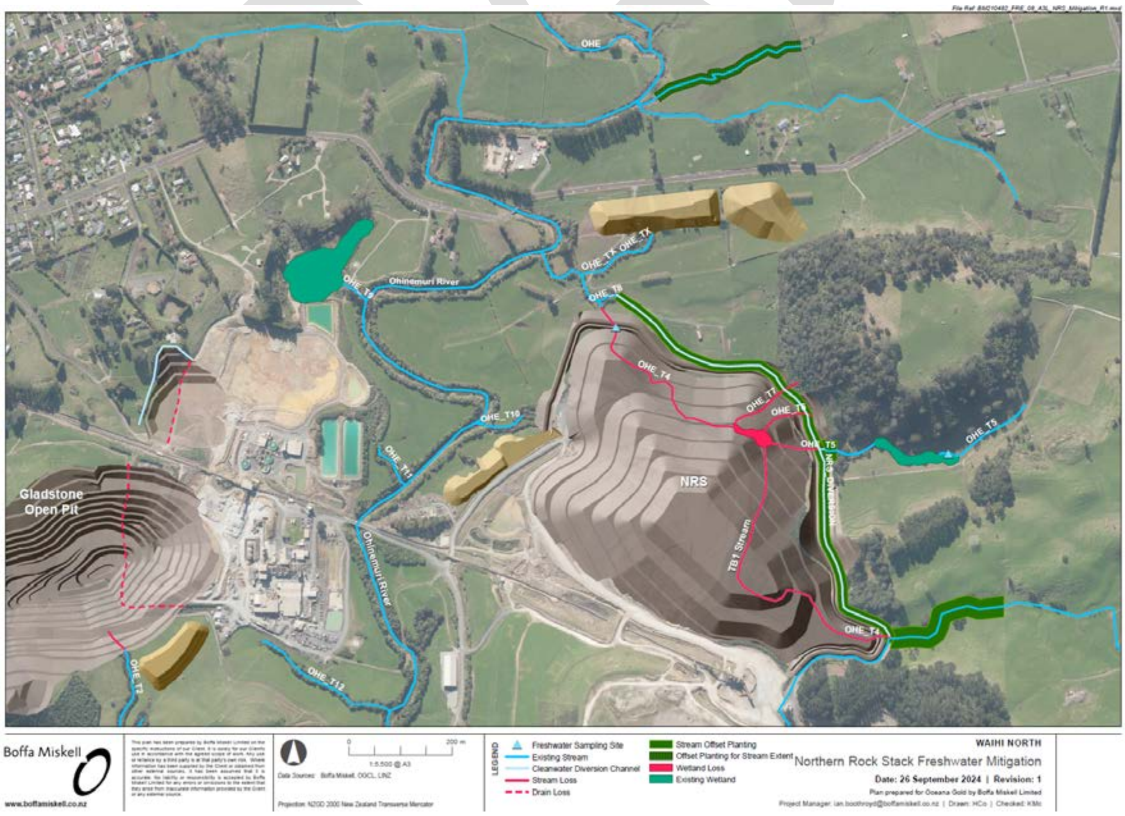

Figure 2 : Map of the Northern Rock Stock area, showing areas of Riparian Planting (Offset Planting).

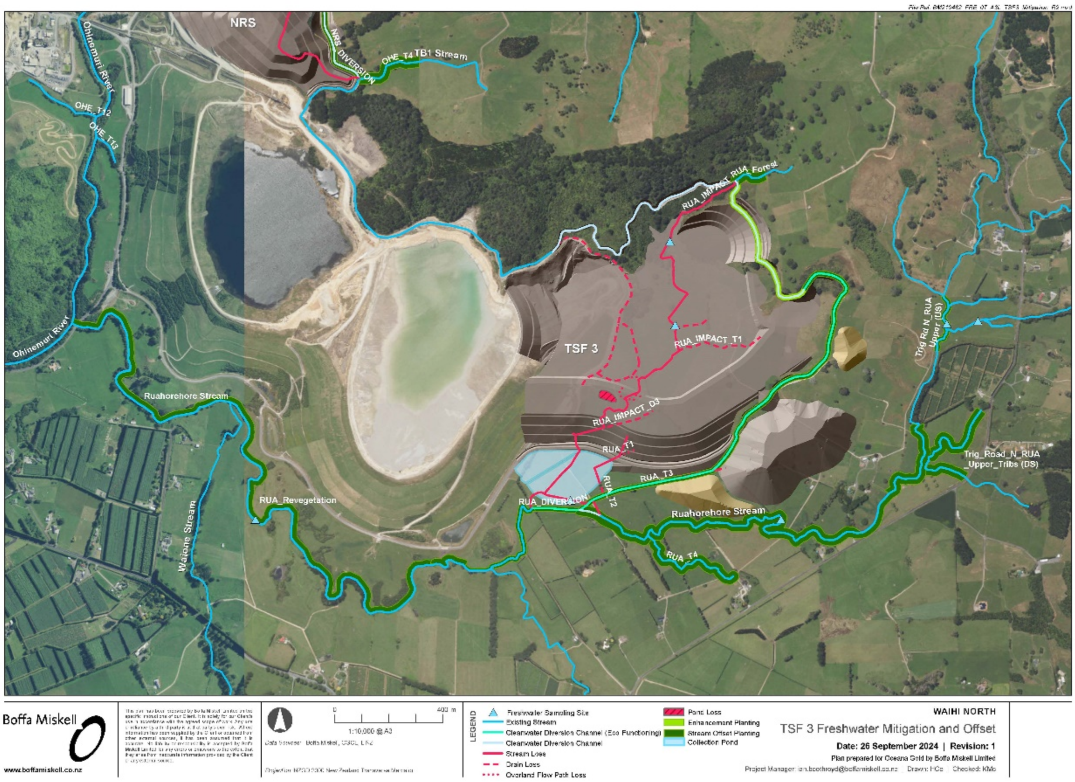

Figure 3 : Map of the Tailings Storage Facility 3 area, showing areas of Riparian Planting (Offset and Enhancement Planting).

3.0 Timing

3.1 Project Timing

The WNP is a large project that will be undertaken in stages across many years. Similarly riparian planting will be undertaken within planting seasons across many years. Where practicable existing stream channels undergoing enhancement planting can be planted as soon as the wider project is consented, as there is no streamworks or earthworks required. Owing to the large amount of riparian planting required across the project, it is not practical to undertake it all prior to any stream reclamation.

The specific timing around the NRS and TSF3 diversion construction is unknown at this stage. Ideally the diversion channels will be created, and operational, prior to the reclamation of any stream channel. However, this may not be feasible.

3.2 Seasonal Timings

All planting should be undertaken during the planting season of April to September, inclusive. Planting should commence no later than one month following the completion of weed control. This will minimise the risk of weed re-infestations competing with native planting.

The planting of diversion channels is subject to the project staging and earthworks schedule and is further described in the Stream Diversion and Development Plan (Boffa Miskell 2025).

4.0 Riparian Planting Objectives

4.1 Background

The enhancement of streams through the use of riparian planting has a myriad of benefits for the ecological health of the stream (Figure 4), including:

- Improved water quality through the filtration of overland flow.
- Increased shade leading to reduced water temperatures and increased oxygen levels.
- Improved bank erosion control through stabilisation from plant roots.
- Improved woody debris and plant detritus within the stream channel for instream fauna.
- Increased instream habitat complexity through overhanging vegetation and inputs of woody debris.

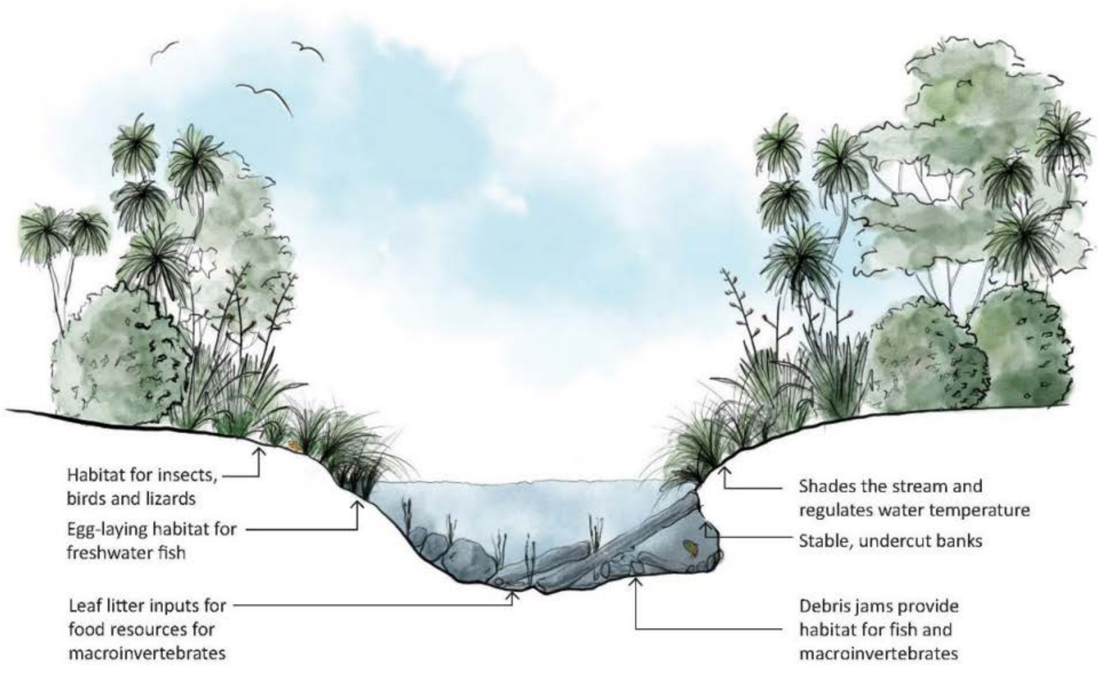

Figure 4: Example of benefits of riparian planting to stream ecology (Boffa Miskell, 2021).

4.2 Planting Plans

A detailed Planting Plan, including a planting schedule and specification, must be prepared and must be consistent with this SERPP. The planting plan should include the all the areas identified in Figure 1, Figure 2 and Figure 3. The planting plans must be specific to each stream reach and its unique hydrological features and ecological function objectives.

The planting plan shall prioritise the use of pioneer species to allow successful competition with potential weed species while providing shade to streams. Detailed planting plans should consider species that provide suitable food sources for bird species and habitat for lizards and bird species.

A 10 metre riparian width, from the edge of the stream channel, is considered to be the minimum width to ensure self-maintenance of the riparian margin from invasive plant species. This 10m is to be the minimum width across riparian margins, with most margins to be planted to an average of 20 m with (See Figure 1-3).

All plants used should be eco-sourced from the Waihi ED, to ensure they are well suited to the conditions. All plant specimens from the Myrtaceae family must be free of myrtle rust.

The riparian planting must be designed to achieve 70-90% shading of the stream channel, 7 years after the completion of planting of the stream reach. Therefore, the Planting Plan must include appropriate overhanging stream-edge and canopy species.

4.3 Site Preparation

The planting plan and associated specification will detail all required site preparations. Some general preparation steps are outlined below that the aforementioned must be consistent with.

Soil Conditions

The contractor should assess the ground and soil conditions prior to any planting, and where they consider that the existing topsoil is deficient, they shall tell the Project representative and ascertain if any remedial action is required.

Clearing

Areas to be planted shall be cleared of any weed species and inorganic debris. Native species are to be retained where possible.

Herbicide

All areas to be planted with established weeds shall be sprayed with a minimum of 2 applications of approved herbicide, commencing at least 6 weeks prior to planting. Each application shall be at least one week apart. The last application should be applied at least two weeks prior to clearing the ground.

If weeds are well-established then existing weed growth may require manual trimming/removal prior to the herbicide application. Vegetation over 0.2m should be removed or mown/mulched prior to herbicide application.

Manual Removal

Cutting of large trees may be required, particularly if willow species are present. All stumps within 5m of streams shall remain in the ground, with the bole of the tree to be cut down to just above the ground level.

4.4 Planting

Prior to any planting, the contractor shall set out the plants according to the planting schedule. The Project Landscape Architect should then confirm the set out of the plants, prior to planting. As much notice as possible should be given of any upcoming inspections.

4.5 Fencing

All stream enhancement and riparian planting that is located within rural areas shall be fenced to prevent livestock access. It is preferable to install a higher quality fence as it is likely have fewer maintenance issues.

5.0 Ongoing Maintenance

5.1 Weed Control

Pest plants and weeds should be controlled regularly for the year following planting. All planted areas shall be kept weed free to the extent that perennial weed species are eradicated, and annual weed species are well controlled. Additional weed control may be required in spring. Spraying should be undertaken using an approved herbicide and should be spot sprayed using a protective spray nozzle/cone to avoid overspray. The maintenance schedule for weed control may differ for each area and will be confirmed in the Planting Specification.

5.2 Plant health

For the year following planting, maintenance of plant health is to be undertaken and may include watering, insect and disease control, pruning, mulching and other accepted horticultural operations to ensure normal and healthy plant establishment and growth. The maintenance schedule may differ for each area and will be confirmed in the Planting Specification.

In addition to routine maintenance, monitoring should be undertaken following significant storm events or during periods of prolonged high or low rainfall.

5.3 Planting Success

The monitoring and maintenance of success of planted species is key to ensuring success of the riparian planting. All plants shall be monitored and maintained for five consecutive years following planting, or until canopy closure has occurred. Initial monitoring should be undertaken at monthly intervals for the first six months, then twice yearly (spring and autumn) every year until the completion of the 5-year period. Specific monitoring details will be confirmed in the planting specification.

Maintenance will include the replacement of any dead or dying planted plants and weed control if required. At the end of the five-year monitoring period a plant survival rate of 90% must be achieved. If this has not occurred, then further replacement planting, and weed control must be undertaken until the 90% survival rate is achieved.

6.0 Pest Animal Control

Pest animal control should be implemented following the completion of planting to ensure the success of the planting. Where there is a risk of the plants being pulled out, by species such as pukekos, then wire staples should be installed around the root balls of plants.

A Pest Management Plan is in preparation that will describe methods for the management of pest animal species within riparian margins.

7.0 Monitoring of Planting Success

Monitoring of the successful establishment of the riparian planting for the Freshwater Ecology Offset Monitoring should be undertaken following the five-year maintenance and monitoring plan by a suitably qualified freshwater ecologist.

Riparian planting should achieve at least 70% canopy cover or 70% stream surface shading. An exception to this is any planting on the Ohinemuri River, as the large width of the river prevents this being achieved. Planting alongside the Ohinemuri River should achieve the 90% plant survival rate with obvious overhanging vegetation and visible stream surface shading. If the planting does not achieve the 70% canopy cover, then a Stream Enhancement and Riparian Remedial Plan shall be prepared outlining methods to in which to achieve the 70% canopy cover.

In addition to the ongoing monitoring of planting success a suitably qualified freshwater ecologist should undertake a Stream Ecological Valuation (Storey et al, 2011) at the following key locations:

- Ruahorehore Stream: Just below stream diversion (location of SEV RUA_Lower).
- Ruahorehore Stream Tributary: (location of SEV RUA_Trig)
- Willows Stream Tributary 3: South Arm (location of SEV Willows 3: South Arm downstream)

The SEV surveys should be undertaken at the mitigation sites at Years 3 and 5 following the completion of riparian planting. SEV scores should be no less than 80% of the predicted SEV Score (SEVm-P). Monitoring shall continue until the SEV score has been achieved, or until a maximum of 5 years. If the SEV score has not been achieved by Year 5, then a Stream Enhancement and Riparian Remedial Plan shall be prepared outlining ways in which to achieve the predicted score.

8.0 Qualifications

Only certified applicators shall be responsible for the application of herbicides.

9.0 Reporting

Yearly reporting should be submitted annually following the planting season and by 30 June detailing the following:

- The location and extent of stream restoration and/or riparian planting undertaken in the preceding planting season.
- The number, mix, size and spacings of planting carried out at each location.
- Records of any dead/dying plants encountered.
- Details of any replacement planting undertaken.
- Any recommendations of additional planting, enhancement or management actions that should be undertaken to ensure successful planting.

10.0 References

Boffa Miskell 2025. Waihi North Project: Freshwater Ecological Assessment. Report prepared for Oceana Gold (NZ) Limited.

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Appendix 1: Description

Appendix 2: Description

Together. Shaping Better Places.

Boffa Miskell is a leading New Zealand environmental consultancy with nine offices throughout Aotearoa. We work with a wide range of local, international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, Te Hīhiri (cultural advisory), engagement, transport advisory, climate change, graphics, and mapping. Over the past five decades we have built a reputation for creativity, professionalism, innovation, and excellence by understanding each project's interconnections with the wider environmental, social, cultural, and economic context.

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