

Tabled @ Hearing  
04.10.2016

Before Environment Canterbury

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Under the Resource Management Act 1991 (RMA)  
In the matter of of Plan Change 5 to the Canterbury Land and Water Regional  
Plan

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**Legal Submissions of Meridian Energy Limited**

4 October 2016

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## Introduction

- 1 Meridian Energy Limited (**Meridian**) made a submission<sup>1</sup> and further submission<sup>2</sup> on Plan Change 5 (Nutrient Management and Waitaki Sub-region) to the Canterbury Land and Water Regional Plan (**PC5**).
- 2 Meridian is interested in the provisions that apply in the Waitaki Sub-region. This interest arises because Meridian owns and operates 6 of the 8 power stations and associated canals, diversion weirs and other structures comprising the Waitaki Power Scheme (**WPS**).
- 3 The WPS is New Zealand's largest integrated source of electricity. It comprises 1,723MW of installed generation capacity contributing on average around 18% of New Zealand's electricity supply per year.
- 4 The WPS is powered by water that naturally occurs in the Waitaki catchment.
- 5 The national significance of the WPS has been recognised previously by Environment Canterbury in the context of other planning processes and is not at issue in PC5. It is however important to note that not only does the significance of the WPS arise because of its installed generation capacity, but also as a consequence of the flexibility in when electricity is able to be generated because of the ability to store water for use at a later time. In this regard it is worth noting that Lake Pukaki is the largest water storage reservoir in the country, and together with Lake Tekapo accounts for approximately 60% of New Zealand's water storage capacity.

### Why is Meridian concerned about water quality?

- 6 Meridian's interest in fresh water outcomes<sup>3</sup> and water quality limits<sup>4</sup> in the Waitaki Sub-region is discussed in detail in the evidence of Mr Page. In summary the interest arises because:
  - (a) Nutrient enrichment of water bodies in the Waitaki catchment gives rise to the potential for increased prevalence of biological growths in the water, which may in turn damage Meridian's generation assets and impose additional maintenance costs<sup>5</sup>.

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<sup>1</sup> Submission Number 53960 dated 11 March 2016

<sup>2</sup> Dated 13 May 2016

<sup>3</sup> 15B.6

<sup>4</sup> 15B.7

<sup>5</sup> Jeff Page, EIC, paragraph 12

- (b) While a principle means of achieving outcomes and meeting limits in fresh water is through controlling land uses that have the potential to impact water quality, Meridian is also aware and has experience of using flushing flows or pulses of water in order to dislodge accumulations of excessive biological growth<sup>6</sup>. The need for flushing flows in the Waitaki catchment to control biological growth can have a direct adverse impact on Meridian by requiring it to spill water. Meridian is therefore concerned to ensure that the outcomes and limits that are established are appropriate and attainable so as to avoid the future prospect that new flushing flows need to be established to address adverse in-river or in-lake effects<sup>7</sup>.
- (c) The construction of the WPS resulted in significant changes to the pre-existing environment. These changes were in part compensated for by the creation of new and modified water bodies which have their own aesthetic and recreational values. Reduction in these values as a consequence of reduced water quality could be seen to go to the heart of the local community benefits derived from the decision to secure the national benefits arising from the construction and operation of the WPS<sup>8</sup>.
- (d) The naturally-occurring glacial flour that is entrained in many of the water bodies in the Upper Waitaki catchment because they are feed by glacial and snow melt means that these water bodies are naturally high in suspended solids and turbidity, and low in clarity. Meridian is concerned to ensure these and other natural characteristics and variability are recognised when setting and applying outcomes and water quality limits.
- 7 The majority of PC5's provisions have been assessed by Meridian as avoiding or assisting in the avoidance of the adverse consequences Meridian and others may face if water quality in the Upper Waitaki surface water bodies deteriorates. However, there are a number of provisions Meridian wishes to see amended in order to better provide certainty that the fresh water outcomes and limits will be met. Meridian also proposes some changes to the fresh water outcomes and limits themselves which better reflect natural water quality in some of the Upper Waitaki's water bodies, and other changes that are appropriate to protect the Upper Waitaki's water bodies in an integrated way.

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<sup>6</sup> For example, the operative Environmental Flow regime established for the Lower Waitaki River in the Waitaki Catchment Water Allocation Regional Plan requires 7 flushing flows per year of at least 450m<sup>3</sup>/s to be released from Waitaki Dam. Meridian also adheres to a voluntary flushing flow regime in the Lower Waiau River in connection with the operation of the Manapouri Power Scheme.

<sup>7</sup> Jeff Page, EIC, paragraph 13

<sup>8</sup> Ibid, paragraph 14

- 8 The changes sought by Meridian are set out in Appendix 2 of Ms Dawson's planning evidence, and a copy is **attached** to these submissions.
- 9 In these submissions I discuss the changes sought under three headings:
- (a) Policy 15B.4.20(d) – the use of adaptive management or monitoring and response conditions on resource consents;
  - (b) Tables 15B(a), (b) and (d) – water quality outcomes and limits, and a new policy linking Policies 4.1 and 4.2 to the water quality outcomes and limits in the particular context of the natural processes and variability within the Waitaki FMUs; and
  - (c) A change to Schedule 27 E1 to allow a more accurate calculation of the unutilised portion of the Haldon Zone Nitrogen Load Limit.

#### **Policy 15B.4.20(d)**

- 10 Meridian is supportive of this policy but requests that it be amended to include the reference to the water quality outcomes in Tables 15B(a) and (b) as well as the water quality limits in Tables 15B(d) and (e).
- 11 The suggested wording is set out in Ms Dawson's evidence in Appendix 2. This wording departs in three ways from the wording recommended to you in Revised Appendix 1 – Part B of the Section 42A Report<sup>9</sup>.
- 12 First, the Meridian version includes reference to the water quality outcomes in Tables 15B(a) and (b) as well as the water quality limits in Tables 15B(c), (d) and (e). As Ms Dawson explains in her evidence<sup>10</sup> the approach taken in existing consents granted in recent years in the Upper Waitaki includes conditions based on fresh water outcomes and limits. In my submission there is no sound reason to depart from that pattern, particularly in light of Objective 3.12 which states "*When setting and managing within limits, regard is had to the community outcomes for water quality and quantity*". I submit that managing to limits only will not necessarily achieve outcomes. A comparison of rivers Tables 15B(a) with 15B(c) and lakes Tables 15B(b) with 15B(d) shows there are some overlaps, but also examples where the stated outcomes do not necessarily follow from meeting the specified limits<sup>11</sup>.

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<sup>9</sup> Section 42A Report, page 8-11

<sup>10</sup> Sarah Dawson, EIC, paragraph 107

<sup>11</sup> Examples include temperature, DO and E.coli outcomes for both rivers and lakes which are unsupported by equivalent limits.

- 13 Second, the Section 42A officers have now recommended that the words "adaptive management" be replaced with "monitoring and response". While at one level Meridian is ambivalent about the choice of words, the stated rationale for the change is of concern. In response to Questions from the Hearing Commissioners the officers have indicated that based on the decision of the Supreme Court in *King Salmon*<sup>12</sup> adaptive management includes establishing thresholds to trigger remedial action before effects become overly damaging or irreversible, whereas the officers are of the view that action to reduce adverse effects before the environment limits are breached is not consistent with the approach of PC5<sup>13</sup>. I submit this view is not consistent with the way the Canterbury Land and Water Regional Plan (CLWRP) is structured<sup>14</sup>. It is at odds with the approach taken in recent consents, and runs the risk of 'closing the stable door after the horse has bolted'. In recent consents, and consistent with good resource management practice, trigger values have been established via consent conditions as a way of reducing the risk of environmental outcomes / limits being breached by requiring actions to reduce nutrient loss when the environmental outcomes/limits are being approached. This approach is effectively one of managing within outcomes and limits, which I equate with the *King Salmon* approach of "before effects are overly damaging". In my submission, Policy 15B.4.20(d) should not artificially foreclose a continuation of this practice if upon enquiry the consent authority finds it is appropriate.
- 14 Third, the officers' recommended version now includes a restriction on the ability to impose monitoring and response / adaptive management conditions to where they "*relate specifically to the effects caused by the activity*". Meridian does not support this restriction. Effects of an activity include cumulative effects<sup>15</sup>, and it is unclear what the inclusion of "specifically" means in this context. If it is intended to exclude the effects of a particular activity in combination with the effects of other activities then it is unhelpful and is opposed.
- 15 As Ms Dawson notes<sup>16</sup>, many of the existing irrigation consents in the Upper Waitaki require adaptive management or response by a consent holder in relation to surface water quality monitoring results downstream of the authorised activity. Most of the consents have a monitoring point specified in Lower Lake Benmore, at a point well below the specific effect of a particular

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<sup>12</sup> *Sustain our Sounds Inc v New Zealand King Salmon Company Limited* [2014] NZSC 40 at [133]

<sup>13</sup> Responses to Questions to Hearings Commissioners on Council Section 42A Report, 12 August 2016; 22.162 2., pages 39-40; 22.168, pages 41-42

<sup>14</sup> For example Strategic Policy 4.7 – resource consents will not be granted if the granting would cause a water quality limit to be breached.

<sup>15</sup> Section 3(d) RMA

<sup>16</sup> Sarah Dawson, EIC, paragraphs 101-105

activity, but at a location where cumulative changes in water quality contributed to by multiple consented activities will be picked up. This is also described at paragraph 22.161 of the Section 42A Report – Part B.

- 16 By monitoring at a downstream location and applying adaptive management or response conditions across all consents authorising activities that contribute to the nutrient load, the Council is able to:
- (a) Ensure necessary modifications to farming practices in response to the cumulative effects of multiple activities are undertaken in a fair way across all contributing properties; and
  - (b) Ensure necessary modifications are made in a timely way. Without the ability to enforce changes under consent conditions, in the event monitoring showed an unexpected adverse change in water quality the Council's likely action would be to develop and notify a proposed plan change to introduce a modified nutrient management regime, and then to review existing consents in line with that modified regime pursuant to section 128(1)(b) of the RMA. That process would likely take years, and in the meantime the outcome and / or limit would be breached or under threat. Further, as Dr James explains<sup>17</sup>, once a lake crosses into a lower trophic state it is very difficult to improve that condition.
- 17 I submit therefore that the additional words "*... and relate specifically to the effects caused by the activity*" should not be added to the notified policy as they will tend to make the policy less efficient and effective in assisting the attainment of the objectives. Further, I submit the officers' approach does not accord with established practice in the Upper Waitaki, including consent conditions supported by Environment Canterbury in consent memoranda approved by the Environment Court<sup>18</sup>, and if adopted would result in a retrograde step in water quality management. Meridian does not agree with the proposition that "*the 'adaptive management' conditions are intended to assist in the management of localised water quality effects rather than cumulative catchment scale effects, as these are managed by the PC5 nitrogen load limits*"<sup>19</sup>. Rather, the adaptive management conditions are designed to ensure consented activities continue to be conducted in a way that maintains the integrity of the water quality outcomes and limits established in the CLWRP. I submit that managing the cumulative effects on water quality arising from multiple land uses in different areas is a complex

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<sup>17</sup> Mark James, EIC, paragraph 62

<sup>16</sup> See for example the consent order in *Five Rivers Limited v CRC* (ENV-2011-CHC-136) in Appendix 3 to Jeff Page's EIC.

<sup>19</sup> Section 42A Report, Part B, paragraph 22.166

business. The consent authority needs to preserve the ability to set conditions on consents to ensure consent holders are required to adapt or modify activities as may be necessary to respond to the results of monitoring. Adopting a policy which restricts the consent authority's ability to impose such conditions must make the task of ensuring water quality is sustainably managed more difficult.

#### **Fresh water outcomes and limits**

18 Policies 4.1 and 4.2 of the CLWRP state:

4.1 Lakes, rivers, wetlands and aquifers **will** meet the fresh water outcomes set in Sections 6 to 15 within the specified timeframes. If outcomes have not been established for a catchment, then each type of lake, river or aquifer should meet the outcomes set out in Table 1 by 2030.

4.2 The management of lakes, rivers, wetlands and aquifers will take account of the fresh water outcomes, water quantity limits and the individual and cumulative effects of land uses, discharges and abstractions will meet the water quality limits set in Sections 6 to 15 or Schedule 8 and the individual and cumulative effects of abstractions will meet the water quantity limits in Sections 6 to 15.

19 Ms Dawson discusses these policies, and their relationship to the catchment-specific provisions for the Waitaki comprised in PC5 in her evidence<sup>20</sup>.

20 In her opinion Policies 4.1 and 4.2 may be read as requiring the Council to place considerable weight on the water quality outcomes and limits set out in the CLWRP for each catchment, including, in this case, the Waitaki catchment. That may take the form of, for example, the setting of conditions on consents to ensure the water quality outcomes and limits are achieved or not exceeded (as the case may be).

21 Ms Dawson notes that Appendix G of the Section 42A Report takes a different view and suggests that, at least so far as the outcomes are concerned, these are only relevant to inform "plan efficacy review".<sup>21</sup>

22 I do not agree with the interpretation placed on the way Table 15B(a) is to be used as set out in Appendix G of the Section 42A Report. In my submission Ms Dawson's interpretation better accords with the plain meaning of the words in Policies 4.1 and 4.2.

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<sup>20</sup> Sarah Dawson, EIC, paragraphs 63-75

<sup>21</sup> Section 42A Report, Appendix G, pages 94-95 referred to in Sarah Dawson EIC, paragraph 61

- 23 In my submission it is likely that the Council will seek to manage to the outcomes and limits, rather than simply referring to them as a benchmark when it reviews the efficacy of the plan. It is also likely in my submission that interested parties will expect the Council to do exactly that. It is therefore important that the outcomes and limits are set with care so that they are accurate; appropriately protective of the water quality parameters necessary to maintain the values of the water bodies (recognising that in the case of the Upper Waitaki some of those values are high<sup>22</sup>); and that they make appropriate allowance for situations where, because of natural processes or variability, the stated outcomes or limits are not met.
- 24 In the Upper Waitaki, to do otherwise would effectively invite recent water permit holders to make applications under section 127 RMA and undo the river periphyton monitoring and response requirements (chl a)<sup>23</sup>. This would surely, in my submission, be an unintended and unwelcome outcome.
- 25 To that end Meridian has suggested several changes to the outcome and limit tables. These are contained in Appendix 2 to Ms Dawson's planning evidence and are discussed in detail in Dr James' ecological evidence.
- 26 Those changes are:
- (a) Expressing the DO outcome as a daily median percentage<sup>24</sup>;
  - (b) Expressing the daily maximum temperature outcome as a 90<sup>th</sup> percentile value assessed on an annual basis<sup>25</sup>;
  - (c) Excluding rivers naturally influenced by glacial flour from the fine sediment maximum bed cover percentage outcome<sup>26</sup>;
  - (d) Excluding lakes naturally influenced by glacial flour from the Lake SPI minimum grade outcome<sup>27</sup>;

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<sup>22</sup> Mark James, EIC, paragraphs 22-24

<sup>23</sup> See for example conditions 95-101 of the Ohau Downs Station consent as contained in the consent order in *Five Rivers Limited v CRC* (ENV-2011-CHC-136) in Appendix 3 to Jeff Page's EIC.

<sup>24</sup> Table 15B(a)

<sup>25</sup> Idem

<sup>26</sup> Idem

<sup>27</sup> Table 15B(b)



- (e) Adding Lake Ruataniwha as an Artificial Lake – On-River and assigning it a TLI outcome of 2.7 (the same as Lake Benmore at Haldon Arm and at Dam)<sup>28</sup>;
- (f) Amending the visual quality outcome for High Country Lakes from no degradation of natural colour by more than 5 Munsell units to maintenance in a natural state<sup>29</sup>;
- (g) Amending the TLI outcomes for Kellands Pond and Wairepo Arm from 3.7 and 4 respectively to 3.2 for both Artificial Lakes<sup>30</sup>;
- (h) Including the TLI for Wairepo Arm as a limit as well as an outcome<sup>31</sup>;
- (i) Changing the Kellands Pond measuring point to mid-pond rather than at the edge<sup>32</sup>; and
- (j) Changing the annual median TN concentration for both Kellands Pond and Wairepo Arm from <math>500\text{mg/m}^3</math> to <math>350\text{mg/m}^3</math><sup>33</sup>.

27 The reasons for these suggested changes are contained in the evidence of Dr James but in summary:

- (a) The changes relating to Lake Ruataniwha, Kellands Pond and Wairepo Arm are necessary because these water bodies create important linkages between the High Country Lakes (Tekapo, Pukaki and Ohau) and Lake Benmore. They are under significant water quality pressure from land use changes, and in Dr James' view poor outcomes in these water bodies could contribute to changes in trophic state and consequential adverse changes in Lake Benmore.
- (b) Naturally-occurring glacial flour in the rivers and lakes, and natural variability in conditions (for example temperature) mean that some water bodies will not meet the outcomes and limits for some parameters some or all of the time, and an allowance needs to be made for this.

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<sup>28</sup> Table 15B(b)

<sup>29</sup> Idem

<sup>30</sup> Idem

<sup>31</sup> Table 15B(d)

<sup>32</sup> Idem

<sup>33</sup> Idem

- 28 As an alternative to amending the tables to address naturally-occurring conditions and variability Ms Dawson has suggested the inclusion of a new policy requiring naturally-occurring processes and natural variability to be taken into account in the implementation of Policies 4.1 and 4.2 in the Waitaki Sub-region FMU. This option would effectively allow individual consent decision makers to make specific inquiry as to the influence of these matters in the particular circumstance of the application being considered.
- 29 I note that inclusion of this policy would mean that the amendments to the tables in relation to Lake Ruataniwha, Kellands Pond and Wairepo Arm would still be required.

#### **Schedule 27**

- 30 Meridian understands the concept of Nitrogen Headroom and accepts the idea that in the Haldon Zone there is some capacity for water quality (as measured by the TLI) in the Haldon Arm of Lake Benmore to be somewhat reduced from the current state while still achieving acceptable water quality. I note the questions and responses in relation to whether this maintains water quality<sup>34</sup>. Meridian expresses no view on this matter.
- 31 Meridian therefore accepts the proposed maximum annual average TLI for the Haldon Arm of Lake Benmore and at the Benmore Dam of 2.7<sup>35</sup>. In relation to the Ahuriri Arm Meridian's position is that this unit is already at its assimilative capacity and no reduction in current state water quality as measured by the TLI is appropriate. Meridian therefore supports the proposed TLI of 2.9 for the Ahuriri Arm.
- 32 Meridian's interest is in ensuring that the policy and accounting methods adopted by PC5 are appropriate in ensuring that the water quality limits are met and not exceeded. As it is only within the Haldon Arm PC5 proposes that there is available nitrogen for allocation, Meridian suggests that an amendment be made to Schedule 27 to ensure that the method of calculation of available Nitrogen Headroom in the Haldon Zone takes into account the impact of consents that have been or may be granted in the period between when the baseline modelling was undertaken (as at December 2013) and when the relevant new rules in PC5 become operative.

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<sup>34</sup> National Policy Statement for Freshwater Management 2014, Objective A2

<sup>35</sup> Table 15B(d)

- 33 The rationale for the suggested change, and the proposed wording, are set out in detail in the evidence of Mr Ellwood.
- 34 The effect of the suggested change is likely to be small in the total N received within the Haldon Arm, but in Meridian's view is significant as it will enable the available Nitrogen Headroom to be determined with greater precision, and reduces the possibility of additional "unaccounted for" nitrogen entering the Haldon Arm and potentially threatening the proposed TLI limit of 2.7. In my submission, the force of the suggested change is that it avoids the potential for effective over-allocation of N.

### **Conclusion**

- 35 Meridian supports PC5.
- 36 Ensuring water quality within the Waitaki catchment is maintained at acceptable levels in the face of land use change is challenging. In an overall sense Meridian considers PC5 goes about this task in a balanced and responsible way, and gives effect to the relevant higher order planning instruments<sup>36</sup>.
- 37 It is submitted the changes sought by Meridian will assist in ensuring the fresh water outcomes are met, and the fresh water limits are not exceeded, while allowing further responsible development of the land resource.
- 38 Meridian's suggested changes clarify the fresh water outcomes and limits and make their application more certain. In doing so, Meridian's changes will improve the efficiency and effectiveness of PC5.
- 39 Meridian has four witnesses:
- (a) Mr Jeff Page, who describes Meridian's interest in water quality in the Waitaki catchment; sets out how adaptive management has been used in the catchment; and describes the fresh water monitoring points Meridian suggests.
  - (b) Mr Brian Ellwood, who describes the suggested change to Schedule 27 in order to better account for the impact of recently granted or applied for consents.
  - (c) Dr Mark James, who describes the existing ecological values and water quality of the Upper Waitaki and recommends some changes to the water quality outcomes and limits contained in PC5.

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<sup>36</sup> Section 67(3) RMA; PC5 Section 32 Report, pages 1-1, 1-4 and 1-9

- (d) Ms Sarah Dawson, who provides planning evidence in reliance on the other Meridian witnesses, and proposes wording to address the matters those witnesses raise.

Dated this 4th day of October 2016



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S W Christensen  
Counsel for Meridian Energy Limited

## Appendix 2

### Amendments sought to PC5

#### 15B.4 Policies:

Amend **Policy 15B.4.20(d)** as follows:

**15B.4.20** *Freshwater quality is maintained in the Upper Waitaki Freshwater Management Unit by:*

.....

- (d) *applying to any resource consent granted for the use of land for a farming activity, or any permit granted for a discharge associated with an aquaculture operation or community wastewater activity, adaptive management conditions in accordance with the water quality limits and outcomes set out in Tables 15B(a), 15B(b), 15B(d) and 15B(e).*

Add the following new policy:

*Within the Waitaki sub-region Freshwater Management Units, when implementing Policies 4.1 and 4.2 to take into account that the existing freshwater quality in the lakes and rivers is influenced by naturally occurring processes, including the glacial origin of the water, and natural variation.*

#### 15B.5 Rules:

Add the following as **Condition 2. to Rule 15B.5.8**, with non-complying or prohibited activity status not to comply with this condition:

**15B.5.8** *The discharge of nutrients onto or into land where the property is supplied with water by an irrigation scheme of principal water supplier is a discretionary activity, provided the following conditions are met:*

....

- 2.** *The aggregated nitrogen loss calculation for all properties supplied with water by the irrigation scheme or principal water supplier and located with the Haldon or Mid-Catchment Zone does not exceed the aggregate of the Upper Waitaki Headroom available for those properties.*

**Schedule 27:**

Amend the formula for calculating **E1 in Schedule 27** (with an associated formula X included) as follows:

*E1 = 66 tonnes N/yr (the unutilised portion of the Haldon Zone Limit in Table 15(f) ~~as at 13 February 2016~~ as at 1 December 2013) \* Z*

*Z = 1-(the amount of on-land based agricultural N load allocated in excess of 1.6 /kg/ha via resource consent granted after 1 December 2013 but before the Rules 5.53A, 5.54A, 15B5.19 to 15B.5.23 become operative) / (66 tonnes\*G)*

**Tables 15B(a) and 15B(b):**

Amend Tables 15B(a) and 15B(b) in accordance with the following tables.



**Table 15B(b) : Freshwater Outcomes for Lakes in the Upper Waitaki Freshwater Management Unit to be achieved by 2030<sup>2</sup>**

Lake Type	Ecological Health Attribute			Eutrophication Attribute TLI <sup>3</sup> (max. annual average)	Visual Quality Attribute Colour	Human Health for Recreation Attribute		Thrypsis Whina Attribute	
	Dissolved Oxygen (min saturation) [%]	Temp. (max) [°C]	Lake SPI <sup>1</sup> (min grade)			SFRG	E.coli/E.Coli(f/100mL)		
							Annual median		95th percentile
Natural state	Dumb-bell Lake Tasman Lake Blue Lake Hooker Lake								
Large High Country Lakes	Lake Tekapo/Takepo Lake Ohau Lake Pukaki		Excellent Excludes lakes naturally influenced by glacial flour	1.7 for all lakes	Lakes are maintained in a natural state		Good	<260	
	Lake Alexandrina Lake McGregor Lake Middleton	70% - hypolimnion/ 90% epilimnion		Lake Alexandrina 3.1 Lake McGregor 3.2 Lake Middleton 3.6		<0.5mm <sup>3</sup> /L biovolume equivalent for all cyanobacteria or <500 cells/mL of total cyanobacteria	Good-Fair	<260	
	Lake Benmore Lake Aviemore Lake Waitaki Lake Ruataniwha		High	Lake Benmore at Haldon Arm 2.7 Lake Benmore at Ahuriri Arm 2.9 Lake Benmore at Dam 2.7 Lake Ruataniwha at Dam 2.2		Natural colour of the lake is not degraded by more than 5 Munsell Units		<540	
Artificial lakes - on-river				4 for all Lakes: Kellands Pond 3.2 3.2 Waipapa Arm 4 Waipapa Arm 3.2				Suitable for the purpose of the Lake	
Artificial Lakes Other	Kellands Pond Waipapa Arm	20% hypolimnion	Suitable for the purpose of the Lake						

<sup>2</sup> Note shaded text indicates recommended changes recommended in S42A report



### 15.7.2 Water Quality Limits for Lakes

Table 15B(d): Water Quality Limits for Lakes in the Upper Waitaki Freshwater Management Unit<sup>3</sup>

Lake Type	Lake Name and measurement location	TLI <sup>1</sup> [maximum annual average]	Total Phosphorus (TP) concentration [mg/m <sup>3</sup> ] [annual median]	Total Nitrogen concentration [mg/m <sup>3</sup> ] [annual median]	Chlorophyll a concentration (mg/m <sup>3</sup> )		Ammoniacal Nitrogen Concentration (mg/L) <sup>2</sup>	
					Annual median	Annual maximum	Annual median	Annual maximum
Large high country lakes	Lake Tekapo: map reference 2311557 5694042	1.7 for all lakes	<10	<160 (seasonally stratified) for all lakes	<2	<10	<0.03	<0.05
	Lake Ohau: map reference 2292672 5653482							
	Lake Pukaki: map reference 2285797 5675254							
Small to medium sized High Country lakes	Lake Alexandrina: map reference 2305600 5694000	3.0	<20	<350 (seasonally stratified)				
	Lake McGregor: map reference 2306958 5693747	3.2						
	Lake Middleton: map reference 22585000 5654000	3.6						
Artificial lakes - on-river	Lake Benmore Ahuriri Arm: map reference 2280270 5626670	2.9	<10	<160 (seasonally stratified)	<5			
	Lake Benmore Haldon Arm: map reference 2288092 5636130	2.7			<2			
	Lake Benmore at Dam: map reference 2287977 5623571	2.7						
	Lake Aviemore: map reference 2295464 5615958	2.0						
	Lake Ruataniwha map reference (at Dam)	2.7						
Artificial lakes – on-river	Kellands Pond 2275898 5652428 <u>1365979 5090899<sup>4</sup></u>	<del>4.0</del> 3.7 <u>3.2</u>		<500 (polymictic) <u>&lt;350</u>				
	<u>Wairepo Arm</u> <u>1366937 5090850<sup>5</sup></u>	<u>3.2</u>		<u>&lt;350</u>				

<sup>3</sup> Note shaded text indicates recommended changes recommended in S42A report

<sup>4</sup> NZTM Grid Reference

<sup>5</sup> NZTM Grid Reference