A HEARING BEFORE

ENVIRONMENT SOUTHLAND

Under An application under the Resource Management Act
APP-20171445

Applicant **WOLDWIDE ONE LIMITED**
ABE AND ANITA DE WOLDE

BRIEF OF EVIDENCE OF JOHN SCANDRETT

16 September 2019

QUALIFICATIONS 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. Prior to that I was a farm adviser, first employed by MAF in 1981.

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. Most clients and associated work are within the Southland and Otago regions; however, clients are situated across New Zealand.

4 I also offer farm management advise through Dairy Green Ltd's founding company, Scandrett Rural Limited. This advise includes assessment and management of soils, both physical properties and soil fertility.

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

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

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

8 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 promotion of storage for deferred irrigation and solids separation using passive settling for dairy farm effluent and pulsed effluent irrigation.

(b) I have been involved in farm drainage design since 1981 and have designed drainage systems for thousands of hectares of farmland.

(c) I have assisted Agresearch Scientists with practical drainage advise for the construction of drainage systems at Edendale, Bogburn, Kelso, Tussock Creek, Woodlands Research Centre and Telford (two occasions) for the monitoring of drainage water from tile and mole systems. This includes from stock grazing

systems and after the application of farm dairy effluent (FDE) from high rate and low rate effluent application systems.

(d) I have been involved in resource consent applications through the Regional Council for clients over the last 11 years.

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

(f) 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.

(g) I worked closely with the late Bill Risk, the soil scientist who wrote the technical data sheets for Topoclimate South. Between 2008 and 2012 he assessed the physical properties of in excess of 300 subsoil samples on my behalf.

SCOPE OF EVIDENCE

9 I will report on the Woldwide Two effluent pond, soil types on Woldwide One and Two and effluent management on these soils.

10 In preparation of this evidence I have reviewed;

(a) The information provided 9th of September 2019 by Environment Southland; headed "Staff Report For Hearing, Hearing of Application APP 20191052"

(b) National Policy Statement for Freshwater Management – 2014

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

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

(e) Te Tangi a Tauira – Murihiku, 2008

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

(g) 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.

(h) 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.

(i) Characterising dairy manures and slurries, Agresearch October 2011, Dave Houlbrooke, Bob Longhurst, Tom Orchiston & Richard Muirhead

(j) Soil Bureau Bulletin 27, General Survey of the South Island, New Zealand, 1968

(k) Topoclimate South Soil Maps hosted by Environment Southland (Beacon) and soil technical data sheets hosted by Venture Southland, now Great South.

CODE OF CONDUCT

11 I have read and agree to comply with the code of conduct for expert witnesses as consolidated into the Environment Court practice note for expert witnesses 2014. I confirm that the information provided is within my area of expertise. I have not knowingly omitted to consider material facts that might alter or detract from the opinions expressed.

EVIDENCE

WoldWide Two Pond

12 Key findings of the 2002 – 2005 SFF Dairy Green project were; effluent should be applied at a rate that the soil can accept; effluent storage is needed to be able to defer irrigation until there is an adequate soil moisture deficit and the application depth should consider the quantity of nutrients being applied.

13 The Woldwide Two pond is a key mitigation measure in the management of effluent so the timing of effluent applications can suit soil moisture conditions and the demand of nutrients by pasture.

14 I believe the pond was built in 2005 using best practise knowledge at that time.

15 The pond banks were constructed from local material and lined with low permeability subsoil harvested from insitu and nearby land.

16 The volume of storage is 3,358m^3 with 0.5m of freeboard.

17 The pond is used to store wintering shed effluent, which is a slurry, and dairy shed effluent when soil conditions don't allow the direct application of effluent.

18 In 2017 Council staff directed that a pond drop test be carried out on the Woldwide Two pond as part of a consenting process, knowing that the pond stored wintering shed effluent and there would be a crust on the pond surface. The drop test was completed in November 2017

and the leakage rate was determined to be less than 2.0mm per 24 hours, with a margin of error of plus or minus 0.2mm. A Chartered Professional Engineer (CPEng) reviewed the test report and concluded the drop test result to be valid and the pond compliant with leakage limits specified in Appendix P of the Southland Water and Land Plan. The test did not meet the Appendix P criterion of no crust on the pond surface during the test because of the nature of wintering shed effluent. The CPEng concluded the result was a fair representation of the pond's performance though.

19 Prior to the drop test being completed I visited the pond in April 2017 to collect information for a structural review by a CPEng, as required by the proposed Southland Water and Land Plan at that time. The results confirmed the banks had been compacted adequately and the clay lining had a very high shear strength. It was also noted though that the action of stirring the pond prior to pumping out had caused some erosion of the clay lining and that some maintenance was required, although the pond passed the drop test leakage requirement 7 months later.

20 Given the need for 3 yearly testing of clay lined ponds in the current Water and Land Plan and that some maintenance of the liner is required the applicant has decided to install leak detection drains and a synthetic liner during the summer of 2019-2020, thereby allowing its use for the autumn of 2020.

21 A consent application has been lodged for this process and is currently being processed by Council. The upgrade design has been approved by a CPEng and the work will be signed off by a CPEng when completed.

22 Woldwide Two will have an operative pond and therefore deferred irrigation will be available for the autumn 2020. The wintering barn isn't used during summer and there is adequate contingency storage for the dairy shed effluent while the pond work is completed, especially considering low risk soils are present on the property which reduces the need for deferred effluent application.

WoldWide One & Two Soils

23 While documenting the subsurface drainage on the property in 2017 it became apparent that there was a discrepancy between the soil types depicted on Topoclimate maps and the actual soil properties observed by Mr de Wolde from many years of farming the property.

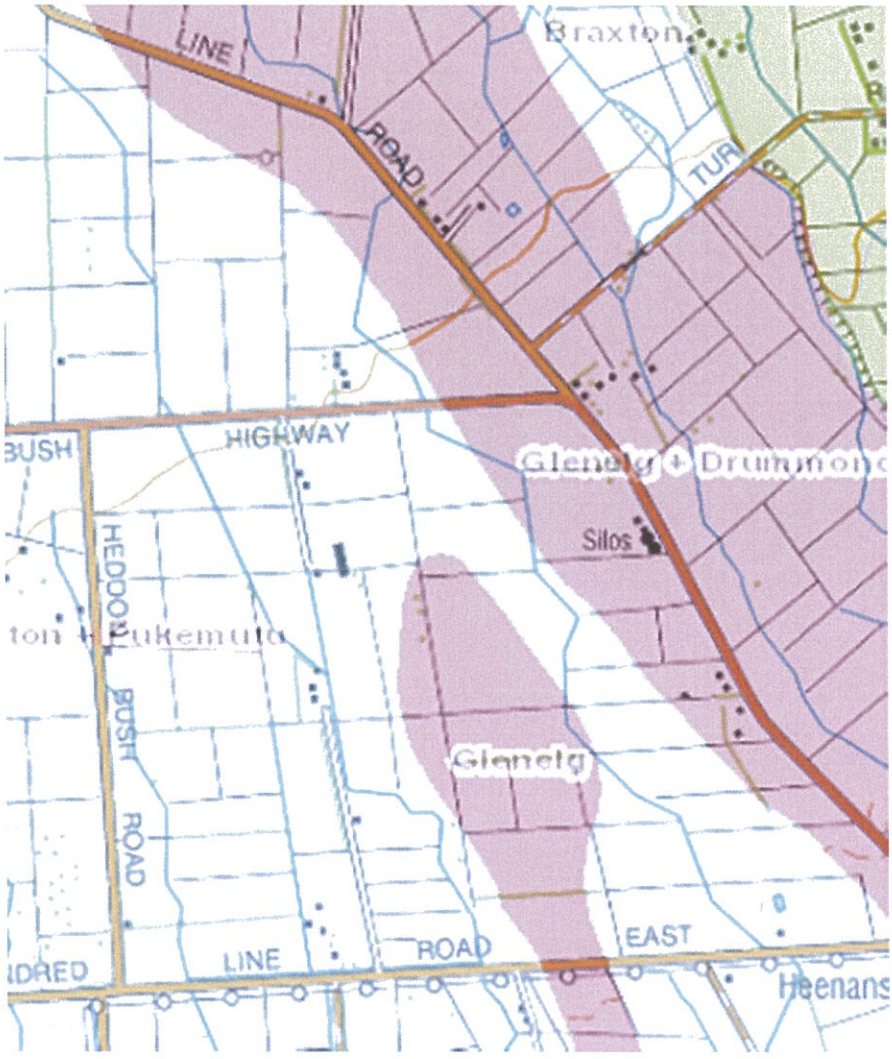
24 Topoclimate depicts most of the farm is under the Braxton soil type with intergrades to a secondary soil, the Pukemutu soil type. According to Topoclimate the dominant Braxton soil is deep to moderately deep, poorly drained and has silty clay to heavy silt loam textures. Mottles, an indication of poor drainage, occur in all horizons,

25 Topoclimate states Pukemutu soils have a heavy silt loam, grading with depth to silty clay, textures and are poorly drained, with a dense fragipan between 60 – 90cm depth which restricts drainage.

26 Braxton and Pukemutu soils respond well to tile and mole drainage and to be fully productive generally must have subsurface drainage installed.

27 Mr de Wolde confirmed tile drainage is limited to the south west corner of the farm and one short drain to the north of SH 96, the rest of the farm doesn't need drainage.

28 *The following map is taken from Topoclimate and covers Woldwide One and Two.*



29 The free draining soil that Topoclimate has mapped along the eastern boundary of the property is the Glenelg soil. This is described in the Topoclimate data sheets as stony in both the topsoil and subsoil.

30 Mr de Wolde's experience was the topsoil was largely stone free east of the Braxton soils and the subsoil, while varying in depth to gravel, was mostly stone free, other than for isolated

patches, such that the profile was typically stone free to a depth of up to 0.5 m, or more. This area covered about two thirds of the property.

31 Prior to Topoclimate remapping the soils in the area covered by the farm, the Soil Bureau Division of the DSIR had mapped the free draining soils as being of the Drummond type, as reported in Soil Bureau Bulletin 27, General Survey of the Soils of South Island, New Zealand, 1968.

32 The Drummond soil is described as a silt loam, 0.5 m deep overlaying sandy gravels, in Soil Bureau Bulletin 27. This description was a good fit with Mr de Wolde's local knowledge of the property.

33 Mr de Wolde provided farm maps showing the paddock boundaries for Woldwide One and Two and on these he marked in the soil boundaries based on his farming experience of the land. This includes where tile drains were located, the location of heavy versus free draining soils, areas sensitive to dry spells/drought etc.

34 In February 2017 I dug 28 test holes to check the soil profiles on either side of the line where Mr de Wolde believed Braxton soils changed to the Drummond type.

35 Prior to digging the test holes, I researched soil information references available for the area using:

35.1 Soil Map of The South Island New Zealand sheet 12;

35.2 General Survey of the Soils of South Island New Zealand, Soil Bureau Bulletin 27, which gave descriptions of Braxton, Drummond, Glenelg and Makarewa soils; and

35.3 Soil technical data sheets from Topoclimate for Braxton, Drummond, Glenelg and Pukemutu soils.

36 Farm plans were provided with the application showing the location of test holes. Mr. de Wolde's revised soil boundary was used as a guide to the digging of 28 test holes. Details of the profile in each paddock were provided.

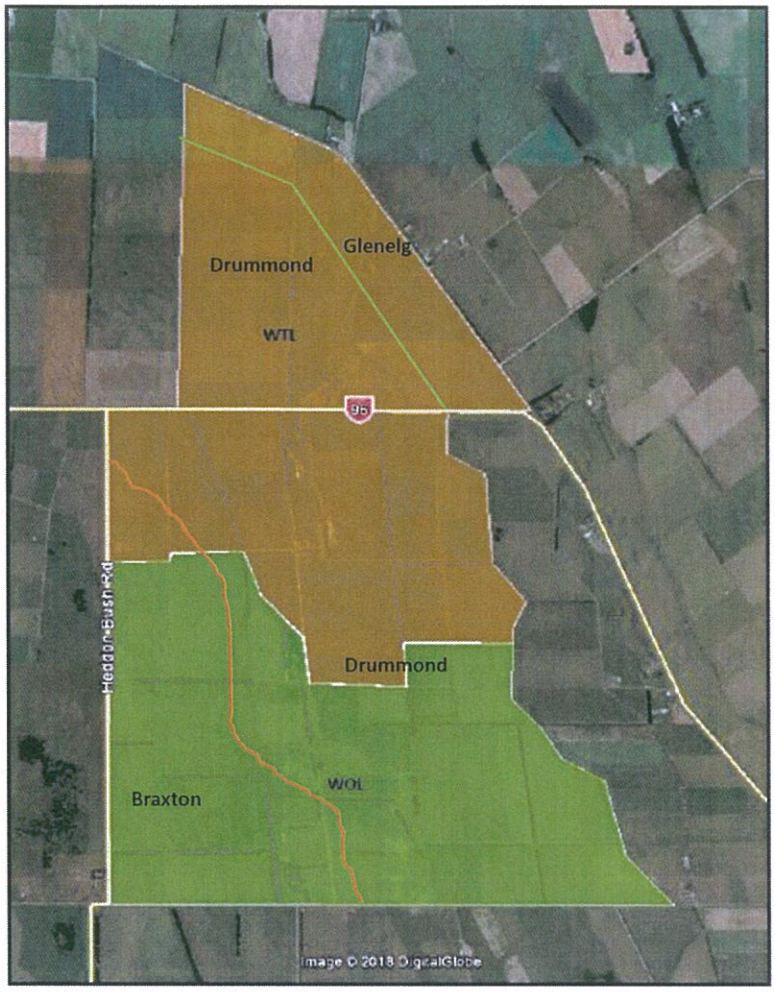
37 The aim of digging the test holes was to confirm the actual soil type at each point, how it compared to Mr de Wolde's assessment and if the Topoclimate soil boundary was correctly located.

38 The topsoil and subsoil were checked for texture using field methods and for the drainage properties mottling was taken as an indication of impeded drainage. A spear was also used to check for soil depth to gravel in the vicinity of the test hole. This confirmed whether the points at which test holes were dug were representative for the area.

39 An example of a test hole dug in paddock 23 on Woldwide One which is recorded as a Glenelg soil by Topoclimate but has no stones in the topsoil or subsoil to 0.5m depth is shown below.

40 A farm plan with revised soil boundaries was compiled, which is shown below.

Farm plan showing Woldwide One and Two boundaries and revised soil boundaries.



WoldWide soils and their suitability to receive effluent

41 Braxton soils are described as having a silty clay to heavy silt loam texture by Topoclimate. To drain these soils intensively typically requires tile and mole drainage.

42 Mr de Wolde has confirmed he purchased Woldwide One in 1991 and Woldwide Two a few years later. He has never done any mole draining on either of these properties.

43 In my experience mole drains at 40cm depth on stable greywacke-based soils such as the Braxton type will last up to 30 years before they become ineffective. It would seem likely that if there were mole drains on the Braxton soil they are no longer contributing to intensive drainage on the Woldwide farms.

44 There are a limited number of tile drains servicing the main hollows on the Braxton soils, in my experience their subsurface drainage effect will be limited to the hollows only.

45 During periods of drought natural drainage down the soil profile is enhanced by the shrinkage that occurs. My observation is that the degree of shrinkage is related to the soil structure and

pasture cover. The better the soil structure and the pasture cover the more likely the shrinkage will exhibit as many small cracks, 1-2mm wide, rather than a few large cracks, 5mm or more wide.

46 Braxton soils are suited to receive effluent provided the application depth is less than the soil moisture deficit in the topsoil. Typically on Woldwide One and Two the average application depth of slurry is no more than 2.5mm and for dairy effluent up 10mm. These depths are based on nutrient loadings rather than hydraulic loadings, as at times the soil moisture deficit will be much greater than these depths.

47 A cautious approach would be to not irrigate Braxton soils during drought conditions to minimise the risk of effluent being washed down the profile by subsequent rainfall. Further the property has a large area of Drummond soils which are low risk soils and it would make more sense to use them during dry periods.

48 Drummond soils also have a silty clay to heavy silt loam texture but are naturally well drained and can be expected to exhibit matrix flow properties.

49 Houlbrook and Monaghan in an October 2009 report prepared for Environment Southland titled "The influence of soil drainage characteristics on contaminant leakage risk associated with the land application of farm dairy effluent" describe matrix flow. They explain matrix flow is often called a piston flow effect where soil surface inputs displace and drain water situated deeper in the soil profile. They also describe how the application depth would have to be more than 50% of the plant available water holding capacity of the soil before there was a risk of contaminants directly reaching drainage water.

50 Drummond soils can be expected to store in the order of 20mm plant available water per 100mm depth. Even a very shallow Drummond soil would be expected to store more than 60mm plant available water.

51 That means in excess of 30mm depth of effluent would need to be applied to a soil already at field capacity before direct losses to drainage occurred.

52 Slurry is applied at an average depth of up to 2.5mm and dairy shed effluent at an average depth of up to 10mm, so the risk of losses to direct drainage is very low.

53 Again, a cautious approach would be to irrigate well established pasture during very dry periods as any surface cracking could be expected to be well controlled by the fibrous root system of grasses.

54 The following 3 photos were taken on 6 December 2017 during a very dry period. A localised area of lighter soil in the background had burnt off. They show paddock 23 on Woldwide One

which was in one year old pasture at the time on a Drummond soil type. The soil cracking was limited and there were no large cracks extending down the profile.

55 Reducing the depth of application is also a measure that would reduce the risk of direct contaminant losses after a drought, even further.

CONCLUSION

56 The Woldwide Two effluent pond has been drop tested and the bank compaction and clay lining tested in 2017. The pond banks were found to be stable and the drop test gave a compliant leakage rate.

57 The pond clay liner needs maintenance, and this will be addressed by the installation of a synthetic liner in 2020.

58 Woldwide One and Two are located on an approximate mix of 25% Braxton poorly drained soils, 65% Drummond free draining soil and 10% light, free draining soil.

59 These soils are all suitable to receive effluent provided their limitations are recognized. The free draining soil provides considerable flexibility in the management of effluent because of the low risk of the direct loss of contaminants to drainage.

Dated 16 September 2019

J S Scandrett

John Stirling Scandrett