UNDER The Resource Management Act 1991

AND

IN THE MATTER OF Resource consent application CRC121814 by DR McIntyre to discharge dairy effluent onto land and to air.

JOINT DECISION OF HEARING COMMISSIONERS
EMMA CHRISTMAS AND HOANI LANGSBURY
3 October 2013

DECISION

1. Under our delegated authority from the Canterbury Regional Council to hear and decide these applications we grant resource consent CRC121814, to discharge dairy effluent onto land and to air, to DR McIntyre subject to the conditions outlined in this decision, with an expiry date of 16 August 2022.

THE HEARING

2. These applications were heard on 4 - 5 September 2013 at the Mackenzie Country Hotel, Twizel. The following appearances were recorded:

For the applicant:

Mr Ewan Chapman, Solicitor
Ms Katherine Forward, Solicitor
Mr David Gordon, Twizel Dairy Business / Operations Manager
Mr Tom Heller, Water Quality Scientist
Mr Trevor Webb, Soil Scientist

Submitters:

Ms Jane Whyte, Planner on behalf of Meridian Energy Ltd
Dr Mark James, Freshwater Ecologist, on behalf of Meridian Energy Ltd
Mr William Chisholm, Environmental Consultant, on behalf of the Ohau Protection Society Inc.
Ms Mandy Waaka-Home, Kati Huirapa
Ms Linda Kirk, Senior Environmental Advisor, Te Rūnanga o Ngāi Tahu

Ms Devon Christensen, Resource Officer Central South Island Fish and Game Council

Section 42A Reporting Officer:
Mr Robert Carson-Iles

3. The hearing was adjourned on the 5th September pending an amended set of consent conditions from the applicant. This was received on 13th September, and the hearing was closed on 17th September.

BACKGROUND

4. An application was made by DR McIntyre in February 2012 to discharge diluted dairy effluent to land via irrigation, and the associated discharge of aerosols and odour into the air. This consent replaces consent CRC022030.1, for the same activity, which expired on 16 August 2012. The activity has been ongoing since this time pursuant to s124 of the RMA

5. Mr McIntyre operates a 2,600 ha dairy farm adjacent to SH8, immediately south of Lake Ruataniwha, close to Twizel, known as Twizel Dairy. The farm has been operating since 2004 and is irrigated using water from the Benmore Irrigation Company Scheme. The property is operated in three separate management units: the 'old dairy shed', 'new dairy shed' and 'out the back', a dairy support block on Table Hill. This application is concerned with the old dairy shed management unit. A separate consent is held for the new dairy shed unit.

6. Up to 2,000 cows are milked in the old dairy shed unit. Mr Gordon described the operation of the dairy effluent discharge. Milking takes place between August and May. The effluent pond has sufficient capacity for 31 days storage. The volume of effluent discharged is metered and the nitrogen concentration in the effluent measured quarterly.

7. Discharge takes place whenever conditions are suitable, with the intent of keeping the pond at a low level to maximise available storage.

8. There is a large riparian setback (approximately 700 m) from Kellands Pond, and a bund around the pond to prevent run-off. Standard setbacks are proposed in the consent conditions of a minimum of 20 m from any bore or surface water body, and 50 m of any spring.

9. In 2011 decisions were released on a large number of applications to take ground and surface water for irrigation within the upper Waitaki catchment. This is relevant as submissions, evidence and decisions from that hearing were referred to or relied upon by various submitters. The hearing panel considered the water quality in the various water bodies and the risks to it from irrigation and the associated intensification in farming activities. As a

result some applications were refused, and others are subject to water quality conditions which limit nutrient discharges and set requirements not to exceed the trophic lake index (TLI – a measure of trophic state) of Lake Benmore.

10. Several of the decisions have been appealed and we were advised by Mr Chapman and Ms Whyte for Meridian Energy Limited (Meridian) that negotiations have been ongoing. As a result, the conditions relating to water quality limits have evolved and are likely to be somewhat different in any consents ultimately granted by the Environment Court. We have considered various evidence to those hearings as it has been referred to us and the part of the decision which discusses water quality[1] .

11. Details of the McIntyre application, the receiving environment, potential effects of the activity and relevant planning provisions are described in both the AEE and the s42A report written by Mr Carson-Iles. To avoid repetition, this information is only summarised briefly below. This decision should therefore be read in conjunction with those reports.

NOTIFICATION AND SUBMISSIONS

12. The application was publicly notified on 20 July 2012. Nine submissions were received; seven in opposition, one in support and one neutral.

13. All the submissions in opposition, and the neutral submission, were concerned with effects on water quality. Mrs Judith Norman and Mr Shaun Norman both sought a reduction in contaminants entering groundwater, and the protection of waterways with fencing and planting. Ms Kiersten McKinley raised concerns about the effect on Kellands Pond in particular. She sought improved farming practices, including a reduction in stocking rates. Central South Island Fish and Game (Fish and Game) was also were concerned about effects on Kellands Pond, as this is used each year for Kids Fishing Days. This location is chosen because of the clear water, low level of macrophytes and sheltered location. Fish and Game also highlighted the importance of Lake Benmore for recreational fishing and the cumulative effect of this application, with others in the Mackenzie Basin, on water quality.

14. The Ohau Protection Society (OPS) highlighted the lack of compliance with consent conditions in the past, and significant odour at SH8. Mr and Mrs Sue and Rob Young shared similar concerns to the OPS, and also drew attention to the effects on large scale dairy farming on tourism in the Mackenzie Basin and New Zealand in general.

15. Te Rūnanga O Ngāi Tahu, Te Rūnanga o Arowhenua, Te Rūnanga o Waihao and Te Rūnanga o Moeraki (Ngāi Tahu) jointly submitted that the declining water quality in the catchment is a physical expression of degradation to the

[1] http://ecan.govt.nz/publications/Consent%20Notifications/upper-waitaki-decision-part-a.pdf

mauri of the water bodies, and could impact upon native fish populations, mahinga kai and the aspirations of the rūnanga to improve the mahinga kai within the catchment. They opposed the application as lodged and sought appropriate consent conditions be attached.

16. Meridian Energy Ltd was neutral in respect of the application, provided that particular conditions governing water quality in Kellands Pond, the Wairepo Arm and Lake Benmore were adhered to. Their primary concerns related to impacts on their operations, in particular increased weed growth fouling screens, and the potential need in future to release flushing flows to remove weed from riverbeds.

17. Benmore Irrigation Company Ltd supported the application, on the basis of the benefits to the local and national economy.

APPLICATION STATUS

18. The activity comprises four parts which are individually subject to rules in the Natural Resources Regional Plan: discharge of liquid effluent to land via irrigation, discharge of solid effluent from the storage pond and stone trap to land, discharge of contaminants including odour to air from the irrigation, and discharge of odour to air from the storage ponds. The storage of effluent in the ponds is authorised by an existing consent (CRC072541).

19. We note that the only relevant plan in terms of activity status is the Natural Resources Regional Plan. The Waitaki Catchment Water Allocation Regional Plan does not contain rules in relation to discharges, and the proposed Land and Water Regional Plan had not been notified at the time the applications were made.

20. It was agreed between parties that the discharge of effluent to land via irrigation is a restricted discretionary activity under Rule WQL25, and that the discharge of solid effluent to land is a permitted activity under Rule WQL23.

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21. The applicant clarified that the discharge of contaminants to air from the irrigation complied with the conditions of Rule AQL65 and was therefore a permitted activity. Despite this, Mr Chapman sought that both this, and the discharge of solid effluent to land, were consented, in order that 'the overall nature of the activity applied for is contained and consented in one document.'

22. The discharge of odour to air from the effluent storage pond is a discretionary activity under AQL69.

23. Mr Carson-Iles bundled the applications together and considered the activity as a whole to be a discretionary activity. Mr Chapman disagreed that this

was appropriate. In support of this he cited various legal cases. In particular, Southpark Corporation v Auckland City Council[2], which sets out a test that defines when it is not appropriate to bundle consents: if one consent is a restricted discretionary activity, and if the discretion is relatively restricted, and if the effects of exercising the two consents would not overlap or have flow-on effects on matters to be considered on the other application.

24. He also discussed North Canterbury Gas Limited v Waimakariri District Council[3], in which the Court found that that consents to install and operate an LPG tank, and the retailing aspect of the proposal, were sufficiently interlinked such that they should be considered as a whole.

25. In this application, the discharge of effluent to land is a restricted discretionary activity, with a narrow focus of discretion; that is, primarily matters related to water quality. The first two criteria are therefore met. The effects of the two activities are quite separate (odour versus water quality). While in this situation the storage of the effluent on land is related to its discharge, we do not think in this case the activities are so closely related, or have flow-on effects to be considered from one activity to the other, that the test cited is met. We therefore consider they should be treated as having different activity statuses.

26. In practice it makes very little difference, as the only effects of the discharge to land with which we are concerned are those of water quality.

RECEIVING ENVIRONMENT

27. The effluent discharge area is located at the eastern site of the McIntrye property. It is bordered by SH8, Kellands Pond, Lake Ruataniwha, Table Hill, and the 'new dairy shed' block to the south. The Wairepo Arm (an extension to Lake Ruataniwha) is immediately across SH8. There is also a shallow pond, known as the Borrow Pit (a former gravel pit) within the property, approximately 500 m west of Kellands Pond.

28. The groundwater in the area is shallow. Mr Carson-Iles states that the depth of water in the Borrow Pit is approximately 2 metres below ground level. Mr Heller described the water level in the Wairepo catchment (a wider area than the discharge area) as being between 5 and 20 m deep. Regardless of the exact depth to groundwater, there was no dispute that a shallow unconfined aquifer is present under the site. This shallow aquifer is susceptible to nutrient leaching the farming operations.

29. Kellands Pond is an artificial pond or lake, fed by shallow groundwater which passes under the irrigation area. It is only 5 m deep, and its water quality

[2] Southpark Corporation Ltd v Auckland City Council, [2001] NZRMA 350 (EnvC)
[3] North Canterbury Gas v Waimakariri District Council A217/2002 [2002] NZEnvC 458

reflects the quality of the shallow groundwater inputs. Kellands Pond connects to the Wairepo Arm via a culvert. The Wairepo Arm is fed primarily by the Wairepo Creek (itself fed by groundwater inflow and diffuse catchment run-off), and groundwater inflows. There is clearly also some mixing with Lake Ruataniwha.

30. Lake Ruataniwha is part of the wider upper Waitaki hydro-electric system, being fed by the Ohau River and the a canal which brings water from Lake Puakaki. Its outflow is via canal to Lake Benmore. Water can also be released from Lake Ruataniwha into the Ohau River bed, which then flows to Lake Benmore. Groundwater also flows into the lake, including from beneath the discharge area.

31. Mr Heller described groundwater flow and water quality in both groundwater and the various surface bodies in some detail. This information is discussed later in the decision. The water quality data provided updates information summarised in the upper Waitaki consent decision, upon which several submitters relied.

Significance of the area to Te Runanga o Ngāi Tahu

32. The importance of the upper Waitaki receiving environment is recognised in the Ngai Tahu Claim Settlement Act (1998). Both Te Ao Marama (Lake Benmore) and Lake Ohau are Statutory Acknowledgement areas. The Statutory Acknowledgement for Te Ao Marama states:

> "*An important and productive fishery exists in the lake, with Haldon and Ahuriri arms once rich in long finned eels, although in more recent times the fishery has been depleted*."

33. The importance to whanau and hapu of the Upper Waitaki and Te Manahuna, which includes the discharge area, is based on generations of mahinga kai (food gathering) use.

34. The use of the Wairepo Arm was specifically identified as a contemporary use area for the temporary storage of tuna (eels). This water body is used on an annual basis to facilitate the downstream transfer of tuna for enhancement purposes. This makes the water quality of Wairepo Arm of particular importance to local Kaitiaki of Ngai Tahu.

SECTION 104 ASSESSMENT

35. Section 104(1) requires that, subject to Part II of the Act, regard must be had to:

(a) any actual or potential effects on the environment of allowing the activity; and

(b) any relevant provisions of

(i) a national policy statement

(ii) a New Zealand Coastal Policy Statement;

(iii) a regional policy statement or proposed regional policy statement;

(iv) a plan or proposed plan; and

(c) any other matter the consent authority considers relevant or reasonably necessary to determine the application.

Section s104(1)(a) - Potential effects on the environment

Management of effluent discharge operation

36. We start our discussion with some comments on the discharge operation. The effects of the discharge on ground and surface water are a direct result of the management of the system. Discharging at inappropriate times, and at inappropriate rates, will increase the amount of nutrient entering groundwater (and ultimately surface water) and significantly increases the risk of direct run-off to surface water. The management measures in place are therefore critical to minimising nutrient loss.

37. The evidence we heard from Mr Gordon has lead us to conclude that this is a well managed and monitored operation. Mitigation measures in place to reduce loss of nutrients include:

- A relatively low rate of discharge of nitrogen, at 64 kg/ha/yr. Mr Carson-Iles referred to research that showed that indicate that spreading effluent at rates of up to 200 kg of nitrogen per hectare per year has little effect on groundwater quality.

- The effluent discharge is metered and the nitrate concentration of the effluent measured quarterly.

- Soil moisture deficit is measured. The application depth is limited to 24 mm (the profile available water of the soils in the discharge area is 88 - 110 mm) .

- An Effluent Management Plan will be prepared detailing how the operation will be managed to meet the consent conditions.

- The storage pond (authorised under consent CRC072541) allows for at least 28 days storage, a volume Mr Carson-Iles considered to be sufficient.

- There is a set-back of several hundred metres from Kellands Pond and Lake Ruataniwha. A low bund has been constructed to prevent run-off into Kellands Pond (although this cannot prevent overland floods in significant rain events). Other setbacks have been detailed earlier.

- Overseer is used to manage nutrients, and has provided useful information on management practices that may exacerbate or remediate nutrient losses. For example, over wintering practices were identified as a significant cause of nutrient leaching, and land on Table Hill, away from the dairy platform, is now being developed for over-wintering.

- Soils within the discharge area classed as high risk from effluent discharge (Buscott and Curraghmore soils) will not be used for discharge (see below).

38. Mr Gordon advised that the level of monitoring and record keeping at the farm is greater than with other effluent discharge operations in Canterbury.

Soil type

39. Of relevance to the effects on water quality is the soil type onto which the effluent is discharged. Mr Webb described the soils under the dairy platform, based on previous soil surveys and additional investigation into soils depth, and organic matter. There are two main types underneath the discharge area, Mackenzie sandy loams and Curraghmore and Buscott silt loams. The Mackenzie soils are classed as low risk for effluent application (risk class D) (Houlbrook et al. (2011)[4], being flat and well-drained. Provided effluent is applied at an appropriate rate, there is a low risk or both overland flow and preferential flow (that is, flow through cracks in the soil). We also note that recent soil analysis by Mr Webb revealed that the profile available water within the irrigated Mackenzie soils was higher that typically observed, due to the build up of organic matter as a direct result of inputs of water and nutrients.

40. Approximately five percent of the discharge area comprises Curraghmore and Buscott soils. These are classed as high risk for dairy effluent discharge, having impeded drainage and a moderate risk of preferential flow. These are predominantly in the area which would be irrigated by the rotorainer. Houlbrook et al. (2011) recommend a maximum application depth of 10 mm, which is not achievable with the rotorainer. The applicant therefore agreed, in the memorandum in reply, not to discharge effluent on these soils.

Effects on groundwater quality

41. The effects on groundwater quality (and the subsequent effect on surface water quality) was one of the primary concerns of submitters.

42. Mr Heller detailed the groundwater flows in the area. To simplify greatly, groundwater in the vicinity of the farm flows in a north-easterly direction. Groundwater under the irrigated area enters either Lake Ruataniwha or

[4] Houlbrooke D., Laurenson s., Carrick S., 2011. Categorising the environmental risk from land application of liquid wastes based on soil properties. AgResearch report prepared for Marlborough dDstrict Council.

Kellands Pond. The Borrow Pit also intercepts groundwater. As Kellands Pond does not receive any surface water inflows (except via the culvert connecting it to the Wairepo Arm), the quality of the Pond is likely to reflect the quality of the groundwater entering it.

43. Groundwater quality on the property has been monitored at wells H39/0186, H39/0187 and H39/0188 since October 2010. H39/0186 and H39/0187 are up-gradient of the discharge area. H39/0188 is within the discharge area but up-gradient of the two pivots where the bulk of the effluent is discharged. The wells have a very short monitoring period, however show some useful trends.

44. There is virtually no nitrate recorded in any of the wells until 2012 or early 2013. Concentrations then increased to 0.26 – 0.29 mg/Lin the two upstream wells, and 0.8 mg/L in H39/0188. Phosphorous levels within the groundwater are virtually non-existent.

45. The only groundwater data record of reasonable length, and the only useful 'down-gradient' bore, is H38/0229. This is at the edge of the discharge area, adjacent to SH8. It is potentially affected by both the applicant's farming operations (including the effluent discharge) and those of the neighbouring property on the other side of SH8, as well as land uses further up-gradient. This bore shows a gradually increasing concentration of nitrate in the groundwater, from 0.6 mg/L in early 2009 to 2.1 mg/L in April 2013 (an increase of 0.23 mg/L per year). Again, there is no virtually phosphorous present.

46. We presume (and no evidence was out forward to suggest an alternative) that this increase is due to the intensification of farming in the catchment both the old dairy shed and new dairy shed operations, together with any other intensive farming up-gradient over recent years. We note that other aspects of the farming operations have the potential to result in leaching of nutrients, separate from the discharge. Mr Heller commented that the effluent discharge would be a small contributing factor, in terms of proportion of total nutrient inputs. The only quantification we have of this is the Overseer model results provided by the applicant. These show a nitrogen loss per hectare per year of 26 kg under present management and a loss of 25 kg if the dairy effluent is exported off-farm, suggesting that nitrogen loss as a result of the effluent discharge is only one kg/ha/yr. We note that we cannot control other aspects of the farming operation through this consent.

47. We also note that Mr Carson-Iles suggested that should the application be declined, the loss of nitrate to groundwater would be replaced by an equivalent loss from fertiliser additional applied to the land. While this may be correct, Mr Gordon advised that in practice there are no realistic alternatives to disposing of the effluent on the farm.

48. In themselves, the nitrate concentrations in the groundwater are not harmful, being well below the New Zealand Drinking Water Standards Maximum Acceptable Value (MAV) (11.3 mg/L), and the maximum rate set in the NRRP and LWRP (also 11.3 mg/L). There are two concerns however; the persistent increase in concentration recorded in bore H38/0229, and the potential effect of nitrate on surface water into which the groundwater discharges.

49. In our opinion, an ongoing increase at this rate is not acceptable, as inevitably there will be effects downstream. While the increase is likely to be primarily the result of the whole farming operation (and possibly other farms up-gradient), the dairy effluent discharge is a component part of this. Reducing the amount of nitrate that leaches to groundwater from the discharge will assist in reducing or stopping this increase.

50. The amount of leachate entering groundwater will be minimised by the best practice methods described earlier.

Effects on surface water quality

Kellands Pond

51. As a small water body fed directly by groundwater flowing under the discharge area, the greatest impact of the discharges will be felt in Kellands Pond.

52. Water quality within Kellands Pond has been recorded since 2003. Data presented by Mr Heller showed that nitrate concentrations up to mid 2008 were generally close to zero. After this period, concentrations increased, fluctuating up to 0.45 mg/L. In Mr Heller's words, this is of some concern. It was suggested at the upper Waitaki hearings by Dr Adrian Meredith, ECan Water Quality Scientist, that this reflected a delay of four years for nitrate from the farming operation to enter surface water.

53. Phosphorous concentrations in the Pond are low, generally below the level of detection. Mr Heller's evidence was that the Pond is phosphorous limited, and any phosphorous entering it will be consumed. Since there is no phosphorous in the groundwater, it is only likely to enter through overland flow.

54. There has been a recent spike in the nitrate concentration in Kellands Pond (1.3 mg/L, July 2013), which could not be explained by Mr Heller, but appears likely to be due to the large flood in June of this year which resulted in overland flow into the Pond. We are satisfied this does not reflect the nitrate concentration in groundwater entering the Pond. There is also organic nitrogen present in many of the samples, which Mr Heller considered likely to be due to run-off.

55. Overland flow and run-off from irrigation is of particular concern as any increase in phosphorous will inevitably result in an increased growth of aquatic plants and a corresponding increase in trophic state.

56. Several submitters sought riparian planting as a way to reduce nutrient inputs and improve water quality within the Pond. There was some discussion at the hearing about the practicality of riparian planting. Mr Gordon's opinion was that significant flood events, such as that of June, could not be prevented from entering the Pond by riparian planting. Planting may be possible in low-lying areas to prevent flow resulting from small events, however some areas were beyond the farm boundary (such as riparian areas around Kellands Pond). It would also be very difficult to establish planting in areas that are not irrigated. Our site visit confirmed the practicality of this. For this reason we are not requiring riparian planting through consent conditions, but we encourage the applicant to investigate where planting might benefit water quality within the Pond, and facilitate this as far as practicable.

57. Fish and Game was particularly concerned about declining water quality within Kellands Pond. They cited various reports, including evidence given at the upper Waitaki consent hearings by Dr Adrian Meredith, indicating that nutrient enrichment was occurring, altering the macrophyte assemblage and resulting in frequent algal blooms. The hearings panel for the upper Waitaki hearings concluded that the declining water quality and increased macrophyte growth was likely to be due to the adjacent dairy farm (Twizel Dairy), that Kellands Pond / Wairepo Arm appeared to be close to the mesotrophic / eutrophic boundary (although there was no good data with which to calculate a TLI accurately), and that no significant net increase in nutrient load should be permitted.

58. Mr Carson-Iles reported that the Trophic Lake Index (TLI) of Kellands Pond, calculated from monitoring data for 2012 and 2013, was 3.04 and 3.17 respectively. This is at the lower end of the mesotrophic scale and lower than estimated at the Upper Waitaki hearing. The application is for an existing activity and will not result in an increase in nutrient load (although the load will have increased over previous years as the farm was developed). Best practice management of the discharge, as outlined in the conditions, should ensure that nutrient loss is minimised.

Wairepo Arm / Lake Ruataniwha

59. Mr Heller's evidence suggested there were unlikely to be direct effects on Wairepo Arm, apart from exchange of water from Kellands Pond through the culvert, due the direction of groundwater flow. However, the direction of groundwater flow is not known precisely and there is the potential for some direct effects, although we acknowledge that effects from farming activities to the east of SH8 are likely to be greater.

60. Ms Waaka-Home, for Ngai Tahu, explained that the Wairepo Arm is used to temporarily store the eel catch in the trap-and-transfer programme, so water quality degradation in this part of the catchment was of particular importance to them.

61. Mr Heller did not present any water quality data specifically from the Wairepo Arm. Water quality is measured by ECan at the point where Wairepo Creek discharges into the Wairepo Arm. Since this is the major inflow in the Arm, the implication is that the water quality in the Wairepo Arm will be similar. The quality of the Wairepo Creek at this site is good (nitrate generally below 0.2 mg/L, and phosphorous generally below 0.05 mg/L) and improving, with concentrations of both nutrients declining over the last six or seven years. This is despite land use intensification within the catchment, and is likely to reflect improved riparian land use practices, such as exclusion of stock from waterways and riparian planting.

62. Mr James provided calculations of TLI for the Wairepo Arm for 2012 and 2013, based on sampling by NIWA. The TLIs of 3.0 and 2.9 put it at the oligotrophic / mesotrophic boundary, significantly below the 3.75 estimated at the upper Waitaki hearing. Mr James considered that the lower TLI values could be due in part to low flows in the catchment, and in part due to inaccurate estimates in 2008/09 as a result of limited data.

63. The water quality of the Wairepo Arm is clearly better than estimated in 2008/09 and if the water quality of Wairepo Creek continues to improve, it will benefit further. However there is a connection to Kellands Pond through the culvert and potentially from direct groundwater flow. The TLIs of the two water bodies are similar. Meridian, Fish and Game and Ngai Tahu all sought TLI monitoring conditions for the Wairepo Arm. Mr Chapman considered this was inappropriate on the grounds that it would be unreasonable to require the applicants to absorb the cost of monitoring at a site where no other consent holder currently monitors, and that the contribution of effluent to the receiving water quality is a small percentage of the total.

64. We have carefully considered the submitters' request, but it is our opinion that the amount of nitrate lost as a result of the effluent discharge does not justify TLI conditions in the Wairepo Arm, or further afield. Any effect that may eventuate from the discharge will be observed firstly in the groundwater, and secondly in Kellands Pond. The applicant undertakes quarterly monitoring of both of these, including chlorophyll a as a biological measure of enrichment in Kellands Pond. Kellands Pond will in effect act as an early warning system for issues arising from Twizel Dairy's operations, before they have an effect further away. Annual reporting is required, including measures taken to mitigate effects. Review of the consent may be undertaken each year. We stress again that the deteriorating water quality already observed is due to the wider farm operation and the effluent discharge is a small part of

this. It is unfortunate that the effects of the whole farm cannot be considered at this time and we have some sympathy with the concerns of the submitters.

65. We agree there is a place for wider catchment TLI monitoring in order to assess the cumulative effects of the total development, but we consider that this is most appropriately linked to the farming operation as a whole, which causes in the greatest nutrient loss, rather than one small part of it. This will be addressed under the LWRP.

Lake Benmore

66. Water from the Wairepo Arm flows via the Ohau Canal to the Haldon Arm of Lake Benmore. In the Upper Waitaki Catchment consent hearings (decisions released November 2011), considerable significance was placed on the water quality in Lake Benmore as the 'ultimate receptacle' of nutrients from the upper catchment, where the cumulative effects of all activities in the upper catchment would become apparent. These cumulative effects will be reflected in the TLI for the lake. The decisions on the Upper Waitaki applications determined that a threshold TLI of 3.0 was appropriate for Lake Benmore, and changes in the TLI up to this constituted a no more than minor effect on water quality. A TLI of 3.0 is also the water quality standard set in the NRRP.

67. Mr Heller's evidence was that between 2010 and 2013 the water quality in Lake Benmore has been good, with a relatively stable TLI of around 2.0 (the boundary between micro-trophic and oligotrophic), again lower than that estimated at the upper Waitaki hearings. This contrasted with Mr James' evidence that: '*Water quality sampling that has been carried out to date indicates that Lake Benmore is at the upper end of the oligotrophic state and at least parts of the lake are in danger of becoming mesotrophic if water quality declines further*.' We presume this relates to data collected and presented to the Upper Waitaki hearings.

68. This lower TLI is reassuring, however we suspect that little new development has occurred within the catchment as many of the upper Waitaki consents are still under appeal.

69. In practice, the effluent discharge will have a negligible impact on water quality within Lake Benmore. As discussed above, we do not consider attaching TLI monitoring conditions to the consent is appropriate.

Conclusion on water quality effects

70. There appears to be little doubt that the development of Twizel Dairy has resulted in a reduction in water quality within Kellands Pond. This has the potential to reduce the ecological, recreation and cultural values of the Pond. The extent of any effects on Wairepo Arm are not clear, but at present was

quality in the Arm appears to be good. The effects of the effluent discharge itself, compared to the effects from the farm in general, are likely to be small.

71. The direct effects of the discharge in the wider catchment will be less than minor, and probably unquantifiable. TLI monitoring in order to detect and address cumulative effects is most appropriately dealt with in terms of the effects of the whole farming operation, and is not justified for the relatively small nutrient loss from this activity.

Effects on public health

72. Mr Carson-Iles advised that soil is an effective remover of pathogens from effluent, and that provided effluent is applied at a rate no greater than 50% of the water holding capacity of the soil, then the risk of pathogens passing through the soil into the groundwater is very low. This limit is a condition of consent.

73. The water quality standard set in the NRRP and pLWRP is one colony forming unit (CFU) per 100 ml of water. Instances higher than this, up to 100 cfu, have been recorded in monitoring wells on the property. Mr Carson-Iles commented that the source of the contamination is not known, as some of the monitoring wells up-gradient of the discharge area have shown elevated levels.

74. In order to avoid any effects from the discharge, appropriate application rates and practices are necessary, including avoiding run-off and application of effluent to saturated soils. Best practice measures have been discussed earlier and are included within the conditions.

75. We consider that the risk of pathogens entering ground or surface water is low.

Odour effects

76. We were advised at the hearing that the discharge of odour to air from the application of the effluent was a permitted activity, as the conditions within Rule AQL69 were met. Consent is required for the discharge of odour from the storage pond.

77. The applicant proposed that the consent authorise all activities. It proposed conditions that spray drift is retained within the property boundary and that there be no odour that is offensive or objectionable beyond the property boundary. These reflect the conditions of the permitted activity.

78. Mr Gordon's evidence was that there is very little odour from the effluent pond. This is corroborated by the monitoring reports attached to the s42A report and also our own site visit.

79. We heard evidence from Mr Chisholm, on behalf of the Ohau Protection Society, that odour is likely to be of most concern when the effluent is atomised and dispersion is poor, for example irrigation during light winds. He suggested conditions preventing discharge in certain wind conditions. Given the discharge of odour from the application of effluent is permitted, we cannot impose conditions in relation to the discharge over and above those of Rule AQL69. The appropriate atmospheric conditions will need to be taken into account by the applicant when considering how to meet those conditions.

Positive effects

80. There are positive effects of the discharge as a source of nutrients from the land, reducing the amount of additional fertiliser inputs required.

Conditions of consent

81. The applicant proposed a number of consent conditions, based on those proposed by Mr Carson-Iles. While we agree that most are appropriate, we wish to comment on the following.

Cow numbers

82. Mr Carson-Iles recommended a condition limiting cow numbers be put on the consent. He explained that it was ECan practice to limit the scope of the activity to that applied for in this way.

83. The applicant wished to retain flexibility in numbers, and limit the activity by means of the total nitrogen that could be discharged. This effectively sets a cap of 2,150 cows. This would allow cows to be moved from one dairy shed unit to the other if required for operational reasons.

84. The rate at which nitrogen is to be applied in effluent to land is relatively low. In our opinion this is a more important limit that the number of cows and therefore agree with the applicant that such a limit is not necessary.

Limit on total nitrogen sources

85. The applicant has previously been bound by a condition (condition 4(b) on consent CRC022030.1) which states that the 'maximum loading of nitrogen from all livestock loads, effluent discharge, nitrogen fixing and artificial fertiliser, shall not exceed a limit of 200 kg /ha/yr'. The applicant advised that no other farming operation has such a condition on their consent, and that the condition double counts the nitrogen inputs – the livestock recycle nitrogen from other sources.

86. Mr Carson-Iles advised that the standard wording attached to other consents is: '*The nitrogen loading rate shall not exceed (a) 200 kilograms of nitrogen per hectare per year…*'.

87. We have used this wording in the conditions.

High risk soils

88. In reply, the applicant agreed not to discharge onto the Curraghmore and Buscott soils, which are classed as high risk for dairy effluent disposal. However this is not clearly stated in the proposed conditions. In addition, there is no explicit requirement in the conditions that discharge does not exceed field capacity of the soil, which we consider important to manage the risk of nutrient leaching. We have therefore amended the conditions to achieve this.

Consent review

89. The possibility of a five year review of all monitoring data was discussed at the hearing. This would allow trends over the previous five years to be determined, and additional mitigation measures, or changes in practice, implemented if required. The proposed conditions include a requirement to report annually to ECan on all monitoring data, including analysis of trends and comment on any changes in farm management required to mitigate effects. This is coupled with a clause allowing annual review of the consent.

90. We do not see there is a need for any additional reporting or review conditions, however we would encourage the applicant to engage with interested parties, particularly Ngai Tahu, in the ongoing monitoring and mitigation of effects.

Section 104(1)(b) - Policy Statements and Plans

NPS Freshwater

91. The NPS Freshwater has two water quality objectives. Objective 1 is to safeguard the life-supporting capacity of fresh water by sustainably managing the use and development of land and discharges of contaminants. Objective 2 includes improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated.

92. The policies require the Regional Council to set freshwater objectives and water quality limits, and establish methods (including rules) to avoid over-allocation. It has done this through its regional plans. Policy A3 is to impose conditions on discharge permits to ensure the limits and targets set are met.

Regional Policy Statement

93. The provisions of the Regional Policy Statement (RPS) that apply to these applications have been summarised in the s42A report. In particular, Policy 7.3.6 requires the establishment and maintenance of minimum water quality standards for each water body. These standards have been set through the NRRP and pLWRP. The parameters of greatest concern are nitrate and phosphorous.

94. The NRRP sets water quality standards for unconfined gravel aquifers in Objective WQL2.1. This states that the overall maximum nitrate-nitrogen concentration should not exceed 11.3 mg/L, and if the overall maximum nitrate-nitrogen concentration exceeds 5.6 mg/L the rate of increase should not exceed 1.5 mg/L every 10 years. Policy 4.1 of the pLWRP sets a standard for nitrate of no more than 11.3 mg/L, and an average of no more than 5.6 mg/L. These limits have not been exceeded.

95. Objective WQL1.2 of the NRRP and Policy 4.1 of the pLWRP set surface water standards for lakes. The standards are the same in each case. Kellands Pond and the Wairepo Arm are classed by ECan as 'Artificial Lakes - others'. A trophic level index (TLI) of 4 is set as a limit. Lake Benmore is an 'Artificial Lake – on river' and a TLI limit of 3 is set.

96. These standards are currently met, and conditions will ensure they are not exceeded as a result of the exercise of this consent, cumulatively with other discharges.

97. Policy 7.3.12 is to take a precautionary approach to the discharge of contaminants in circumstances where the effects of these on freshwater bodies are unknown or uncertain.

98. Policy 7.3.11 recognises substantial investment in infrastructure and provides for the continuation of these activities, while requiring a reduction in adverse environmental effects, where appropriate. There has been an improvement in practice over recent years and we expect this to continue.

Natural Resources Regional Plan

99. Objectives WQL1.2 and WQL2.1, which set water quality standards for surface and groundwater, are discussed above. Policy WQL10 is to minimise the leaching of nutrients to groundwater by using best management practices to manage the input of nitrogen so that it matches plants' requirements, avoid the accumulation of high concentrations of nitrogen in the soil, and limit the loss of contaminants to groundwater.

100. Policy WQL5.1 provides guidance for the non-point source discharge of contaminants to surface water. Clause (1) is to avoid, or where this is not

practicable minimize, the cumulative adverse effects on surface water quality from non-point source discharges, including nutrients and pathogenic micro-organisms. Clause (4) is to reduce run-off from irrigated land by implementing measures to increase the efficient use and application of irrigation water. The conditions proposed by the applicant should ensure that these requirements are met.

Proposed Land and Water Regional Plan

101. Hearings have been held on the Land and Water Plan but no decisions have been released. It is therefore at an early stage of the process. It implements the 2013 RPS and deals with issues that have arisen since the NRRP was first notified, including deteriorating water quality, in a more comprehensive way than does the NRRP.

102. Strategic Policy 4.1 sets water quality limits for groundwater, as discussed above. Policy 4.2 requires that the management of lakes, rivers, wetlands and aquifers will take account of the cumulative effects of land uses, discharges and abstractions in order to meet the fresh water outcomes in accordance with Policy 4.1. These standards will be met.

103. Policy 4.11 requires that any discharge to land where it may enter groundwater does not exceed the natural capacity of the soil to remove the contaminant, and does not exceed the available water storage capacity of the soil. Policy 4.28 requires that the loss of nitrogen to water is minimised through first raising awareness of the nitrogen losses from farming by requiring record-keeping on existing farms, and secondly, by supporting the use of industry articulated good practice. We are confident from the evidence presented that the operation is managed in accordance with best practice techniques.

104. Policy 4.27 requires that effluent storage systems are large enough to avoid the need to dispose of effluent at times when there is an increased risk of run-off into surface water or leaching into groundwater. This policy is complied with.

105. Strategic Policy 4.3 requires that any discharge of contaminants to water does not diminish any values of cultural significance to Ngāi Tahu. The catchment as a whole is significant to Ngai Tahu, due to the long association with the area for mahinga kai. Te Runanga aspire to improve its modern day mahinga kai potential. There is a particular association with Wairepo Arm, which is used as a temporary storage area for tuna.

106. As discussed earlier, the discharge is managed to minimise the loss of nutrients to the water bodies. Monitoring conditions are in place and will identify any future problems. The water is in the Wairepo Arm appears to be improving in quality.

Section 104 (1)(c) - any other matters

There are no relevant matters.

Section 105

107. Section 105 requires that in addition to the matters in s104, regard must be had to:

(a) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and
(b) the applicant's reasons for the proposed choice; and
(c) any possible alternative methods of discharge, including discharge into any other receiving environment.

108. The nature of the discharge and sensitivity of the environment is described above. There are no reasonable alteratives to the discharge of effluent to land on the property.

Section 107

109. Section 107 restricts the granting of discharge permits that give rise to particular effects in the receiving waters. I am satisfied that none of the effects listed in section 107 will occur.

PART II OF THE RESOURCE MANAGEMENT ACT 1991

110. The purpose of the Act is to promote the sustainable management of natural and physical resources. Sustainable management involves managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural well-being and for their health and safety.

111. However, the Act promotes the use and development of natural resources only while (s5):

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and
(b) safeguarding the life-supporting capacity of air, water, soil and ecosystems; and
(c) avoiding, remedying or mitigating any adverse effects of activities on the environment.

112. The effects of the proposed activities have been discussed above. With the conditions proposed, the life-supporting capacity of water resources will not be affected, and potential adverse effects will be minor.

113. Overall, we consider that the activity meets the purpose of the Act.

Section 6, 7 and 8

114. Sections 6 and 7 identify matters that must be recognised and provided for, and matters to which particular regard should be had. Section 8 requires that the principles of the Treaty of Waitangi are taken into account. Of relevance are Section 6(e) - the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, wahi tapu and other taonga, Section 7(a) kaitiakitanga, and Section 7(h) – the protection of the habitat of salmon and trout.

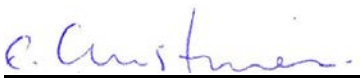
115. The effect on water quality, which affects the relationship of Ngai Tahu with the catchment, has been discussed earlier. We are satisfied that nutrient loss will be minimised, and that effects on the wider catchment will be negligible. Kellands Pond will be monitored, and measures put in place should water quality deteriorate. We note that the decline in water quality experienced to date is due to the wider farm operation, and the dairy effluent is a small part of this. We cannot control other aspects of the farm operation through this consent.

116. For the same reasons, we are confident that there will be a no more than minor effect on habitat for salmon and trout.

DECISION

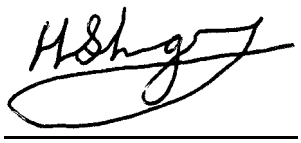
117. For the reasons given above, we grant application CRC121814 to discharge effluent to land and to air, subject to the conditions set out in Annexure 1 below, with an expiry date of 16 August 2022. This is the same expiry date as the dairy effluent discharge for the 'new dairy shed' operation, and will allow consideration of nutrient discharges from the property to be considered together.

DATED the 3rd day of October 2013

Signed: 

E Christmas, Chair

Signed:



H Langsbury, Commissioner

Annexure 1 Conditions of consent

1. The discharge shall be only:

   (a) Liquid effluent diluted with wash down water, ("the diluted discharge");
   (b) Solid effluent ("the solid discharge"); and
   (c) Odour from the liquid and solid effluent in 1(a) and 1(b) and odour from the effluent storage facility.

2. The liquid and solid effluent specified in the condition 1(a) and 1(b) shall only be derived from a dairy shed located on the land parcel with the legal description Pt Lot 1 DP 301367 as shown on Plan CRC121814a which forms part of this consent.

3. The discharge specified in condition 1(a) and 1(b) shall only be onto the area labelled the "Discharge Area" on Plan CRC121814a which forms part of this consent.

4. The maximum nitrogen loading from the Diluted Discharge shall not exceed:

   (a) 64 Kilograms of nitrogen per hectare per year within the Discharge Area; and

   (b) 13,920 kilograms of nitrogen per year discharged from the spray irrigation over the whole Discharge Area.

5. The maximum nitrogen loading rate shall not exceed:

   (a) 200 kilograms of nitrogen per hectare per year; or

   (b) 100 kilograms of nitrogen per hectare within any consecutive three month period.

6. Nitrogen, phosphorous and potassium loadings from the discharge(s) specified in condition 1(a) and 1(b) shall be determined at least once every two years using an interactive farm nutrient budgeting model. The results of the interactive farm nutrient budgeting model are to be provided to Environment Canterbury Attention: RMA Compliance and Enforcement Manager within one month of the calculation.

7. Grab samples of effluent shall be taken from the effluent storage pond, four times per year in January, April, July and October and analysed for total nitrogen and;

   (a) shall be analysed using the most appropriate scientifically recognised and current method by a laboratory that is certified for that method of

analysis by an accreditation authority such as International Accreditation New Zealand (IANZ); and

(b) data collected over each twelve month period shall be used to calculate an annual mean total nitrogen concentration which shall be used to ensure compliance with condition 4 and for inputs into the interactive farm nutrient budgeting model specified in condition 6; and

(c) the results of the samples taken and analysed under clauses 7(a) and 7(b) shall be provided to Environment Canterbury, Attention: RMA compliance and Enforcement Manager as part of the annual report specified in the condition 31.

8. The volumes of effluent discharged shall be measured by a flow meter located on the outlet pump from the storage pond for each event where effluent is being disposed and recorded as required in the Effluent Management Plan. The flow meter shall have an accuracy of within plus or minus five percent or better.

Irrigation of Diluted Discharge

9. The Diluted Discharge shall only be via a spray irrigation system.

10. If the irrigation system used to distribute the Diluted Discharge is also used to distribute water, a backflow preventer manufactured in accordance with AS 2845.1 (1998) or an equivalent standard, shall be installed within the pump outlet plumbing or within the mainline, to prevent the backflow of water or contaminants into the bore.

11. Any backflow preventer, referred to in condition 10, shall be tested to the standard set out in AS 2845.3 (1993) or an equivalent standard within one month of its installation and annually thereafter by a suitably qualified person, A test report shall be provided to the Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager, within two weeks of each inspection.

12. (a) (i) The discharge shall only be onto risk category class D soils for effluent, as defined in Houlbrouke D, Laurenson S and Carrick S, 2011, '*Categorising the environmental risk from land application of liquid wastes based on soil properties',* Report prepared for Marlborough District Council.

(ii) The risk category class D soils for effluent within the discharge area are shown as 'Mk2+1', 'Mk2+1b', 'Mk1+2' and 'Mk2+3b' on the attached plan CRC121814b.

(ii) The extent of the risk category class D soils within the discharge area may be amended by means of a field investigation undertaken by a suitably

qualified and experienced soil scientist. The results of such an investigation, including revised soil maps and GPS locations of soils if appropriate, shall be provided to Canterbury Regional Council Attention: RMA Compliance and Enforcement Manager, prior to any discharge onto re-classified soils.

(b) The Diluted Discharge and any irrigation water applied with the discharge or within 24 hours before or after the discharge application shall not:

(i) exceed an application depth of 24 millimetres;

(ii) result in runoff of effluent from the Discharge Area; and

(iii) result in ponding on the land surface; and

(iv) shall not exceed the soil water deficit.

13. There shall be no discharge:
(a) within 20 metres of any bore, soak-hole, surface water body or artificial watercourse with the exception of springs;

(b) within 50 metres of any spring;

(c) such that the discharge is likely to run-off and enter groundwater, any surface water body or any artificial watercourse;

(d) into surface water as a consequence of the exercise of this consent;

(e) onto frozen ground or snow-covered ground.

14. The discharge specified in condition 1(a) and 1(b) shall be managed to ensure that aerosols and spray-drift arising from the application of the discharge onto land are contained within the boundary of the property.

15. Any contaminant contained within any associated distribution or treatment system, shall not cause an odour which results in offensive or objectionable effects on the environment beyond the property boundary.

Monitoring and Management

16. An Effluent Management Plan shall be submitted to the Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager, within one month of the granting of this consent.

17. The Effluent Management Plan shall set out how the activity authorised by this consent will be operated to enable compliance with this consent and shall include but not be limited to:

(a) daily operation and maintenance procedures including maps;

(b) details of the sampling carried out under conditions 6, 7, 23 and 26;

(c) details of contingency measures in the event of equipment failure and adverse weather conditions;

(d) how and when equipment maintenance will be carried out; and

(e) relevant emergency contact details.

18. The consent holder shall manage their operation in accordance with the Effluent Management Plan to ensure the conditions of this consent are complied with at all times.

19. Prior to any change in the activity authorised by this consent occurring, the Effluent Management Plan shall be updated and shall be supplied to the Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager.

20. A copy of the Effluent Management Plan shall be given to all persons undertaking activities authorised by this consent.

21. The Effluent Management Plan shall be updated annually, and a copy of the updated plan shall be received by the Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager, no later than 1 August each year.

22. A copy of this resource consent and a summary of the Effluent Management Plan responsibilities shall be positioned in a prominent place in the dairy shed at all times.

Groundwater monitoring

23. The consent holder shall, at the frequencies described in condition 29, take a groundwater sample from the following monitoring bores shown on Plan CRC121814a:

(a) H39/0186 (control bore) at or about map reference NZMS 260 H39:7090-4800;

(b) H39/0187 at or about map reference NZMS 260 H39:7270-4860;

(c) H39/0188 at or about map reference NZMS 260 H38:7360-5070; and

(d) H38/0229 (ECan bore) at or about map reference NZMS 260 H38:7700-5220;

24. The groundwater samples specified at condition 23 shall be analysed:

(a) for nitrate-nitrogen, ammoniac nitrogen, total nitrogen, dissolved reactive phosphorous, *E. coli* and electrical conductivity;

(b) using the most appropriate scientifically recognised and current method by a laboratory that is certified for that method of analysis by an accreditation authority such as International Accreditation New Zealand (IANZ).

25. The results of the analyses obtained in accordance with condition 24 shall be provided from the laboratory referenced in clause 24(b) to the Canterbury Regional Council via an agreed digital exchange format, with reference to Canterbury Regional Council assigned site numbers, (well numbers or water quality site numbers) within 10 working days of completion of the analysis.

Surface water monitoring

26. The consent holder shall, at the frequencies described in condition 29, take surface water samples from:

(a) The Borrow Pit at or about map reference NZMS 260 H38: 7520-5270; and

(b) Kellands Pond at or about map reference NZMS 260 H38:7580-5220.

27. The surface water samples specified at condition 26 shall be analysed:

(a) for nitrate-nitrogen, ammoniacal nitrogen, total nitrogen, total phosphorous, dissolved oxygen (field meter), *E.coli*, turbidity, temperature, pH and electrical conductivity and chlorophyll a; and

(b) using the most appropriate scientifically recognised and current method by a laboratory that is certified for that method of analysis by an accreditation authority such as International Accreditation New Zealand (IANZ).

28. The results of the analyses obtained in accordance with condition 27 shall be provided from the laboratory referenced in clause 27(b) to the Canterbury Regional Council via an agreed digital exchange format, with reference to Canterbury Regional Council assigned site numbers, (well numbers or water quality site numbers) within 10 working days of completion of the analysis.

29. The water quality samples described in conditions 23 and 26 of this consent shall be taken in October, January, April and July for the duration of the consent.

30. The results of the sampling undertaken in conditions 23 and 26 shall be compared to:

(a) Table CRC121814 (1) and table CRC121814 (2) appended to this consent.

(b) The water quality in control bore H39/0186 specified at condition 23(a).

31. The consent holder shall provide an annual report to the Canterbury Regional Council, Attention: RMA Compliance and Enforcement Manager, by 15 September each year. The report shall include but not be limited to:

(a) a summary and interpretation of the data collected under conditions 24 and 27;

(b) identification and discussion of any trends in the results;

(c) a comparison of the results with results in previous reports prepared under this consent, the results from control bore H39/0186 and with the data provided in tables CRC121814 (1) and CRC121814 (2) of this consent;

(d) an explanation of any operational difficulties, changes or improvements made to the processes which could result in changes in the effects on water quality or the wastewater discharged; and

(e) if applicable, an outline of any measures undertaken to mitigate any adverse environmental effects and to prevent a recurrence and a comment on the effectiveness of these measures. Measures may include, but are not limited to:

i. additional sampling and analysis;

ii. investigation of whether the exceedance has adversely affected groundwater quality or surface waterways; and

iii. changes in the farm management, such as improving the treatment of the dairy shed effluent, improving the efficiency of irrigation to minimise drainage to groundwater and changing the distribution of irrigation, including effluent, on the property.

Administration

32. The Canterbury Regional Council may, once per year, on any of the last five working days of March, June or November serve notice of its intention to review the conditions of this consent for the purposes of:

(a) dealing with any adverse effect on the environment which may arise from the exercise of this consent and which it is appropriate to deal with at a later stage;

(b) requiring the adoption of the best practicable option to remove or reduce any adverse effect on the environment;

(c) requiring the consent holder to carry out monitoring and reporting instead of, or in addition to, that required by the consent; and

(d) requiring the consent holder to undertake remediation action instead of, or in addition to, that required by the consent.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

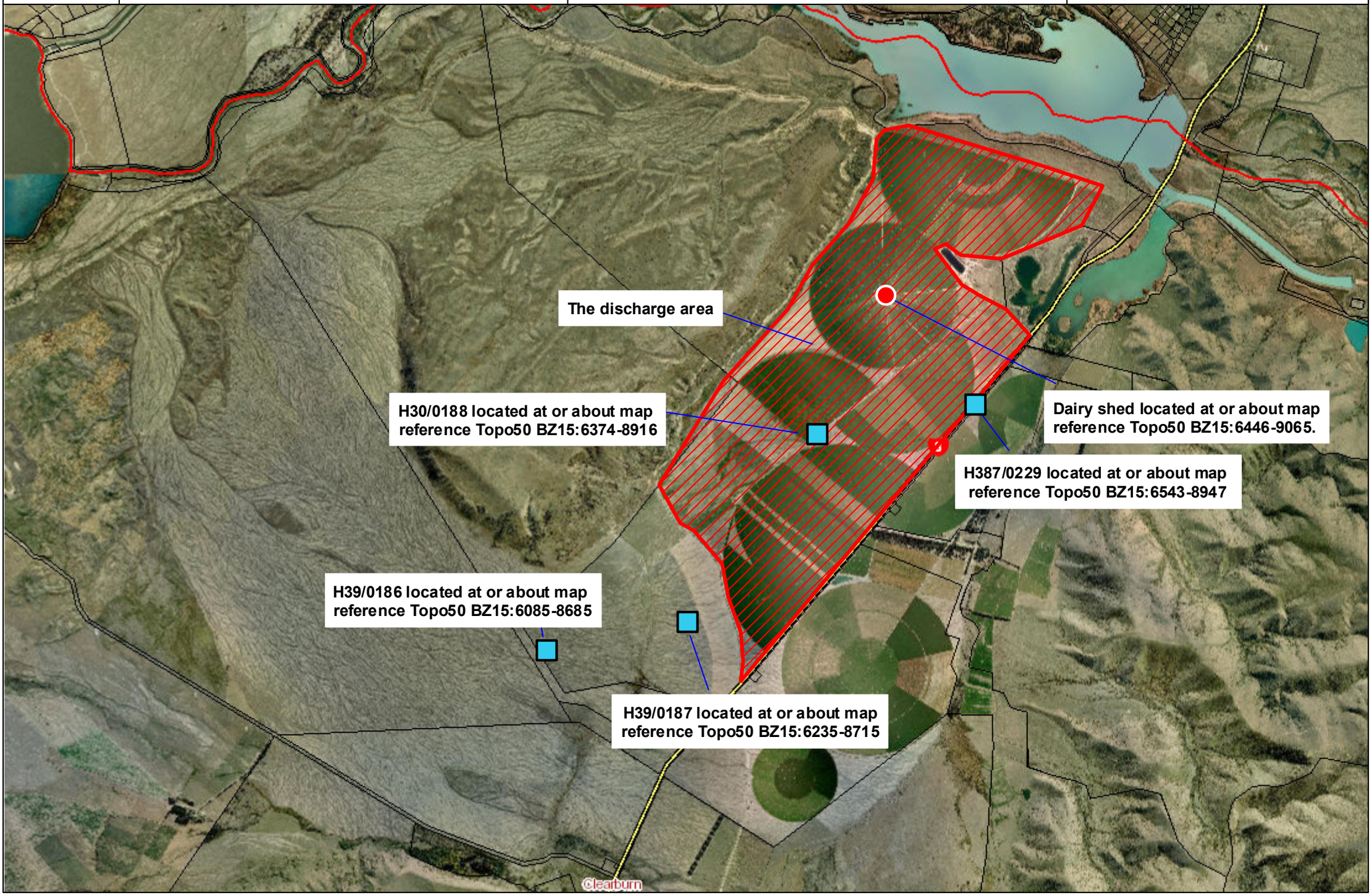
Plan A CRC121814 DR McIntyre

N

0 0.5 1 1.5 2 Kilometres

Scale: 1:50,000 @A4

Map Created by Environment Canterbury on 8/10/2013



PLAN CRC121814b

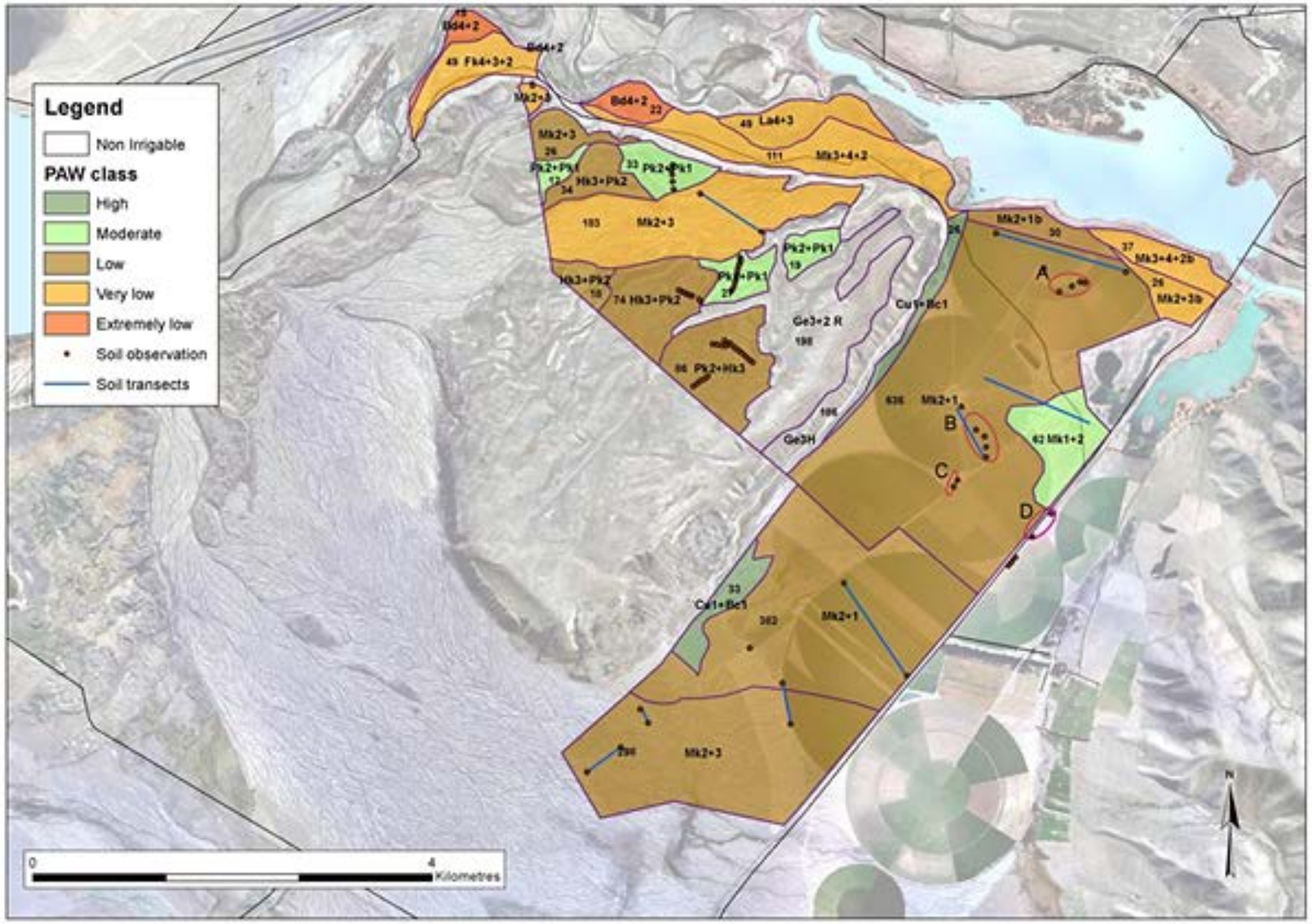


Table CRC121814 (1)

<table>
<tr><th rowspan="3">Management unit</th><th colspan="4">Ecological health indicators</th><th>Eutrophication indicator</th><th>Visual quality indicator</th><th>Microbiological indicator</th></tr>
<tr><th colspan="2">Dissolved Oxygen [min] (%)</th><th rowspan="2">Temp [max] (ºC)</th><th rowspan="2">Lake SPI* [min grade]</th><th rowspan="2">Trophic Level Index (TLI)* [max score]</th><th rowspan="2">Colour</th><th rowspan="2">Suitability for contact recreation [SFRG]*</th></tr>
<tr><th>Hypo-limnion</th><th>Epilimnion</th></tr>
<tr><td>Natural state</td><td colspan="7">Lakes are maintained in a natural state</td></tr>
<tr><td>Large high country lakes</td><td rowspan="5">70</td><td rowspan="5">90</td><td rowspan="5">19</td><td>Excellent</td><td>2</td><td rowspan="6">The natural colour of the lake is not altered by more than five Munsell Units</td><td>Good</td></tr>
<tr><td rowspan="2">Small to medium sized high country lakes</td><td rowspan="2">High</td><td>Māori Lakes and Lakes Emily, Emma and Georgina
4</td><td rowspan="2">Good</td></tr>
<tr><td>All other small to medium sized high country lakes
3</td></tr>
<tr><td rowspan="2">Coastal lakes</td><td rowspan="2">Moderate</td><td>Coopers Lagoon/Muriwai
4</td><td rowspan="2">No value set</td></tr>
<tr><td>All other coastal lakes
6</td></tr>
<tr><td>Artificial lakes - on-river</td><td>High</td><td>3</td><td>Good</td></tr>
<tr><td>Artificial lakes – others</td><td>20</td><td colspan="3">Suitable for the purpose of the lake</td><td>4</td><td>Suitable for the purpose of the lake</td></tr>
<tr><td rowspan="2">All lake management units</td><td colspan="7">Toxin producing cyanobacteria shall not render the lake unsuitable for recreation or animal drinking water</td></tr>
<tr><td colspan="7">Fish shall not be rendered unsuitable for human consumption by contaminants in a lake</td></tr>
</table>

*Key:

Lake SPI = Lake Submerged Plant Indicators from Clayton J, Edwards T, (2002) LakeSPI: a method for monitoring ecological condition in New Zealand lakes (Technical report version 1 Report by NIWA)

TLI = Trophic Level Index from: Protocol for Monitoring Trophic Levels of New Zealand Lakes and Reservoirs (Report by Lakes Consulting, March 2000)

SFRG = Suitability for Recreation Grade from: Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas, Ministry for the Environment, June 2003

Table CRC121814 (2)

Management unit	Subunit	Appearance & Palatability	Health indicators			
		Guideline value for any aesthetic determinand [DWSNZ*]	Nitrate-nitrogen Concentration (mg/L)		Escherichia coli [median concentration of organisms per 100ml of water]	All other inorganic or organic determinands of health significance [DWSNZ*] (% Max Acceptable Value)
			Max	Average		
Coastal Confined Gravel Aquifer System		Water quality in each aquifer is maintained at least in the state recorded or reasonably deduced in the three years prior to 1 November 2010				
Unconfined gravel aquifers	Shallow groundwater predominantly recharged by soil drainage	Within the Guideline value	< 11.3	≤ 5.6	< 1	≤ 50% MAV
	Deep groundwater predominantly recharged by rivers	Water quality is maintained at least in the state recorded or reasonably deduced in the three years prior to 1 November 2010				

*Key
DWSNZ = Drinking Water Standards for New Zealand 2005