BEFORE THE ENVIRONMENT COURT

Decision No. C 80/2009

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an appeal under section 120 of the Act

BETWEEN LOWER WAITAKI RIVER MANAGEMENT SOCIETY INCORPORATED

(ENV-2009-CHC-20)

Appellant

AND CANTERBURY REGIONAL COUNCIL

Respondent

AND MERIDIAN ENERGY LIMITED

Applicant

Court: Environment Judge J R Jackson (presiding)
Environment Commissioner A J Sutherland
Environment Commissioner H M Beaumont
Deputy Environment Commissioner K D F Fletcher

Hearing: At Oamaru on 22 to 25, 29 and 30 June, 1 to 3 July 2009, and at Christchurch on 6 and 7 July 2009
Site inspection 9 July 2009
Final submissions received 18 August 2009

Appearances: J M Appleyard, N McIndoe and J E Meech for Meridian Energy Limited
M Dysart for Canterbury Regional Council
C M Owen for Lower Waitaki River Management Society Incorporated and for Central South Island Fish and Game Incorporated
D and A M MacTavish for D MacTavish (section 274 party)

R M Dunningham for K and D Farms Ltd, Kokoamo Farm Ltd, Lower Waitaki Irrigation Co Ltd, North Otago Irrigation Co Ltd, and Maraewhenua District Water Resource Committee (section 274 parties)
H F Brookes for Waitaki First Incorporated (section 274 party)

Date of Decision: 21 September 2009

Date of Issue: 24 September 2009

INTERIM DECISION

A Under section 290 of the Resource Management Act 1991 the resource consents granted by the Canterbury Regional Council, being:

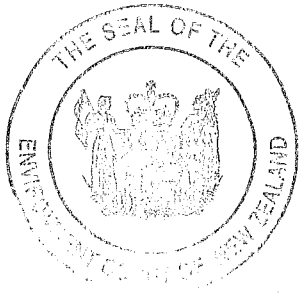
To take water from Lake Waitaki (CRC071903);
To use water from Lake Waitaki for hydroelectricity generation (CRC071139);
To discharge water from the outfall into the lower Waitaki River (CRC071096);
To discharge water from the outfall onto land (the riverbed) (CRC071878);

– are, subject to Orders B, C and D, granted for a term of 35 years subject in each case to the Special Conditions and General Conditions in Schedule B to this Decision.

B Order A is subject in all respects to the Court's satisfaction with:

1. amended Wetlands/Repo Raupo objectives and a more focussed Wetlands/Repo Raupo Management Plan which must contain detailed proposals for:

(1) the enhancement of existing wetlands between the Waitaki Dam and Stonewall;



(2) the creation of new terrace wetlands;

(3) legal protection of the right to carry out the necessary work, planting, fencing and ongoing maintenance of all proposed enhanced and new terrace wetlands

– and to achieve the above the Court directs:

(a) that Meridian prepare, lodge and serve its draft proposals by 27 November 2009 or such longer period as Meridian applies for and the Court approves;

(b) the other parties are by 26 February 2010 to confirm to Meridian whether they approve Meridian's draft proposals or advise Meridian what changes they seek;

(c) Meridian is to lodge and serve its amended proposed Wetlands/Repo Raupo conditions and Management Plan by 28 March 2010 and any supporting evidence;

(d) the Canterbury Regional Council is to lodge and serve any further evidence it wishes to call on wetlands by 23 April 2010;

(e) any other party may lodge and serve its further evidence on wetlands by 23 May 2010;

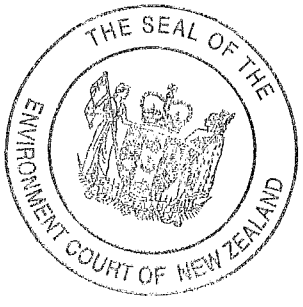
(f) any rebuttal evidence for Meridian Limited and (where applicable) the Canterbury Regional Council shall be lodged and served by 14 June 2010 so that the hearing may then be resumed, provided that:

(g) if, under order D below, Meridian obtains more time to comply with (a) above, then orders (b) – (f) will each automatically be extended by an equivalent amount of time;

2. new proposed conditions for:

(a) the study of the causes of population decline of braided river birds (especially black-fronted terns and black-billed gulls) in the lower Waitaki; and

(b) the conditions about Braided River Bird Management to implement any recommendations from (a);



– and if there is any disagreement over these matters the same timetable as in 1.(a)-(g) above shall be followed.

3. amended River Management Plans to reflect the changes made under 1. and 2. above.

C Subject to B and D, the parties are to confer about:

(a) whether there are any drafting errors or inconsistencies in or omissions from the other Conditions of Consent proposed by the Court; or

(b) any of this Court's deletions from or changes to the Hearing Commissioners' General Conditions which any party considers:

(i) are not necessary to meet the spirit and intent of the Reasons for this Decision; or

(ii) are wrong on the face of our findings and predictions in the Reasons below;

– and are then:

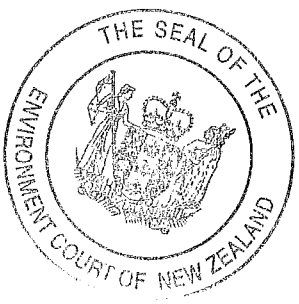
(c) if they can agree by 27 November 2009, to lodge a memorandum by 11 December 2009 as to any further changes to the conditions;

(d) if they cannot agree, each to lodge and serve submissions by 29 January 2010 as to what are the appropriate conditions; with

(e) to lodge and serve any reply on submissions served under (d) by 26 February 2010.

D In addition to the matters in Orders B and C, leave is reserved for any party to apply on notice by 27 November 2009 to be heard further:

1. on the proposed General Conditions about 'Existing Lawful and Consented Water Users at the date of these consents'; and in particular
2. on whether Meridian should be obliged to supply potable water;



3. on why Meridian's obligations with respect to Wainui Stream under General Condition 7 should be different especially given Mr Potts' evidence [Environment Court document 32 at para 27.5] and if we receive nothing the relevant Condition (currently General Condition 7f) will be deleted without further notice;
4. on any other matter in Chapter 5.0 of the Reasons where the Court indicated it would reserve leave for a party to be heard further;
5. on amendments to the timetables in orders B and C, if that party considers they are too restrictive.

E Costs are reserved.

REASONS

Table of Contents

			Para
1.0	Introduction		[1]
	1.1	The issue	[1]
	1.2	Background	[5]
	1.3	The appeals	[8]
2.0	The facts		[10]
	2.1	The Waitaki River	[10]
		The river's form	[15]
		Effects of human actions on the river	[19]
		The mouth and coast	[21]
		Adjacent coast	[23]
		Current human use	[25]
	2.2	Flow regimes, sediment transport, and erosion	[27]
	2.3	The extent of the riverbed: finding the 'banks' of the river	[30]
	2.4	Groundwater	[36]
	2.5	Wetlands	[41]
		Describing the wetlands	[41]
		Classifying and assessing wetlands under the proposed NRRP	[46]
		Classifying and assessing the lower Waitaki wetlands	[48]
	2.6	Water quality	[56]
		Microbiological water quality	[56]
		Physical and chemical water quality	[58]
	2.7	Instream flora including didymo	[65]
		Periphyton	[67]
		Didymo	[70]
		The varial zone	[71]
		The relationship with the flow regime	[73]

2.8 Instream native fauna [75]
Native fish [75]
Threatened fish species [79]
Invertebrates [82]
Impact of didymo [85]
2.9 Braided river birds [87]
2.10 Salmon, trout and angling [95]
Chinook salmon [95]
Trout [101]
Impacts of existing hydro-electricity activity [105]
Angling [106]
2.11 Recreation, access and amenities [110]
2.12 The mauri of the lower Waitaki [117]

3.0 The law [121]
3.1 Overview: the instruments to be considered, and Part 2 of the Act [121]
3.2 The proposed Natural Resources Regional Plan [123]
3.2.1 Introduction [123]
3.2.2 Water quality [125]
3.2.3 Wetlands [128]
3.3 The Waitaki Catchment Water Allocation Regional Plan [131]
3.4 The rules in the Waitaki Catchment Water Allocation Regional Plan [159]
3.4.1 The rules [159]
3.4.2 Provisions of the proposed NRRP incorporated by reference [168]
3.4.3 Are the NBTC's proposed activities prohibited under rules 4 and 13? [173]
The meaning of the words in rule 4 [174]
The purpose of rule 4 [178]
The scheme and layout of the WCWARP [180]
Conclusion as to the meaning of rule 4 [185]
3.5 The Canterbury Regional Policy Statement [188]
3.6 Part 2 of the RMA [191]
3.6.1 Introduction [191]
3.6.2 Section 7 of the RMA (generally) and section 7(ba) [193]
3.6.3 Efficient use of natural and physical resources (section 7(b)) [194]
All relevant resources must be considered [196]
Costs and benefits [197]
3.7 The Soil Conservation and Rivers Control Act 1941 [203]

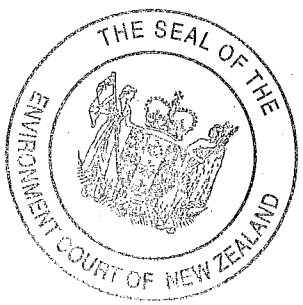
4.0 Predictions [207]
4.1 Introduction [207]
4.2 Changed flow regimes [210]
4.2.1 Introduction [210]
WRP-with hydro [211]
AFR-with hydro [213]
AFR consented [215]
4.2.2 Characteristics of possible future flows [217]
'With hydro' regimes: statistical parameters [219]
'With hydro' regimes: flow variability [225]
'With hydro' regimes: Reach 6 [229]
AFR Consented regime [230]
4.3 Electrical energy and reduction of greenhouse gases [233]
Energy generated [233]
Reduction in greenhouse gases [238]

4.4	Potential effects on riverbed and bank morphology	[242]
	4.4.1 Future trends under status quo flows	[242]
	4.4.2 Predicted effects of the NBTC on vegetation and braiding of the riverbed	[243]
	4.4.3 Bedload transport	[246]
	4.4.4 Predicted effects below the outfall	[250]
	4.4.5 Predicted effects at the river mouth and on the coast to the north	[252]
	4.4.6 Effects on the banks of the river	[254]
4.5	Effects on groundwater	[259]
	River flow and groundwater levels	[259]
	Groundwater abstraction	[262]
	Groundwater quality	[264]
	Wetlands and springs	[266]
4.6	Effects on wetlands	[268]
	The change in water levels	[268]
	The terrace wetlands	[271]
	The riparian wetlands	[273]
	Assessment of effects	[276]
4.7	Effects on water quality and the concentration of pollutants	[279]
	Microbiological water quality	[279]
	Physical and chemical water quality	[286]
4.8	Habitat modelling based on the flow regimes	[288]
	The IFIM approach	[290]
	The surveys	[297]
	Habitat suitability curves	[300]
	The results	[302]
	The flushing flows, channel maintenance flows and flow variability	[305]
4.9	Effects on instream flora	[307]
	Effects from the Waitaki Dam to Kurow	[308]
	Effects from Kurow to Stonewall	[309]
	Effects below Stonewall	[313]
	Nuisance growth of periphyton including didymo	[314]
	Effectiveness of the flow regime for didymo control	[319]
	Finding on instream flora	[322]
4.10	Effects on invertebrates and their habitat	[323]
4.11	Effects on native fish and their habitat	[326]
4.12	Effects on braided river birds and their habitat	[331]
	Trends under current flows	[331]
	The AFR-with hydro flows	[332]
4.13	Effects on salmon habitat and breeding	[334]
	Salmon	[335]
4.14	Effects on rainbow and brown trout	[340]
4.15	Effects on fish catchability and angling	[345]
4.16	Effects on other recreation, access and amenities	[356]
	Jet boating	[357]
	Four wheel driving, quad biking and motor biking	[365]
	Swimming	[366]
	Overall conclusion on effects on other recreation, access and amenities	[369]
4.17	Effects on the mauri of the Waitaki	[370]
4.18	Other water permits	[373]

5.0 Remedying and mitigating potential adverse effects [375]
5.1 Introduction: the proposed General Conditions of consent [375]
5.2 Adaptive management and environmental compensation [381]
5.2.1 Adaptive management [381]
5.2.2 Environmental compensation [383]
5.3 Mitigating effects of the flow regimes [386]
5.3.1 Introducing the flow regimes [386]
5.3.2 Minimum river flow rates [387]
5.3.3 Protection for other abstractive users [393]
5.3.4 Users below the tunnel outfall at Stonewall [395]
5.3.5 Flushing flows [399]
5.3.6 Ramping rates [401]
5.3.7 The Waitaki mouth [402]
5.3.8 Floods above 900 m^3/s [403]
5.4 The varial zone [405]
5.5 Geomorphological effects in the riverbed [406]
5.6 Reducing concentrations of contaminants [411]
5.7 Remedying and mitigating lowering groundwater levels – wells [420]
5.8 Remedying and mitigating lowering groundwater levels – wetlands [423]
5.8.1 Terrace wetlands [423]
5.8.2 Riparian wetlands [428]
5.8.3 All riverine wetlands [434]
5.9 Instream flora, invertebrates and native fish [440]
5.9.1 Didymo [440]
5.9.2 Invertebrates [441]
5.10 Protection of braided river birds [442]
5.10.1 Introduction [442]
5.10.2 Maintaining braided river bird habitat [443]
5.10.3 Creating bird islands [447]
5.10.4 Enhancing recruitment of braided river birds [450]
5.11 Salmon and trout habitat and catchability [454]
5.12 Recreation [455]
5.13 Mitigating effects on the mauri on the Waitaki [457]
5.14 Other observations on the proposed conditions [458]
5.14.1 Drafting issues [458]
5.14.2 Self-irrigating soils [461]
5.14.3 In-stream ecological values [463]
5.14.4 Fish exclusion measures [464]

6.0 Consideration and Outcome [465]
6.1 The gateway tests [465]
6.2 Part 2 of the Act and Objectives 1 and 2 of the WCWARP [467]
6.2.1 Introduction [467]
6.2.2 Safeguarding the life-supporting capacity of the river and its ecosystems [469]
6.2.3 Safeguarding the integrity, form, functioning and resilience of the braided river system [471]
6.2.4 Mauri of the river [473]
6.2.5 Maintaining and enhancing public access to and along rivers [475]
6.3 Section 7(b): Efficient use of natural and physical resources [479]
6.3.1 The Meridian evidence on benefits and costs [479]
Effects on other water users – benefits or costs [483]
6.3.2 The evidence of opposing parties [486]
(1) Future demand for energy [487]
(2) Value of avoided greenhouse emissions [492]

(3) Construction carbon costs [494]
6.3.3 Conclusions on the benefits [495]
The price of electricity [495]
Electricity price suppression [504]
Impacts of construction on the local economy [507]
Avoided greenhouse gas emissions [509]
Benefits summary [512]
6.3.4 The costs [513]
Displaced activities and other environmental costs [513]
Assessing the costs of the NBTC [516]
6.3.5 Summary of cost benefit analysis [522]
6.4 Other section 7 matters [527]
Kaitiakitanga (section 7(a)) [527]
The ethic of stewardship (section 7(aa)) [529]
Efficient use of resources (section 7(b) and 7(ba)) [530]
Maintenance and enhancement of amenity values and quality of the environment (section 7(c) and 7(f)) [531]
Intrinsic values of ecosystems (section 7(d)) [532]
The finite characteristics of natural and physical resources (section 7(g)) [533]
The protection of the habitat of trout and salmon (section 7(h)) [534]
Effects of climate change (section 7(i)) [535]
The use and development of renewable energy (section 7(j)) [536]
6.5 Other matters (section 104(1)(c) and 290A of the RMA) [537]
6.5.1 Having regard to the Hearing Commissioners' decision [537]
6.5.2 Other arguments in the submissions [539]
6.5.3 Consideration of alternatives [544]
Do the factors necessitating looking at alternatives apply? [544]
What alternatives should be considered? [545]
The alternatives to the NBTC [550]
6.6 Conclusions [554]
6.7 Outcome [558]
6.7.1 Provisional grant of consents [558]
6.7.2 Term of the consents [559]
6.7.3 Costs [560]



1.0 Introduction

1.1 The issue

[1] Should Meridian Energy Limited ("Meridian") be granted resource consents to take water from the Waitaki Dam Reservoir – thus reducing the flow in the Waitaki River by (on average) 211 m^3/sec between the dam and a place called Stonewall about 30 kilometres downstream and then to discharge it back into the river at Stonewall after generating energy at a power station?

[2] That question and many subordinate issues arise out of Meridian's proposal – which it calls the North Bank Tunnel Concept ("NBTC") – to:

(1) take water directly from Lake Waitaki into an underground tunnel with its intake immediately upstream of the Waitaki Dam structure;
(2) bore a 34 kilometre long, 10-12 metre diameter tunnel on the north bank of the lower Waitaki River, through which the water would flow;
(3) construct an outfall from the tunnel back to the lower Waitaki River upstream from Stonewall;
(4) operate one power station either incorporated upstream and underground close to the Waitaki Dam, or downstream above ground at the outfall location near Stonewall[1]; and
(5) operate with a tunnel design flow of 260 m^3/s and an approximate average take and discharge of 211 m^3/s.

The location of the NBTC tunnel would provide approximately 125 metres of head[2] available for hydro-electricity generation. A map[3] showing the lower Waitaki River and the notional location of the NBTC tunnel is annexed marked "A".

1 Stonewall is located, according to Meridian, at map reference NZMS 260 J40, 345-911.
2 The height through which the water drops.
3 Produced by Meridian Energy Limited.

[3] The Waitaki Power Station currently generates approximately 500 GWh of electricity per year. If the NBTC becomes operational this is predicted to reduce by approximately 225 GWh per year. Taking into account the design variables, the actual or gross generation through the NBTC will be 1375 to 1675 GWh per year. The lost generation of 275 GWh per year through Waitaki Power Station needs to be discounted from these figures. Hence, a net gain in energy of 1100 GWh to 1400 GWh per year is expected from the NBTC. That is enough energy to power the households in a city the size of Christchurch for a year[4].

[4] The NBTC will result in reduced minimum, and very stable, flows in the lower Waitaki River between the Waitaki Dam and Stonewall. It will reduce the mean flow from 382 m^3/sec to about 165 m^3/sec and median flow from 369 m^3/sec to about 140 m^3/sec.

1.2 Background

[5] Meridian applied to the Canterbury Regional Council ("the CRC") for four water permits on or shortly after 20 December 2006:

> To take water from Lake Waitaki – called CRC 071903
> To use water from Lake Waitaki for hydroelectricity generation – called CRC 071139
> To discharge water from the outfall – called CRC 071096
> To discharge water from the outfall to land (the riverbed) – called CRC 071878.

In its applications Meridian acknowledged that the concept would require works for the establishment of the intake and outfall structures, the building and operation of the tunnel, the power station and other associated infrastructure, and detailed consents for the construction process itself. It advised the CRC that those matters would be subject to a separate process of investigation, assessment and applications mainly for land use consents from the relevant territorial authorities.

[4] Mr N C Eldred, evidence-in-chief para 46 [Environment Court document 16].

[6] At first sight that approach offends the principle that all resource consents should be applied for at the same time so that all effects can be considered together – see *Affco NZ Ltd v Far North District Council No. 2*[5]. However, Mr P R Skelton, the very experienced[6] Chairman of the Hearing Commissioners appointed by the CRC, held that in the circumstances facing Meridian its approach was in order. That procedural decision was generally supported by submitters and was not appealed since all parties see the granting or declining of the water consents as the critical matter for determination.

[7] Meridian's applications attracted 400 submissions, primarily in opposition. The applications were heard by the Hearing Commissioners in 2007. In December 2008 the CRC granted consents subject to a comprehensive suite of conditions. The NBTC flow regime as consented by the Commissioners comprises:

(1) a variable minimum discharge, as measured at the Kurow recorder, to the lower Waitaki River between Waitaki Dam and Stonewall as follows[7]:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum River Flow in m^3/s	140	150	145	125	120	110	110	110	120	125	130	140

(2) at least seven seasonally timed flushing flows of 450 m^3/s for 24 hours[8]. (Meridian's initial applications sought a minimum of four flushing flows as a non-complying activity but this was not accepted by the Hearing Commissioners);

(3) channel maintenance flows (tunnel shutdown) for 48 hours when flows at Aviemore Dam exceed 900 m^3/s. These flows would be driven by natural floods[9];

---

5 [1994] NZRMA 224.
6 A former Judge of the Planning Tribunal and its successor the Environment Court.
7 Condition 10 of CRC071903.
8 Condition 20 of CRC071903.
9 Conditions 8 and 9 of CRC071903.

(4) controlling ramping rates, primarily for safety reasons in relation to recreational users, and to avoid fish strandings[10];

(5) reduction in current short term (daily/weekly) flow variability;

(6) provision for existing and future water abstractors within the affected part of the Waitaki River above Stonewall by release of an additional flow of water over the minimum flow and downstream of the tunnel discharge point in times of tunnel shutdown[11].

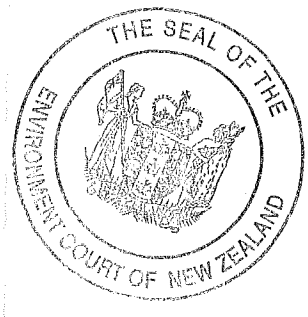
1.3 The appeals

[8] Five appeals were lodged against the granting of the resource consents. The appeal by Te Runanga o Ngai Tahu[12] has since been withdrawn, and Meridian has reached agreement with Mr Garth William Dovey[13], Ngai Tahu-Mamoe Fisher People Incorporated[14], and Waitaki Protection Trust[15]. The only extant disputed appeal is by the Lower Waitaki River Management Society Incorporated ("the Society"). That appeal is the subject of this decision.

[9] A number of persons joined the appeals as parties pursuant to section 274 of the Resource Management Act 1991 ("the RMA" or "the Act"). The Waitaki Protection Trust maintained a 'watching brief' as did the Central South Island Fish and Game Council. In fact that meant they took no part in the hearing. Ms Dunningham's clients presented evidence (entered on the record by consent since no party sought to cross-examine) and Waitaki First Inc presented thorough submissions from Dr H F Brookes but called no evidence. Mr Dugald MacTavish both called (limited) evidence and gave submissions.

---

10 Condition 25 of CRC071903; Condition 8 of CRC071096; Condition 8 of CRC071878.
11 Conditions 15 to 19 of CRC071903; Conditions 4 to 10 of the General Conditions.
12 ENV-2009-CHC-22.
13 Appeal ENV-2009-CHC-018.
14 Appeal ENV-2009-CHC-023.
15 Appeal ENV-2009-CHC-024.



2.0 The facts

2.1 The Waitaki River

[10] We first have to describe the setting of the NBTC within the existing environment. We emphasise that the environment should never be regarded as static in any case. At the least the description of the existing environment should be regarded as a snapshot of existing elements and activities with some future activities superimposed on them under the principles set out by the Court of Appeal in *Hawthorn Estates Ltd v Queenstown Lakes District Council*[16]. In many cases the description of the environment needs to have regard to the dynamism of many of its elements. That is particularly so in relation to a braided river like the Waitaki as it is a very complex and dynamic hydrological and ecological system.

[11] From the Waitaki Dam to near the Kurow bridge the Waitaki River is a large single stem river running swiftly between adjacent hills with mountains behind. At Kurow the character of the river changes – it braids into channels across a wide shingle bed with terraces on either side. The river largely retains that character until below Stonewall. Here, opposite Black Point, hills cease and the open plain – much of it gravel from the Waitaki catchment – opens up with the river continuing its braided path to the sea. The most familiar view of the Waitaki River – from the SH 1 bridge – gives a good idea of its general character between the Kurow and the sea: at mean flows of 321 m^3/s the river flows around islands of gravel, flood debris or gorse, with margins of willow and more gorse, and banks of pines (in the lower reaches), grass or weeds.

[12] With a mean flow of some 382 m^3/s at the Waitaki Dam[17] the Waitaki River is New Zealand's fourth largest in terms of discharge. The Waitaki Power scheme uses this discharge together with the storage provided by Lakes Tekapo and Pukaki to provide a generation capacity of 1723 MW being approximately 30% of New Zealand's installed capacity[18]. The lakes provide around 60% of the country's hydro storage[19].

---

16 [2006] NZRMA 424 (CA).

17 As stated above the mean flow is slightly less (321 m^3/sec) at the SH 1 bridge near the sea – the difference is due, in part, to abstractions for irrigation.

18 Mr N C Eldred evidence-in-chief para 48 [Environment Court document 16].

19 Mr J T Truesdale, evidence-in-chief para 16 [Environment Court document 4].

[13] This proceeding is focused on the Waitaki River between the Waitaki Dam upstream of Kurow and a placed called Stonewall, almost opposite the Black Point intake to Bortons Pond (an irrigation scheme).

[14] By 'Waitaki River' we mean the bed of the river and its waterbody. Those terms are defined in the RMA as follows[20]:

> **Bed** means, -
>
> (a) In relation to any river –
>
> (i) For the purposes of esplanade reserves, esplanade strips, and subdivision, the space of land which the waters of the river cover at its annual fullest flow without overtopping it banks;
>
> (ii) In all other cases, the space of land which the waters of the river cover at its fullest flow without overtopping its banks; and
>
> **Waterbody** means fresh water or geothermal water in a river, lake, stream, pond, wetland, or aquifer, or any part thereof, that is not located within the coastal marine area.

Actually applying the definition of the river 'bed' is a particularly difficult exercise for the Waitaki River below Kurow because its banks are often hard to find. We discuss this further in Chapter 2.0. The term 'wetland' is itself defined in the same section:

> **Wetland** includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions …

The river's form

[15] The physical elements of the Waitaki River and its catchment as a whole are succinctly described in the Waitaki Catchment Water Allocation Regional Plan ("WCWARP")[21] and we adopt that description here. We only add what is necessary for the purpose of this decision.

20 Section 2 of the RMA.
21 WCWARP p. 5-10.

[16] The form of the lower Waitaki River and its sediments reflect a long history of periodic glacial activity in the upper catchment. We have described the terraces parallel to the river. These were developed as the river incised during times of lower sediment supply[22]. The sediments also constructed the broad alluvial fan downstream of Black Point. The resulting form of the river is the single thread channel in the confined section below Waitaki Dam and, below Kurow, a braided section over the fan. The number of braids at any section is an increasing function of the discharge and remains essentially constant throughout the braided reach for any given discharge.

[17] The lower Waitaki only has one sizeable tributary on the north bank – the Hakataramea River. Closer to the coast the smaller Waikakaki Stream which wanders across the northern plain and enters the Waitaki west of the SH 1 bridge is of interest because it has been the subject of a study on 'Linkages between land management activities and stream water quality in a border dyke irrigated pastoral catchment'[23]. On the south side of the lower Waitaki there are several tributaries:

- the Awakino River upstream of Kurow;
- the Kurow River;
- the Otiake River;
- the Otekaieke River;
- the Maerewhenua River;
- the Awamoko Stream.

– all of which run out of mountains and carry gravel and other sediment loads. Further downstream Welcome Creek is a spring-fed stream that joins the Waitaki main stem about 2 kilometres upstream of the SH 1 bridge. The Welcome Stream is the most highly polluted tributary of the lower Waitaki[24].

---

22 Dr D M Hicks, evidence-in-chief para 8 [Environment Court document 12].

23 Monaghan, R M; Carey P L; Wilcock R J; et ors (2009) *Agriculture, Ecosystems and Environment* 129: 201-211 (cited in Dr E J Norton's Supplementary Statement, 7/7/09, at para 13 [Environment Court document 8C]).

24 Mr E J Norton, evidence-in-chief, table 2, Attachment 1 [Environment Court document 8].

[18] A feature of the lower Waitaki is the presence of many wetlands adjacent to the river ("riparian wetlands") and on or at the foot of the terraces ("terrace wetlands"). These wetlands are important ecologically as they provide habitat – now very modified – for a wide variety of native flora and fauna, and are discussed in the following sections.

Effects of human actions on the river

[19] Human actions since Europeans arrived have strongly affected the river. Such actions include hydro electric development, introduction of exotic vegetation (gorse, broom, crack willow and tree lupin), river control works and farm encroachment onto the river bed. The effects of those activities are:

(1) the effects of the hydro dams include stopping the supply of bed material to the lower Waitaki and damping of flood peaks. The latter reduces the ability of the lower Waitaki to transport bed material to the sea. It is estimated[25] that of the historical transport of 114,000 m^3/yr only 74,000 m^3/yr is now transported to the coast;

(2) establishment of exotic vegetation within the river bed has been aided by the damped flood regime imposed by the hydro operations. By the 1950's the river bed was choked by exotic vegetation and a succession of river control schemes was implemented to maintain a fairway width of between 400m and 700m. This is carried out (at present) by the Canterbury Regional Council by spraying over a five year cycle to control willows[26]. As vegetation encroaches onto the river bed the tendency for the river to braid is reduced. Thus the hydro controlled flow regime has contributed to driving the river to a less braided state;

(3) encroachment of farmland onto the river bed has narrowed the river corridor and reduced the width of the vegetated buffer strip along the river bed margins. The result has been a greater vulnerability to erosion and inundation of pastures.

25 Dr D M Hicks, evidence-in-chief, paras 16 and 18 [Environment Court document 12].
26 Dr D M Hicks, evidence-in-chief, para 26 [Environment Court document 12].

[20] The result of all the human influences has been a reduced river corridor, increased vegetation cover within the corridor (more trees and woody shrubs), a reduced average width of fairway and a reduced number of braids at any given discharge[27].

The mouth and coast

[21] The river enters the ocean through the Waitaki Lagoon, an elongated body of generally fresh water that runs at times up to 3 km parallel to the coast. It is separated from the ocean by a porous barrier of sandy gravel which is broken by the river's outlet channel. The location of this channel changes in response to river and coastal processes. It can migrate up to 3 km to the north of the channel centre line. This has the effect of raising water levels in the lagoon and thus increasing flood levels in the lowest reaches of the river and over the low lying farm land to the south. To avoid this the Canterbury Regional Council opens a river mouth on the channel centre line as required, the most recent opening being in January 2009.

[22] No historical trend of reducing barrier size such as one might expect in response to a reduced supply of river gravels has been noted and no occurrences of mouth closure have been reported. The mean flow of the Waitaki is much larger than those of Canterbury rivers that have had mouth closures e.g. the Ashburton, Opihi and Rangitata[28] rivers. Consequently Dr Hicks rates the probability of Waitaki river mouth closure as extremely low at current flows.

Adjacent coast

[23] Wave action and sea level changes have combined to erode the alluvial fan thus producing the erosion prone cliffed coastline with its narrow beaches of sand and gravel. Littoral drift is to the north which can result in the river mouth being offset to the north. This causes erosion of the cliffs in front of the Waitaki Huts. A gravel barrier protecting the coastal land extends north from the river mouth to the Wainono lagoon.

27 Dr D M Hicks, evidence-in-chief, para 28 [Environment Court document 12].
28 Dr D M Hicks, evidence-in-chief, para 59 [Environment Court document 12].

[24] Measurements of coastal erosion rates from 1864 until 2004 show no clear consistent signal that can be related to the reduced amounts of sediment reaching the coast after construction of the Waitaki Dam[29]. It remains unclear whether effects from the river on coastal erosion rates can be distinguished from other effects such as wave action.

Current human use

[25] The lower Waitaki is an important recreational resource. Recreational activities which have some relationship with the river include[30]:

Trout fishing	Swimming
Jet boating	Cycling
Salmon fishing	Sightseeing
Picnicking	Camping
Whitebaiting and eeling	Driving
Tramping, walking	Photography
Horse riding	Hunting

4WD, quad biking and motor biking.

In terms of salmon and trout fishing the river is described as nationally significant and it is recognised as a significant river for jet boating[31].

[26] We record that who has existing lawful and consented rights to take is not precisely known. We asked for and received after the hearing an affidavit[32] from Mr R J Potts listing his understanding of the existing water permits to take. However, by memorandum[33] counsel for the irrigators involved as section 274 parties challenged the accuracy of Mr Potts' evidence, so we do not rely on it as being completely accurate. In any event it appears to be common ground that currently about 53 m^3/s of water may be taken from the lower Waitaki under Canterbury Regional Council consents for

---

29 Dr R M Hicks, evidence-in-chief, para 38 [Environment Court document 12].
30 Mr R J Greenaway, evidence-in-chief para 14 [Environment Court document 15].
31 Mr R J Greenaway, evidence-in-chief, para 16 [Environment Court document 15].
32 Affidavit of Mr R J Potts dated 16 July 2009 [Environment Court document 32A].
33 Memorandum of Ms R M Dunningham dated 24 July 2009.

irrigation of 70,521 hectares and that a further 23.6 m^3/s to irrigate 45,824 hectares is under consideration in new applications[34]. Other abstractive uses include domestic and commercial supplies and public water supplies. The volumes taken for the latter uses are small in comparison to the irrigation takes.

2.2 Flow regimes, sediment transport, and erosion

[27] Historical flows in the Waitaki River have been highly modified over the last 74 years by the construction and operation of the Waitaki hydro scheme. The Waitaki dam was (principally) commissioned in 1935 and has been followed by seven other dams/generation stations with the last being Ohau C, commissioned in 1985. There are also three canals linking Lakes Tekapo, Pukaki and Ohau. Our understanding of the historic, current and possible future flow regimes is derived from the evidence-in-chief of Dr R D Henderson, a scientist in the Applied Hydrology Group of the National Institute of Water and Atmospheric Research. No party sought to challenge or cross-examine this evidence.

[28] Hydrological records dating from the 1920s exist for the three dammed lakes. They form a robust basis for a simulation of what unregulated flows in the Waitaki might have been. Dr Henderson[35] presented the results of such a simulation and compared them with values relating to the measured flows from Waitaki dam for the period 1980 to 2003. The results show the regulated flow to have:

- essentially the same mean flow of 384.6 m^3/s as the simulated flow;
- a larger median flow – 369.4 m^3/s compared to the simulated 333.5 m^3/s;
- a reduced mean annual flood – 1054 m^3/s compared to the simulated 1412 m^3/s;
- a larger mean annual seven-day low flow – 202.6 m^3/s compared to 148.6 m^3/s;
- on average only one third of the number of floods per year that are greater than three times the median flow of the whole record.

34 Mr R J Potts, evidence dated 11 November 2007 for the Hunter Downs hearing, Table 11, page 26 [Environment Court document 32a].

35 Dr R D Henderson, evidence-in-chief Table 1, p. 7 [Environment Court document 18].

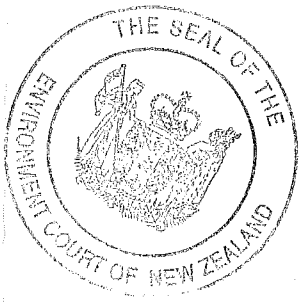
[29] Meridian's current consent to operate the Waitaki power station has a minimum flow condition at the Kurow recorder of 120 m^3/s. However Meridian has allowed a buffer of 30 m^3/s and thus the flow has rarely been below 150 m^3/s in the last 26 years[36]. As a result the status quo flow regime will differ slightly from the 1980-2003 measured flow regime described above. Relevant parameters for the current (status quo) regime as measured and presented in the evidence-in-chief of Dr Henderson are:

Mean flow	382 m^3/s
Median flow	369 m^3/s
Minimum flow at Kurow	120 m^3/s
Mean seven-day annual low flow	206 m^3/s
Average no. of >900 m^3/s floods per year	0.49
Average no. of flows per year greater than 3 times the median ("FRE3")	0.42

The values given above apply for the length of the river from Waitaki Dam to the sea. The frequency of floods greater than three times the median flow (the FRE3 statistic) is a commonly used statistic for indicating the degree to which the river biota will be disturbed[37]. However, the degree of disturbance of the river biota will depend at least in part on the characteristics of the substrate. These may not be the same for different median flows.

2.3 The extent of the riverbed: finding the 'banks' of the river

[30] We have noted that human influences have narrowed the river corridor over recent decades[38]. Mr Ross J Vesey, the Regional Engineer with CRC, presented aerial photographs of the lower Waitaki River showing draft 'river boundaries'[39] for the purposes of the Regional Council's river protection scheme. The boundaries drawn on the photographs show the approximate position of the 'design fairway' at 600 metres wide plus a 'buffer zone edge' of at least 150 metres on each side of the fairway. Also marked on each side of the river is the 'draft RMA river boundary', which was generally wider than the design fairway plus the buffer zone. Mr Vesey explained that the river protection scheme is about maintaining an average fairway width of 600 metres



36 Dr R D Henderson, evidence-in-chief para 26.1 [Environment Court document 18].
37 Dr R D Henderson, evidence-in-chief para 55 [Environment Court document 18].
38 See Section 2.1 *The Waitaki River* above.
39 Exhibit 39.1.

although in practice this was something between 400 metres at the top end and 700 metres at the downstream end. The buffer zone is the outer boundary of the river protection area where vegetation, such as willows, is desirable to provide protection from erosion[40].

[31] In response to questions from the Court Mr Vesey commented that there were difficulties in translating the Act's definition of the bed of a river into something on the ground. He explained that the delineation of the 'RMA river boundary' was a work in progress and followed from a consideration of historical photographs[41]. He noted that the 10-year return flow in the Waitaki River, of about 1600 m^3/s, played a part in determining the boundary. He observed that a large part of what the RMA defines as riverbed is already under intensive agricultural use and provided examples of recent encroachment[42].

[32] In response to questions from the Court Mr Jowett also commented on the natural flow regime and on historical changes in the extent of the riverbed[43]:

> Well of course, if you look back at the first aerial photographs of the river taken I think about 1938 then, you know, you will see a vast expanse of gravel – like a lot of Canterbury. And with agriculture, bank protection and flow control the rivers just got narrower and narrower.
>
> If you reinstated the sort of natural flow regime of the river, you know, you would have farmers chasing you with a pitchfork I imagine because they would be losing an awful lot of land.

[33] The RMA definition of the bed of a river involves consideration of both the 'fullest flow' and the position of the 'banks'. It is difficult to define the position of the banks for a braided river such as the Waitaki, particularly in the lower reaches where the river flows across a broad gravel fan. Obviously the banks are somewhere beyond the edges of the channels within which the river flows for most of the time.

---

40 Transcript page 703 *et ff.*
41 Transcript page 723.
42 Exhibit 39.3.
43 Transcript page 221

[34] Turning to the second, relevant, part of the definition of the bed of a river[44] we would need to find 'the space of land which the waters of the river cover at its fullest flow without overtopping its banks'. Therefore we would consider the fullest flow of the river and the position of the banks to determine the extent of the bed. For the CRC, Mr Vesey took a pragmatic approach to defining the extent of the riverbed by considering the extent of the historical flood flows. Engineering considerations with respect to flood protection works and the protection of private property drive his analysis and we are content to accept that (for the purposes of this proceeding only).

[35] We add that Meridian is itself a landowner in the lower Waitaki – it owns about 3,000 hectares there. A number of its farms run along an edge (to use a neutral term) of the river. We mention that as potentially relevant to Meridian's ability to provide wetlands compensation if that becomes a significant issue.

2.4 Groundwater

[36] Groundwater runs through the gravels of the riverbed, floodplain and adjacent terraces. The river system has divided the floodplain gravels into older Pleistocene[45] terrace gravels that border the river floodplain and the younger post-glacial gravels that underlie the river floodplain. These gravels are typically 5 to 15 metres thick but may range up to 70 metres thick[46]. Together with the Pleistocene gravels they form significant aquifers which support 104 active wells supplying water for irrigation, stock water, domestic supply and dairy sheds[47].

[37] Mr I R Fraser, a hydrogeologist with URS New Zealand Limited who was called by Meridian, emphasised the connectedness of the Waitaki River and surrounding groundwater system[48]:

---

44 Quoted in section 2.1 of this decision.
45 The geological epoch which started 1.64 million years ago. We are now in the Holocene epoch.
46 Mr I R Fraser, evidence-in-chief paras 12 – 17 [Environment Court document 17].
47 Mr I R Fraser, evidence-in-chief para 32 [Environment Court document 17].
48 Mr I R Fraser, evidence-in-chief para 51 [Environment Court document 17].

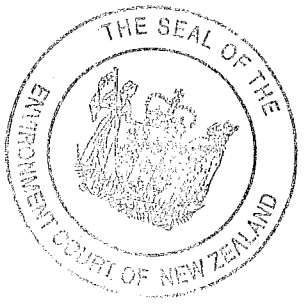
> Due to the high level of connectedness (or degree of interrelationship or response of the groundwater to changes in river flow) between the River and the groundwater system, any significant change in the flow regime of the River has an effect on the surrounding groundwater levels and associated surface water features.

Based on his evidence we find that within the post-glacial gravels groundwater levels and spring flows generally less than one metre above the river level are closely linked to river levels. They respond almost immediately to changes in river level if within 50 metres of the river. The responses become more subdued and delayed as distance from the river increases. At 300 to 600 metres from the river groundwater levels reflect 3 to 6 day moving averages of river levels. At about 1200 metres only significant changes in river levels over sustained periods can be discerned in ground water levels. Groundwater levels in the gravels adjacent to tributary streams reflect the levels in those streams with the Waitaki River having only limited influence [49].

[38] Springs within the post-glacial gravels are frequently associated with wetlands that have significant environmental value. A number also serve as sources of mahinga kai. Mr Fraser expressed the view that the river and the post-glacial gravels are essentially one[50] and we accept that.

[39] Groundwater in the Pleistocene terraces shows little variation when there are changes in river level and is almost without exception above the levels in the post-glacial gravels and the river. It is recharged by rainfall and by seepage from irrigation schemes' water races. Discharge from the terrace groundwater is generally through springs at the base of the terrace – often forming wetlands which have been labelled 'terrace wetlands' – and thence to the river or through the post-glacial gravels to the sea.

[40] The groundwater quality is high and all nitrate concentrations were below the New Zealand Drinking Water Standard (2005) with 1.9 g/m^3 the maximum concentration reported. Only two of the ten monitoring wells detected *E coli* levels in excess of the drinking water standard[51].



49 Mr I R Fraser, evidence-in-chief paras 22 – 29]Environment Court document 17].
50 Mr I R Fraser, evidence-in-chief para 34 [Environment Court document 17].
51 Mr I R Fraser, evidence-in-chief para 48 [Environment Court document 17].

2.5 Wetlands

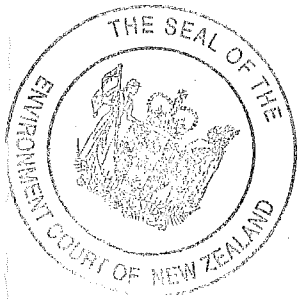
Describing the wetlands

[41] Meridian's witness, Ms D Robertson, an ecologist, described three wetland types associated with the lower Waitaki system as follows[52]:

- terrace wetlands are away from the river edge and do not have surface water inflows from the Waitaki river. Between Waitaki Dam and Stonewall there are approximately 83 hectares[53] of terrace wetlands that could possibly be affected by the NBTC proposal;
- riparian wetlands are adjacent to the river between the cleared fairway and intensively managed farmland, and have at least occasional surface inflows from the river. There are approximately 1660 hectares of riparian zone and an estimated 223 hectares of riparian wetlands[54] between the dam and Stonewall;
- estuarine wetlands are those adjacent to the mouth of the river and are influenced by coastal processes and low salinity conditions. These wetlands will not be effected by the NBTC proposal and we do not consider them further.

We should add that 'terrace wetland' is a confusing name because most of the 'terrace wetlands' are at the foot of terraces, not on the terraces. We adopt Ms Robertson's nomenclature for consistency but on that understanding of their location.

[42] The lower Waitaki Valley wetlands are extremely varied and exist under conditions of highly fluctuating water supply due both to the large variability in river flow and seasonal variations in irrigation patterns. They provide habitat for a diverse range of native and exotic plants and animals and act to varying degrees as sinks for nutrients and suspended sediment. Waters flowing from wetlands are thus generally of higher quality than the inflows. Riparian wetlands have historically been and continue to be important mahinga kai sites.



52 Ms D M Robertson, evidence-in-chief para 17 [Environment Court document 13].
53 Ms D M Robertson, evidence-in-chief para 23 [Environment Court document 13].
54 Ms D M Robertson, evidence-in-chief para 45 [Environment Court document 13].

[43] The riparian wetlands include small braids of the river under a willow canopy. Willow, gorse and blackberry dominate with native species (mainly spike sedge, and swamp kiokio, and occasionally *Carex secta* and *Carex virgata*) found scattered at the edges of the channels. The slower-flowing or standing water wetlands are dominated by gorse and broom with areas of spike sedge and less often *Gunnera dentata, Carex maorica, Carex coriacea* and *Carex flaviformis*[55]. The flowing channels and swamps in the riparian areas provide habitat for eels and bullies[56]. In Ms Robertson's view[57]:

> many of the riparian wetlands are of low ecological significance due to the transforming effect of willows, the sparse occurrence of native vegetation communities and much of the bird habitat value being limited to waterfowl.

[44] Thirteen mahinga kai sites together with their historical values, current condition, threats and possible mitigation measures are given by Ms Robertson[58]. She identified[59] the location of thirty sites: two are contemporary and the remainder are labelled as traditional. The contemporary sites are both on the south side of the river: one at Black Point and the other immediately upstream of the SH 1 bridge.

[45] Ms Robertson observed that the extent and number of wetlands in the lower Waitaki was declining in line with nationwide trends. She attributed this to continuing development of land for and intensification of agriculture. Conversely she noted the increase of lacustrine (open water) wetlands with the development of irrigation schemes. Ms Robertson regarded the invasion of exotic species, particularly crack willow, as a major threat to indigenous biodiversity values[60]. That is of concern because it appears that willows are still being planted in the riverbed of the lower Waitaki.

---

55 Ms D M Robertson, evidence-in-chief paragraphs 56–57 [Environment Court document 13].
56 Ms D M Robertson, evidence-in-chief para 61 [Environment Court document 13].
57 Ms D M Robertson, evidence-in-chief para 79 [Environment Court document 13].
58 Ms D M Robertson, evidence-in-chief Table 2, App 1 [Environment Court document 13].
59 Ms D M Robertson, evidence-in-chief Figure 4 [Environment Court document 13].
60 Ms D M Robertson, evidence-in-chief paragraphs 67–70 [Environment Court document 13].

Classifying and assessing wetlands under the proposed NRRP

[46] We are satisfied that Ms Robertson has classified and assessed the significance of many of the wetlands in the lower Waitaki between the Waitaki Dam and Stonewall under[61] the assessment methods in Appendix WTL1 to the proposed Chapter 7 (Wetlands) of the proposed Natural Resources Regional Plan ("NRRP"), although the fact she had done so only emerged fully in her further evidence. The relevant Appendix is incorporated into the WCWARP by reference[62] and because of the potential importance of any wetlands we outline its methodology here. It contains effectively four parts – a classification system, a record of the wetland's condition, a record of any 'pressure indicators' and fourthly a recipe for assessing 'significance':

(1) Classification

Appendix WTL1 explains that[63]:

> Each surveyed wetland is classified based, in descending order, on:
>
> (a) The wetland system (i.e., estuarine or palustrine);
> (b) Wetland subsystem, based on water flow regime (e.g., intertidal, non-tidal, permanent, ephemeral);
> (c) Wetland class, based on substrate and site chemistry (e.g., saltmarsh, mudflat, swamp, bog, flush);
> (d) Wetland form, based on landform (e.g., estuary, lagoon, shore, slope, channel, basin).
>
> The main vegetation types (indicated on an accompanying map) would also be recorded on the field sheet, together with notes on native fauna and other general comments.

---

61 Ms D M Robertson, evidence-in-chief para 71 [Environment Court document 13] and evidence-in-reply paragraphs 13-17 [Environment Court document 13A].

62 Certification dated 30 September 2005 by the Waitaki Catchment Water Allocation Board [Separate volume of the WCWARP called 'Material Incorporated by reference' p. 2].

63 Wetland assessment methodology Appendix WTL1 [Proposed NRRP, Chapter 7 (Wetlands) p. 7-58 *et ff*].

(2) Record of condition

(a) Change in hydrology.

(b) change in physico-chemical parameters (e.g., fire damage, sedimentation, erosion, nutrient enrichment).

(c) Change in ecosystem intactness (i.e., loss in area of original wetland, fragmentation).

(d) Change in browsing, predation and harvesting regimes (i.e., effects of introduced herbivores, predators and humans).

(e) Change in dominance of native plants (i.e., proportion of introduced species in canopy and understorey).

This rather unusual provision appears to provide for the assessment of a wetland in accordance with changes from an historical original (although how that is known is not identified). The changes to be recorded are[64]:

(3) Record of pressure indicators

The pressure indicators are[65]:

(a) Modifications to catchment hydrology

(b) Catchment water quality

(c) Animal access (livestock or other introduced mammals)

(d) Key undesirable species (weeds or pests)

(e) Proportion of the catchment in introduced vegetation

(f) Other pressures (as specified).

(4) Assessing significance

The wetland may then be assessed for significance under "four main criteria"[66]:

(a) Representativeness

(b) Rarity/distinctiveness

(c) Ecological context

(d) Viability

---

64 Wetland assessment methodology Appendix WTL1 [Proposed NRRP, Chapter 7 (Wetlands) p. 7-57].

65 Appendix WTL1 [Proposed NRRP, Chapter 7, p. 7-60].

66 Appendix WTL1 [Proposed NRRP, Chapter 7, p. 7-64].

[47] In terms of representativeness the Appendix states[67]:

> (1) Lowland wetlands that retain even a small proportion of their original character will be of *very high* representative significance because their previous extent has been so vastly reduced.

We note that Appendix WTL1 of the proposed NRRP does not say who is to make the classification, record the condition and pressure indicators, and assess the significance of any wetland.

Classifying and assessing the lower Waitaki wetlands

[48] Each wetland identified[68] by Ms Robertson was assessed for ecological significance using the methodology in the Canterbury Regional Council's NRRP.

[49] Seven of the twenty three terrace wetlands above Stonewall were assessed as being of high significance with seven and nine being of moderate and low significance respectively[69]. Although she gave us a table[70] identifying the wetlands the significance of each wetland was not individually identified by Ms Robertson. The terrace wetlands provide additional habitat for many of the braided river birds as well as wetland birds such as white-faced herons, black and little shags, pukeko, grey duck, mallard, scaup and NZ shovelers. Common and upland bullies, short and long-fin eels and brown trout are also found[71].

[50] Of the seven riparian wetlands assessed above Stonewall six were assessed as moderate and one as high significance[72]. Again these wetlands were not individually identified for us by Ms Robertson. Ms Robertson described the riparian zone as highly modified citing the invasion of exotic trees and shrubs, agricultural development, altered

---

67 Appendix WTL1 [Proposed NRRP, Chapter 7, p. 7-65].
68 Ms D Robertson, evidence-in-chief new appendix 1 [Environment Court document 13.7].
69 Ms D M Robertson, evidence-in-chief para 78 [Environment Court document 13].
70 Ms D M Robertson, evidence-in-chief Table 1 [Environment Court document 13].
71 Ms D M Robertson, evidence-in-chief paragraphs 38–39 [Environment Court document 13].
72 Ms D M Robertson, evidence-in-chief para 79 [Environment Court document 13].

river flows and active vegetation management in the fairway and margins. She noted that accurate measurement of the riparian wetlands (comprising old river channels with slow flowing or standing water, swamps and marshes) was not possible because of dense gorse shrublands limiting access[73]. Ms Robertson wrote[74] that there will be other riparian areas of moderate or higher significance where native plants dominate or there is high habitat value for indigenous fauna.

[51] Dr Stephen Rate, an ecologist called by the Society, noted that wetlands are a nationally rare vegetation/habitat type and that the lower Waitaki River valley is largely located within an acutely threatened land environment, with less than 10% of its original vegetation cover. He referred to the National Priorities for biodiversity on private land[75] and quoted National Priority 2: "To protect indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity"[76]. Dr Rate was concerned that the omission of this context for wetlands had led to an underestimation of the significance of the wetlands in the lower Waitaki River valley. He considered the wetlands to be significant under section 6(c) of the Act because of their national and regional importance as under-represented indigenous vegetation[77].

[52] Ms Robertson acknowledged the reduction in wetlands that has occurred, particularly in lowland Canterbury, and the national priority for protecting wetlands on private land. She agreed with Dr Rate on the significance of many wetlands under section 6(c) of the Act. Ms Robertson considered that the NRRP methodology that she had followed had taken this broader context into account and noted that the only wetlands that did not achieve the "representativeness" criteria for significance were artificially created ponds or modified remnant wetlands with low habitat and vegetation values[78].

---

73 Ms D M Robertson, evidence-in-chief paragraphs 42–46 [Environment Court document 13].
74 Ms D M Robertson, evidence-in-chief para 79 [Environment Court document 13].
75 Ministry for the Environment and Department of Conservation 2007 *Protecting our places: introducing the national priorities for protecting rare and threatened native biodiversity on private land.*
76 Dr S R Rate, evidence-in-chief paragraphs 9 – 11 [Environment Court document 53].
77 Dr S R Rate, evidence-in-chief para 12 [Environment Court document 53].
78 Ms D M Robertson, evidence-in-reply para 5 [Environment Court document 13A].

[53] Dr Rate considered that the lack of detail in the descriptions of wetlands (vegetation, habitat, and species) and the inconsistencies in the identification of nationally threatened and uncommon species led to uncertainty in the identification of ecological values and subsequent assessments of significance[79]. He noted that the confidentiality of assessments of significant wetlands on private land made it very difficult to gauge the scope and quality of the information and the accuracy of the significance assessments[80]. During cross-examination Dr Rate acknowledged that Ms Robertson had carried out detailed surveys (as further explained in her evidence-in-reply) but as he had not seen the information or the significance assessments he could not judge the quality of that work[81].

[54] In response to cross-examination on the ecological significance assessment Ms Robertson explained[82] that her database contained the details for each of the wetlands including an assessment of the representativeness, the rarity, the ecological context and the viability, including a rationale for each decision. In response to questions from the Court Ms Robertson confirmed that the NRRP did not list wetlands of moderate or high significance and that a project to do so had been controversial and difficult[83].

[55] We are satisfied that Ms Robertson has classified and assessed the significance of most of the wetlands in accordance with the NRRP. It is regrettable that we were not provided with the individual assessments of significance of particular wetlands although we understand that the confidentiality requirements were imposed by private landowners, no doubt in return for access to and across their properties. Similarly it has not been helpful that the more detailed survey information was not made available for review.

---

79 Dr S R Rate, evidence-in-chief paragraphs 13 – 15 [Environment Court document 53].
80 Dr S R Rate, evidence-in-chief para 17 [Environment Court document 53].
81 Transcript p. 982 *ff.*
82 Transcript p. 453.
83 Transcript p. 455.

2.6 Water quality

Microbiological water quality

[56] The microbiological quality of the river was assessed through water quality surveys conducted from January 2002 through to April 2008. Samples were tested for the standard faecal indicator bacterium, *Escherichia coli (E coli),* and three water borne pathogens, *Campylobacter, Giardia* and *Cryptosporidium.* Mr Andrew Ball described the survey results as follows[84]:

- no *Giardia* or *Cryptosporidium* were found;
- *E coli* and *Campylobacter* concentrations generally increased moving downstream;
- high *E Coli* concentrations were found at times in all tributaries and concentrations in tributaries generally exceeded those in the Waitaki River;
- *Campylobacter* concentrations in the lower Waitaki are already "too high"[85].

Mr Ball identified waterfowl and livestock in riverbeds as the main sources of *E coli* contamination[86].

[57] Most sites on the Waitaki River were classified as good or very good in terms of suitability for recreation. The exceptions were the river below the State Highway 1 bridge and immediately below the Hakataramea confluence.

Physical and chemical water quality

[58] The physical and chemical quality of the water in the river is high with most water quality parameters meeting the NRRP Alpine water standards and the Australia and New Zealand Environment and Conservation Council (ANZECC) guidelines most of the time. The exceptions are low clarity and associated high turbidity, which are natural characteristics due to the presence of glacial silt. However most parameters indicate that water quality deteriorates with distance downstream from the Waitaki Dam[87].

---

84 Mr A Ball, evidence-in-chief, paragraphs 13-22 [Environment Court document 23].
85 Mr A Ball, evidence-in-chief, para 35.11 [Environment Court document 23].
86 Mr A Ball, evidence-in-chief, para 20 [Environment Court document 23].
87 Mr E J Norton, evidence-in-chief paragraphs 20–21 [Environment Court document 8].

[59] The most recent monitoring results (2005 – 2008) show an increase in nutrient concentrations, indicated by dissolved inorganic nitrogen ("DIN") and dissolved reactive phosphorus ("DRP") downstream of Stonewall, with the highest concentrations at the State Highway 1 bridge. Nitrate, ammonium, DIN and DRP levels are generally higher in tributaries and nitrate higher in bank-side channels than in the main stem of the river. Water quality appears to be declining with time at the SH 1 bridge and in some tributaries. Tributaries and groundwater are considered to be a significant source of nutrients to the Waitaki River[88].

[60] Mr Norton identified nutrient enrichment from agricultural and horticultural activities as the greatest contaminant risk to water quality in the lower Waitaki River[89]. Dr G P Burrell, a freshwater scientist, reviewed Mr Norton's evidence and queried the significance of the observed increases in nitrate-nitrogen. He suggested that the monitoring period chosen was too short to draw any conclusions regarding trends and the increases could simply be due to low river flows rather than increased agricultural activity[90].

[61] In response to Dr Burrell's analysis and comments Mr Norton compared his data with the data from the long term National River Water Quality Network ("NRWQN"). The comparisons confirm that the 2005 – 2008 data are representative of water quality shown in the long term data except that the very recent (last two years) data indicate that water quality is declining in the lower part of the river[91]. Mr Norton converted the concentrations into daily load data as a simple correction for flow. He found that the increasing trend in daily nitrate-nitrogen loads at the SH1 bridge were highly statistically significant and not caused by lower river flows[92]. Mr Norton was certain of the trend for increasing nitrogen loads to the Waitaki River but did not have sufficient information to estimate the magnitude and rate of that increase[93].

---

88 Mr E J Norton, evidence-in-chief paragraphs 22–23 [Environment Court document 8].
89 Mr E J Norton, evidence-in-chief para 26 [Environment Court document 8].
90 Dr G P Burrell, evidence-in-chief para 22 [Environment Court document 41].
91 Mr E J Norton, evidence-in-reply para 12 [Environment Court document 8B].
92 Mr E J Norton, evidence-in-reply para 11 [Environment Court document 8B].
93 Mr E J Norton, supplementary evidence para 19 [Environment Court document 8C].

[62] In response to questions from the Court Mr Norton subsequently provided an overview of research into land-use intensification and contamination of waterways[94]. There is considerable research being undertaken into land-water interactions and the impacts of pasture based farming. We have already referred to the fact that research has been carried out on the Waikakahi Stream catchment which connects to the Waitaki River just upstream of the SH 1 bridge[95]. The resulting paper states:

> Water quality of the Waikakahi Stream is typical of other dairy catchment streams in New Zealand, and can be characterised as having higher concentrations of E coli, suspended solids and nutrient compared to other low-elevation streams.
>
> Inventory assessments of key sources on nitrogen and phosphorous within the catchment indicate that dairy farms contribute a disproportionately large percentage of both nutrients to stream loads accounting for more than 70% of loads despite occupying only 40% of the total catchment area.

[63] Mr Norton also provided a copy of a very recent (July 2009) Ministry for the Environment report on water quality in selected dairy farming catchments that includes the Waikakahi catchment[96]. The report comments on water quality and the actions being taken:

> Monitoring results indicate that water quality is generally degraded in the selected dairy catchments, particularly with respect to faecal and nutrient contamination. However, the extent and pattern of degradation are variable, both within and between catchments, as is the evidence of ecological consequences. This highlights the complex and scale dependent nature of the relationships between land use and water quality in modified catchments, and also reflects the differing underlying geology and natural stream bed conditions.
>
> Actions to reduce the impacts of dairying include fencing to keep stock from waterways, riparian planting, improved control of effluent discharges, bridging and culverting of streams, wintering off stock, and adopting fertiliser management plans and nitrification inhibitors.

---

94 Mr E J Norton, supplementary evidence paras 8 – 19 [Environment Court document 8C].

95 Monaghan R M, Carey P L, Wilcock R J, Drewry J J, Houlbrooke D J, Quinn J M, Thorold B S (2009). Linkages between land management activities and stream water quality in a border dyke irrigated pastoral catchment. *Agriculture, Ecosystems and Environment* 129: 210-211.

96 Ministry for the Environment (2009) *Water quality in selected dairy farming catchments: a baseline to support future water-quality trend assessments.* Wellington: Ministry for the Environment.

On our site inspection we saw signs of some of those actions being carried out in the lower Waitaki. However, we also saw many places on or near the river where those actions are not being carried out.

[64] A quotation from Dr R J Wilcock, an active researcher in New Zealand, summed up the challenge[97]:

> There is no doubt that agriculture degrades surface water quality and that there are limits to what can be done to decrease loadings on to land or to intercept contaminants in run-off pathways, through the use of best management practices. Agricultural landscapes are inherently 'leaky' and there are limits to land-use intensification that will be tolerated without breaching receiving water quality standards.

We consider the potential effects of agricultural pollution on the proposal in Chapter 4.0 of this decision.

2.7 Instream flora including didymo

[65] The instream flora of the Waitaki River includes periphyton (the microflora coating stones, weeds and any other stable object in the water) and macrophytes (the larger submerged or emergent plants). Macrophytes are found in stable slow moving water habitats such as backwaters, stable braids and wetlands. A total of 45 species have been identified in the lower Waitaki River, lagoon, tributaries and wetlands and none of these are rare or endangered[98].

[66] As for many South Island rivers, a worrying change in recent years has been the accidental introduction of a new periphyton species colloquially dubbed 'rock snot'. Mr E J Norton[99], a water scientist, and Mr W P Chisholm[100], a zoologist, both noted that this

---

97 Mr E J Norton, supplementary evidence para 10 [Environment Court document 8C] citing Wilcock, R J (2008). Land-water interactions: impacts on the aquatic environment. Chapter 3. In *Environmental impacts of pasture-based farming.* McDowell, R J (Ed), Wallingford, Oxfordshire. CAB International. 283 p.

98 Mr E J Norton, evidence-in-chief paragraphs 40 and 41 [Environment Court document 8A].

99 Mr E J Norton, evidence-in-chief para 18 [Environment Court document 8A].

100 Mr W P Chisholm, evidence-in-chief para 15 [Environment Court document 51].

species, the invasive alga didymo (*Didymosphenia geminata)*, was first reported in the Waitaki River in January 2006.

Periphyton

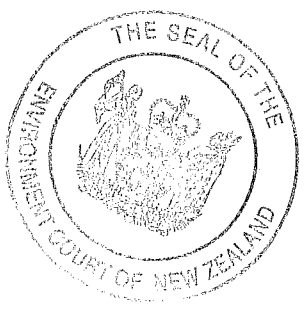
[67] Periphyton communities in the lower Waitaki River provide an energy source for higher levels in the food chain, primarily the invertebrates that live in the streambed. The best periphyton for most invertebrates are those composed of diatoms and these are the most common form of periphyton in the lower Waitaki and its tributaries. No rare or endangered algal species have been identified in surveys[101]. Periphyton remove nitrogen and phosphorous from stream waters and these nutrients, accumulated as biomass, are often flushed out of the system during floods[102].

[68] Periphyton can proliferate to nuisance levels when nutrient concentrations and light levels are high, and the substrate is stable (in the absence of fresh and flood events). Mr Norton considered that the potential for nuisance growths exists in the peripheral braids of the Waitaki River and had occurred in some tributaries, particularly the Hakataramea River. He noted that this could get worse in the future with increased intensification of agriculture in the valley[103].

[69] Some periphyton species, particularly the cyanobacteria or blue-green algae, can produce natural toxins which are a threat to people and animals. The *Phormidium* species has been reported to cause the death of dogs in the Waitaki, Ashley and Selwyn Rivers during summer low flows[104].

Didymo

[70] Didymo is a conspicuous species that can tolerate a wide variety of flow conditions and requires greater flood flow peaks to remove the biomass than other nuisance periphyton. This quickly developed to nuisance proportions in the Waitaki River. Didymo cover of the wetted riverbed peaked at nearly 100% in its first summer in the catchment (January 2006), 80% in the 2006/07 summer and 70% in the 2007/08



101 Mr E J Norton, evidence-in-chief para 37 [Environment Court document 8A].
102 Mr E J Norton, evidence-in-chief para 14 [Environment Court document 8A].
103 Mr E J Norton, evidence-in-chief para 16 [Environment Court document 8A].
104 Mr E J Norton, evidence-in-chief para 17 [Environment Court document 8A].

summer. During 2008 the didymo cover declined further to an average of 30% by December 2008. There is no obvious flow related explanation for the decline in didymo cover. Mr Norton suggested[105] that it might be due to aging mats becoming more weakly attached to the bed, the action of invertebrates or microbial pathogens, or for some other reason. Further, the January 2009 flood, with a peak flow of about 1000 m^3/s, removed more than 90% of the remaining didymo throughout the length of the river[106]. The extent of the didymo recovery is being monitored.

The varial zone

[71] The variability of flows under the status quo frequently dewaters parts of the riverbed at the edges of the channels. Dr Jowett explained that the periodic dewatering of the riverbed between the high and low weekly flows prevents the dewatered areas from becoming viable physical habitat for non-mobile benthic organisms[107]. Mr Norton referred to this frequently wetted and dried habitat as the "varial zone". He observed virtually no periphyton growth and no invertebrate biomass in this zone[108]. Dr Stark considered the varial zone to be the area of riverbed under water at flows of 330 m^3/s but exposed at 235 m^3/s. No reasons were advanced for selecting these two flows. He observed the varial zone as defined to be between 3 metres and 20 metres wide which is a considerable area of riverbed habitat[109]. Dr Stark estimated that the artificial flow variations of the status quo resulted in a net loss of physical habitat for aquatic communities of about 20 to 40% compared with the natural flow variability[110]. Dr Stark does not state what he considers the natural flow in the Waitaki to be. We assume he means the flow regime that existed prior to the construction of the Waitaki Dam in 1935.

---

105 Mr E J Norton, evidence-in-chief, paras 47-49 [Environment Court document 8A].
106 Mr E J Norton, evidence-in-chief para 50 [Environment court document 8A].
107 Mr I G Jowett, evidence-in-chief para 40.2 [Environment Court document 7].
108 Mr E J Norton, evidence-in-chief para 35.4 [Environment Court document 8A].
109 Dr J D Stark, evidence-in-chief para 62 [Environment Court document 28].
110 Dr J D Stark, evidence-in-chief para 94 [Environment Court document 28].

[72] Mr Norton described the varial zone as a distinct habitat type in the Waitaki River produced by the fluctuating flows (between 150 and 350 m^3/s) resulting from power generation. It is occupied by desiccation-tolerant low mound macrophytes and does not contribute to the overall productivity of the aquatic ecosystem[111]. However the low mound communities in the varial zone are considered to be of high botanical interest due to their indigenous nature and high diversity[112].

The relationship with the flow regime

[73] Native periphyton and macrophyte communities are adapted to conditions of considerable flow variability and quickly re-colonise substrate denuded by high flows. Their main habitat is the margins, riffles and backwaters where velocities are moderate to low (less than 0.5 m/s). There is little such growth in the middle of the main channels where the water is swift and turbulent and bed sediments unstable[113].

[74] We find that periphyton proliferation and excessive growth of alien macrophyte species are directly related to long periods of low stable flow. This can be mitigated because regular flushing flows slough off excess periphyton and leave low cover communities providing good habitat and food value for invertebrates[114].

2.8 Instream native fauna

Native fish

[75] Dr D J Jellyman described the distribution and abundance of native fish in the lower Waitaki River. He noted that the native fish community is dynamic with movement of fish and changes in species abundance occurring throughout the year[115]. He considered the species composition to be typical of South Island braided rivers and the abundance of native fish to be relatively high, with the exception of longfin eels[116].

111 Mr E J Norton, evidence-in-chief paragraphs 34–35 [Environment Court document 8A].
112 Mr E J Norton, evidence-in-chief para 41 [Environment Court document 8A].
113 Mr E J Norton, evidence-in-chief para 61.4 [Environment Court document 8A].
114 Mr E J Norton, evidence-in-chief para 61.3 [Environment Court document 8A].
115 Dr D J Jellyman, evidence-in-chief para 8 [Environment Court document 9].
116 Dr D J Jellyman, evidence-in-chief para 22 [Environment Court document 9].

[76] Lake Waitaki contains longfin and some shortfin eel, common bullies and koaro. Manual transfer of juveniles from below the dam maintains eel populations. Meridian also runs a netting programme to capture adult eels in the upstream lakes and release them below the Waitaki Dam thereby providing access to the sea[117].

[77] The Waitaki River between the Waitaki Dam and Kurow supports mainly common bullies and koaro. Some non-diadromous[118] galaxids and occasional upland bullies and longfin eels also occur[119]. Continuing downstream: upland bullies and longfin eels are dominant in the braided gravel river habitat between Kurow and Stonewall. The reach of the river between Stonewall and the lagoon contains the greatest diversity as it includes the diadromous species that do not penetrate further inland (bluegill bullies, torrent fish and common bullies) together with longfin and some shortfin eels[120].

[78] The wetlands support shortfin eels, upland and common bullies and longfin eels. No Canterbury mudfish were found during surveys conducted in January 2002 although they have been recorded previously on the north bank of the Waitaki and near Welcome Creek.

Threatened fish species

[79] The longfin eel is in gradual decline having been subject to heavy exploitation and habitat reduction[121]. Mrs Anne P S Te Maiharoa-Dodds, an elder and chairperson of the Waitaha Taiwhenua o Waitaki Trust Board Incorporated (called by the Society), described the dramatic reduction in eel catches from the river[122]. Dr Jellyman agreed that the longfin eel fishery is of concern and noted that this has been recognised by the

---

117 Dr D J Jellyman, evidence-in-chief para 9 [Environment Court document 9].

118 A diadromous species lives part of its lifecycle in the sea and part in freshwater. A non-diadromous stays in one or the other.

119 Dr D J Jellyman, evidence-in-chief para 11 [Environment Court document 9].

120 Dr D J Jellyman, evidence-in-chief para 12 [Environment Court document 9].

121 Dr D J Jellyman, evidence-in-chief para 25.1 [Environment Court document 9].

122 Ms A P S Te Maiharoa-Dodds, evidence-in-chief paragraphs 38–43 [Environment Court document 47].

Ministry of Fisheries and the Department of Conservation[123]. In response to questions from the Court Dr Jellyman attributed the drop in longfin eel numbers to the imposition of dams in the catchment and the extent of the commercial fishing over the last 15 to 20 years[124]. We believe that may be only part of the answer because, as he wrote in his evidence-in-chief[125]:

> Nationally, there are concerns about reductions in recruitment of longfin eels, and certainly low numbers of juvenile eels (elvers) have been recorded at Waitaki Dam over recent years. As recruitment of juvenile eels (glass eels) is random (i.e. there is no homing of juveniles back to the waterways inhabited by their parents), low recruitment is indicative of a national trend and does not directly reflect river management processes within the Waitaki catchment. Because of this low recruitment, it is highly unlikely that eel stocks in the river below Waitaki Dam are limited by lack of suitable habitat.

[80] The Canterbury mudfish is nationally endangered. None of the sites where the mudfish has been identified would be impacted by the NBTC proposal[126].

[81] The lowland longjaw galaxis, found in the middle reaches of the Hakataramea River, is classified as nationally critical[127] but it too would not be affected by the NBTC proposal.

Invertebrates

[82] Dr J D Stark described the invertebrate communities of the Waitaki River as having high species richness, compared to other large east coast rivers, reflecting the greater flow and substrate stability of the regulated river[128]. *Deleatidium, Aoteapsyche*, elmid beetles, *Potamopyrgus, Pycnocentrodes*, orthoclad chironomids, and amphipods dominate the invertebrate communities. He noted that stable habitats in the river supported higher densities of invertebrates and higher numbers of *Ephemeroptera* mayflies, *Plecoptera* stoneflies, *Tricoptera* caddisflies ("EPT") taxa than unstable habitats[129].

---

123 Transcript p. 274.
124 Transcript p. 282 *et ff.*
125 Dr D J Jellyman, evidence-in-chief para 29 [Environment Court document 9].
126 Dr D J Jellyman, evidence-in-chief para 25.2 [Environment Court document 9].
127 Dr D J Jellyman, evidence-in-chief para 25.3 [Environment Court document 9].
128 Dr J D Stark, evidence-in-chief para 51 [Environment Court document 28].
129 Dr J D Stark, evidence-in-chief para 52 [Environment Court document 28].

[83] Almost all of the invertebrate taxa present were found in the Waitaki River both upstream and downstream of Kurow despite the marked difference in the physical configuration of the river[130]. Tributary streams were noted for their greater overall species diversity and greater variety of EPT taxa[131]. The varial zone provides poor habitat with low densities and limited variety of invertebrates[132].

[84] Invertebrate communities in the wetlands, backwaters and lagoon did not differ significantly but taxonomic richness was highest in the wetlands and lowest in the lagoon. EPT taxa richness was significantly higher in the backwaters reflecting connectedness to the riverine habitats where EPT taxa were even better represented[133].

Impact of didymo

[85] Mr Norton summarised a number of New Zealand studies of the impact of didymo on the native periphyton and invertebrate communities in South Island rivers. They found greatly increased periphyton biomass, increased invertebrate densities and a shift in periphyton and invertebrate community compositions. In general didymo proliferation shifted invertebrate communities from a predominance of EPT taxa to a predominance of crustaceans, non-EPT insects and worms[134]. Mr Norton's own studies in the Waitaki have yielded similar results with increased densities of snails, worms, purse caddis and chironmid larvae, and decreased densities of hard cased caddis larvae and mayflies in sites where didymo was present[135].

[86] No noticeable negative impacts of didymo on native or introduced fish species have been reported although there is a paucity of evidence on this rather than evidence of the absence of such impacts. Research is ongoing[136].

---

130 Dr J D Stark, evidence-in-chief para 58 [Environment Court document 28].
131 Dr J D Stark, evidence-in-chief para 53 [Environment Court document 28].
132 Dr J D Stark, evidence-in-chief para 59 [Environment Court document 28].
133 Dr J D Stark, evidence-in-chief para 55 [Environment Court document 28].
134 Mr E J Norton, evidence-in-chief paragraphs 52–53 [Environment Court document 8A].
135 Mr E J Norton, evidence-in-chief para 59 [Environment Court document 8A].
136 Dr E J Norton, evidence-in-chief paragraphs 51–60 [Environment Court document 8A].

2.9 Braided river birds

[87] The river is nationally and internationally[137] significant in terms of providing habitat for highly threatened bird species even though it is in a "state of major degradation"[138]. Surveys in 2001 and 2005 showed[139] about 27 braided river bird species (species of shags, geese, ducks, oyster catchers, stilts, plovers, gulls and terns). Bar-tailed godwit, white-faced heron, black swan and royal spoonbill were also recorded. Few species were recorded[140] in the single stem between the Waitaki Dam and Kurow. The braided reaches below Kurow showed[141] the highest numbers of black-fronted terns, black-billed gulls, banded dotterels and paradise ducks. Downstream of Stonewall produced[142] the highest numbers of black-backed gulls, white-fronted terns, red-billed (silver) gulls, feral geese, spotted shags and white-faced herons. Other species occurred with more even distributions.

[88] On the next page we show a table, derived from Dr R K McClellan's evidence for the Society, which lists:

(1) the species found in the 2001 and/or 2005 counts;

(2) the maximum count for the five replicate surveys in November and December of those two years; and

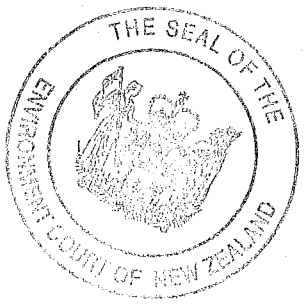
(3) the status of each species under the (new) New Zealand threat classification system as described in Conservation Status of new Zealand Birds[143];

(4) the information about species which are nationally vulnerable/endangered/critical in emphasis.

---

137 Dr R K McClellan, evidence-in-chief paragraphs 17 *et ff* [Environment Court document 49].
138 Dr R K McClellan, evidence-in-chief paragraphs 50 and 51 [Environment Court document 49].
139 Dr M D Sanders, evidence-in-chief para 34 [Environment Court document 14].
140 Dr M D Sanders, evidence-in-chief para 35 [Environment Court document 14].
141 Dr M D Sanders, evidence-in-chief para 35 [Environment Court document 14].
142 Dr M D Sanders, evidence-in-chief para 35 [Environment Court document 14].
143 Miskelly C M, Dowding J E, Elliot G P, Hitchmough R A, Powlesland R G, Robertson H A, Sagar P M, Scofield R P and Taylor G A(2008) *Notornis 5S* pp 117-135.

Species	**Max. Count 2001**	**Max. Count 2005**	**Miskelly *et al.* 2008**
Black shag	41	25	Naturally Uncommon
Little shag	47	43	Naturally Uncommon
Spotted shag	50	41	Not threatened
White-faced heron	33	18	Not threatened
Black swan	3	7	Not threatened
Canada goose	252	250	Introduced and naturalised
Feral goose	67	65	Introduced and naturalised
Mallard/**grey duck**	**611**	**430**	Introduced and naturalised/**Nationally critical**
Grey teal	84	44	Not threatened
Australasian shoveler	49	9	Not threatened
Paradise shelduck	99	28	Not threatened
New Zealand scaup	4	12	Not threatened
N.Z. pied oystercatcher	67	37	Declining
Pied stilt	333	188	Declining
Black stilt	**3**	**0**	**Nationally Critical**
Hybrid stilts	4	2	
Banded dotterel	**103**	**55**	**Nationally Vulnerable**
Wrybill	**6**	**4**	**Nationally Vulnerable**
Spur-winged plover	224	70	Not threatened
Black-backed gull	6,305	6,383	Not threatened
Black-billed gull	**2,109**	**1,002**	**Nationally Endangered**
Red-billed gull	**120**	**162**	**Nationally Vulnerable**
Black-fronted tern	**712**	**791**	**Nationally Endangered**
White-fronted tern	1,327	1,585	Declining
Caspian tern	**20**	**14**	**Nationally Vulnerable**
Variable oystercatcher	1	2	Recovering
Royal spoonbill	1	0	Naturally Uncommon
Turnstone	2	0	Migrant
Bar-tailed godwit	0	2	Migrant



[89] Three of the bird species present and identified as nationally critical or vulnerable probably cannot be assisted in the lower Waitaki River. The New Zealand grey duck[144] is being genetically swamped by mallards and it is very difficult for observers to distinguish which species is which as Dr Rate conceded to the Court[145]. The black stilt and wrybill occur in such low numbers they can probably only be aided incidentally. The black stilt's main breeding habitat appears to be further up the catchment in headwater streams and rivers like the Cass River near Lake Tekapo or the Ahuriri River. The wrybill too is a river bed breeder, usually higher up.

[90] Red-billed gulls and caspian terns are more common below Stonewall so we do not consider them further. However for three species – white-fronted terns (*Sterna striak*), black-fronted terns (*Sterna albostriata*) and black-billed gulls (*Larus bulleri*) – the NBTC is potentially very significant. The current national populations of those species are not known accurately but the best counts or estimates (and the years of the estimates or counts) are:

	1995	1996	1997	2009
Black-billed gulls	86,000	96,000	44,000[146]	-
White-fronted terns	8,000	17,600	23,000[147]	-
Black-fronted terns		5,000		7,000-10,000[148]

[91] Thus the lower Waitaki held the following (approximate) proportions of the national population[149] of these three species:

---

144 Probably the same species as the Pacific Black duck found in Australia and some Pacific Ocean islands.

145 Transcript page 984.

146 Doubling the nesting pairs referred to by Dr R K McClellan, evidence-in-chief para 12 [Environment Court document 49].

147 Dr R K McClellan, evidence-in-chief para 14 [Environment Court document 49].

148 Dr R K McClellan, evidence-in-chief para 15 [Environment Court document 49].

149 Dr R K McClellan, evidence-in-chief para 12 *et ff* [Environment Court document 49].

Black-billed gulls	2.5%[150]
White-fronted terns	20 – 36%[151]
Black-fronted terns	7.1% to 7.9%[152]

[92] As their conservation statuses suggest a number of species are in decline, some critically. The numbers of these birds is unlikely to be determined by food supplies or adequate feeding habitat[153].

[93] Research shows that one of the major limiting factors on their population is lack of success in raising eggs and chicks to the juvenile stage[154]. A major cause of this is predation. The principal predators are introduced cats, mustelids (weasels, ferrets, stoats), rats and hedgehogs[155]. Birds such as black-backed gulls are also responsible for some predation, but how much is not yet "well-understood"[156].

[94] There are other factors contributing to the lack of breeding success or maintenance of population. Nesting habitat is reduced by vegetation encroachment, particularly gorse and broom onto the riverbed because most braided river birds like clear gravel and cobbles. Another factor is floods although they are phenomena the species presumably evolved with. Dr Sanders identified[157] "other factors that can detrimentally affect braided river birds" as being[158]:

> Other factors that can detrimentally affect braided river birds include damming and inundating rivers; water abstraction; habitat disturbance and degradation (e.g. from gravel extraction and river engineering works); disturbance from off-road vehicles; grazing stock, and anglers.

The impacts of these factors have not been quantified.

---

150 Dr R K McClellan, evidence-in-chief para 12 [Environment Court document 49].
151 Dr R K McClellan, evidence-in-chief para 14 [Environment Court document 49].
152 Dr R K McClellan, evidence-in-chief para 15 [Environment Court document 49]. (Based on the most optimistic estimate of natural population of 10,000 birds).
153 Dr M D Sanders, evidence-in-chief para 51 [Environment Court document 14].
154 Dr M D Sanders, evidence-in-chief para 47 [Environment Court document 14].
155 Dr M D Sanders, evidence-in-chief para 46 [Environment Court document 14].
156 Dr M D Sanders, evidence-in-chief para 47 [Environment Court document 14].
157 Dr M D Sanders, evidence-in-chief para 50 [Environment Court document 14].
158 Dr M D Sanders, evidence-in-chief para 50 [Environment Court document 14].

2.10 Salmon, trout and angling

Chinook salmon

[95] Chinook salmon *(Oncorhynchus tshawytscha)* were first released[159] into the Waitaki River in the early 1900s. They subsequently spread throughout the Waitaki catchment. However, when the Waitaki Dam was completed in 1935 that prevented migrating adult salmon from reaching upper catchment spawning areas. A fish pass was built, but this was unsuccessful because of its design and location.

[96] Approximately 75% of the salmon spawning in the lower Waitaki River occurs upstream of Black Point and Stonewall. Salmon eggs are deposited in gravel nests called "redds" in relatively shallow, high velocity, water. Eggs incubate from April to October. The eggs and sac called "alevins" require stable flows and clean, cool, well oxygenated water for successful incubation and survival. Mr E Graynoth, the freshwater fisheries scientist called by Meridian wrote that[160]:

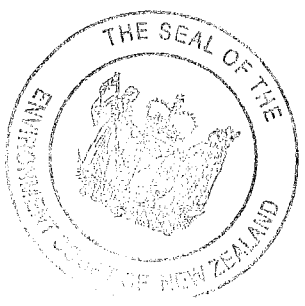
> Survival rates from egg to fry emergence are relatively high because of the coarse substrate and small amounts of sand present.

[97] Salmon fry emerge from the redds from mid to late August. They are most abundant in October. Apparently[161] habitat preferences change with size and age. Young fry tend to be found near instream cover along the margins of shallow, slow flowing braids. Larger juveniles occur mainly in backwaters and side pools. They feed mostly on aquatic insect larvae and adult aquatic and terrestrial insects.

[98] Salmon in the Waitaki River have alternative strategies as described by Mr Graynoth[162]:

---

159 Mr E Graynoth, evidence-in-chief para 15 [Environment Court document 10].
160 Mr E Graynoth, evidence-in-chief para 17 [Environment Court document 10].
161 Mr E Graynoth, evidence-in-chief para 19 [Environment Court document 10].
162 Mr E Graynoth, evidence-in-chief para 18 [Environment Court document 10].



> Ocean-type juveniles remain in fresh water for up to three months, entering the ocean during late spring and summer. 'Stream-type' juveniles remain in fresh water for a full year and enter the ocean during the second spring. Stream-type fish account for an unusually high 57% of the adult salmon returning to the Waitaki River.

Food supplies and habitat present normally determine the number of juveniles (now called "smolts") migrating to the sea. Conditions in the sea can have a major impact[163] on the number of adults returning.

[99] Adults return to spawn when they are between two and five years old. Most adult salmon enter the river between January and March, and spawning occurs from April to June. Seventy-five percent of Waitaki salmon spawn in the side braids of the main stem above Stonewall and below Kurow. They spawn in the Waitaki River at a mean depth of 0.33 metres (range 0.14 to 0.58 metres)[164] and mean velocity of 0.64 metres/sec (range 0.16 to 1.50 m/sec). The remaining 25% breed either below Stonewall or in tributaries, although in respect of the latter Mr Graynoth wrote[165]:

> Runs into the Hakataramea River have declined markedly in recent years because of insufficient flows in the Hakataramea River and other tributaries occasionally have very small spawning runs.

[100] The salmon run in the Waitaki River has been unusually low in recent years. In Mr Graynoth's view[166] this does not necessarily mean that the runs are declining. Similar fluctuations in abundance have occurred in all East Coast rivers and this indicates that changes in marine conditions are primarily responsible. Improvements in marine survival rates should result in a resurgence of salmon runs both in the Waitaki and other rivers.

---

163 Mr E Graynoth, evidence-in-chief para 20 [Environment Court document 10].
164 Mr E Graynoth, evidence-in-chief para 30 [Environment Court document 10].
165 Mr E Graynoth, evidence-in-chief para 16 [Environment Court document 10].
166 Mr E Graynoth, evidence-in-chief para 21 [Environment Court document 10].

Trout

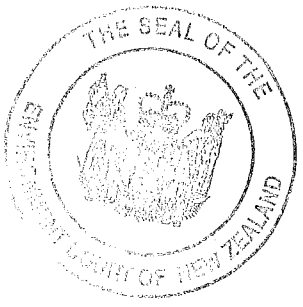
[101] Brown trout *(Salmo trutta)* are common throughout the lower Waitaki River and tributaries. They spawn primarily in May and June in some side braids of the river and in the tributaries, but there are no statistics as to the proportions. Just as for salmon eggs and alevins require clean, cool, well oxygenated water for successful incubation. When redds are exposed to the air (by changing flows), removed by floods or covered with silt, then the eggs will not hatch. The incubation period extends from May to October. Trout fry emerge from the gravels in late August to early November.

[102] Rainbow Trout *(Oncorhynchus mykiss)* are found throughout the catchment, although they are most common between Kurow and the Waitaki Dam. They spawn from late July to mid October in tributaries (not in the main river). Juveniles rear in the tributaries and the mainstem. Mr Graynoth described how[167]:

- rainbow trout fry migrate downstream to the main river from late October to early January, although some fish remain resident in the tributaries for up to a year;
- juvenile rainbow trout habitat appears to be limited and of poor quality in the mainstem.

[103] Juvenile trout of both species feed on small animals such as midge and mayfly larvae. Adults eat drifting terrestrial insects, snails, EFT taxa larvae and small native fish. The numbers and size of trout in New Zealand rivers often depends upon the amount of food present[168].

[104] As to numbers Mr Graynoth wrote[169]:



167 Mr E Graynoth, evidence-in-chief para 23 [Environment Court document 10].
168 Mr E Graynoth, evidence-in-chief para 24 [Environment Court document 10].
169 Mr E Graynoth, evidence-in-chief para 25 [Environment Court document 10].

> Adult trout appear to be most abundant near Kurow and between SH 1 and the sea. Adult rainbow trout tend to be scarce in small side braids (<8 m^3/s), and are more abundant in deeper, faster water than brown trout. The percentage composition of brown and rainbow trout varies between years. Clear water appears to favour rainbow trout over brown trout, possibly through its influence on feeding behaviour. Historical records indicate trout abundance varies substantially depending upon flow fluctuations, the timing and size of floods and changes in water clarity. Approximate estimates of the numbers of adult trout present in the lower Waitaki River range from 60 to 364 per km. Trout growth, size and condition has improved in recent years due to improvements in water clarity, reductions in floods and a resulting increase in food supplies.

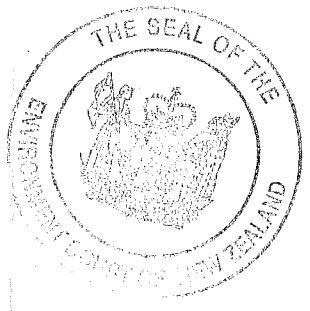
Impacts of existing hydro-electricity activity

[105] Mr Graynoth wrote on this issue[170]:

> Short term fluctuations in flows have the potential to strand juvenile salmonids, dewater redds and productive riffles and pose a danger to anglers (Graybill et al 1990). The risks were greatest from the mid-1950's to the early 1970's when flows fluctuated widely on a daily basis. Flow fluctuations have become much less severe since the mid-1970's.
>
> To reduce the risk of fish stranding and redd dewatering Graybill et al (1990) recommended flow reductions below 200 m^3/s be limited to 10% of the flow per hour but that flow increases remain at 30 $m^3/s/hr$. The present resource consents for the Waitaki Power Station allow frequent flow fluctuations. Although there are limits on the allowable rate of change in flow (ramping rate of 30 m^3/s per hour), this does not restrict the amount of change that can occur over a day.

Angling

[106] The lower Waitaki River is nationally important for anglers. There were about 34,500 angler visits in 1994/95 and 26,600 in 2001/02. Annual salmon catches from 1980 to 1986 ranged from 1,700 to 19,700. The average was 8,600 fish. However, catches have declined in recent years to an average of 1,800 by Central South Island licence holders[171]. The numbers caught by other licence holders is not known.



170 Mr E Graynoth, evidence-in-chief paragraphs 26-27 [Environment Court document 10].
171 Mr E Graynoth, evidence-in-chief para 12 [Environment Court document 10].

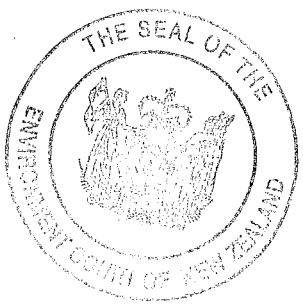
[107] Spawning runs have also decreased in recent years. From 1980 to 1986 the runs ranged from 5,500 to 35,600 salmon per annum, the highest in New Zealand. However, since 1997 numbers of salmon returning to the Waitaki (and other Canterbury rivers) has reduced. Mr Graynoth wrote that[172] the runs in 2007 were possibly the highest for five years with from 2,000 to 3,000 fish being present.

[108] As for trout in the lower Waitaki about 8,000 fish were caught[173] per year in the mid 1980s. Mr Graynoth[174] wrote that these were mostly brown trout but there were some rainbow trout. The trout caught by anglers range from about 30 to 50 cm in length, although fish up to 70 cm and up to 4 kg in weight are occasionally taken[175]. The average length and weight remained virtually unchanged from 1957 to the mid 1980s.

[109] It was common ground that 36% of angling effort for salmon in the lower Waitaki occurs in the affected reach, i.e. from Stonewall upstream to the dam. The other 74% occurs between Stonewall and the sea. With its mean flows of about 382 m^3/sec (depending on where on the river the angler is) the Waitaki has a considerably greater flow than any other Canterbury braided river:

- Rangitata – mean flow 100 m^3/sec;
- Rakaia – mean flow 203 m^3/sec;
- Waimakariri – mean flow 126 m^3/sec;
- Waiau – mean flow 98 m^3/sec.

That shows that the Waitaki gives a 'big river' experience – which is much appreciated by anglers.



172 Mr E Graynoth, evidence-in-chief para 13 [Environment Court document 10].
173 Mr E Graynoth, evidence-in-chief para 14 [Environment Court document 10].
174 Mr E Graynoth, evidence-in-chief para 14 [Environment Court document 10].
175 Mr E Graynoth, evidence-in-chief para 14 [Environment Court document 10].

2.11 Recreation access and amenities

[110] In addition to trout and salmon fishing (covered previously), the lower Waitaki is used for many other recreational pursuits. These have been listed in section 2.1 above. Potentially a part of all pursuits on, in and around the river is the "big river" experience. As Mr Parker, an experienced angler and recreational user of the Waitaki for over 50 years, put it[176]:

> The big river experience is more than about flow, it is mainly about the complete river environment which effectively is the whole river width from bank to bank. It is the landscape, the sky the sound of the water – everything around you gives that feel.

The "big river" experience was acknowledged[177] by Mr Greenaway, the recreation witness, and Dr Hayes, the fisheries witness. The WCWARP itself recognises the 'big river' experience[178] although, as we shall see in the next chapter, it does not contain any policy in respect of it.

[111] Jet boating is a high profile activity on the river, one in which the "big river" experience is a particularly significant component[179]. The length, braided nature and variable flows of the Waitaki represent a challenge to experienced jet boaters, although higher flows can deter recreational boaters on safety grounds. There are 6-8 major events on the river annually, catering to both recreational and international sporting users. These include international and national marathon events. There is a jet sprint course immediately downstream of the Kurow Bridge[180].

---

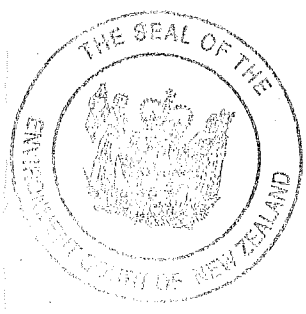
176 Mr B J Parker, evidence-in-chief para 72 [Environment Court document 46].

177 Mr R Greenaway, evidence-in-chief paragraphs 39, 65 and 87 [Environment Court document 15], Dr J W Hayes, evidence-in-chief paragraphs 74 and 105 [Environment Court document 11]. Who was copying whom in these two statements of evidence we cannot tell, but they are remarkably similar.

178 WCWARP p. 12.

179 Mr R Greenaway, evidence-in-chief para 39 [Environment Court document 15].

180 Mr R Greenaway, evidence-in-chief para 40 [Environment Court document 15].



[112] Access to the river is a major determinant of the recreational activity that is undertaken. There are numerous access points to the river, but many are known only to locals and regular users[181]. There are numerous 4-wheel drive tracks giving access to the river. There are formal boat ramps at Kurow, Duntroon and below the State Highway 1 bridge. Informal launching sites include Ferry Road, Priest Road, Bortons Pond, Henstridges Road and below the Hakataramea River confluence. All launch sites are subject to river conditions to some extent[182].

[113] Once the river has been reached, access up and down the river by vehicle or on foot is determined by the combination of the water level and the vegetation. Lower river levels provide easier access along the riverbank and across the smaller channels and braids, while vegetation acts to inhibit movement along the river bed.[183] The gorse and willows are often so dense that access is difficult for vehicles.

[114] Four-wheel drive and quad bike activity in the riverbed is popular, both to access fishing or other activity, and in its own right. Over time this usage has formed a number of unofficial tracks from the more popular angling access points. This has enhanced angler access along the river.[184]

[115] Formal camping facilities are available in Kurow and Duntroon. Informal camping occurs along the river margins, especially around angler access points. Commercial recreation services available include fishing guides, accommodation, transport, jet boat operators, hunting and 4-wheel driving.

[116] Swimming generally occurs in the quieter water along the river edge and in back braids[185]. Mr Parker indicated[186] that the swimming season extends from Christmas/New Year until the end of March.

---

181 Mr R Greenaway, evidence-in-chief para 52 [Environment Court document 15].
182 Mr R Greenaway, evidence-in-chief para 41 [Environment Court document 15].
183 Dr J W Hayes, evidence-in-chief para 22 [Environment Court document 11], Mr R Greenaway, evidence-in-chief para 33 [Environment Court document 15].
184 Mr R Greenaway, evidence-in-chief para 47 [Environment Court document 15].
185 Mr R Greenaway, evidence-in-chief para 48 [Environment Court document 15].
186 Transcript p. 768.

2.12 The mauri of the lower Waitaki

[117] Mr Buddy Mikaere, a consultant specialising in tangata whenua issues relating to resource management, had reviewed the scientific and cultural evidence on behalf of Meridian. He considered that water quality was indicative of the 'health' of a water body which in turn would be indicative of the health of the customary fisheries. He opined[187]:

> Using the term health in this respect is a simple (though not definitive) way of expressing the mauri concept.

Mr Mikaere considered that the starting point for the mauri should be the state of the river as it is today and noted that the spiritual nature of the Waitaki had been heavily compromised since the arrival of the first humans in the valley[188]. He believed the maintenance of water quality to be an essential ingredient in safeguarding the mauri of a water body and the best physical response to a metaphysical issue.

[118] We have already mentioned that Mrs Te Maiharoa-Dodds gave evidence about tuna (eels) in the Waitaki. In fact her evidence went a good deal further than that. She wrote that she has lived all her life (she is now active in retirement) at Glenavy on the north bank of the Waitaki. She claimed (and we have no reason not to accept this) that she is[189] "... manawhenua holding ahikaa uninterrupted". She stated that she is a whanau member of the Ngati Rakai hapu[190] of Waitaki but that is not Ngai Tahu nor registered as Ngai Tahu[191].

Mr Mikaere acknowledged the sincerity and genuine nature of the concerns put forward by Mrs Te Maiharoa-Dodds for the viewpoint of Waitaha[192]. During cross-examination he confirmed that he had no issue with her whakapapa or standing as Waitaha[193].

---

187 Mr B Mikaere, evidence-in-chief para 31 [Environment Court document 6].
188 Mr B Mikaere, evidence-in-chief paragraphs 35–37 [Environment Court document 6].
189 Mrs A P S Te Maiharoa-Dodds, evidence-in-chief para 18 [Environment Court document 47].
190 Mrs A P S Te Maiharoa-Dodds, evidence-in-chief para 14 [Environment Court document 47].
191 Mrs A P S Te Maiharoa-Dodds, evidence-in-chief para 22 [Environment Court document 47].
192 Mr B Mikaere, evidence-in-reply para 25 [Environment Court document 6A].
193 Transcript p. 184.

[119] Mrs Te Maiharoa-Dodds and her 13 siblings are great-grandchildren of Tohuku Te Maiharoa (1800-1866) who was she wrote "... proud of his Waitaha ancestry". In fact Te Maiharoa is also claimed by Ngai Tahu – see the Crown's Statutory Acknowledgement[194] for Waitaki River in the Ngai Tahu Claims Settlement Act 1998 ("NTCSA"). Further, that statute defines 'Ngai Tahu" as meaning[195] (relevantly):

> ... the collective of individuals who descend from the primary hapu of Waitaha, Ngati Mamoe, and Ngai Tahu ...

However, the Maori Land Court have acknowledged that more than one hapu may have manawhenua (see *Rangitane O Tamaki Nui-a-Rua Incorporated Society*[196]) and we consider that an appropriate approach here. We find based on Mrs Te Maiharoa-Dodd's evidence, uncontested on this point, that she and her hapu are tangata whenua of the Waitaki.

[120] After establishing her manawhenua, Mrs Te Maiharoa-Dodds described the Waitaki River as the fishing ground of her ancestors and highlighted its value to Ngä Uri oWaitaha as a customary resource as well as for its intrinsic values[197]. She considered the mauri (the life giving force of the river) to be reduced by any reduction in both water quality and quantity[198]. She emphasised taha wairua (the spiritual side) as an essential requirement for health and noted that land, lakes, mountains and rivers have spiritual significance quite apart from economic and agricultural considerations[199].

---

194 Schedule 72 to the NTCSA 1998.
195 Section 10.
196 [1996] NZAR 312.
197 Mrs A P S Te Maiharoa-Dodds, evidence-in-chief paragraphs 35–36 [Environment Court document 47].
198 Mrs A P S Te Maiharoa-Dodds, evidence-in-chief paragraphs 44–47 [Environment Court document 47].
199 Mrs A P S Te Maiharoa-Dodds, evidence-in-chief para 33 [Environment Court document 47].

3.0 The law

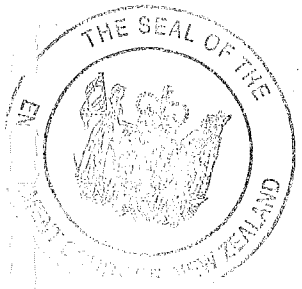
3.1 Overview: The instruments to be considered, and Part 2 of the Act

[121] To ascertain whether or not implementing the water permits sought by Meridian would be sustainable management of the resources involved we need to have regard to[200] the objectives and policies of the relevant statutory instruments. In these proceedings the most relevant instruments are the Canterbury Regional Policy Statement ("the RPS"), the Waitaki Catchment Water Allocation Regional Plan ("WCWARP") and the CRC's proposed Natural Resources Regional Plan. In theory the National Coastal Policy Statement and the Canterbury Regional Council Coastal Plan of 2005 are also relevant but no issue was raised in respect of them.

[122] We outline the provisions of the statutory instruments which are relevant under section 104(1)(b) of the Act in this order:

- the proposed Natural Resources Regional Plan;
- the WCWARP;
- the RPS;
- Part 2 of the RMA.

Finally we refer to the Soil Conservation and Rivers Control Act 1941 because it partly explains current management of the Waitaki river bed.



200 Section 104(1)(b) of the RMA.

3.2 The proposed Natural Resources Regional Plan

3.2.1 Introduction

[123] The proposed Natural Resources Regional Plan ("the proposed NRRP") was notified on 1 June 2002. It is one of the disappointments of resource management in Canterbury that after seven years the Regional Council has not yet finished its hearings on the proposed NRRP, and consequently has not released any decisions, let alone put a full regional plan into operation. The only operative regional plans are the Canterbury Regional Coastal Plan and the allocation plan for the Waitaki – the WCWARP – which was prepared by a special board under specific legislation[201].

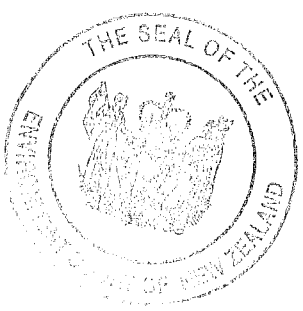
[124] The proposed NRRP is important because it addresses potentially relevant matters not covered by the WCWARP such as[202]:

- water quality;
- soil and bank erosion;
- wetland management – fencing and siltation;
- operational management of beds and rivers;
- management of floods;
- ramping rates;
- passage of fish past structures;
- fish screening of intakes.

We have read and will apply all the relevant provisions, but we only discuss the main objectives and policies below, or others which are incorporated by reference into the WCWARP.

3.2.2 Water quality

[125] Chapter 4 of the proposed NRRP deals with water quality. Objective WQL1.1(1) requires that where river water quality or the riverbed substrate is polluted they be maintained or improved so that they are suitable or provide for contact recreation at swimming holes, stock drinking water, habitat for indigenous species or



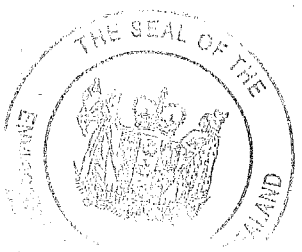
201 The Resource Management (Waitaki Catchment) Amendment Act 2004.
202 The list is taken from the WCWARP p. 20.

salmonids, amenity values and Ngai Tahu cultural values. Objective WQL 1.1(2) is probably not relevant, although it is so confusingly worded it is difficult to be confident about that.

[126] More focused on proposals such as the NBTC is Objective WQL1.1(3). This objective requires that[203]:

> ...
>
> (3) Where the water quality of a river, or the physical and chemical characteristics of the riverbed substrate, have been or are likely to be affected by a change to the flow regime of a river as a result of augmentation of flow, damming, diversion, or discharge of water or contaminants:
>
> (a) the instream values in the river, which existed before a change to the flow regime, are provided for, by ensuring that:
>
> (i) any change to water quality, including changes to clarity, natural water temperature, dissolved oxygen concentrations, or contaminants caused by reducing or low oxygen conditions;
>
> (ii) sedimentation of the riverbed; or
>
> (iii) excessive growth of periphyton, or aquatic plants;
>
> have no significant adverse effects on the instream values of the river; or
>
> (b) where the instream values have been adversely affected by a change to the flow regime, the water quality of the river and the physical and chemical characteristics of the riverbed substrate, are improved to restore, as far as practicable, the instream values of the river that existed before the change to the flow regime; and
>
> (c) the quality of river water recharging groundwater will not prevent the achievement of Objective WQL2.
>
> [Our emphasis]

The objective recognises[204] that existing concentrations of contaminants, sediments, and aquatic plants can all be affected by a change to the flow regime, and it seeks that such changes have no "significant adverse effects".



203 Proposed NRRP, Chapter 4 – Water Quality [p. 4-21].

204 Also see the Explanation to objective WQL1 [Proposed NRRP p. 4-25].

[127] A definition of 'divert' in the proposed NRRP states[205]:

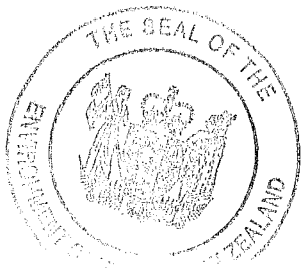
> ... to alter in any way the natural course of water flows, whether over or under the ground. It includes but is not limited to cases where all or some of the flow is returned to the same water body further downstream.

By Memorandum[206] dated 14 August 2009 Ms Dysart answered our request to know whether there were submissions seeking changes to this definition. The answer is that there are, but they appear to be additions to the definition rather than any change to its core meaning. We discuss what the latter is later in this chapter.

3.2.3 Wetlands

[128] Chapter 7 of the proposed NRRP deals with wetlands. The principal and most relevant objective is Objective WTL1. It states[207]:

> (1) Canterbury's wetlands are managed in ways that enable people and communities to provide for their social, economic and cultural wellbeing, while meeting the constraints listed (a) to (d) below:
>
> (a) no overall reduction in the area of moderate or higher significance wetlands in the region, increasing that area where possible, especially in coastal, lowland and inland basin parts of the region;
>
> (b) no overall reduction in the natural character of wetlands and their margins, and in particular no overall loss of significant areas of indigenous vegetation or significant habitats of indigenous fauna;
>
> (c) no overall reduction in the contribution wetlands make to outstanding natural landscapes or as outstanding natural features; and
>
> (d) no overall reduction in the contribution of wetlands to the relationship of Ngai Tahu and their culture and traditions with their ancestral lands, water, sites, wahi tapu and wahi taonga.
>
> (2) In addition, the quality and quantity of wetlands is enhanced where possible, particularly in areas where wetlands are most depleted, and as a minimum there is:



205 Proposed NRRP, Chapter 4 – Water Quality – p. 4-301.
206 Environment Court document 75.
207 Chapter 7 – Wetlands [Proposed NRRP p. 7-13].

(a) no overall reduction in the cultural, heritage, and recreational values of wetlands, or the maintenance and enhancement of their amenity values, or their value as significant habitats of trout and salmon; and

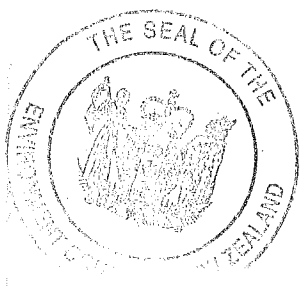
(b) … no overall reduction in the role that wetland ecosystems play in water capture, groundwater recharge, water storage and flow attenuation, and in maintaining water quality.

So the principal objective is not to reduce wetlands in area or quality. That is supported by sub-objective (2) which is to enhance depleted wetlands.

[129] The interception of groundwater flowing into wetlands is identified earlier in Chapter 7 of the proposed NRRP as being a factor[208] in the "… very serious decline in total area of wetlands in the region …". Despite that, the proposed NRRP does not contemplate the preservation of all wetlands. Rather it envisages environmental compensation being provided. That is expressly stated in policy WTL1 which states that[209]:

> … Environment Canterbury will require as a condition of any resource consent granted in accordance with this policy, an enforceable arrangement to offset any loss or reduction of moderate or higher significance wetland pursuant to that consent.

Further, Rule 5.10[210] of the Proposed Canterbury Natural Resources Regional Plan (NRRP) as incorporated by reference into the Waitaki Catchment Water Allocation Regional Plan (WCWARP) gives the Council the ability to impose financial contributions to "offset the actual or potential loss of in-stream or riparian habitat values" arising from a resource consent. This appears to allow the imposition of a charge to cover those losses that cannot be remedied or mitigated at least in respect of habitat values. If the value of those losses can be estimated in dollar terms, and a charge equal to that value imposed, this would internalise the environmental costs to the applicant.



208 Proposed NRRP, Chapter 7 – Wetlands [p. 7-12].
209 Proposed NRRP, Chapter 7 – Wetlands [p. 7-13].
210 Rule 5.10 (Proposed NRRP chapter 5 p. 5-192].

[130] We explained in Chapter 2.0 how Appendix WTL1 to the proposed Chapter 7 is also incorporated into the WCWARP by reference[211]. We do not need to discuss that further here.

3.3 The Waitaki Catchment Water Allocation Regional Plan

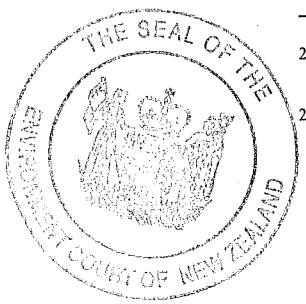
[131] The Waitaki Catchment Water Allocation Regional Plan has five objectives. They are[212]:

Objective 1 To sustain the qualities of the environment of the Waitaki River and associated beds, banks, margins, tributaries, islands, lakes, wetlands and aquifers by:

a. recognising the importance of maintaining the integrity of the mauri in meeting the specific spiritual and cultural needs of the tangata whenua, and by recognising the interconnected nature of the river
b. safeguarding the life supporting capacity of the river and its ecosystems
c. managing the water bodies in a way that maintains natural landscape and amenity characteristics and qualities that people appreciate and enjoy
d. safeguarding the integrity, form, functioning and resilience of the braided river system
e. providing for individuals' reasonable domestic water needs
f. providing for individuals' reasonable needs for their animals' drinking-water
g. providing for fire-fighting water needs.

Objective 2 To the extent consistent with Objective 1, to enable people and communities to provide for their social, economic and cultural wellbeing and their health and safety, by providing for water for:

a. town and community water supplies
b. hydro-electricity generation
c. agricultural and horticultural activities
d. industrial and commercial activities



211 Certification dated 30 September 2005 by the Waitaki Catchment Water Allocation Board [Separate volume of the WCWARP called 'Material Incorporated by reference' p. 2.]

212 Waitaki Catchment Water Allocation Regional Plan, Chapter 6 p. 24. The underlined terms are defined in the WCWARP.

e. tourism and recreation facilities

f. any other activities.

Objective 3 In allocating water, to recognise beneficial and adverse effects on the environment and both the national and local costs and benefits (environmental, social, cultural and economic).

Objective 4 To promote the achievement of a high level of technical efficiency in the use of allocated water.

Objective 5 To provide for a practical and fair sharing of allocated water during times of low water availability.

[132] Mauri is defined in the WCWARP as:

> Essential life force or principle; a metaphysical quality inherent in all things both animate and inanimate.

Chapter 4 of the WCWARP earlier set out the tangata whenua's cultural requirements for water drawing on the Te Runanga o Ngai Tahu Freshwater Policy[213] which explained that:

> Sustaining the mauri of a water body requires management of water bodies that:
>
> - Protects the water's capacity to renew its groundwater and surface water flows and stocks;
> - Sustains habitats, breeding, food sources and migratory requirements of mahinga kai species such as eels, flax, and watercress, in their freshwater and coastal environments;
> - Provides seasonal flow variability via a range of flows including seasonal floods of different magnitudes;
> - Protects the exchange of freshwater and seawater at the mouth, maintains freshwater flows in estuaries, and prevents the unnatural closing of a river mouth;
> - Prohibits the unnatural mixing of water from different bodies.

213 Waitaki Catchment Water Allocation Regional Plan, p. 16

[133] Those objectives are fairly simple to understand even if not to apply. However, there is one exception – objective 4 with its aim of promoting a high level of 'technical efficiency'. That term is defined in the WCWARP[214] as meaning "Using a resource in a way that any given output is produced at least cost, including avoiding waste". We do not see that as adding anything to section 7(b) of the Act (which we discuss later in this Chapter). If anything the objective and definition complicate matters by:

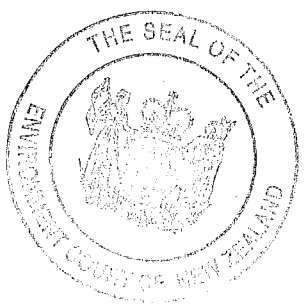
(a) blandly referring to 'avoiding waste' without making a comparison. One person's waste (watching one person in a car crossing Auckland Harbour Bridge without passengers) is another's efficient use (the driver in our example obviously thinks it is efficient)[215];

(b) defining technical efficiency differently from the way engineers normally do as the ratio of output to input.

[134] Chapter 7 of the WCWARP then states that objectives 1-5 will be achieved through the 46 policies, 28 of which are general and the rest are described as locality specific[216]. The relevant general policies are given first. The first policy is:

> **Policy on a whole-catchment approach**
>
> **Policy 1**[217] [to] recognise the importance of connectedness between all parts of the catchment from the mountains to the sea and between all parts of freshwater systems of the Waitaki River and associated beds, banks, margins, tributaries, islands, lakes, wetlands and aquifers.
>
> Cross-Ref: Objective 1

Of course the further one travels downstream the more what occurs upstream is usually a given, at least in terms of flow rates and water quality. For example, the level of contaminants in the lower Waitaki between the Waitaki Dam and Stonewall is contributed to greatly by activities further upstream in the main river or in tributaries



214 WCWARP p. 60.
215 "What is food to one man may be fierce poison to others", Lucretius [99-55 BCE].
216 WCWARP p. 39.
217 WCWARP p. 25.

such as the Hakataramea River. Ecologically the position is more complex in respect of those species of fauna[218] which travel upstream from the sea.

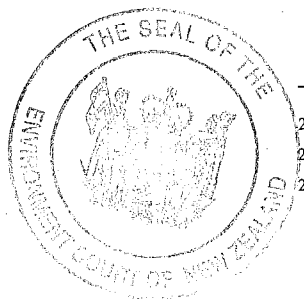
[135] There follow several policies on environmental flow and level regimes. Policy 2 relates to some (identified) special water bodies[219]. It is:

> **Policy 2** To recognise that the following water bodies have a high natural character worthy of a high level of protection, because they are currently either in largely unmodified parts of the catchment; or contain rare or important species and habitat or habitat assemblages:
>
> Cross-ref: Objective 1
>
> a. tributaries of Lakes Tekapo, Pukaki and Ohau;
> b. mainstems and tributaries of Fork Stream, Irishman Creek and Mary Burn, upstream of the Braemar Road;
> c. mainstem and tributaries of the Twizel River, upstream of the Pukaki Canal;
> d. wetlands with a moderate or higher significance throughout the catchment;
> e. Lakes Alexandrina, McGregor and Middleton and their tributaries and other lakes upstream of Lakes Tekapo, Pukaki and Ohau.

This policy is important both for what it says and for what it implies, which is that some parts of the Waitaki Catchment are modified. In fact, we have found that the lower Waitaki is highly modified.

[136] Policy 2 focuses on some special water bodies by recognising that they are worthy of a high level of protection. It may be worth observing here that it does not require 'complete protection or preservation'. A further point is that policy 2 is only directly relevant in respect of any 'wetlands with a moderate or higher significance …', a phrase which the WCWARP defines[220] as meaning:

> A wetland that has been assessed and has been classified as moderate or higher significance in accordance with the criteria and methodology in Appendix WTL1 of the [NRRP].



218 e.g. the diadromous species of fish discussed in Chapter 2.0 of this decision.
219 WCWARP p. 25.
220 WCWARP, Section 10, Definitions … [p. 60].

That is relevant because of our finding in Chapter 2.0 that all the wetlands we are concerned with in these proceedings are not in unmodified parts of the catchment but in modified areas which contain or may contain "rare and important species and habitat or habitat assemblages". A number of wetlands in the NBTC reach have been classified for the purposes of this case as having moderate or high significance.

[137] A vital general policy in this case is:

> **Policy 3**[221] [to] set... environmental flow and level regimes in the water bodies of the Waitaki catchment (other than those identified in Policy 2) that enable access to water for the activities identified in Objective 2, to the extent consistent with Objective 1.
>
> Cross-ref: Objectives 1 and 2

This policy shows that in implementation of the objectives by setting environmental flow and level regimes for the water bodies of the Waitaki catchment (except for the special cases in policy 2 such as – in these proceedings – any wetlands with moderate or higher significance) achieving objective 2 is subservient to achieving objective 1.

[138] The next policy assists policy 3 by providing a checklist of some of the matters to be considered when allocating water. It is[222]:

> **Policy 4** [to] consider ... the following matters when setting environmental flow and level regimes:
>
> a. mauri and healthy ecosystems of indigenous species, including mahinga kai species;
> b. wahi tapu sites or areas, and wahi taonga;
> c. natural character, landscape, and visual amenity;
> d. vegetation within and adjacent to the water body;
> e. habitats including those of invertebrates, birds and fish;
> f. fish passage, as appropriate, including controlling spread of non-indigenous species into new areas;
> g. undesirable periphyton and sediment accumulation;
> h. effects on water quality;
> i. maintenance of groundwater flows;

221 Waitaki Catchment Water Allocation Regional Plan, p. 26.
222 WCWARP, Policy 4, [p. 26].

j. naturally occurring dry river or stream beds;
k. the potential for establishment of invading exotic vegetation;
l. bedload and sediment transport processes;
m. shoreline or bank erosion;
n. functioning of the river mouth;
o. recreation opportunities;
p. existing flow and level regimes, physical resources and activities;
q. the amount and reliability of water that can be taken, used, dammed or diverted; and
r. accessibility to water bodies and their margins.

Most of those matters can logically be seen to be relevant to objective 1. There are only a few exceptions: visual amenity in matter c., shoreline and bank erosion in matter m., recreation opportunities in matter o., and accessibility in matter r., relate more to objective 2.

[139] There is a specific policy in respect of groundwater which may be relevant. It is:

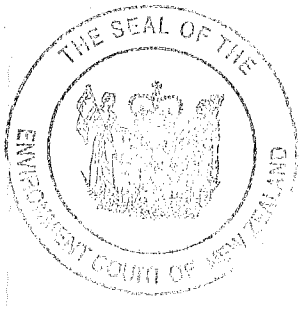
Policy 5[223] [to] consider … the following additional matters when setting groundwater flow and level regimes:

Cross-ref: Objectives 1 and 2

a. any surface water body into which the groundwater flows, in particular wetlands and springs;
b. the long-term water level and/or artesian pressure in each aquifer;
c. the location of the salt-water interface;
d. the potential for deterioration in water quality through water loss from one aquifer to another as a result of cross-connection and/or reversed pressure gradients between aquifers; and
e. the potential for land subsidence.

Of those matters a., b. and (possibly) d. are relevant in these proceedings.

[140] The explanation for policies 3-5 includes the following:



223 Waitaki Catchment Water Allocation Regional Plan, p. 27.

The range of components that may make up the environmental flow and level regime in any particular instance include flow-sharing, allocation limits, flushing flows and minimum flows and levels.

...

Policies 4 and 5 identify the matters considered when setting environmental flow and level regimes and these should be addressed when considering any application for a resource consent that is a non-complying activity in respect of the environmental flow and level regimes established in this Plan. Because the Plan does not set environmental flow and level regimes for groundwater (other than that covered by Policy 6), applications to take or use groundwater will be considered against Policy 4 and 5.

[141] Further relevant general policies are[224]:

Policy 6

To recognise the close connection between groundwater and surface water in some locations, by requiring any take, use or diversion of:

Cross-ref:

a. connected groundwater;

Objectives 1 and 2

...

c. shallow groundwater in the Hakataramea and Maerewhenua catchments

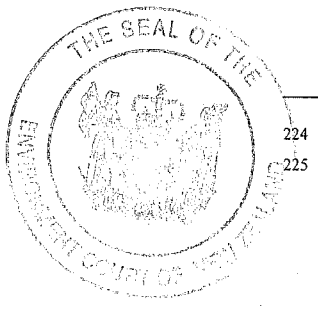
to comply with environmental flow and level regimes set for the relevant surface water body.

...

'Connected groundwater' is defined in the WCWARP as meaning[225]:

(i) The full amount of water specified in a resource consent to take groundwater is considered connected groundwater if the effect of seven days groundwater abstraction on the surface water body is equal to or greater than 90 percent of a continuous steady abstraction rate.

Otherwise



224 Waitaki Catchment Water Allocation Regional Plan, p. 28.
225 Waitaki Catchment Water Allocation Regional Plan, Chapter 10, Definitions [p. 59].

(ii) The stream depletion effect is considered connected groundwater provided it is greater than 5 l/s. The stream depletion effect is that determined as the effect after 150 days groundwater abstraction at a continuous abstraction rate consistent with the flows specified in the resource consent.

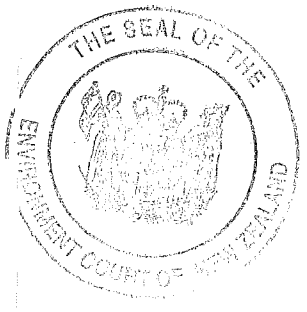
[142] Then there is an express policy with a biblical ring – the policy 'on the mixing of waters'[226]. It is:

Policy 9	(1)	… [to] discourag[e]… further taking, use or diverting of water so that it mixes with water of another catchment or sub-catchment.
Cross-ref: Objective 1	(2)	The adverse effects of taking, use or diverting of water so that it mixes with water of another catchment or sub-catchment may be mitigated:
		a. if the mixing has no significant adverse effect on the ability of people and communities (including tangata whenua) to provide for their cultural wellbeing.
		b. if the water taken, used or diverted passes through earth before it mixes with water of another catchment or sub-catchment.
		c. if there is no significant adverse effect on the quality, amenity values or natural character of any receiving water body in the Waitaki catchment.
		d. if there is no significant risk of an undesirable organism being introduced into a receiving water body that is in the Waitaki catchment.

The second subpolicy appears to be a proviso to the first.

[143] There is a 'small quantity' policy under the rather ambiguous title[227] 'Policies on the allocation to activities'. It is:

Policy 10	[to] enabl[e]… small amounts of water to be taken or diverted, outside of the water bodies identified in Policy 2, where singly and cumulatively with other such takes or diversions, the amounts are so small that the effects on the matters outlined in Policy 4 and 5 will be minor.
Cross-ref: Objectives 2 and 3	



226 Waitaki Catchment Water Allocation Regional Plan, p. 29.
227 Waitaki Catchment Water Allocation Regional Plan, p. 30.

Explanation

Outside of the water bodies identified as needing a high level of protection to preserve their high natural character, this policy recognises that there are some water uses that are of sufficiently minor effect that they can occur without significant adverse effects. These can be permitted without requiring a resource consent for each take or diversion.

This policy and the associated rules do not apply to the taking and using of freshwater for an individual's reasonable domestic needs and the reasonable needs of an individual's animals for stock water. These takes and uses under section 14(3)(b) of the RMA do not require a resource consent if the taking or use does not, or is not likely to, have an adverse effect on the environment. Water for fire-fighting can be taken and used without resource consent. Rule 1 which implements this policy substantially mirrors the quantity of water permitted to be taken by the Canterbury Transitional Regional Plan.

[144] A policy under the same heading but with wider effect[228] is:

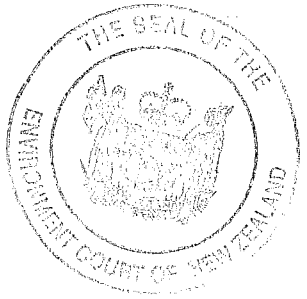
Policy 11	In considering effects when allocating to activities under the provisions of this Plan:	
Cross-ref:	a.	Tangata whenua values are those held by Ngai Tahu.
Objectives 2 and 3	b.	national effects refer to those that arise within New Zealand.
	c.	local effects refer to those that arise in the Mackenzie District, the Waimate District and the Waitaki District.

The Explanation states that:

> This policy presents the scope of effects as they apply to this Plan. Part (a) reflects the Ngai Tahu Claims Settlement Act 1998 which recognises the mana of Ngai Tahu in relation to a range of sites and areas in the South Island.

Ngai Tahu is defined in the WCWARP as meaning:

> The collection of individuals who descend from the primary hapu of Waitaha, Ngati Mamoe, and Ngai Tahu, namely Kati Kuri, Kati Irakehu, Kati Huirapa, Ngai Tuahuriri and Kai Te Ruahikihiki.



228 WCWARP p. 30.

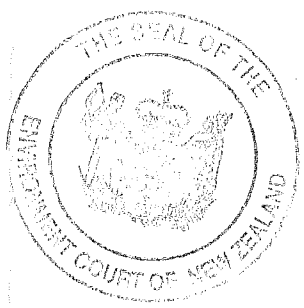
[145] The general allocation policy is[229]:

> **Policy 12** To establish an allocation to each of the activities listed in Objective 2 by:
>
> Cross-ref: Objectives 1, 2, 3, 4 and 5
>
> a. having regard to the likely national and local effects of those activities;
> b. reference to relevant national, regional and local plans and strategies;
> c. recognising the iconic nature of Lakes Tekapo, Pukaki and Ohau;
> d. recognising the importance of Lakes Tekapo, Pukaki, Ohau, Ruataniwha, Benmore, Aviemore and Waitaki and their associated infrastructure to New Zealand's electricity system;
> e. recognising the importance of irrigation for agriculture and horticulture;
> f. considering the relative environmental effects of the activities including effects on landscape, water quality, mauri, and the beds of lakes and rivers;
> g. assuming a high level of efficacy and technical efficiency;
> h. giving a preference to needs for water within the catchment; and
> i. expressing the allocation to activities in annual volumes:
>
> - upstream of the outlets of each of Lakes Tekapo, Pukaki, and Ohau;
> - upstream of Waitaki Dam;
> - downstream of Waitaki Dam but upstream of Black Point; and
> - downstream of Waitaki Dam but downstream of Black Point.

We consider each of those matters later (other than c. and d.) to the extent relevant.

[146] Policies 13 and 14 are not of direct relevance to this case since they are concerned with, respectively, the allocation of water for agricultural and horticultural uses and with allocation of water for use outside the catchment.

[147] The policies on efficient and effective use include (relevantly)[230]:



229 Waitaki Catchment Water Allocation Regional Plan, p. 31.
230 Waitaki Catchment Water Allocation Regional Plan, p. 33.

Policy 15 By ensuring that the rate of abstraction and the annual volume of resource consents for taking, using, damming or diverting water are reasonable for the intended end use, and thereby avoiding significant wastage of water.

Cross-ref: Objectives 1, 2, 3 and 4

...

[148] There is a set of policies on restrictions during times of low water availability. These are relevant because there will probably be prolonged periods when the Waitaki Dam to Stonewall section of the river is flat-lining at or a little above a flow of 121m^3/sec. They are[231]:

Policy 23 By ensuring environmental flow and level regimes are complied with by requiring all consent holders to restrict their rate of taking or diverting shallow groundwater (upstream of Lake Benmore, in the Maerewhenua catchment or in the Hakataramea catchment), connected groundwater, or surface water when the amount of water available for taking or diverting is low, except where the water is used for essential domestic uses, essential animal drinking needs and for the processing and storage of perishable produce.

Cross-ref: Objectives 1 and 5

Policy 24 By allowing consent holders to take water for domestic, stock drinking-water uses and for the processing and storage of perishable produce when rivers or lakes are at or below minimum flows or levels provided the amount taken does not exceed 250 litres per person per day based on the population being supplied at that time, plus actual stock drinking-water requirements, plus the minimum necessary to maintain fire-fighting capability and for the processing and storage of perishable produce. In addition, an allowance may be made for reasonable losses from reticulated supply schemes.

Cross-ref: Objectives 1, 4 and 5

Policy 25 By allowing the restrictions on takes and diversions to be achieved by sharing the available water between resource consent holders within a water-users group, provided the total amount taken by any individual does not exceed their resource consent, and the sum of the takes does not exceed the water available above the minimum flow or minimum lake level.

Cross-ref: Objectives 1, 4 and 5

231 Waitaki Catchment Water Allocation Regional Plan, p. 36.

[149] Policy 26 does not apply to the main stem of the Waitaki but to tributaries. Policy 46, considered later, provides a separate regime for the lower Waitaki River.

[150] The explanation for policies 23-27 states[232]:

> This suite of policies sets out how restrictions will be applied when, on a run-of-river basis, there is not enough water for all resource consent holders to take, divert or use at the peak rates specified in their consents.
>
> ...
>
> Where a consent is for combined uses, only that proportion of the consent that is identified for essential uses is exempt from the restrictions.
>
> Policy 25 encourages water-user groups as a means for users to collectively manage their cumulative abstraction within the limits of the environment flow and level regime.

[151] A policy on replacement of existing consents states[233]:

> **Policy 28** In considering whether to grant or refuse applications for replacement of existing consents[234], the consent authority will:
>
> Cross-ref: Objectives 3 and 4
>
> a. consider whether all reasonable attempts to meet the efficiency expectations of this Plan have been undertaken;
>
> b. recognise the value of the investment of the existing consent holder; and
>
> c. maintain the inclusion of the consent, if granted, in any allocation limits and priority bands on the water body concerned.

---

232 Waitaki Catchment Water Allocation Regional Plan, pp 36-37.

233 Waitaki Catchment Water Allocation Regional Plan, p. 38.

234 Footnote 9 in the Waitaki Catchment Water Allocation Regional Plan states: "Sections 124A, 124B and 124C as inserted into the RMA by the Resource Management Amendment Act 2005 will apply to applications for a new consent to replace an existing consent from 10 August 2008. These sections set up a process to give existing consent holders priority (in having their application determined) over new applications when an existing consent holder applies for a new consent to replace an existing consent."

Explanation

There is no right of renewal of a resource consent, and this policy provides guidance on how an application to replace an existing consent should be considered by the consent authority. The consideration of the efficiency of use of water being used under an existing consent is critical to ensure that the efficiency expectations of this Plan are implemented. The policy provides for maintaining an existing consent in the same allocation limit and priority band when it is replaced. It also provides for recognition of the value of the investment when an application for replacement is considered.

[152] There is then a set of 'Policies for High Natural-Character Water Bodies'[235]. They start:

Policy 29 By recognising the high natural character of the water bodies listed in Policy 2 through restricting the cumulative allocation to activities from them.

Cross-ref:
Objectives 1 and 2

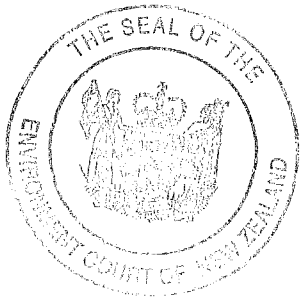
Policy 30 By preventing the taking, using, damming or diversion of water from Lakes Alexandrina, McGregor[236] and Middleton and their tributaries, other lakes[237] upstream of Lakes Tekapo, Pukaki and Ohau **and wetlands**, unless it is a wetland that is not a wetland with a moderate or higher significance, for the purpose of protecting their:

Cross-ref:
Objective 1

a. natural character intrinsic and amenity values;
b. ecosystems of indigenous species, including mahinga kai species;
c. Ngai Tahu relationships; and
d. trout and salmon habitat (where these species are currently found).

[our emphasis]

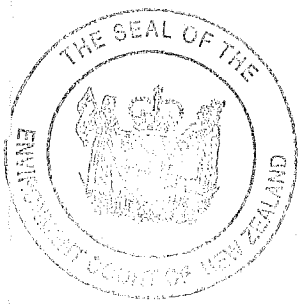
The divisions used for most of the locality-specific policies are illustrated on Map 2 of the Waitaki Catchment Water Allocation Regional Plan. The exception is that the locality of all the high natural character wetlands is not shown.



235 Waitaki Catchment Water Allocation Regional Plan, p. 39.
236 Lake McGregor has a statutory acknowledgement in the Ngai Tahu Claims Settlement Act 1998.
237 Lakes, as defined by the RMA, includes tarns.

[153] Policy 31 relates to the rivers flowing into high country lakes (Tekapo, Pukaki and Ohau). Policies 32 – 34 then state[238]:

Policy 32 Cross-ref: Objectives 1 and 2	In considering whether to grant or refuse consents to take, use, dam or divert water from the High Natural-Character Water Bodies, the consent authority will ensure that any taking, using, damming or diverting of water does not, by itself, or in combination with any other take, use, dam , or diversion in the same area, have a more than minor adverse effect on: a. the natural flow variability b. mauri, and ecosystems of indigenous species, including mahinga kai species c. indigenous vegetation within and adjacent to the water body d. natural character and landscape e. sites of wahi tapu f. sites of wahi taonga g. habitats including those of invertebrates, birds and fish h. passage and spawning areas for trout and salmon (where these species are currently found) i. amenity values, including wild and scenic values j. existing water quality.
Policy 33 Cross-ref: Objectives 1 and 2	In considering whether to grant or refuse consents to take, use, dam or divert water from the High Natural-Character Water Bodies the consent authority will recognise the need for taking, using, damming and diverting of water to be distributed among High Natural-Character Water Bodies to avoid the concentration of effects on any one water body.
Policy 34 Cross-ref: Objectives 1 and 2	In considering whether to grant or refuse consents to take, use, dam or divert water from the High Natural-Character Water Bodies the consent authority will, for activities for which water is taken and returned to the sub-catchment such as snow-making and micro hydro-electricity generation, have regard to any benefit of returning the water to the vicinity of the take or diversion point provided the take or diversion is consistent with Policies 32 and 33.



238 Waitaki Catchment Water Allocation Regional Plan p. 40.

[154] The Explanation for policies 29 – 34 states[239]:

> These policies recognise the high natural character of particular water bodies within the catchment and generally control the taking, using, damming or diversion of water from them. In the most sensitive water bodies, (moderate or higher significance wetlands, Lakes Alexandrina, McGregor and Middleton and their tributaries and other lakes upstream of Lakes Tekapo, Pukaki and Ohau) taking, using, damming or diversion of water is prevented.
>
> Policies and subsequent rules recognise that there are some water uses that are of sufficiently minor effect that they may be able to occur without materially disturbing the special features of these areas. In the case of wahi tapu this may be a stringent test.

[155] Unlike policy 2, policy 30 does "... prevent ... the taking, using, damming or diversion of water from ... wetlands, unless it is a wetland that is not a wetland with a moderate or higher significance ..."[240]. That raises the question whether policy 30 is consistent with policy 2 at least in respect of wetlands in that [unless (in both cases) the wetland has low significance] policy 2 provides for a high level of protection for wetlands whereas policy 30 simply 'prevents' takes and diversions. Policy 30 is absolute, allowing no shades of compromise, whereas Policy 2 does (albeit with care) if a high level of protection is achieved.

[156] The policy for the Hakataramea catchment[241] includes one that is relevant to the NBTC. Policy 43 is to:

> ... set ... an environmental flow regime in the Hakataramea River that:
>
> (i) recognises:
>
> ...
>
> b. the importance of maintaining flows through the wetlands at the confluence of the Hakataramea River with the Lower Waitaki River.

239 Waitaki Catchment Water Allocation Regional Plan, p. 40.
240 Waitaki Catchment Water Allocation Regional Plan, p. 39.
241 Waitaki Catchment Water Allocation Regional Plan, p. 43.

We understand that wetland to be called the 'Fettercairn II' wetland[242] and, as we shall see, it is likely to be affected by operation of the NBTC.

[157] The relevant 'Policies for the lower Waitaki River' (main stem) are[243]:

> **Policy 45**
>
> Cross-ref:
>
> Objectives 1 and 2
>
> (1) [to] set … an environmental flow regime in the Lower Waitaki River that:
>
> (i) maintains
>
> a. the physical characteristics (including flow variability) of a dynamic braided river;
>
> b. the physical and ecological functioning of the river mouth;
>
> c. the connectedness of the main flow with riparian margins, wetlands, and back water areas;
>
> d. habitats for aquatic plants, invertebrates, birds and fish;
>
> e. support for cultural relationships (including those of Ngai Tahu) with the river;
>
> f. the opportunity for people to experience the river's aesthetic characteristics, including openness, naturalness, and magnitude; and
>
> g. recreational opportunities;
>
> and
>
> (ii) enables appropriate access to water for the activities identified in Objective 2, to the extent consistent with Objective 1.
>
> (2) In deciding whether to grant or refuse consent for an application to take, use, dam or divert water from the Lower Waitaki River upstream of Black Point that would result in a cumulative peak rate of abstraction greater than 90 cubic metres per second, the consent authority will have regard to the extent to which the exercise of the consent would maintain the matters listed in Policy 45(1)(i).

242 Ms D M Robertson, evidence-in-chief Table 1 [Environment Court document 13].
243 Waitaki Catchment Water Allocation Regional Plan, pp 44-45.

Policy 46 By maintaining a flow of water into the Lower Waitaki River downstream of the Waitaki Dam that is sufficient to maintain:

Cross-ref: Objectives 2, 3 and 5

(i) the minimum flow and flushing flows of the environmental flow regime for the Lower Waitaki River;

and

(ii) the aggregate of:

a. the actual requirements of exercising existing[244] and new[245] consents (at their points of taking) in the Lower Waitaki River for town and community water supplies, industrial and commercial activities, tourism and recreational facilities, and any other activities provided for within the annual allocations for all those activities; and

b. the actual requirements of exercising existing[246] consents for agricultural and horticultural activities (at their points of taking) in the Lower Waitaki River provided for within the annual allocation for those activities; and

c. the actual requirements of exercising, up to 95 percent of the peak rate of taking, of new[247] consents for agricultural and horticultural activities (at their points of taking) in the Lower Waitaki River provided for within the annual allocations for those activities;

up to a maximum of 80 cubic metres per second.

[158] The explanation for policies 45-46 states[248]:

These policies describe the basis on which the environmental flow regime for the Lower Waitaki River has been set. In the rules, there are two different environmental flow regimes set in the Lower Waitaki River, both of which contain minimum flows. For the reach downstream of Black Point, flow variability above the minimum flow is provided for by an allocation limit. In the reach between Waitaki Dam and Black Point, variability above the minimum flow is provided for by flushing flows and the requirements in Policy 45(2).

---

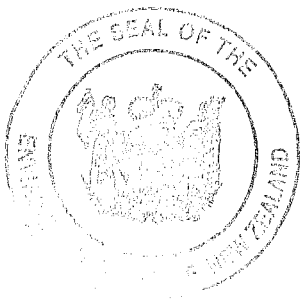
244 Authorised by resource consent in effect on the date the Plan becomes operative; and a consent in replacement of it.

245 Not authorised by resource consent in effect on the date the Plan becomes operative.

246 Authorised by resource consent in effect on the date the Plan becomes operative; and a consent in replacement of it.

247 Not authorised by resource consent in effect on the date the Plan becomes operative.

248 Waitaki Catchment Water Allocation Regional Plan, p. 45.



> Because the flow in the river is artificially controlled, the reliability for downstream users is dependent on the pattern of flow releases.

3.4 The rules in the Waitaki Catchment Water Allocation Regional Plan

3.4.1 The rules

[159] Rule 1 states[249]:

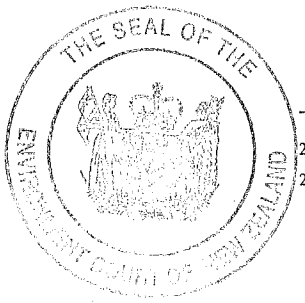
> Subject to rules 9 and 10, no person shall take, use or divert more than 10 m^3/day per property at a rate not exceeding 5 litres per second.

At first sight this rule is worded negatively which is rather curious given that section 14 of the Act provides that no person may take, use, dam or divert any water unless allowed by section 14(3). One of the exceptions in section 14(3) is where:

> (a) The taking, use, damming, or diversion is expressly allowed by a rule in a regional plan and in any proposed regional plan or a resource consent.

However, we consider that the main purpose of rule 1 is, as the cross-reference to rule 10 suggests, to allow small takes as permitted by the Canterbury Transitional Regional Plan, while ensuring that the subsequent rules as to minimum flow are also complied with. Because the rules are drafted as a package rule 1 is also used as a catch-all, whereby any take use or diversion which exceeds the rates in the rule requires resource consent (rules 9 and 10 are not relevant here).

[160] Because the volume to be taken vastly exceeds the limit in rule 1, the fundamental rule for Meridian's applications is rule 2. It states[250] (relevantly):



249 Waitaki Catchment Water Allocation Regional Plan, Section 8, Rules [p. 46].
250 Waitaki Catchment Water Allocation Regional Plan, pp 46-49.

Rule 2

Cross-ref:
Policies 1-8, 23, 24, 28, 29, 32 and 38-45

(1) Except as provided in (2) and (3), no person shall take, use, dam or divert surface water or groundwater unless:

a. the flow in the relevant river or stream, or the level in the relevant lake, is above the minimum flow or level in Table 3; and

b. the amount taken or diverted from the relevant river or stream is for a replacement consent[251] or in combination with the amount of water authorised to be taken or diverted by existing resource consents, does not exceed the allocation limits in Table 3; and

c. the take or diversion complies with a flow-sharing regime such that no more than half of the water above or between the thresholds in Table 3 can be taken or diverted; and

d. the consent holder provides the flushing flows in Table 3 xvii(b) where applicable.

(2) Water taken for essential drinking, stock drinking-water, maintaining fire-fighting capacity, and for the processing and storage of perishable produce is exempt from minimum flow and level and flow-sharing regimes.

(3) Water taken or diverted and returned to the same water body in the vicinity of the take or diversion point, in the same condition and quality as taken, for micro hydro-electricity generation or fisheries and wildlife, is exempt from the allocation limits in Table 3.

[161] Table 3 is very long. The relevant provisions are:

251 With the same or lesser amounts of water to be taken or diverted.

Table 3: Environmental flow and level regimes for water bodies in the Waitaki catchment

Water bodies	Environmental Flow regimes
i. High Natural-Character Water Bodies as defined in Policy 2a, b and c	a. An allocation limit of 10% of the Mean Annual Low Flow of the water body as assessed by the Canterbury Regional Council b. No flow-sharing regime
...	...
xvi. Lake Waitaki	a. A minimum lake level of 227 metres a.m.s.l.
xvii. Lower Waitaki River	a. A minimum flow from Waitaki Dam to the sea of 150 m^3/s, except that: if, throughout the period from 1 November in any year to the following 30 April, the sum of all the catchment inflows above Waitaki Dam as determined by the Canterbury Regional Council are less than, or equal to, the 1-in-20 year inflows, then, during the following period from 1 June to 31 August, a minimum flow equivalent to the natural flow at Waitaki Dam or 150 m^3/s which ever is the lesser b. From Waitaki Dam to Black Point, flushing flows of at least 450 m^3/s for not less than 24 hours are to be provided no less than 7 times per year, no fewer than 2 of which are to be in the period 1 February to 31 March in every year c. An allocation limit of 90 m^3/s not counting any flows abstracted from the Lower Waitaki River above Black Point that are returned to the Lower Waitaki River above Black Point d. All flows in the Lower Waitaki River determined for the purpose of this item xvii are to be based on measurements at the Kurow recorder[252] and based on 1-hour rolling averages e. No flow-sharing regime

[162] Rule 3 is not relevant except for interpretative purposes. We refer to it later. Another important rule – because of the potential impact of the NBTC on wetlands – is rule 4. It states[253]:

252 Water level recording site number 71104.
253 Waitaki Catchment Water Allocation Regional Plan, p. 51.

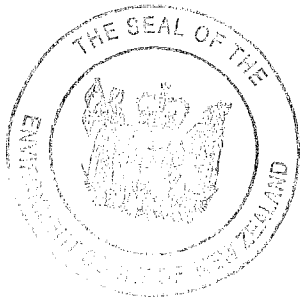
Rule 4	No person shall take, use, dam or divert water from a wetland[254] that:	
	a.	has not yet been classified according to the criteria for classifying wetlands in Chapter 7 of the Natural Resources Regional Plan; or
Cross-ref: Policies 1, 2, 4 29 and 30	b.	has been so classified as a wetland with a moderate or higher significance.

[163] Rule 5 relates to the upper Waitaki catchment and is only relevant to interpretation of rule 4.

[164] Another rule which is relevant at first sight provides limits on 'the annual allocation to activities'. It is[255]:

Rule 6	(1)	Except as provided in (2), no person shall take, use, dam or divert water when, by itself or in combination with any other take, use, dam, or diversions, the sum of the annual volumes authorised by resource consent, exceeds the annual allocation to that activity in Table 5.
Cross-ref: Policies 1, 10-14, and 31	(2)	Water taken or diverted and returned to the same water body in the vicinity of the take or diversion point, in the same condition and quality as taken, for micro hydro-electricity generation or fisheries and wildlife, does not need to be accounted for in the annual allocation to activities in Table 5.

[165] In fact the take or diversion for hydro-electricity generation in Table 5 turns the issue back to rule 2 as the relevant entry (emphasised) in Table 5 below shows:



254 As defined in section 2 of the RMA.
255 Waitaki Catchment Water Allocation Regional Plan, p. 52.

Table 5: Annual allocations to activities

Note: units = millions of m^3 per year.

		Town and Community water supplies	Industrial and commercial activities (outside municipal or town supply areas)	Tourism and recreational facilities	Agricultural and horticultural activities	Any other activities	**Hydro-electricity generation**
i.	Upstream of Lake Tekapo outlet	1.6	NIL	0.6	275[256]	NIL	All other inflows
...							
v.	Downstream of Waitaki Dam but upstream of Black Point	3	1	2	150	16	**All other flows except the flows that must remain in the rivers, pursuant to the <u>environmental flow regimes</u>**
vi.	Downstream of Waitaki Dam but downstream of Black Point	19	8.5	4.3	1100	144	

[166] Rule 7 is designed to ensure that existing permit holders below the Waitaki Dam have enough water coming down to them to be able to exercise their rights. It is:

Rule 7

Cross-Ref:

Policies 10-14, 46

In addition to the <u>minimum flows</u> and <u>flushing flows</u> of the <u>environmental flow regime</u> for the Lower Waitaki River, the consent-holder for the Waitaki Dam shall provide flows in the Lower Waitaki River sufficient to meet the actual requirements of activities identified in Policy 46(ii) (at their points of taking), up to a maximum of the flows in Table 6.

Table 6: Provision of flows into the Lower Waitaki River

Month	Flows to be provided above the <u>minimum flow</u> (in m^3/s)
October to March	80
April and September	50
May and August	20
June and July	10

256 While the consents to operate the Waitaki power scheme remain in force, the Upper Catchment is already fully allocated to a holder of those consents and other existing consent holders (see discussion at p.14 of the s.32 report).

[167] There are two relevant rules as to the status of the proposed water permit[257]:

> **Rule 13** Any activity that does not comply with Rule 4 is a prohibited activity.
>
> **Rule 16** Any activity which contravenes any of Rules 2, 6 or 7 is a non-complying activity. In considering an application to which this rule applies the consent authority will have regard, among other matters, to all the policies of this Plan.

3.4.2 Provisions of the proposed NRRP incorporated by reference

[168] Clause 30 of the First Schedule to the RMA provides that certain material[258] may be incorporated by reference in a plan and if it is then it "... has legal effect as part of the plan ..."[259]. We have already mentioned that the Waitaki Catchment Water Allocation Board used that power in respect of an Appendix to Chapter 7 (Wetlands) of the proposed NRRP. In fact the full list of material incorporated by reference in the WCWARP is as follows[260]:

> 1. The following provisions of the Proposed Canterbury Natural Resources Regional Plan (adopted by the Canterbury Regional Council on 28 March 2002 and publicly notified on 1 June 2002 for submissions, including variation 1 to that plan, adopted by the Canterbury Regional Council on 27 May 2004 and publicly notified on 3 July 2004 for submissions):
>
> - Section 1.3.1 Cross boundary processes
> - Objective WQL1 Water quality outcomes for rivers and lakes
> - Objective WQL2 Water quality outcomes for groundwater and contaminated land
> - Objective WQL3 Water quality outcomes for community drinking water sources
> - Section 5.7 Making resource consent applications and providing information
> - Section 5.10 Financial contributions
> - Section 5.12 Water quantity monitoring
> - Table WQN26: Daily Stockwater requirements
> - Table WQN27: Example of application of provisions for stockwater
> - Appendix WTL1: Wetland Assessment Methodology

257 Waitaki Catchment Water Allocation Regional Plan, pp 54-55.
258 Clause 30(1) of the First Schedule to the RMA.
259 Clause 30(3) of the First Schedule to the RMA.
260 See Certification dated 30 September 2005 by the Board [WCWARP Material Incorporated by Reference p. 2].

2. Table A1 in "Schedule WQN9 Revision – Review of seasonal use approach included in proposed NRRP". Report U05/15, May 2005. Prepared for Environment Canterbury by Anthony Davoren and David Scott.

[169] Some of the rules in Chapter 5: Water Quantity of the proposed NRRP are incorporated by reference, specifically those on:

- making resource consent applications;
- financial contributions;
- water quantity monitoring.

[170] The rules in making applications for resource consents include both general information requirements[261] and specific information requirements[262]. The latter are broken into applications for:

- the taking, using, damming or diverting of surface water[263];
- the taking and use of groundwater[264];
- the planting of forestry in flow-sensitive catchments.

Applications for the diversion of groundwater do not have specific information requirements.

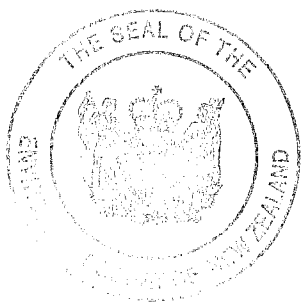
[171] Rule 5.10 in Chapter 5: Water Quantity of the proposed NRRP provides for financial contributions. The primary purpose of such financial contributions is "... to offset the actual or potential loss or reduction of instream or riparian habitat values ..."[265].

261 Rule 5.7.2 [Proposed NRRP Chapter 5 pp. 5-163 and 5-164].
262 Rule 5.7.3 [Proposed NRRP Chapter 5 p. 5-164].
263 Rule 5.7.3.1 [Proposed NRRP Chapter 5 p. 5-164].
264 Rule 5.7.3.2 [Proposed NRRP Chapter 5 p. 5-166].
265 Rule 5.10(b) [Proposed NRRP Chapter 5 p. 5-192].

[172] Finally we draw attention to the potential confusion in incorporating provisions of a proposed (regional) plan into an operative plan – which is that the proposed plan may change due to submissions or be withdrawn. However, once part of any proposed plan is included in an operative plan it becomes part of the latter plan so that a general regional plan may (when the proposed plan becomes operative, perhaps after changes are made as a result of submissions) have provisions dealing with the same issues that are different from, and perhaps inconsistent with, a more specific regional plan. We suspect the Waitaki Catchment Water Allocation Board was alert to these problems because of the care it took in having the relevant provisions of the proposed (general) NRRP printed as a separate volume of the WCWARP.

3.4.3 Are the NBTC's proposed activities prohibited under rules 4 and 13?

[173] Anticipating our predictions as to the potential effects of the NBTC it is likely that the water take (if consents are granted) would generally lower the level of groundwater close to the river (in places by 0.50 metre) and partly dewater some wetlands. For the Society Ms Owen submitted that those effects amount to a diversion of the water either from wetlands that have not been classified (under Chapter 7 of the proposed NRRP) or from wetlands that have been classified as having moderate or higher significance, so that rules 4 and 13 of the WCWARP together make the diversions prohibited activities. Assuming for the present that she is correct as to the facts – i.e. that the wetlands have been classified under Appendix WTL1 of the proposed Chapter 7 as wetlands of moderate or higher significance, or not yet classified at all – we now consider whether her legal argument is correct. We must[266] look at the text of the rule and its purpose, and we may[267] look at the organisation and format of the WCWARP. We must also remember that, as stated by Woodhouse P for the Court of Appeal in *J Rattray & Son Limited v Christchurch City Council*[268] (approved for instruments under the RMA by the Court of Appeal in *Powell v Dunedin City Council*[269]):



266 Section 5(1) Interpretation Act 1999.
267 Section 5(2) and (3) Interpretation Act 1999.
268 *J Rattray & Son Limited v Christchurch City Council* (1984) 10 NZTPA 59 at 61 (CA).
269 *Powell v Dunedin City Council* [2005] NZRMA 174 at [30] (CA).

> ... assistance not only may but ought to be sought from the composite planning document taken as a whole whenever obscurities or ambiguities might seem to arise.

In this case the composite document is the WCWARP including the provisions of the proposed NRRP included by reference as discussed above.

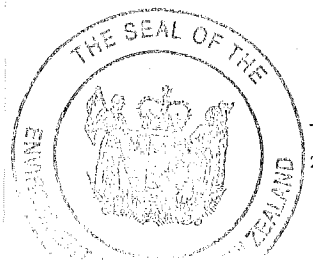
The meaning of the words in rule 4

[174] Rule 4 states:

> No person shall take, use, dam or divert water from a wetland that:
>
> a. has not yet been classified ...
>
> b. has been so classified as a wetland with a moderate or higher significance.

Obviously rule 4 is not as clear as it might be. For a start it is vague as to who is to do the classification of wetlands. Secondly, the rule is ambiguous as to where water is to be diverted from. Finally, when one looks at Appendix WTL1 'classification' is not the only step required under Chapter 7 of the proposed NRRP.

[175] The word 'divert' is not defined in the RMA. The normal use of the phrase 'divert from' when used of a thing or substance is that it means to change the course or path of the thing or substance so that it does not arrive where it otherwise would For the Society Ms Owen implicitly adopted that definition when she referred to *Chatham Islands Seafoods Ltd v Wellington Regional Council*[270]. We accept that if the normal meaning of 'divert' is used then the NBTC does divert water from wetlands between Kurow and Stonewall because the current surface water and groundwater will not reach many wetlands in the same quantities or at the same levels. Thus there would be a prohibited diversion under rule 4 in respect of each affected wetland (unless it had been classified as having a less than moderate significance).



270 *Chatham Islands Seafoods Ltd v Wellington Regional Council* Decision A18/2004.

[176] Because the text must be interpreted in its "immediate context" – *Powell v Dunedin City Council*[271] – and because definitions must be part of any immediate context, we consider 'divert' should be presumed to be used in the same way in the WCWARP as in the proposed NRRP. As it happens there is a definition of 'divert' in the proposed NRRP which states[272]:

> ... to alter in any way the natural course of water flows, whether over or under the ground. It includes but is not limited to cases where all or some of the flow is returned to the same water body further downstream.

Accordingly rule 4 can be expanded so that it reads:

> no person shall take, use, dam or [alter in any way the natural course of (water flows)] water from a wetland.

The words '... water flows' in the definition appear to be redundant in this context. The important point about rule 4 once the proposed NRRP definition is added is that we find that rule 4 is concerned with water flowing <u>from</u> a wetland, not with water flowing into it.

[177] We hold that, on its correct literal interpretation in its immediate context and, using the definition in the proposed NRRP, the first part of rule 4 should be as follows:

> No person shall:
>
> (a) take or use water from the wetland; and
>
> (b) dam the wetland at any point; and/or
>
> (c) alter the natural course of water flows from a wetland
>
> ...

An example of this sort of diversion would be to dig a drain leading water away in an artificial manner from the wetland.

---

271 *Powell v Dunedin City Council* (2005) 11 ELRNZ 144; [2005] NZRMA 174 at para [35] (CA).

272 Proposed NRRP, Chapter 4 – Water Quality – p. 4-301.

The purpose of rule 4

[178] The marginal notes to rule 4 refer to policies 1, 2, 4, 29 and 30. So the purpose of the rule is to implement the policies recognising:

- the importance of the connectedness of all parts of the catchment (policy 1);
- the high level of protection that is due to specified categories of water bodies (policy 2);
- the potential impact of cumulative allocations on the high natural character of the water bodies listed in policy 2 (policy 29); and
- the need to prevent the taking, use, damming or diversion from those water bodies (policy 30).

The overall purpose of rule 4 as revealed in these policies suggests that the rule may be about water flowing into wetlands as well as out.

[179] Given the interconnectedness[273] of the river, aquifers and groundwater in the lower Waitaki, every take from the river, its tributaries, a spring or a well is likely to have an effect, however small, on the riparian wetlands and possibly some of the terrace wetlands of the lower catchment. In that case every take diverts water from wetlands. That would explain and justify a rule (rule 4) that states that, where those wetlands have not been classified (systematically or otherwise) or classified as of moderate or higher significance, the takes are prohibited activities.

The scheme and layout of the WCWARP

[180] The scheme of the rules of the WCWARP is guided by the heading for each group of rules:

- rules 1 – 5 set environment flow and level regimes[274];
- rules 6 and 7 come under the heading[275] 'rule [sic] on the annual allocation to activities';

273 Recognised in Policy 1 [Waitaki Catchment Water Allocation Regional Plan p. 25].
274 Heading above rule 1, Chapter 8, Rules [WCWARP p. 46].
275 Heading above rule 6, Chapter 8, Rules [WCWARP p. 52].

- rule 8 is about transfer of resource consents[276];
- rules 9 – 24 give the status[277] of various activities;
- rule 25 identifies the role of the rules in relation to existing resource consents;
- rules 5.7, 5.10 and 5.12 of Chapter 5: Water Quantity of the proposed NRRP (incorporated by reference) provide for respectively:
  - making resource consent applications;
  - financial contributions;
  - water quality monitoring.

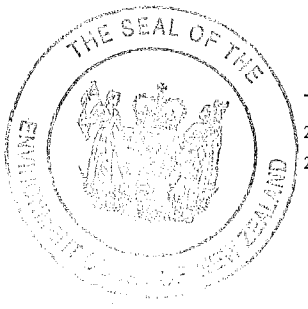
Rule 2 is the general rule as to flow regimes. It provides that no person shall take or divert surface, water or groundwater unless certain conditions are met. Rule 3 similarly covers the taking of water from lakes Tekapo, Pukaki and Ohau.

[181] The proposed NRRP meaning of 'divert' is to alter the natural course of water. But an alteration of water so that it is directed away from a wetland before it reaches the wetland must be a diversion of either surface water or groundwater which is managed under rules 1 or 2. Further, rules 3 and 5 cover specific circumstances – specifically taking, using, damming water or diversions of water in:

- Lakes Tekapo, Pukaki and Ohau (rule 3);
- Various smaller lakes (rule 5).

[182] Each of the rules 3 to 5 uses the formula:

> 'No person shall take, use, dam or divert water from … [an identified water body or class of water body].



276 Heading above rule 8, Chapter 8, Rules [WCWARP p. 53].
277 Heading above rule 8, Chapter 8, Rules [WCWARP p. 53]

All the rules cover taking, use, or damming of water from specified water bodies or wetlands. It is particularly notable that where Rule 5 seeks to make it clear that water flowing into Lake Alexandrina (for example) is to be covered by the rule it expressly states:

> No person shall take, use, dam or divert water from Lakes Alexandrina, McGregor and Middleton and their tributaries.
> [Our underlining].

The inference is that, in other contexts where tributary flows and groundwater flows are not referred to, they are not included in the scope of rules 3 to 5. Otherwise takings, use and diversions from surface water and groundwater which are governed by rules 1 and 2 will also trigger (here) rule 5.

[183] As mentioned earlier rule 5.7.3.1 of Chapter 5 provides for specific information when an application to take, use, dam or divert surface water is applied for. One of the requirements is that there be[278]:

> an assessment of any actual and potential effects that the activity may have on ...
> (1) aquatic ecosystems values ...

There may be a weak inference to be drawn from this that a separate application for indirect diversion from a wetland is not required by the scheme of the WCWARP because the effects of the water take/diversion from the Waitaki Dam can already be taken into account.

[184] We consider the financial contribution rules are neutral as to the interpretation of rule 4. However, the important point about the provisions of the proposed NRRP which are imported into the WCWARP by reference is that as they all contain the word divert, they must be presumed to do so in the sense defined in the proposed NRRP as notified.

[278] Rule 5.7.3.1(g)(vii) [Proposed NRRP Chapter 5, p. 5-166].

Conclusion as to the meaning of rule 4

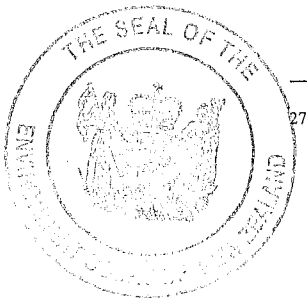
[185] We are left with a situation where on the one hand the normal dictionary meaning of the phrase 'divert water from a wetland' which includes 'preventing water from reaching a wetland' and the precise purpose of rule 4 as set out in policies 1, 2, 34, 29 and 30 all move in favour of the dictionary meaning. On the other hand, if we insert the proposed NRRP meaning of 'divert' and also consider the overall scheme of the rules the meaning of the rule is that only alterations of the flow out of the wetland are caught.

[186] To adopt the literal meaning of rule 4 under the narrower purpose of policies 1, 2, 4, 29 and 30 of the WCWARP would mean that all takes of water from the Waitaki catchment are prohibited because the interconnectedness of all water in the catchment means that there will be an adverse effect on wetlands – a diversion of water (in a very small quantity in most cases) from reaching it. We consider that approach is unlikely to be the correct interpretation of the WCWARP because it would be unworkable. Rather we must adopt an interpretation of the rule which makes the WCWARP work: *Northland Milk Vendors Association Incorporated v Northern Milk Limited*[279].

[187] In summary, because, first we must look at the WCWARP as a whole, secondly because we must try to make its scheme work, and thirdly because we consider that the word 'divert' should be used consistently in the WCWARP and in the proposed NRRP, we hold that 'divert from a wetland' in rule 4 means:

> ... alter the natural course of flows ... from a wetland.

Consequently the taking of water by NBTC is not prohibited under rule 4 of the WCWARP, even when it does have the effect of reducing water levels in some wetlands.



[279] *Northland Milk Vendors Association Incorporated v Northern Milk Limited* [1988] 1 NZLR 530, 538 (CA).

3.5 The Canterbury Regional Policy Statement

[188] The RPS contains a number of relevant objectives and policies under the headings:

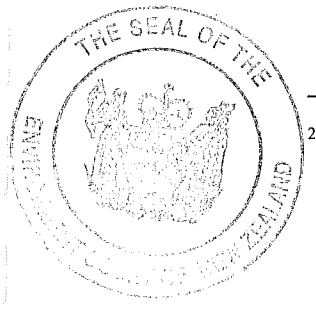
- Landscape, ecology and heritage;
- Water;
- Beds of rivers and lakes and their margins;
- Energy.

[189] To some extent those objectives and policies have been particularised in the WCWARP. However, there are a few provisions which we should identify because they gave a different emphasis than the WCWARP. First objective 1 of the landscape, ecology … section requires[280] (in part) the "[p]rotection or enhancement of wetlands, particularly the gross area of wetlands in the region …" (our underlining). There is a similar reference to protection and enhancement in objective 3 in relation to indigenous biodiversity. We mention those references because, given our findings of fact as to the importance of the majority of wetlands in the lower Waitaki, we consider enhancement may be an important mechanism to maintain the gross area of wetlands in the region.

[190] As for the objectives in the section of the RPS on 'Beds of Rivers and Lakes and their Margins' objective 1 provides (generally) for the protection of the section 6 values of rivers. Objective 2 is:

> [to] protect the flood-carrying capacity of rivers from the adverse effects of land use within the beds and margins of rivers, or the obstruction of waterways by the accumulation of bed material and vegetation.

How that objective is met by the planting of willows on the riverbed is unclear to us, yet there are signs of such planting.



[280] Canterbury RPS p. 104

3.6 Part 2 of the RMA

3.6.1 Introduction

[191] Section 5(2)(b)(c) states that the purpose of the RMA is, in part, to:

- safeguard the life-supporting capacity of air, water, soil and ecosystems; and
- avoid, remedy or mitigate any adverse effects of activities on the environment.

Much of the evidence in this case is about how to safeguard the capacity of the ecosystems of the Waitaki River to support particular species of native flora and fauna, when at present their numbers are declining at worrying speeds. Indeed some of Meridian's proposals are to remedy adverse effects of activities for which it is not responsible in order to compensate those effects which will or may result from the NBTC.

[192] It is common ground in these proceedings that we must recognise and provide for the following relevant matters of national importance[281]:

(a) the preservation of the natural character of … wetlands, … and rivers and their margins, and the protection of them from inappropriate … use, and development:

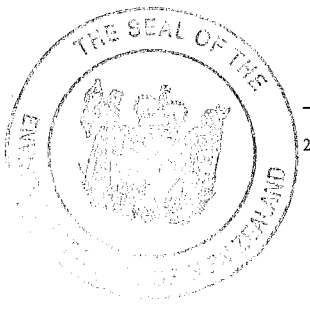
…

(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna:

(d) the maintenance and enhancement of public access to and along … rivers:

(e) the relationship of Maori and their culture and traditions with their ancestral lands, water … and other taonga.

Later in this decision we determine those matters of national importance are effectively subsumed in objective 1 of the WCWARP – as is section 8 of the RMA (in objective 1(a)) – except for section 6(d) which we consider separately in Chapter 6.0.



[281] Section 6 of the RMA.

3.6.2 Section 7 of the RMA (generally) and section 7(ba)

[193] Kaitiakitanga will be discussed in the context of section 6(e) of the Act and, more particularly, of objective 1(a) of the WCWARP in Chapter 6.0 of this decision. All the other paragraphs in section 7 are prima facie relevant and will be had particular regard to, except for section 7(ba). That requires us to have particular regard to 'the efficiency of the end use of energy'. While we read some evidence[282] about this and about the virtues of demand side management we consider once electricity goes into the National Grid it is beyond the powers and capacity of this Court in this case to say whether it is being used efficiently. We adopt the approach of the Board of Inquiry into the Upper North Island Grid Upgrade[283] concerning section 7(ba):

> ... the end-use of energy, outside the scope of a transmission grid, and is beyond being influenced by however robust and resilient the grid may be. This topic is simply irrelevant to the circumstances of the proposed ... resource consents.

No issues were raised concerning the application of the other paragraphs of section 7 except section 7(b) to which we now turn.

3.6.3 Efficient use of natural and physical resources (section 7(b))

[194] Section 7(b) requires us to have particular regard to the efficient use and development of natural and physical resources. We need to do so in the context of WCWARP objective 4 which requires us "to promote the achievement of a high level of technical efficiency in the use of allocated water".

[195] We need to elaborate on what we understand section 7(b) to mean for several reasons. First and most importantly it is directly relevant to our consideration of the disputed evidence as to the benefits and costs of the proposal. We return to that in Chapter 6.0 of this decision. Secondly we consider it is important, when ascertaining whether resources are being used efficiently, to consider all the relevant resources. Thirdly, we consider that the potential for section 7(b) to give consent authorities a way of assessing the benefits and costs of proposals more objectively is still under-appreciated, and we briefly try to explain how that is so.

---

282 Associate Professor S Krumdiek, evidence-in-chief [Environment Court document 55].
283 Draft Report and Decision (May 2009) at para 2341.

All relevant resources must be considered

[196] We consider that efficiency in section 7(b) of the RMA requires a consent authority to consider the use of all the relevant resources and, preferably, their benefits and costs. It is nearly meaningless to consider the benefits of only some of the resources involved in the proceeding because the artificial weighting created by sections 5 to 8 of the Act will not be kept within the statutory proportions if the only matters given the 'particular regard to' multiplier (see *Baker Boys Limited v Christchurch City Council*[284]) in section 7(b) are those which are not identified elsewhere in section 7. Further, it is very helpful if the benefits and costs can be quantified because otherwise the section 7(b) analysis merely repeats the qualitative analysis carried out elsewhere in respect of sections 5 to 8 of the Act.

Costs and benefits

[197] To some extent qualitative findings as to whether the net effect of the use of all the natural and physical resources in question in an application for resource consent results in greater waste merely mirrors some of the other relevant considerations when we come to our overall judgement under section 5 of the Act. As we suggested above the potential power of section 7(b) is in giving a relatively[285] more objective measure of the efficiency of a proposal. That is because the obverse of allocating limited resources to the uses for which society values them most is to examine the least cost solution to questions of resource allocation. Where all the costs and benefits are known and fully priced, a competitive market operating perfectly will result in a least-cost allocation of resources. When some costs or benefits are not fully priced in competitive markets, explicit cost-benefit analysis allows the identification of the least-cost allocation of resources. Cost-benefit analysis enables the identification of the proposal that has the greatest net benefit (or least cost), and so will maximise economic efficiency[286]. Economic efficiency generally requires that all credible alternatives to a proposal should

284 *Baker Boys Limited v Christchurch City Council* [1998] 433 at para (98).
285 We accept that questions about efficiency always incorporate value judgements somewhere.
286 Kahn, James R. The Economic Approach to Environmental & Natural Resources, 3rd ed. Thompson South-Western, Ohio, USA. (2005) p. 151

be identified and included within a cost-benefit analysis[287] to reduce the risk of choosing projects ahead of alternatives that contribute more to society. Not only should the benefits of a project be greater than the costs, but the least cost way of producing those benefits should be implemented[288]. However, there is a real issue as to whether that is required by the RMA. Before we consider that we should examine a little further what is required by an economic test for efficiency.

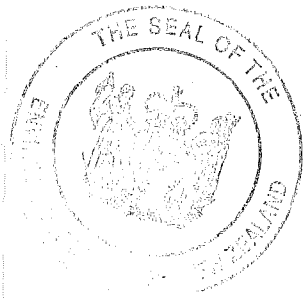
[198] Cost-benefit analysis requires that both private and public costs and benefits are considered in determining the least cost use of natural and physical resources. Costs and benefits are usually expressed in market prices, but that only works if there are markets for the resources in question. Where there are no markets, or the markets are not fully competitive, non-market valuation techniques may be available – there was some reference to them in this case as we shall explain. So even when there are no valuations available for some costs, cost-benefit analysis is still a valuable tool. Calculation of the known net benefit (valued benefits minus valued costs), and identification of the costs and benefits for which no value is available may more clearly identify the size the missing values must be if they are to sway the scales to one alternative or another[289]. If the measured size of the net benefit for the different alternatives is known, then qualitative assessments of the unmeasured costs of each alternative can be considered. For example, as Dr B Layton (an experienced economist in the energy field called by Meridian) put it in this case[290]:

> The quantified benefits of electricity generation and greenhouse gas emissions avoidance indicate how substantial any unquantified adverse impacts would need to be to eclipse the benefits of generating power from the NBTC scheme.

[199] As to the applicability of the concept of efficiency to the RMA in this case, we were fortunate to hear the evidence of Dr Layton. He agreed[291] that from an economic efficiency perspective, least cost requires consideration of alternatives, and that this includes alternative ways of achieving the same objective, as well as the alternative of

---

287 Kahn (2005) p. 155.
288 Kahn, James R. (2005) pp 154 to 155.
289 Kahn, (*op cit*) p. 162.
290 Dr T B Layton, evidence-in-chief para 78 [Environment Court document 3].
291 Transcript p. 87 and pp 111-112.



doing nothing. However, Dr Layton considered[292] that a consent authority under the RMA should be more restricted than an economist in thinking about efficiency. He considered that a cost benefit analysis under the RMA is restricted to only considering the proposal against the status quo – in other words the alternatives are between the proposal or doing nothing. His argument was that under the RMA consent authorities (or on appeal, the Environment Court) only permit proposals, they do not decide between proposals. As such, a consent authority can only decide between the merits of the proposal against not the proposal. Dr Layton's view was that if a consent authority permits a proposal, there may be another mechanism that decides between different proposals, i.e. a competitive market. In other words[293]:

> ... society has decided they [applicants] sort themselves out by being incentivised but wear the costs of getting it wrong.

His view was that if consent authorities attempt to decide between proposals, they risk acting as central planners, whereas a better approach is to allow the merits of the proposals to be determined by a competitive market (if it exists).

[200] Elaborating on that Dr Layton considered a consent authority's role is to create a level playing field in the market by identifying the environmental costs of a proposal and to internalise those to the applicant by way of remedial and mitigatory conditions. As an economist, Dr Layton would prefer[294] that a consent authority impose a charge on the applicant that covers those costs that cannot be remedied or mitigated and then leave it to the market to decide (provided there is a market[295] and that it is competitive), with all proposals having all the costs fully internalised. To the extent that the costs of the proposal cannot be internalised to the applicant, then Dr Layton considered it our role to assess whether those costs are acceptable or not, and make our decision accordingly.

---

292 Transcript p. 112.
293 Transcript p. 113.
294 Transcript p 116-117
295 That cannot always be assumed: in most cases involving subdivision and residential development under the RMA there is no market (let alone a competitive one) for the congestion on the roads around New Zealand's cities.

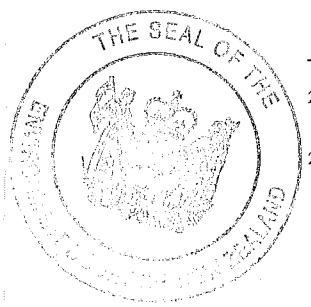
[201] We conclude that the role of a consent authority, when having particular regard to section 7(b), is, where possible, to internalise the effects of a proposal, so that the cost of the externalities are imposed on the consent holder. It is then left to that person to decide whether their proposal can compete against others in the market. Consequently it is not usually necessary to consider alternative uses of the resources in question, or the use of alternative resources to obtain a similar benefit. However, there are at least three exceptions:

(1) where the costs cannot be fully internalised to the consent holder;

(2) where there is no competitive market (e.g., in congestion on roads where the relevant resource is the land near those roads; we also note there is a very limited market in water permits); or

(3) where there is a matter of national importance in Part 2 of the Act involved and the cost benefit analysis requires comparing measured and unmeasured benefits and costs (as is usually the case) so that the consent authority has to rely principally on its qualitative assessment, e.g. *TV 3 Network Services Limited v Waikato District Council*[296].

[202] Finally, there are two other points to note about section 7(b) of the RMA. First cost benefit analysis and economic efficiency under the RMA do not determine a resource allocation decision. That is consistent with economic theory which recognises that cost benefit analysis provides information and organises that information, enabling it to be placed alongside other decision-making criteria in a useful manner[297]:



296 *TV 3 Network Services Limited v Waikato District Council* [1997] NZRMA 539; [1998] 1 NZLR 360 (HC).

297 Kahn, J R (2005) *op cit*, p. 150.

> Cost Benefit analysis is only one input into public policy, but it is important. We need a formal and systematic way of measuring the impacts of proposed regulations and comparing them across a common economic scale. ... (C)ost-benefit analysis can be useful without being the alpha and omega of policy analysis. [298]

Secondly Section 7(b) requires us to consider the benefits and costs in terms of the "natural and physical resources". We are not required to have regard to the benefits and costs in terms of the **financial** resources of the applicant. Whether the applicant makes a profit on a project, the size of that profit, or the wisdom or otherwise of their investment decisions is not our concern[299].

3.7 The Soil Conservation and Rivers Control Act 1941

[203] We described in Chapter 2.0 the continuing encroachment of willows on the riverbed of the Waitaki and, earlier, the proposal by Meridian for the consent holder of the NBTC to clear a fairway about 600 metres wide from Kurow to the sea. It is rather paradoxical that willows are still being planted along the edges of the river. We now set out the opposing laws which allow that state of affairs to continue.

[204] At first sight the planting of willows on the riverbed of the Waitaki is managed under section 13 of the RMA which states:

---

298 Revesz, Richard L & Livermore, Michael A. Retaking Rationality: How Cost-Benefit Analysis can Better Protect the Environment and Our Health, Oxford University Press, New York. 2008. p. 15.

299 We see no reason for the doubts in *Marlborough Ridge Limited v Marlborough District Council* [1998] NZRMA 73 at 89.

Section 13 Restriction on certain uses of beds of lakes and rivers

(1) No person may, in relation to the bed of any lake or river, –

(a) Use, erect, reconstruct, plan, alter, extend, remove, or demolish any structure or part of any structure in, on, under, or over the bed; or

(b) Excavate, drill, tunnel, or otherwise disturb the bed; or

(c) Introduce or plant any plant or any part of any plant (whether exotic or indigenous) in, on, or under the bed; or

(d) Deposit any substance in, on, or under the bed; or

(e) Reclaim or drain the bed –

unless expressly allowed by a rule in a regional plan and in any relevant proposed regional plan or a resource consent.

That suggests willows cannot be planted unless expressly allowed by a regional rule or a resource consent.

[205] However, some transitional provisions of the RMA still apply to make section 13 inapplicable. Section 418 of the Act states relevantly:

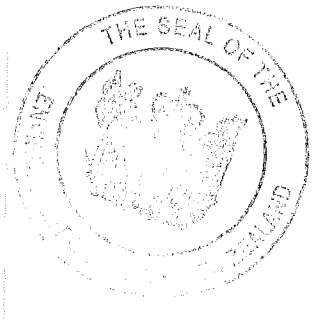
Section 418 Certain existing permitted uses may continue

...

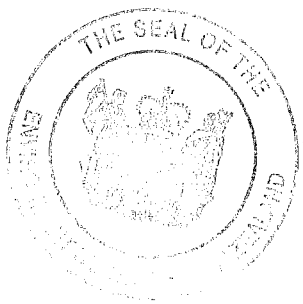
(3) For the purposes of this Act, section 13(1) shall not apply in respect of any activity lawfully being carried out in relation to the bed of any river or lake before the 1st day of October 1991 which did not require any licence or other authorisation relating to such activity under any of the Acts, regulations, or bylaws, or parts thereof, amended, repealed, or revoked by this Act, until a regional plan provides otherwise.

(3A) For the purposes of this Act (except where section 383A applies), section 13(1) shall not apply in respect of any activity lawfully being carried out in relation to the bed of any river or lake while any licence or other authorisation, granted pursuant to an application made before the 1st day of October 1991, relating to such activity under any of the Acts, regulations, or bylaws, or parts thereof, amended, repealed, or revoked by this Act remains in force, until a regional plan provides otherwise.

In other words until there is an operative regional plan section 13(1) of the RMA does not apply to any activity which was legal before 1 October 1991 (when the RMA came into force).



[206] Ms Dysart submitted for the CRC that it may continue to carry out its function under the Soil Conservation and Rivers Control Act 1941 ("the SC&RCA") to "... minimise and prevent damage within its district by flood and erosion"[300] and that authorises the planting of willows. The paradoxical result in practice is that the CRC is empowered to contract for the planting of willows where it considers they are needed on the lower Waitaki, but in practice appears unable to afford to remove them where they spread and change the character of the river by squeezing it into fewer braids, or cause ecological damage.



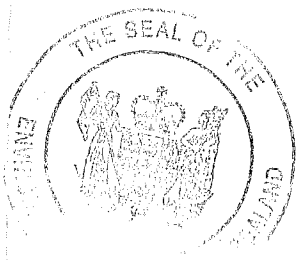
[300] Section 126(1) of the SC&RCA.

4.0 Predictions

4.1 Introduction

[207] Before we can make any judgement as to the overall effect of the NBTC we must predict, as best we can on the evidence before us in the light of our collective experience and knowledge and of our predictions as to the potential effects of the proposal and the environment they will accumulatively create as compared with the existing environment (see *Queenstown Lakes District Council v Hawthorn Estates Limited*[301]). In terms of flow regimes in the lower Waitaki River the existing environment is generally synonymous with the status quo flow regime. That is represented by the hydrographs of the actual (past) flows in the river on the assumption that the near future is likely to have the same patterns as the recent past. That and other aspects of the existing environment have been described in Chapter 2.0 of this decision. However, we should also record here that we regard the 'existing environment' of a braided river as very dynamic in itself: its braids are changing all the time, and we have also described other changes in the riverbed and its vegetation. Where necessary we make predictions as to the changes which might occur if the water permits sought by Meridian are refused

[208] As for the basis on which we should make findings about the likelihood of future effects on the existing environment, in the absence of clear higher authority in New Zealand, we adopt the approach that has been adopted in most overseas common law jurisdictions (and followed in New Zealand by the Environment Court in *Long Bay – Great Park Society Incorporated v North Shore City Council*)[302]. These authoritative cases were usefully summarised by the Supreme Court of Canada in *Athey v Leonati*[303] which relied on decisions of the highest Courts in the United Kingdom, Canada and Australia when it held that:



301 *Queenstown Lakes District Council v Hawthorn Estates Limited* [2006] NZRMA 424 at [57], [74] and elsewhere (CA).

302 *Long Bay – Great Park Society Incorporated v North Shore City Council* Decision A78/2008.

303 *Athey v Leonati* [1996] 3 SCR 458.

> [F]uture events need not be proven on a balance of probabilities. Instead they are simply given weight according to their relative likelihood, *Mallet v McMonagle*[304] …, *Malec v C Hutton Proprietary Limited*[305] …, *Janiak v Ippolito*[306] …

We respectfully agree that is the logical and scientifically consistent approach to assessing and then weighing the probabilities of (possible) future events.

[209] Next we make predictions about the effects of the most likely flow regime changes. We then consider the probabilities of all the potential future effects (positive or negative) raised by the evidence: the main positive effects (generation of energy, potential reduction of greenhouse gases) first, then the negative effects.

4.2 Changed flow regimes

4.2.1 Introduction

[210] There are three particularly relevant possible flow regimes in the Waitaki River should a NBTC proceed. These are referred to as:

(1) the WCWARP with Hydro ("WRP-with hydro"), which assumes an abstraction of water for a tunnel scheme equivalent to the proposed NBTC;
(2) the Alternative Flow Regime with Hydro ("AFR-with hydro"); and
(3) Alternative Flow Regime Consented by the Hearing Commissioners ("AFR Consented").

We describe each in turn.

WRP-with hydro

[211] Table 3 of the WCWARP sets out the flow requirements to be met by Meridian in operating the Waitaki Dam power station in accordance with the regional plan as:

- a minimum flow from Waitaki Dam to the sea of 150 m^3/s with a relaxation for exceptional circumstances

---

304 *Mallet v McMonagle* [1969] 2 All ER 178 at 190-191 (HL).
305 *Malec v C Hutton Proprietary Limited* (1990) 169 CLR 63 (HCA).
306 *Janiak v Ippolito* [1985] 1 SCR 146 (SCC).

- flushing flows of at least 450 m^3/s for not less than 24 hours at least 7 times per year with at least 2 to be in February and March
- all flows to be measured at the Kurow recorder

The flushing flows are designed to move fine sediment and periphyton without significantly disturbing bed material.

[212] Rule 7 of the WCWARP requires additional flows to be provided which may range up to 10 m^3/s in June and July to 80 m^3/s from October to March. These flows are to meet the requirements of existing consents to take water from the river, and to meet at least 95% of the peak rate of taking of anticipated new consents to take water from the river for agricultural and horticultural activities as set out in Policy 46 of the WCWARP.

AFR-with hydro

[213] This scenario assumes:

- a seasonally varying minimum flow as shown below (in m^3/s):

Jan	Feb	Mar	Apl	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
140	150	145	125	120	110	110	110	120	125	130	140

- a diversion to the tunnel of up to 260 m^3/s, but greater than the tunnel minimum flow of 65 m^3/s;
- the full WCWARP allocation for irrigation abstractions;
- the flushing flows detailed for the WRP-with hydro are included;
- provision for a 48 hour shut down of the tunnel when flows passing Aviemore Dam exceed 900 m^3/s. Such flows are referred to as channel maintenance flows and have a return period of 1.9 years under the status quo regime.

[214] Dr Henderson considered that channel maintenance flows are likely to provide sufficient energy to move bed material and to assist with maintaining an open braided fairway. He also thought it likely that they would remove significant amounts of didymo from the channel[307]. A 48 hour shut down of the tunnel was recommended by experts since "the majority of each flood's ecological 'cleansing function' and didymo removal may be achieved in this period, with diminishing ecological benefit to be gained from longer durations"[308]. The 48 hour period also keeps the return period of the 900 m^3/s flow between Waitaki Dam and Stonewall at 1.9 years.

AFR Consented

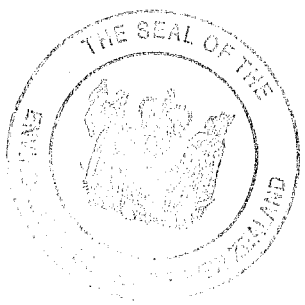
[215] The AFR Consented regime incorporates all the conditions imposed by the Hearing Commissioners at the initial hearing. In addition to the attributes of the AFR-with hydro regime the AFR Consented regime has minimum flows calculated in accordance with different consent conditions according to whether the tunnel is operating[309] or empty[310]. This results in higher minimum flows than for the AFR-hydro. The values in m^3/s are shown below:

Tunnel flow	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Greater than 0	152.2	162.2	157.2	137.2	121.0	111.0	111.0	111.0	132.2	137.2	142.2	152.2
Equal to 0	152.2	162.2	157.2	152.0	121.0	111.0	111.0	111.0	152.0	152.0	152.0	152.0

[216] Should the WRP-with hydro, the AFR-with hydro or the AFR Consented regime be implemented the characteristics of the flow particularly that between Waitaki Dam and the tunnel exit at Stonewall will change from those of the status quo. The characteristics of these three possible regimes are described next. The effects of these regimes on the channel morphology and ecological values are considered in the subsequent sections of this decision.

---

307 Dr R D Henderson, evidence-in-chief para 52 [Environment Court document 18].
308 Dr R D Henderson, evidence-in-chief footnote p. 19 [Environment Court document 18].
309 AFR Consented conditions 10, 15(b) and 15(c).
310 AFR Consented condition 18.



4.2.2 Characteristics of possible future flows

[217] Time series of discharges for the status quo, WRP-with hydro and AFR-with hydro regimes for the period 1 July 1979 to 31 December 2005 were simulated using an Excel model of the Waitaki system below Benmore Dam[311]. Dr Henderson considered[312] this period sufficiently representative for modelling the effects of these possible future scenarios. After the Hearing Commissioners' Decision issued, the AFR consented regime was also modelled. Mr Searle presented details of the model, how it operates and of its restrictions in his evidence-in-chief[313]. We note that the mean flow for the modelled period is lower than the long term mean and that there are few examples of sustained low flow. These discrepancies should not alter any assessment of the effects of the NBTC on the river because the low flow values can always be met. It is the tunnel flows that would be reduced in the event of a dry year[314].

[218] Flows in the reach immediately below the Waitaki Dam (Reach 1) and the reach immediately below Stonewall (Reach 5) were examined. Irrigation takes were accounted for but the flow from the Hakataramea River was excluded. The seven flushing flows were not included. To do so could alter the FRE3 statistic but have no effect on other flow parameters. In most cases the 48 hour shut down with flows greater than 900 m^3/s was not modelled. These cases are identified when the results are discussed. As no party sought to cross-examine Dr Henderson or Mr Searle we accept their modelling results. First we compare the results for the 'with hydro' regimes with the status quo, and then we consider the AFR Consented regime.

'With hydro' regimes: statistical parameters

[219] Modelling results for the 'with hydro' flows are presented below. The status quo figures are included for comparison. All values are in cubic metres per second (m^3/s).

311 Mr G J Searle, evidence-in-chief paragraphs 22 and 23 [Environment Court document 27].
312 Dr R D Henderson, evidence-in-chief para 24 [Environment Court document 18].
313 Environment Court document 27.
314 Dr R D Henderson, evidence-in-chief para 25 [Environment Court document 18].

	Mean		Median		Minimum		MALF	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
Reach 1	182	165	157	140	150	110-150	150	110
Reach 5	376	376	387	373	150	110-150	193	195
Status Quo	382		369		120		206	

Notes:
- MALF is the Mean annual low flow
- Columns (i) refer to the WRP-with hydro scenario
- Columns (ii) refer to AFR-with hydro scenario
- The 900m^3/s shut down flows were not modelled. Doing so would apparently[315] not produce significantly different results.

[220] Flow duration curves[316] for Reach 1 show that each 'with hydro' scenario is at its minimum flow for about 80% of the time. In contrast the status quo flow is above these flows for some 98% of the time. For Reach 5 the flow duration curves are essentially the same for all three scenarios with only slight differences at low flows. The same result was found for the most downstream reach[317].

[221] Flood flows for various return periods for the two with hydro scenarios are essentially the same in Reach 1 and smaller than the equivalent status quo flow. For Reach 5 there are only minor differences between the three scenarios[318]. These results are without considering the 48 hour shut down condition. When this is considered the return periods of the 'with hydro' scenarios would be closer to those of the status quo with the return period for the 900 m^3/s flow being the same for all three scenarios. This

315 Dr R D Henderson, evidence-in-chief Tables 2, 3 and 4 [Environment Court document 18].
316 Dr R D Henderson, evidence-in-chief Figure 1 [Environment Court document 18].
317 Dr R D Henderson, evidence-in-chief Figures 3 and 4 [Environment Court document 18].
318 Dr R D Henderson, evidence-in-chief Table 7, p. 17 [Environment Court document 18].

does not mean there would be no change in the number of days for which the flow exceeds 900 m^3/s. Indeed in Reach 1 they would be reduced from 4.4 to 3.1 days per year while in Reach 5 the reduction is to 4.0 days per year[319].

[222] The modelling showed both the frequency of FRE3 flows and the associated number of days per year increase in Reach 1 with respect to the status quo regime for each of the 'with hydro' scenarios[320]. This is because of the reduction in the median flow in Reach 1. In this reach the median flow for the AFR-with hydro regime is 140 m^3/s and thus a 450 m^3/s flushing flows is a FRE3 flow. The FRE3 statistic will thus be at least 7 as opposed to 0.42 for the status quo.

[223] In Reach 5 there is little difference between the FRE3 statistics of the three regimes. The associated number of days per year is reduced slightly[321].

[224] The timing of floods and freshes influences the ecological values of a river. Floods greater than 900 m^3/s will continue to occur in the November to April period as they do under the status quo regime. Under the 'with hydro' regimes the freshes of between 75 and 150 m^3/s are distributed throughout the year. Under the status quo regime they are described as frequent. As larger flows are considered one finds the distribution tends to that of the large floods[322].

'With hydro' regimes: flow variability

[225] A feature of the status quo regime is the flow variability within a day. Six hour average flows on average varied by 50 m^3/s and for 11% of the time the daily variation in six hour averages was greater than 100 m^3/s. This variation produces the varial zone which we described earlier. However, the variation will be markedly reduced by the 'with hydro' regimes. It is Meridian's stated intention to modify the operation of the lower power stations so that flow variations between Waitaki Dam and Stonewall are

319 Dr R D Henderson, evidence-in-chief Table 9, p. 18 [Environment Court document 18].
320 Dr R D Henderson, evidence-in-chief Table 10, p. 20 [Environment Court document 18].
321 Dr R D Henderson, evidence-in-chief Table 10, page 20 [Environment Court document 18].
322 Dr R D Henderson, evidence-in-chief paragraphs 60, 61 and 63 [Environment Court document 18].

reduced to "suit the ecological conditions recommended by technical experts to maintain ecosystem values"[323].

[226] Both weekly and monthly variations would also be changed significantly by the 'with hydro' regimes. With the status quo there are rarely periods of stable flow. Both 'with hydro' regimes would have significant periods of stable flow in Reach 1 with weekly variation near zero for a large proportion of the time. There is little difference between the weekly or monthly variations of all regimes in Reach 5[324].

[227] Seasonal variations in monthly mean flows in Reach 1 for the 'with hydro' regimes parallel those of the status quo with the actual values being approximately half those of the status quo. In Reach 5 there are no significant differences in seasonal variations between the three scenarios. The seasonal variations in minimum flows in Reach 1 for the 'with hydro' regimes are determined by the minimum flow conditions at Waitaki Dam. Consequently they differ significantly from those of the status quo[325].

[228] Year to year variability is much larger than the differences between the 'with hydro' regimes, and it is comparable with the differences between the status quo and the 'with hydro' regimes. Mean flows in any one year as measured at Waitaki Dam in years between 1979 and 2005 ranged from 275 m^3/s to 488 m^3/s while the corresponding median flows ranged from 260 m^3/s to 430 m^3/s[326].

'With hydro' regimes: Reach 6

[229] Reach 6 is the river reach downstream of all irrigation abstractions and extending to the river mouth. An analysis of the reach was undertaken to assess the likelihood of changes in the flow regime affecting the hydrodynamics of the river mouth. The results are presented as flow duration curves which differ only very slightly from the status quo curves. The differences occur at the low flows and reflect the different irrigation cut-off points under the various flow regimes[327]. Compared with the status quo regime the

323 Dr R D Henderson, evidence-in-chief para 71 [Environment Court document 18].
324 Dr R D Henderson, evidence-in-chief paragraphs 73 and 74 [Environment Court document 18].
325 Dr R D Henderson, evidence-in-chief Figure 18, page 49 [Environment Court document 18].
326 Dr R D Henderson, evidence-in-chief para 78 [Environment Court document 18].
327 Dr R D Henderson, evidence-in-chief Figure 4, p. 35 [Environment Court document 18].

proposed flow regimes would all have a higher minimum flow but flows would be at their minimum values for slightly longer on average.

AFR Consented regime

[230] The modelling for the AFR Consented regime included time series data for the period January 2006 to February 2009 which had become available since the earlier modelling had been completed. This data includes more of the drier years since 2000.

[231] The net result of the higher required minimum flows and the dry years is an increase in the mean flow of 1 m^3/s in Reach 1 and a decrease in mean flow of 8 m^3/s in Reach 5 when compared with AFR-with hydro regime. Likewise the median flows are reduced by some 2% and the mean annual low flows by 1.5%. Flood magnitudes are reduced for a given return period by 3% and 5% in Reaches 1 and 5 respectively with the 900 m^3/s flow remaining a 1 to 2 year event. Flow variability is expected to remain unchanged[328]. Dr Henderson considers these changes to be small to insignificant in their effect on the hydrological statistics he derived for the 'with hydro' regimes[329].

[232] The FRE3 statistic is reduced by about 10% in Reach 1 and 2% in Reach 5[330]. The possible significance of these changes was not assessed by Dr Henderson.

4.3 Electrical energy and reduction of greenhouse gases

Energy generated

[233] If the NBTC scheme proceeds it will have an installed capacity of 200 to 285 MW and be capable of producing 1000 to 1400 GWh per annum of energy for the national grid, depending on the choice of tunnel diameter. We have described how this is achieved by increasing the available head at the Waitaki Dam from 21.5 metres to approximately 125 metres for 56% of the flow. NBTC would thus be making more effective use of the water stored in the lakes of the Waitaki Power Scheme. The dry year capability of New Zealand's electrical supply system as a whole will thus be increased. For example, if NBTC had been operational during the 1992 drought it

328 Dr R D Henderson, evidence-in-chief paragraphs 82-87 and 89 [Environment Court document 18].
329 Dr R D Henderson, evidence-in-chief para 93[Environment Court document 18].
330 Dr R D Henderson, evidence-in-chief para 88 [Environment Court document 18].

would have increased supply from the Waitaki hydro system by 830 GWh[331]. For the Society Mr Mitchell asserted[332] that the need for more South Island generation to cover dry year risk is a fallacy. We find his limited supporting statement unconvincing in the light of the 1992 example.

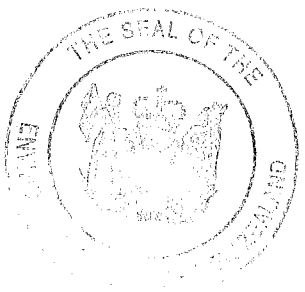
[234] The above figures are predicated on the proposed AFR –with hydro flow regime. Should a WRP-with hydro flow regime, with its flat lined minimum flow of 150 m^3/s, be used it would produce approximately 92% of the 1000 to 1400 GWh noted above[333].

[235] Because the demand for energy in the South Island has outstripped generation developments there, the extent and frequency of electricity transfers to the South Island has increased progressively over time[334]. Because it would be located in the South Island the NBTC would assist in reducing these transfers.

[236] The case for the Society on this issue was, if we understood it correctly, that the benefits claimed for the NBTC were overstated. They pointed out that energy production in the Waitaki region greatly exceeds demand in that region and thus the excess must be exported[335]. Mr Mitchell drew our attention to transmission constraints that may inhibit this energy being transmitted to the North Island via the HVDC link or to Christchurch[336]. The HVDC link is presently constrained by the removal of Pole 1 from the link. The northward transmission capacity of link is to be restored prior to the commissioning of the NBTC. This will provide an extra 500MW capacity which is more than enough to accommodate the anticipated output from the NBTC[337].

---

331 Mr J T Truesdale, evidence-in-chief footnote 51, page 23 [Environment Court document 4].
332 Mr K S Mitchell, evidence-in-chief para 137 [Environment Court document 52].
333 Mr N C Eldred, evidence-in-chief para 28 [Environment Court document 16].
334 Mr J T Truesdale, evidence-in-chief para 73 [Environment Court document 4].
335 Mr K S Mitchell, evidence-in-chief para 108 [Environment Court document 52].
336 Mr K S Mitchell, evidence-in-chief paragraphs 109 and 110 [Environment Court document 52].
337 Mr J T Truesdale, evidence-in-chief para 78.2 [Environment Court document 4].



[237] With respect to transmission to Christchurch Mr Mitchell, relying on a Transpower report[338], asserted that an expensive upgrade to the transmission system will be needed[339]. Mr Truesdale was not convinced of this, writing that it is unclear what incremental impact the NBTC would have on future transmission requirements[340]. We consider that constraints are integral parts of all transmission networks – remove one and the next weak point pops up as a constraint. Constraints must be considered by generators as they contemplate generation proposals. In this case it is up to Meridian to assess the financial risk of not being able to export their energy from the NBTC or indeed their other investments in the Waitaki Valley. Our concern is with economic risk and we discuss that in Chapter 6.0 below.

Reduction in greenhouse gases

[238] A modern combined cycle gas fired generating plant emits 380 tonnes of carbon dioxide for each GWh of electricity generated, and a coal fired plant emits 900 tonnes of carbon dioxide (on average) per GWh generated[341]. Thus, assuming NBTC generation of 1,250 GWh per annum an equivalent generation from a modern gas or coal fired power station would produce around 0.5 million or 1.1 million tonnes of carbon dioxide per annum respectively[342].

[239] Should the electricity generated by the NBTC be in place of that generated by a modern coal or gas fired plant then one can say the above figures represent the annual reduction in carbon dioxide (a greenhouse gas) emissions. Of course NBTC generation may replace other non emitting generation in which case the reduction in emissions will be less. However given the (usually) higher cost of running thermal plant as opposed to hydro or wind generation it is likely that thermal generation will be replaced first.

---

338 Mr K S Mitchell, Supplementary Statement of Evidence, Attachment E [Environment Court document 52A].

339 Mr K S Mitchell, evidence-in-chief para 110 [Environment Court document 52].

340 Mr J T Truesdale, evidence-in-chief para 82.2 [Environment Court document 4].

341 Dr TB Layton evidence-in-chief, para 64 [Environment Court Document 3].

342 Mr J T Truesdale, evidence-in-chief para 13 [Environment Court Document 4].

[240] The Society's witness Dr Bennett drew our attention to the carbon emissions associated with the construction of the NBTC[343] by suggesting they should be offset against any gains claimed. He did not produce any figures from which we could gain an appreciation of the magnitude of these emissions. Dr Layton[344] produced some 2004 figures based on life cycle emissions of various forms of generation. He listed "other stage" emissions in tonnes of carbon dioxide equivalent as: for coal fired, 10 to 30; for gas fired 30 to 70; for hydro 3 to 40. "Other stage" emissions are those arising from construction and dismantling of the generation plant. We conclude that taking into account construction emissions would favour hydro generation and thus take Dr Bennett's suggestion no further.

[241] The economic benefits that may accrue from the reduction in emissions are considered in Chapter 6.0.

4.4 Potential effects on riverbed and bank morphology

4.4.1 Future trends under status quo flows

[242] The vegetation on the bed of the Waitaki River has changed markedly over the last 70 years as described in Chapter 2.0. It is important to recognise that those changes are continuing. For Meridian, Dr Sanders described[345] how:

> Based on analysis of aerial photos, the amount of low and tall vegetation has increased since 1936 from an average of 112 m to 655 m width across the floodplain, while bare gravel has decreased from an average width of 380 m to 133 m. Vegetation continues to encroach into the riverbed at an average rate of approximately 14 m per year despite the vegetation control carried out currently and previously by Environment Canterbury and its predecessors.

That vegetation in the river bed influences braiding. The vegetation in the river bed under the status quo is far from an equilibrium state as evidenced by both the spraying and mechanical vegetation clearance programmes and the planting programmes[346] carried out under existing resource consents by the Canterbury Regional Council[347].

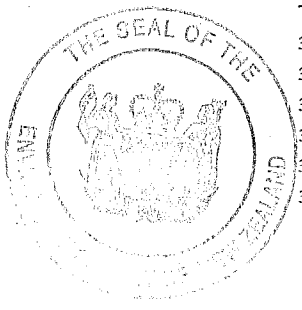
---

343 Dr N R Bennett, evidence-in-chief para 66 [Environment Court Document 48].
344 Dr T B Layton, evidence-in reply para 27 [Environment Court Document 3].
345 Dr M D Sanders, evidence-in-chief para 31 [Environment Court document 14].
346 Transcript pp. 703 and 704.
347 Mr R J Vesey, evidence-in-chief para 14 [Environment Court document 39].

4.4.2 Predicted effects of the NBTC on vegetation and braiding of the riverbed

[243] Between Kurow and Stonewall, relative to the status quo regime, there would be immediate effects on braiding should any one of the possible future flow regimes be introduced[348]. The current tendency to a reduced number of braids would be increased as a result of the lower median flows associated with the three regimes. The expectation under the NBTC regime is that the river will have an average of six braids on the Kurow-Stonewall reach, compared to the current range of 7.7-9.1 associated with the status quo[349].

[244] The NBTC flow regime is likely to produce a greater tendency for vegetation to encroach on to the riverbed[350]. The proposed flushing and channel clearing flows will, at best, maintain the river's competence to scour vegetation at current levels[351]. To maintain the current braiding pattern with any of the proposed flow regimes will require increased intervention by way of vegetation clearance. The current programme targets only willows. We would expect an enhanced programme[352] to control woody weeds also (at least from the Waitaki Dam to Stonewall). This issue is addressed in the Geomorphological and Vegetation Management Plan proposed in the consent conditions attached to the Hearing Commissioners' decision. Mr Vesey, the Regional Engineer for the Canterbury Regional Council expects the management plan process with its peer review will provide the opportunity to achieve the desired outcomes within the river channel[353]. Should consent be granted it will be on condition that the river fairway between Kurow and Stonewall will be cleared of willows and woody weeds.



348 Dr D M Hicks, evidence-in-chief para 87 [Environment Court document 12].
349 Dr D M Hicks, evidence-in-chief para 87 [Environment Court document 12].
350 Dr D M Hicks, evidence-in-chief para 91 [Environment Court document 12].
351 Dr D M Hicks, evidence-in-chief paragraphs 92-94 [Environment Court document 12].
352 Hearing Commissioners' General Condition 29.3.
353 Mr R J Vesey, evidence-in-chief para 12 [Environment Court document 39].

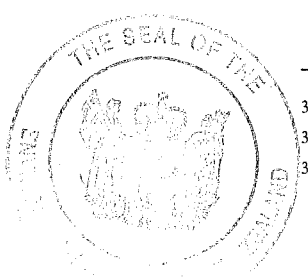
[245] Downstream of Stonewall, operation of the proposed NBTC will not change the braiding characteristics of the lower Waitaki. We note though that future increases in irrigation abstractions may exacerbate the present vegetation and hydro-induced tendency towards a reduced braiding pattern.

4.4.3 Bedload transport

[246] Under the AFR-with hydro regime there will be significant reductions in the duration of flows between 400 and 900 m^3/s and smaller reductions in the duration of flows greater than 900 m^3/s. Consequently, compared to the status quo regime, the proposed flows will have a reduced transport capacity in the reach upstream of Stonewall[354]. There will therefore be less entrainment of material from the bed and the proportion of fine material in the bed will be increased. Increased deposition of fine sediment in side braids and backwaters is to be expected. Such deposits could degrade the in-stream habitat[355].

[247] Contributions of bedload from the tributary streams will continue unchanged with fan deltas being built at their confluences with the main river bed. Under the NBTC flow regime these deltas are likely to be larger. There are two reasons for this. First, the transport capacity of the main river flow is reduced. Second, the expected increase in vegetation encroachment, if not prevented, may inhibit the main river from reaching some or even all of the tributary fans. This is a further reason for requiring increased vegetation control as a mitigation measure should we grant the consent.

[248] The critical section of the river with respect to bedload transport will be between the Otekaieke stream and Stonewall because that section contains the largest tributary inputs. Dr Hicks' calculations show that the NBTC flow regime, including the seven flushing flows and the 900 + m^3/s flows, will likely still transport the gravel supplied by the tributaries[356]. We note that for this to happen a braid with sufficient transport capacity must reach the fan. Dr Hicks acknowledged the imprecision of his



354 Dr D M Hicks, evidence-in-chief, para 97 [Environment Court document 12].
355 Dr D M Hicks, evidence-in-chief, para 119 [Environment Court document 12].
356 Dr D M Hicks, evidence-in-chief, para 106(a) [Environment Court document 12].

calculations[357] and proposed monitoring to reduce associated uncertainties. The Hearing Commissioners accepted that and should we grant consent we will also require monitoring.

[249] Downstream of Stonewall there are no significant differences in sediment transport capacity between the status quo and the proposed flow regimes. There may be effects arising from the reduced gravel supply from upstream but they will be offset by increased entrainment of bed material in this reach. This process is ongoing in any river starved of bed material. In this case the process will be hastened towards what is the inevitable end point of a fully armoured bed, with respect to the smaller flows, upstream of Stonewall and a reduced sediment supply to the coast. We accept that it is not possible to estimate with any confidence when this may be reached either with the status quo or with the proposed regimes[358].

4.4.4 Predicted effects below the outfall

[250] Under the NBTC Meridian proposes to return a maximum discharge of 260 m^3/s to the river at or immediately upstream of Stonewall through a tail race from the tunnel portal to the nearest braid. Although measures are proposed to limit associated scour in the receiving braid, this could reach a depth of two metres[359]. Two possible consequences might affect Bortons Pond on the other side of the river and a little downstream. First a flow concentration on the north bank may reduce flows to the pond and, second, channels shifts may be induced forcing flows against the works protecting the pond. There may also be adverse effects on the irrigation intake on the north bank just downstream of Stonewall.

[251] Dr Hicks wrote that these structures are already in danger from flooding and operation of the NBTC would simply increase the probability of harm[360]. We agree and thus will require appropriate mitigation if consent is granted. The Draft Abstractive Users' Management Plan attached to the Hearing Commissioners' decision sets out how this is to be achieved. In particular we note the plan is to address "Measures to mitigate

357 Dr D M Hicks, evidence-in-chief, para 107 [Environment Court document 12].
358 Dr D M Hicks, evidence-in-chief, paras 110 and 111 [Environment Court document 12]
359 Dr D M Hicks, evidence-in-chief, para 122 [Environment Court document 12]
360 Dr D M Hicks, evidence-in-chief, para 125 [Environment Court document 12].

effects on the physical performance of abstraction systems...". In addition the Hearing Commissioners' conditions 16 and 17 of Consent CRC071096 require precautionary works and remedial repairs be undertaken to protect private land and abstraction facilities. We endorse this approach.

4.4.5 Predicted effects at the river mouth and on the coast to the north

[252] There is a low probability that tendency for the mouth to migrate north would increase with the extended periods of low flows anticipated under the NBTC flow regime as modelled. This arises from the reduction in frequency of freshes in the 400-600 m^3/s range. Northward migration of the river mouth increases flooding and erosion problems around the mouth. The seven flushing flows were not included in the numerical model studies of this regime. Their presence in reality will offset to some extent the effect of the extended low flow periods[361]. We do not consider the effect of NBTC on the position of the river mouth will be separable from the effects under the status quo. As for mouth closure (when a gravel bar closes a river), assuming that current irrigation restrictions will continue, the predicted minimum flows at the river mouth of between 110 and 150 m^3/s are well above the value of 30 m^3/s which has led to closure at other Canterbury sand and gravel river mouths. This led Dr Hicks to conclude that the NBTC would not significantly affect the already low probability of mouth closure[362].

[253] If the NBTC is implemented then the complexity of the sedimentation dynamics at the river mouth is likely to preclude any definite attribution of any observed changes at the river mouth to the NBTC. The complexities include coastal sediment flows from the south and the range of time scales over which the various processes operate. Any requirement for mitigation of effects at the mouth is thus inappropriate. Similarly any effects of the NBTC on the coast to the north would be masked by the processes currently controlling coastal erosion and advance. Further, the time scales involved are decades rather than years and thus predicting possible effects of the NBTC is not currently possible[363]. Recognising this situation the Hearing Commissioners imposed a

361 Dr D M Hicks, evidence-in-chief para 12 [Environment Court document 12].
362 Dr D M Hicks, evidence-in-chief para 130 [Environment Court document 12].
363 Dr D M Hicks, evidence-in-chief paragraphs 140 and 143 [Environment Court document 12].

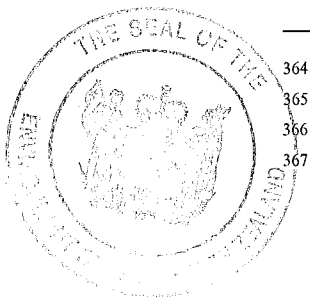
condition[364] that monitoring be undertaken to improve the current understanding of the relationship between the Waitaki River flow regime and coastal processes. We see this as appropriate.

4.4.6 Effects on the banks of the river

[254] The Canterbury Regional Council has expressed concern that existing and future river protection works may be put under greater pressure by the implementation of the NBTC flow regime. Possible mechanisms for this are[365]:

- the proposed flushing flows and the 900+ m^3/sec flood flows and the associated ramping rates;
- in-channel works associated with braid management and vegetation clearance;
- construction and operation of the outfall;
- other parties carrying out the work;
- lowered water levels causing flood protection vegetation to die.

[255] The Hearing Commissioners imposed a condition limiting ramping down rates to 50m^3/s/hr which is in accord with ramping down rates recorded at the Waitaki Power Station since 1977[366]. This suggests bank erosion effects due to these flows will be no worse than at present. However, Meridian has agreed to fund a programme to monitor and if necessary mitigate any bank erosion effects associated with the flushing and channel clearance flows[367]. Should we grant consent this programme is to be incorporated into the Riverbed Geomorphology and Riverbed Vegetation Management Plan and will be enforced by a specific condition.



364 General Condition 29.9.
365 Dr D M Hicks, evidence-in-chief para 166 [Environment Court Document 12].
366 Dr D M Hicks, evidence-in-chief para 168 [Environment Court Document 12].
367 Dr D M Hicks, evidence-in-chief para 169 [Environment Court Document 12] .

[256] Construction and operation of the outfall will likely lead to flow concentrations and channel alignments that may exacerbate bank erosion[368]. Consent conditions imposed by the Hearing Commissioners[369] require Meridian to fund additional precautionary and, as necessary, remedial works in the vicinity of the outfall to mitigate effects on bank stability and flow into irrigation intakes. We see this as appropriate. We also note Meridian has agreed to a monitoring programme that would monitor channel configuration and bed levels in the area of the outfall on an annual basis. This is included in the Riverbed Geomorphology and Riverbed Vegetation Management Plan. The results of this monitoring would inform any annual review of consent conditions as provided for in General Condition 1.

[257] Ms Robertson considered possible effects of lowered water levels on the willows used as bank protection vegetation[370]. She noted that crack willows are well adapted to the current dynamic hydrological environment and can withstand flows of around 200 m^3/s for extended periods. She did not anticipate that the change from the current flow regime to the proposed NBTC flow regime will affect willow survival or health[371].

[258] In response to a question the Regional Council's witness, Mr Vesey, assured the Court that the Regional Council's concerns listed above have been adequately addressed or will be by conditions[372]. Further, Meridian and Canterbury Regional Council have agreed[373] that it is best if all in-stream works are managed by the Regional Council with appropriate financial contributions from Meridian. That agreement ameliorates the Regional Council's concerns with respect to in-stream works. Given that, we have no concerns with respect to possible effects on the river banks caused by the NBTC.

---

368 Dr D M Hicks, evidence-in-chief para 170 [Environment Court Document 12].
369 Conditions 16 and 17 on CRC071096.
370 Ms D M Robertson, evidence-in-chief para 139 [Environment Court Document 13].
371 Ms D M Robertson, evidence-in-chief para 139 [Environment Court Document 13].
372 Transcript p. 724.
373 Mr R J Vesey, evidence-in-chief para 13 [Environment Court Document 39] and Transcript p. 714.

4.5 Effects on groundwater

River flow and groundwater levels

[259] Mr Fraser described two flow trials: a low flow trial carried out in July 2001 (reducing the flows to 150, 120 and 85 m^3/s) and a controlled flow trial carried out in January 2005 (flows of 330, 235 and 145 m^3/s). Detailed river gauging was carried out during the low flow trial to establish the relationship between river flow and river stage height[374]. The response of the groundwater during both trials was observed in wells, springs and ponds[375]. The relationship between change in stage height and river flow was 0.33 metres for every 100 m^3/s in the single channel between the Waitaki Dam and Kurow, and 0.185 metres for every 100 m^3/s in the braided section from Kurow to Black Point. Along the braided section of the river some variation is expected where the width of the river changes significantly[376].

[260] For the single channel section of the river between the Waitaki Dam and Kurow the groundwater resource is limited and largely independent of the flow of the river. There is limited use of this groundwater and no springs or wetlands have been identified[377]. Below Kurow the groundwater levels and spring flows in the flood plain are, as described in Chapter 2.0 (The facts), closely linked to the water level in the Waitaki River. The most obvious confirmation of this is the monitoring data that showed groundwater levels within 50 metres of the river responded almost immediately to changes in flow[378].

[261] Mr Fraser estimated the potential reduction in groundwater level for the AFR-with hydro flow regime from the stage height difference between the historical monthly mean flows and the proposed minimum monthly flows. The results range from 0.40 to 0.56 metres with the annual average 0.47 metres. Given that the monthly mean flow will be above the minimum Mr Fraser adopted 0.5 metres as a conservative estimate of the long-term effect in the groundwater adjacent to the river[379]. During cross-examination Mr Fraser agreed that the 0.5 metre difference in groundwater level

---

374 Stage height is the elevation of the water surface above a defined datum (often mean sea level).
375 Mr I R Fraser, evidence-in-chief paragraphs 52 to 55 [Environment Court document17].
376 Mr I R Fraser, evidence-in-chief paragraphs 55 to 57 [Environment Court document17].
377 Mr I R Fraser, evidence-in-chief para 62 [Environment Court document 17].
378 Mr I R Fraser, evidence-in-chief para 59 [Environment Court document 17].
379 Mr I R Fraser, evidence-in-chief paragraphs 65–66 [Environment Court document 17].

between the status quo and the AFR-with hydro was a significant difference[380]. Mr Fraser explained that the magnitude of the effect would generally decrease with distance away from the river, although areas of high hydraulic connection that might respond significantly and quickly irrespective of distance complicated this trend. He considered the reduction in groundwater levels would extend across the Post Glacial gravels to the boundary with the first Pleistocene gravel terrace. The groundwater level reduction at the base of the terrace is likely to be significantly less or absent[381].

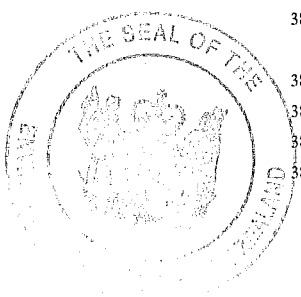
Groundwater abstraction

[262] Groundwater is generally taken from open pits and galleries in the Post Glacial gravels. The thickness of these is generally greater than 5 metres so deepening, if required, would maintain the supply of water. Wells would require more detailed assessment and potential deepening or pump lowering. The lowering of the water table would slightly increase the power required to pump water[382].

[263] In many places along the river there are 'self-irrigating soils'. Mr T H Webb, an experienced soil scientist from Landcare Research based at Lincoln, presented uncontested evidence[383] on the extent of soils benefiting from 'upflow' of water from the groundwater to the pasture, and the effects on affected areas of a drop in groundwater levels resulting from NBTC. He summarised the extent and severity of the effects on a map of the braided reach of the river from Kurow to Black Point and two tables[384]. He grouped the affected land into three classes[385]. All Class A land, covering 123 hectares, receives significant[386] benefit from upflow and will lose most of that benefit under NBTC. A large proportion (between 60% and 100% of the land area) of Class B land, covering 307 hectares, receives some[387] benefit from upflow. Where not at present irrigated or only partly so, Class B land will lose most of the benefit of that upflow. A small to moderate proportion (20-60% of Class C land receives a small[388]

---

380 Transcript p. 594.
381 Mr I R Fraser, evidence-in-chief paragraphs 71–74 [Environment Court document 17].
382 Mr I R Fraser, evidence-in-chief paragraphs 75–79 [Environment Court document 17].
383 Mr T H Webb, evidence-in-chief [Environment Court document 33].
384 Mr T H Webb, evidence-in-chief Figure 7 in Annexure 3 and Tables 7 and 8 in Annexure 2 [Environment Court document 33].
385 Mr T H Webb, evidence-in-chief para 57 [Environment Court document 33].
386 Greater than 60% of evapotranspiration comes from upflow.
387 Between 15% and 60% of evapotranspiration.
388 Up to 15% of evapotranspiration.



benefit from upflow, and a large proportion (up to 60%) receives a minor benefit from upflow. Mr Webb considered that this land will already be under irrigation to meet the needs of land not benefiting from upflow, and so water needs of Class C land receiving upflow will be fully met by the irrigation.

Groundwater quality

[264] Mr Fraser considered the effects of increasing concentrations of microbial and nutrient concentrations in the river on the groundwater system. He noted that the sandy gravels of the Post Glacial material are effective water filters and pathogens would not find their way into the groundwater. He considered the nutrient concentrations to be low and to have a minimal effect when compared to the drinking water standard for nitrate nitrogen[389]. In response to questions from the court Mr Fraser opined that increases in nutrient or microbial contamination in the groundwater would be more likely to be due to intensification of land use than any change in water quality in the river[390].

[265] The drop in groundwater level would reduce the dilution capacity of the aquifer for contaminants derived from the surface of the land. For most of the aquifers any change in water quality as a result of this decreased dilution capacity would be difficult to detect given the natural variability. In areas where the aquifer is very thin nutrient concentrations could increase significantly[391].

Wetlands and springs

[266] The lowering of the groundwater would impact on those wetlands and springs that are recharged by the river. The water levels in riparian wetlands are predicted to reduce by up to 0.5 metres over the long-term. The changes in water levels in other wetlands are predicted to be minor[392]. Mr Fraser presented observations of the drop in water level in selected wetlands following the low flow period 14 June to 16 July 2008. The river flow reduced from typical flows of 320 m^3/s to around 170 m^3/s for five weeks. Mr Fraser used these observations to predict the water level change for the

389 Mr I R Fraser, evidence-in-chief paragraphs 89–90 [Environment Court document 17].
390 Transcript p. 625.
391 Mr I R Fraser, evidence-in-chief paragraphs 91–94 [Environment Court document 17].
392 Mr I R Fraser, evidence-in-chief paragraphs 81-84 [Environment Court document 17].

AFR-with hydro flow scenario[393]. In response to questions from the court Mr Fraser explained that he used a 256 m^3/s reduction in flow for AFR-with hydro to factor up the change that could be expected in each wetland. The wetlands were selected to give a good geographic spread and a range of wetland types[394].

[267] We reproduce Mr Fraser's Table 5[395] showing water level changes with the names of the wetland sites drawn from Ms Robertson's new Appendix 1[396].

Wetland site	Observed 2008 (m)	Change per 100 m^3/s (m)	Predicted AFR with hydro (m)
#39 Fettercairn II	0.277	0.16	0.42
#2 Kurow River Terrace 3	0.127	0.078	0.19
#140 Kurow River Terrace 1	0.058	0.036	0.09
#7 Wainui swamp	0.044	0.027	0.07
#70 Duntroon wetland	None		
#118 Strachan's wetland	None		

The observed changes in water level, when expressed as a change per 100 m^3/s, are all less than the corresponding 0.185 metre drop in stage height of the river. The greatest change is that observed in the Fettercairn II wetland. This supports Mr Fraser's prediction that the water levels in the wetlands would reduce by up to 0.5 metres over the long term. We find that it is likely that water levels in the wetlands will reduce by that amount over the long term. We discuss this in more detail in the next part of this decision.

393 Mr I R Fraser, evidence-in-chief paras 84 – 87 [Environment Court document17].
394 Transcript p. 623 *et ff.*
395 Mr I R Fraser, evidence-in-chief para 86 [Environment Court document 17].
396 Ms D M Robertson, new Appendix 1 [Environment Court document 13.7].

4.6 Effects on wetlands

The change in water levels

[268] The Society is concerned that the significance of the wetlands and the adverse effects of the changed flow regime have been underestimated and that insufficient detail has been provided. For Meridian, Ms Robertson – relying on Dr Henderson and Mr Fraser – explained that the NBTC flow regime would lower groundwater levels in riparian and some terrace wetlands, and reduce the surface water supply to some riparian wetlands. The effects vary depending on the nature of the water sources and the particular characteristics of each wetland[397]. We have described how Mr Fraser estimated that the long-term effect of the proposed flow regime on wetlands is likely to vary from no effect to a drop in water level of up to 0.5 metres[398]. He observed that the riparian wetlands located close to the river or within a former braid are significantly influenced by changes in the Waitaki River flow[399]. In other locations the magnitude of the change in the wetland is only a fraction of that observed in the river[400].

[269] For the Society Mr Sinclair stated that the susceptibility of wetlands to changes in water level varies and is determined by a complex relationship between the underlying substrate, the water level in the river and the relative contributions of water from other sources. He was satisfied with Mr Fraser and Ms Robertson's analysis of potential affects on wetlands, although he noted that the full range of groundwater related effects might not have been identified[401]. Mr Sinclair considered that groundwater in the stretch between the Waitaki Dam and Kurow, and around Duntroon, may experience changes that exceed 0.7 metres based on 2001 trials[402].

---

397 Ms D M Robertson, evidence-in-chief para 94 [Environment Court document 13].
398 Mr I R Fraser, evidence-in-chief para 81 [Environment Court document 17].
399 Mr I R Fraser, evidence-in-chief para 82 [Environment Court document 17].
400 Mr I R Fraser, evidence-in-chief para 83 [Environment Court document 17].
401 Mr B A Sinclair, evidence-in-chief paragraphs 24–25 [Environment Court document 44].
402 Mr B A Sinclair, evidence-in-chief para 15 [Environment Court document 44].

[270] During cross-examination Mr Fraser agreed that the trials had shown larger drawdowns at specific locations. Importantly, he explained that these monitoring bores were immediately adjacent to the river and he postulated that they were close to an elevated side braid that had drained completely at low flows[403], although he had no knowledge as to whether that was the situation[404]. He confirmed his prediction that for the significant majority of the area next to the river there would be a maximum drawdown of 0.5 metres[405]. Although he was not part of the project during the 2001 low-flow trial[406], Mr Fraser expressed confidence that his estimates of effects on the water levels in wetlands would be valid for long term low flow changes. He referred in particular to the observations of a five-week low flow period in the winter of 2008[407]. We accept his predictions.

The terrace wetlands

[271] As noted in Chapter 2 the terrace wetlands are those located away from the river's edge with no surface water connectivity with the river. Ms Robertson has undertaken an assessment of 45 terrace wetlands and ranked the effects on a scale from 0 (no effects) to 3 (major loss of values due to reduction in size, water depth and connectivity[408]).

Of the 83 hectares of terrace wetlands between the Waitaki Dam and the outfall an estimated 13 hectares would be lost overall and the effects on individual wetlands are summarised as[409]:

- 16 hectares (3 wetlands) would be unaffected;
- 45 hectares (12 wetlands) would experience minor effects although there would be no loss of ecological value;

---

403 Transcript p. 598.
404 Transcript p. 634.
405 Transcript p. 597 *et ff.*
406 Transcript p. 630.
407 Transcript p. 606.
408 Ms D M Robertson, evidence-in-chief new appendix 1 [Environment Court document 13.7].
409 Ms D M Robertson, evidence-in-chief paragraphs 106-109 [Environment Court document 13].

- 22 hectares (8 wetlands) would experience some loss of values;
- no terrace wetlands would experience a major loss of values.

[272] Of the eight wetlands that would experience some loss of values two have been assessed as having high ecological significance, four are of moderate significance and two of low significance[410]. During cross-examination Ms Robertson confirmed that those terrace wetlands having high or moderate ecological significance also had this significance ranking using the NRRP criteria[411].

The riparian wetlands

[273] The riparian wetlands would experience greater loss in area as the groundwater levels are more directly affected by the river and the wetlands may also have surface water connections that will change as a result of the proposed flow regime[412]. These wetlands are generally old river channels with slow flowing or standing water and swamps and marshes[413]. Ms Robertson ranked the effects for seven riparian wetlands (occupying 53 hectares) which we summarise as[414]:

- 1 wetland (6 hectares) would experience minor effects
- 4 wetlands (26 hectares) would experience some loss of values
- 2 wetlands (21 hectares) would experience major loss of values.

Of the six wetlands that would lose more than minor ecological values one, Fettercairn II below the Hakataramea confluence, is of high significance and five are of moderate significance[415].

---

410 Ms D M Robertson, evidence-in-chief para 110 [Environment Court document 13].
411 Transcript p. 407.
412 Ms D M Robertson, evidence-in-chief para 122 [Environment Court document 13].
413 Ms D M Robertson, evidence-in-chief para 130 [Environment Court document 13].
414 Ms D M Robertson, evidence-in-chief para 124 – 125 [Environment Court document 13].
415 Ms D M Robertson, evidence-in-chief para 126 [Environment Court document 13].

[274] The overall loss of riparian wetlands was quantified using the data from 23 riparian transects[416]. Of the estimated 223 hectares of riparian wetlands Ms Robertson predicted[417] that 135 hectares or 60% would be lost. She noted that this loss did not take into account wetlands forming in new locations as a result of the changed flow regime[418]. A factor to take into account is that, as described earlier, the riparian wetlands are highly modified largely due to the dominance of willows[419]. The main loss of area (98 hectares) is in willow forest and exotic scrub dominated wetlands, with 37 hectares of native dominated wetlands predicted to be lost[420]. Broken down by vegetation type the losses of those native dominated riparian wetlands were[421]:

	Current area (hectares)	Area lost (hectares)	Area lost (%)
Carex sedgeland	35	28	80
Typha reedland	5	3	60
Juncus rushland	4	3	75
Gunnera turfland	3	3	100

[275] On the complete loss of the low mound communities of *Gunnera* turfland Ms Robertson explained during cross-examination that the estimated losses did not take into account the possibility for the wetlands and associated vegetation to establish in other areas suitable for it. She commented that it was difficult to quantify any new wetland areas that would be formed[422].

Assessment of effects

[276] Dr Rate agreed with Ms Robertson that effects would vary between wetlands depending on the major source of recharge water[423]. He was concerned that there was no assessment of whether there would be loss of particular wetland classes or particular

---

416 Ms D M Robertson, evidence-in-chief new appendix 2 [Environment Court document 13.8].
417 Ms D M Robertson, evidence-in-chief para 130 [Environment Court document 13].
418 Ms D M Robertson, evidence-in-chief heading to Table 1 [Environment Court document 13].
419 Ms D M Robertson, evidence-in-chief para 151 [Environment Court document 13].
420 Ms D M Robertson, evidence-in-chief para 131 [Environment Court document 13].
421 Ms D M Robertson, evidence-in-chief para 127 Table 1 [Environment Court document 13].
422 Transcript p. 414 *et ff.*
423 Dr S R Rate, evidence-in-chief para 27 [Environment Court document 53].

plant or animal species[424]. Ms Robertson replied[425] that all of the surveyed wetlands were swamp, marsh or surface water wetland classes and none of these classes would be lost. She said that no animal or plant species would be lost, but wrote[426] that "[b]irds with specific habitats such as marsh crake and bittern have the potential to be most affected". That was confirmed by the CRC's witness Dr P B Grove[427].

[277] Dr Rate considered that there was insufficient detail and location specific information to assess the potential adverse effects on indigenous vegetation, habitats and fauna[428]. During cross-examination Dr Rate acknowledged Ms Robertson had a considerable amount of data but because he had been unable to see it he could not make a judgement on its quality. He was particularly concerned that some of the information on the assessment of the significance of individual wetlands was confidential[429].

[278] While we are satisfied that Ms Robertson has adequately described the likely overall effects of the proposed flow regime on the wetlands associated with the lower Waitaki River, we agree with Dr Rate that having more detailed information on the ecological significance of individual wetlands would have assisted in evaluating the significance of the adverse effects. We are not able to predict with any confidence the efficacy and efficiency of the proposed mitigation. We consider that further in Chapter 5.0 of this decision.

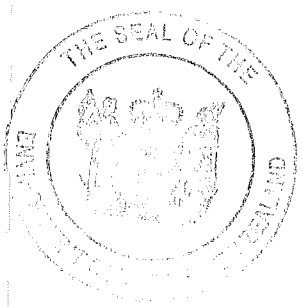
4.7 Effects on water quality and the concentration of pollutants

Microbiological water quality

[279] We have found that the Waitaki's tributaries generally contribute water of poorer quality to the river and that there are non-point sources of faecal contamination from livestock and waterfowl along the Waitaki River itself. Mr Ball explained that the proposed diversion of a portion of the river flow would not add to the microbial load, but the diversions of the better quality water from the river between the Waitaki Dam and Stonewall would reduce the dilution of contaminants entering this section of the

---

424 Dr S R Rate, evidence-in-chief para 28 [Environment Court document 53].
425 Ms D M Robertson, evidence-in-reply para 21 [Environment Court document 13A].
426 Ms D M Robertson, evidence-in-chief para 133 [Environment Court document 13].
427 Dr P B Grove, evidence-in-chief para 24 [Environment Court document 38].
428 Dr S R Rate, evidence-in-chief para 31 [Environment Court document 53].
429 Transcript page 981 *et ff.*



river. He assessed the probable deterioration in water quality and then the (increased) risk of disease through recreational contact, drinking water and the consumption of mahinga kai[430].

[280] To assess the effects on recreational water quality Mr Ball took the ratio of the median flows from December to April (when most recreation occurs on the river) between the status quo and AFR-with hydro (156 m^3/s) scenario. He used this ratio to predict future *E coli* concentrations and compared these to the Recreational Water Guidelines[431]. The results, assuming that the sources of microbial contamination were unchanged, were that the reduced flow would have a significant impact on the suitability for recreation as measured by the guidelines. At present five out of six sites sampled between the dam and Stonewall are classified as 'very good to good' (the exception being 'poor to very poor' just below the confluence with the Hakataramea River). Under the AFR-with hydro scenario all but one of these sites drops to 'fair to poor'. The exception is the Kurow boat ramp which is likely to remain 'very good'[432].

[281] Mr Ball also considered the impact of the minimum flow under the AFR-with hydro scenario (110 m^3/s) on *E coli* concentrations. He predicted that most sites are likely to deteriorate further to 'poor to very poor'. However, these low flows would occur during June to August when recreational activity is at its minimum[433].

[282] Mr Ball then considered the risk of *Campylobacter* infection from recreational exposure in the river between the Waitaki Dam and Stonewall. His modelling and risk assessment gave a best estimate that 22 per thousand swimmers are likely to be infected at present river flows and this would increase with the proposed reduction in flow. He considered the data to be insufficient to reliably quantify the increased future risk of infection. We should add that Mr Ball considered that the current risk of recreationally acquired *Campylobacter* infection is already 'too high'[434]. We note that Mr Ball's assessments are based on the assumption that microbial loading does not increase due to

---

430 Mr A Ball, evidence-in-chief paragraphs 23–24 [Environment Court document 23].
431 Mr A Ball, evidence-in-chief para 27 [Environment Court document 23].
432 Mr A Ball, evidence-in-chief para 29 [Environment Court document 23].
433 Mr A Ball, evidence-in-chief para 30 [Environment Court document 23].
434 Mr A Ball, evidence-in-chief para 35.11 [Environment Court document 23].

changes in livestock numbers in the catchment[435]. Given the trend is to greater intensification in agricultural operation in the area, it is likely that this is not a valid assumption, and that the outcome in terms of campylobacter infection will be even worse than Mr Ball is suggesting. Any increase due to increased agricultural operations cannot, of course, be held against the NBTC.

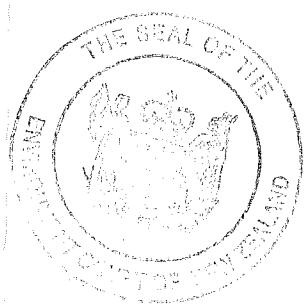
[283] Mr Ball reviewed the drinking water quality monitoring data for seven supplies in the lower Waitaki catchment. None of the treatment plants met the requirements for protozoan compliance (adequate treatment to remove *Cryptosporidium*)[436]. None of the supplies achieved consistent bacteriogical compliance over the years 2001 to 2007[437] although compliance at Kurow has improved since 2004. The Kurow and Duntroon supplies are in the section of the river affected and these are both groundwater sources.

[284] Mr Ball considered the possible decline in microbiological quality in the groundwater (following reduced river flows) and the potential impact on compliance with the drinking water standards. He noted that the increase in bacterial concentrations with reduced flows was small (two to three-fold) and insignificant compared with the large fluctuations (say 100 times background) expected in surface waters. He considered that such an increase would not impact compliance for water supplies that were adequately treated[438]. Such an increase might affect compliance at Kurow although he believed that grazing animals in the vicinity of the wells posed a greater risk[439].

[285] Overall the deterioration in microbial quality would increase the risk of contracting drinking-water-borne disease, but the increase is likely to be marginal[440]. Mr Ball concluded by noting that improvements to the drinking water treatment processes of these supplies would be required in order for them to comply with the *E coli* and protozoal criteria of the drinking water standards irrespective of the flow regime

---

435 Mr A Ball, evidence-in-chief para 28(c) [Environment Court document 23].
436 Mr A Ball, evidence-in-chief para 39 [Environment Court document 23].
437 Mr A Ball, evidence-in-chief para 41 [Environment Court document 23].
438 Mr A Ball, evidence-in-chief paragraphs 45–46 [Environment Court document 23].
439 Mr A Ball, evidence-in-chief para 47 [Environment Court document 23].
440 Mr A Ball, evidence-in-chief para 68 [Environment Court document 23].



in the Waitaki River[441]. Finally we record that Mr Ball considered the health risk associated with the consumption of mahinga kai to be very small at present and to remain so under the proposed flow regime[442].

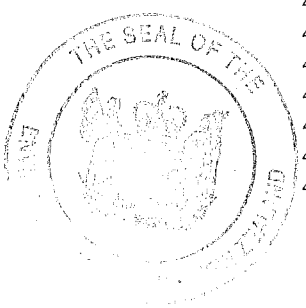
Physical and chemical water quality

[286] Mr Norton outlined his methodology for assessing the effects of the proposed flow regime on water quality in the section of the river between the Waitaki Dam and Stonewall[443]. He considered the median flows for the status quo (369 m^3/s) and the AFR-with hydro scenario (140 m^3/s) and used the ratio of the flows (approximately 2.6) to calculate the reduced dilution capacity[444]. He predicted that the reduced dilution capacity would mean increased contaminant concentrations, possibly breaching the NRRP water quality standards particularly for dissolved nutrients – dissolved inorganic nitrogen ("DIN") and dissolved reactive phosphorous ("DRP)[445]. He noted that the median nutrient concentrations did not breach the MfE (2000) periphyton guidelines[446] – being 93% of the guideline value for DRP and 65% of the guideline value for DIN – although they would be breached on some occasions[447].

[287] In response to questions from the court Mr Norton confirmed that he had not taken into account the possibility of increased intensification of agriculture in the catchment nor any potential lag between intensification and the resulting increased nutrient concentrations in the river. He explained that nutrient budgets had not been attempted on a catchment wide basis although research was continuing in some sub-catchments[448]. Dr Burrell[449] and Mr Norton[450] agreed that the key issue relating to the increased nutrients is that it would increase the risk of periphyton growth. We discuss this further in the next section. Mr Norton concluded that there would not be breaches

---

441 Mr A Ball, evidence-in-chief para 48 [Environment Court document 23].
442 Mr A Ball, evidence-in-chief paragraphs 55-59 [Environment Court document 23].
443 Mr E J Norton, evidence-in-chief para 19 [Environment Court document 8].
444 Mr E J Norton, evidence-in-chief para 30 [Environment Court document 8].
445 Mr E J Norton, evidence-in-chief para 31 [Environment Court document 8].
446 Attachment I to Mr E J Norton, supplementary evidence [Environment Court document 8C].
447 Mr E J Norton, evidence-in-chief para 32 [Environment Court document 8].
448 Transcript page 254 *et ff.*
449 Dr G P Burrell, evidence-in-chief para 26 [Environment Court document 41].
450 Mr E J Norton, evidence-in-reply para 18 [Environment Court document 8B].



of any other physical or chemical water quality parameters due to the reduced dilution[451].

4.8 Habitat modelling based on the flow regimes

[288] Mr Jowett considered the historical record of flows in the lower Waitaki River and the influence of the Waitaki power scheme on changes in habitat. He noted that from 1926 through to 1952 the 7-day minimum flows were less than 110 m^3/s on six occasions and monthly minimum flows were less than 130 m^3/s on seven occasions. The mean of the lowest flows that occur continuously over a 7-day period (the mean annual low flow or MALF) was used as an indicator of low flow limitations on aquatic benthic populations with life cycles longer than a year[452].

[289] In the lower Waitaki River the MALF increased (with the construction of dams and controls on lake levels) from just over 120 m^3/s prior to 1950 to about 200 m^3/s after 1980[453]. That change is because the power scheme reduces the seasonal variation with flows lower in spring and summer and higher in winter than they would be naturally. Flood flows have also reduced, particularly in the mid range[454]. The operation of the Waitaki power station also results in a greater daily flow fluctuation than would occur naturally. Between 1996 and 2000 the average daily fluctuation was 80 m^3/s and the average 30-day fluctuation about 300 m^3/s[455]. Mr Jowett noted that a reduction in the magnitude and frequency of these fluctuations would reduce the varial zone and is likely to increase the benthic productivity of the river[456]. We accept his opinion on that.

---

451 Mr E J Norton, evidence-in-chief para 33 [Environment Court document 8].
452 Mr I G Jowett, evidence-in-chief paragraphs 36–37 [Environment Court document 7].
453 Mr I G Jowett, evidence-in-chief para 37 [Environment Court document 7].
454 Mr I G Jowett, evidence-in-chief para 38 [Environment Court document 7].
455 Mr I G Jowett, evidence-in-chief para 39 [Environment Court document 7].
456 Mr I G Jowett, evidence-in-chief para 42 [Environment Court document 7].

The IFIM approach

[290] Mr Jowett outlined his assessment of the effects on instream habitat of the proposed flow regime for the lower Waitaki River. He used a technique known as the instream flow incremental methodology ("IFIM") to consider the environmental changes (including physical habitat, water temperature, water quality and river morphology) accompanying a change in flow. He explained that the IFIM habitat analysis had three steps:

- Survey and hydraulic modelling
- Selection of habitat suitability criteria
- Evaluation of flow regime requirements and alternatives.

The physical habitat (water depth, velocity and substrate) component of the IFIM quantifies the change of physical habitat for alternative flow scenarios[457]. Mr Jowett wrote that he had reviewed seven studies of the application of IFIM to predict the response of aquatic communities to flow changes. He noted that the biological responses were consistent with predictions in all but one study, that of trout and invertebrate communities in the Ohau River. He suggested that the lower trout numbers in that case might be due to problems with recruitment and fish passage[458].

[291] Mr Jowett had acknowledged some limitations of IFIM in his evidence-in-chief[459]:

> It is unlikely that the state of knowledge of biological systems will ever reach the stage where the effect of flow changes on stream populations can be predicted with absolute certainty. Experience, case studies, environmental risk, and out-of-stream benefits all play a part in the decision-making process.

457 Mr I G Jowett, evidence-in-chief paragraphs 11–19 [Environment Court document 7].
458 Mr I G Jowett, evidence-in-chief para 29 [Environment Court document 7].
459 Mr I G Jowett, evidence-in-chief para 20 [Environment Court document 7].

He also pointed out that the main source of error is the assumption that the surveyed reaches are representative of the whole lower river[460]. We look more closely at this issue when we discuss those surveys in more detail below. Dr Richard M Allibone, called by the Canterbury Regional Council, had reviewed the instream habitat modelling work carried out by Mr Jowett. He opined that the three reaches chosen were appropriate for such modelling and provided adequate representation of the river. He was satisfied that appropriate fish species had been included[461].

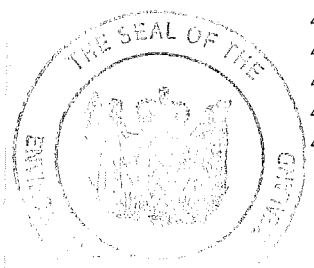
[292] Dr Michel P Dedual, a fishery scientist called by the Society, challenged the use of IFIM and the physical habitat simulation modelling (PHABSIM) approach. He considered this tool to be overly simplistic given that physical habitat is just one of many variables that can influence aquatic communities[462]. He expressed concern about the uncertainties associated with transects being representative of the river, the validity of the assumption that fish will chose the same physical habitat under differing flow conditions, and the accuracy of the preference curves[463].

[293] Mr Jowett did not accept the criticisms of the IFIM approach and referred both to a detailed explanation of the method that he had published, and to Ministry for the Environment draft guidelines for methods for establishing ecological flows and water levels. He noted that the draft guidelines recommend instream habitat modelling for rivers such as the Waitaki where the degree of hydrologic alteration is high[464].

[294] For his part Dr Dedual considered that it was critical to incorporate elements of the natural flow regime to ensure ecosystem integrity. He favoured, but did not apply to the lower Waitaki, a technique called the Range of Variability Approach ("RVA") for setting environmental flow targets based on the river's natural flow regime[465]. During cross-examination Dr Dedual said that he had never visited the Waitaki River and he was not familiar with the braided rivers of Canterbury[466]. Nor was he familiar with

---

460 Mr I G Jowett, evidence-in-chief para 22 [Environment Court document 7].
461 Dr R M Allibone, evidence-in-chief paragraphs 14-15 [Environment Court document 40].
462 Dr M P Dedual, evidence-in-chief paragraphs 12–13 [Environment Court document 54].
463 Dr M P Dedual, evidence-in-chief paragraphs 16–29 [Environment Court document 54].
464 Mr I G Jowett, rebuttal evidence paragraphs 2.2–2.4 [Environment Court document 7A].
465 Dr M P Dedual, evidence-in-chief paragraphs 42–52 [Environment Court document 54].
466 Transcript p. 1017.



existing or proposed flow regimes of the lower Waitaki River and the impact of the power scheme[467].

[295] Mr Jowett agreed with Dr Dedual that the RVA methodology would produce a flow regime that would maintain the existing ecosystem, provided there were no other changes. However, he contended that the RVA method did not predict the effects on habitat for different flow regimes and simply assumed that the natural flow regime was the best. Mr Jowett also noted that the current flow regime of the lower Waitaki River is substantially different to its natural flow and yet it supports a highly valued aquatic ecosystem[468]. Mr Jowett described how his experience of flow regime changes in other rivers supported his contention that flows very much lower and different from natural flow regimes can maintain healthy ecosystems, healthy benthic invertebrate communities and provide excellent fisheries[469].

[296] In response to questions from the Court Dr Dedual acknowledged that changing the flow regime of the river may be of benefit to some species and detrimental to others. He considered that the outcome for the ecosystem as a whole was likely to be detrimental although the complexity of the response made predictions difficult[470]. He agreed that adaptive management was an appropriate response to the uncertainties in any modelling approach[471]. We consider that Dr Dedual has raised important criticisms of PHABSIM particularly for rivers with more natural flows than the Waitaki. Further, Mr Jowett acknowledged that there are limitations in any modelling approach. However, Mr Jowett has had considerable experience with the IFIM approach and (as we have said) presented case studies of its application in other rivers. Dr Allibone supported[472] the modelling approach and the manner in which it has been carried out. We are satisfied for the purposes of this hearing that it is an established, relatively robust and scientifically valid approach given the historical alteration to the natural flow regime and artificial nature of both the status quo and proposed flow regimes. Overall

---

467 Transcript p. 1021.
468 Mr I G Jowett, rebuttal evidence paragraphs 2.6–2.8 [Environment Court document 7A].
469 Mr I G Jowett, evidence-in-chief para 98 [Environment Court document 7A].
470 Transcript p. 1024.
471 Transcript p. 1024.
472 Dr R M Allibone, evidence-in-chief paragraphs 14 to 16 [Environment Court document 40].

we find that IFIM is an appropriate model for predicting effects on the lower Waitaki River.

The surveys

[297] One reach was surveyed in the single channel section between the Waitaki Dam and Kurow at three flows (320, 227 and 141 m^3/s). The habitat/flow relationships in this reach were very different to those in the braided section of the river.

[298] Two reaches (Ferry Road and Priest Road) were surveyed in the lower Waitaki River below Kurow at nominal flows of 350, 150, 120 and 85 m^3/s. The main source of potential error is the assumption that these two reaches are representative of the whole of the lower river[473]. Mr Jowett accepted that if the study reaches were not representative the predictions might not reflect the true habitat at a particular flow[474]. However, he was confident that the reaches were representative for two reasons. Firstly the factors controlling the morphology of the river (strength of banks and bed, gradient, and magnitude of flood flows) do not change significantly between Kurow and the sea. And secondly the habitat/flow predictions from each reach were practically identical[475].

[299] During cross-examination[476] Mr Jowett acknowledged that the Ferry Road reach had fewer channels and deeper water than the Priest Road reach and was not representative of the river in terms of braiding intensity. He explained that, despite this difference, the habitat/flow relationships were similar. He further explained that this finding supported his contention that it is gradient, substrate composition and flood flows that generate morphology and not the number of braids or small changes in river width. Mr Jowett acknowledged that the Ferry Road reach is below Stonewall and the proposed outfall. He argued that it was still appropriate to use the results because the morphology of the river was similar. He also noted that he came up with the same assessment of effects whether he used the data from the Priest Road reach, the Ferry Road reach or both reaches together[477]. Based on that evidence we are satisfied that the

---

473 Mr I G Jowett, evidence-in-chief para 22 [Environment Court document 7A].
474 Transcript p. 195.
475 Dr I G Jowett, evidence-in-chief para 23 [Environment Court document 7].
476 Transcript p. 199 *et ff.*
477 Transcript p. 200.

Ferry Road and Priest Road reaches are sufficiently representative of the lower braided section of the Waitaki River.

Habitat suitability curves

[300] Habitat suitability curves for benthic invertebrates were constructed by Mr Jowett from measurements in the braided section. The curves assume that any depth of water would provide suitable habitat although studies in the single channel section indicate abundance decreases with depth and distance from the bank[478]. In response to questions from the court Mr Jowett clarified that this would lead to an over estimate of the habitat available at high flows[479].

[301] Electrofishing surveys were used to develop habitat suitability criteria for fish, specifically upland bully, common bully, bluegill bully, longfin eel, shortfin eel, torrentfish, Canterbury galaxias, juvenile brown trout and Chinook salmon. These criteria and curves from other research were used to model native fish habitat. Habitat suitability curves from other research on trout, food production and Chinook spawning were used to model salmonid habitat[480].

The results

[302] Mr Jowett assumed[481] that the current mean annual 7-day minimum flow of 220 m^3/s set the present extent of viable habitat for instream organisms. His results showed:

(a) for the Waitaki to Kurow single channel section the maximum area of habitat for particular species is provided by a range of flows[482]:
< 110 m^3/s for native fish and juvenile trout
150 m^3/s for benthic invertebrates
100 m^3/s for brown trout
150-200 m^3/s for adult rainbow trout

478 Mr I G Jowett, evidence-in-chief para 52 [Environment Court document 7].
479 Transcript p. 225.
480 Mr I G Jowett, evidence-in-chief paragraphs 53–55 [Environment Court document 7].
481 Mr I G Jowett, evidence-in-chief para 57 [Environment Court document 7].
482 Mr I G Jowett, evidence-in-chief para 58 [Environment Court document 7].

(b) For the braided section below Kurow the area of suitable habitat predicted increases almost indefinitely with flow as the river spreads out[483]. Conversely, the amount of physical habitat available for most species declines as flows reduce below 220 m^3/s caused by the reduction in total water surface area. At flows less than 100 m^3/s the proportion of runs reduce sharply, pools increase, and the river is predominantly confined to the main channels[484].

[303] In Mr Jowett's opinion the reduction in habitat with lower river flows would be partially offset by the decrease in short-term flow fluctuations and the consequent decrease in the varial zone. This decrease would increase the productive area and suitable physical habitat for a wide range of ecosystem components[485]. In particular the more stable physical habitat would benefit benthic invertebrates and consequently native fish and salmonids[486].

[304] Mr Jowett used both the physical habitat availability (weighted usable area or WUA) and the average habitat suitability (habitat suitability index or HIS) as indicators of habitat quantity and quality. For the lower Waitaki River the flow reduction from 220 to 150 m^3/s caused a loss of habitat area for 32 species out of 36 species and an increase for those species that preferred deep water with moderate velocity (adult trout and salmon). The quality of habitat improved for 23 species and declined for 13 although the changes were relatively small. A similar pattern occurred for flow reduction to 110 m^3/s with overall loss of habitat area and increase in average habitat quality[487]. Mr Jowett commented[488]:

---

483 Mr I G Jowett, evidence-in-chief para 87 [Environment Court document 7].
484 Mr I G Jowett, evidence-in-chief paragraphs 59–60 [Environment Court document 7].
485 Mr I G Jowett, evidence-in-chief para 64 [Environment Court document 7].
486 Mr I G Jowett, evidence-in-chief paragraphs 89–90 [Environment Court document 7].
487 Mr I G Jowett, evidence-in-chief paragraphs 94-96 [Environment Court document 7].
488 Mr I G Jowett, evidence-in-chief para 97 [Environment Court document 7].

> In my studies of native fish, benthic invertebrates and trout I have formed the opinion that the quality of the habitat in a river is a better indicator of the aquatic communities present than the quantity of habitat, although often there is very little difference between the two measures.

The flushing flows, channel maintenance flows and flow variability

[305] Mr Jowett explained that regular flushing flows would scour fine sediments and periphyton from the bed of the river. The timing is a balance between these positive effects and potential disturbance to birds and salmonids[489]:

> The NBTC flow regime, with 6 releases between January and April and one between July and August (as provided by the consent conditions), offers more protection to nesting birds and emerging salmonids, but may result in greater accumulation of periphyton.

Mr Jowett opined that the number and timing of the flushing flows could be determined by the adaptive management approach in response to the occurrence of nuisance periphyton events. He considered that up to nine events per year might be required and recommended that the timing be synchronised with flow variations in the tributary streams to minimise accumulations of fine sediment[490]. Mr Jowett also explained that large floods (flows greater than 900 m^3/s) would maintain the fairway by removing some vegetation, retain the natural braiding pattern and move sediments contributed from tributaries[491].

[306] As for the overall impact of the WRP-with hydro and AFR-with hydro flow scenarios. Mr Jowett concluded[492]:

> Overall, biological productivity of the system is expected to increase with either scenario, although this depends on the effectiveness of the flushing flows, channel maintenance flows and flow variability. The effects of the WRP-with hydro and AFR-with hydro flow scenarios on aquatic ecosystems are similar.

489 Mr I G Jowett, evidence-in-chief para 77 [Environment Court document7].
490 Mr I G Jowett, evidence-in-chief para 77 [Environment Court document7].
491 Mr I G Jowett, evidence-in-chief para 78 [Environment Court document7].
492 Mr I G Jowett, evidence-in-chief para 101 [Environment Court document 7].

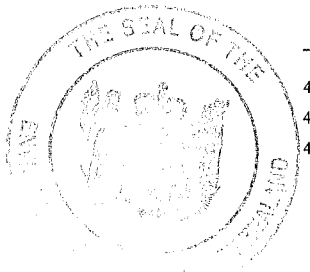
We accept the results of the habitat modelling that has been carried for the lower Waitaki River and Mr Jowett's overall conclusion that the biological productivity of the system is likely to increase compared with the status quo. Whether this results in a positive or negative effect overall is much more difficult to evaluate. To resolve this issue we must consider the effects on individual species and communities within the ecosystem. To the extent necessary we perform that exercise below.

4.9 Effects on instream flora

[307] The Society is concerned that the proposed flow regime in the lower Waitaki will significantly increase the proportion of didymo colonising the modified river from the Waitaki Dam to Stonewall. For the Society Mr Chisholm predicted an increase in the proportion of didymo and considered that it would have adverse effects on a wide range of values. For Meridian Mr Norton considered that the effects of the AFR-with hydro and WRP-with hydro scenarios were equivalent with respect to consequences for the periphyton and macrophyte communities. To predict the effects of the AFR-with hydro flow scenario compared with the status quo for three sections of the lower Waitaki River, Mr Norton relied on the hydrological predictions of Dr Henderson and on the instream habitat analysis carried out by Mr Jowett[493].

Effects from the Waitaki Dam to Kurow

[308] Mr Norton predicted that under the AFR-with hydro scenario the location of suitable habitat for periphyton and macrophyte communities would shift inwards towards the centre of the single stem. The overall cover and biomass of most species would be similar compared with the status quo (largely because the percentage of suitable habitat area for most macrophytes and periphyton would be similar as shown by Mr Jowett's in-stream habitat analysis). Lower velocities might favour a small increase in filamentous periphyton but this is unlikely to cause nuisance growths[494] under the AFR-with hydro. Decreased short-term flow fluctuations under the NBTC would also reduce the varial zone and reduce suitable habitat for the low mound macrophyte communities. These communities are relatively rare in this single channel section of the river[495].



493 Mr E J Norton, evidence-in-chief para 62 [Environment Court document 8A].
494 Mr E J Norton, evidence-in-chief paragraphs 63–64 [Environment Court document 8A].
495 Mr E J Norton, evidence-in-chief para 65 [Environment Court document 8A].

Effects from Kurow to Stonewall

[309] Compared with the status quo, under the AFR-with hydro scenario the percentage of suitable habitat for short filamentous periphyton and diatoms would be the same, although the location would shift. The area of suitable habitat for long filamentous periphyton is expected to increase. The periphyton habitat quality is expected to improve with the reduction in short-term flow fluctuations. Overall increased periphyton growth is expected[496]. Mr Norton commented[497]:

> Whether increased periphyton growth has solely beneficial effects for biological productivity or whether nuisance periphyton blooms (including didymo) will occur depends on several factors including water temperature, nutrients, the presence of invertebrate grazers, and the frequency of flushing flows and floods.

He considered that water temperature is unlikely to change. On the other hand nutrient concentrations are likely to increase, although that effect is likely to be offset since periphyton grazers are also expected to increase and control periphyton blooms to some extent.

[310] The key controlling factors are the flow regime and the frequency of flushing flows and floods[498]. Under the AFR-with hydro scenario nuisance blooms are likely to increase due to the reduced frequency of small floods (less than 900 m^3/s). The consent conditions include 450 m^3/s flushing flows and a 48 hour tunnel shut-down during flows above 900 m^3/s. We return later to the issue of the potential for nuisance growths of periphyton, particularly didymo.

[311] Only a small proportion of the riverbed is suitable for macrophytes and the area of suitable habitat is not expected to change. The habitat quality is likely to improve, given lower velocities and reduced small floods, but the overall biomass would continue to be limited by the large floods. Mr Norton considered there was a risk of enhanced growth of invasive exotic macrophytes (such as *Lagarosiphon major* and *Egeria densa*)

---

496 Mr E J Norton, evidence-in-chief para 67 [Environment Court document 8A].
497 Mr E J Norton, evidence-in-chief para 68 [Environment Court document 8A].
498 Mr E J Norton, evidence-in-chief para 69 [Environment Court document 8A].

if they became established in the river. He recommended ongoing surveillance monitoring for such nuisance species[499].

[312] As for the low mound communities (at present mainly in the varial zone) Mr Norton predicted a 60% reduction in the suitable habitat for these communities and a shift in location at the new water surface/bank interface. While he considered this to be an adverse effect of the reduction in the varial zone he noted the wider context of benefits for other components of the aquatic ecosystem including benthic invertebrate productivity, native fish, trout and riverbed birds.

Effects below Stonewall

[313] The effects on periphyton and macrophytes in the section of river downstream of Stonewall are small because the hydrology of the river is largely unaffected by the NBTC[500].

Nuisance growth of periphyton including didymo

[314] Mr Norton was not able to make firm predictions as to the effects of the proposed flow regime on didymo. He noted that didymo was new to New Zealand and that it was not possible to predict how it would mature in our rivers. He has assumed that didymo is here to stay[501]. On that basis Mr Norton's initial instream habitat analysis predicted that 67% of the wetted area of the riverbed would be suitable habitat for didymo for the AFR-with hydro scenario compared to 74% for the status quo[502].

[315] Mr Chisholm cautioned against such a simple approach and used his own observations of didymo in the river to construct a habitat suitability curve. He looked at the habitat suitability at the median flow and deducted 13% for the varial zone, which is didymo free, under the status quo[503]. He then predicted an increase in didymo habitat suitability from 0.435 under the status quo to 0.610 for AFR-with hydro[504].

---

499 Mr E J Norton, evidence-in-chief paragraphs 71–72 [Environment Court document 8A].
500 Mr E J Norton, evidence-in-chief para 75 [Environment Court document 8A].
501 Mr E J Norton, evidence-in-chief para 80 [Environment Court document 8A].
502 Mr E J Norton, evidence-in-chief para 81 [Environment Court document 8A].
503 Mr W P Chisholm, evidence-in-chief paragraphs 42 – 47 [Environment Court document 51].
504 Mr W P Chisholm, evidence-in-chief para 48 [Environment Court document 51].

[316] Mr Norton accepted that Mr Chisholm's habitat suitability curve was useful and Mr Jowett used that curve to predict the physical habitat using RHYHABSIM (River Hydraulics and Habitat Simulation Model). RHYHABSIM takes into account the fluctuations in flow and predicted that 37 to 50% (depending on the fluctuation in flow) of the wetted area of the riverbed[505] would be suitable habitat under the status quo compared to 61% for the AFR-with hydro flow regime. Mr Norton accepted that this agrees with Mr Chisholm's analysis[506] and explained the predictions as to habitat[507]:

> What this means is if I went to the Status Quo river at Priest Road while it was flowing at 220 m^3/s I would expect to see about 43% of the riverbed covered with didymo. If I went to the same place in the river under the AFR-with hydro regime I would expect to see about 61% of the riverbed covered with didymo.

We note that Mr Norton stated, when questioned by the Court[508], that he was actually referring to the wetted area of the riverbed not to the riverbed generally.

[317] In supplementary evidence Mr Norton quantified the extent of suitable didymo habitat at Priest Road for the status quo and AFR-with hydro flow regimes in this table[509]:

	Flow (m^3/s)	Wetted width (m)	% didymo habitat	Width didymo habitat (m)
Status quo	220	280	43	120
AFR with hydro	120	209	61	127

505 i.e. habitat was expressed as a percentage of the wetted area of the riverbed and not as a percentage of the riverbed as a whole [Transcript p. 263].

506 Mr E J Norton, evidence-in-reply para 23 [Environment Court document 8B].

507 Mr E J Norton, evidence-in-reply para 24 [Environment Court document 8B].

508 Transcript pp 263 and 264.

509 Mr E J Norton, supplementary evidence para 3 [Environment Court document 8C].

Mr Norton explained that nuisance periphyton habitat is usually expressed relative to the wetted area of the riverbed, rather than in absolute terms, because that is what is noticed by people standing in or beside the river[510]. He observed that didymo would grow across all of the most productive habitat of the river under both the status quo and AFR-with hydro scenarios. He considered that the actual area covered by didymo is likely to be similar in the two scenarios (as shown in the table above) and that the impact on ecosystem productivity is likely to be similar[511].

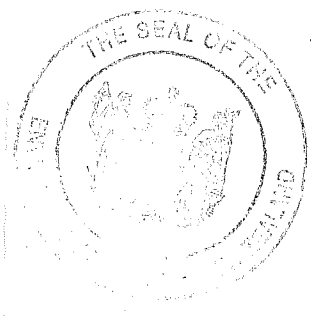
[318] Mr Chisholm outlined the adverse effects of didymo on a wide range of values[512]:

- Instream – adverse effects on other algae, macroinvertebrates, native fish, trout and wading birds
- Health – direct effects causing itchy skin, rashes etc.
- Water quality – effects on water odour, taste and texture
- Recreational – effects on fishing, jet boating, whitebaiting, swimming etc.
- Aesthetic – the brown slimy look of didymo is not aesthetically pleasing
- Economic – clogging irrigation, water supply intakes, canals etc.

We discuss some of these in what follows, but always bear in mind that Meridian is not responsible for the didymo in the river.

Effectiveness of the flow regime for didymo control

[319] Mr Norton[513] and Mr Chisholm[514] agreed that didymo tolerates a wider variety of flow conditions than most native filamentous periphyton, growing well in water velocities up to 1.5 m/s. They disagreed on the flow requirements for the removal of didymo:



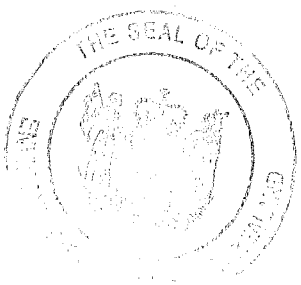
510 Mr E J Norton, supplementary evidence para 4 [Environment Court document 8C].
511 Mr E J Norton, evidence-in-reply para 25 [Environment Court document 8B].
512 Mr W P Chisholm, evidence-in-chief para 13 [Environment Court document 51].
513 Mr E J Norton, evidence-in-chief para 46 [Environment Court document 8A].
514 Mr W P Chisholm, evidence-in-chief para 17 [Environment Court document 51].

- Mr Chisholm considered that flushing flows, three times greater than the base flow, would be effective in removing native periphyton but not didymo[515]. He considered that some didymo would be dislodged but not sufficient to reduce the densities below nuisance levels[516];
- Mr Parker was also concerned that the proposed 450 m^3/s flushing flows would not remove didymo as he considered that the gravel bed must move to effectively dislodge the growth[517];
- Mr Norton agreed that didymo is more resistant to flushing and that the 450 m^3/s flushing flows may not remove the majority of didymo from the river[518]. He had initially predicted that the flood flows in the order of 900 m^3/s would be needed to remove significant didymo[519]. Since observing the 90% reduction in didymo in the river following the January 2009 flood (peak flow about 1000 m^3/s) Mr Norton considered that smaller floods would also remove significant didymo[520] because the dramatic removal of didymo in January 2009 occurred under a flood flow that was less than three times the base flow in the river[521].

[320] From observations of the river following flood events and normal river flows Mr Norton concluded that didymo was removed by a number of mechanisms and did not always require mobilisation of the gravel bed. He considered that the 450 m^3/s flushing flow could be more effective at removing didymo when the base flow of the river is lower. He noted studies of native periphyton communities that established biomass removal is a function of the relative increase in flow velocity. He acknowledged that this relationship might not hold for didymo[522].

---

515 Mr W P Chisholm, evidence-in-chief paragraphs 64-65 [Environment Court document 51].
516 Mr W P Chisholm, evidence-in-chief para 72 [Environment Court document 51].
517 Mr B J Parker, evidence-in-chief para 102 [Environment Court document 46].
518 Mr E J Norton, evidence-in-chief para 86 [Environment Court document 8A].
519 Mr E J Norton, evidence-in-chief para 87 [Environment Court document 8A].
520 Mr E J Norton, evidence-in-chief para 87 [Environment Court document 8A].
521 Mr E J Norton, evidence-in-reply para 30.2 [Environment Court document 8B].
522 Mr E J Norton, evidence-in-reply para 39 [Environment Court document 8B].



[321] Mr Norton was cautious about the exact flow requirements to remove didymo while optimistic about some beneficial removal at 450 m^3/s. He considered that the adaptive management approach would provide the opportunity to observe the effectiveness of flows between 450 and 900 m^3/s. Adjustments to the flow regime could then be considered[523]. During cross-examination he confirmed that trialling adjustments to the flushing flows would enable a better understanding of how didymo responds to changes in flow between 450 and 900 m^3/s[524]. Mr Norton concluded that he was more optimistic than Mr Chisholm about the potential effectiveness of the flushing flows for the removal of didymo, although he acknowledged that uncertainties remain[525].

Finding on instream flora

[322] We find that both native periphyton and didymo are likely to increase between Kurow and Stonewall. The magnitude and significance of that increase will depend on the effectiveness of the flushing and flood flow regime, particularly for removing nuisance growths. The potential for nuisance growths is related to both the flow regime and the nutrient concentrations in the river, tributaries and side braids. We conclude that there is insufficient experience of didymo in the Waitaki River to confidently prescribe a flow regime to manage nuisance growths. Accordingly we agree that an adaptive management approach is appropriate.

4.10 Effects on invertebrates and their habitat

[323] Dr Stark explained that invertebrate communities in gravel-bed rivers are intimately linked to periphyton communities, and that bed sediment stability and velocity affect both[526]. He considered the relationship between the discharge of the river and the area of suitable habitat for ten of the dominant invertebrate species recorded in the river surveys. For the single channel section of the river upstream of Kurow Dr Stark predicted that flows between 100 and 150 m^3/s would provide conditions that

523 Mr E J Norton, evidence-in-reply para 30.4 [Environment Court document 8B].
524 Transcript p. 248.
525 Mr E J Norton, evidence-in-reply para 33 [Environment Court document 8B].
526 Dr J D Stark, evidence-in-chief para 76 [Environment Court document 28].

would maintain the character and productivity of invertebrate communities close to the status quo[527].

[324] In the braided section of the river between Kurow and Stonewall Dr Stark considered that flows between 150 and 200 m^3/s would provide optimum habitat for invertebrates. He noted that the status quo flow regime is sub-optimal due to the extensive unproductive varial zone along the river margins and the deep swift central zone. A minimum flow regime between 110 and 150 m^3/s could cause a slight loss of habitat for benthic invertebrates but the loss would be offset by the reduction in the magnitude and frequency of flow fluctuations[528]. The greatest reduction in habitat would be for taxa that prefer swift waters[529].

[325] Mr Jowett described the change in composition of benthic invertebrate community between Kurow and Stonewall would be from one dominated by elmid beetles, *Pycnocentrodes,* caddisflies, mayflies, and snails to one dominated by snails, *Pycnocentrodes,* and perhaps net-spinning caddisflies. He considered that the total density of invertebrates would increase and have a positive effect on fish in the river[530], and we accept that prediction as being of medium likelihood.

4.11 Effects on native fish and their habitat

[326] Dr Jellyman considered the proposed flow regime with its much lower median flows, reduced flow variability compared with the status quo, and flushing flows. He considered that the increased flow stability of the proposed flow regime is likely to benefit native fish populations[531]. He considered that the flushing flows and flood flows would not have significant adverse effects, as native fish are well adapted to such conditions[532].

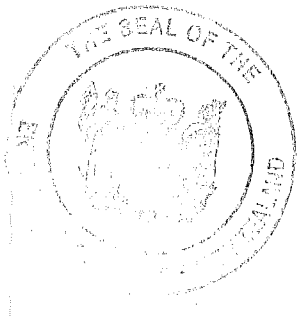
---

527 Dr J D Stark, evidence-in-chief para 81 [Environment Court document 28]
528 Dr J D Stark, evidence-in-chief para 88 [Environment Court document 28].
529 Dr J D Stark, evidence-in-chief para 82 [Environment Court document 28].
530 Mr I G Jowett, evidence-in-chief para 91 [Environment Court document 7].
531 Dr D J Jellyman, evidence-in-chief paragraphs 39–41 [Environment Court document 9].
532 Dr D J Jellyman, evidence-in-chief para 47 [Environment Court document 9].

[327] In respect of the habitat for native fish in the single stem river from the Waitaki Dam to Kurow Dr Jellyman explained that native fish are confined to the edge of the channel and that the IFIM analysis predicts flow reductions would provide more potential habitat, particularly for longfin eels greater than 300 mm in length. He cautioned that this would not automatically lead to greater numbers of fish. He noted that these larger long finned eels required daytime concealment cover, which might be provided by increased macrophyte growth as depths and velocities reduced[533].

[328] From Kurow to Stonewall the IFIM analysis predicted that the amount of usable habitat for native fish would decrease as flows reduce[534]. Upland bullies and a few longfin eels are the only native fish species present in significant numbers between Kurow and Stonewall. Dr Jellyman predicted that upland bullies will increase due to only a small reduction in habitat area, improved habitat quality and their observed ability to colonise a wider range of habitats than predicted by the IFIM model[535]. Habitat for longfin eels is predicted to reduce substantially – to 45% for small longfins and to 29% for larger longfins. Dr Jellyman considered this reduction to be of little practical significance given the very low numbers of the species in the river[536]. The reduction in the extent of the varial zone would improve the quality of their habitat.

[329] Dr Jellyman considered that the outfall near Stonewall would attract upstream migrating fish and exclusion could be achieved through a velocity barrier with flows above 1.5 m/s. He also recommended a deflecting structure to exclude those species able to leave the water and climb along the wetted margins. Dr Jellyman noted that Condition 14 of consent CRC071878 requires fish exclusion measures at the outfall[537]. Dr Jellyman noted a potential need for a small ladder to convey diadromous fish, especially juvenile eels, from below to above the outfall.



533 Dr D J Jellyman, evidence-in-chief paragraphs 44–45 [Environment Court document 9].
534 Dr D J Jellyman, evidence-in-chief para 50 [Environment Court document 9].
535 Dr D J Jellyman, evidence-in-chief para 51 [Environment Court document 9].
536 Dr D J Jellyman, evidence-in-chief para 52 [Environment Court document 9].
537 Dr D J Jellyman, evidence-in-chief paragraphs 82–85 [Environment Court document 9].

[330] Dr Allibone reviewed Dr Jellyman's evidence and agreed with his description of native species in the Waitaki River. He considered that Dr Jellyman had provided a good assessment of the likely outcome of NBTC on the native fish and agreed that the effects, with the proposed mitigation, would be minor or even positive in some parts of the river[538]. We accept those effects are likely to occur.

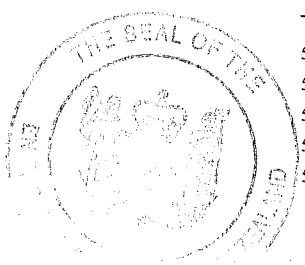
4.12 Effects on braided river birds and their habitat

Trends under current flows

[331] The current low success rate of breeding of black-fronted terns and black-billed gulls in the Waitaki is of great concern. Limited research carried out by Boffa Miskell Ltd on the upper Waitaki River showed that 10 black-fronted tern colonies (we were not given nest numbers) raised an average of 0.18 fledglings per nest[539]. Elsewhere within the Waitaki catchment research on the Ohau River showed breeding success of between 0.23 to 0.37 fledglings per nest[540] (1022 nests over 3 years). Similar research by Dr McClellan (for the Society) in Southland showed that breeding success of black-billed gulls varied between colonies from 0 and 0.88 fledglings per nest[541]. Dr McClellan concluded in respect of the status quo[542]:

> Thus maintaining the current level of breeding success on the Waitaki River will not sustain populations of black-fronted terns and black-billed gulls in the Waitaki and surrounding area.

That prediction was not challenged.



538 Dr R M Allibone, evidence-in-chief, paragraphs 22–30 [Environment court document 40].
539 Dr R K McLennan, evidence-in-chief para 22 [Environment Court document 49].
540 Dr R J Keedwell 'Breeding Biology of Black-fronted terns' *Emu 105*: 39-47.
541 Dr R K McClellan, evidence-in-chief para 22 [Environment Court document 49].
542 Dr R K McClellan, evidence-in-chief para 23 [Environment Court document 49].

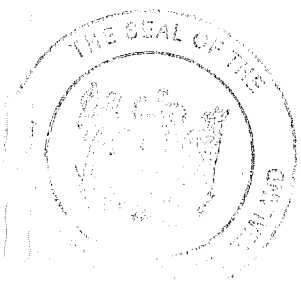
The AFR-with hydro flows

[332] The NBTC flow regime would result in increased exotic vegetation[543] in the lower Waitaki riverbed between Kurow and Stonewall. That is likely to have detrimental effects on braided river birds. Vegetation encroachment reduces[544] suitable sites for nesting, breeding, roosting and feeding. We accept that the Waitaki River is already 'poor habitat'[545] for braided river birds and is likely to become even worse unless remedial steps are taken.

[333] Given that context Dr Sanders described the four potential adverse effects and one potential positive effect of the NBTC as[546]:

(1) a loss of bird habitat, especially breeding sites, because of vegetation encroachment;
(2) a possible increase in predation because reduced flow might facilitate access to bird breeding sites by mammalian predators;
(3) a potential for increased conflict between human use of the river and breeding birds under lower flows because reduced flow might facilitate access to the river by humans and stock;
(4) a possible decrease in the availability of suitable aquatic foraging habitat or food supplies because of reduced flows;
(5) a possible reduction in losses of eggs and chicks to flooding because of an increase in flow stability.

Those problems are recognised by Meridian and it has suggested conditions obliging it to:



543 Dr D M Hicks, evidence-in-chief para 91 [Environment Court document 12].
544 Dr D M Sanders, evidence-in-chief para 48 [Environment Court document 14].
545 Dr D M Sanders, evidence-in-chief para 48 [Environment Court document 14].
546 Dr D M Sanders, evidence-in-chief para 61 [Environment Court document 14].

- maintain an area of suitable braided river bird habitat, not less than the area available prior to the commencement of the exercise of these consents;
- maintain, and where practicable, enhance the breeding success of threatened braided river bird species following the exercise of these consents.

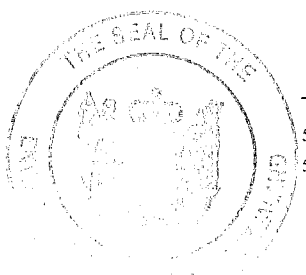
Those conditions are also the objectives of a "Braided River Bird Management Plan" prepared by Meridian. We will discuss the adequacy of the conditions and the management plan in Chapter 5.0.

4.13 Effects on salmon habitat and breeding

[334] The Society and supporting section 274 parties are concerned that the new flow regimes of the AFR-with hydro will have serious adverse effects on salmon breeding and populations. We read evidence on this from Mr Graynoth, the freshwater fisheries scientist called by Meridian. We have already mentioned that Dr Dedual was called by the Society, under a witness summons, to give evidence casting doubt on the methods relied on by Mr Graynoth.

Salmon

[335] As we stated in Chapter 2.0 salmon breed between April and June. The first issue to consider is whether the greatly reduced flows under the NBTC will reduce habitat. Mr Graynoth calculated[547] that, because of the reduced median flow in those months from the status quo of 347 m^3/sec to the AFR-with hydro predicted median of 122.6 m^3/sec there would be a 35% decrease in salmon spawning habitat above Stonewall. That is, at first sight, important because in fact[548] most salmon breeding takes place above Stonewall and below Kurow (where the braids start). However, such a major reduction in salmon breeding habitat is, or becomes, important only if habitat is a limiting factor to salmon breeding.



547 Mr E Graynoth, evidence-in-chief para 33 [Environment Court document 10].
548 See Chapter 2.0.

[336] The likely 35% reduction in spawning habitat under the AFR-with hydro flow scenario is a reduction from the present total of 680,000m^2 under the status quo to about 440,000m^2 under the NBTC. Relying on some 1973 American research[549], Mr Graynoth considered that each spawning pair needs an average 13.4m^2 for its redd and then made the simple calculation[550] that the 440,000m^2 of suitable habitat that would remain under the AFL-with hydro flow regime would be sufficient for 33,000 spawning pairs of salmon. He wrote[551] that in fact between 1967 and 2007 the maximum number of redds (in spawning pairs) was estimated at 7,000. In other words there is likely to be plenty of habitat for spawning salmon at current survival rates.

[337] Mr Graynoth acknowledged[552] that the area of suitable salmon habitat may be reduced by excessive growths of didymo and macrophytes (larger instream weeds) but pointed out, we think fairly, that this could occur with or without the AFR-with hydro flows. He also regarded the reduction in short-term fluctuations in flows as beneficial[553] in reducing the possibility of dewatering salmon redds or stranding fry.

[338] Salmon fry and fingerlings prefer to live and feed in slow flowing pools and backwaters[554]. The amount of that habitat is likely to stay the same[555] over a wide range of flows above 100 m^3/sec (remembering that the minimum low flow under the AFR-with hydro scenario is 110 m^3/sec), so those small juveniles are unlikely to be affected by the NBTC. Floods, even minor flushing events, harm salmon fry because they displace them[556]. At worst floods or flushing may wash salmon fry out to sea where the shock of the saltwater often kills them[557]. Of course the AFR-with hydro regime will

---

549 Bell, MC Fisheries handbook of engineering requirements and biological criteria: (Oregon US Army Corps of Engineers North Pacific Divers 1973).

550 Mr E Graynoth evidence-in-chief para 35 [Environment Court document 10].

551 Mr E Graynoth evidence-in-chief para 36 [Environment Court document 10].

552 Mr E Graynoth, evidence-in-chief para 37 [Environment Court document 10].

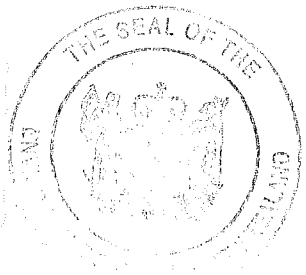
553 Mr E Graynoth, evidence-in-chief para 38 [Environment Court document 10].

554 Mr E Graynoth, evidence-in-chief para 47 [Environment Court document 10].

555 Mr E Graynoth, evidence-in-chief para 47 [Environment Court document 10].

556 Mr E Graynoth, evidence-in-chief para 43 [Environment Court document 10].

557 On our understanding of Chinook Salmon's native environment in North America they have much larger areas of sheltered mixed sea and freshwater in the fiords and sounds of the west coast of Canada and Puget Sound off Washington.



not stop floods coming down the river, but it can be and has been, designed[558] to avoid flushing flows in the spring months when salmon fry are at their most vulnerable.

[339] Mr Graynoth acknowledged, if only in his summary of potential adverse effects, that[559]:

> In some years the lack of natural floods, increased siltation and compaction of gravels, together with excessive growths of macrophytes and didymo, could reduce the survival of eggs and alevins in redds and possibly food supplies for juvenile fish.

However, overall he considered[560] that the AFR-with hydro flow regime is likely to be beneficial to salmon subject to uncertainties about the effects of didymo. We accept that evidence.

4.14 Effects on rainbow and brown trout

[340] Obviously the NBTC would have no effect on breeding of brown trout in the tributaries of the Waitaki River provided trout continue to have access to them. In the main stem between Kurow and Stonewall the effect of the AFR-with hydro flow regime on spawning would be[561] to reduce available habitat by nearly half (47%). That amount of habitat could be reduced[562] even further by large growths of didymo. While the AFR-with hydro's midwinter flushing flow might remove some didymo the flow might also damage some trout redds[563].

---

558 Mr E Graynoth, evidence-in-chief para 45 [Environment Court document 10].
559 Mr E Graynoth, evidence-in-chief para 51.2 [Environment Court document 10].
560 Mr E Graynoth, evidence-in-chief para 52 [Environment Court document 10].
561 Mr E Graynoth, evidence-in-chief para 55 [Environment Court document 10].
562 Mr E Graynoth, evidence-in-chief para 55 [Environment Court document 10].
563 Mr E Graynoth, evidence-in-chief para 55 [Environment Court document 10].

[341] Despite the large reduction in main stem breeding habitat for brown trout Mr Graynoth considered[564] that there is still a large amount of braided habitat (370,000 m^2) in the 31 kilometres between Stonewall and Kurow at flows of 130 m^3/s. Further as a positive point, Mr Graynoth described[565] how short term flow fluctuations will be minimised compared with the status quo fluctuations. That variation will[566]:

> ... reduce gravel movement, scouring and the exposure of redds[,] and improve egg and alevin survival when compared with the status quo.

[342] As we stated in Chapter 2.0 rainbow trout do not spawn in the main stem so their breeding will not be affected by the AFR-with hydro flows. As for the likely effect of the AFR-with hydro on juvenile trout rearing habitat that is, according to Mr Graynoth[567], that AFR-with hydro will reduce habitat by up to 21%. However, that may be offset to some extent by flow stabilisation, increased cover because macrophytes ('weeds') may increase[568], and the removal of flushing flows from September to December[569].

[343] As for trout food supplies, we found above that reductions in flow under the AFR-with hydro will increase the density of benthic invertebrates although there are concerns about changes in composition of invertebrate taxa, and about their accessibility within didymo.

[344] As for adult trout, in Mr Graynoth's opinion the instream habitat for brown trout peaks at very low flows 50 to 100 m^3/sec and for rainbow trout at 175 m^3/sec (in the single channel reach)[570]. We find there is a medium likelihood that the AFR-with hydro flow regimes are better for trout than the status quo, although the proportions of trout may change (although Mr Graynoth did not indicate in which direction).

---

564 Mr E Graynoth, evidence-in-chief para 57 [Environment Court document 10].
565 Mr E Graynoth, evidence-in-chief para 56 [Environment Court document 10].
566 Mr E Graynoth, evidence-in-chief para 56 [Environment Court document 10].
567 Mr E Graynoth, evidence-in-chief para 59 [Environment Court document 10].
568 Mr E Graynoth, evidence-in-chief para 59 [Environment Court document 10].
569 Mr E Graynoth, evidence-in-chief para 60 [Environment Court document 10].
570 Mr E Graynoth, evidence-in-chief para 70 [Environment Court document 10].

4.15 Effects on fish catchability and angling

[345] The question whether the AFR-with hydro flows will affect (mainly) salmon angling is an important issue to the Society. It called Mr B J Parker, a very experienced and knowledgeable angler, to give evidence about the values of the river at present and about the potential impact of the NBTC on those values. For its part Meridian called Dr J W Hayes, a scientist specialising in recreational trout and salmon fisheries with 26 years experience on the subject. Dr Hayes' overall conclusion[571] was that:

> Overall, ... the effects of the AFR-with hydro and WRP-with hydro flow scenarios on salmon angling habitat are minor, but the effect on water clarity, which is likely to translate to reduced catch rate, is more than minor. However, flushing flow conditions will act as mitigation for increased water clarity and will benefit salmon angling, as too will vegetation control measures.

Mr Parker was critical of this on the grounds that salmon anglers preferred flows over 300 m^3/sec both because (in his opinion) they caught more fish and because they enjoyed the big river experience.

[346] There is some doubt in our minds as to whether in fact anglers do catch more salmon at flows over 300 m^3/sec. The evidence for the assertion seems to be an example of the status quo heuristic – people are comfortable with what they know best – as Mr Parker conceded in cross-examination. Further, we received some evidence that more salmon are caught at lower flows. Dr Hayes wrote[572]:

> Modelling and analysis of expert angler assessment of the relationship between angling lies and flow indicate that the best flows for salmon angling habitat in the Lower Waitaki River fall in the range 130 m^3/s and 200 m^3/s, with the best single flow being 150 m^3/s. When evaluating flow regimes for salmon angling habitat it is the median flow during the salmon angling season (January – April) that is most relevant – i.e., the flow that the river is at most of the time.

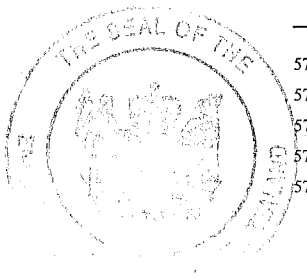
(We are surprised that Dr Hayes confused the median flow with the modal flow in that statement, but do not consider the confusion material.) On that basis he concluded that the best to worst flows for salmon angling would likely be:

571 Dr J W Hayes, evidence-in-chief para 113 [Environment Court document 11].
572 Dr J W Hayes, evidence-in-chief paragraphs 102 and 103 [Environment Court document 11].

- the 150 m^3/sec minimum flow in the WCWARP;
- the AFR-with hydro, median flow;
- the status quo.

[347] Dr Hayes pointed out[573] that the Waitaki IFIM results differed from those for the Rakaia River, and that the Rakaia results most closely agreed with the expert anglers' assessments. In response to Ms Owen, Dr Hayes conceded[574] that considering the WUA derived from the Rakaia fishery, the modelling indicated that the flow range of 150-230 m^3/s would give the maximum angling habitat. He reiterated[575] the uncertainty in the angling suitability curves and indicated that we should consider the Waitaki curve as well as the Rakaia curve. In his summary of the angling suitability curves[576] Dr Hayes clearly preferred the Rakaia curve as most closely matching the experts' assessments, and used aspects of the Waitaki and Rangitata curves to "provide supporting information".

[348] We conclude that river-specific angling suitability curves are an imprecise tool and have considerable uncertainty associated with them. Estimates of Weighted Usable (angling) Area derived from them need to be used cautiously. Therefore, we conclude that the WUA evidence is best interpreted as indicating that the area of angling habitat is highest over the range of flows from 130 m^3/s to over 250 m^3/s. We consider that trying to identify a single flow that gives the likely maximum area of angling habitat is to stretch the data and method too far. Noting Dr Hayes' comment to Ms Owen[577] that the message of the curves is that there is a lot of salmon angling habitat available, we conclude that there is plenty of salmon angling habitat at flows of up to (at least) 350 m^3/s. The amount of salmon angling habitat declines steeply as the flow falls to around 100 m^3/s or below.



573 Dr J W Hayes, evidence-in-chief paragraphs 47 - 49 [Environment Court document 11].
574 Transcript p 312
575 Transcript p 313
576 Dr J W Hayes, evidence-in-chief paragraph 52 [Environment Court document 11].
577 Transcript p. 314.

[349] In considering the meaning of the expert assessment and the weighted usable area assessment together, we note that angling is an art not a science, and that there are more factors involved than flow, water depth and velocity. Dr Hayes mentioned the presence and number of downstream 'leads'; the presence of shallow water (eg gravel bars) upstream; water clarity; and turbulence. We are therefore cautious in drawing conclusions from the WUA evidence, and place more weight on the experts' assessment than the WUA assessment. We conclude that there is plenty of good angling at flows from 150 m^3/s up to at least 350 m^3/s. We are hesitant in determining a single flow that maximises angling opportunities, but we suggest that Dr Hayes' evidence indicates that the most angling opportunities might lie in the range of flows from 200 to 250 m^3/s. Dr Hayes limited his consideration to only the identified flow scenarios and in doing so restricted himself to choosing one of those flow scenarios as the best single flow. We consider that identifying any single flow as the best for angling is problematic.

[350] In summary, under the NBTC flow regime there should still be plenty of good angling habitat between Kurow and Stonewall. The amount and quality of angling habitat at 150 m^3/s is significantly below that available at the best flows of 200-250 m^3/s. The best flows for angling habitat will not occur under NBTC except for brief periods as the periodic flushing flows are being ramped up and down. Those best flows are potentially available during the fishing season under the status quo flow regime. However, under the status quo regime, flows can be well above 350 m^3/s, with angling habitat availability at levels probably considerably lower than at 150 m^3/s. Under NBTC, the flow stability brings an advantage in terms of having plenty of angling habitat available on a much more predictable basis. Where the balance lies between plentiful, but less than optimal, angling habitat availability on a predictable and almost certain basis, versus plentiful but more variable angling habitat availability with the potential for both ideal and lesser availability, is not clear.

[351] Further, there is more to good fishing than angling habitat. Fundamental is the presence of fish. We have largely accepted already Mr Graynoth's evidence that the NBTC flow regime is likely to be beneficial to salmon, although there were some negative factors, uncertainty of the effects of increased didymo being the main one. He also considered the NBTC regime to be better (overall) for trout than the status quo.

We take into account Mr Parker's views[578] on the importance of the sidestreams and backwaters of good quality, and conclude that maintaining these characteristics of the river geomorphology is important to the maintenance of the angling experience. It is not just that the river remains braided that is important; the nature of the braids is also of some importance for anglers because fish (especially trout) may escape there – where the water often remains clear – if the river is discoloured[579] by a fresh.

[352] Dr Hayes discussed[580] the effect of freshes and floods in stimulating salmon upstream migration, and so their catchability. He noted that the NBTC regime is very stable in the affected reach. He considered[581] flow variations of 30-50% or more, lasting a few days, on a weekly or fortnightly basis as ideal. He noted that the six flushing flows between 1 January and 30 April (24 hours every three weeks on average) required by the Hearing Commissioners' General Conditions of consent will only partially mitigate for the reduced flow variability under NBTC. Dr Hayes addressed the issue of increased water clarity under NBTC and acknowledged the slight detrimental effect this will have on angling.

[353] Finally there is the 'big river' experience. Dr Hayes acknowledged there will be some loss of this experience, but he considered the Kurow-Stonewall reach of the Waitaki would still be a 'big river' under NBTC, yet with an advantage in terms of better angling access for foot anglers due to the lower river level.

[354] We consider that the pleasure or benefit from angling is subjective and complex. As well as the obvious considerations of the presence of fish and accessibility (both in terms of time and of physical access) there are elements of challenge, variety, isolation and 'getting away', as well as the amenity of the views, sights, smells and

578 Mr B J Parker, evidence-in-chief paragraphs 34-39 and 115 [Environment Court document 46].
579 Mr B J Parker evidence-in-chief para 115 [Environment Court document 46].
580 Dr J W Hayes, evidence-in-chief paragraphs 94-100 [Environment Court document 11].
581 Dr J W Hayes, evidence-in-chief para 97 [Environment Court document 11].

sensation of being on the river. The benefits and enjoyment of angling on the lower Waitaki are never going to be fully captured by measuring a limited number of physical attributes. They can be and have been encapsulated in the phrase, "the big river experience". Whether or not the lower Waitaki in the affected reach still remains 'big' relative to other rivers, it will no longer be 'big' in the way that it is under the status quo. With the flow under NBTC at less than one-half what it is currently and with the changes in channel form that will inevitably go with the lower flow regime, fishing in the affected reach of the river will be different from what it is now. We note that the big river experience from Stonewall to the sea, where 74% of the fishing takes place, will not be affected by the NBTC.

[355] Overall, we are uncertain whether angling on the affected reach of the Waitaki is likely to be detrimentally affected by NBTC compared to the status quo, due in part to the highly subjective nature of the 'big river' angling experience, as well as the uncertainties around angling habitat and didymo. There are positives for anglers from lower river levels in terms of improved access and potentially safer river conditions encouraging more fishing activity.

4.16 Effects on other recreation, access and amenities

[356] We have commented on the effects on eels, fish habitat, breeding, catchability and angling above. We now consider the effects on other recreation, access and amenities. From the list of activities identified in section 2.1, we consider the following may be affected by NBTC: jet boating, 4WD, quad biking and motor biking, and swimming. We consider each in turn.

Jet boating

[357] Jet boating a high flow, braided river like the Waitaki is not a common opportunity, and the NBTC flow regime would reduce this. Mr Greenaway downplayed the significance of this reduction, describing it as 'minor', due to the reduction only affecting the reach above Stonewall, and that reach only being affected by a partial reduction in the experience.[582] In assessing the effect on the reach above Stonewall as only a partial reduction, Mr Greenaway seemed to be relying on the view

[582] Mr R Greenaway, evidence-in-chief para 74 [Environment Court document 15].

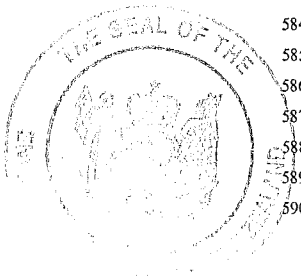
that the Waitaki above Stonewall under the NBTC flow regime would still be 'big', as expressed by Dr Hayes[583]. In response to questions from the Court[584] he compared the above-Stonewall reach under the NBTC regime with the Waimakariri River. Mr Greenaway claimed that the Waimakariri, which he said has a flow of 110-130 m^3/s – less than the Waitaki under NBTC, is described as big and is the most jet-boated river in New Zealand.

[358] Mr Greenaway also commented[585] that "[under NBTC] ... there would be a potential to increase conflict due to the increased ease of jet boating". Mr Greenaway was referring in this comment to increased interaction between jetboats and anglers as a result of their increased numbers. Earlier he stated that the more 'user friendly' environment of lower and more stable flows may increase the levels of conflict between recreational users, but that he considered the river well below its 'social carrying capacity' and that there was 'much scope for additional use before recreational conflict results'[586]. Mr Parker seemed to agree with Mr Greenaway when he stated[587] in cross-examination that "parts of the Waitaki are not under huge people pressure." However, Mr Parker suggested[588] that low flows would increase conflict by making more of the river accessible to vehicles.

[359] Mr Greenaway noted[589] that didymo is a reality of jet-boating on the Waitaki, and adds a new hazard. He referred[590] to Mr Norton's conclusions that some negative effects of didymo may be a little worse under NBTC, with didymo being more visible and faster growing, that there will be increased opportunity to manage didymo through flushing and channel maintenance flows, and that which effect would dominate was unknown. He added that vegetation encroachment and any reduction in the number of braids available to jet boaters would be an adverse effect of NBTC on jet-boating. He noted Dr Sanders as indicating that vegetation encroachment was occurring under the status quo, and that there would be a large reduction in the extent and density of weed

---

583 Mr R Greenaway, evidence-in-chief para 64 [Environment Court document 15].
584 Transcript pp 535-536.
585 Mr R Greenaway, evidence-in-chief para 74 [Environment Court document 15].
586 Mr R Greenaway, evidence-in-chief para 64 [Environment Court document 15].
587 Transcript p. 758.
588 Mr B J Parker, evidence-in-chief para 92 [Environment Court document 46].
589 Mr R Greenaway, evidence-in-chief para 75 [Environment Court document 15].
590 Mr R Greenaway, evidence-in-chief para 77 [Environment Court document 15].



cover in the riverbed under the river fairway vegetation control measures incorporated in the NBTC.

[360] Mr Greenaway concluded by acknowledging that there would be "some modification to the recreation setting", but then stated[591]:

> However, considering the opportunity to improve the amenity of the angling and jet boating setting upstream of the proposed outlet, while maintaining the 'big river' setting downstream, the net result is potentially positive.

We have difficulty in understanding how Mr Greenaway could conclude that the amenity of the jet boating setting upstream of the outlet would be improved. He stated that the 'big river' experience would be reduced; that the effects of NBTC on didymo are unknown; that any reduction in the number of braids would be a "potential adverse effect" on jet boating[592], but does not mention that the number of braids is expected to reduce from between 7.7 and 9.1 at present to six braids between Kurow and the discharge point under the NBTC. Mr Greenaway appears to offset these affects by enhanced vegetation clearance, and "increased ease of jet boating"[593] (presumably due to reduced risk at high flows encouraging more recreational jet boaters[594]). That this equates to a net enhancement of jet boating amenity is not apparent to the Court.

[361] We have already accepted that:

- there is likely to be a reduction in the number of braids from 7.7-9.1 to an average of six braids;
- there is a medium likelihood (33% to 67% probability) that there will be an increase in the percentage area of didymo between Kurow and Stonewall; and
- that the effectiveness of flushing flows to manage didymo is unknown.

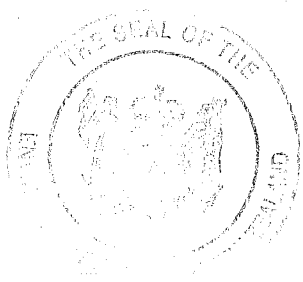
591 Mr R Greenaway, evidence-in-chief para 91.2 [Environment Court document 15].
592 Mr R Greenaway, evidence-in-chief para 78 [Environment Court document 15].
593 Mr R Greenaway, evidence-in-chief para 74 [Environment Court document 15].
594 Mr R Greenaway, evidence-in-chief para 39 [Environment Court document 15].

We conclude that the reduced flow regime of NBTC will reduce the 'big river' experience between the Waitaki Dam and Stonewall. This will have a detrimental effect on the quality of jet boating on the Waitaki in the Kurow-Stonewall reach.

[362] We have noted that the granting of consents will require an enhanced programme of woody weed control to maintain the average 600-metre width fairway down the length of the river. Whether this will have any beneficial affect on jet boating other than assisting to maintain the average number of braids at six is unclear. If the vegetation is physically removed from the river, there may be a benefit in terms of fewer hazards to avoid in the river. It may also mean easier access to water suitable for jet boating.

[363] Overall, we conclude that the negative effects on jet boating of the reduced number of braids, the likelihood of increased didymo and the reduction in the 'big river' experience outweigh the potential benefits of increased access by less experience boaters and any benefits from increased vegetation clearance. We find it is likely that there will be an adverse effect on jet boating on the lower Waitaki between the Waitaki Dam and Stonewall.

[364] As for access: being able to drive to the riverbank, manoeuvre and park vehicles with trailers, and launch and recover boats, safely and without undue difficulty is fundamental to jet boating on the river. Reducing the flow as proposed is likely to cause existing launch points to lose contact with the main river. However, since the areas exposed will be clear substrate it will be a relatively easy matter to continue access to the water. Further, the contact to the main river of any given launch point is already subject to the level of the river. The river level under NBTC is a level that is currently experienced during the year. The cleared fairway and the increase in exposed gravel will enhance vehicle access to and along the river. We consider that any issues of access that may arise are best addressed within the development and implementation of the Recreational Management Plan that Meridian has offered to fund. We do not see any need for the Hearing Commissioners' General Condition 29.4 which required that access levels under NBTC are maintained consistent with the level of access prior to the operation of the consent.



Four wheel driving, quad biking and motor biking

[365] We were given no specific evidence as to effects on these activities of the NBTC. However, we were informed that vegetation was a significant inhibitor of vehicle access along the riverbank. Mr Parker suggested this in the context of fishing in his evidence[595] and expanded on it in response to cross-examination by Ms Appleyard[596]. As noted above[597], the NBTC flow regime is likely to increase vegetation encroachment along the riverbank. This may make vehicle access along the riverbank more limited, and so restrict 4WD, quad-biking and motor bike use of the river. Alongside this, the achievement of a cleared fairway of sufficient width to accommodate the 900 m^3/s flow may significantly reduce vegetation cover in the riverbed. Together with the much lower water level for extended periods, this would enhance vehicle access along the riverbed. Both these effects could occur simultaneously in different parts of the riverbed, working in favour of vehicular movement in the middle part of the riverbed, and against it at times along the margins of the riverbed. Given continued vehicle access to the riverbed (see above) at present levels, there is the potential for much more extensive use of the riverbed by 4WD, quad- and motor-biking enthusiasts. We note that this benefit of NBTC may work to the detriment of rare and endangered birds nesting on the exposed gravel banks. Greater public vehicle access along the length of the river may increase the likelihood of disturbance of nesting river birds.

Swimming

[366] Mr Greenaway noted that exotic vegetation within the river fairway was increasing under the status quo, potentially affecting access to the river for swimming. He considered that increased vegetation control under NBTC would assist in combating this.[598] We note Mr Greenaway's comment[599] that swimming generally occurs in quieter, more stable locations along the river edge and back braids. We accept that swimming locations are probably variable under the status quo, and that new locations may emerge under any alternate flow regime.

---

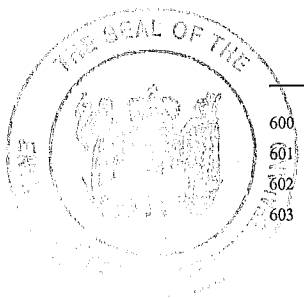
595 Mr B J Parker, evidence-in-chief para 30 [Environment Court document 46].
596 Transcript pp 757-758.
597 Section 4.4.2 of this decision.
598 Mr R Greenaway, evidence-in-chief para 79 [Environment Court document 15].
599 Mr R Greenaway, evidence-in-chief para 48 [Environment Court document 15].

[367] As noted above, didymo is an existing reality in the lower Waitaki, and may increase under NBTC, although the effectiveness of the flushing flows in controlling didymo is unknown.

[368] Mr Greenaway draws on the evidence of Mr Ball in stating[600] that there will be an increased risk of campylobacter infection from swimming in the lower Waitaki under the NBTC flow regime. The increased risk comes about due to the removal of good quality water that would otherwise dilute the lower quality water joining the river from tributaries and the direct deposition into the river from livestock and wildlife[601]. As we have noted above[602] the NBTC flow regime will reduce recreational water quality from 'very good to good' to 'poor to very poor' at five out of the six sites sampled between the dam and Stonewall. Mr Ball stated[603] that the current risk of recreationally acquired campylobacter infection was too high, and that it would increase under the NBTC flow regime.

Overall conclusion on effects on other recreation, access and amenities

[369] Assessing the potential effect of NBTC on other recreation on and around the affected reach of the river is complex and subject to a number of uncertainties. There are some potential benefits in terms of access along the river, and greater opportunities for less experienced jet boaters. These are outweighed by the negative effects of the loss of the 'big river' experience, the reduction in the number of braids and the possible increase in didymo on jet boating, together with the reduced quality of water for recreational swimming in the Kurow to Stonewall stretch of river. The reduction or loss of the 'big river' experience over this stretch of the river is unquantifiable but real. It will have a diminishing effect on most recreational activities carried out on, in or around the affected reach of the lower Waitaki. Boat launching sites risk losing contact



600 Mr R Greenaway, evidence-in-chief para 81 [Environment Court document 15].
601 Mr A Ball, evidence-in-chief para 23 [Environment Court document 23].
602 Section 4.7 of this decision.
603 Mr A Ball, evidence-in-chief para 35.11 [Environment Court document 23].

with the river and we suspect there will be adverse effects on the jet boat sprint course. Access effects, and any effects on the sprint course, will be able to be mitigated within the Recreational Development Plan.

4.17 Effects on the mauri of the Waitaki

[370] The Society is concerned that the proposed reduction in flow will further reduce the mauri of the river. For Meridian, Mr Mikaere considered the physical impact of the proposal on tangata whenua values to be less than minor. He considered that intangible impacts relating to spiritual beliefs in terms of mauri, mana and identity could only be addressed through tangible solutions. He further argued that the cultural concerns echoed the wider community concerns and are largely addressed through the environmental issues of water quality, habitat protection and enhancement and ecological values. He gave the protection and enhancement of mahinga kai sites as an example[604]. Mr Mikaere considered the crucial issue to be the proposed flow regime and ecological and water quality concerns that arise. He considered there to be a direct link between the ecological issues and mahinga kai and taoka species[605]. He also opined that there was no physical impact on wahi tapu and cultural sites (with the exception of mahinga kai)[606].

[371] For the Society Mrs Te Maiharoa-Dodds considered the proposed reduction in flow and the reduction in water quality to diminish the mauri of the Waitaki River. She was concerned that the native fishery would suffer, particularly through the loss of eel habitat in the wetlands. She opined that the reduced volume of water in the river would mean that the Waitaki would no longer have the mauri of a mighty river[607]. During cross-examination Mrs Te Maiharoa-Dodds emphasised there that there was much more to mauri than just safe-guarding natural resources[608]. For his part, also under cross-examination, Mr Mikaere acknowledged that mauri was not simply about water quality and safe-guarding food resource. He emphasised that while the concept was wider the

---

604 Mr B Mikaere, evidence-in-chief paragraphs 10–13 [Environment Court document 6].
605 Mr B Mikaere, evidence-in-chief paragraphs 41–45 [Environment Court document 6].
606 Mr B Mikaere, evidence-in-chief para 49 [Environment Court document 6].
607 Mrs A P S Te Maiharoa-Dodds, evidence in chief paragraphs 41–47 [Environment Court document 47].
608 Transcript p. 783.

major intent is the protection of mahinga kai and that mauri could be improved if mahinga kai sites were protected and enhanced[609].

[372] We agree with Mrs Te Maiharoa-Dodds and Mr Mikaere that mauri encompasses and is wider than the protection of mahinga kai and taonga species. There is a spiritual and intangible element to the concept of mauri that applies to the Waitaki River. We find that this would be affected and diminished by the proposed changed flow regime. The evaluation of the significance of this must be considered in the context of the mitigation proposed by Meridian. We return to this matter in Chapter 6.0.

4.18 Other water permits

[373] For the Society Ms Owen submitted that Meridian's agreement to supply existing abstractors between the Waitaki Dam and the outlet at Stonewall with 100% security of supply goes beyond the WCWARP[610], and that that would be at the expense of the ecological values of the river. We find that she is incorrect. To meet any obligations to the other abstractors the consent holder will put extra water into the river that would otherwise go down the tunnel. This water will be in the river for the section Waitaki Dam to the intake of the irrigator closest to but upstream of Stonewall. The Waitaki River above Stonewall is thus better off than if Meridian did not guarantee 100% security of supply. This seems like a win/win situation which we endorse.

[374] The effects of the NBTC on existing abstractors was, naturally, of concern to the irrigators who joined as section 274 parties. The Hearing Commissioners added conditions to protect their existing abstraction rights and we discuss these in the next Chapter.

609 Transcript page 187 *et ff.*
610 WCWARP policies 26.a and 46(ii)(c).

5.0 Remedying and mitigating potential adverse effects

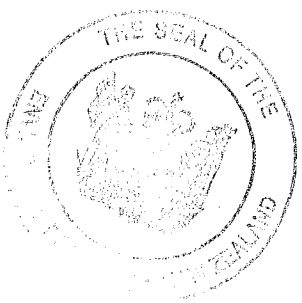
5.1 Introduction: the proposed General Conditions of consent

[375] When we come to weigh all factors for and against the proposal in coming to our overall decision we must consider the adverse effects as appropriately avoided, mitigated or remedied: *Stokes v Christchurch City Council*[611]. We now turn to discuss the various proposals for remediation and mitigation discussed in the evidence.

[376] There is one substantial adverse effect of the NBTC which cannot be avoided – substantially reduced flows over 30 kilometres of the Waitaki River by (on average) 211 m^3/s. Meridian has acknowledged that effect and has made considerable attempts to remedy or mitigate the consequential and related adverse effects of that flow reduction. It has also offered considerable but vaguely defined environmental compensation to offset the flow reduction and to enhance achievement of objective 1 of the WCWARP and section 6 of the RMA. Its efforts to deal with the adverse effects are contained in the General Conditions set by the Hearing Commissioners and by a proposed regime of 'adaptive management'. We elaborate on all that shortly, but first we should explain our understanding of the resource consents granted by the Canterbury Regional Council.

[377] Each resource consent granted by the Hearing Commissioners contains four parts:

1. the description of the consent under section 13 of the RMA;
2. the term (35 years);
3. the general conditions – contained in Schedule 1 to the consent;
4. specific conditions.



611 *Stokes v Christchurch City Council* [1999] NZRMA 409 at 434.

[378] The consents granted by the Hearing Commissioners contained extensive conditions. Some "General Conditions" are rather obscurely introduced in a 'condition' which should be an operative part of each consent. For example, the introductory words of the first consent – to take water from Lake Waitaki are:

> **Water Permit CRC071903 to Take Water from Lake Waitaki**
>
> To take water from Lake Waitaki via an intake into a tunnel.
>
> Duration of this water permit – 35 years.
>
> **Conditions of this Consent:**
>
> 1 This consent is subject to the general conditions listed in Schedule 1 – General Conditions
>
> 2 Water shall be taken from Lake Waitaki, immediately upstream of the Waitaki Dam, on the true left bank of the lake, at or about map reference NZMS 260:140:061-102
>
> 3 Water shall only be taken under this consent when water is being discharged in accordance with consents CRC071878 and CRC071096
>
> ***Maximum Flow Rate of Water Take***
>
> 4 The take of water from Lake Waitaki into the tunnel shall have a maximum flow rate of 260 cubic metres per second, determined in accordance with Conditions 5 – 7.
>
> ...

That is a minor drafting issue which is easily remedied by removing Condition 1 and placing it in the resource consent itself.

[379] Turning to the substance of the Hearing Commissioners' General Conditions, they contain specifications for the preparation of several management plans[612]. They are the:

(a) Abstractive Users' Management Plan ("the AUMP") under which Individual Mitigation Plans are to be prepared for each existing abstractor or affected landowner (General Conditions 6 and 7);

(b) Flow and In-stream Habitat Management Plan;

(c) Riverbed Geomorphology and Riverbed Vegetation Management Plan;

612 Ms S M Dawson, evidence-in-chief Attachment 2 Draft Management Plans [Environment Court document 36].

(d) Braided River Bird Management Plan;

(e) Wetlands/Repo Raupo Management Plan.

[380] We now outline the mitigation and environmental compensation as proposed in the conditions and management plans and then discuss how we consider they should be improved. Finally in this chapter we make some more detailed observations as to the wording of possible amended conditions. But first we outline what is proposed by Meridian in the way of adaptive management and environmental compensation (although it does not expressly use this latter term), and what is meant by these terms. Our entire discussion of conditions assumes we will grant consent but is subject to our final determination of that issue in the next chapter.

5.2 Adaptive management and environmental compensation

5.2.1 Adaptive management

[381] Adaptive management is a way of dealing with some of the future uncertainties. It is defined by the consent holder's proposed Draft Riverbed Geomorphology and Riverbed Vegetation Management Plan ("the RGRVMP") as being[613]:

> an ongoing and cyclic process, with feedback loops so that management can improve over time … the key stages in the cycle are:
>
> *Setting Objectives* – the issue is identified and defined, and the resource information is reviewed. Hypotheses can then be developed about how the resource will respond to management. Once the objectives are set specific indicators of management success (or failure) can be identified.
> *Design and planning* – the preparation of management plans and programmes for managing the resource.
> *Managing the resource* – implementing management actions and methods
> *Monitoring* – monitoring the effects of management on indicators
> *Evaluation* – analysis of monitoring results in relation to objectives and the management programme i.e. are the objectives being achieved.
> *Review and response* – reviewing and refining the hypothesis, management plan and programme to better meet the objectives. There may also need to be adjustment of policies, programmes, and budgets … After this stage the process starts again with *design and planning*.

613 RGRVMP p. 4.

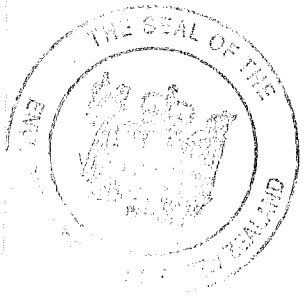
The concept of adaptive management has been discussed and approved by the Environment Court in a number of cases, e.g. *Golden Bay Marine Farmers v Tasman District Council*[614] and *Clifford Bay Marine Farms Limited v Marlborough District Council*[615]. The Court always has to be careful to ensure that the objectives for the adaptive management are reasonably certain and enforceable. Further, in this case, we consider that more detail is required in the management plans before we can be reasonably confident of their success.

[382] In addressing the impacts of the NBTC the applicant is offering to remedy or mitigate some adverse effects of the reduced flow of the Waitaki River between the Waitaki Dam and Stonewall, and also offering what is in effect 'environmental compensation'.

5.2.2 Environmental compensation

[383] The Court wrote in *J F Investments Limited v Queenstown Lakes District Council*[616]:

> The concept arises in this way: an applicant for a resource consent may choose or be required to avoid or mitigate or, occasionally, to remedy the adverse effects of a proposal. Or the applicant may volunteer to remedy or mitigate adverse effects of other activities. The offer may be fungible, that is of the same kind as the values or resources being lost, or different; it may be to remedy or mitigate adverse effects on-site or off-site. We define as 'environmental compensation' any action (work, services or restrictive covenants) to avoid, remedy or mitigate adverse effects[617] of activities on the relevant area, landscape or environment as compensation for the unavoided and unmitigated adverse effects of the activity for which consent is being sought.



614 *Golden Bay Marine Farmers v Tasman District Council* W19/2003 at [405] and [407] to [408] (Judge Kenderdine presiding).

615 *Clifford Bay Marine Farms Limited v Marlborough District Council* C131/2003.

616 *J F Investments Limited v Queenstown Lakes District Council* Decision C48/2006 at [8].

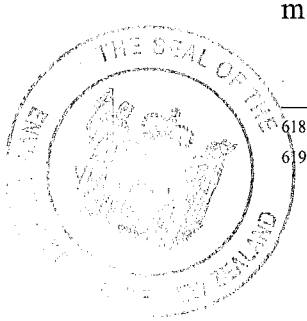
617 Theoretically any action under section 5(2)(a) and (b) [of the RMA] may also be the positive limb of environmental compensation.

A form of environmental compensation is included in the WCWARP in its financial contributions provisions (discussed in Chapter 3.0). However, whether incorporated in a plan provision or not, environmental compensation is always potentially relevant under the RMA. It is a way of contributing to a net conservation benefit on any proposal for resource consent, and therefore of minimising the cumulative effects of developments.

[384] As for whether proposed environmental compensation is adequate in any case we adopt the approach stated by the Environment Court in the *JF Investments Limited* case[618]:

> ... off-site work or service or a covenant, if offered as environmental compensation or a biodiversity offset[619], will often be relevant and reasonably necessary under [(now section 104(1)(c) of the RMA] if it meets most of the following desiderata:
>
> (1) it should preferably be of the same kind and scale as work on-site or should remedy effects caused at least in part by activities on-site;
> (2) it should be as close as possible to the site (with a principle of benefit diminishing with distance) so that it is in the same area, landscape or environment as the proposed activity;
> (3) it must be effective; usually there should be conditions (a condition precedent or a bond) to ensure that it is completed or supplied;
> (4) there should have been public consultation or at least the opportunity for public participation in the process by which the environmental compensation is set;
> (5) it should be transparent in that it is assessed under a standard methodology, preferably one that is specified under a regional or district plan or other public document.

In respect of items (5) and (4) on that list: in this case a standard methodology is not specified in the regional plan – the WCWARP and the NRRP appear to be silent on the issue. As for public consultation, while there has been some opportunity for that to date, further consultation is proposed by the Management Plans imposed under the Hearing Commissioners' consents. Opportunities for public participation have been given by the Hearing Commissioners' and Environment Court's hearings. The other matters on the *JF Investments* list will be considered below.



618 Decision C48/2006 at para [42].
619 The term used in Biodiversity Offsets: Views, experience and the business case: by K ten Cate, J Bishop and R Bayon [IUCN November 2004].

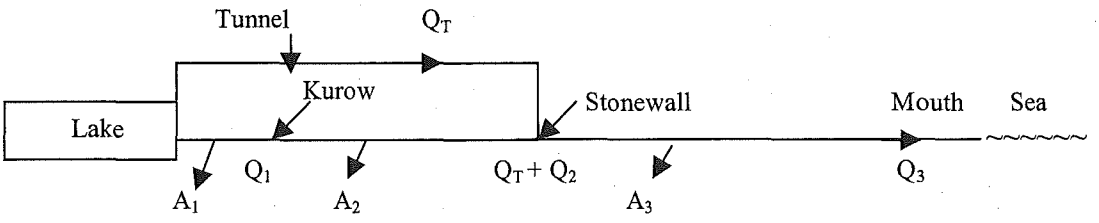
[385] The Hearing Commissioners' General Conditions put considerable weight on the various obligations imposed on the consent holder to comply with a set of "River Management Plans". The Society and its witnesses expressed some unease about the wording of those plans and their enforceability. On reflection we consider they may have reason for their concerns. In particular there is no direct obligation to meet the fundamental objectives stated in those plans. We agree that for enforcement purposes (in case some future consent holder is not as diligent as we hope and expect Meridian will be) there should be more direct obligations in the conditions. We have provisionally redrafted the General Conditions accordingly by moving the objectives so they are performance standards to be complied with, not only objectives for management plans.

5.3 Mitigating effects of the flow regimes

5.3.1 Introducing the flow regimes

[386] We first consider how the potential adverse effects of the NBTC's flow regimes can be mitigated. We will attempt to be rigorous so that conditions can be stated with more precision, should we grant consent. We start by representing the lower Waitaki hydrological system as follows:

Figure 1:



where Reach 1 is Waitaki Dam to Kurow

Reach 2 is Kurow to tunnel outfall at Stonewall

Reach 3 is tunnel outfall to mouth

A_i is the abstraction from Reach i (m^3/s) (i = 1,2,3)

Q_i is the river flow rate at the downstream end of Reach i (m^3/s)

Q_T is the flow rate in the tunnel where $65 \leq Q_T \leq 260$ m^3/s when the tunnel is operating.

In terms of the above, Q_1 is the flow recorded by the Kurow recorder[620].

5.3.2 Minimum River Flow Rates

[387] The minimum river flow rates in the lower Waitaki are ostensibly set in the Hearing Commissioners' Condition 10 of the water permit to take water from Lake Waitaki. However, their Take Condition 11a shows that those minimum rates are merely notional, because extra water has to be left in the river for abstractions under existing water permits and, possibly, for future permits. We consider that it is preferable to have a direct figure in the minimum flow condition, and we consider it may be calculated as set out below (although we will reserve leave for the parties to come back to the Court in case we have overlooked something). We have also had some thoughts about improving the other flow conditions and we add these below.

[388] Take Condition 15b of the Hearing Commissioners' decision states that the maximum consented rate of take between the dam and the tunnel discharge point is 8.3311 m^3/s. Thus, at present the sum of the abstractions from reaches 1 and 2 can be stated as:

$$A_1 + A_2 \leq 8.3111 \text{ m}^3/\text{s}$$

Their Take Condition 15c suggests the maximum rate of <u>future</u> takes is 3.945 m^3/s.

Hence in the future:

$$A_1 + A_2 \leq 12.2561 \text{ m}^3/\text{s}.$$

The Kurow recorder gives results only to 10 l/s hence we can round this to:

$$A_1 + A_2 \leq 12.26 \text{ m}^3/\text{s}.$$

620 Canterbury Regional Council water level recording site number 71104.

[389] Accepting for the moment the minimum flow rates as set out in Take Condition 10 of the Hearing Commissioners' decision we denote them, on a monthly basis, by Q_{min}. An appropriate tunnel flow cut off condition is one that ensures the flow at the end of Reach 2 (Q_2) at the tunnel outfall always exceeds Q_{min}. Thus:

$$Q_2 \geq Q_{min}.$$

Although Q_2 is not directly measured we know that $Q_2 = Q_1 - A_2$ (ignoring inflows and channel leakage) where Q_1 is the actual flow as measured by the Kurow recorder. Thus the condition becomes:

$$Q_1 \geq Q_{min} + A_2$$

This is a very simple condition if we know A_2.

[390] In fact A_2 is readily calculable. At present $A_1 = 1.37\ m^3/s$[621]:

so $A_1/(A_1 + A_2) = 1.37/8.31$
Therefore $A_1/A_2 = 0.2$ (at present)

If we assume the same ratio persists into the future, and we know that:

$$A_1 + A_2 = 12.26\ m^3/s$$

– then $A_2 = 10.22\ m^3/s$.

Our cut-off condition becomes:

$$Q_1 \geq Q_{min} + 10.22.$$

621 Mr R J Potts, evidence-in-chief for Hunter Downs, Attachment B [Environment Court document 32A].

[391] Therefore we suggest the tunnel should be shut down whenever:

$$Q_1 \leq Q_{min} + 11 + Q_{mit}$$

– where Q_{mit} is the flow required for mitigation purposes determined under the Hearing Commissioners General Conditions[622]. To give effect to this our Take Condition 9 will (if we grant consent) read:

> 9. The taking of water in terms of this permit shall cease whenever the flow rate in the Waitaki River as measured at the Kurow recorder falls below the sum of:
>
> (a) the minimum river flow rates in the table below; plus
> (b) 11 m^3/s; plus
> (c) mitigation flows in compliance with Individual Mitigation Plans relevant to the reaches Waitaki Dam to Kurow and Kurow to Stonewall as prepared under General Conditions 6 and 7.

Month of Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Minimum River Flow m^3/s	140	150	145	125	120	110	110	110	120	125	130	140

[392] Consequential points are:

- Take Condition 11a of the Hearing Commissioners' decision should be deleted. Their Take Conditions 11b and 11c will be retained in our Take Conditions as 10a and 10b;
- There is provision in General Condition 1 for a review of our Take Condition 9 if, for example, future consents exceed the maximum rate of take we have assumed, viz 3.945 m^3/s.

622 Hearing Commissioners' General Conditions 4 to 9.

5.3.3 Protection for abstractive users

[393] We turn now to the Hearing Commissioners' Take Condition 15 *et ff* which are to protect abstractive users in Reach 1 and Reach 2, both when the tunnel is operating and when it is not operating. If we require, as for the cut off condition above, that

$$Q_1 \geq Q_{min} + 11 + Q_{mit}$$

– at all times, this protects the present and future abstractors in Reach 1 and Reach 2 at all times. The advantage of this approach is that the Hearing Commissioners' Take Condition 16 with all its complexities (based around each individual user) can be deleted. Take Condition 17a is also not required.

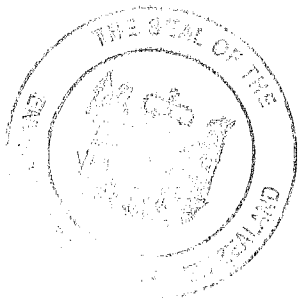
[394] Our Take Condition to protect abstractive users in Reach 1 and Reach 2 would become:

> From the date at which this consent is first exercised, regardless of whether the tunnel is operating or not pursuant to the consent, the flow rate in the Waitaki River at the Kurow recorder shall equal or exceed the sum of those flows specified in condition 9(a), (b) and (c).

This condition would become our Take Condition 14 and replace the Hearing Commissioners' Take Conditions 15, 16 and 17. Their Take Condition 17b is retained but placed earlier in our conditions as Condition 2(b).

5.3.4 Users below the tunnel outfall at Stonewall

[395] The Hearing Commissioners protected the interests of existing users below Stonewall during the irrigation season (September to April inclusive) when the tunnel is not operating through their Take Condition 18. Essentially this ensures a flow of at least 152 m^3/s at Stonewall. We assume that the Hearing Commissioners' flow of 152 m^3/s covers the ecological requirements, the consented abstractions and the mitigation flows required in the reach Stonewall to the sea.



[396] We follow the same approach in our Take Condition 15 which has the same form as our Take Condition 14 by requiring the flow as measured by the Kurow recorder to exceed 152 m^3/s plus 11 m^3/s for use by abstractors between Kurow and Stonewall plus the required mitigation flows from the same reach.

[397] When the tunnel is operating there will be at least:

- 65 m^3/s (the minimum tunnel flow) plus
- the flow required by our Take Conditions 9 and 14

– so below Stonewall there will be no concerns when the tunnel is operating because in the river at Stonewall flows will equal or exceed current low flows.

[398] The Hearing Commissioners' General Condition 1 – as to review of conditions under section 129 of the RMA – contained a paragraph (2) which related to their Take Condition 15. We consider any such specific review power is inappropriate in a general condition which applies to several water permits. Accordingly we have moved the specific review condition to our Take Condition 30.

5.3.5 Flushing flows

[399] Some submitters questioned the effectiveness of the proposed flushing flows to control excessive periphyton growth and to remove fine sediment. Further, Mr Jowett drew our attention to some possible adverse effects of the flows[623]. These revolved around effects on nesting birds and emerging salmonids. There is thus a balance to be struck between the beneficial and the adverse effects of the flushing flows. This is to be achieved by controlling the timing of the flows. Mr Norton suggested six between the period 1 January to 30 April[624] while Mr Jowett favoured a spread throughout the year with slightly more in summer than in winter[625].

623 Mr I G Jowett, evidence-in-chief para 77 [Environment Court Document 7].
624 Mr E J Norton, evidence-in-chief para 46 [Environment Court Document 8].
625 Mr I G Jowett, evidence-in-chief para 77 [Environment Court Document 7].

[400] We regard flushing flows as an appropriate mitigation measure. We also consider that their effectiveness should be monitored to allow adaptive management of the size, frequency and timing of the flows[626]. Because of the importance of the flushing flows, should we grant consent, there will be a condition requiring them and periodic reviews of their effectiveness in accord with an In-stream Habitat Management Plan. Flushing flows have been referred to throughout the hearing as being at least 450 m^3/s. We adopt this figure and reject the complexities inherent in the Hearing Commissioners' conditions. Our Take Condition 16 thus replaces and simplifies the Hearing Commissioners' Take Conditions 20 and 21.

5.3.6 Ramping rates

[401] We see no need to allow for abstractions between the dam and Kurow (1.37 m^3/s) when measuring flows of the order of 200 m^3/s. Accordingly our Take Condition 21 replaces and simplifies the Hearing Commissioners' Take Conditions 25 and 26.

5.3.7 The Waitaki mouth

[402] We do not see mouth migration or closure as an issue because there was no evidence that the NBTC would affect the mouth of the river in any significant way. Consequently we fail to see why the consent holder should be made responsible for maintaining an open river mouth.

5.3.8 Floods above 900 m^3/s

[403] When any flow from Aviemore Dam exceeds 900 m^3/s it is proposed to shut the tunnel for 48 hours and thus pass the total flow to the lower Waitaki. Such flows are termed channel maintenance flows. It is expected that they will disturb surface bed material and redistribute gravels, remove most periphyton, including didymo, and remove some encroaching fairway vegetation. These floods have a return period of about two years and should preserve the river's current competence to scour significant areas of vegetation[627].

626 Mr E J Norton, evidence-in-chief para 47 [Environment Court Document 8].
627 Dr D M Hicks, evidence-in-chief para 93 [Environment Court Document 12].

[404] We accept that channel maintenance flows as proposed are necessary for the efficient functioning of the lower Waitaki River. Should we grant consent we will impose a condition requiring these flows and that their effectiveness be monitored. An outcome may be that the duration of the flows needs to be increased or the 900 m^3/s threshold be lowered. Since the necessary flows only occur on average about every two years the monitoring programme will need to be in place for at least eight or ten years.

5.4 The varial zone

[405] The extent of the varial zone under the status quo is artificial, and there is an overall ecological benefit to be gained by eliminating such short-term variability of flows.

5.5 Geomorphological effects in the riverbed

[406] In section 4.4 we identified the following as possible effects on the geomorphology of the riverbed and banks of a change from the status quo flow regime to a NBTC flow regime:

- greater tendency for vegetation encroachment on to the riverbed;
- a reduced number of braids in the Kurow to Stonewall section of river;
- development of a finer bed surface;
- reduced sediment transport capacity in the Kurow to Stonewall section of the river;
- adverse effects on irrigation intakes from the outfall;
- increased size of fan deltas built by tributary streams;
- effects on bank and river protection structures.

[407] The objectives of the Draft Riverbed Geomorphology and Riverbed Vegetation Management Plan address all of these effects. Of prime importance are the objectives to maintain a clear fairway below Kurow, to maintain a flood flow regime and to maintain the existing geomorphology of the river at the expected median flow of approximately

140 m^3/s. Dr Hicks[628] discussed the draft plan and the conditions associated with it. He recommended a programme of monitoring and adaptive management involving interventions with mechanical means and changes to the flow regime. Dr Davies[629] believed this to be the only realistic technique available for managing the impacts of the NBTC on the river morphology. However, he was not enthusiastic about the mechanical approach. He strongly preferred adjustments to the flow regime[630]. Dr Davies was also of the view that monitoring should be done annually[631] as opposed to the five and ten year programmes proposed by Dr Hicks. We are inclined more to Dr Davies' view and this should be reflected in the monitoring programme defined in the Riverbed Geomorphology and Riverbed Vegetation Management Plan.

[408] In summary on this issue: we accept the management plan approach with its adaptive management philosophy provided it is adequately backed up by robust conditions of consent, and subject to one other difficulty – the issue of clearing the fairway below Stonewall to the sea.

[409] Fairway clearance below Stonewall may be, and probably is, a desirable action although we heard little evidence about that. Mr Vesey was certain of the benefits of fairway clearance for the flood protection scheme for the lower Waitaki River which is limited by the very small rating base and consequent constraints on funding[632]. He explained that the intention is to enhance vegetation control such that effectively all vegetation (including willow, gorse and broom) would be removed from the Waitaki Dam to the sea[633]. However, the fairway clearance below Stonewall is not required to mitigate directly any adverse effects of the NBTC proposal. It could be regarded as environmental compensation, but if so, it is difficult to see how it meets the criterion that it creates environment of the same kind as will be lost on-site (see *J F Investments Limited v Queenstown Lakes District Council*[634]) – that is, on the riverbed between Kurow and Stonewall. Our concern is that the consent holder will spend significant

---

628 Dr D M Hicks, evidence-in-chief para 160 *et ff* [Environment Court Document 12]
629 Dr T R H Davies, evidence-in-chief para 13 [Environment Court Document 50]
630 Dr T R H Davies, evidence-in-chief paragraphs 22 and 23 [Environment Court Document 50].
631 Dr T R H Davies, evidence-in-chief para 18 [Environment Court Document 50].
632 Transcript p. 711.
633 Transcript p. 279.
634 *J F Investments Limited v Queenstown Lakes District Council* Decision C48/2006 at [42].

sums of money on fairway clearance below Stonewall when there are other more direct and valuable forms of mitigation which require funding.

[410] Our inclination is to remove the requirement to clear the fairway below Stonewall and we have worded (new) General Condition 24 accordingly. However, since we have not heard from the parties on this issue we reserve leave for submissions on whether the condition should require fairway clearance to the sea.

5.6 Reducing concentrations of contaminants

[411] We have predicted the concentration of pollutants (e.g. nitrogen, phosphorous and microbiological contaminants such as faecal coliforms) would increase especially if pollution inputs from the intensification of agriculture continue[635] to increase. Non-point sources of pollutants are notoriously difficult to ascertain and control. However direct sources such as stock and waterfowl in the river and localised inputs from groundwater are obvious contributions. The tributaries of the Waitaki are definitely sources of pollution: the Awakino River, Hakataramea River, Kurow Creek, Otiake River, Otekiake River, Maerewhenua River, Waikakahi Stream, Awamoko Stream and Welcome Creek all contribute high concentrations of nutrients and microbiological contaminants[636].

[412] Given the reduced dilution capacity of the river between the Waitaki Dam and Stonewall the only way to decrease the concentration of contaminants is to lower the contaminant input into the river. Mr Norton wrote that achieving good water quality is a catchment-wide management issue and while Meridian can have some influence the responsibility lies with a number of stakeholders[637]. We agree. The questions then become what Meridian can do directly and how can Meridian effectively influence behaviour in the wider catchment.

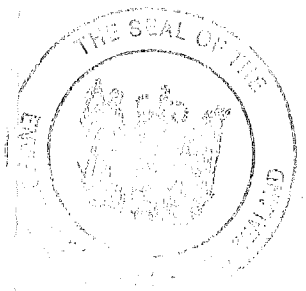
635 Mr E J Norton, evidence-in-chief paragraphs 17 and 26 [Environment Court document 8].
636 Mr E J Norton, evidence-in-chief para 55 [Environment Court document 8].
637 Mr E J Norton, evidence-in-chief para 36 [Environment Court document 8].

[413] Mr Norton noted[638] that Objective 7 of the Flow and In-stream Habitat Management Plan (Hearing Commissioners' General Condition 28) requires the consent holder to promote best practice management in relation to water quality contaminants. Action 2 in the draft management plan presented to the court addresses this in some detail[639] and includes the statement:

> ... Meridian will support recognised best practice guidelines including:
>
> - *Dairying and Clean Streams Accord* (2003) (Fonterra, MfE, MAF, LGNZ)
> - *A Guide to Managing Waterways on Canterbury Farms* (Ecan)
> - *A Companion Guide to Managing Waterways on Canterbury Farms – Inland Basin Streams*
> - *A Companion Guide to Managing Waterways on Canterbury Farms- Hill Country Streams*
>
> On Meridian owned land Meridian will also support recognised best practice actions such as:
>
> - Excluding stock – exclude all cattle and deer from rivers, lakes and their banks
> - Leaving a long grass margin – i.e. along waterways
> - Managing wetlands – e.g. fencing and stock exclusion
>
> Where Meridian land is on-sold, covenants will be included in the land titles to ensure that these practices continue. Where land is leased Meridian will endeavour to implement these practices and undertake to meet the costs associated with for example, fencing, and planting to ensure best practice actions continue.

We consider the General Conditions should support this process, and would amend them accordingly. We discuss the targets in the *Dairying and Clean Streams Accord* in a little more detail shortly.

[414] The performance measures associated with this 'wider catchment management' action are specified in the draft plan and include[640]:



638 Mr E J Norton, evidence-in-chief para 50 [Environment Court document 8].

639 Ms S M Dawson, evidence-in-chief Attachment 2 Flow and In-stream Habitat Management Plan (draft April 2009) page 26 [Environment Court document 36].

640 Ms S M Dawson, evidence-in-chief Attachment 2 Flow and In-stream Habitat Management Plan (draft April 2009) page 47 [Environment Court document 36]

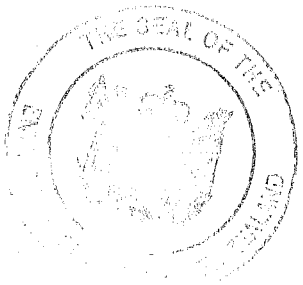
- Water quality monitoring results reported annually
- Best land management practice supported where possible
- Monitoring shows contaminant concentrations on a decreasing trend

Mr Norton wrote that quantifying the overall effectiveness of best land management practices and evaluating particular methods is the subject of ongoing research. He commented[641]:

> My assessment from the literature is that effectiveness of these measures varies widely with the quality of design and care in implementation, and will also be strongly influenced by local conditions such as soils, climate, time-scale, and topography. For this reason, I do not consider it is yet possible to quantify the potential effectiveness of BMPs [best management practices] in reducing contaminant levels in the lower Waitaki River. BMPs and other initiatives are unlikely to offset contaminants by 100% but reductions could be significant. The goal of 50% reduction of contaminant loads adopted by the New Zealand dairy industry (Dairy Environment review Group 2006[642]) may be realistic, but will require commitment to the BMPs over years to achieve.

We agree with Mr Norton that quantifying the effectiveness of such techniques is difficult. This leads to the further difficulty of setting performance measures in the conditions of consent to ensure the effective mitigation of the reduced dilution capacity of the river. We acknowledge here that Meridian's NBTC does not increase the contaminant load to the river and it is largely the farming activities within the catchment that are contributing the nutrient and microbiological contaminants of concern.

[415] In response to questions from the Court Mr Norton confirmed that he had not taken into account any future increase in contaminant concentrations due to either the lag time for contaminants arising in more distant parts of the catchment (that is the time taken to travel through the groundwater and reach the river), or any ongoing increase in agricultural activity within the catchment. When asked about the uptake of best management practices within the catchment and compliance or otherwise with the Dairying and Clean Streams Accord Mr Norton could not give specifics but considered



641 Mr E J Norton, evidence-in-chief para 52 [Environment Court document 8].

642 Dairy Environment Review Group (2006), Dairy industry strategy for sustainable environmental management. Dairy Insight, Wellington.

that there was a full range of practices[643]. From the limited observations we were able to make of the fencing of waterways on our site visit we would agree with his assessment.

[416] Despite the difficulties in quantifying the effectiveness of particular best management practices it is clear that fencing of waterways to exclude stock is beneficial in terms of reducing both nutrient and microbial contamination. Exclusion of stock from waterways (including streams, rivers, and lakes) and fencing of 'significant or important wetlands' is required by the *Dairying and Clean Streams Accord.* We consider that fencing and the exclusion of stock should be a priority for the lower Waitaki, its wetlands and tributaries.

[417] Mr Norton gave us evidence of the targets in the *Dairying and Clean Streams Accord*[644] agreed between MfE, MAF, regional authorities and Fonterra in May 2003:

- dairy cattle excluded from 90% streams, rivers and lakes by 2012
- 90% of regular crossing-points have bridges or culverts by 2012
- 100% dairy farm effluent discharge complies with resource consents and regional plans
- 100% dairy farms have systems to manage nutrient inputs and outputs
- 90% regionally significant wetlands are fenced by 2012.

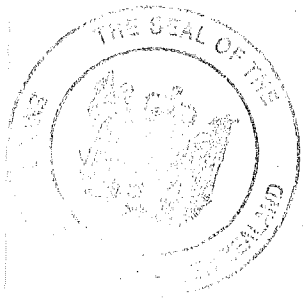
[418] Supporting those targets is Mr Norton's supplementary evidence. He referred to the research on farm management measures carried out in the Waikakahi Stream (a tributary that flows into the Waitaki River downstream of Stonewall) catchment[645]. The researchers noted:

---

643 Transcript page 255 *et ff.*

644 Mr E J Norton, supplementary evidence para 17 and Attachment XVI [Environment Court document 8C], citing Ministry for the Environment 2009 *Water quality in selected dairy farming catchments: A baseline to support future water-quality trend assessments.* Wellington.

645 Mr E J Norton, supplementary evidence para 13 and Attachment VI [Environment Court document 8C], citing Monaghan R M, Carey P L, Wilcock R J, Drewry J J, Houlbrooke D J, Quinn J M, Thorrold B S (2009) Linkages between land management activities and stream water quality in a border dyke-irrigated pastoral catchment. *Agriculture, Ecosystems and Environment* 129:201-211



> Assessments of the effectiveness and cost-effectiveness of a number of potential mitigation practices identified that managements which targeted reducing irrigation run-off (e.g. by installing bunds or using appropriate watering times) and fencing and planting riparian margins, showed the greatest potential to meet these key values [healthy trout fishery and stream suitable for recreational use] with least cost to farm businesses.

[419] Dr Burrell had assessed Mr Norton's recommendations for monitoring effects on general water quality and considered the level of monitoring to be 'more than acceptable'. He concurred that the promotion of catchment-wide best practices for land use was the only practical form of mitigation[646]. When considering how to mitigate the increased concentration of pollutants we have concluded that maximising fencing of the lower Waitaki between the Waitaki Dam and Stonewall is highly desirable under the RMA and its subordinate instruments. However, we do not consider Dr Burrell is entirely correct. There are other choices:

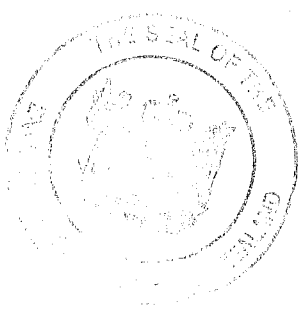
(a) it may be within our powers to direct that Meridian fence its own waterways and wetlands as a condition of granting consent; and

(b) another method is to require marginal fencing as part of the wetlands management regime.

5.7 Remedying and mitigating lowering groundwater levels – wells

[420] The NBTC scheme may have an effect on some wells by lowering the groundwater. The proposed General Conditions deal with the effects of that dewatering by putting the issue off for later resolution. First, the Hearing Commissioners' General Condition 4 requires the consent holder to submit an 'Abstractive Users' Management Plan ("AUMP") to the Regional Council at least two years before commissioning. The purpose of the AUMP is[647]:

> To provide a process for offering, seeking and – with the agreement of the relevant consent holder and/or landowner – implementing the appropriate measures to mitigate or remedy effects attributable to the exercise of resource consents CRC071903, CRC071096 and CRC071878.



646 Dr G P Burrell, evidence-in-chief para 32 [Environment Court document 41].

647 Hearing Commissioners' General Condition 4.

[421] Then a further condition[648] contemplates an Individual Mitigation Plan ("IMP") for each existing 'consented and lawful' abstractor and each owner of 'self-irrigating land' – land which relies on plants taking up groundwater. The IMPs are to include[649] "Measures to mitigate adverse effects on the water quality of existing consented and lawful abstractions used for potable water supply". While we see the merit of the consent holder having to supply water we are concerned about the obligation imposed on the consent holder to ensure that all abstractors have potable water. We can see that it is appropriate for the communities at Kurow and Duntroon. However, rural landowners appear to be in big part responsible for the current (deteriorating) quality of the groundwater, so we do not consider they should individually or collectively be let off resolving the problem by passing it onto the consent holder for the NBTC which is not responsible for causing the deterioration in water standards. We are not prepared to approve the word 'potable' in the Hearing Commissioners' General Condition 7b and in following conditions without hearing further argument and/or evidence.

[422] If we grant the consents and Meridian wishes to have the Hearing Commissioners' General Condition 7b maintained for public relation purposes, then that is acceptable provided that:

- the costs of providing potable water (as opposed to the costs of run of river or groundwater as it comes) are isolated and reported on in the individual management plans;
- the costs are not taken into account when considering the practicability of further mitigation or environmental compensation for the river's ecosystems.

5.8 Remedying and mitigating lowering groundwater levels – wetlands

5.8.1 Terrace wetlands

[423] In her Table 1 to her evidence-in-chief Ms Robertson described all terrace wetlands (and some of the riparian wetlands). She tabulated the following information for each wetland:

648 Hearing Commissioners' General Condition 6.
649 Hearing Commissioners' General Condition 7b.

- her identification number for the wetland;
- the name of the wetland (usually by place, e.g. Kurow River);
- the area;
- the tenure;
- the wetland class, structure, and dominant cover;
- whether the wetland is 'terrace' or 'riparian'
- a score on a scale of 0-4 of potential effects of the NBTC;
- a summary of values and effects;
- action proposed.

[424] Meridian accepted in relation to terrace wetlands that it would need to at least replace the area of wetlands affected by the NBTC. As we outlined in Chapter 4.0 its witnesses predict about 18 hectares in (apparently) at least eight terrace wetlands would be lost overall. Meridian appears to contemplate providing 18 hectares of replacement wetlands. We have some difficulty with that figure because even allowing for the fact that some of the wetlands to be lost are of low quality, it takes time for new wetlands to build up and sustain populations of flora and fauna, and some may fail. Another factor to be considered when considering the quantity and quality of wetlands is that looking after and improving them is one of the few ways that eel populations can potentially be increased.

[425] The actions identified by Ms Robertson are potentially helpful, but they are very general. We consider they need to be specified in considerably more detail in a way that makes them enforceable. New Zealand's wetlands have been so reduced in area and quality – and the Waitaki's wetlands are typical of that – that the public is entitled to be sure that Meridian's good intentions are carried out. We realise that designing enhancement or creation of wetlands is an expensive exercise, and carrying out the work, fencing and ongoing maintenance (especially weed control) is much more so. But if we grant the water consents for the NBTC conditionally the consent holder will have the confidence to spend the money (if all its other figures stack up) to carry out the design and budget for the work of fencing and maintenance.

[426] A further difficulty for the terrace wetlands is that there is a variety of ownerships. The terrace wetlands are owned – in some cases by more than one owner for a small wetland – by either private owners, Meridian, the Department of Conservation, or Land Information New Zealand. We will need to be satisfied that Meridian has both entered into agreements with enough landowners and is prepared to covenant its own land to create a sufficient area of new terrace wetlands.

[427] Further, the area of new or enhanced terrace wetlands may need to be greater than conceived by Ms Robertson because, as we shall see shortly, we foresee difficulties with creating and consistently maintaining riparian wetlands. We will give time to Meridian to research this and also reserve leave for Meridian to lodge and serve evidence about the detail of enhancement or creation of new terrace wetlands.

5.8.2 Riparian wetlands

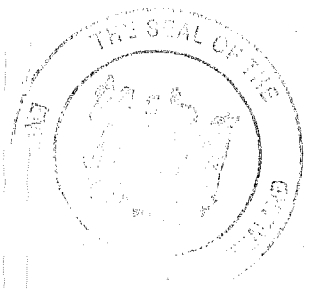
[428] The most relevant objective for the riparian wetlands is[650] objective 2 of the Wetlands/Repo Raupo Management Plan. It is:

> To retain important ecological and recreational values of the riparian wetlands (immediately prior to the exercise of these consents) under the flow regime associated with the exercise of these consents and, if this cannot be achieved, to mitigate the loss of such values by way of riparian wetland enhancement to offset the loss.

We are concerned about the vagueness of this objective. For a start it does not identify what the 'important ecological and recreational values of the riparian wetlands' are, or whether those values are compatible; secondly it is not a direct objective but only an objective for a management plan.

[429] We have found that the important ecological values of the riparian wetlands include:

- as habitat for marsh crake and bittern;
- as habitat for wild fowl;
- as habitat for native fish especially eels;



650 Hearing Commissioners' General Condition 31(2).

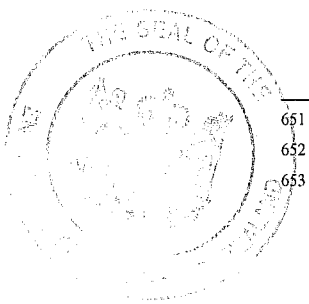
- as habitat for 'low mound' plant species (e.g. *Gunnera* spp);
- as habitat for other native plant species;
- improving water quality by trapping sediment and taking up nutrients.

[430] Given the importance of almost all remaining lowland wetlands in New Zealand, and certainly the importance of these riparian wetlands and that their area may be reduced by 60% by the NBTC we consider the conditions need stiffening up. As to implementation of the objective for riparian wetlands Ms Robertson wrote that[651] "the draft [WMP] provides for the enhancement or creation of up to 70 hectares of riparian wetlands close to the main river". In fact the figure of 70 hectares appears in the WMP at page 28 as being for "protection and enhancement". In any event Ms Robertson proposed that for her predicted total loss of riparian wetlands (135 hectares including 38 hectares dominated by native plants) mitigation of 70 hectares 'close to the main river' would be sufficient[652] to maintain the important ecological value of the riparian wetlands.

[431] Then Ms Robertson wrote[653]:

> The target of up to 70 hectares of riparian wetland creation would ensure that the 38 hectares [of wetlands dominated by native vegetation] is replaced, would allow for creating larger native wetlands, encourage a more diverse range of native vegetation and provide specific faunal habitat that is currently limited. Such wetland creation would provide for the range and populations of existing wetland species. The reduction in flow variability will also benefit species which prefer specific and more stable hydrological conditions.

No clear picture of what area of riparian wetlands should be created has been presented to us. Nor is any target area for riparian wetlands included in the management plan.



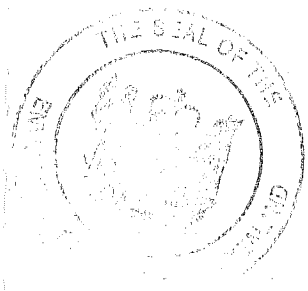
651 Ms D M Robertson, evidence-in-chief para 144 [Environment Court document 13].
652 Ms D M Robertson, evidence-in-chief para 145 [Environment Court document 13].
653 Ms D M Robertson, evidence-in-chief para 146 [Environment Court document 13].

[432] The picture is complicated by two other factors. First, it must always be understood that, as the CRC witness Dr Grove confirmed in cross-examination[654], "the riparian wetland environment is naturally dynamic. The channels move". Secondly it is not clear – due to the ownership confusion – where the consent holder may be able to enhance existing or create new riparian wetlands. Those matters are important because in response to questions from the Court Dr Rate stated that created or enhanced wetlands should be of high ecological value and commented that size and location were important factors[655]. He favoured an approach to ensure no net loss of area or value of the riparian wetlands.

[433] Ms Robertson wrote[656]:

> A number of "new" wetlands will be formed under the NBTC Flow Regime. New wetlands are likely to form in the cleared fairway where shallow braids would no longer maintain connection at the lower flows. These wetlands are unlikely to become willow wetlands as they will be within the fairway that will be managed to be free of willow and woody weeds. Other wetland vegetation is likely to establish in these. These wetlands will likely be reconnected to braids during the planned flushing flows, channel maintenance flows and other higher flow events in the river.

We accept that and predict that under the proposed fairway management regime new riparian wetlands within the fairway will form without intervention. Some thought may need to be given to weed control while minimising the interference with native biota established in these wetlands when the fairway vegetation clearance is carried out. Apart from that we see little point in the consent holder spending further money and effort on creating what are essentially ephemeral wetlands within the riverbed that could be altered or obliterated by floods at any time.



654 Transcript p. 696.
655 Transcript pp 988 *et ff.*
656 Ms D M Robertson, evidence-in-chief para 137 [Environment Court document 13].

5.8.3 All riverine wetlands

[434] Ms Robertson contemplated[657] some riparian wetlands being created at the same time as the fairway work is carried out. She noted that the sites for restoration and creation of riparian wetlands would be chosen after considering biodiversity and habitat creation, mahika kai values, land tenure, braiding patterns and flood risk. We agree with this approach and its consideration of the ecological context, cultural and social factors, as well as the viability of the site. We would also favour connection with terrace wetlands to provide a greater overall area at individual locations and a gradient of wetlands types with their associated plant and animal communities (that is riparian and terrace wetlands linked with both marsh and swamp classes present). We note the importance of corridors and connections for the overall functioning of ecosystem within the braided river system.

[435] We accept that there is a cost to creating and maintaining weed-free riparian wetlands. Invasion by weeds and destruction by floods are potentially difficult issues. Further, even if Meridian has answers to all the technical problems (and is prepared to spend the money to resolve them) we have concerns about any consent holders' rights to carry out the necessary work. For a start it would probably need to have resource consents to carry out the necessary work. That is relatively easily resolved: Meridian can apply for further resource consents (if necessary) from the CRC when it applies for all necessary land use consents. More fundamentally the ownership of the Waitaki riverbed is so complex that we need some re-assurance that any consent holder has the property right to create riparian wetlands.

[436] If the problems in the previous paragraphs are too expensive for Meridian to resolve there may be an answer within Meridian's grasp. We have already recorded that Meridian owns land adjacent to the Waitaki. As far as creating wetlands is concerned it may be preferable to leave riparian wetlands largely to the mauri of the Waitaki, (except for existing significant riparian wetlands where enhancement and protection are viable) and for any consent holder's obligations to be to create or enhance larger areas of terrace wetlands on land it owns or can gain access to.

657 Ms D M Robertson, evidence-in-chief para 148 [Environment Court document 13].

[437] Accordingly we consider that a greater area of terrace wetlands should be created than that lost to ensure there is no net loss of ecological values. An increase to cover uncertainties seems appropriate, so we hold that the consent holder should enhance or create 75 hectares of new high quality fenced and buffered permanent terrace wetland. We note that some of the terrace wetlands are on the edge of limestone terraces (especially south of the Otiake River) and we hope special consideration will be taken to include at least some of these wetlands in the mitigating package, if at all practicable.

[438] Specific proposals for specific existing or new wetlands will need to be put forward in further evidence so that these can be added to the conditions and Wetlands Raupo/Repo Management Plan. For example Ms Robertson referred to designing a 'leaky' tailrace above Stonewall[658] so that additional water can be supplied to the riparian zone around Stonewall. While we approve the idea in principle, we consider the 'objectives' in the General Conditions should go further towards ensuring that the leaked water goes to a wetland that will benefit.

[439] Finally, another objective required in the General Conditions should be to enhance habitat for marsh crake and bittern as Dr Grove said[659] of the management plan in answer to Ms Owen.

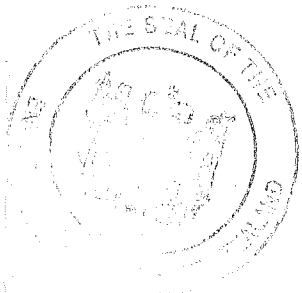
5.9 Instream flora, invertebrates and native fish

5.9.1 Didymo

[440] Flushing flows and adaptive management are proposed to address the (increased) potential impact of didymo under the current state of knowledge. Continued monitoring as promoted by the General Conditions may allow further methods to be devised. The CRC could introduce those in a review of the conditions of the consents.

5.9.2 Invertebrates

[441] The higher concentrations of pollutants and changed flows may have an impact on the invertebrates of the river especially the sensitive EPT taxa. Little can be done directly about these changes, except to mitigate the impact of pollutants. Much of that is outside the consent holder's control, but what can be done by it is identified above.



658 Ms D M Robertson, evidence-in-chief para 150 [Environment Court document 13].
659 Transcript p. 689.

5.10 Protection of braided river birds

5.10.1 Introduction

[442] Recognising that several species of river birds are endangered Meridian has taken steps to try to reverse some of the factors leading to removal of habitat and low breeding success of, in particular, black-fronted terns and black-billed gulls. The conditions approved by the Hearing Commissioners include two which are particularly relevant. They are the objectives for the Hearing Commissioners' General Condition 30 and are:

1. To maintain an area of suitable braided river bird habitat, not less than the area available prior to the commencement of the exercise of these consents;
2. To maintain, and where practicable, enhance the breeding success of threatened braided river bird species following the exercise of these consents.

5.10.2 Maintaining braided river bird habitat

[443] The first objective is obviously heading in the right direction if the decline in numbers of the threatened bird species is to be halted. However, we have a concern that the objective appears to allow the existing conditions to worsen between now and commencement of the consents. That is particularly important because various specific conditions give the consent holder 12 years to commence exercising the resource consents. Dr McClellan suggested the objective should create a base-line at 2001 (or earlier) when the vegetation of the riverbed was first surveyed comprehensively for Meridian. While we consider the records are too vague to go back to 2001 we judge that the objective should be reworded as follows:

1. To maintain an area of suitable braided river bird habitat, not less than the area available in 2009.

[444] We now turn to other difficulties in implementing the objective. First, because the existing willow and weed encroachment on the braided riverbed is likely to be exacerbated (between Kurow and Stonewall) by the NBTC abstraction, Dr Sanders proposed[660] three methods of mitigating weed encroachment on the riverbed as proposed by Meridian in the expectation that these will mitigate likely effects on braided river birds:

(1) as we have described, Meridian proposes general vegetation control between Kurow and the sea in terms of the Hearing Commissioners' General Condition 29:

> to maintain a fairway that is clear of willows and largely clear of woody weeds between Kurow and the sea, to an overall average width of 600 m …

(2) floods above 900 m^3/s will be allowed to pass out of the Waitaki dam undiverted by the NBTC, as channel maintenance flows[661].

(3) Meridian will control weeds more intensively on selected islands in the river "in order to provide high quality habitat for river birds"[662];

[445] While the general vegetation clearance would potentially maintain or even increase habitat for braided river birds, there are some potential adverse effects from the 600 metre fairway. First, it may increase access (especially by vehicles such as 4WDs or motor bikes) and that may cause more disturbance to the braided river bird species. Secondly, Dr McClellan was concerned the created habitat may be weedy or silty and therefore not attractive to black-fronted terns and black-billed gulls.

660 Dr D M Sanders, evidence-in-chief, para 58 et ff [Environment Court document 14].
661 Dr D M Sanders, evidence-in-chief, para 58.3 [Environment Court document 14].
662 Dr D M Sanders, evidence-in-chief, para 58.2 [Environment Court document 14].

[446] In her evidence for the Society Dr McClellan expressed concern[663] about whether clearing the fairway (Hearing Commissioners General Condition 29.3) would increase the habitat available for braided river birds. Based on her research on rivers in Southland over the last few years she is concerned that removal of willows and the woody weeds (gorse and broom) will open the way[664] for lower growing species such as pasture grasses, lupins and 'other herbaceous species'. Further sites which are cleared of the woody species will in her opinion have accumulated layers of silt/litter[665] which is unsuitable for birds like black-fronted terns and black-billed gulls which like clean gravel for nesting (and we note that overseas research shows that for some species with precocial chicks, predation rates increase if they are on sand rather than coarser substrates[666]). She also asked[667] if the flow regime is sufficient to clear silt, how many years will it take? Finally, she was concerned also about the chemicals which might be introduced into the Waitaki River system in order to control weeds.

5.10.3 Creating bird islands

[447] The 'bird island' concept is potentially useful. Dr Sanders described how he carried out a trial on a 7.8 hectare island over the last summer. This involved[668]:

> selecting a suitable island; working with ECan river engineering staff and contractors to initially clear weeds in autumn, using a bulldozer; doing follow-up control of weed re-growth with herbicides in early spring, and monitoring bird use of the island over the spring-summer breeding season.

Dr Sanders found that[669]:

> ... the trial site provided highly suitable river bird habitat. It was used by a much greater diversity and abundance of water birds than an adjacent non-treatment site. Birds that used the site included breeding pairs of three species of threatened braided river birds – black-fronted terns, wrybills, and banded dotterels.

---

663 Dr R K McClellan, evidence-in-chief, para 28 et ff [Environment Court document 49].
664 Dr R K McClellan, evidence-in-chief, para 34 [Environment Court document 49].
665 Dr R K McClellan, evidence-in-chief, para 37.3 [Environment Court document 49].
666 e.g. M A Colwell and others "Age-related Survival and Behaviour of Snowy Plover Chicks" (2007) The Condor 109(3): 638-647.
667 Dr R K McClellan, evidence-in-chief, para 37.6 [Environment Court document 49].
668 Dr D M Sanders, evidence-in-chief, para 69 [Environment Court document 14].
669 Dr D M Sanders, evidence in chief, para 70 [Environment Court document 14].

In passing we note that high ground on the island provided a safe refuge from the 980 m^3/s flood – January 2005 – so Dr Sanders regarded high ground as an important part of the Braided River Bird Management Plan.

[448] Dr Sanders was of the opinion that islands are better for breeding success than banks and that even very small flows[670] (0.06 to 3.0 m^3/s) can deter (but not prevent) mammal predators. Dr Sanders then stated that with the 120-140 m^3/s flow during the breeding season being carried in 6-6.6 braids the actual flows will be many times the deterrent flows he described. He thus considered the risk of increased access to the islands by mammalian predators to be low. Dr McClellan agreed that islands are better but stated that her research showed[671] that small braids are not successful. Despite that Dr McClellan supported the idea of clearing islands – although her other concerns about the exposed substrate being silt remained.

[449] Unfortunately while the trial demonstrated that suitable breeding habitat may be established very quickly, it does not show how to improve the breeding success rate. The Meridian trial was a sad disappointment because despite the breeding success almost all the young birds died before fledging. That was "... almost certainly [because] ... eggs and/or chicks on the island were preyed upon"[672]. Dr Sanders does not know what the predators were, or even whether they were mammals or birds such as black-backed gulls or harriers. That leads us to the second objective.

5.10.4 Enhancing recruitment of braided river birds

[450] The second objective in the Hearing Commissioners' General Condition 30 is:

> ... to maintain and, where practicable, enhance breeding success of threatened river bird species ...

670 Dr M D Sanders, evidence-in-chief, para 76 [Environment Court document 14].
671 Dr R K McClellan, evidence-in-chief, para 46 [Environment Court document 49].
672 Dr D M Sanders, evidence-in-chief, para 71 [Environment Court document 14].

To achieve that Meridian relies on the creation of bird islands along the model of its test over the 2008/09 summer. We accept that is an appropriate general approach to environmental compensation for the existing (worsening) situation of the braided river birds because it at least mitigates some of the effects caused by existing and proposed activities (encroachment of vegetation, approach by terrestrial predators, human disturbance), it will be in the affected reaches of the rivers, and it should be enforceable under conditions.

[451] However, Meridian accepts that if the island refuges are to be regarded as adequate environmental compensation for the potential loss of habitat, the causes of unsuccessful breeding and/or fledging will have to be researched and controlled. The Draft Braided River Bird Management Plan proposes to monitor breeding success, the effects of predation, and methods of predator control (which have not been uniformly successful in the past[673]). We have concerns that the condition as worded may leave determination of what enhancement is practicable to the consent holder. First, a future consent holder may not be as responsible as Meridian (Meridian may be sold off or broken up) so that a subjective and self-serving test of what is practicable may be adopted. Secondly, we are concerned that even Meridian's assessment of practicability may be viewed in the light of other expenses it is incurring in order to obtain approvals legal (or de facto) from submitters or appellants e.g.:

- the $250,000 per annum for recreation in the Hearing Commissioners' General Condition 38;
- providing potable water to existing consent holders when little of the contamination is likely to come from Meridian's own land and farming practices ;
- clearing the fairway below Stonewall.

673 Dr D M Sanders, evidence-in-chief, para 79 [Environment Court document 14].

[452] We accept Dr McClellan's evidence[674] that black-backed gulls may be a threat to black-billed gulls, black-fronted terns, banded dotterels and wrybills. We agree that either the Braided River Bird Management Plan or even the general conditions of consent (if granted) should impose an obligation on the consent holder to research possible predation by black-backed gulls (and/or by harriers[675]), and other causes of fledging failure of at least black-fronted terns and black-billed gulls. Any research programme will need to be comprehensive recognising that there may be many contributing causes.

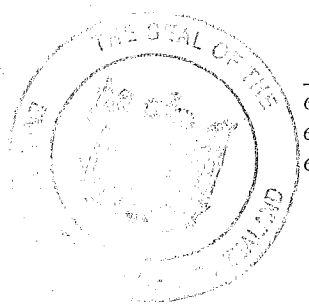
[453] We consider that if we are to grant consent the General Conditions of Consent will need to be amended along the lines we have suggested in paragraphs 26 to 28 and 41 of the General Conditions attached.

5.11 Salmon and trout habitat and catchability

[454] We consider the Hearing Commissioners' General Conditions are satisfactory, except that since the objectives of the Flow and In-Stream Management Plan are now being heightened in importance as management objectives we consider the objective of maintaining fish stocks should be subject to both enhancing indigenous in-stream values and to maintaining and enhancing tangata whenua values and have amended the condition accordingly.

5.12 Recreation

[455] Meridian has offered[676] to spend $1 million on investigating recreation possibilities in the changed river, plus ongoing contributions of $250,000 each year, and we find that is very generous. Whether those payments can all be justified as a proper RMA cost is questionable.



674 Dr R K McClellan, evidence-in-chief, para 39 et ff [Environment Court document 49].
675 *Circus approximans*.
676 Mr N C Eldred, evidence-in-chief, para 105 [Environment Court document 16]

[456] Much was made by the Society and Dr Brookes of the loss of the big river quality of the river. We accept that is so in respect of the 34 kilometre stretch between the Waitaki Dam and Kurow but record that many of the alleged consequential effects are either likely not to occur or will be adequately mitigated.

5.13 Mitigating effects on the mauri of the Waitaki

[457] We accept that there will be a general adverse effect on the mauri of the Waitaki but consider that it will be partly offset by specific increases in the special braided river birds which contribute to that mauri, and also by enhanced wetlands as habitat for eels.

5.14 Other observations on the proposed conditions

5.14.1 Drafting issues

[458] We explained earlier how the resource consents approved by the CRC's Hearing Commissioners are proposed to be subject to both specific and general conditions. We now give some comments on the general conditions in order to make them enforceable.

[459] The Hearing Commissioners' General Conditions included a number of conditions on 'Existing Lawful and Consented Water Users' in order to reassure existing takers from the lower Waitaki River that their rights will not be interfered with. While we have no difficulty with the general concept we are uneasy about some aspects of the conditions. We have therefore amended them (see General Conditions 4 to 10 in Schedule 2 below) to reflect our concerns. However, because we have not heard any of the parties on the changes we will reserve leave for any party to call evidence and make submissions on those conditions.

[460] To assist the parties in understanding our motivation for making the changes to the conditions discussed in the previous paragraph we can summarise our main concerns as follows:

(1) the appointment and role of the Independent Technical Review Panel was obscure so we have endeavoured to tidy that up;

(2) some obligations of the consent holder can only be on a 'best endeavours' basis since the alteration of existing water permits is within the Canterbury Regional Council's power;

(3) we have tried to make it clear that the NBTC consent holder's obligations apply to existing abstractors not future takers;

(4) there are several other drafting changes which should be checked carefully

(5) we do not understand why Wainui Stream abstractors should have special treatment especially in the light of the evidence of Mr Potts[677];

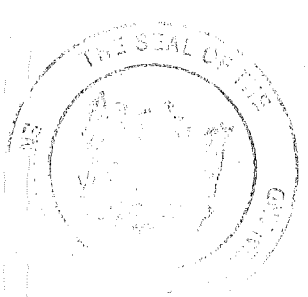
(6) we see no need for a General Condition as to post-commissioning monitoring since it is already required by our proposed General Conditions 31 and 33.

5.14.2 Self-irrigating soils

[461] General condition 4 proposes an Abstractive Users Management Plan. Condition 5 states that the AUMP will deal, amongst other issues, with the effects of lower river levels on self-irrigating soils. We are concerned about the reasonableness and vagueness of that phrase. At the least we consider it should refer to:

> Soils which are regarded as self-irrigating by the Independent Technical Review Panel.

[462] If self-irrigating soils are soils which are close enough to existing water tables for plants to suck up water from the table, then such soils may in future be found closer to the river i.e. within the banks described in Chapter 2.0. At first sight we do not consider this condition should apply to such soils. We do not consider there should be incentives created by the exercise of these consents for landowners to encroach further on the riverbed even if they have riparian rights (and quite how riparian rights were acquired on the Waitaki River – which is navigable by some boats – is not an issue we need, or have jurisdiction, to inquire into).



677 Mr R J Potts, evidence-in-chief para 27.5 [Environment Court document 32].

5.14.3 In-stream ecological values

[463] Finally, we are not prepared to accept the Hearing Commissioners' objective about "in-stream ecological values" for the Flow and In-stream Habitat Management Plan – which we would change from being merely a management plan objective to a general condition [General Condition 21(2)]. First while we would approve an objective which maintains populations of aquatic organisms as at a defined date, we cannot accept a condition that gives a date in the past (1 January 2001) about which there is no evidence (or so we assume); secondly we consider "enhancing indigenous in-stream ecological values" is too vague to be enforceable.

5.14.4 Fish exclusion measures

[464] Fish exclusion measures were included in the Hearing Commissioners' Discharge Permits. We consider that giving the consent holder six months before it stops discharging water from the tunnel on every occasion the exclusion measures fail is excessively generous, and would amend the conditions accordingly.

6.0 Consideration and Outcome

6.1 The gateway tests

[465] Because the NBTC's applications are for non-complying activities we do not have to consider the proposal further if it fails the particular restrictions for non-complying activities in section 104D of the RMA. The 'gateway tests' stipulate that:

> (1) Despite any decision made for the purpose of section 93 in relation to minor effects, a consent authority may grant a resource consent for a non-complying activity only if it is satisfied that either –
>
> (a) the adverse effects of the activity on the environment (other than any effect to which section 104(3)(b) applies) will be minor; or
>
> (b) the application is for an activity that will not be contrary to the objectives and policies of –
>
> (i) the relevant plan, if there is a plan but no proposed plan in respect of the activity; or
>
> (ii) the relevant proposed plan, if there is a proposed plan but no relevant plan in respect of the activity; or
>
> (iii) both the relevant plan and the relevant proposed plan, if there is both a plan and a proposed plan in respect of the activity.
>
> ... [subsection (2) is not relevant]

[466] It is obvious that some of the adverse effects of the NBTC, such as reducing the flow in the river between the Waitaki Dam and Stonewall by on average 211 m^3/s , are more than minor, so the first gateway test[678] is failed. However, we consider that the Meridian proposal is not inconsistent with the objectives and policies of either the WCWARP or the proposed NRRP if the adverse effects are mitigated, remedied or compensated for as discussed in the previous chapter, so the second gateway test[679] is passed.

678 Section 104D(1)(a) of the RMA.
679 Section 104D(1)(b) of the RMA.

6.2 Part 2 of the Act and Objectives 1 and 2 of the WCWARP

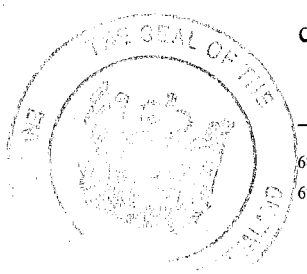
6.2.1 Introduction

[467] We have to consider all the matters we have described and make a judgement as to whether the purpose of the RMA – sustainable management of the relevant natural and physical resources[680] – is better met by granting or refusing consent. We consider that sustainable management is more likely to be achieved if the five objectives of the Waitaki Catchment Water Allocation Regional Plan are met, always recognising that objective 2 allows for allocations which are consistent[681] with achieving objective 1. In particular we hold that all relevant aspects of section 6 of the RMA are effectively subsumed in the five objectives of the WCWARP except for the provision as to access in section 6(d) which we consider separately in section 6.2.5 below.

[468] Objective 1 of the WCWARP is vital. It is:

> To sustain the qualities of the environment of the Waitaki River and associated beds, banks, margins, tributaries, islands, lakes, wetlands and aquifers by:
>
> a. recognising the importance of maintaining the integrity of the mauri in meeting the specific spiritual and cultural needs of the tangata whenua, and by recognising the interconnected nature of the river
> b. safeguarding the life supporting capacity of the river and its ecosystems
> c. managing the water bodies in a way that maintains natural landscape and amenity characteristics and qualities that people appreciate and enjoy
> d. safeguarding the integrity, form, functioning and resilience of the braided river system
> e. providing for individuals' reasonable domestic water needs
> f. providing for individuals' reasonable needs for their animals' drinking-water
> g. providing for fire-fighting water needs.

There is no issue about paragraphs e., f. and g. in these proceedings. If water permits are granted conditions of consent are proposed which will safeguard those matters. Paragraph c. is only relevant in terms of the 'big river' and related landscape amenity effects as considered under d. As for a. (maintaining the integrity of the mauri) we will consider that last, because in many ways it is the sum of the other paragraphs. We consider how the NBTC achieves the other paragraphs of objective 1 in order below.



680 Section 5(1) of the RMA.
681 Objective 2, Waitaki Catchment Water Allocation Regional Plan [p. 24].

6.2.2 Safeguarding the life-supporting capacity of the river and its ecosystems

[469] This is a crucial issue in this case. The appellant society and the section 274 parties supporting it said that the Waitaki River would shrink if the NBTC was built and operated, and that there would be various adverse effects, some of which e.g. the reduction in area of salmon breeding habitat could not be mitigated or remedied. Our best prediction is that most of the effects in respect of salmon and trout are likely not to be as bad as those parties fear. However, given that there is a possibility we may be wrong, a more important factor is that the existing management of the lower Waitaki does not safeguard the life supporting capacity of the river and its ecosystems. In particular key native species – fish (especially eels), birds and plant communities – are already (highly) threatened. That is because, as we found in Chapter 2.0, the lower Waitaki River:

(1) is a dynamic braided river at present but it may be changing to a single stem river as a result of the factors we describe next;

(2) is heavily modified as a result of continuing vegetation encroachment in the riverbed. The wide, relatively bare gravel beds that existed before the 1930s have been replaced by willows (some planted as part of flood protection work), gorse and broom;

(3) experiences dampening effects on flood peaks and low flows caused by the Benmore, Aviemore and Waitaki dams.

Further:

(4) the flora of the river itself has been changed, possibly substantially, by the arrival of didymo since the WCWARP came into force in July 2006;

(5) the fauna of the Waitaki River has been changed by the introduction of brown and rainbow trout and chinook salmon;

(6) the native bird species that depend on the river and its associated wetlands are (highly) threatened;

(7) the quality of the water is being changed by increasing pollution (mainly nitrogen and faecal coliforms) from farming activities in the catchment. Particularly polluted tributaries are the Hakataramea River and the Welcome Stream (just above the State Highway 1 bridge on the south side of the river).

[470] The NBTC hopes to safeguard the life-supporting capacity of the Waitaki River's ecosystems in these important ways:

(1) the local populations of braided river birds should increase by virtue of improved habitat, increased breeding success and reduced disturbance and predation;
(2) the viability and quality of wetlands should improve;
(3) the population of eels, bitterns and crakes may increase.

6.2.3 Safeguarding the integrity, form, functioning and resilience of the braided river system

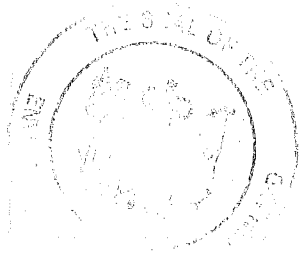
[471] As Ms Owen pointed out for the Society, and she was supported by Dr Brookes on this, the defining characteristic of the Waitaki River at least below Kurow at present is its braided nature. Not only is maintenance of that character an important component of objective 1, it is also, as Ms Owen submitted and we accept, a matter of national importance under section 6(a) of the Act. However, another characteristic of the river is its dynamic, changing nature, and that is changed further by the effects of the dams upstream of the NBTC. We have accepted Dr Hick's view[682] that the probability of the Waitaki River retaining its braided river character is less than 50% over a 100 year period even without the reduced flows of the AFR-with hydro.

[682] Dr D M Hicks, supplementary evidence (30 June 2009) para 10 [Environment Court document 12B].

[472] Faced with the fact of change the Society argued that it is water flow which is the 'real solution' to the Waitaki's decreasing braids[683]. However, we have found on the evidence that it is likely the braids are losing the battle against weed species (including willows as weeds). The Regional Council still allows, and may in fact require, willows to be planted to control floods is inconsistent with its desire (not supported by funds) to control willows elsewhere in the riverbed. These contradictory policies are not helping the river safeguard its integrity, form, functioning or resilience. We have no power (in these proceedings) to change the CRC's policies but, at least for the length of river between Kurow and Stonewall, Meridian's volunteered condition to clear the 600 metre fairway is likely to assist the river maintain its braided form even with reduced flows.

6.2.4 Mauri of the river

[473] We recognise that the mauri of the Waitaki will be diminished by the taking of over 200 m^3/s between the Waitaki Dam and Stonewall. However, we consider that Mr Mikaere's point that the physical effects are largely remedied or mitigated is strengthened by the important consideration that both the physical and (we assume) the spiritual aspects of the river's mauri have been weakened in the last 120 years since Europeans arrived in the area in force (as Te Maiharoa and his people learnt to their cost) and are continuing to be weakened by current management of the river. We consider that the physical function, form, resilience and remaining integrity of the river are likely to be improved if the wetlands and braided river bird conditions are significantly tightened up, and we trust that the benefits for the mauri will outweigh the adverse effects. Doing nothing will lead to further inexorable decline in the qualities that give the river its mauri, whereas the NBTC does (at significant cost) give hope that the mauri might be strengthened overall.



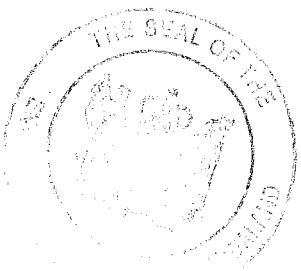
683 Ms C M Owen, submissions para 181 [Environment Court document 61].

[474] The river management plans in the proposed conditions include consideration of mahika kai sites and potential improvements to both quality and access of these sites, with ongoing involvement of tangata whenua. We also note that Meridian has come to an agreement with Ngai Tahu with respect to their ongoing relationship and mitigation of the effects of the Waitaki Power Scheme on Ngai Tahu cultural values[684]. This relationship is also provided for in the conditions of the consent, as is the relationship between Waitaha and the Waitaki.

6.2.5 Maintaining and enhancing public access to and along rivers

[475] Section 6(d) of the RMA requires us to recognise and provide for, as a matter of national importance, the maintenance and enhancement of public access to and along the Waitaki River. We consider that access to the lower Waitaki is unlikely to be affected directly by the NBTC if implemented. The routes to water may (on average) be slightly longer than at present but the extensions will be over bare cobbles and are likely to be kept open by use. Access along the river is likely to be considerably increased, at least in the short term, between Kurow and Stonewall because there will be much less water flowing in the existing channels and therefore wide expanses of gravel to travel up and down. Over time willows and woody weeds are very likely to move onto the unused channels which may then reduce human mobility up and down the river, although that effect would be ameliorated by Meridian's volunteered condition to maintain an overall average fairway width of 600 metres.

[476] We accept that access to wetlands may be reduced simply because there may be less riparian wetlands on public land. However, the matter of national importance is to maintain and enhance access to and along "the coastal marine area, lakes and rivers", not to wetlands so we do not have to be as concerned about access to wetlands.



684 Ms L H Mead, evidence-in-chief para 17 [Environment Court document 22].

[477] Another relevant consideration on this matter is a condition being volunteered by Meridian. The General Conditions provide for very large sums to go to recreation: first $1 million to go to preparation of a recreation plan, and then a fund of $250,000 per year is to be distributed through a charitable trust to recreation for each of the 35 years of the consents' terms. We would have preferred that money to go to repair the ecological damage currently being wreaked on the river but accept Meridian's right to volunteer it (and the General Condition) as a way of improving its relationship with the community. Because of their size we do not see Meridian's payments as a reasonable RMA cost and so hold they should not count when considering the practicability of other remedial or mitigating action that is required under the RMA.

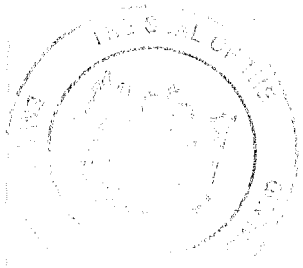
[478] In summary, section 6(d) of the RMA is readily satisfied in this case because physical access to and along the flowing or intermittently flowing water of the Waitaki will be increased by the proposal. Initially there will be increased areas of bare cobbles which will allow access up and down the river, and later the consent holder will be obliged to maintain an open fairway, at least between Kurow and Stonewall. We are also conscious that it may be that to some extent section 6(d) works against section 6(c) in that it is possible that movement of people may be one of the factors limiting successful breeding of the threatened braided river birds.

6.3 Section 7(b): Efficient use of natural and physical resources

6.3.1 The Meridian evidence on benefits and costs

[479] We are required by section 7(b) of the RMA to have particular regard to the "efficient use and development of natural and physical resources". We discussed what that means in Chapter 3.0 and concluded it requires a comparison of public benefits and costs.

[480] For Meridian the evidence of Dr Layton outlined[685] and quantified as he considered practical the likely benefits and costs of the NBTC. Dr Layton summarised the costs and benefits in a table[686], which we have summarised even further below.



685 Dr T B Layton, evidence-in-chief beginning at para 35 [Environment Court document 3].
686 Dr T B Layton, evidence-in-chief para 73 [Environment Court document 3].

Benefits	**Value $million**	**Qualitative assessment**	**Who benefits or bears the cost?**
Net value of electricity produced	$80-$103m pa	Large impact	NZ economy
Suppression of South Island electricity prices		Medium impact	South Island electricity consumers
Impacts on local economy of construction, spread over **seven years**	$304-$350 million	Large impact	Regional economy
Impacts on local economy of on-going operation	$5m pa	Small impact	Local economy
Avoided greenhouse gas emissions	$8-$40m pa	Large impact	NZ economy
Costs			
Displaced activities (irrigation and recreation)		Minimised by mitigation and therefore minor	Irrigators and the general public
Other environmental impacts on flora, fauna, heritage and landscape		Minor impact	General public

Notes: (a) operating and maintenance costs ($5m/year) have been netted off the sale value of electricity;

(b) the gaps are where Dr Layton made no attempt to quantify the costs.

[481] We have omitted the following from the above table:

(a) The total construction cost, as Dr Layton stated in response to questioning by the court[687] that this was a "private cost to Meridian" and therefore not something that we should take account of.

(b) Any synergies in operating the tunnel in conjunction with other generation. Dr Layton assessed these in his table as having a small impact. He made only passing mention of it in the text of his evidence[688], and in doing so stated that it would be a "benefit … realised by Meridian", from which we conclude that this is a private benefit and therefore not something we should take account of.

687 Transcript pp 85-86.

688 Dr T B Layton, evidence-in-chief para 41.1(c) [Environment Court document 3].

(c) General suppression of price increases as Dr Layton assessed[689] these as "difficult to quantify" and having a small impact.

(d) Avoided transmission losses on southward electricity flows, as he assessed the impact as small.

(e) Reduced probability of supply reduction as Dr Layton assessed this as having probably a small impact.

(f) Increased electricity system operation costs as these were assessed as likely to be negligible.

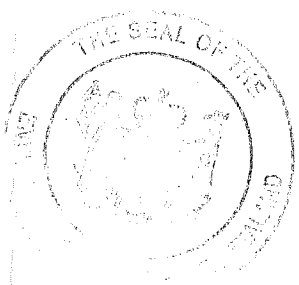
[482] One benefit that was not well canvassed in the written evidence is the claim that the NBTC will produce increased energy storage. Mr Truesdale wrote[690] that the NBTC would increase New Zealand's energy storage capacity. He explained in cross-examination[691] there is no additional water storage, but said that adding generation capacity to water released from the Upper Waitaki hydro storage lakes increases the energy storage. We disagree: the NBTC does not increase energy storage since it neither raises water levels nor increases the volume of water stored. What it does do is make more effective use of the water that is already stored by enabling generation of an extra 1100 to 1400 GWh per year through the tunnel.

Effects on other water users – benefits or costs

[483] Mr Ford, an agricultural and resource economist, agricultural consultant and director of The Agribusiness Group, gave us evidence on the reliability of the water supply to agricultural irrigators under the NBTC flow regime. Based on the 100% reliability of the NBTC (as assessed by Mr Potts)[692], Mr Ford assessed the value of that reliability compared to the greater uncertainty under other possible regimes[693]. That will be of relevance if we consider costs and benefits of alternative flow regimes. The evidence of Mr Potts was that the status quo has had 100% reliability[694] to date.

---

689 Dr T B Layton, evidence-in-chief para 73 [Environment Court document 3].
690 Mr J T Truesdale, evidence-in-chief para 16 [Environment Court document 4].
691 Transcript p. 125.
692 Mr S J Ford EIC para 9.4 [Environment Court document 24].
693 Mr S J Ford EIC para 41 [Environment Court document 24].
694 Mr S J Ford EIC para 9.1 [Environment Court document 24].



[484] Mr Potts suggested[695] that, as Meridian may now be able to operate within the 120 m^3/s minimum flow of its resource consent without the need for the full 30 m^3/s buffer used to date, there was the potential for the status quo reliability to reduce in the future. The implication of Mr Potts' suggestion is that there is a potential benefit of the NBTC flow for irrigators compared to the status quo. However, Mr Potts was unable to assess[696] how likely it was that future reliability would be different from historical reliability under a status quo regime. Mr Ford did not differentiate between the value of farm gate production under a future status quo regime and that under the historical status quo regime[697]. Lacking the evidence to do otherwise, we therefore assume that without NBTC the future reliability to abstractors would be unchanged from that in the past. Thus when comparing NBTC to the status quo flow regime the NBTC provides no benefit or cost in terms of reliability to water abstractors downstream of the Waitaki Dam.

[485] It is apparent that there is the potential for adverse impacts on the ability of some irrigation and domestic water abstractors to access their water under NBTC. This will be due to the reduced river level being below the intake level, the braids reducing in number or shifting so that the intakes lose contact with the river, or the lower groundwater level affecting the efficiency of groundwater abstractions. We understand that the Hearing Commissioners' General Conditions 6-10 require that such effects are fully mitigated[698] and the Meridian will fully fund this mitigation[699]. Therefore these costs will be fully internalised to Meridian and we do not need to have further regard to them.

6.3.2 The evidence of opposing parties

[486] We have identified only three points on which the appellants have challenged Dr Layton's cost benefit analysis: predicted increase in the quantity of energy demanded; the value of predicted savings of greenhouse gas emissions; and thirdly the cost of carbon used in constructing the NBTC.

---

695 Mr S J Ford EIC para 10.1 [Environment Court document 24].
696 Mr R J Potts, evidence-in-chief para 56.4 [Environment Court document 32].
697 Mr S J Ford, evidence-in-chief para 41, Table 4 [Environment Court document 24].
698 Mr R J Potts, evidence-in-chief para 27 [Environment Court document 32].
699 Mr R J Potts, evidence-in-chief para 28 [Environment Court document 32].

(1) Future demand for energy

[487] Underlying Dr Layton's assessed benefit of the value of the electricity produced from NBTC is the assessment of future demand growth provided by Mr Truesdale[700]. While not favouring any particular electricity demand forecast, Mr Truesdale noted that:

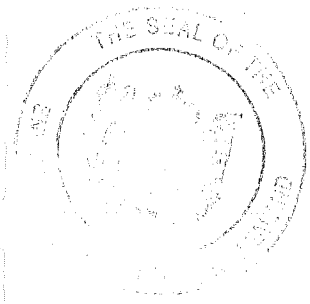
- the historic rate of demand growth was around 2% per annum;
- the Electricity Commission is forecasting average growth of between 1.0% and 1.8% through to 2030;
- the Ministry of Economic Development is forecasting average growth of 1.3%; and
- the New Zealand Energy Strategy's lowest growth scenario has generation growth of 0.5% per annum to 2025.

[488] Dr Bennett[701], Mr Mitchell[702] and Dr Krumdieck[703] all took issue with the premise of continuing demand growth. Dr Bennett noted that the latest Statement Of Opportunities ("SOO") from the Electricity Commission includes a review of demand forecasts with the result that "projections of long term demand growth (have been) lowered as a result"[704], and that the SOO forecasts are primarily based on forecast Gross Domestic Product (GDP) growth of 2% per annum. Dr Bennett was pessimistic about future economic growth and said that the Court should not be "held to ransom" by any claim for this project to proceed "in urgent national interest"[705].

[489] Mr Mitchell stated that Meridian witnesses "rely on Meridian's own forecasts of growth"; that he based his analysis on Electricity Commission information; and that the two sources do not reconcile[706]. He later quoted Transpower data (not Electricity Commission data) showing total New Zealand growth forecast at 2.83% per annum to 2017, with the majority of the growth being in the North Island, and the South Island

---

700 Mr J T Truesdale, evidence-in-chief paragraphs 60-61 [Environment Court document 4].
701 Dr N R Bennett, evidence-in-chief paragraphs 56-59 [Environment Court document 48].
702 Mr K S Mitchell, evidence-in-chief paragraphs 29 and 94 [Environment Court document 52].
703 Dr E Krumdieck, evidence-in-chief para 11 [Environment Court document 55].
704 Dr N R Bennett, evidence-in-chief para 55 quoting from the 2008 SOO [Environment Court document 48].
705 Dr N R Bennett, evidence-in-chief para 59 [Environment Court document 48].
706 Mr K S Mitchell, evidence-in-chief para 29 [Environment Court document 52].



growth focused on Christchurch. He made the point that demand growth south of the Waitaki is only 1.09% p.a. to 2017[707].

[490] Dr Krumdieck argued that continuous demand growth is not sustainable. She pointed out that demand growth of 2% per annum would require a doubling of the generation output in 35 years, while just 1% p.a. growth would require a doubling of output in 70 years. She suggested that it is inconceivable that New Zealand has the potential generation resources to be able to do this, that we do not have the equivalent of a Waikato and Waitaki river system left to exploit for hydro-generation purposes. Therefore at some point demand growth must go to zero[708].

[491] We accept that there is a large degree of uncertainty in forecasting future electricity demand, especially over multi-decade timeframes. We agree that historical relationships between economic activity (GDP) growth and electricity demand may not be a good guide as to future demand, especially in the long term. However, we note that the forecasts referred to by Mr Truesdale cover a range of estimates, all of which are below the historic rate of demand growth, and one of which is as low as 0.5% per annum. We are aware that new forms of generation (e.g. solar and tidal generation) are under active investigation, and that wind generation is increasingly becoming part of the generation mix in New Zealand. We note that reducing generation emissions of greenhouse gases will require the replacement of existing thermal generation with non-emitting forms of generation. Dr Layton's benefits are not predicated on a particular level of demand growth, but on an increased demand for renewable, non-carbon emitting generation. We accept that this will occur and that the assumption of demand growth underlying Dr Layton's benefits is reasonable.

(2) Value of avoided greenhouse emissions

[492] Dr Bennett challenged Dr Layton's estimate of the value of avoided greenhouse gas emissions. Dr Bennett agreed that NBTC will be a low-emission electricity generator and this is a benefit. He disagreed with Dr Layton's valuation of any avoided emissions. He noted that the European price of carbon has fallen in the current

707 Mr K S Mitchell, evidence-in-chief para 93, Table A [Environment Court document 52].
708 Dr E Krumdieck, evidence-in-chief para 11.2 [Environment Court document 55].

recession, that the New Zealand carbon market is not well developed and its links to international markets are erratic. He stated that the United States carbon price was much lower than the European price (NZ$2.18 per tonne in the United States, compared to NZ$33.30 in Europe), and that the different markets may combine following any international agreement on climate change. Balancing this potential lower valuation Dr Bennett acknowledged the possibility of increased carbon reduction targets coming out of international agreements that could increase carbon prices. On this basis Dr Bennett claimed that it is "difficult to predict the value of any carbon credits"[709].

[493] Dr Bennett suggested a price of NZ$10 per tonne rather than Dr Layton's NZ$21-$33 per tonne. On this basis Dr Bennett suggested a value of avoided emissions of NZ$5 million per year, rather than Dr Layton's NZ$8.4 - $40 million per year[710]. In response[711], Dr Layton pointed out that the European carbon market is linked to the Kyoto liabilities of European Union countries, whereas the United States market is voluntary, and that post-Kyoto agreements are likely to be at least in line with the Kyoto agreement, and probably more stringent. He agreed with Dr Bennett that more stringent carbon reduction targets will increase prices. He maintained that NZ$21 per tonne is reasonable as the lower end of the likely price range. In these proceedings we accept Dr Layton's view of the likely price of carbon and find that the price range he has used is reasonable and conservative.

(3) Construction carbon costs

[494] The third challenge by the appellants to Dr Layton's cost benefit analysis is Dr Bennett's view that carbon emissions arising from construction will be significant and should be offset against the value of carbon credits[712]. Dr Bennett gave no detailed analysis to support his opinion. Dr Layton acknowledged[713] that Meridian has not analysed in any detail the greenhouse gas emissions that will occur during construction but said that in his opinion the limited international data available suggests hydro

---

709 Dr N R Bennett, evidence-in-chief para 64 [Environment Court document 48].
710 Dr N R Bennett, evidence-in-chief para 65 [Environment Court document 48].
711 Dr T B Layton, evidence-in-reply paragraphs 23-25 [Environment Court document 3A].
712 Dr N R Bennett, evidence-in-chief para 66 [Environment Court document 48].
713 Dr T B Layton, evidence-in-reply paragraphs 26-30 [Environment Court document 3A].

generation construction carbon costs are low compared to other generation construction carbon costs. He also pointed out that most of the in-ground construction of the tunnel will be done using electrically-powered machinery. Therefore he considered that not including a full emissions analysis likely works against NBTC when compared to other forms of generation. Further, Dr Layton noted that Meridian promotes itself as a carbon neutral business, and if it keeps to its promotion the costs of carbon emissions will be fully internalised[714]. We agree that construction carbon costs should be included in the cost benefit analysis unless (as is likely) they are fully internalised to Meridian.

6.3.3 Conclusions on the benefits

The price of electricity

[495] In estimating the net benefit from the production of electricity at $80-$103million per year, Dr Layton has used an average electricity price of $80/MWh[715] although he provided no justification for $80/MWh being the price in his written evidence. Questioned by the Court he referred[716] to a graph of what he suggested was a long run marginal cost curve in his evidence in reply[717]. The various indicators on this graph seem to us to reach about $70-$75/MWh as a maximum price over the period 2006-2008. In response to questioning Dr Layton conceded that what was shown on the graph were not spot prices but hedge contract prices[718], and that he did not use this data when he made his calculations using $80/MWh[719]. He stated his $80/MWh was derived from "trends that have been occurring in the spot prices … and where that had got to as an average – a long run average". When pressed as to the period the average covered he stated "Oh, about over the last three years, I think. It was a three year average"[720]. A little later he suggested[721] of the $80/MWh price that it was a long run marginal cost.

---

714 Dr T B Layton, evidence-in-reply para 30 [Environment Court document 3A].
715 Dr T B Layton, evidence-in-chief para 45 [Environment Court document 3].
716 Transcript p. 91.
717 Dr T B Layton, evidence-in-reply para 41[Environment Court document 3A].
718 Transcript p. 92.
719 Transcript p. 93.
720 Transcript p. 93.
721 Transcript p. 94.

[496] We are not satisfied that $80/MWh is the appropriate price to be using to calculate the value of electricity produced in the cost benefit analysis. As Dr Layton has used current 2009 prices in the rest of his cost benefit analysis, it is appropriate that a current average electricity price also be used. We are unclear as to exactly what his price of $80/MWh represents: a three year rolling average of spot prices, an estimate of where the trend in the average spot price will be at some point in the future or an estimate of the long run marginal cost of generation (either currently or at some point in the future). If he has used a three year average price, we would be concerned that the effect of the extremely high spot prices of 2008 would be over-represented in an average of only three years. We put this concern to Dr Layton and he agreed (in a qualified way)[722]. We note that the peak monthly average price in 2008 of $351/MWh was in fact well above the highest monthly average price pre-2008 of $238/MWh in July 2001[723].

[497] To clarify what electricity price should be used in the cost benefit analysis, we requested that the monthly average Benmore spot price time series be produced as evidence. Mr Truesdale provided this via a second supplementary statement of evidence[724], both as hard copy and as a XL spreadsheet on a disc. Using this we have calculated the rolling three-year average price (ending June 2009) was $73.36/MWh. Dr Layton's evidence was dated 15 April 2009, and he stated that he used the half hourly pricing data[725]. We calculate the three-year average price as at the end of March and April 2009 as $79.50 and $76.62/MWh respectively.

---

722 Transcript p. 93.

723 Mr J T Truesdale, second supplementary statement Appendix A [Environment Court document 4D].

724 Mr J T Truesdale, second supplementary statement (6 July 2009) Appendix A [Environment Court document 4D].

725 Transcript p. 98.

[498] We conclude that using a trend in spot prices[726] as at April 2009 does not justify a price of $80/MWh as reasonable in the cost benefit analysis. The 3-year average is obviously dominated by the extreme price peaks of mid-2008. The 3-year average price immediately prior to that price spike was less than $70/MWh[727]. Even in April 2009 the 3-year average was obviously trending very strongly downward towards $70/MWh[728].

[499] Mr Truesdale viewed[729] the inclusion of 2008 prices in any average calculated as appropriate. Insofar as he appears to be referring to the 2008 annual average price (in his graph of the five-year rolling average price[730]) rather than the individual monthly average prices of 2008, we agree. Dry years do happen and the effect of them on price needs to be included in the price used in the cost benefit analysis. Our concern is with the extreme prices of May and June 2008, not those of 2008 generally. If the price impact of an extreme dry year event, of perhaps a one in fifty year return period, is included in a three-year average price, it sets a price as if that event actually occurred once in every three years. This may result in the price used being too high and thus significantly overstating the benefit (in this case) to be expected.

[500] Mr Truesdale commented[731] on the risks in using historical prices to assess future prices. He suggested that forward contract prices (hedge prices) or long run marginal costs of new generation are more appropriate. He supplied some data on hedge prices and referred to Dr Layton's estimates of long run marginal costs of new generation. We accept the risks inherent in using the past to represent the future, and acknowledge that there are different ways to assess future prices. However, Mr Truesdale's comment confused the issue of what a cost benefit analysis is trying to

---

726 Which is what Dr Layton said he did: Transcript p. 98.

727 The three-year monthly average spot price was $68.26/MWh in January 2008. The average spot price was $66.76/MWh in January 2008 and nearly doubled to $126.28 in February, remained relatively stable for March and April ($118 & $134 respectively) before doubling again to $306 in May and peaking at $351 in June 2008.

728 The three-year monthly average was $79.50 in March 2009, and $76.62 in April down from the peak of $93.02 in August 2008.

729 Mr J T Truesdale, second supplementary statement paragraphs 6 and 7 [Environment Court document 4D].

730 Mr J T Truesdale, first supplementary statement Figure 1 [Environment Court document 4C].

731 Mr J T Truesdale, supplementary evidence paragraphs 6-10 [Environment Court document 4C] and Transcript p. 143.

assess. The role of the price is to provide a value for the volume of benefits (MWh of electricity) produced over the life of the project. That value of benefits is compared to the value of costs. To be comparable the costs and the benefits need to be expressed in the prices of the same period. This was what Dr Layton was referring to when he stated[732]:

> More generally, in cost-benefit analysis it is essential that the costs and benefits and the discount rate are consistent with one another. If inflation adjusted benefits are used, then costs must also be inflation adjusted and a (higher) nominal discount rate must be applied. If a (lower) real discount rate is used, then there should be no inflation adjustment of either costs or benefits.

[501] One way of doing this is to estimate future prices and apply the time series of prices to the time series of volumes to get an income stream. This then needs to be adjusted for inflation over the length of the series and adjusted to take account of the changing time value of money. As Dr Layton put it when we asked whether the Court could rely on the Benmore spot price data[733]:

> I think I will take the opportunity but briefly one – there is an argument about taking a forward projection and then discounting it back to today to try and get the figures comparable if you do think there is going to be any ongoing rises of those prices.

Dr Layton expanded on this in supplementary evidence following the hearing[734] but he did not attempt the exercise[735] himself. He had followed the alternative, and simpler, path, which is to apply the current period (2009) price to the average volume of electricity expected to be produced, and then compare this to the expected annual average costs plus the one-off costs expressed in the prices of the same period. Thus Dr Layton was careful to state that his estimate of construction and operation costs of NBTC were in 2009 prices[736], viz:

---

732 Dr T B Layton, evidence-in-reply para 10 [Environment Court document 3A].
733 Transcript p. 98.
734 Dr T B Layton, supplementary statement of evidence (10 July 2009) paragraphs 7-10 [Environment Court document 3B].
735 Transcript p. 98.
736 Dr T B Layton, evidence-in-chief para 43 [Environment Court document 3].

> ... the cost of constructing the NBTC scheme will total between $864.7 million and $993.6 million **(in 2009 dollars)** ... Meridian calculates the ongoing operation and maintenance of the NBTC scheme to cost $5.0 million per year **(in 2009 dollars)** .
> [Our emphasis]

[502] The issue is not what will be the average spot price in the future, but what is the appropriate average spot price in 2009. Dr Layton used $80/MWh as the appropriate average spot price for 2009. In advocating for his price of $80/MWh in his Supplementary Statement, Dr Layton summarised his views as follows[737]:

> Prices in 2009 dollars will in future years trend around the level the three-year rolling average of spot prices reached in 2008-09, but will not trend upwards or downwards after adjustment for inflation.

We find that this is not an appropriate justification for his average price for 2009. The extreme dry year of 2008 (and the resulting price spike) is too unusual an event to use, unadjusted, in a three-year average being used to estimate the value of benefits into the future.

[503] We conclude that an appropriate electricity price for use in the cost benefit analysis should be no higher than $70/MWh. Using a price of $70/MWh, the gross benefit from the sale of electricity that Dr Layton calculated as $85-$108 million per year using a price of $80/MWh, is more appropriately calculated as $74-94 million per year[738]. After allowing for operational costs of $5 million per year, the net benefit is $69-$89 million per year.

Electricity price suppression

[504] We agree with Dr Layton that the effect of the NBTC on general electricity prices will not be large. Dr Layton also argued that NBTC may have a more significant impact on South Island electricity prices. He noted that in 2008 South Island prices were considerably higher than in the North Island, and that additional South Island generation would act to avoid future increases arising from the effect of dry year risk on

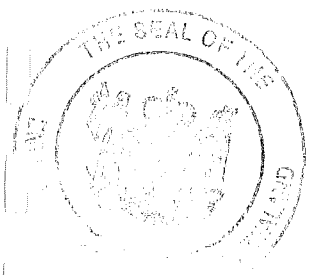
---

737 Dr T B Layton, supplementary statement para 9 [Environment Court document 3B].
738 70/80 * $84.7 = $74.1, 70/80 * $107.7 = $94.2.

generators regional pricing policies.[739] Dr Layton did not discuss the causes of the margin of South Island prices over those in the North Island.

[505] We understand that the electricity market is a national one, but that local price spikes can occur where there is a constraint operating in the transmission system. Where this occurs, more generation behind the constraint would act to reduce price spikes behind a constraint, and this may have downward pressure on regional retail electricity prices. However we have doubts as to whether NBTC would have this effect in this case. Firstly there are already two consented large generation projects in or near Otago – the proposed Mahinerangi and Kaiwera Downs wind farms. There is a possible third very large wind farm on the Lammermoor in eastern Central Otago, but we cannot take that into account in these proceedings because it is subject to appeal and waiting on a decision from this Court. Given the electricity demand relative to capacity in the South Island, we are doubtful that granting consent to a third project will add anything to the localised downward price pressure. The first one to be built will ease the price pressure behind the constraint. Which (if any) project will be built and come on stream first is unclear at this point although media releases for TrustPower New Zealand Limited while we finalise this interim decision suggest Mahinerangi may proceed quite soon. In any event we note that NBTC still has a considerable further consenting process to go through – for land use consents –, in the event we grant these consents, and then has a lengthy construction time before generation would commence. We consider it likely that if price pressures behind the constraint continue to cause a significant price differential between North and South Island prices, then commercial incentives will operate to bring one or both of the wind farms into production well before the NBTC scheme. This will alleviate the local price pressure.

[506] Secondly, we understand that the significant constraint contributing to the South Island local price spikes in 2008 was the lack of capacity on the HVDC. The evidence before us is that the HVDC link will be upgraded by 2012-2014[740], well before NBTC would begin generation. We understand this will effectively remove the constraint on



739 Dr T B Layton, evidence-in-chief paragraphs 47-50 [Environment Court document 3].
740 Mr J T Truesdale, evidence-in-chief para 77 [Environment Court document 4].

importing electricity from the North Island, and so significant price differentials between the islands will be avoided.

Impacts of construction on the local economy

[507] Dr Layton used multiplier analysis to estimate the effect of NBTC construction on the local economy as between $304 and $350 million over the seven years of construction activity. He gave us appropriate cautions[741] on the use of this estimate due to the extreme age of the multipliers, dating as they were from the early 1980s. He stated that such analysis was unable to account for the extent to which the local economy may not be able to respond to meet the increased demand of such activity, and was unable to distinguish between trade creation and trade diversion. He referred to the benefit stimulus large infrastructure projects could have in times of recession.

[508] In response to questions from the Court[742] Dr Layton acknowledged that new generation capacity was going to be constructed somewhere in New Zealand: it is a question of what form and where. In this case, on a national basis the benefits of construction will cancel out, but there could be a significant local effect. He also acknowledged that with construction several years in the future, the economic situation at the time construction occurs is unknown. Thus, although the analysis is valid, we agree with Dr Layton when he said to the Court[743] that very little weight should be placed on the results of this analysis. Taking into account this uncertainty we find that there is likely to be a medium beneficial effect on the local economy.

Avoided greenhouse gas emissions

[509] Further to our discussion in Chapter 4.0 and in section 6.3.2 above we acknowledge that the future price of carbon credits is uncertain, and that there are currently various carbon markets with considerable difference in the prices the produce. We consider Dr Layton was appropriately cautious in the range of possible values he has used to estimate the benefit of avoided carbon emissions. His range of NZ$21-$33/tonne straddles the current Treasury estimate and uses the current price on the

741 Dr T B Layton, evidence-in-chief para 60 [Environment Court document 3].
742 Transcript pp 100-101.
743 Transcript p. 102.

European market as a maximum. We do not agree with Dr Bennett that the Chicago price is likely to be relevant.

[510] We note that the carbon emission profile of the generation required if NBTC is not built is unknown, and that this may at times be another renewable generator[744]. Presumably this becomes more likely as the country increases the proportion of electricity generated from renewable sources. So we conclude that the volumes of avoided carbon emissions that Dr Layton gives[745] are maximums, and may not necessarily be achieved.

[511] Dr Layton assessed the value of avoided carbon emissions as having a large impact. If the price was at the top of Dr Layton's range, and the maximum volume of emissions avoided, we would agree. Given the uncertainty over the price, and the likelihood that emissions avoided will be less than the maximum possible, we assess it as having a medium impact.

Benefits summary

[512] Our summary of the quantified expected benefits from NBTC is as follows:

Benefits	**Value $million**	**Qualitative assessment**	**Who benefits?**
Net value of electricity produced	$69-$89m p.a.	Large impact	NZ economy
Suppression of South Island electricity prices		No impact	
Impacts on local economy of construction, spread over **seven years**	$304-$350 million	Treat with caution and low weight so impact medium	Regional economy
Impacts on local economy of on-going operation	$5m p.a.	Small impact	Local economy
Avoided greenhouse gas emissions	$8-$40m p.a.	Medium impact	NZ economy

744 Dr T B Layton, evidence-in-chief para 66 [Environment Court document 3].
745 Dr T B Layton, evidence-in-chief para 64 [Environment Court document 3].

6.3.4 The costs

Displaced activities and other environmental costs

[513] Dr Layton stated that the costs in terms of displaced activities and other environmental impacts are intangible and not traded in markets, and so the value of such costs can only be inferred indirectly[746]. Where no valuations of these costs are available, he was of the view that they are externalities and form part of our overall judgement under Part 2 of the RMA[747]. We consider that the environmental costs should be remedied or mitigated through the imposition of conditions, and the costs imposed on Meridian. To the extent that this can be done, those costs are internalised into Meridian's financial assessment and are excluded from our cost benefit analysis. Only those displacement and other adverse environmental impacts that cannot be remedied or mitigated form part of our consideration of efficiency.

[514] Dr Layton provided only a qualitative assessment of the environmental costs[748]. He relied on the assessments of other experts called by Meridian to conclude that the remaining environmental impacts would be acceptable and generally minor. He referred to Dr Kerr's assessment of the value of recreation on and around the lower Waitaki, but unless we can quantify the effect on recreation, the value of recreation can only provide an estimate of the theoretical maximum possible cost. Dr Layton stated[749] that the quantified net benefit of the proposal indicates how significant any unquantified adverse effects would have to be to "eclipse" the benefits of NBTC.

[515] Dr Kerr's estimates of the value of fishing and other recreation in the affected reach of the Waitaki were of interest to the Court. The use of non-market valuation techniques to assess the cost of externalities of proposals is encouraged. In this case, given our findings as to the effects of NBTC on recreation, and the compensation that will be provided by the funding of the development and implementation of a Recreational Development Plan, further consideration of Dr Kerr's evidence is not required.

---

746 Dr T B Layton, evidence-in-chief para 56 [Environment Court document 3].
747 Dr T B Layton, evidence-in-chief para 57 [Environment Court document 3].
748 Dr T B Layton, evidence-in-chief para 57 [Environment Court document 3].
749 Dr T B Layton, evidence-in-chief para 78 [Environment Court document 3].

Assessing the costs of the NBTC

[516] The NBTC flow regime will result in many impacts on the environment that are not included in the cost benefit analysis above. In Chapter 4.0 (Predictions) of this decision we discussed the possible effects on the environment of the NBTC proposal. Comparing the two we find that the NBTC is likely to produce some benefits not included in the cost benefit analysis above. These are:

1. provision of the optimum habitat for invertebrates in the braided reach of the river between Kurow and Stonewall, with a consequential increase in total invertebrate density, having beneficial effects for fish in the river[750];
2. a likely benefit to native fish populations due to improved quality of habitat[751];
3. a likely beneficial effect on salmon due to reduced dewatering of salmon redds and reduced fry loss due to strandings or floods offsetting the reduction in spawning habitat[752];
4. a likely net improvement in conditions for trout due to the flow stability increasing egg and juvenile survival and increased food supplies (benthic invertebrates) offsetting the reduced habitat and possible adverse change in the invertebrate composition[753].

[517] Next we need to treat as neutral those costs which are remedied or mitigated as discussed in Chapter 5.0 and identified below:

1. the requirement to maintain a dynamic pattern of braiding in the reach between Kurow and Stonewall, when the number of braids is in gradual decline[754], together with on-going river and coastal monitoring[755];

750 Section 4.10 of this decision.
751 Section 4.11 of this decision.
752 Section 4.14 of this decision.
753 Section 4.14 of this decision.
754 Environment Court General Condition ("ECGC") 24(1).
755 ECGG 46(b).

2. the requirement to maintain a fairway cleared of willows and woody weeds between Kurow and Stonewall[756];
3. the requirement to ensure that there is no long-term accumulation of gravel at tributary confluences and that tributary bedloads are transported to below the outfall[757];
4. the requirement to mitigate or remedy effects attributable to NBTC on existing consented abstractions[758];
5. the requirement to mitigate the effect on potable water abstraction for the townships of Kurow and Duntroon[759];
6. the requirement to provide at least 75 hectares of new or restored terrace wetland[760]; to achieve no net loss of area and ecological value of terrace wetland[761] and to compensate for the loss of area and ecological values of riparian wetlands[762];
7. the requirement to follow best management practices on Meridian owned land[763] and to promote best practice in the wider catchment, including funding a 0.25 full-time equivalent position[764];
8. the requirement to maintain diversity and quality of aquatic habitat[765] and for monitoring to extend the understanding of didymo and the effectiveness of the control regime for didymo in the river[766];
9. the requirement to commission research into threats to, and the breeding and fledging of, braided river birds[767]; maintain the populations of braided river birds at not less than the 2009 levels[768]; and to implement any recommendations arising from the commissioned research[769]; pre-

---

756 ECGC 24(1).
757 ECGC 24(2).
758 ECGC 4 to 10.
759 ECGC 7(b).
760 ECGC 29a.
761 ECGC 30(1).
762 ECGC 30(2).
763 ECGC 22.
764 ECGC 23.
765 ECGC 21.
766 ECGC 44(c).
767 ECGC 28.
768 ECGC 26(a).
769 ECGC 26(b).

commissioning monitoring for at least three years[770]; maintaining at least 10 hectares of suitable breeding habitat[771];

10. the requirement for pre-commissioning monitoring of sports fish and angler satisfaction[772];
11. the volunteered requirement[773] to fund a recreational development plan ($1 million over three years) and its implementation ($250,000 p.a.)[774].

[518] To the extent that externalities are mitigated then the costs are internalised to Meridian. They will then fall into Meridian's decision-making as to the financial viability of the NBTC. Those externalities that are not fully mitigated remain to be included in our cost benefit analysis. We consider that the following adverse effects of NBTC are fully remedied/mitigated by the relevant remedies and mitigation above and so are excluded from our further consideration under section 7(b) of the RMA:

- the geomorphological impacts on the reduction in the ability of the river to transport bedload. We consider that the flushing and channel-clearing flows, together with the other interventions as required to prevent buildup of gravel at tributary confluences[775] and to transport tributary bedloads to below the outfall[776] will largely mitigate these effects;
- the potential effects on abstractors and the loss of water to self-irrigating soils. The abstractors will receive 100% reliability of supply, an improvement on what they would otherwise receive;
- the effects on jet boating and recreation other than fishing. We have described how there are positives and negatives for jet boating in the proposal. Water quality will decline and the location and quality of swimming holes will change. The recreational values of riparian wetlands are likely to be maintained[777]. We consider that to the extent that there is a net adverse effect on jet boating and other recreation, the recreational

---

770 ECGC 44.
771 ECGC 27.
772 ECGC 44(e).
773 ECGC 50.
774 ECGC 51.
775 ECGC 24(2).
776 ECGC 24(2).
777 ECGC 30(3).

development plan and its implementation will provide adequate compensation for the adverse effects;

- the decrease in chemical and micro-biological water quality due to decreased dilution. The contamination is not of Meridian's making. There is a requirement to supply potable water to Kurow and Duntroon[778]. Meridian is committed to applying best practice on its land[779] and to encourage its adoption elsewhere in the catchment[780]. We consider that this is all that can reasonably be required of Meridian to remedy or mitigate the decrease in micro-biological water quality due to reduced dilution;
- the detrimental impact on braided river birds. Although there will be increased risks to braided river birds from NBTC, those that are most threatened are declining on the river currently. The requirement to maintain populations at not less than current levels, to commission research and to implement its recommendations, (including we predict increased predation controls) should outweigh the negatives. There may be a net gain for the birds, but the uncertainties around this argue against it being counted as providing any environmental compensation.

[519] We consider the following costs of NBTC are only partly or uncertainly remedied or mitigated by the proposals above and to the extent not so mitigated or remedied they remain relevant to our consideration:

- the geomorphological impacts on the decreased number of braids and the degradation of instream habitat due to increased deposition of fine sediments. Although the number of braids will decline, the number is already declining due to the unnatural damming of the river. The General Conditions seek to limit the decline in braiding density[781];

778 ECGC 7(b).
779 ECGC 22.
780 ECGC 20A and 20B.
781 ECGC 24(1).

- the greater area for vegetation to encroach onto. The requirement to maintain a clear fairway addresses some of this issue, and provides environmental compensation within the fairway. However, although willows and woody weeds will be targeted, it is likely that there will be increased cover[782] of herbaceous grasses in the increased fine sediments deposited on the islands of the river, where currently there is washed gravels. There will also be an increased tendency to vegetation encroachment outside the cleared fairway;
- the adverse effects on wetlands. There is likely to be replacement of terrace wetland lost[783], some net loss of riparian wetland[784] and better protection for the enhanced or created wetlands[785]. However, we still have doubts around the location, extent and viability of the created/enhanced wetlands given the legal uncertainties, their vulnerability to damage by floods and the uncertainties around the capacity of created wetlands to match the complexities of the eco-systems they are replacing;
- the adverse effects on fishing. Although there are potential positives for fishing in terms of access and perhaps more /better angling habitat, we are concerned with the uncertainties of outcome for the effects of the geomorphological changes and didymo on angling habitat, and the loss of the 'big river' experience;
- the diminishment of the mauri of the river. The ongoing involvement of tangata whenua through the Ngai Tahu and Waitaha Liaison Groups provides some compensation, and the requirements on wetlands[786], aquatic diversity[787] and braided river birds go some way towards mitigating the loss. However the mauri is more than the physical or biological aspects of the river and there remains a net loss to the mauri of the river.

---

782 Dr R K McClellan, evidence-in-chief para 34 [Environment court document 49].
783 ECGC 29a).
784 ECGC 30(1).
785 ECGC 29.
786 ECGC 30(4).
787 ECGC 21(2).

[520] The following costs of NBTC may have some residual (the sum is greater than the parts) effects which are unremedied or mitigated by the proposals above:

- the flow reduction between the Waitaki Dam and Stonewall, although many of the effects of the reduction will be fully or partly mitigated;
- the reduction in groundwater levels by up to 0.5 m. Although the impact on abstractors is being mitigated, and the effects on wetlands partially so, there is no remedy or mitigation for the reduction in groundwater level generally.

[521] Finally there are two other ecological concerns which are unremedied or mitigated:

- the biological productivity of the river will increase. There may be some positives for life in the river in terms of increased food supplies for some species and the requirement to maintain sufficient diversity and quantity of aquatic habitat, and there may be an increased ability to manage didymo. However, there are still many uncertainties in this area. They may be increased didymo coverage, increased risk of invasive exotic macrophytes and detrimental changes in the composition of invertebrates;
- there will be significantly reduced habitat suitable for low mound macrophyte communities.

6.3.5 Summary of cost benefit analysis

[522] The measured net benefit of NBTC defines the size that the unmeasured adverse impacts must be if the NBTC is to be assessed as not an efficient use of natural and physical resources in absolute terms. The annual measured net benefit of NBTC is between $82m and $134m[788]. There are some benefits from NBTC that are not amenable to measurement and so are not included in this value. These are the provision of improved habitat for invertebrates between Kurow and Stonewall; the improved quality of habitat for native fish species; improved salmon spawning due to reduced dewatering of redds and reduced fry loss due to strandings or floods; and increased trout egg and juvenile survival and increased trout food supplies.

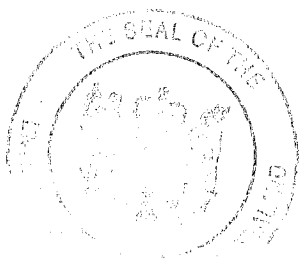
[788] $69m + $5m + 8m = $82m, $89m + $5m + $40m = $134m.

[523] Offset against these are the unmeasured adverse impacts that are not remedied or mitigated, or are only partially so. Those that are largely not remedied or mitigated are the uncertainties around the effects on biological productivity in the river. Those that have been partially remedied or mitigated are: the geomorphological effects on the average braiding density and the increased deposition of fine sediments; the greater tendency for vegetation encroachment; the effects on wetlands; the adverse effect on fishing, especially the loss of the 'big river' experience; and the diminishment of the mauri of the river.

[524] Other adverse effects have been mitigated or remedied by the conditions of this consent, and thus their cost has been internalised to Meridian. It falls to Meridian and the market to assess whether, after consideration of these internalised costs, the project provides a net benefit, and whether the net benefit of NBTC is greater than alternative projects that might produce a similar level of electricity.

[525] Our role is to determine, firstly, whether there is an overall net benefit, taking account of both the measured costs and benefits and the unmeasured externalities that remain after remedy and mitigation. Secondly, and only if there is a net overall benefit, we need to decide whether we should have regard to possible alternative uses of the resources or, in special cases like this one where the resources proposed to be used are of national importance under section 6, the use of alternative resources to produce the same or similar benefits. The third step, if we get there, is to decide what alternatives we should consider, and then to consider them. The final task in considering the efficient use and development of the natural and physical resources involved is to draw a conclusion as to whether the NBTC is an efficient use of the natural and physical resources involved.

[526] Considering both the measured benefits and the positive and negative externalities that remain, we conclude that the NBTC does produce a net economic benefit.



6.4 Other section 7 matters

Kaitiakitanga (section 7(a))

[527] We consider this can best be given effect to by acknowledging that despite Policy 11 of the WCWARP Waitaha have, as a matter of fact, separate manawhenua over the Waitaki. This is consistent with the comment of the Maori Appellate Court in *re Rangitane O Tamaki Nui-a-Rua (Incorporated)*[789] that "... there is no reason why there could not be more than one tangata whenua in any given area".

[528] To ensure that Waitaha, who do not affiliate to Ngai Tahu or Ngati Mamoe, can exercise kaitiakitanga we consider there should be a separate smaller 'Waitaha Group' by analogy with the Ngai Tahu Group. We suggest such a group with our General Condition 17.

The ethic of stewardship (section 7(aa))

[529] This will be adequately had particular regard to if (as Meridian accepted at the hearing) the appellant society is given representation on the Consultative Liaison Group. This is provided by our General Condition 18.

Efficient use of resources (section 7(b) and 7(ba))

[530] We discussed section 7(b) in the previous section of this decision, and the reasons why we do not need to address section 7(ba) in Chapter 3.0.

Maintenance and enhancement of amenity values and quality of the environment (section 7(c) and 7(f))

[531] We accept that some aspects of amenity may be reduced in value, but we also predict that others will increase. We consider that overall the environment of the Waitaki will improve.

789 *re Rangitane O Tamaki Nui-a-Rua (Incorporated)* [1996] NZAR 312 at 317.

Intrinsic values of ecosystems (section 7(d))

[532] A huge part of this case is about the intrinsic values of ecosystems. Meridian is prepared to make great efforts as consent holder to improve the situation of the native fauna of the lower Waitaki. We should add that two witnesses called for the Society, Dr Rate and Dr McClellan, impressed us with their knowledge of the threatened species and we would particularly value their responses to Meridian's amended wetlands proposals.

The finite characteristics of natural and physical resources (section 7(g))

[533] Hydroelectricity generation is a non-consumptive use of water. Thus the finite characteristic of water in the Waitaki River as measured by its discharge to the sea is unaffected. However, the finite characteristics of the section of river between Waitaki Dam and Stonewall together with its adjacent wetlands and groundwater have been reduced. We have had particular regard to these issues as evidenced by the extensive discussion of them and the mitigation measures we have imposed through our General Conditions.

The protection of the habitat of trout and salmon (section 7(h))

[534] The habitat of these species is going to be reduced. For salmon that does not matter because we found that habitat does not limit the population. As for trout, while their habitat may shrink, their numbers are likely to increase (subject to, at present, unforeseeable problems with didymo) rather than the opposite.

Effects of climate change (section 7(i))

[535] We heard little or no direct evidence about how the NBTC proposal will have any effect on this issue. Professor R E H Sims gave general evidence[790] on the effects of climate change in New Zealand but that is of little help to us because the NBTC is so small in the scale of things.

790 Professor R E H Sims, evidence-in-chief [Environment Court document 35].

The use and development of renewable energy (section 7(j))

[536] This proposal does utilise a natural resource to generate renewable energy and we have considered the extent carbon emissions will be foregone. We quantified that earlier in this Chapter.

6.5 Other matters (sections 104(1)(c) and 290A of the RMA)

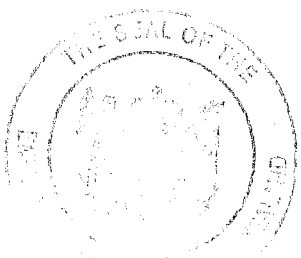
6.5.1 Having regard to the Commissioners' decision

[537] One of the matters we must have regard to is the Hearing Commissioners' decision[791]. Dr Brookes submitted that the Interim Decision of the Hearing Commissioners placed 'inadequate weight' on mitigation of the effects of activities on the Waitaki River. We disagree with her. We respectfully consider that the Commissioners largely made the correct decision except that, as we have discussed at some length in Chapter 5.0, and return to shortly, we consider they were not specific enough about some of the environmental mitigation and compensation required of the applicant and/or consent holder.

[538] As we have also tried to explain, the lower Waitaki and its native species and habitat are in a sad and neglected state now and the decline in its native biodiversity is continuing. Meridian's application gives an opportunity to recognise and protect values that are of national importance under section 6 of the RMA while also enabling economic and social and improving cultural welfare under section 5 of this Act.

6.5.2 Other arguments in the submissions

[539] A question was raised in submissions by the Society and supporting parties whether granting resource consents would create a precedent or affect the integrity of the WCWARP. We respectfully follow the discussion of those non-statutory terms by Cooper J in *Rodney District Council v Gould*[792]. Ms Owen and Mr MacTavish both submitted that confirming the resource consents to Meridian would set a bad precedent for future applications. We agree with the spirit of the submissions of Meridian's counsel that the proposal would not create a precedent for two reasons – first it would effectively use up most of the water that might be available for abstraction between the



791 Section 290A of the RMA.

792 *Rodney District Council v Gould* [2006] NZRMA 217 at para [99] (HC).

Waitaki Dam and Stonewall; and secondly the proposal is nearly unique in its proposal to convey the water by tunnel, so that it is unlikely that any similar proposal will be put to the Regional Council. We are encouraged that the Hearing Commissioners came to a similar conclusion[793].

[540] Nor do we consider that granting the consents will affect the integrity of either the proposed NRRP or the WCWARP both because of the exceptional nature of the proposal and because we have found it does not breach the objectives and policies of the regional plans.

[541] We mention two more matters briefly, out of deference to Ms Owen's submissions for the Society. First she made much of the comparisons by Meridian's witnesses of its NBTC, as exemplified especially in the AFR – with hydro flow regimes, with the scenario called WRP-with hydro. She submitted that the latter – especially its 145 m^3/s minimum flow[794] – was being treated as the 'permitted baseline'[795] when clearly it is not such a baseline. In her closing submissions Ms Appleyard eschewed any reliance on the WRP-with hydro as a permitted baseline. She pointed out that the only permitted baseline water take is of 10 m^3 per day at a rate not exceeding 5 litres/second[796]. Counsel for Meridian also explained[797] that the witnesses compared the effects of the AFR – with hydro with the WRP-with hydro to assist the Court with its examination of the gateway tests under section 104D above. She wrote that it is Meridian's case that "... there is not one single number for the minimum flow that would be consistent with the objectives and policies of the [WCWARP]. A range of flows [is] acceptable".

[542] Ms Owen also submitted that the proper way for Meridian to proceed was to promote a plan change. That is not correct: a person is entitled to apply for a resource consent at any time unless an activity is prohibited. We have held in Chapter 3.0 (The law) that Meridian's proposal is not for prohibited activities.

---

793 Commissioners' Interim Decision p. 179.
794 Rule 2 and Table 3 of the WCWARP [p. 46 *et ff*].
795 Section 104(2) of the RMA.
796 Rules 1 and 9 of the WCWARP.
797 Ms J Appleyard, final submissions para 19.2 [Environment Court document 64]

[543] Finally Dr Brookes emphasised that the NBTC did not meet policy 12(h) which requires us to give a preference to needs for water within the catchment. Apart from the fact that we were given very little evidence of other "needs for water" within the lower Waitaki we consider that argument founders on the point that the water proposed to be taken would in fact be used within the catchment (to generate electricity) and then returned to the river, albeit much lower down than the taking point near the Waitaki dam.

6.5.3 Consideration of alternatives

Do the factors raising alternatives apply?

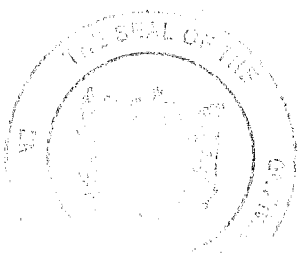
[544] In Chapter 3.0 (The law) we identified three largely separate situations where the RMA may require the consideration of alternative uses of the resources involved and/or the use of alternative resources. Those situations are where the costs could not be fully internalised to the consent holder, where there was no competitive market for the resources involved, or where there was a matter of national importance involved. The NBTC fits into all three categories so we should examine relevant alternatives.

What alternatives should be considered?

[545] At first sight there are three types of alternatives that a consent authority should consider when the consideration of alternatives is required although it is arguable that the first is merely a subset of the second. They are:

(1) the proposal versus the status quo;
(2) the proposal versus alternative use of the resources;
(3) the proposal versus using other resources to achieve the same benefit at less cost.

Those parallel the considerations an applicant would undertake in terms of financial risks and costs before it put a proposal forward for resource consent.



[546] Comparing a proposal to the status quo is uncontroversial and is the standard method of evaluating a proposal. However, the more general second option: comparing a proposal with alternative uses of the same resources is less useful for several reasons. An alternative use of the resources may also cause adverse effects. Only alternative uses of the resource that are likely to have significantly lesser adverse effects, or considerably greater benefits, should be considered. Secondly, we doubt that this option has much merit in situations (e.g. uses of land) where there is a competitive market in the resource and there are no costs that cannot be fully internalised to the applicant. Thirdly, there is a fine line between considering alternative uses of, versus alternative applications for, the same resource. The latter may offend the first come, first served principle stated by the Court of Appeal in *Fleetwing Farms Limited v Marlborough District Council*[798] as confirmed and applied in *Central Plains Water Trust v Ngai Tahu Properties Limited*[799].

[547] The third type of alternative is to consider the use of alternative resources to achieve the same or similar benefit at less cost. As Hammond J stated in *TV3 Network Services Limited v Waikato District Council*[800]:

> ... when an objection is raised as to a matter being of "national importance" on one site, the question of whether there are other viable alternative sites for the prospective activity is of relevance.

---

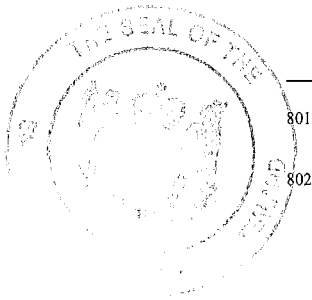
798 *Fleetwing Farms Limited v Marlborough District Council* [1997] 3 NZLR 257; [1997] NZRMA 385.

799 *Central Plains Water Trust v Ngai Tahu Properties Limited* [2008] NZCA 71; [2008] NZRMA 200.

800 *TV3 Network Services Limited v Waikato District Council* [1998] 1 NZLR 360; [1997] NZRMA 539 at 551 (HC).

That raises the issue of how far an applicant, a consent authority or, ultimately, the Environment Court needs to go in considering alternative ways to produce the same or similar benefit. We respectfully agree with Priestly J[801] in *Dome Valley District Residents Society Incorporated v Rodney District Council* that applicants are not expected to assess every other "backyard" to appease an owner whose backyard contains the applicant's preferred site. On the other hand applicants for land use or subdivision consent routinely alter the location of buildings (and thus use alternative resources) to avoid or mitigate adverse effects (subject to the principles confirmed by the Supreme Court in *Waitakere City Council v Estate Homes Limited*[802] that an amended application must not "... become ... in substance a different application").

[548] We consider that which alternative resources should be considered, and at what level the comparison should be made, can only be determined in the context of the specific facts of the case and should only be raised if one of the three situations arises that we described in Chapter 3.0 (The law). Any consideration of alternative resources by consent authorities can only be at a general level, in terms of the attributes, benefits and costs of the proposal versus those that might relate to a reasonably foreseeable alternative. Practicality will play a large part in any consideration of alternatives by consent authorities. Assessing the attributes, benefits and costs of the project in question on the evidence, the best that can be done by a consent authority is to consider the likely externalities that could reasonably be expected from a project of similar attributes or that would produce the same or similar benefits but not using (for example) resources of national importance. Applicants should assist the consent authority by complying with Clause 1 of Schedule 4 to the RMA by at least describing alternative sites, or preferably by giving information as to how their proposal is likely to provide greater benefits, or less costs, than alternatives not using (for example) resources of national importance.



---

801 *Dome Valley District Residents Society Incorporated v Rodney District Council* HC Auckland, CIV-2008-404-587, 8 December 2008, at paragraphs [37] and [38].

802 *Waitakere City Council v Estate Homes Limited* [2006] NZSC 112; [2007] NZRMA 137 at 29.

[549] Comparing the use of an alternative resource is particularly useful when there are alternative resources which do not for example generate the same adverse effects on a resource of national importance as the proposal under consideration especially if that proposal adversely affects unique resources. For example, the applicant in *TV3 Network Services Limited v Waikato District Council*[803] should at least have shown why it did not consider placing its proposed translator on a hill which did not raise issues under section 6(e) of the RMA.

The alternatives to the NBTC

[550] In this case the first alternative to the NBTC is simply the option of not carrying out the proposal. This was covered in the cost benefit discussion above where we concluded that NBTC has a net benefit. Therefore it is more efficient than the status quo.

[551] The option of using the water of the Waitaki River for other purposes, e.g. irrigation, was barely covered in the evidence. Despite our prehearing directions, obtaining evidence of the value of the water for different uses was extraordinarily difficult. We only received some evidence on that from Dr Layton after the end of the hearing[804]. While that evidence showed that water is of more value for irrigation than for generating electricity from the NBTC it does not help us much because we do not know the likely effects of removing water from the Waitaki River below Stonewall (or indeed where the water might be abstracted from). Further, we are aware from Mr Potts' evidence[805] that there are a number of other applications to take water from the Waitaki which might directly affect the river. This might cross the line from considering alternative uses to considering alternative applications and so offend the *Fleetwing* principle which prevents us from considering those applications.

---

803 *TV3 Network Services Limited v Waikato District Council* [1998] 1 NZLR 360; [1997] NZRMA 539 (HC).

804 Dr T B Layton, supplementary statement of evidence 10 July 2009 [Environment Court document 3B].

805 Mr R J Potts, further evidence 2 July 2009 [Environment Court document 32A].

[552] As for finding alternative sources of water generating hydro-electricity, the only evidence we heard was that Meridian had identified some 3,000 GWh of identified hydro projects and a further 7,000 GWh of possible projects not yet identified in the public domain[806]. We have noted that the lower Waitaki River is highly degraded and still declining. The NBTC is very unusual as a tunnel proposal which actually returns the water to the river (albeit after 34 kilometres). It is also unusual in adding significantly to the generation capacity associated with existing water storage facilities. As such it is an efficient use of the physical resources of the Waitaki Power System. We also consider we can take judicial notice of the facts that the hydro-electricity industry is well established in New Zealand, and in particular on the Waitaki River. Given these facts, although it is finely balanced, we consider that this is not a case where the applicant needed to give evidence ruling out alternatives elsewhere in New Zealand, even though matters of national importance under section 6 of the Act are raised.

[553] Our conclusion on alternatives is that the net benefit of the NBTC (subject to the conditions proposed in Chapter 5.0) compared with the status quo is the only aspect of the alternatives which we need to carry forward to our overall judgement in the next section of this decision.

6.6 Conclusions

[554] Returning to the overall weighing of all relevant matters to achieve sustainable management under section 5 of the Act, and recognising the substantial positive effects of the energy that a NBTC would generate (and other consequential positive effects) there are three matters of national importance under section 6 which come very close to outweighing those positive effects. They are:

- the effects of the abstraction of over 200 m^3/s on the mauri of the lower Waitaki (section 6(e)) and its relationship within Waitaha;

806 Exhibit 2.1, Options, Choices Decisions, 2009 Update, p. 9.

- the need to protect significant habitats of indigenous fauna, specially of braided river bird species (section 6(c));
- the need to preserve the wetlands of the lower Waitaki (section 6(a) and (c)).

As the previous chapters should have made clear we are not satisfied with the proposed mitigation or compensation proposed in respect of braided river birds or wetlands. As to the former it concerns us that Meridian found out it could increase the number of eggs laid in the lower Waitaki but then did not propose any concrete way forward to protect the eggs until young birds fledge. It relied on monitoring and an adaptive management plan. We accept that goes some way towards potentially finding a solution to current problems, but we consider the consent holder should go further. In relation to wetlands the Meridian proposals are even less certain and again lack specific action plans. Nor are we satisfied that any consent holder would have the legal right to perform all of the works that might be required under the Management Plans, and finally we have concerns about the enforceability of those plans if not supported by conditions.

[555] As indicated earlier we are prepared to receive further evidence from Meridian on those issues so that it can satisfy us that the probability of real progress for braided river birds and wetlands is high. Obviously other parties should be given a right to respond.

[556] We also consider that if Meridian can satisfy us on wetlands and braided river birds then the mauri of the lower Waitaki is likely to be enhanced also.

[557] Provided we are satisfied on the above matters then, taking into proper consideration all the matters we have identified as relevant and assessed we judge that the NBTC with its adverse effects mitigated or compensated for as described in Chapter 5.0 of this decision will achieve sustainable management of the lower Waitaki and provide a greater net conservation benefit and net economic benefit than the alternative (the status quo). That is because it will enable people and communities throughout New Zealand to promote their welfare by providing electric energy, a commodity which is essential for modern living in New Zealand, to the National Grid, while recognising

and improving the current very degraded state of the lower Waitaki riverbed and margins and wetlands and the degraded state of the water body in the main stem by maximising the benefits under section 5(2)(a) to (c) of the RMA and objectives 1 and 2 of the WCWARP.

6.7 Outcome

6.7.1 Provisional grant of consents

[558] Accordingly the resource consents sought by Meridian are likely to be granted if the Court is satisfied:

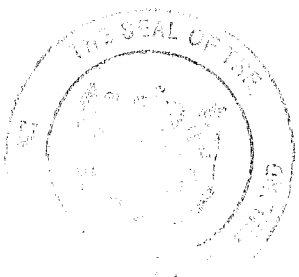
(a) as to the amended conditions especially in relation to maintaining and enhancing the breeding and fledging success of braided river birds;

(b) by further evidence that some existing wetlands can and will be enhanced and that new terrace wetlands can and will be created, and that both will be legally protected and maintained as stated in Chapter 5.0.

We will give orders allowing further evidence if the conditions both cannot be agreed and are not approved by the Court.

6.7.2 Term of the consents

[559] Meridian has requested a 12-year lapse period for these consents. While we understand and accept the logic behind this in this case, we do not consider it to be in the interests of efficiency for Meridian to hold these consents for this length of time if they are not going to exercise them. Therefore we will require Meridian to relinquish these consents if it decides not to utilise them for the purpose for which they applied for them. To enforce this, recognising that there are many decision points in the time between the granting of these consents and the implementation of them, if we grant consents we will impose conditions requiring that they be relinquished if action is not taken within a reasonable period (say six years) to carry out the necessary groundwork and obtain the other necessary resource consents.



6.7.3 Costs

[560] Our preliminary view is that costs should lie where they fall with one exception. There is a reasonable case for holding that Meridian should bear the costs of the Society's witnesses, Dr Rate, Dr McClellan, and Mr Chisholm. Without the comfort of their critical evidence we may have refused the consents on the grounds of the vagueness of the proposed objectives and conditions on the subjects on which they gave evidence.

J R Jackson
Environment Judge

A J Sutherland
Environment Commissioner

H M Beaumont
Environment Commissioner

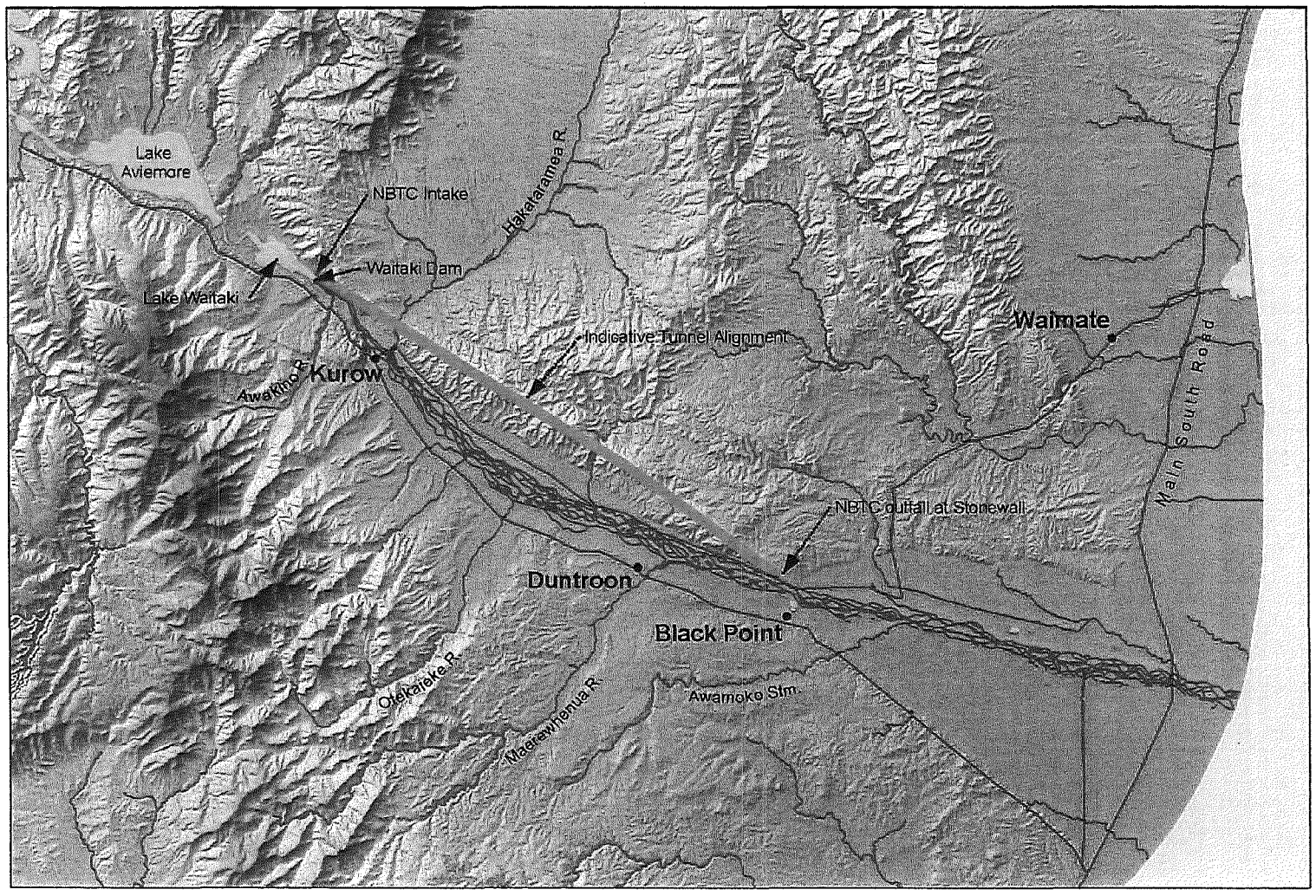
K D F Fletcher
Deputy Environment Commissioner

Attachments:

A: Map of lower Waitaki and the proposed North Bank Tunnel location

B: Schedule of Consent Conditions

Indicative Route of a North Bank Tunnel Concept



A.

B: SCHEDULE OF NBTC CONSENT CONDITIONS

Water Permit to Take Water from Lake Waitaki (CRC 071903)

To take water from Lake Waitaki via an intake into a tunnel.

Duration of this water permit – 35 years.

This consent is subject to:

(1) the specific conditions in Schedule 1 below; and

(2) the general conditions listed in Schedule 2 – General Conditions.

Schedule 1

Specific Conditions of this Consent

Location of take

1 Water shall be taken from Lake Waitaki, immediately upstream of the Waitaki Dam, on the true left bank of the lake, at or about map reference NZMS 260: I40:061-102.

Relationship to discharge consents

2 a. Water shall only be taken under this consent when water is being discharged in accordance with consent CRC071878 – CRC 071096;

b. The tunnel discharge point is defined as the point at which the flow from the tunnel, into which the water for this water permit is taken, is discharged back into the Waitaki River as specified in the conditions of discharge permit CRC071096.

Maximum Flow Rate of Water Take

3 The take of water from Lake Waitaki into the tunnel shall have a maximum flow rate of 260 cubic metres per second, determined in accordance with Conditions 4-6.

4 For the purposes of determining compliance with Condition 3:

a. the consent holder shall provide an independent measuring device within the tunnel to enable Canterbury Regional Council to verify the measurements of tunnel flow when the tunnel is operating;

b. the flow rate of the take of water from Lake Waitaki into the tunnel shall be the recorded flow at the tunnel power station;

c. the instantaneous flow rate (in cubic metres per second) shall be recorded at least every 5 minutes;

d. the average flow rate (in cubic metres per second) over the previous 1-hour shall be recorded at least every 60 minutes.

5 Notwithstanding Condition 3:

a. any instantaneous recorded flow rate (under 4b. above) may exceed the maximum flow rate specified in Condition 3 when the rules to limit the occurrences of momentary fluctuations set out in Electricity Governance Rules apply;

b. in the event that any instantaneous recorded flow rate (under 4b. above) exceeds the maximum flow rate in Condition 3, the consent holder shall ensure that the subsequent 1-hour average flow rate starting with that 5 minute period does comply with the maximum flow rate in Condition 3. This shall be deemed to constitute compliance with Condition 3;

c. any instantaneous recorded flow rate (under 4b. above) shall not be more than 20% greater than the maximum flow rate specified in Condition 3.

6 Condition 5c. shall not apply during an Emergency Condition. An emergency condition is defined to occur when an unplanned electricity grid event occurs (such as a generator or unit or Cook Strait Cable trip), equipment failure, or other unplanned event, (in accordance with the System Operator Guidelines for responses to changes in system frequency outside the band of 47Hz to 52Hz)[1]. If the System Operator Guidelines change or are updated, the consent holder may apply to change this condition pursuant to Section 127 of the Resource Management Act 1991.

Shut-down of Water Take during High Flows

7 When the flow rate at Aviemore Dam has exceeded 900 cubic metres per second for more than 30 minutes continuously, this water permit to take water into the tunnel shall cease to be exercised for the following 48 hours, except for any minor flow required for tunnel power station ancillary services such as cooling water.

8 For the purposes of Condition 7, the flow rate at Aviemore Dam shall be calculated as the 1-hour rolling average (recorded at 5 minute intervals) of the sum of the measured flows of the power station generators, by-pass hydraulic structures and any ancillary flows.

Minimum River Flow Rates

9 The taking of water in terms of this permit shall cease whenever the flow rate in the Waitaki River as measured at the Kurow Recorder[2] falls below the sum of:

(a) the minimum river flow rates in the table below; plus

(b) 11 cubic metres per second; plus

(c) mitigation flows in compliance with Individual Mitigation Plans relevant to the reaches Waitaki Dam to Kurow and Kurow to Stonewall as prepared under General Conditions 6 and 7.

1 Electricity Governance Rules, Part C, Section II, Paragraph 2.2.3
2 Canterbury Regional Council water level recording site number 71104

Month of Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Minimum River Flow m^3/s	140	150	145	125	120	110	110	110	120	125	130	140

10 For the purposes of determining compliance with Condition 9:

a. the instantaneous flow rate (in cubic metres per second) shall be recorded at least every 5 minutes;

b. the average flow rate (in cubic metres per second) over the previous 1-hour shall be recorded at least every 60 minutes.

11 Notwithstanding Condition 9:

a. any instantaneous recorded flow rate (under 10a. above) may be less than the minimum flow rates specified in the table in Condition 9 when the rules to limit the occurrences of momentary fluctuations set out in Electricity Governance Rules apply;

b. in the event that any instantaneous recorded flow rate (under 10a. above) is less than the minimum flow rates in the table in Condition 9, the consent holder shall ensure that the subsequent 1-hour average flow rate starting with that 5 minute period does comply with the minimum flow rates in Condition 9. This shall be deemed to constitute compliance with Condition 9;

c. any instantaneous recorded flow rate (under 10a. above) shall not be more than 20% less than the minimum flow rates specified in the table in Condition 9.

12 Condition 11c shall not apply during an Emergency Condition as defined in Condition 6.

Minimum Lake Level

13 The taking of water in terms of this permit shall cease whenever the lake level in Lake Waitaki falls below 227 metres a.m.s.l.

Provision for Other Water Takes between Waitaki Dam and the Tunnel Discharge Point

14 From the date at which this consent is first exercised, regardless of whether the tunnel is operating or not pursuant to the consent, the flow rate in the Waitaki River at the Kurow recorder shall equal or exceed the sum of the flows specified in condition 9a, b and c.

Provision for Other Water Takes downstream of the Tunnel Discharge Point

15 During the months of September to the following April (inclusive), whenever this water permit to take water into the tunnel is not being exercised (other than for any minor flow required for tunnel power station ancillary services such as cooling water), the flow rate in the Waitaki River as measured by the Kurow recorder shall not be less than 163 cubic metres per second plus mitigation flows in compliance with Individual Mitigation Plans relevant to the reach Kurow to Stonewall as prepared under General Conditions 6 and 7.

Flushing Flows

16 Subject to Condition 17, the taking of water in terms of this permit shall cease unless at least seven times each calendar year, the flow rate in the Waitaki River at the Kurow Recorder is at least 450 cubic metres per second for at least 24 hours continuously. These flows are referred in these conditions as 'flushing flows'. The consent holder shall ensure:

a. that at least six of these flushing flows occur within between 1 January and 30 April in each year, and use its best endeavours to space these flushing flows equally over this period;

b. that the first of these flushing flows for the calendar year occurs during January each year;

c. at least one of these flushing flow occurs in the period between 1 July and 31 August each year;

d. that the management of the flushing flows is also in accordance with the provisions of the Flow and In-Stream Habitat Management Plan as set out in General Condition 28.

17 When the flow rate at Aviemore Dam exceeds 900 cubic metres per second and this water permit to take water into the tunnel has not been exercised (as required by Condition 7) for at least 24 hours during the periods within which the flushing flows are required in terms of Condition 16 or during the 6 weeks preceding each of those periods, such flow shall be deemed to be a flushing flow for the purpose of Condition 16.

18 Subject to Condition 19 below, in addition to the flushing flows required under Condition 16, if Flushing Flow – Trigger monitoring shows that the average periphyton cover (excluding didymo) exceeds the Periphyton Trigger level as determined by the In-stream Habitat Management Plan, a flushing flow of at least 450 cubic metres per second measured at the Kurow recorder for at least 24 hours continuously shall be provided no more than 2 weeks after the date of the monitoring.

19 Notwithstanding Condition 18, the additional flushing flow is:

a. not required sooner than 6 weeks after a flushing flow provided in accordance with Condition 16;

b. not required, and shall not be provided, within the period from 16 August to the following 24 January, unless the In-stream Habitat Management Plan provides for additional flushing flows in this period.

20 The consent holder shall give at least 48 hours notice to the Regional Engineer, Canterbury Regional Council of the timing of each flushing flow.

Ramping Rates

21 The consent holder shall ensure that, within any one-hour, the change in the flow rate in the Waitaki River at the Kurow Recorder does not exceed the following changes in flow rate:

Waitaki River Flow	less than 200 m^3/s	greater than 200 m^3/s
Maximum Change in River Flow Rate per hour		
When Flow Rate is Increasing	30 (m^3/s) / hour	No restriction
When Flow Rate is Decreasing	50 (m^3/s) / hour	50 (m^3/s) / hour

22 Condition 21 shall not apply during an Emergency Condition. An emergency condition is defined to occur when an unplanned electricity grid event occurs (such as a generator or unit or Cook Strait Cable trip), equipment failure, or other unplanned event (in accordance with the System Operator Guidelines for responses to changes in system frequency outside the band of 47 Hz to 52Hz)[3], or where a rapid change in flow is necessary for public safety reasons or to prevent damage to property or parts of any electricity generation or transmission infrastructure. If the System Operator Guidelines change or are updated, the consent holder may apply to change this condition pursuant to section 127 of the Resource Management Act 1991.

23 Condition 21 shall not apply to flood flows at Waitaki Dam. At the time of the granting of this consent, a flood flow at Waitaki Dam occurs when the total flow at Waitaki power station exceeds 850 cubic metres per second.

Provision of Water Flow and Volume Data to Environment Canterbury

24 All data measured and calculated in accordance with Conditions 3 - 23, shall be provided to the Canterbury Regional Council "Attention: RMA Compliance and Enforcement Manager" on request, and shall be in a form that is available for electronic downloading by the Canterbury Regional Council and that is suitable for public information.

Public Safety

25 The consent holder shall erect and maintain signs warning of the potential danger of being caught in the flow into the tunnel intake at Lake Waitaki.

26 The consent holder shall erect and maintain signs warning of the danger of fluctuations in river flows and levels at points of access to the Waitaki River.

[3] Electricity Governance Rules, Part C, Section II, Paragraph 2.2.3

27 The consent holder shall install and operate audible sirens to warn of the danger of fluctuations in river flows immediately downstream of Waitaki Dam. These audible sirens are to be operated when a sudden change of flow occurs due to an Emergency Condition as defined in Condition 22.

Eel Exclusion

28 At the tunnel intake from Lake Waitaki, the consent holder shall install, maintain and operate exclusion measures for downstream migrating eels. These exclusion measures shall incorporate:

a. bars with a between-bar spacing of 25 mm;

b. approach velocities not exceeding 0.5 m/s; and

c. a small surface or subsurface bypass at the northern end of Waitaki Dam.

29 If the Eel Management Strategy developed in terms of the Flow and In-stream Habitat Management Plan determines that an alternative approach to the management of eels in the Waitaki catchment is more appropriate than the fish exclusion measures referred to in the previous condition, whilst still providing safe downstream passage for adult migrating eels, the consent holder may apply to change this condition pursuant to section 127 of the Resource Management Act 1991.

Review by Consent Authority

30 In addition to the general power of review given in General Condition 1, the consent authority may review condition 15 of this Water Permit to take water from Lake Waitaki by giving notice in accordance with Section 129 of the Act within 6 months of the completion of any review pursuant to Section 128(1)(b) of the Act of a minimum flow cut-off condition on any existing consent (at the date of granting of these consents) to take water from the Waitaki River downstream of the tunnel discharge point for the purpose of considering the need for changes to Condition 15 of this water permit.

Giving Effect to this Consent

31 Pursuant to Section 125 of the Resource Management Act 1991, the period within which the consent holder may give effect to this consent shall be 12 years from the grant of this consent provided that this condition will lapse automatically:

a. unless within six years of the date of this consent the consent holder lodges with the Canterbury Regional Council:

(i) evidence that it has commenced complying with the pre-commissioning conditions; and
(ii) full applications for all other necessary resource consents; and/or

b. if the necessary land use consents for a North Bank Tunnel Concept have been refused and all rights of appeal without leave exhausted.

Water Permit to Use Water from Lake Waitaki for Hydroelectricity Generation (CRC 071139)

To use water from Lake Waitaki, taken into an intake to a tunnel, for hydroelectricity generation.

Duration of this water permit – 35 years.

This consent is subject to:

(1) the specific conditions in Schedule 1 below; and

(2) the general conditions listed in Schedule 2 – General Conditions.

Schedule 1

Conditions of this Consent:

Relationship to discharge consents

1 Water shall only be used for hydro-electricity generation purposes.

Giving Effect to this Consent

2 Pursuant to Section 125 of the Resource Management Act 1991, the period within which the consent holder may give effect to this consent shall be 12 years from the grant of this consent.

Discharge Permit to Discharge Water into Water in the Lower Waitaki River (CRC 071096)

To discharge water taken from Lake Waitaki into the lower Waitaki River.

Duration of this water permit – 35 years.

This consent is subject to:

(1) the specific conditions in Schedule 1 below; and

(2) the general conditions listed in Schedule 2 – General Conditions.

Schedule 1

Conditions of this Consent:

Location of discharge

1 The location of the water discharge shall be at Stonewall, on the true left bank of the Waitaki River, at or about map reference NZMS260 J40:345-911.

Relationship to take consents

2 The water discharged in accordance with this permit shall only be water taken from Lake Waitaki for hydro-electricity generation purposes under permit CRC071903.

Maximum Flow Rate

3 Water shall be discharged to the Waitaki River at a flow rate not exceeding 260 cubic metres per second, determined in accordance with Conditions 4-6.

4 For the purposes of determining compliance with Condition 3:

a. the flow rate of the water discharge shall be the recorded flow at the tunnel power station;

b. the instantaneous flow rate (in cubic metres per second) shall be recorded at least every 5 minutes;

c. the average flow rate (in cubic metres per second) over the previous 1-hour shall be recorded at least every 60 minutes.

5 Notwithstanding Condition 3;

a. any instantaneous recorded flow rate (under 4b. above) may exceed the maximum flow rate specified in Condition 3 when the rules to limit the occurrences of momentary fluctuations set out in Electricity Governance Rules apply;

b. in the event that any instantaneous recorded flow rate (under 4b. above) exceeds the maximum flow rate in Condition 3, the consent holder shall ensure that the subsequent 1-hour average flow rate starting with that 5 minute period does comply with the maximum flow rate in Condition 3. This shall be deemed to constitute compliance with Condition 3;

c. any instantaneous recorded flow rate (under 4b. above) shall not be more than 20% greater than the maximum flow rate specified in Condition 3.

6 Condition 5c shall not apply during an Emergency Condition. An emergency condition is defined to occur when an unplanned electricity grid event occurs (such as a generator or unit or Cook Strait Cable trip), or there is equipment failure, or any other unplanned event, (in accordance with the System Operator Guidelines for responses to changes in system frequency outside the band of 47Hz to 52Hz)[4]. If the System Operator Guidelines change or are updated, the consent holder may apply to change this condition pursuant to section 127 of the Resource Management Act 1991.

Ramping Rates

7 The consent holder shall ensure that, within any one-hour, the change in the flow rate of the water discharge does not exceed the following changes in flow rate:

Flow Rate in the Waitaki River immediately downstream of the discharge	**less than 200 m^3/s**	**greater than 200 m^3/s**
Maximum Change in Water Discharge Flow Rate per hour		
When Flow Rate is Increasing	30 (m^3/s) / hour	No restriction
When Flow Rate is Decreasing	50 (m^3/s) / hour	50 (m^3/s) / hour

8 For the purposes of Condition 7, the flow rate of the water discharge shall be the recorded flow at the tunnel power station.

9 For the purposes of Condition 7, the flow rate in the Waitaki River immediately downstream of the discharge point shall be calculated as the sum of:

a. the flow rate of the water discharge determined in accordance with Condition 8; plus

b. the flow rate in the Waitaki River at the Kurow Recorder, which shall be the actual flow recorded at the Kurow Recorder (recorded at least every 5 minutes), taking into account the travel time for water down the Waitaki River from the Kurow Recorder to the discharge location which for the purpose of this consent shall be assumed to be approximately 5 hours.

[4] Electricity Governance Rules, Part C, Section II, Paragraph 2.2.3

10 Condition 7 shall not apply during an Emergency Condition. An emergency condition is defined to occur when an unplanned electricity grid event occurs (such as a generator or unit or Cook Strait Cable trip), equipment failure, or other unplanned event (in accordance with the System Operator Guidelines for responses to changes in system frequency outside the band of 47Hz to 52Hz)[5], or where a rapid change in flow is necessary for public safety reasons or to prevent damage to property or parts of any electricity generation or transmission infrastructure. If the System Operator Guidelines change or are updated, the consent holder may apply to change this condition pursuant to section 127 of the Resource Management Act 1991.

Provision of Water Flow and Volume Data to Environment Canterbury

11 All data measured and calculated in accordance with Conditions 3-10, shall be provided to the Canterbury Regional Council on request, and shall be accessible and available for downloading by the Canterbury Regional Council and be suitable for public information.

Public Safety

12 The consent holder shall erect and maintain signs warning of the danger of fluctuations in river flows and levels at points of access to the Waitaki River and on the riverbed below the tunnel outlet.

Fish Exclusion

13 At the discharge point into the Waitaki River, the consent holder shall install, maintain and operate fish exclusion measures to avoid trout, salmon and native fish from entering the outfall and the tunnel, and to ensure that fish bypass the outfall and return to a flowing braid of the Waitaki River. Such measures shall be generally in accordance with the conceptual design contained in Appendix 4 to the resource consent application for water-only consents for a North Bank Tunnel Concept, October 2006.

14 Within 24 hours of becoming aware that the fish exclusion measures have been damaged or are ineffective, the consent holder shall notify the Canterbury Regional Council "Attention: RMA Compliance and Enforcement Manager" of the situation, of any remedial measures likely to be required, and of the likely timeframes for implementing those measures. The consent holder shall use its best endeavours to restore the effectiveness of the fish exclusion measures in accordance with Condition 13 as soon as possible.

15 This discharge permit to discharge water from the tunnel outfall and any related water permits to take water from the Waitaki Dam shall not be exercised if the effectiveness of the fish exclusion measures in accordance with Condition 13 has not been restored:

a. within six (6) months of the fish exclusion measures first becoming damaged or ineffective; and

b. within one (1) month of any subsequent damage to the fish exclusion measures.

[5] Electricity Governance Rules, Part C, Section II, Paragraph 2.2.3

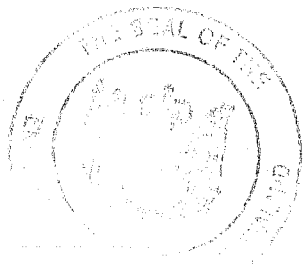
Channel Scouring

16 The consent holder will undertake necessary precautionary works in the riverbed in accordance with the Riverbed Geomorphology and Vegetation Management Plan in order to prevent damage from erosion to private land or to irrigation or other water abstraction intake works for at least 3km downstream of the tunnel outfall, which is likely to occur as a result of the exercise of this consent to discharge water.

17 The consent holder shall make sure remedial repairs are undertaken in accordance with the Riverbed Geomorphology and Vegetation Management Plan in order to remedy any damage from erosion which occurs for at least 3km downstream of the tunnel outfall as a result of the exercise of this consent to discharge water.

Giving Effect to this Consent

18 Pursuant to Section 125 of the Resource Management Act 1991, the period within which the consent holder may give effect to this consent shall be 12 years from the grant of this consent.



Discharge Permit to Discharge Water to Land (Crown Riverbed) in circumstances where it may enter Water in the Lower Waitaki River (CRC 071878)

To discharge water taken from Lake Waitaki on to land (Crown Riverbed) in circumstances where it may enter the lower Waitaki River

Duration of this water permit – 35 years.

This consent is subject to:

(1) the general conditions listed in Schedule 2 – General Conditions; and

(2) the specific conditions in Schedule 1 below.

Schedule 1

Conditions of this Consent:

Location of discharge

1 The location of the water discharge shall be at Stonewall, on the true left bank of the Waitaki River, at or about map reference NZMS260 J40:343-917 for the discharge of water to land (Crown Riverbed).

Relationship to take consents

2 The water discharged in accordance with this permit shall only be water taken from Lake Waitaki for hydro-electricity generation purposes under permit CRC071903.

Maximum Flow Rate

3 Water shall be discharged to the Waitaki River at a flow rate not exceeding 260 cubic metres per second, determined in accordance with Condition 4-6.

4 For the purposes of determining compliance with Condition 3:

a. the flow rate of the water discharge shall be the recorded flow at the tunnel power station;

b. the instantaneous flow rate (in cubic metres per second) shall be recorded at least every 5 minutes;

c. the average flow rate (in cubic metres per second) over the previous 1-hour shall be recorded at least every 60 minutes.

5 Notwithstanding Condition 3;

a. any instantaneous recorded flow rate (under 4b. above) may exceed the maximum flow rate specified in Condition 3 when the rules to limit the occurrences of momentary fluctuations set out in Electricity Governance Rules apply;

b. in the event that any instantaneous recorded flow rate (under 4b. above) exceeds the maximum flow rate in Condition 3, the consent holder shall ensure that the subsequent 1-hour average flow rate starting with that 5 minute period does comply with the maximum flow rate in Condition 3. This shall be deemed to constitute compliance with Condition 3;

c. any instantaneous recorded flow rate (under 4b. above) shall not be more than 20% greater than the maximum flow rate specified in Condition 4.

6 Condition 5c shall not apply during an Emergency Condition. An emergency condition is defined to occur when an unplanned electricity grid event occurs (such as a generator or unit or Cook Strait Cable trip), or there is equipment failure, or any unplanned event, (in accordance with the System Operator Guidelines for responses to changes in system frequency outside the band of 47Hz to 52Hz)[6]. If the System Operator Guidelines change or are updated, the consent holder may apply to change this condition pursuant to section 127 of the Resource Management Act 1991.

Ramping Rates

7 The consent holder shall ensure that, within any one-hour, the change in the flow rate of the water discharge does not exceed the following changes in flow rate:

Flow Rate in the Waitaki River immediately downstream of the discharge	**less than 200 m^3/s**	**greater than 200 m^3/s**
Maximum Change in Water Discharge Flow Rate per hour		
When Flow Rate is Increasing	30 (m^3/s) / hour	No restriction
When Flow Rate is Decreasing	50 (m^3/s) / hour	50 (m^3/s) / hour

8 For the purposes of Condition 7, the flow rate of the water discharge shall be the recorded flow at the tunnel power station.

9 For the purposes of Condition 7, the flow rate in the Waitaki River immediately downstream of the discharge point shall be calculated as the sum of:

a. the flow rate of the water discharge determined in accordance with Condition 8; plus

6 Electricity Governance Rules, Part C, Section II, Paragraph 2.2.3

b. the flow rate in the Waitaki River at the Kurow Recorder, which shall be the actual flow recorded at the Kurow Recorder (recorded at least every 5 minutes), taking into account the travel time for water down the Waitaki River from the Kurow Recorder to the discharge location which for the purpose of this consent shall be assumed to be approximately 5 hours.

10 Condition 7 shall not apply during an Emergency Condition. An emergency condition is defined to occur when an unplanned electricity grid event occurs (such as a generator or unit or Cook Strait Cable trip), equipment failure, or other unplanned event (in accordance with the System Operator Guidelines for responses to changes in system frequency outside the band of 47Hz to 52Hz)[7], or where a rapid change in flow is necessary for public safety reasons or to prevent damage to property or parts of any electricity generation or transmission infrastructure. If the System Operator Guidelines change or are updated, the consent holder may apply to change this condition pursuant to section 127 of the Resource Management Act 1991.

Provision of Water Flow and Volume Data to Environment Canterbury

11 All data measured and calculated in accordance with Conditions 3-10, shall be provided to the Canterbury Regional Council on request, and shall be accessible and available for downloading by the Canterbury Regional Council and be suitable for public information.

Public Safety

12 The consent holder shall erect and maintain signs warning of the danger of fluctuations in river flows and levels at points of access to the Waitaki River.

Fish Exclusion

13 At the discharge point into the Waitaki River, the consent holder shall install, maintain and operate fish exclusion measures to avoid trout, salmon and native fish from entering the outfall and the tunnel, and to ensure that fish bypass the outfall and return to a flowing braid of the Waitaki River. Such measures shall be generally in accordance with the conceptual design contained in Appendix 4 to the resource consent application for water-only consents for a North Bank tunnel Concept, October 2006.

14 Within 24 hours of becoming aware that the fish exclusion measures have been damaged or are ineffective, the consent holder shall notify the Canterbury Regional Council "Attention: RMA Compliance and Enforcement Manager" of the situation, any remedial measures likely to be required, and the likely timeframes for implementing those measures. The consent holder shall use its best endeavours to restore the effectiveness of the fish exclusion measures in accordance with Condition 13 as soon as possible.

15 This discharge permit to discharge water from the tunnel outfall and any related water permits to take from the Waitaki Dam shall not be exercised if the effectiveness of the fish exclusion measures in accordance with Condition 13 has not been restored:

a. within six (6) months of the fish exclusion measures first becoming damaged or ineffective; or

[7] Electricity Governance Rules, Part C, Section II, Paragraph 2.2.3

b. within one (1) month of any subsequent damage to the fish exclusion measures.

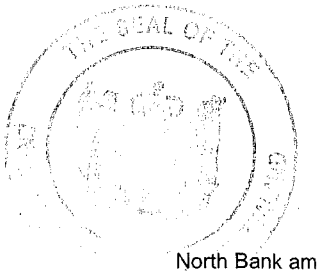
Channel Scouring

16 The consent holder will undertake necessary precautionary works in the riverbed in accordance with the Riverbed Geomorphology and Vegetation Management Plan in order to prevent damage from erosion to private land or to irrigation or other water abstraction intake works for at least 3km downstream of the tunnel outfall, which is likely to occur as a result of the exercise of this consent to discharge water.

17 The consent holder shall make sure remedial repairs are undertaken in accordance with the Riverbed Geomorphology and Vegetation Management Plan in order to remedy any damage from erosion which occurs for at least 3km downstream of the tunnel outfall as a result of the exercise of this consent to discharge water.

Giving Effect to this Consent

18 Pursuant to Section 125 of the Resource Management Act 1991, the period within which the consent holder may give effect to this consent shall be 12 years from the grant of this consent.



Schedule 2

General Conditions

Review by Consent Authority

1 All conditions of these resource consents may be reviewed by the consent authority giving notice in accordance with Section 129 of the Act within 3 months of every anniversary of the commencement of these consents for the purpose of dealing with any actual or potential adverse effect on the environment which may arise from the exercise of the consents and which it is appropriate to deal with at a later stage provided that:

a. subject to b, from the 10th anniversary of the date at which these consents are first exercised, this condition shall not be exercised to review the same condition more than once in any 5 year period;

b. notwithstanding the 5 year limitation in a, this condition may be exercised to review the following specified conditions not more than once in the specified time periods:

- Provision for Other Water Takes between Waitaki Dam and the Tunnel Discharge Point – Condition 9 of the Water Permit to take water from Lake Waitaki – 1 year time period, for the purpose of reviewing the accuracy of the base information to ensure that the flow rates of water to be provided for other water takes are correct in respect of the consents between Waitaki Dam and the tunnel discharge point identified in Attachment 1;

- Flushing Flows – Conditions 16 to 20 of the Water Permit to take water from Lake Waitaki – 2 year time period;

- Braided River Bird Management – Conditions 26 to 28 of the General Conditions – one (1) year time period;

- Wetlands / Repo Raupo Management – Conditions 29 and 30 of the General Conditions – one (1) year time period.

2 In addition to the review provision specified in General Condition 1, the Independent Peer Review Panel, described in General Condition 11, may, following its review of each Annual Environmental Report from the consent holder (under General Condition 13c), recommend to Canterbury Regional Council that it considers a particular condition(s) should be subject to review. Any such recommendation shall be provided by the Independent Peer Review Panel to the Canterbury Regional Council before 1 April in the year following the provision of the Annual Environmental Report as required by General Condition 47 (30 November each year). Upon receipt of such a recommendation from the Independent Peer Review Panel, the consent authority may give notice in accordance with Section 129 of the Act that the particular condition(s) recommended by the Independent Peer Review Panel is to be reviewed by the consent authority.

Exercise of these Consents generally in accordance with Information Provided

3 The exercise of these consents shall be undertaken:

a. generally in accordance with the following documents (where applicable); Meridian Energy Limited, North Bank Tunnel Concept, Resource consent application for water-only consents, dated October 2006; except as amended within the evidence given by witnesses for Meridian Energy Ltd during the hearing of the

resource consent applications.– except where amendments are required by conditions of these consents; provided that

b. in the event of differences or conflict between the measures described in the documents and these conditions or the specific conditions in Schedule 1 for each resource consent, the conditions shall prevail.

Existing Lawful and Consented Water Users at the date of these consents

4 At least two years prior to the exercise of these consents the consent holder shall submit to the Canterbury Regional Council an Abstractive Users' Management Plan which shall include the following purpose:

Purpose
To provide a process for offering, seeking and - with the agreement of the relevant consent holder and/or landowner – implementing appropriate measures to mitigate or remedy effects attributable to the exercise of this consent on existing lawful and consented water takers and users at the date of these consents.

5 The Abstractive Users' Management Plan will include:

(1) A process for identifying, offering and, with the consent of the relevant consent holder and/or landowner, implementing the appropriate measures to mitigate effects of the exercise of these consents including but not limited to effects of:

- Existing intake infrastructure being unable to capture required abstractive flows due to insufficient water levels or loss of connection to river braids.
- Existing infrastructure utilising groundwater bores, or galleries, experiencing a reduction in performance due to a lowering of groundwater levels.
- Lower river levels on soils which are (in the absence of agreement) regarded as self irrigating soils by the Independent Technical Review Panel referred to in (3) below.

(2) This process shall specify how the consent holder will work with each water abstractor or landowner to develop, where required, cost-effective, practical, flexible and realistic solutions to mitigate any effects identified, including agreement as to the appropriate expert to undertake this work (or appointment of an expert by the Canterbury Regional Council's Principal Water Engineer in the absence of such agreement).

(3) As part of the process required by General Condition 5(1):

a. the Canterbury Regional Council will appoint an Independent Technical Review Panel, comprising 3 people (with decisions to be made on a simple majority basis);

b. the Technical Review Panel will carry out the following functions:

(i) provide an independent review of and direction in relation to, any Individual Mitigation Plans offered to consent holders and/or landowners where consent holders and/or landowners are not satisfied with the process for:

- identifying whether the land is likely to be affected by the NBTC abstraction; or

- identifying the land as self-irrigating; or
- identifying the mitigation measures;
- determining the mitigation being offered, or not being offered by the holder of these consents through the Individual Mitigation Plans;

(ii) following the review of any Individual Mitigation Plan and if agreement cannot be reached between the holder of these consents and the relevant consent holders and/or landowners in the light of that review, then hear from both parties and/or their advisers and determine the mitigation measures (if any) to be implemented through the relevant Individual Mitigation Plans and direct that the Individual Mitigation Plans be amended accordingly.

c. the holder of these consents shall meet the reasonable costs of the Independent Technical Review Panel.

(4) Measures to mitigate adverse effects of this consent on the water quality of existing consented and lawful abstractions used for potable water supply for the towns of Kurow and Duntroon.

6 At least one year prior to the exercise of these consents the consent holder shall submit to the Canterbury Regional Council Individual Mitigation Plans for:

- every existing consented and lawful abstractor of surface water or groundwater; and
- the owner of every area of land within which one hectare or more of vegetation cover is self-irrigating from the availability of groundwater

– who are, or are likely to be, detrimentally affected by the operation of these consents. Preparation of Individual Mitigation Plans will occur in accordance with the process provided for in the Abstractive Users' Management Plan.

7 The Individual Mitigation Plans shall include, but not be limited to, addressing the following matters (where relevant) provided that, except where otherwise expressly stated, the consent holder shall not be under any obligation as to the water quality (in particular the water is not required to be potable):

a. measures to mitigate adverse effects on the physical performance of abstraction systems relating to existing consented and lawful abstractors of surface water or groundwater at the date of these consents;

b. provisions to provide for the reinstatement of any intake structures affected by a flushing flow required by Condition 16 of the Water Permit to take water from Lake Waitaki as soon as reasonably practical and, where possible, within 24 hours of the completion of the flushing flow;

c. the measures which the consent holder will offer to each water abstractor, under existing consented and lawful abstractions of surface water as at the date of these consents, to undertake physical works that may be needed in the bed of the river as a result of the reducing of river flows through the exercise of these consents, in order to maintain the links between the river and intakes for abstractive use, including (where applicable) measures to endeavour to keep water in side braids, extension and/or variation and/or relocation of existing water supply intake structures, and diversion of flows;

d. the measures which the consent holder will offer to each owner of land, within which vegetation cover is self irrigating from the availability of groundwater, to mitigate any adverse effects on the availability of that groundwater to such vegetation cover from the exercise of these consents;

e. A commitment by this consent holder, in relation to the resource consents shown in Attachment 1 which have consent cut-offs of 130 cubic metres per second to use best endeavours to facilitate changes to those consent conditions, or obtain new consents, that reflect the flow rates specified in Condition 9 of the Water Permit to take water from Lake Waitaki;

f. A commitment by this consent holder, in relation to any consents shown in Attachment 1 which have conditions referring to a minimum flow in Wainui Stream, to use best endeavours to ensure that the consents can continue to be exercised (which may include augmentation of the flow in Wainui Stream and/or relocation of take locations).

g. A commitment by this consent holder, in relation to any consents downstream of the tunnel discharge point which reference the Kurow recorder, to use best endeavours to facilitate changes to those consents to refer to the flow at the Kurow recorder plus the flow in the tunnel in relation to compliance with minimum flow conditions;

h. A requirement to take all reasonable and practicable steps to identify any likely effects of the exercise of these consents on existing lawful and consented water users as at the date of these consents including where appropriate a pre and post commissioning monitoring programme to determine the nature and extent of any adverse effect from the exercise of these consents and the adequacy and effectiveness of mitigation carried out under the Individual Management Plan. Such programme could include where appropriate GPS locations of surface water, groundwater bore and gallery installations and verification of the distance of groundwater installations to surface water;

i. The work protocol which the consent holder will follow when undertaking any mitigation actions.

8 In addition to General Conditions 4 – 7 above, the consent holder shall offer to fund and assist with the variation of any existing consent where further works are found to be necessary in order to implement General Conditions 4 – 7, or where a variation is required to accommodate the flow regime in the Waitaki River as a result of the exercise of these consents.

9 The consent holder, at its own cost, shall undertake the mitigation measures and other actions specified in each Individual Mitigation Plan, in accordance with the protocol and timetable specified in the relevant Individual Mitigation Plan.

10 By 1 October of each year, for the first 5 years following the commencement of the exercise of these consents and every 5 years thereafter, the consent holder shall complete a review of the Abstractive User's Management Plan, detailing:

a. the monitoring undertaken of:

- each potentially adversely affected existing consented and lawful abstractions of surface water or groundwater; and
- each potentially adversely affected area of vegetation cover that is self irrigating from the availability of groundwater;

b. the results of that monitoring, the mitigation measures undertaken in terms of the Individual Mitigation Plans and the adequacy and effectiveness of those measures.

Peer Review and Liaison Groups

Independent Peer Review Panel

11 At least one year prior to the exercise of these consents, the consent holder shall establish, at its own cost, an Independent Peer Review Panel, to review annually each of the River Management Plans required under General Condition 30 and to assess whether their purposes and objectives are being achieved. The Independent Peer Review Panel shall comprise at least three persons:

a. who shall be independent of the consent holder;

b. at least two of whom shall be scientists who, between them, are experienced in at least two of the following scientific areas – freshwater science, braided river ecology and/or braided river geomorphology, – and are recognised by their peers as having such experience, knowledge and skill, and shall be approved in writing by Canterbury Regional Council;

c. one of whom may be nominated by, or on behalf of, Ngai Tahu should Ngai Tahu decide to do so.

12 As part of undertaking its review and assessment, the Independent Peer Review Panel shall provide an opportunity for the following parties to submit information to the Panel that relates to the matters it is required to consider under General Condition 13 and for the parties to meet and speak with the Panel, whilst it is preparing its annual report:

a. the Ngai Tahu Group (Refer to General Condition 16);

b. the Waitaha Group (Refer to General Condition 17);

c. the Consultative Liaison Group (Refer to General Condition 18);

d. the Statutory Liaison Group (Refer to General Condition 19).

13 The Independent Peer Review Panel shall prepare an annual report[8] for the consent holder on the following matters:

a. its review of each of the River Management Plans (see below) and its assessment as to the adequacy of actions and methods proposed in each River Management Plan to achieve their purposes and objectives and whether or not the actions and methods are in accordance with good practice;

b. whether the annual reviews of, and amendments to, each River Management Plan adequately respond to the results of the monitoring undertaken in the preceding year and the appropriateness of the adaptions proposed to the objectives, actions and methods of each River Management Plan to achieve their purposes and objectives;

c. a review of the Annual Environmental Report prepared by the consent holder and its assessments as to whether the purposes and objectives of each River Management Plan are being achieved;

[8] The information reported in this annual report shall comply with any relevant legislation governing privacy.

d. any recommendations as to whether it considers any particular condition(s) should be subject to review in accordance with Section 129 of the Act.

14 Where the Independent Peer Review Panel does not have the expertise in any of the areas it is required to report on, it may, following consultation with the consent holder, engage the services of an appropriate expert to report on the relevant matter to the Independent Peer Review Panel. Any report from such an expert shall form part of the annual report provided by the Independent Peer Review Panel as required by these conditions.

15 Copies of the annual report from the Independent Peer Review Panel, and all associated expert reports, shall be provided by the consent holder to the Consultative Liaison Group, the Statutory Liaison Group, the Ngai Tahu Group, the Waitaha Group and Canterbury Regional Council, within two weeks of its receipt by the consent holder.

Ngai Tahu Group

16 At least one year prior to the exercise of these consents, the consent holder shall offer Te Runanga o Ngai Tahu, Te Runanga o Arowhenua, Te Runanga o Waihao, Te Runanga o Moeraki and other manawhenua the opportunity to establish, and decide the membership of, a Ngai Tahu Group.

a. The members of the Ngai Tahu Group shall be offered the opportunity of an annual meeting, an annual inspection of the lower Waitaki River from Waitaki Dam to the sea, including mahika kai and other waahi taonga, and the provision of any information to which Canterbury Regional Council and/or the Independent Peer Review Panel is entitled by virtue of these consents, at the consent holder's expense.

b. A representative of the consent holder shall attend all meetings of the Ngai Tahu Group.

c. At least one representative from Canterbury Regional Council (in a resource consent regulatory capacity) shall be invited to attend meetings in an observer capacity.

d. The main purposes of the meetings of the Ngai Tahu Group are to:

- Provide input and feedback on the preparation, implementation, review and adaption of the River Management Plans;
- Be presented by, and discuss with, the consent holder the results of all monitoring and reporting as required by the conditions of these consents, including the Annual Environmental Report prepared by the consent holder;
- Discuss and make recommendations to the consent holder regarding any concerns from Te Runanga o Ngai Tahu, Te Runanga o Arowhenua, Te Runanga o Waihao, Te Runanga o Moeraki and other manawhenua regarding the effects of the exercise of these consents on the lower Waitaki River.

e. In particular, the Ngai Tahu Group shall be offered the opportunity to work jointly with the consent holder in the preparation, implementation, monitoring and review of the Wetlands / Repo Raupo Management Plan in accordance with General Condition 31.

f. In addition, the members of the Ngai Tahu Group shall be offered the opportunity to review and provide input and feedback on the initial River Management Plans, the annual reviews of and amendments to these Management Plans.

g. The Ngai Tahu Group will be provided with the opportunity to submit information to the Independent Peer Review Panel that relates to the matters it is required to consider under General Condition 13, and to meet and speak with the Panel, whilst the Panel is preparing its annual report to the consent holder.

Waitaha Group

17. At least one year prior to the exercise of these consents, the consent holder shall offer Te Runanga o Waitaha as another iwi with manawhenua the opportunity to establish, and decide the membership of, a Waitaha Group.

a. The members of the Waitaha Group shall be offered the opportunity of an annual meeting, an annual inspection of the lower Waitaki River from Waitaki Dam to the sea, including mahika kai and other waahi taonga, and the provision of any information to which Canterbury Regional Council and/or the Independent Peer Review Panel is entitled by virtue of these consents, at the consent holder's expense.

b. A representative of the consent holder shall attend all meetings of the Waitaha Group.

c. At least one representative from Canterbury Regional Council (in a resource consent regulatory capacity) shall be invited to attend meetings in an observer capacity.

d. The main purposes of the meetings of the Waitaha Group are to:

- Provide input and feedback on the preparation, implementation, review and adaption of the River Management Plans;
- Be presented by, and discuss with, the consent holder the results of all monitoring and reporting as required by the conditions of these consents, including the Annual Environmental Report prepared by the consent holder;
- Discuss and make recommendations to the consent holder regarding any concerns from Waitaha regarding the effects of the exercise of these consents on the lower Waitaki River.

e. In particular, the Waitaha Group shall be offered the opportunity to work jointly with the consent holder in the preparation, implementation, monitoring and review of the Wetlands / Repo Raupo Management Plan in accordance with General Condition 31.

f. In addition, the members of the Waitaha Group shall be offered the opportunity to review and provide input and feedback on the initial River Management Plans, the annual reviews of and amendments to these Management Plans.

g. The Waitaha Group will be provided with the opportunity to submit information to the Independent Peer Review Panel that relates to the matters it is required to consider under General Condition 13, and to meet and speak with the Panel, whilst the Panel is preparing its annual report to the consent holder.

Consultative Liaison Group

18 At least one year prior to the exercise of these consents, the consent holder shall undertake an open, public process to offer local residents and interested people the opportunity to establish a Consultative Liaison Group.

a. The Consultative Liaison Group shall consist of a maximum of nine persons with representation offered to each of the following:

- recreational users of the lower Waitaki River;
- property owners alongside both banks of the lower Waitaki River;
- lower Waitaki River Management Society;
- other non-governmental environmental groups with a particular interest in the lower Waitaki River;
- local residents and businesses in the lower Waitaki Valley;
- abstractive users from the lower Waitaki River including from hydraulically connected groundwater;
- the lower Waitaki River Rating Liaison Group;
- Ngai Tahu Mamoe Fisher People Incorporated;

b. Representative(s) of the consent holder shall attend all meetings of the Consultative Liaison Group.

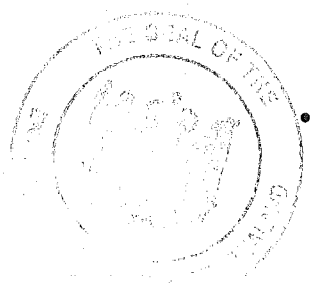
c. At least one representative from Canterbury Regional Council (in a resource consent regulatory capacity) shall be invited to attend meetings in an observer capacity.

d. The members of the Consultative Liaison Group shall be offered the opportunity of an annual meeting, an annual inspection of the lower Waitaki River from Waitaki Dam to the sea, and the provision of any information to which Canterbury Regional Council and/or the Independent Peer Review Panel is entitled by virtue of these consents, at the consent holder's expense.

e. Meetings of the Consultative Liaison Group are to be open to any member of the public to attend in an observer capacity. Any reports or other information made available to the Consultative Liaison Group can be made available to any member of the public.

f. The main purposes of the meetings of the Consultative Liaison Group are to:

- Provide input and feedback into the preparation, implementation, review and adaption of the River Management Plans;
- Be presented by, and discuss with, the consent holder the results of all monitoring and reporting as required by the conditions of these consents, including the Annual Environmental Report prepared by the consent holder;
- Discuss and make recommendations to the consent holder regarding any community concerns regarding the effects of the exercise of these consents on the lower Waitaki River.



g. In particular, the members of the Consultative Liaison Group shall be offered the opportunity to review and provide input and feedback on the initial River Management Plans, the annual reviews of and amendments to these Management Plans.

h. The Consultative Liaison Group will be provided with the opportunity to submit information to the Independent Peer Review Panel that relates to the matters it is required to consider under General Condition 13 and to meet and speak with the Panel, whilst the Panel is preparing its annual report to the consent holder.

Statutory Liaison Group

19 At least one year prior to the exercise of these consents, the consent holder shall offer the following organisations the opportunity to establish a Statutory Liaison Group as follows:

a. The Statutory Liaison Group shall consist of one representative from each of the following organisations (where the organisations wish to provide a representative):

- Central South Island Fish and Game Council;
- Department of Conservation;
- Land Information New Zealand;
- Te Runanga o Ngai Tahu;
- Canterbury Regional Council (in a river management capacity);
- Waitaki District Council;
- Waimate District Council.

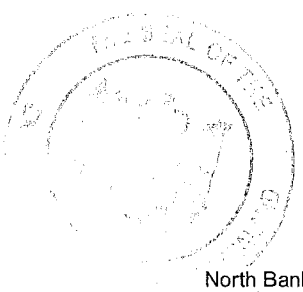
b. At least one representative of the consent holder shall attend all meetings of the Statutory Liaison Group.

c. Representative(s) from Canterbury Regional Council (in a resource consent regulatory capacity) shall be invited to attend meetings in an observer capacity.

d. The members of the Statutory Liaison Group shall be offered the opportunity of an annual meeting, an annual inspection of the lower Waitaki River from Waitaki Dam to the sea, and the provision of any information to which Canterbury Regional Council and/or the Independent Peer Review Panel is entitled by virtue of these consents, at the consent holder's expense.

e. The main purposes of the annual meeting of the Statutory Liaison Group are to:

- Provide input and feedback on the preparation, implementation, review and adaptation of the River Management Plans;
- Receive from, and discuss with, the consent holder the results of all monitoring and reporting as required by the conditions of these consents;
- Liaise regarding the various complementary functions of these statutory organisations and those of the consent holder in relation to the management actions identified in the River Management Plan and ensure the efficient integration of these functions;



- Discuss and make recommendations to the consent holder regarding any concerns from these statutory organisations regarding the effects of the exercise of these consents on the lower Waitaki River.

f. In particular, the members of the Statutory Liaison Group shall be offered the opportunity to review and provide input and feedback on the initial River Management Plans, the annual reviews of and amendments to these Management Plans.

g. The Statutory Liaison Group will be provided with the opportunity to submit information to the Independent Peer Review Panel that relates to the matters it is required to consider under General Condition 13 and to address the Panel, whilst the Panel is preparing its annual report to the consent holder.

Administration and Costs of the Independent Peer Review Panel and Liaison Groups

20 The consent holder shall, in relation to the Independent Peer Review Panel, the Ngai Tahu Group, the Waitaha Group, the Consultative Liaison Group and the Statutory Liaison Group:

a. develop protocols regarding appointment processes, including resignations, replacements and reappointments; the holding of meetings; provision of information; administrative support; and other necessary and related procedures. Such protocols to be developed in consultation with the groups and organisations to be represented on the relevant Panel or Group;

b. maintain and support the ongoing purposes and work of the Panel or Group, as required by the conditions of these consents;

c. meet the reasonable costs of undertaking their functions in accordance with the conditions of these consents.

River Management

Flow and In-stream Habitat Management

21 For the Waitaki River between the Waitaki Dam and Stonewall the consent holder must achieve these objectives:

(1) Minimise exotic riverbed periphyton and maintain low flow water clarity conditions as at the date of these consents.

(2) Maintain diversity and quality of aquatic habitat.

(3) Maintain and as far as reasonably practicable enhance aquatic habitat for mahinga kai and tangata whenua values.

(4) Facilitate and support the development of an Eel Management Strategy to review the effectiveness of the exclusion measures specified in Condition 28 of the water permit to take water from Lake Waitaki, and to assess possible alternative approaches to those specified in Condition 28 for the management of eels and eel passage within the Waitaki Catchment, whilst still providing safe downstream passage for adult migrating eels.

(5) Subject to (3) and (4) above, maintain fish stocks and fisheries.

22 On all agricultural production land adjacent to the lower Waitaki or its tributaries which is:

a. owned by Meridian as at the date of issue of this interim decision; or

b. subsequently acquired or leased by Meridian or its successors to these consents;

– the consent holder must implement best management practices with regard to the protection of lakes, rivers, streams and wetlands (other than those protected by the Wetland/Repo Raupo Management Plan to which higher standards apply). These will include, but are not limited to:

- the exclusion of all stock from lakes, rivers, streams, wetlands and their margins;
- planting the margins of lakes, rivers, streams, and all wetlands with appropriate species to intercept overland flows;
- bridging of all crossings of rivers, streams and wetlands;
- the use of water and nutrient budgets.

Where such land is on-sold, covenants must be included to ensure best practices are maintained.

23 The consent holder will support and promote the use of best land management practice throughout the catchment of the lower Waitaki. This will include, but is not limited to:

- hosting demonstrations of best practice on its properties;
- publicising the results of its water quality monitoring in the catchment;
- encouraging and promoting best practice through the Abstractive Users' Management Plan and the Individual Mitigation Plans;
- encouraging local landcare and watercare groups;
- funding a 0.25 full time equivalent position focussed on the promotion of best practice commencing two years prior to commissioning of the NBTC and to continue for at least five years after the commissioning of the NBTC.

River Geomorphology and Riverbed Vegetation Management

24 The consent holder must:

a. Maintain a fairway that is clear of willows and largely clear of woody weeds: between Kurow and Stonewall, to a width sufficient to ensure:

- Adequate capacity to convey floods up to a 1.9 year return period (Kurow flow = 900 m^3/s) without leaving the fairway.
- Turnover of an adequate proportion of riverbed by flood flows, through bedload transport, bank erosion and lateral channel migration, in order to maintain a dynamic pattern of braiding.

b. Maintain a flood flow regime, or use alternative mechanical means, adequate to transfer, on average, all of the bedload supplied by the tributary rivers, to ensure that:

- There is no long-term (e.g., decadal) accumulation of gravel at the tributary confluences.

- The tributary bedloads are transferred to the river downstream of the tunnel outfall.

25 The consent holder must achieve the following objectives as far as is reasonably practicable:

(1) maintain existing permanent surface flow connections between the Awakino River, Maerewhenua River, Hakataramea River, Kurow Creek and the system of braids;

(2) ensure that river form provides adequate flow connection for consented lawful takes as at the date of this decision for irrigation and other users;

(3) below the NBTC outfall, avoid or mitigate the effects of operating these consents on bank erosion and irrigation intakes.

Braided River Bird Management

26 The consent holder must achieve the following objectives as far as is reasonably practicable:

a. maintain the populations of braided river birds at 2009 levels or (preferably) enhance the populations; and

b. implement any recommendations that arise out of the research programmes referred to in General Condition 28.

27 The consent holder must clear and maintain at least three islands with a combined area of at least 10 hectares as potential breeding habitat for braided river birds.

28 The consent holder must:

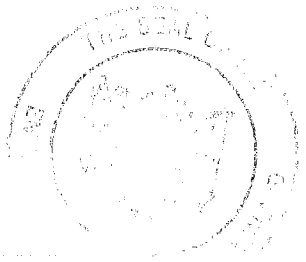
a. commission independent research for at least four (4) years prior to commissioning of any tunnel for a NBTC on:

- breeding and fledging success for (at least) black-fronted terns and black-billed gulls;

- the factors that reduce populations of those species in the lower Waitaki River;

- how fledging success of those species may be improved in the lower Waitaki;

b. have the research programmes approved by the Independent Peer Review Panel prior to implementation.



Wetlands/Repo Raupo Management

29 For the lower Waitaki River between the Waitaki Dam and the sea the consent holder must provide, within two (2) years of the commissioning date of any tunnel for the NBTC, an area of new or restored to largely indigenous condition terrace wetlands (together "the mitigating wetlands") that is the larger of:

a. 75 hectares; or

b. the area (and quality) of wetlands that is agreed under the Wetlands/Repo Raupo Management Plan

provided that in respect of the mitigating wetlands:

c. at least 50 hectares are fenced and legally protected;

d. 50 hectares must achieve the high ecological significance standard under the NRRP; and

e. at least 50 hectares of the wetlands shall be upstream of Stonewall (and downstream of the Waitaki Dam)

f. in respect of any property on which any of the mitigating wetlands are located is at Meridian's expense fenced along the bank of the river as located in a notional 10 year AEP flood as assessed by the Canterbury Regional Council's relevant officer

–unless the mitigating wetland can be excluded from the property by fencing which includes it with the river.

30 The consent holder must achieve the following objectives as far as reasonably practicable:

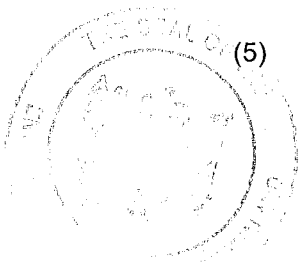
(1) achieve no net loss of area and ecological values of the terrace wetlands as a result of the flow regime associated with the exercise of these consents;

(2) compensate for the loss of area and ecological values of the riparian wetlands lost as a result of the NBTC flow regime;

(3) retain important ecological and recreational values of the riparian wetlands (immediately prior to the exercise of these consents) under the flow regime associated with the exercise of these consents and, if this cannot be achieved, to mitigate the loss of such values by way of riparian wetland enhancement to offset the loss;

(4) retaining both the ecological values that support cultural values in river terrace and riparian wetlands as defined by the Ngai Tahu Group and the Waitaha Group, and access to the two existing mahika kai sites, (both at similar levels to those immediately prior to the exercise of these consents), under the flow regime associated with the exercise of these consents and, if this cannot be achieved, to mitigate the loss of such values by way of wetland enhancement and enhancement of access to mahika kai sites, to offset the loss, in a manner to be determined with the Ngai Tahu Group and the Waitaha Group through the processes for annual review and amendment to the Wetlands / Repo Raupo Management Plan;

(5) enhance habitat for marsh crake and bittern.



River Management Plans

31 Prior to the exercise of these consents, the consent holder shall prepare and submit to the Canterbury Regional Council the following plans:

a. a Flow and In-Stream Habitat Management Plan;

b. a River Geomorphology and Riverbed Vegetation Management Plan;

c. a Braided River Bird Management Plan;

d. a Wetlands / Repo Raupo Management Plan.

Collectively, these plans shall be known as "River Management Plans". Each River Management Plan shall include the objectives and achieve the targets and other matters set out above by including performance measures and monitoring programmes to enable review of the achievement of the above objectives and conditions.

32 In general, each River Management Plan shall provide details of the procedures to be put into place to operate the water take and discharge and water use for hydroelectricity generation in compliance with the conditions of those consents and to minimise the potential for adverse effects arising from the operation of those consents.

33 Each year, the consent holder shall undertake the required actions, methods and monitoring in accordance with the current provisions of each River Management Plan in order to achieve the conditions and objectives set out under the heading **River Management** in these General Conditions.

34 The consent holder, by 30 November each year, shall as part of the Annual Environmental Report required by General Condition 47 complete a review of each River Management Plan, including the results of the monitoring undertaken, for the year ending the previous 30 June. The review shall assess whether management practices are resulting in compliance with the conditions of these consents, and whether the purpose and objectives of the River Management Plans are being met through the actions and methods undertaken. The review shall propose any amendments that the consent holder considers are necessary to better achieve the purpose and/or objectives of the River Management Plans.

35 The consent holder shall supply the proposed River Management Plans and any associated expert reports to the Independent Peer Review Panel for their review and assessment in terms of General Condition 13 prior to finalising its initial River Management Plans. The consent holder shall receive, and give due consideration to, any resulting report from the Independent Peer Review Panel prior to finalising each River Management Plan.

36 Prior to finalising its annual review of, and any amendments to, each River Management Plan; the proposed amendments to the River Management Plans, the annual reviews, and any associated expert reports, shall be provided to the Independent Peer Review Panel for their review and assessment in terms of General Condition 13. The consent holder shall receive, and give due consideration to, the annual report from the Independent Peer Review Panel prior to finalising its annual review of, and amendments to, each River Management Plan.

37 Prior to finalising its initial River Management Plans, and then prior to its annual review of, and any amendments to, each River Management Plan, the consent holder shall provide the opportunity to the Ngai Tahu Group, the Waitaha Group, the Consultative Liaison Group and the Statutory Liaison Group to:

a. receive and discuss the results of all monitoring and reports as required by the conditions of these consents, and as prepared for the purpose of preparing and reviewing the River Management Plans;

b. provide input and feedback into the initial preparation, review and adaption of the River Management Plans.

Flow and In-Stream Habitat Management Plan

38 The purpose of the Flow and In-Stream Habitat Management Plan shall be to achieve the objectives of Flow and In-Stream Habitat Management as set out in General Condition 21.

39 The management plan shall also state:

a. The operational measures that will be implemented by the consent holder to ensure that the flow conditions in the Specific Conditions of the various consents are achieved;

b. Monitoring to be undertaken prior to the exercise of these consents in order to better understand the ecology of didymo on the lower Waitaki River, the implications of this for the flushing flow and tunnel shut-down conditions of these consents, and the process for amending these requirements in response to any increased understanding of didymo ecology.

River Geomorphology and Riverbed Vegetation Management Plan

40 The purpose of the River Geomorphology and Riverbed Vegetation Management Plan is:

(1) to achieve the objectives in and implement General Conditions 24 and 25; and

(2) to provide for:

a. a process for determining respective responsibilities for riverbed vegetation management works with Canterbury Regional Council, Department of Conservation, and LINZ.

b. a programme to commence vegetation clearance within the river fairway, in accordance with Condition 24(1) above, at least 3 years prior to commissioning.

Braided River Bird Management Plan

41 The purpose of the Braided River Bird Management Plan is:

(1) to achieve the objectives of General Condition 26 and to implement General Conditions 27 and 28;

(2) to co-ordinate processes with other river management plan implementation in order to take into account the needs of specialist braided river bird species (including the natural variation by season, habitat requirements, and the effect of vegetation, flooding and other disturbances).

Wetlands / Repo Raupo Management Plan

42 The purpose of the Wetlands / Repo Raupo Management Plan is:

(1) to achieve the objectives of General Condition 30 and to implement General Condition 29;

(2) to ensure the opportunity for the Ngai Tahu Group and other representatives of Te Runanga o Ngai Tahu, Te Runanga o Arowhenua, Te Runanga o Waihao, Te Runanga o Moeraki and other manawhenua to work jointly with the consent holder in the preparation, implementation, monitoring and review of the Wetlands / Repo Raupo Management Plan.

(3) to apply the "Handbook for monitoring wetland condition" (Ministry for the Environment Sustainable Management Fund Project 5105), revised October 2004; the "Maori environmental performance indicators for wetland condition and trend", May 2002 (Ministry for the Environment Sustainable Management Fund Project 5105); and any subsequent national guidelines for monitoring wetlands, as the basis for measuring pre- and post-commissioning ecological, mahika kai and associated values of wetlands.

Groundwater Monitoring

43 Groundwater shall be monitored as follows:

(1) At least three years before commissioning of any NBTC tunnel, the consent holder shall submit a Groundwater Monitoring Plan to the Canterbury Regional Council. The Groundwater Monitoring Plan shall identify the location, sampling and water level monitoring frequency and any water level and water quality analyses that will be undertaken at the proposed monitoring wells. The locations and monitoring frequency will be selected in order to provide a comprehensive record of spatial and temporal changes that occur in groundwater level and water quality, prior to construction, during construction, during commissioning and during the consented period. The monitoring program must provide for:

a. Spatial coverage of groundwater levels within the Post Glacial gravels on the north and south banks of the Waitaki River, including some locations downstream of Stonewall;

b. Groundwater levels in those aquifers which are hydraulically connected to the river, including some locations on the Pleistocene Gravel Terraces;

c. Groundwater levels in the areas of all identified self irrigating soils;

d. Groundwater levels associated with key wetlands and spring fed streams, having regard to the location of mahika kai sites;

e. Spatial coverage of groundwater quality including microbial contaminants and nutrients, with particular emphasis on areas where the gravel thicknesses are limited and where groundwater is used for domestic supply;

f. Changes to the frequency of monitoring and reporting to reflect changes that may occur at any particular time, such as during construction or commissioning works, and the timing of information needs for mitigation.

(2) The Groundwater Monitoring program shall be integrated with monitoring undertaken in accordance the Abstractive Users' Management Plan and the Wetlands / Repo Raupo Management Plan.

(3) Prior to the exercise of these consents, the consent holder shall undertake groundwater monitoring in accordance with the Groundwater Monitoring Plan.

Pre-Commissioning Monitoring

44 At least three (3) years before the consent holder commissions any tunnel as part of a North Bank Tunnel Concept it shall submit a Pre-commissioning Monitoring Plan to the Canterbury Regional Council. The Pre-commissioning Monitoring Plan shall identify the location, sampling and frequency of monitoring in order to provide a comprehensive spatial and temporal record of the existing baseline against which to measure post-commissioning monitoring. The program will include:

a. Monitoring of water quality down the length of the lower Waitaki River and on all major tributaries between Waitaki Dam and Stonewall, using monthly sampling of a range of water quality parameters including pH, electrical conductivity, DRP, total dissolved phosphorous, NH4-N, NO3-N, total dissolved nitrogen, visual clarity and suspended solids as well as monitoring of microbiological indicators (*E.coli* and *Campylobacter).*

b. Monitoring to be undertaken seasonally (4 times per year) to establish the baseline condition of periphyton, macrophytes and macroinvertebrates.

c. Monitoring of didymo in order to better understand the ecology of didymo on the lower Waitaki River, the implications of this for the flushing flow and tunnel shut-down conditions of these consents, and the process for amending these requirements in response to any increased understanding of didymo ecology.

d. Monitoring of native fish using annual quantitative electric fishing surveys of at least five mainstem study sites between Waitaki Dam and Stonewall, and sites on all tributaries between Waitaki Dam and Stonewall with permanent flow connections (Awakino River, Maerewhenua River, Hakataramea River and Kurow Creek). In addition to the annual electric fishing surveys, quantitative monitoring of the following two additional aspects of native fish communities to provide a baseline for post-commissioning comparisons - the densities of adult longfin eels in the tree-lined stable side braids, and the success of inanga spawning at reaches on the north side of the lagoon.

e. Sportsfish monitoring, including surveys of: salmon and rainbow and brown trout spawning, trout and salmon populations, juvenile trout and salmon, and angler satisfaction.

f. Monitoring of wetland habitat, including the two contemporary mahika kai sites, using quantitative surveys (conducted in accordance with the methods prescribed in any national guidelines) within one year of the completion of the Pre-Commissioning Monitoring Plan and one year prior to the commissioning of the scheme.

g. Monitoring of water levels in a range of wetlands, representing the range of hydrological connections of wetlands to the Waitaki River, during at least two low river flow periods that reflect different hydrological conditions, when the daily mean

river flow is between 150 and 200 cubic metres per second for at least 14 days continuously, at least one year prior to commissioning.

h. Monitoring of access to the two contemporary mahika kai sites, within one year of the completion of the Pre-Commissioning Monitoring Plan and one year prior to the commissioning of the scheme.

i. Monitoring of braided river birds to include replicated counts of braided river birds and measures of braided river bird breeding success.

j. Remote-sensing and ground-checking to assess the area of bare gravel island habitat for braided river birds between Waitaki Dam and Stonewall.

k. Monitoring of the river geomorphology using aerial and/or ground surveys including:

   i. an aerial survey of the river at a reference discharge to ascertain the average number of braids and channel widths in relation to the distance down river of the reference point and to map the locations of channel banks;

   ii. a ground survey of the riverbed surface to undertake mapping of the distribution of channels, bars, and gravel sheets at transects along the river, including sampling of the surface material of a representative number of channels, bars, and gravel sheets;

   iii. a survey of bed levels in the areas of the tributaries and Stonewall.

l. Monitoring of riverbed vegetation using transect surveys at a reference time within one year immediately prior to commissioning the scheme.

45 Prior to the exercise of consents, the consent holder will undertake monitoring in accordance with the Pre-commissioning Monitoring Plan.

Annual Environmental Report

46 The consent holder shall complete an Annual Environmental Report and provide it to the Canterbury Regional Council, by 30 November each year, covering for the twelve (12) months ending 30 June in that year the following matters:

a. A summary of the operation of the water take, use and discharge, and the river flows downstream of Waitaki Dam based on the monitoring undertaken in accordance with these consents;

b. A description of the works (including mitigation and rehabilitation), carried out;

c. A review of the results of all monitoring (other than that referred to in a. above) and of any studies undertaken as part of the exercise of these consents;

d. A list of all reports prepared relating to the exercise of these consents and a summary of the findings of each report;

e. Explanations of any changes from the previous Annual Environmental Report;

f. A description of mitigation and rehabilitation works, monitoring studies and reporting intended to be carried out in the next 12 months with an approximate timetable of activities;

g. A description and analysis of any unexpected adverse effect on the environment that has arisen as a result of the exercise of these consents, the steps taken in response to that effect, and the results of those steps;

h. The review of each management plan required by General Condition 34.

47 Copies of each Annual Environmental Report shall also be:

a. provided by the Consent Holder to the Independent Peer Review Panel, the Consultative Liaison Group, the Statutory Liaison Group, the Waitaha Group, and the Ngai Tahu Group; and

b. published on the consent holder's website.

Suitable Person for Management Plans, Monitoring and Environmental Reporting

48 The consent holder shall retain suitably qualified and experienced persons to supervise the preparation, review and adaption of each of the River Management Plans and Abstractive Users' Management Plans, the implementation and review of the monitoring required by these consent conditions, and the preparation of the Annual Environmental Report.

Lower Waitaki River Recreation Development Plan

49 Prior to the exercise of these consents, the consent holder shall provide a sum of $1 million over 3 years to support the development by the community of a Recreation Development Plan for the reach of the Waitaki River between Waitaki Dam and Stonewall provided that this plan shall be subject to and complement the River Management Plans.

50 On commencement of the exercise of these consents, the consent holder shall provide an annual sum of $250,000 per annum, inflation adjusted to the CPI, for the term of these resource consents. The distribution of these funds shall be by way of a charitable trust established for the purpose of:

a. implementing the Recreation Development Plan developed in accordance with General Condition 49, for the reach of the Waitaki River between Waitaki Dam and Stonewall;

b. Supporting initiatives which enhance community utilisation of, and community benefit from, the recreational resource of the Waitaki River between Waitaki Dam and Stonewall.

The distribution of these funds shall be informed by advice to be sought from the Consultative Liaison, Statutory Liaison, the Waitaha and Ngai Tahu Groups.

Certain costs excluded when considering practicability

51. In these conditions tests for reasonable practicability – especially in relation to management of wetlands and braided river birds – shall not include the sums that Meridian chooses to spend on:

    a. recreation ($1 million plus $250,000 p.a.);

    b. potable water ($ unquantified) except for Kurow and Duntroon;

    c. payments to Te Runanga o Ngai Tahu.

Attachment 1

Water Takes for Agricultural and Horticultural Activities to be provided under General Condition 15 of the Water Permit to Take Water from Lake Waitaki

EXISTING CONSENTS

Column No.		1	2	3
Surface Water Takes				
Consent No	**Consent Holder**	**Max Consented Rate of Take and Diversion (l/s)**	**Max Consented Rate of Take (l/s)**	**Min Flow (m^3/s) Cut off >110**
CRC980921. 2	Meridian Energy Limited	770	542	
CRC952215	Maerewhenua District Water Resource Company Limited	900.0	900	
CRC001203	Maerewhenua District Water Resource Company Limited	250	250	
CRC940497B.3	Meridian Energy Limited	65	65	
CRC030182.1	Meridian Energy Limited	230	230	130
CRC961298	Mr & Mrs A W & S J Gibson	280	280	
CRC022002	Mr & Mrs B W & T F Hore	9	9	
CRC012812	Mr & Mrs E M & S A Ross	230	230	
CRC012445.1	GSI Trading Limited	56	56	
CRC012641	Mr & Mrs R J & R M Irving	60	60	130
CRC992778.1	Mr & Mrs T W & J K Allan	120	120	130
CRC000042.1	Mr & Ms A P & H E Turner-Heaton & Scott	25	25	
CRC950119.1*	Keeling Dairies Limited	115	115	
CRC981733*	Mr N O Dogterom	450	450	
CRC952149	Mr P F McIlraith	91	91	
CRC021158	Normanvale Limited	50	50	130
CRC960030. 2	Papamoa Enterprises Limited and Station Peak Partnership	570	570	
	Sub-Total Existing Surface Water Takes	**4,271**	**4,043**	
Groundwater Takes				
Consent No	**Consent Holder**	**Max Consented Rate of Take (l/s)**	**Maximum Net Rate of Take (l/s)**	**Min Flow (m^3/s) Cut off >110**
CRC962259	Clarkesfield Holdings (1996) Limited.	130.0		

CRC021235.2	D D Chalmers & Kokoamo Farms Limited	208.0		130
CRC000347	D J & L M Parker	50		
CRC021983	G W Dovey	20		
CRC980851	G W Dovey	19		
CRC012337	Haricot Investments Limited	23.8		
CRC020642.5	K & D Farms Limited	50.0		
CRC021286.3	K & D Farms Limited	51.0		
CRC030183.1	Meridian Energy Limited	34		130
CRC031246	Mr & Mrs A W & S J Gibson	92		130
CRC021028.1	Mr & Mrs S R G & J S Fielding	40.0		130
CRC020869	Mr E R Rutherford	3.3		
CRC012648	Mr K M Pavletich	90		
CRC020744	Mr W N Cameron	225		130
CRC060998	Station Peak Limited	150		
CRC962093.2	Mr MB & Mrs DM Turner & Mr D R T Salter	4.5		
CRC081841	RPNZ Properties Limited	17.5		
	Sub-Total Existing Groundwater Takes	**1208.1**		

NEW CONSENTS AND RENEWALS

Column No.		**1**	**2**	**3**
Surface Water Takes				
Consent No	**Consent Holder**	**Max Consented Rate of Take and Diversion (l/s)**	**Max Consented Rate of Take (l/s)**	**Min Flow (m^3/s) Cut off >110**
WTK878031.2 + CRC061919	Clarkesfield Holdings (1996) Limited.	39.5	39.5	130
CRC051795	Papamoa Enterprises Limited and Station Peak Partnership	150	150	
CRC041003	Mr W N Cameron	30	30	
CRC041002	Mr W N Cameron	53	53	
CRC032177	Hakataramea Valley Irrigation Inc	1,000	1,000	
CRC073237	Torach Farm Limited	100	100	
CRC061399	Waitaki Orchards Limited	98	98	
	Sub-Total New Surface Water Takes	**1,470.5**	**1,470.5**	
Groundwater Takes				
Consent No	**Consent Holder**	**Max Consented Rate of Take (l/s)**	**Maximum Net Rate of Take (l/s)**	**Min Flow (m^3/s) Cut off >110**
WTK878031.2 + CRC061931	Clarkesfield Holdings (1996) Limited.	5.5		130
CRC041004	Maerewhenua District Water	468		

CRC063815	Resource Company Limited Mr E R Rutherford **Sub-Total New Groundwater Takes**	81 **554.5**		

Water Takes in terms of Existing Consents Town & Community and Industrial & Commercial Activities to be provided under General Condition 15 of the Water Permit to Take Water from Lake Waitaki

Town & Community				
Column No.		**1**	**2**	**3**
Surface Water Takes				
Consent No	**Consent Holder**	**Max Consented Rate of Take and Diversion (l/s)**	**Max Consented Rate of Take (l/s)**	**Min Flow (m^3/s) Cut off >110**
CRC962154.1	Waimate District Council	17	17	
	Sub Total Town and Community Surface Water Takes	**17**	**17**	
Groundwater Takes				
Consent No	**Consent Holder**	**Max Consented Rate of Take (l/s)**	**Maximum Net Rate of Take (l/s)**	**Min Flow (m^3/s) Cut off >110**
CRC940477	Waitaki District Council	28		
CRC982133	Waitaki District Council	5		
	Sub Total Town and Community Groundwater Takes	**33**		
Industrial & Commercial				
Column No.		**1**	**2**	**3**
Surface Water Takes				
Consent No	**Consent Holder**	**Max Consented Rate of Take and Diversion**	**Max Consented Rate of Take (l/s)**	**Min Flow (m^3/s) Cut off >110**

		(l/s)		
CRC921660C/CR C921660B	Mr A J Nicol	1,000	-	
CRC916614	Transpower	30	-	
	Sub Total Industrial and Community Surface Water Takes	**1,030**	-	
Groundwater Takes				
Consent No	**Consent Holder**	**Max Consented Rate of Take (l/s)**	**Maximum Net Rate of Take (l/s)**	**Min Flow (m^3/s) Cut off >110**
CRC921659	Mr A J Nicol	5		
	Sub Total Industrial and Community Groundwater Takes	**5**		

Notes:

1. For surface water diversions:

   (a) Where a diversion also includes a take (Column 1), and the diverted water is returned to the river in close proximity to where it was diverted, the maximum consented rate of take (Column 2) is based on the take rate alone;

   (b) Where a diversion does not include a take (Column 1), then the diversion rate has been used as the maximum consented rate of take (Column 2);

   (c) Where water is diverted without a take (Column 1) but never leaves the river margins, e.g. Nicol Trout Farm at Kurow, the diversion rate has not been included in the maximum consented rate of take (Column 2);

   (d) The difference between Columns 1 and 2 represents the additional surface water diversions which have not been included in the maximum consented rate of take (Column 2).

2. For groundwater takes, the net rates of take (Column 2), take into account stream depletion. However, stream depletion has not yet been determined for groundwater takes and the net rates of take have, therefore, not been included in Attachment 1.

3. The Transpower consent, CRC916614, is no longer used as transformers are now air-cooled. When it was in use, there was no taking of water. Water was used and it stayed in the river.

4. For CRC020744, the Canterbury Regional Council believes this is linked to Wainui Stream only. However, the consent has a minimum flow linked to the Waitaki River.