WHITE WATERS LTD

APPLICATION EVIDENCE FOR HEARING

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of a resource consent application
BY	**WHITE WATERS LIMITED** **<u>Applicant</u>**
TO	**ENVIRONMENT SOUTHLAND** **<u>Local Authority</u>**

JOINT STATEMENT OF EVIDENCE OF

JOHN SCANDRETT
AND
QUINTON SCANDRETT

ON BEHALF OF

WHITE WATERS LTD

21 AUGUST 2018

QUALIFICATION AND EXPERIENCE:

1. My full name is John Stirling Scandrett

2. I am an Agricultural and Engineering Consultant and have been in sole practice since 2002. I am the principal consultant of Dairy Green Limited. Quinton Scandrett has been the lead consultant for the White Waters Limited applications.

3. Dairy Green Ltd is a local Southland business that provides consultancy services typically within the agricultural industry. The company has a diverse client base which includes farming businesses, primary industry service & processing businesses and government agencies. The majority of clients and associated work are within the Southland and Otago regions; however, clients are situated across New Zealand. Dairy Green Limited runs along-side its founding business Scandrett Rural Ltd which provides sheep and beef farm management consultancy and facilitation of numerous discussion groups within the South Island.

4. I hold the qualification of Bachelor of Agricultural Science with first class Honours from Lincoln University.

5. I hold the qualification of; Certificate in Farm Dairy Effluent System Design and Management from Massey University, 2011; and

   Certificates in Farm Dairy Effluent Pond Design and Pond Construction Training courses from Infratrain New Zealand Ltd, 2012.

6. I have been involved in the following relevant projects and work:

   (a) From 2003 to 2005 I facilitated a Sustainable Farming Fund project called Dairy Green, which developed low rate effluent application using K-Line pods. Further developments included solids separation using passive settling for dairy farm effluent and pulsed effluent irrigation.

   (b) I have been involved in farm drainage design since 1981, including the drainage of hundreds of hectares of farm land in the Te Anau basin. I am particularly familiar with the drainage of seasonally wet seepages typical of this land area.

   (c) I have been involved in resource consent applications through the Regional Council for clients over the last 10 years.

   (d) I have designed, supervised the construction of and installed many dairy farm effluent systems including storage structures, pumping systems, irrigation mainlines and irrigation technology.

   (e) I have carried out annual data collection and assessments of soils, water and effluent, providing written reports for clients to allow compliance with consent requirements relating to effluent application.

7. My full name is Quinton Richard Scandrett

8. I am an Agricultural and Engineering Consultant and have been in full time employment with Dairy Green Ltd since 2010.

9. I have studied at Lincoln University and through Massey University towards a Bachelor of Agriculture with a minor in soil science.

10. As part of this study I completed a specialist soils research paper which included a literature review on the application of effluent to well drained soils under the supervision and assessment of Professor Keith Cameron.

11. I have worked on dairy production units in Southland and Canterbury.

12. I have been involved in the following relevant projects and work:

    (a) From 2013 – 2015 I carried out monitoring and data collection for NIWA on a dairy farm in Southland monitoring the seasonal range in effluent volumes, effluent composition and biogas production.

    (b) I have been involved in resource consent applications through the Regional Council for clients over the last 8 years.

    (c) I have designed, supervised the construction of and installed many dairy farm effluent systems including storage structures, pumping systems, irrigation mainlines and irrigation technology.

    (d) I have provided on farm education and systems training to clients in the sustainable application of dairy farm effluent to land.

    (e) I have carried out annual data collection and assessments of soils, water and effluent providing written reports for clients to allow compliance with consent requirements relating to effluent application.

13. In preparation of this evidence John Scandrett and Quinton Scandrett have reviewed;

    (a) The information provided via email on the 14th of August 2018 by Environment Southland; headed *Hearing Report and appendices attachments for White Waters Ltd*

    (b) National Policy Statement for Freshwater Management - 2014

    (c) Resource Management Act (RMA) – New Zealand, 1991. Relevant objectives and policies to the proposed consented activity

    (d) Regional Water Plan (RWP) – Southland, 2010

    (e) Regional Effluent Land Application Plan (RELAP) – Southland, 1998

(f) Te Tangi a Tauira – Murihiku, 2008

(g) The proposed Southland Water and Land Plan (pSWLP) – decisions version 4th April 2018

(h) Compliance Overview – Environment Southland Effluent Discharge Authority number 301177, White Waters Limited 2012 - 2018

(i) Houlbrooke DJ, Monaghan RM 2009. The influence of soil drainage characteristics on contaminant leakage risk associated with the land application of farm dairy effluent. Environment Southland, October 2009.

(j) Roach CG, Longhurst RD, Ledgard SF 2001. Land application of dairy farm effluent for sustainable dairy farming. Proceedings of the New Zealand Grasslands Association 63: 53-57.

(k) White Waters Ltd – Megapond Structural Review. Kensington Consulting, August 2018.

CODE OF CONDUCT

14. Both John Scandrett and Quinton Scandrett have read and agree to comply to the code of conduct for expert witnesses as consolidated into the Environment Court practice note for expert witnesses 2014.

EXECUTIVE SUMMARY

15. White Waters Ltd (WWL) is applying for the renewal of dairy effluent discharge to land and groundwater abstraction consents that were first granted after public notification and a hearing in 2012.

16. The viability of WWL business is dependant on the granting of these consents.

17. The management aim of the effluent application to land is for all nutrients to be applied in a manner that allows them to remain in the root zone for plant uptake.

18. During the course of the last 5 years the effluent storage and pumping infrastructure has been upgraded with appropriate fail safes and monitoring systems also installed.

19. The Hynds storage pond has adequate storage based on a conservative scenario used in the DESC.

20. The Te Anau soils on the property are nominally low risk soils for effluent application, however a conservative approach is being taken to irrigation scheduling. Irrigation will be based on there being an adequate soil moisture deficit for the depth of effluent to be applied.

21. The irrigation area is sufficiently sized at 103 ha to ensure sustainable application of effluent and the nutrient it contains.

22. Best practice effluent application management will be applied and the direct loss of nutrients from the effluent is expected to be close to zero for nitrogen and phosphate.

23. Therefore, the effects of the discharge will be less than minor.

24. The application meets the required policies in the pSWLP and RWP.

25. The proposed activity is consistent with the purpose and principles of the RMA 1991.

SCOPE

26. White Waters Limited (WWL) is applying for a dairy farm effluent discharge to land and ground water take to be able to operate an existing dairy farm.

27. Without these consents WWL cannot operate sustainably as a dairy farm. We note that Miss Allan has not given any consideration in her report to the economic loss that will occur as a result of the application being declined. Although it is acknowledged that Section 104 (2A) does not apply in this instance, there is still clear direction in both the pSWLP and NPS for Freshwater Management to recognise that the use and development of land and water resources enables people and communities to provide for their social, economic and cultural wellbeing. By not granting consent to this application the land will not be able to continue to operate sustainably as a dairy farm, which will result in a loss of income for the client. This will negatively affect the client, his family and staff both economically and socially. We ask that the Hearing Panel take this into consideration when making a decision on the application.

28. What needs to be determined is will there be an environmental effect from the discharge of effluent to land as proposed and will that effect be less than minor. The evidence presented here will explain why the proposed discharge activity will have effects that are less than minor.

EVIDENCE

29. This document will review the application details, describe the components of the effluent system, comment on relevant details and discuss system management. It will

discuss the expected effects of the discharge using relevant, applicable science that is available. This science is the most reliable means of making an assessment, because generally when monitoring at a farm level it is not possible to differentiate between the stock effects, which are a permitted activity and the discharge effects.

30. The evidence will demonstrate that the effluent system can be operated sustainably and with effects that are less than minor on the environment.

APPLICATION BACKGROUND

31. WHITE WATERS LTD is an existing dairy property situated at 893 Kakapo Road, Te Anau. The previous effluent discharge and groundwater abstraction consents expired on the 26th of July 2017. R.D Agritech Ltd completed the initial consent renewal application with work on this commencing in April 2017. The application was lodged in September 2017, the application was returned by Environment Southland as incomplete under section 88. The application was relodged on the 6th of April 2018. Dairy Green Ltd were requested to assist with the application on the 18th of April 2018, Council were informed of this change in consultant on the 18th of April 2018.

32. The previous consent application which was processed during 2012 was granted following public notification and extensive consultation. The potential effects from the discharge activity were discussed at this time and monitoring was proposed to allow potential effects from the activity to be measured.

33. The discharge consent conditions proposed are the same as the previous consent with two additions, the inclusion of effluent generated by calves in a calf rearing shed as recommended by the Regional Council and the use of low rate effluent irrigation which can be considered best practice effluent management relative to the effluent receiving area. Draft conditions were provided on the 27th of July in the information provided following the pre hearing meeting.

34. Further to that the applicant will undertake through their consultant surface water monitoring as it is considered most relevant to the physiographic zone and proposed activity. The applicant tried to advise Council that the proposed monitoring bore location would not be suitable and suggested a different location, which was not accepted. Some of the non compliance history for the previous consent relates to the delay in timing of the bore being drilled due to these discussions with Council and non compliance due to the delay in supplying to the consent authority the bore log and water level. Groundwater monitoring has not been possible because the bore is dry.

35. Compliance: A large proportion of the compliance issues with the property relate to the original conversion and implementation of the consent conditions over this time. Milestones or consent conditions relating to the installation of infrastructure were met, albeit late. A mistake made by a staff member lead to a further compliance breach and prosecution. Upgrades to the yard area, stone trap and pump sumps and pumps along with monitoring and alarm systems have been installed over the term of the

previous consent. **Note:** The transfer pumps in the dairy shed sumps are automated and do not need manually switched on and off. This is also outlined in the effluent operational management plan that was supplied with the prehearing further information in July 2018. Once the infrastructure was in place compliance ratings improved.

36. Where requested Dairy Green Ltd provides follow up services to ensure the applicant meets the requirements of their consent conditions. This is important as the processes associated with a consent renewal do not stop once the consent is granted.

37. The groundwater abstraction application is not in contention so has not been included in any information or discussion following, it is acknowledged that it is being declined **only** due to its association with the discharge consent.

PROPOSED DISCHARGE ACTIVITY SUMMARY

38. The discharge of dairy farm effluent from the milking of up to 599 cows, seasonal supply.

39. The discharge of effluent generated from rearing calves housed in a shed with woodchip and straw bedding during August, September and October. The R.D Agritech application had provided for this as a permitted activity under rule 38.

40. Application of effluent using a 4 sprinkler Larall low rate irrigation system, high application rate Joskin slurry tanker along with low depth and deferred irrigation management practices. The proposed installation of the Larall system has replaced the initial design consideration of using two large low rate sprinklers.

41. The Massey DESC has been used to determine the storage requirement for the proposed farming activity. Adequate storage is available as calculated by Dairy Green Ltd and Ms Johnston, expert witness for Environment Southland.

42. A sufficiently sized discharge area is proposed to allow low annual nutrient loadings per hectare as a result of the proposed discharge activity. Nitrogen loadings will not exceed 150 kg/N/ha/year from effluent.

43. A discharge area comprising approx. 103 ha of predominantly **Te Anau** soils with sensitive areas of the property either excluded outright or protected using buffer zones. Bill Risk provided the site survey and soil assessment for the initial consent application, this formed the basis of the discharge area.

44. Te Anau soils have silt loam topsoil textures with clay content typically below 20% and organic matter content above 12%. These soils have a minimal structural compaction risk. Soils are moderately to well drained with a slight vulnerability to waterlogging. These soils have a moderate plant available water holding capacity

influenced by rooting depth. Permeability is rated at moderate, soil infiltration rates are expected to be typical of a silt loam at 30 mm/hour.

45. On farm monitoring of soil moisture (Te Anau soil) and climatic conditions using Harvest Electronics. (Measured Ltd is the service agent).

46. Topography in the discharge area ranges from predominantly flat/undulating areas to rolling. The associated land classification within the discharge area includes **categories A, C and D land** which includes high risk and low risk areas for effluent application. A map has been appended (Appendix 1) with this evidence to demonstrate that there is only a very small portion of land over 7º slope in the discharge area.

47. The properties physiographic zone is Bedrock/Hill country - the critical contaminant pathway for this zone on the property is overland flow to surface water. Groundwater is minimal within these physiographic land areas and as such the risk to groundwater is low.

48. Subsurface drainage within the discharge area has been mapped as best as possible using current knowledge, this will be updated as further subsurface drainage is installed or identified.

49. A consent term of 5 years is requested as briefly discussed during the pre-hearing meeting. This is in acknowledgement of the sensitive catchments and environment surrounding the subject property.

50. Monitoring of tile drain water is proposed from an effluent receiving area and non effluent area. This may indicate if there is any effect from the effluent discharge. It is acknowledged though that the farming effect may mask any discharge effect, but this is the best option available.

EFFLUENT SYSTEM

51. Effluent from the vat stand, dairy shed and main yard is collected via a concrete channel in the yard and sand trap. PVC piping allows the effluent to gravity flow from the sand trap to the main pump sump to the west of the dairy shed and yard. Effluent from the dairy shed entry and exit races is collected in a second pump sump. A Mono brand positive displacement pump transfers the effluent to the main pump sump. A second Mono positive displacement pump is used in the main pump sump to transfer effluent via a MD 90 mm pipeline to the Hynds Mega Pond (storage tank). These two transfer pumps are <u>not</u> manually controlled, pump operation is automated using float switches. Both pumps also have loss of prime, low and high pressure fail safes. The pumps are set to turn on when the sumps are half full with effluent.

52. A float switch controlling the entry and exit race transfer pump has failed in the past however it did not result in effluent reaching surface water, a prosecution was taken

against WWL though. A new design of float switch has been installed to mitigate this issue from occurring again, along with failsafe alarms.

53. The combined volume of the sumps is sufficient to hold in excess of one days volume of effluent. High level alarm monitoring including text message alerts have been installed. The slurry tanker is used to empty the sumps in the event of a pump failure or power outage. The slurry tanker is also used to maintain an effective storage volume by de-sludging the sumps as required. The level of storage provided at the dairy shed is not dissimilar to the amount of storage that many dairy shed pump sumps have. Considering the sump sizes and expected volume of effluent produced daily the transfer pump is appropriately sized.

54. The Hynds Mega pond has a total storage volume of 1,500 m^3. This storage pond is also fitted with a high level, text message alert monitoring system. The storage pond has a 3 phase power supply to site. A DeLaval pond stirrer is installed in the storage pond to allow agitation of any sludge and the crust within the volume of effluent stored.

55. The Hynds pond is appropriately sited on the farm as it is central to the discharge area, which suits the slurry tanker and low rate application. There is no disadvantage in having the pond at this location, 20 m above the dairy shed height. Effluent pumps routinely operate between heads of 50 m and 80 m, a static lift of 20 m does not create any difficulties.

56. A new effluent irrigation distribution mainline and hydrants will be installed along the central lane from the storage pond. Up to 200 m (2 x 100 m lengths) of drag hose will be used to connect between the desired hydrant and the irrigation system. An irrigation pump will draw from the existing effluent storage pond on farm and provide the system with the design flow rate and pressures. The pump will have a high and low pressure fail safe system which will monitor the pumping pressure and shut the pump off if the operating pressure moves out of the pre-set range. The pump running time will be controlled using a simple time clock. The total run time can be set to determine the depth applied and a pulse timer can be set to reduce the application rate over a period of time, for example 2 hours rest before a second pump cycle.

57. A low rate Larall Smart Hydrant irrigation system will cover an approx. 25 ha area of the effluent discharge area. 4 sprinklers will be used which operate for a pre-set time of approx. 10 – 15 mins each per hour. The smart hydrant switches between each sprinkler based on the volume of effluent that has been applied. A flow meter on the unit controls this switching. The system design for White Waters is based on 4 large sprinklers as this is considered sufficient for the consented herd numbers and paddock sizes. This also allows easy placement of each individual sprinkler within a paddock to avoid specific riskier areas. The sprinklers are simple to move and require low labour inputs for the application of large volumes of effluent especially compared to the slurry tanker.

58. It is proposed to have a low rate effluent system that can potentially manage the total annual effluent volume of 8,367 m^3 which has been determined by the DESC. The system and its proposed receiving area, assuming a maximum of 150 kg/N/ha is

applied with an average effluent nitrogen concentration of 40 mg/L is sufficient in size. However, potassium loadings will be the determining factor as to how much effluent and subsequent nitrogen is actually applied per hectare. It is widely recognised that potassium concentrations in effluent are typically higher than nitrogen.

59. The Larall system has been demonstrated to be capable of applying sufficient volumes of effluent to maintain adequate buffer capacity in the storage tank. Further to that the average application rate is below 2 mm per hour. The greatest strength of any low rate system such as the Larall is that pumping time controls the application depth.

60. The Larall system utilises a flow meter to control the switching between sprinklers, this is arguably a more reliable and consistent method of controlling application depths compared to a manually operated or timer controlled system, it also proves a record of the volume of effluent pumped, we are unaware of any other effluent irrigation systems other than custom installed ones that control pumping time to the sprinklers using cumulative flow or have a flow meter to record volumes applied. The Larall system can also incorporate mobile phone messages to inform of any operating faults or when the system is finished operating. These technologies are over and above the starting point for the majority of other irrigation technologies used in the region.

61. The weight of the Joskin slurry tanker owned by the applicant will not be over 50 tonnes when full of effluent as suggested by Ms Johnston. The slurry tanker holds 12 m^3 of effluent which at most will weigh 13.2 T. The tare weight of the slurry tanker will be in the order of 6.5 T. The all up weight of the slurry tanker when full is likely to be less than 19 tonnes, this load is spread over 4 flotation tyres and the rear axle of the tractor, which has either 2 or 4 tyres if duals are attached. To provide context this is a similar GVW to a truck type fertiliser bulky commonly used to apply fertiliser to farms.

62. The applicants slurry tanker has been previously shown to be able to apply effluent to less than 5.0 mm depth. There is no reason to believe that it still wont achieve this. Slurry tankers use a rotary vane vacuum pump to create the vacuum to fill the tank and supply compressed air to discharge the effluent. The pump does not come into contact with effluent and as such is not subject to wear a pump in contact with effluent does. Further to that, the nozzle size that discharges the effluent can be changed and reduced in size if necessary to reduce application depths down to 2 - 3 mm at the same travel speed. The nozzle and splash plate are easily visible and can be checked for any damage prior to use.

63. On this farm it is standard practice for the operator of the slurry tanker to only apply effluent when traveling down slope, ensuring the desired travel speed can always be achieved. Therefore the desired application depth can easily be maintained.

64. From the applicants experience an average of 3 loads of 12 m^3 can be discharged per hour, this equates to a volume of 36 m^3 per hour. That equates to 288 m^3 over an 8 hour working day. **Note:** The greatest volume that has actually been discharged in one working day on the WWL property using the slurry tanker is 492 m^3. Although

labour intensive the slurry tanker can lower the stored volume of effluent faster than a conventional pump system.

STORAGE ADEQUACY

65. In our opinion the DESC provides two key functions:

    1. To determine the storage volumes required by a farming system when completing an effluent system upgrade or installing new infrastructure such as wintering facilities or converting a property to dairy.

    2. To determine if an existing storage system on an already operating farm is sufficient to defer effluent irrigation until there is a suitable soil moisture deficit and soil temperature. The irrigation method is a critical determining factor in the storage volume required.

66. In reply to Ms Johnston, Council have consistently requested the DESC reflects the exact proposed consented scenario. In this case the proposed scenario is for a consented term of 5 years and consistent management during that period as advised by the applicant. It is not uncommon for multiple changes to be made to a DESC scenario as the result of commentary from Council. An example of this in this consent process is the request of the calf rearing shed effluent to be included in the DESC allowances.

67. The DESC assumes that the volume of irrigation entered will be applied on any given day that a soil moisture deficit exists that is 1 mm over and above the depth of effluent entered to be applied. Deferred irrigation is the postponement of application until a suitable soil moisture deficit and soil temperature is met. The benefit of this is that the application will not induce drainage allowing the nutrient to remain in the root zone to be utilised by actively growing pasture plants. An added bonus is that deferred storage capacity allows effluent to be scheduled to suit pasture grazing management and the operators time availability.

68. WWL is not proposing any change in on farm management practices during the next five years. The scenario of inputs entered into the DESC reflects the most likely management but with contingencies allowed for and is entirely appropriate. The applicants farming model is unlikely to change significantly in terms of calving date as an all grass farming system, to be efficient must operate within the provisions of the farms typical annual pasture growth curve as close as possible. It is not biologically possible to have 599 cows in milk from the 1st of September as Ms Johnston has allowed for when the calving date is the 1st of September. We believe we have opted for a very conservative and sensible calving pattern.

69. The DESC predicts a 90% probability storage volume requirement of 886 m^3. The effluent tank is 2.3 m in total depth. A volume of 886 m^3 would use a depth of 1.36 m leaving 0.94 m for freeboard and dead storage due to sludge accumulation should that be necessary.

70. The volume of storage required as calculated by the DESC provided on the 27th of July 2018 is conservative for the following reasons:

(a) The DESC requires the average number of cows to be milked for each month to be entered each month the shed is used. Under current farm management the due date for calving is 1st of September, but an average of 110 cows has been allowed for in the DESC from the 25th of August.

(b) Using industry average data, no more than 400 cows would be expected to have calved by the 30th of September, giving an average number of cows in milk for September of 200, however 360 cows has been entered.

(c) Likewise, for October the expected average number of cows in milk would be 485, but 500 has been entered.

(d) In the Autumn current farm management is to go to 16 hour milking intervals in April and then shift to once per day with the remaining cows still in milk during May. However the use of 40L wash water per cow per day has been allowed, in practice water use under this autumn regime will be significantly less than this.

(e) For spring a discharge volume of 60 m³ per day has been allowed for. This equates to 3.3 hours of run time for the Larall system. No allowance has been made in this volume for running the slurry tanker. The slurry tanker could be used to apply effluent during this time at 3 mm depth if desired.

(f) The Larall system and slurry tanker could be operated at the same time during summer and autumn allowing for the discharge of much greater than 96 m³ per day.

(g) The DESC does not allow for the entering of the umbilical system alongside the low rate system. The umbilical system could potentially empty the storage tank in one day. This is quite feasible as it only requires 24 ha of effluent receiving area to be available assuming 5 mm application depth. Machines available typically have 2 km or more of pipe to allow large distances and areas to be covered.

71. It should also be noted the DESC has a number of limitations as noted below:

(a) The DESC program has significant limitations when modelling low rate irrigation systems. The program was designed for rotating boom traveling irrigators where the speed of the irrigator determines the depth applied. For a low rate system where pumping time controls application depth the programme has limitations as multiple application depths and volumes cannot be entered within one season. The calculator does not allow irrigation to occur until the calculated soil moisture deficit is greater than the proposed depth of application entered into the programme. This means it does not allow for applications to occur at lower depths than the nominated depth. The compromise used is to enter a lower depth than the average depth that might be applied during that season.

(b) The DESC applies effluent to the 10 ha of low risk area first and then uses the full area entered into the high risk area before returning to the low risk area again. Prudent management on farm would be to use the low risk areas if necessary, during periods when soil moisture deficits are close to field capacity and to otherwise use the high risk areas. This means there is always an area of low risk soil available if required especially when minimum return periods are considered.

72. Additional points to note in regard to both the DESC and effluent management are as follows:

(a) The DESC calculations supplied to date provides an explanation for the input of 5 cows in the animal shelter over calving. This is an allowance for the calf rearing shed effluent which the Council requested be included in the discharge consent and therefore the DESC also. **Note:** The farm does not have a calving pad.

(b) In regards to the DESC "hours in yard" column. With the current version of the calculator it doesn't matter if 1 hour or 10 hours is entered for each month, it has no effect where solids are not separated on the storage requirement. Further to that, the hours entered in this section is the average time spent by cows on the yard, which is quite different from the total milking time.

(c) In regard to storage and contingency requirements, the pump sumps at the dairy shed have been entered into the DESC under storage. This is to allow for these areas as contributing to the overall catchment. They are not considered as additional deferred storage by the programme as they have not been entered as "pumped" storage. In excess of a days storage is available in these sumps if an issue arises. Secondly, the slurry tanker is available on farm which can be used to transfer, irrigate or hold effluent from milking if required. A neighbouring farmer is also a contractor and has a 12 m³ and a 18 m³ slurry tanker available as a further contingency measure.

(d) The Hynds storage pond is fitted with a Delaval pond stirrer. The stirrer will break up surface crusts and mobilise sludge on the base of the pond floor and so is an important tool for the management of solids within the effluent.

(e) The applicant is confident 40/L/cow/day is a sufficient volume of water for yard and plant wash, this is consistent with the total daily volume of water available for dairy shed and stock water of 55 m³, or approx. 90 L/cow/day.

(f) The slurry tanker is filled by creating a vacuum within the tank, it is ideally suited to handle solids in suspension and remove sludge from the pond floor and pump sumps. The Larall system is also designed to handle suspended solids.

(g) The Larall system and associated infrastructure could be installed in a matter of days. Electricity is already supplied to the proposed irrigation pump location at the pond. There are several propriety control panels available off the shelf for pump operation. The Larall system is supplied as a completed unit ready to operate.

(h) The application rate for a low rate irrigation system is pre-set by the number of sprinklers, the wetted area, nozzle size and pumping pressure. The application rate is not the variable the DESC programme considers when scheduling irrigation it is the depth.

(i) The Hynds storage pond on farm is made of concrete and is relatively small in surface area in regard to wind and wave effects so 0.3 m of freeboard is considered adequate.

(j) The pond has an effective stirring system that will limit crust development and circulate settleable solids and this coupled with the use of a slurry tanker and Larall system provides good solids control. A sludge depth of 0.1 m has been allowed for to provide for some accumulation of sludge which is dead storage.

73. The applicant proposes to apply effluent when there is an adequate soil moisture deficit for the depth to be applied. The volume of storage required was checked without allowance for the low risk soil area. The required volume was 1,257 m^3 which is 19 m^3 over the calculated effective storage volume. 19 m^3 over the surface area of the tank is insignificant being 29 mm depth.

74. The DESC has been used to demonstrate the number of irrigation days available at three irrigation depths during the dates of 10th of August to the 31st of October, a conservative approach has been taken with only the high risk soils considered.

Table 1; DESC determined application depth vs number of irrigation days – 10th August to 31st October

DESC Determined Irrigation Days - High Risk Soils; White Waters Ltd			
No. days	**3mm depth**	**5mm depth**	**7mm depth**
Min	22	17	10
Max	69	73	70
Average	43	37	32
Total *(10 Aug – 31 Oct)*	82	82	82

75. Using the minimum number of days when scheduling irrigation to 7 mm depth during the modelled time is the most conservative scenario. Using the Larall system applying effluent on the 10 days available with 2 irrigation settings allows 165 m^3 to be applied per day. This equates to 1,650 m^3 of irrigation potential. The maximum volume of effluent generated during the same period as determined by the DESC is 2,325 m^3. In this scenario the potential residual effluent volume at the 31st of October is 675 m^3 and equates to the storage tank being approx. half full. The table demonstrates the low rate system is capable of operating within the deferred irrigation criteria.

76. Soil moisture is monitored on farm with Aqua Flex soil moisture tapes to assist effluent management and irrigation scheduling.

77. On the 6th of August two of Councils consent staff inspected the Hynds tank on the WWL property as part of a site inspection for the discharge of effluent from the tank to a neighbouring property. A subsequent file note from the site visit was supplied by Council, a section in the file note stated, *"There were two stress fractures in the pond (below) structure itself although all effluent was contained"*. A picture was also provided which showed an image of one of the joins between two panels that make up the storage pond. The applicant's consultant was asked to comment on any errors or information that had been excluded from the report, the opportunity was taken to correct the Council staff member that the "stress fractures" were actually panel joins. This was overlooked and a subsequent request for a structural integrity report from a suitably qualified person followed. The applicant has had the tank inspected by a Chartered Professional Engineer who concluded the tank to be in good condition. A copy of this report has been provided as appendix 2.

78. Mr Kensington concluded in his report:

    (a) As a result of our inspection and the observations made at the time, we would conclude that the ponds structural elements all appear to be in good condition, with no visible signs of distress noted.

    (b) We would therefore conclude that the tank can remain in service and would strongly recommend a maintenance review of the joints is undertaken at the earliest opportunity as outlined more fully below and that regular inspections are maintained.

79. In summary there is adequate storage to be able to manage the application of effluent effectively. The storage on farm is fit to remain in service.

SOILS

80. The late Bill Risk, from Rural Management Services Limited inspected the soils on the White Waters property early in 2012. Bill is the person who wrote all the Soil Technical Data Sheets for the soils mapped in the Topoclimate South programme. Bill stated the following properties for Te Anau undulating and rolling shallow and moderately deep silt loam soils at the White Waters property.

    (a) Te Anau soils are suitable for effluent application as long as their limitations are recognised.

    (b) Te Anau soils have a moderate water holding capacity

    (c) Te Anau soils are moderately well drained

(d) Low vulnerability to treading damage

(e) Good recovery to treading

(f) Bypass down soil cracks is possible in very dry conditions

(g) Ponding and runoff can occur if soils are water logged

(h) High vulnerability to leaching

81. The definition of moderately well drained is soils that have adequate aeration all year except during winter at depths usually below 0.45 m and generally below 0.9 m.

82. From experience areas of Te Anau soils can be seasonally wet due to seepages redistributing shallow ground water. The seepage source area is usually small but can affect a larger area down slope of it. These seepages are readily drained with the installation of intercept drainage. In this regard they are no different to many other undulating soils in Southland.

83. Te Anau soils are not mole drainable, so this is not an associated risk factor of the artificial drainage land category rating for the property.

84. The WWL property has a soil type that exhibits matrix flow rather than bypass flow.

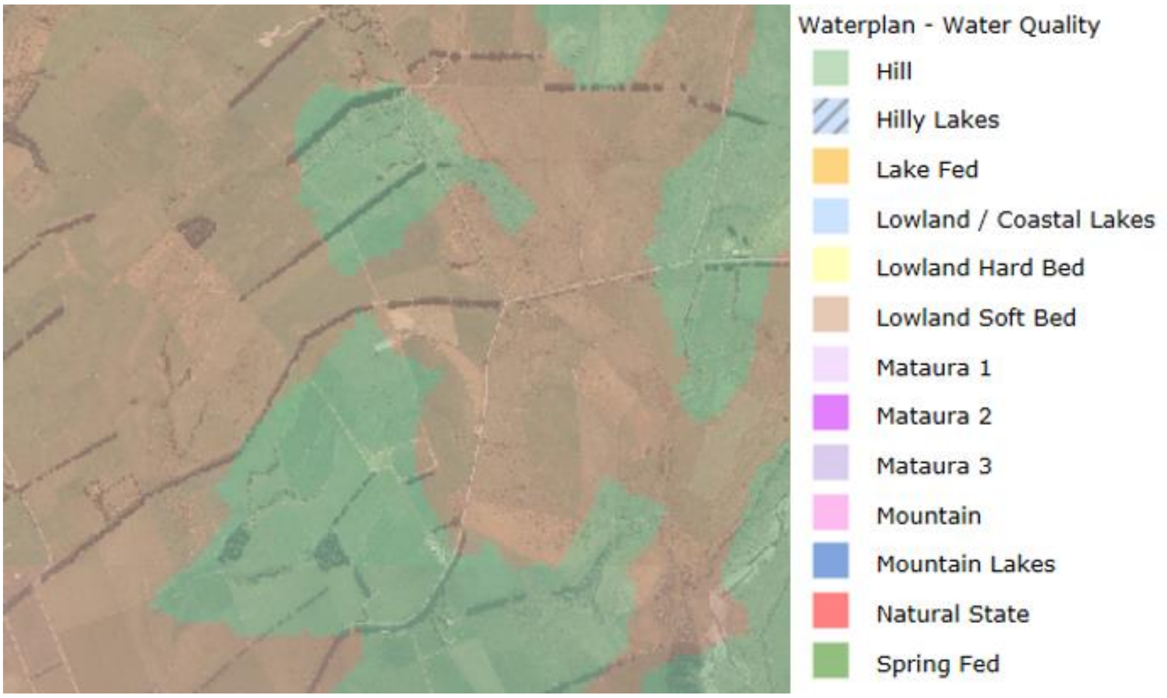
85. Within the effluent discharge block on the WWL property there are areas of well drained soils without seepages, these are low risk soils for effluent application.

86. There are no known freshwater springs within the discharge area. A spring by definition flows all year round.

87. The applicant has stated the only water way that flows through the discharge area, with part of it within the Upukerora catchment and the remaining within the Whitestone catchment, are routinely summer dry.

88. The pSWLP and RWP provide maps of the freshwater management units across Southland. Figure 1 below adopted from Environment Southlands GIS Mapping System; Beacon shows the map for the property area and surrounding vicinity, the two water quality management units on the property are Hill and Lowland Soft Bed and not Spring Fed.

Figure 1: Water quality management units associated within the subject property and the relative vicinity.



89. The applicant understands the benefits of subsurface drainage in the development of the property and its performance but also the risk that subsurface drains pose in relation to contaminant losses to surface water. However; it is the applicant's opinion that installing the subsurface drainage on the property is significantly beneficial to surface water quality as it reduces the volume of overland flow during the winter months or during extended wet periods, this is important relative to the permitted farming activity but also effluent application. With less overland flow Phosphate, E.coli and sediment losses will be significantly reduced. Dr Ryder in his evidence has identified the benefits to receiving waters by minimising phosphate loss, especially in surface water ways at risk of elevated nitrogen concentrations also. Miss Allan in her section 42A report is correct in stating that the applicant has identified drainage seepages during winter within the discharge area.

90. The applicant understands the risk associated with subsurface drainage in relation to effluent application, the location of the subsurface drainage within the discharge area has been provided on a map. This map is part of the effluent operational management plan and as such is updated at least annually, the locations of these drains represents the flow of drainage water during winter and extended wet periods annually.

TOPOGPHAHY

91. A site map of the WWL property boundary, the proposed discharge area and the slope rating has been appended with this document, see appendix 1. The approx. 30% estimation of land over 7° slope in the discharge area previously stated has been demonstrated as conservative. In reality the small area of 7° and greater slope areas will not actually be required to receive effluent.

92. The greatest risk of nutrient loss is potentially from overland flow. The options for minimising this risk include using appropriate buffer distances, low application rate irrigation and low depth irrigation. Applying effluent when there is a suitable soil moisture deficit also mitigates the risk of overland flow. All of these measures will be adopted.

93. For low rate effluent application at 1.5 mm depth per hour the risk of overland flow reaching a sensitive area such as a waterway is extremely low when a 20 m buffer distance is observed from the wetted application edge.

94. For slurry tanker operation the applicant is very aware of the need for appropriate buffer distances and is prepared to increase the buffer distance to negate any risk of overland flow. This management decision can be made at the time of effluent application, taking into account the conditions at the time.

95. The most at risk area for nutrient loss to a waterway will be in the area adjacent to the waterway that bisects the northern portion of the discharge area. The actual length of open water way in this area is only approx. 80 m. A much greater buffer distance has already been allowed for in this area as illustrated on the discharge map. The land area alongside the 80 m of open water way in this area is relatively flat.

GOOD MANAGEMENT PRACTICES SUMMARY

96. The information provided following the pre-hearing meeting by Dairy Green Ltd on the 27th of July 2018, outlined the management practices that will be implemented on farm to ensure the application of effluent results in effects on the environment that are no more than minor. Overall this importantly provided the inclusion of best practice low rate effluent irrigation. Dairy Green Ltd has provided the applicant with a design and costing for an effluent irrigation mainline, pumping system and Larall Smart Hydrant sprinkler system. Information directly from Effluent and Irrigation Ltd was provided at the time on the capability of the Larall Smart Hydrant System.

97. The good effluent management practices that will be implemented on the WWL property are consistent with current standards and meet the policies of the pSWLP, specifically policy 17, with the adoption of best practice effluent management.

98. The effluent management practices on the general good management practices fact sheet relative to the physiographic zones in the region will be adopted. Further to that the storage volume has been shown to be sufficient for the property to meet the deferred irrigation criteria specified by Houlbrooke and Monaghan.

99. Deferred irrigation is considered best practice for all effluent discharges to land in Southland. The WWL property will utilise the deferred irrigation management practice to apply effluent when a suitable soil moisture deficit occurs. However deferred irrigation will also be used to ensure a best management practice base soil temperature of 7° C is met, ensuring active pasture growth when effluent is applied and increasing the rate of nutrient uptake.

100. Best practice low rate effluent application will be utilised on the WWL property to apply effluent. Application rates below 2 mm/ hour will be achieved. This is below the 4 mm/hour definition for low rate systems provided by Houlbrooke.

101. Low depth is considered best practice for high application rate irrigation tools. The slurry tanker will be used with low depth irrigation management. This limits the volume of effluent applied and reduces the risk of overland flow and preferential flow down larger soil pores. Low depth application is best practice for rolling or sloping land areas. Low depth mitigates the need for larger buffer zones on gently sloping land e.g under 7° slope. Limiting the depth increases the number of irrigation days available over the milking season. The Larall system will also be operated under low depth management with a maximum of 10 mm per application. Importantly low depth management limits the nutrient loading applied per application, specifically K and N. Limiting N applied per setting is important as it mitigates the vulnerability of leaching loss from the Te Anau soil.

102. Pulsed irrigation is an application management "tool" that is very important when applying effluent to undulating topography especially in variable soil moisture conditions that can be typical of early spring. Pulsed irrigation allows effluent to be irrigated at a range of application depths per hour. Pulsing between 4 sprinklers allows application rates below 2 mm per hour while maintaining a flow rate of 18 m^3 per hour to ensure sufficient pumping time and volumes are achievable.

103. Buffer Distances: The management practice of using a sufficient buffer distance between the wetted irrigation area and the sensitive area being protected will be implemented at all times. There is only <u>one</u> surface water way that flows <u>through</u> the proposed effluent irrigation area. This area has been protected by a significantly larger buffer distance than the regional industry standard 20 m. Other surface water bodies have been completely excluded from within the discharge area. It was clearly explained during the prehearing meeting that the proposed irrigation area is the most suited area of the property. Soil, topography (slope) and proximity to surface water was all considered when consenting the previous and same proposed discharge area. This has been acknowledged by Dr Ryder in his evidence.

104. Best management practice has been met by having a minimum consented discharge area that meets 8 ha per 100 cows. The maximum WWL proposed

consented herd is 599 cows which therefore at this ratio requires 48 ha of receiving area. The WWL discharge area has twice this area available with a slope under 7°.

POTENTIAL EFFECTS OF EFFLUENT APPLICATION

105. The aim of operating the effluent system is to apply the effluent so that it is retained in the soil and all the nutrients available are used for growth.

106. To monitor an operating dairy farm with the aim of determining the effects of effluent application is extremely difficult because the farming effect will always be much greater than any potential effect from the effluent discharge.

107. For that reason it is best to refer to the science that is available to determine what constitutes best practice effluent application and what effects can be expected when best practice is used.

108. D. J Houlbrooke and R. M Monaghan prepared for Environment Southland a report entitled "The influence of soil drainage characteristics on contaminant leakage risks associated with the land application of farm dairy effluent". There are a number of important observations made in that report, that apply to the applicant's property.

109. The first relates to the soil type effluent is being applied to. "Soils that exhibit matrix flow show a very low risk of direct contaminate loss for FDE under wet soil moisture conditions".

110. Secondly; "In a review of potential for preferential flow across a wide range of New Zealand soil types and characteristics, Mcleod et al (2008) reported that the following soil orders in New Zealand were identified as having a low preferential flow risk: Recent soils, Pumice soils, Allophanic soils, Sem- arid soils." The Te Anau soil type is an Allophanic soil. However, we acknowledge that this soil is well to moderately well drained, i.e. some areas can be seasonally winter wet, and there are the presence of seasonally wet seepages.

111. Houlbrooke developed the concept of deferred irrigation when effluent is applied to soils with drainage limitations. "Deferred irrigation involves storing effluent in a pond then irrigating strategically when there is a suitable soil moisture deficit, thus avoiding the risk of generating surface run off or direct drainage of effluent"

112. Houlbrooke reported the results of a 3 year research trial at Massey University that assessed the direct losses of nutrients in mole and pipe subsurface drainage when FDE was applied to land according to deferred irrigation criteria. "The strategy of irrigating smaller quantities of FDE, more frequently (7 irrigation events at an average of 9 mm depth) in 2001/02 resulted in zero drainage of applied effluent through the mole and pipe drainage system and consequently no direct loss of nutrients". Average

annual nutrient losses from direct drainage of FDE following irrigation using deferred irrigation criteria over three lactation seasons were ^{C}. 1.1 kg N/ha^{-1} and 0.2 kg P/ha^{-1}. **Note:** These results were achieved with a rotating boom travelling irrigator which is a high rate application tool and the effluent was applied to high risk soils.

113. A further best management practice is to use low application rate tools. The Larall system is a low rate application tool. The Larall system is able to handle whole effluent, i.e. unseparated effluent or effluent containing solids in it. Houlbrooke states "Low rate applicators apply effluent at rates of 4 mm/hour or less and therefore reduce the risk of exceeding a soils infiltration capacity, thus preventing ponding" and "Furthermore lower application rates increase the likelihood of retaining the nutrients applied in the root zone as the low application rate reduces the risk of preferential flow and allows a greater volume of applied FDE to move through smaller pores via matrix flow, thus allowing for greater attenuation of effluent contaminates. (Houlbrooke et al 2006, Mcleod et al, 1998)".

114. The applicant wants to use the nitrogen more sustainably over as large an area as possible, this also achieves the objective of using the potassium in the effluent over a larger area.

115. The management of the effluent system and in particular when to irrigate in the proposed situation is conservative as it is not taking into account the matrix flow properties of the soil. Instead, irrigation will only be scheduled to occur when there is a suitable soil moisture deficit greater than the irrigation depth. On farm soil moisture monitoring and the Environment Southland website can both be used to assist with irrigation scheduling.

116. The proposed maximum irrigation depth is 10 mm per irrigation event for the low rate system and 5.0 mm depth for the slurry tanker regardless of whether the soil moisture deficit is greater than that. The low rate system will use pulsed irrigation to achieve an application depth of 1.5 mm per hour.

117. 5.0 mm depth of application for a slurry tanker is considered best practice in the UK when applying slurry and is based on limiting the amount of nitrogen applied. (pers comm Dr David Houlbrook). David also told me he recommended a 5.0 mm slurry application depth in New Zealand as an interim measure until some New Zealand research was done. To date he knows of no research having been done, so the interim measure of 5.0 mm depth per pass has been adopted for slurry tankers. He acknowledged that dairy effluent is likely to be 25% of the nutrient strength of slurry and a greater application depth could be safely used based on potential N loadings. The use of 5.0 mm depth is therefore conservative and considered best practice.

118. In summary, the applicant proposes to use best management practices of deferred irrigation, low rate irrigation, low depth irrigation, buffer zones. The use of the slurry tanker allows the adoption of best practice relating to nutrient loadings as it provides a suitable means of spreading effluent over a larger area and therefore mitigating effluent application effects. Best practice in terms of receiving area is considered at 8ha/100 cows which is easily achieved on the WWL property. Based on

the work of Houlbrooke and Monaghan the effects of the effluent application should be zero or close to zero.

OBJECTIVES AND POLICIES

119. The preceding technical and performance information explains why the effects of the proposed discharge will be less than minor. This then allows consideration of objectives and policies.

120. Miss Allan identifies four key provisions in her Section 42A Report which she considers the discharge to be contrary to. These are Policy 6 and Policy 17 of the pSLWP and Policy 31A and Policy 42 in the RWP. I disagree with her conclusion in respect to these provisions.

121. With reference to Policy 6 of the pSLWP, Miss Allan is of the opinion that the good management practices proposed by the application are not sufficient to avoid or mitigate adverse effects on water quality. The good management practices proposed by the application include buffer distances, low rate and low depth irrigation, and effluent storage. As identified earlier in this evidence and summarised in paragraph 118 and contrary to Miss Allan's assessment, the implementation of these methods is sufficient to avoid or mitigate adverse effects from contaminants. I therefore consider the proposal to be in accordance with Policy 6.

122. Policy 17 is split into two parts. Part 1 seeks to avoid significant adverse effects on water quality and avoid, remedy or mitigate other adverse effects of the operation of, and discharges from, agricultural effluent management systems. Part 2 of the Policy provides direction on the management of agricultural effluent systems and discharges from them. The Section 42A report makes several conclusions in respect of Part 2 of Policy 17. I disagree with the view of Miss Allan that the current infrastructure for the discharge of effluent is not designed or located in accordance with best practice. Paragraphs 51 to 64 explain that the infrastructure is suited to the property, appropriately designed and fail safes are installed.

123. I also do not agree with the assessment that the proposal is inconsistent with best practice guidelines. Miss Allan has taken a narrow view on what she considers to be "best practice" basing her opinion solely on the 'examples' referred to in the supplementary note to the policy. As identified in my earlier evidence (paragraphs 108 to 118) there is science which support the measures proposed by the application as 'best practice'.

124. With regards to Policy 17(2)(c) and (d), it is the view of Miss Allan that the current effluent management system proposed is not sufficient as mitigation to avoid any surface run-off or overland flow, and consequently the discharge of untreated effluent to water. This is strongly disputed. As previously discussed it is only proposed to irrigate when there is an adequate soil moisture deficit. The property has

adequate storage available to successfully achieve deferred irrigation criteria even if the low risk soil is not allowed for. I therefore consider the application to be in accordance with Policy 17.

125. In regard to Policy 31A of the RWP, Miss Allan considers that the management of the discharge does not meet the environmental risks posed and is therefore contrary to the policy. These risks are stated in the Section 42A Report as being a high rainfall site and containing sloping land. The attached map shows the majority of the 103 ha effluent receiving area is flatter than 7^{o} slope. The DESC confirms there are adequate irrigation days during a season to discharge all effluent. The application is therefore not contrary to Policy 31A of the RWP.

126. Policy 42 of the RWP determines land categories and identifies different criteria to match discharge to effects based on these categories. Miss Allan believes that the adverse effects of the proposal, with the mitigations proposed, will not avoid adverse effects on water quality and that this is supported by the evidence of Ms Johnston and Dr Ryder. We have identified that the soil has a background classification of Category D land with areas of Category A land and a small area of Category C land. For the purposes of irrigation management the discharge area is being treated as category A which is conservative. The application is therefore not contrary to Policy 42.

127. Miss Allan refers to a number of other provisions which she considers the application to be contrary to including Objective 15 and Policies 2, 3, 6, 15B(2), and 16(2) of the pSLWP, Objective 4 of the RWP and Policies 3.3.12(5), 3.5.1(8) and 3.5.1(10) of Te Tangi a Tauira. As outlined by this evidence, we have shown that the adverse effects from the discharge activity will be less than minor. I therefore do not agree with Miss Allen’s assessment and consider the application to be in accordance with these provisions.

128. Finally, the section 42A report does not include any assessments on social, economic or cultural effects of using the land. It should be noted that not granting a consent to discharge effluent will result in financial hardship for the applicant.

129. Any adverse effects of the proposed activities on the wider environment will be less than minor. The Proposal is not contrary to the Objectives and Policies of the RWP, RELAP, pSLWP and Te Tangi a Tauira. The proposal is consistent with the purpose and principles of the RMA.

White Waters Limited – APP 20181247

CONSENTS HEARING
APPENDICES

APPENDIX ONE

Slope Map – Effluent Discharge Area

APPENDIX TWO

Kensington Consulting
White Waters Ltd Storage Tank
Structural Assessment Report