

IN THE MATTER OF the Resource Management Act 1991
AND
IN THE MATTER OF applications for resource consents by Meadowflower (No CRC041784), to take ground water for irrigation.

EVIDENCE OF IAN MCINDOE

1. My name is Ian McIndoe. I am a Soil and Water Engineer and hold the qualifications of BE (Hons) from Canterbury University and Dip Bus Stud (Finance) from Massey University. I am currently employed as Principal Engineer, Aqualinc Research Ltd, of which I am a director. Previously, I was employed by Lincoln Environmental, a division of Lincoln Ventures Ltd.
2. I have 26 years experience in groundwater related work, having spent two years well drilling in Canterbury after graduation, carrying out groundwater development in the Middle East, groundwater modelling in New Zealand and prior to joining Lincoln Ventures, was MAF's water resources specialist in Canterbury involved in surface and groundwater allocation.
3. I have considerable expertise in groundwater hydraulics and well hydraulics, irrigation design, irrigation efficiency, pump tests, and related effects such as the effect of pumping on neighbouring wells.
4. In recent years, I had a major involvement in preparing or supervising the preparation of technical assessments for irrigation resource consent applications, including assessing the cumulative effects of groundwater takes on neighbouring bores, aquifers and on the environment.
5. I am currently involved in providing technical input and direction into two large groundwater investigations in Canterbury (Dunsandel-Te Pirita groundwater investigation and the Mid Canterbury groundwater investigation).
6. My primary purpose at this hearing is to present evidence to show that consent application CRC041784 should be granted.
7. In summary, the application by Meadowflower Dairies, is to take and use groundwater at a maximum combined rate of 192 litres per second, with a volume not exceeding 16,589 cubic metres a day from bores/galleries L36/1837, L36/1840 and L36/1841 for the spray irrigation of 525 hectares of crops and pasture at Steeles Road, Te Pirita.
8. Partial irrigation of this property is currently authorised under consent CRC990979, held by Meadowflower Properties Ltd. CRC990979 allows the taking of up to 113 l/s of water from the Rakaia River via the Selwyn District Council (SDC) stock water race for irrigation of land. The effective area irrigated under CRC041784 will be 332 ha, with the balance irrigated under existing consent CRC990979.

MATTERS TO BE CONSIDERED

9. The Investigation Officers report (Simon Johnson, ECan) list matters to be considered in making the decision on whether the consent authority should grant the consent. In summary, paragraph 27 of his report states that the consent authority must have regard to the effects of the activity, the Regional Policy Statement (RPS), the Transitional Regional Plan (TRP), the Rakaia Water Conservation Order (NWCO) and other relevant matters.
10. Paragraph 44 of the IO report list the following effects that could arise as a result of granting the consents.
- Adverse effect of take on surrounding groundwater users
 - Adverse cumulative effect of take on other groundwater users
 - Adverse effect of inefficient take on other groundwater users
 - Adverse effect of take on other users from seawater intrusion
 - Adverse effect of take on aquifer stability
 - Adverse effect from cross connection on groundwater quality
 - Adverse effect of take on surface water ecosystems and users
 - Adverse effect of use on water quality
 - Adverse effect of take and use on tangata whenua values
 - Positive effects of take and use
11. Of vital importance is the fact that adverse takes, in the absence of an operational water plan, have to be decided on the basis of that required by the RMA, that is in terms of potential adverse effects of the take on the environment.
12. Also vitally important, is that the application is to take groundwater, not surface water. It may be that some of the water abstracted is sourced indirectly from the Rakaia River through hydraulic linkages, but so is the majority of groundwater in Canterbury sourced from river recharge. Marc Ettema's comment in paragraph 102 that "the relevant aquifer can be regarded as an underground extension of the Rakaia River and that the allocation should all be from the Rakaia River allocation block" is completely unfounded. ^{Not} ?
13. The IO (paragraph 93) makes the point that "the assessment was prepared as a take of groundwater". That is absolutely correct, as it *is* a groundwater take. We did assess the effects of the take on other groundwater users and did not seek written approvals from surface water take consent holders.
14. It is also important to point out that the NWCO rules are not wide enough to apply to groundwater takes, whether deemed to be hydraulically linked to the river or not. The fact that some groundwater takes have had minimum flow conditions applied in the past has largely occurred because ECan has insisted on those conditions to be able to grant applications without public notification.

DESCRIPTION OF THE AFFECTED ENVIRONMENT

15. I believe that the IO, with the attached evidence from Marc Ettema, reasonably describes the regional and local environment (paragraph 35-43 of the IO report and paragraph 3-6

of Marc Ettema's report).

16. In the Te Pirita area, the Rakaia River and the shallow groundwater system lose water to deep groundwater as seen in Marc Ettema's diagram paragraph 6. This will be occurring over the full extent of the river and shallow groundwater, wherever a downward hydraulic gradient exists.
17. The fact that the Rakaia River is perched well above the deeper aquifers in the Te Pirita area (as evidenced by the difference between river water levels and deep groundwater levels), means that pumping the shallow aquifer will not significantly affect the deep aquifer. That is generally accepted by groundwater experts. Marc Ettema (paragraph 11) provides a good explanation of why that is the case.
18. Where my opinion differs to that of the IO and Marc Ettema is their belief that the shallow aquifer is simply an extension of the river and that rainfall/recharge will play a very minor part in that.
19. There is no doubt that the shallow aquifer is hydraulically linked to the river. It is also true that water moves from the aquifer to the river and vice versa. The direction of flow depends on the relative heights of river water levels and groundwater levels.
20. An examination of relative shallow groundwater levels surprisingly shows that there is a hydraulic gradient towards the river for a significant proportion of the time. That is seen in the general trend of recorded groundwater levels in the area and was evident at the end of the irrigation season this year on the Ngamarua Farm, between Te Pirita Rd and Darrochs Road. This was at a time when the reverse would have been expected.
21. At this time, I don't have a clear explanation for why that is so. I suspect that the shallow aquifer extends further into the plains than Marc Ettema suggests. The fact that it is not recorded on bore logs doesn't surprise me as drillers would naturally pass through it towards the more reliable deeper groundwater.
22. Rainfall recharge and the additional recharge from irrigation is no doubt having an effect. With irrigation in the Te Pirita area, some of the deep groundwater is effectively being transferred to the shallow groundwater through irrigation losses, and rainfall recharge is also increased due to rainfall falling on wet ground. Closer to Meadowflower, Grasslands irrigation from Rakaia River water will be transferring surface water and additional rainfall recharge into the groundwater system, raising shallow groundwater levels in that region. Within Meadowflower itself, the consented surface water take of 113 l/s will also be transferring Rakaia River water into the shallow groundwater and also increasing rainfall recharge. The other irrigation takes from the Early's intake stockwater race further down will be doing the same thing.
23. It is also interesting to look at the long term record for the ECan monitoring bore L36/0010, located in the shallow aquifer on Burns Road (Figure 1 attached). The general trend of groundwater levels in the bore follows the normal rainfall recharge patterns of being lower in summer and higher in winter. If, as Marc Ettema suggests in paragraph 10, that the time scale of effects between the river and shallow groundwater levels is short (days), why doesn't this bore record more closely follow the river flow trend, which is lowest in winter and highest in summer, especially since a lot of the records were pre irrigation in the area.

24. I think Marc Ettema's comment (paragraph 10) that the proposed groundwater take should be considered as 100% surface water take is a gross simplification and is not supported by any evidence.
25. ECan has not agreed with our estimates of transmissivity for the shallow aquifer from which Meadowflower proposes to take groundwater. Marc Ettema suggests in his evidence a value of 4000-5000 m²/d based on Rakaia Island and other galleries in Canterbury. (I would like to know which galleries he is talking about!)
26. Marc Ettema appears to have limited knowledge of gallery performance in the Te Pirita area. Contrary to his thinking, the gravels in the shallow aquifer in the Te Pirita area are not clean well-sorted gravels that would be expected to produce transmissivities of 4000-5000 m²/d. In my view, transmissivities will be much lower in the area that Meadowflower proposes to install galleries.
27. If transmissivities were as high as he suggests, why would consent holders with smaller takes need galleries at all? The reality is that the galleries in the upper parts of the river terraces (both the north and south banks) have struggled to produce sustainable consented yields. From my own personal knowledge, virtually all of the galleries from the Main South Road up to Te Pirita have had problems with sustaining flows at times. Even 50 m long galleries have struggled to provide 25 l/s sustainably.
28. Above Meadowflower, Grasslands attempted to find usable areas of shallow groundwater between the bottom terrace and the Rakaia River. They ended up taking surface water from the Early's Intake stock water race system.
29. If transmissivities were as high as Marc Ettema suggests, why would these shallow groundwater systems *all* be struggling to pump at their consented rates. I cannot be sure of what the transmissivity values would be at Meadowflower, but I am certain they won't be anywhere near 4000-5000 m²/d. In my view it is possible but will not be easy for Meadowflower to obtain 192 l/s from the three proposed galleries, because of low transmissivity.
30. The best way to find out what the aquifer parameters are is to complete a pump test. Unfortunately, the significant amount of preferred channelisation and claybound layers that occurs in these gravels and the fact that many of the assumptions applying to the use of Theis-based groundwater analysis are violated in galleries makes it difficult to draw any clear conclusions about aquifer properties and likely stream depletion effects. To compound matters, it is impossible to measure stream depletion effects in the Rakaia River because the potential stream depletion effect compared to the river flow is immeasurable.
31. Also, the assumption that all galleries are in unconfined aquifers is probably only partially correct. The depth of galleries (10 m is proposed for Meadowflower), means that the shallow aquifer could be leaky confined due to the claybound layers and channelisation that occurs. That will be known at the time of construction.
32. Personally, I see limited value in quantifying the stream depletion effects of pumping galleries on the Rakaia River to the extent that ECan suggests in the NRRP. There are too many uncertain variables in the method (eg gallery design, transmissivity, storativity,

leakage, distance, bed conductance, variation in flow rates, boundary effects, extent of aquifer, other recharge and discharge) to be able to draw any firm conclusions. It is much better to take a broader view based on the relative scale of effects and make a valued judgement on all of the available information.

EFFECT OF TAKE ON SURROUNDING GROUNDWATER USERS

33. The primary concern about groundwater takes in the Te Pirita area relates to *deep* groundwater. Given that there is wide agreement amongst experts that pumping the *shallow* aquifer will not adversely affect the deep aquifer, submitters concerned about the effect of granting the Meadowflower shallow groundwater consent on the deep groundwater need not be concerned. The IO also came to this conclusion.
34. A very conservative assessment of the effects of the take on surrounding shallow bores was taken. Our assessment used the Theis method with a low value of transmissivity and did not take into account the effect of river recharge or other forms of recharge when making this assessment. As the closest bore was found not to be adversely affected, it can be reasonably assumed that bores further away will also not be adversely affected. The IO agreed with this assessment.

ADVERSE CUMULATIVE EFFECTS ON GROUNDWATER

35. One of the main reasons that the Meadowflower consent was publicly notified was that it was a groundwater take, albeit hydraulically linked to the Rakaia River, and that it was in the Rakaia-Selwyn "red zone". Under ECan's policy, all groundwater takes in a red zone not allowed under a general authorisation are to be publicly notified because of potential cumulative adverse effects on the groundwater system and other groundwater users.
36. I think that ECan has quite rightly now agreed with our assessment that Meadowflower pumping shallow groundwater along the Rakaia River will not adversely affect other groundwater users, despite their red zone policy.
37. Because groundwater is primarily a volumetric resource and ECan now recognises that within the NRRP policies, the volume of water that Meadowflower proposes to take out of the groundwater system can be estimated using the concept of net use. This concept was described at the recent Chertsey hearing.
38. By considering the volumetric water balance for the Meadowflower property, we can get an indication of the relative magnitude of the effect of the Meadowflower take on the groundwater resource.
39. If we ignore groundwater flows such as river recharge into and out of the property from other areas, the basic equations used to describe the soil-water balance for the property are:

For non irrigated areas

$$\mathbf{Rainfall} = \mathbf{Evapotranspiration}_{dryland} + \mathbf{Recharge}_{dryland} \quad (1)$$

For irrigated areas

$$\mathbf{Rainfall} + \mathbf{Irrigation} = \mathbf{Evapotranspiration}_{irrigated} + \mathbf{Recharge}_{irrigated} \quad (2)$$

If we ignore evaporation in the air and direct runoff, the only additional water that is used

when water is applied to a crop is the increase in evapotranspiration that results from applying that water. This additional water is known as *net use*.

Net use is therefore defined as:

$$\text{Net use} = \text{Evapotranspiration}_{\text{irrigated}} - \text{Evapotranspiration}_{\text{dryland}} \quad (3)$$

Alternatively, it can be expressed as:

$$\text{Net use} = \text{Irrigation} - \text{Recharge}_{\text{irrigated}} + \text{Recharge}_{\text{dryland}} \quad (4)$$

The two equations are essentially interchangeable and have been derived from equations (1) and (2).

40. If the supply of irrigation water is from groundwater, the only additional water taken out of the ground and permanently out of the groundwater system is the net use. This fundamental concept allows us to determine a true estimate of groundwater use in the property by simply considering the difference in evapotranspiration under irrigated conditions and evapotranspiration under dryland conditions.
41. Table 1 provides an estimate of net use based on conditions likely to occur at Meadowflower. The actual evapotranspiration has been calculated using a simple soil moisture model assuming Hororata rainfall and Winchmore PET.

Table 1 : Annual net use of water

Soil	AEI irrigated (mm)	AEI dryland (mm)	Net use PET (mm)
Lismore stony silt loam	840	550	290
Waimakariri sandy silt loam	870	600	270
Templeton silt loam	880	670	210

42. The soil type on Meadowflower tends to be variable but towards the lighter end of the range. This means that net use will be about 280 mm on average, taking the higher figures to be conservative. Net use over the proposed 332 ha irrigated is therefore about 0.93 million cubic metres per year (Mm^3/y).
43. For the amount of water applied, we can conservatively use the seasonal application depth of 560 mm as suggested in the IO report (paragraph 70), which equates to $1.86 \text{ Mm}^3/\text{y}$. If we then assume that half of that water comes from the Rakaia River through hydraulic linkage with the river (and ECan suggests it is higher than that), about $0.93 \text{ Mm}^3/\text{y}$ of water will be added to the groundwater system from the river, which is the same as the net use.
44. What this means is that the effect on the shallow groundwater system overall will be neutral. If the hydraulic linkage from the Rakaia River is greater than 50%, there will be a net gain to the groundwater system from Meadowflower irrigating their land.
45. If you take into account the fact that Meadowflower already holds a consent for 113 l/s from the Rakaia River through the Early's stock water race, which is used to irrigate the remainder of the property, there will almost certainly be a net gain to groundwater from irrigation of the property as a whole. ? Bull
46. Given that on a volumetric basis, some water is being transferred from the Rakaia River

to the shallow groundwater system, it is useful to examine what that volume means in terms of the volume of water passing down the Rakaia River.

47. The volume of water passing via the Rakaia River to the sea is about 7000 Mm³/y, based on an average flow of 220 cumecs. As before, assuming half of the Meadowflower take is river water and that the take is about 1.86 Mm³/y, Meadowflower Dairies will take less than 0.93Mm³/y of water or about one hundredth of one percent of the Rakaia annual volume.
48. So overall from a volumetric perspective (which the red zone analysis is based on), the exercising of the Meadowflower consents will have a neutral or positive effect on the shallow groundwater volume and an infinitesimal effect on the Rakaia River volume.

EFFECT OF INEFFICIENT TAKE ON OTHER USERS

49. Section 6.3 in the IO's report addresses this issue. Paragraph 71 states that the applicant's proposed volume of 2,488,320 cubic metres over a deemed irrigation season of 150 days does not meet the reasonable use test as the volume exceeds the ECan guideline by 34%. The guideline is given in Table WQN24 in the NRRP Water Quantity Chapter Schedule WQN9.
50. I need to point out that the applicant did not propose volume described by the IO or any seasonal volume in the application. The volume above assumes continuous pumping of 192 l/s for 150 days. The AEE actually stated that the take would be intermittent, particularly in the early and latter parts of the irrigation season. At the time the application was made, seasonal volumes were not required by ECan. The guidelines described by the IO came into being when the NRRP was notified in July.
51. There are some facts with respect to the guidelines in Schedule WQN9 that the hearing panel should know about. The message I have been getting from farmers concerned about the guidelines is that ECan has been implying that the numbers in the guidelines came from me. They did not. The figures in Table WQN24 were based on data supplied to ECan by Dr Tony Davoren, from an analysis of irrigation water use by his clients measured using soil moisture monitoring.
52. There are three key facts that need to be understood regarding the guidelines. Firstly Canterbury has been divided into "climate" zones and figures given for pasture and intensive crops for shallow deep and medium soils. These are a simplification of the real world. Secondly, in some combinations, the number of measurements in Dr Davoren's data set were very small and upper Te Piritia is one of those areas. Thirdly, the data was from a group of farmers managing their production systems and their irrigation at a very high level – probably the top 10% of farmers. Dr Davoren freely admits the limitations of the guidelines and advises caution at this stage.
53. The guidelines are divided into maximum rates of take and seasonal depths of water applied. In general, the maximum rates of take exceed the design capacity of nearly all irrigation systems in Canterbury and are essentially non-limiting for most irrigators. However, if individual irrigators decide to install a system with the capacity to meet the highest demand conditions, the guidelines provide the flexibility to do so. In the case of Meadowflower, the allowable peak rate of take is not at issue as it is greater than the design capacity proposed for irrigation.

54. Whether the seasonal guidelines are reasonable for Meadowflower is unknown at this stage because measurements are not available. We have no idea at this time whether the climate in that area is wetter, drier, hotter, colder or windier than the guidelines allow for. A higher predominance of NW winds down the Rakaia River may mean more water is required.
55. The point is, Meadowflower will be using centre-pivots and their own soil moisture monitoring to manage the irrigation at a very high level. Over time, they will find out what is reasonable and what is not. It is not in their interests, both environmentally or economically, to waste water.
56. Volumetric seasonal allocations are useful because they quantify the allocation (something that has not occurred in the past) and set upper limits on abstraction. However, it also needs to be pointed out that the effects of excessive takes on other groundwater users in the context of shallow groundwater are neutral because excess water quickly returns to the shallow groundwater system and is essentially recycled.
57. At this stage, I would recommend that Meadowflower be granted an allocation of 600 mm per season. As the takes will be monitored, two or three season's irrigation will soon establish whether it is reasonable or not.
58. Incidentally, the numbers that we (Lincoln Environmental) provided to ECan were based on computer modelling and had lower peak takes and higher seasonal takes than the ECan guideline. We felt that our figures better represented achievable takes given reasonable irrigation performance.

EFFECT OF TAKE RE SEAWATER INTRUSION, AQUIFER STABILITY AND CROSS CONNECTION

59. These issues were addressed by the applicant in the AEE. The IO has agreed that potential adverse effects arising from these issues will not occur. These need not be considered further.

EFFECT OF TAKE ON THE RAKAIA RIVER AND OTHER USERS

60. There are several reasons why the Meadowflower application should be granted with Rakaia River minimum flow restrictions according to NWCO minimum flows and not the minimum flows proposed by ECan. They are:
- The NWCO rules are not wide enough to apply to groundwater takes, whether deemed to be hydraulically linked to the river or not.
 - Applying the NWCO minimum flows will protect the river according to the NWCO.
 - There is no justification for applying the same minimum flows to a groundwater take as for a direct surface water take, as ECan is proposing.
 - The scale of the potential effect is insignificant compared to the scale of the environment.
 - The magnitude of the potential effect, including the cumulative effects of all of the other shallow groundwater takes along the Rakaia River is well below the margin of error of flow measurements – essentially, the effects cannot be detected.
 - There are no precedents set for applying higher minimum flows than NWCO

galleries to be 250 m *Flowing head are there?*

minimums and the rules applied by ECan have been very inconsistent.

- Granting of the Meadowflower application with NWCO minimum flows will not start a "gold rush" for similar takes as ECan has suggested.

IT HAS

61. Given that the NWCO does not include groundwater, the effects of exercising the proposed take have to be assessed in terms of their effect on the environment, as required under the RMA. That means the effect on the Rakaia River and not based on arbitrary rules that have been proposed in the NRRP. It is important to understand that the stream depletion rules as proposed in the NRRP are guidelines on how to assess proposed takes and those rules do not directly take into account the effect of the scale of an activity on the environment.
62. If the NWCO flows are applied to the Meadowflower take, the Rakaia River will still be protected according to NWCO minimum flows. All surface water takes and those groundwater takes deemed to be hydraulically linked are required to cease taking water at this point.
63. The low flow conditions (fourth band) proposed by ECan for Meadowflower are the same as those currently attached to small surface water takes. This means that there is no advantage in taking groundwater over direct surface water takes in terms of reliability of supply. Is ECan trying to encourage people into direct surface takes rather than groundwater, because that is what the proposed rules are implying? If so, I find that very strange, given that galleries will always have a much smaller effect on the river and its environs than surface takes. It also needs to be noted that smaller direct surface takes are usually cheaper to construct than galleries.
64. Further, with respect to the difference between groundwater takes and surface water takes, it appears that in setting the Rakaia River allocation blocks, ECan has treated hydraulically linked groundwater takes and direct surface takes the same way. That approach is overstating effects and is an extremely conservative approach for several reasons.
65. Not all consent holders will be taking water at their consented rate at the same time. There is a natural diversity in the take. Some consents are not being exercised, some are not being exercised at the consented rate and some would not be irrigating at a particular time because they don't need to or they are shifting irrigators or whatever.
66. The groundwater takes are not fully hydraulically linked to the river. It has been shown in previous applications that some of the takes only have a poor connection with the river. Others will have varying degrees of connection with the river and so on.
67. With hydraulically linked groundwater, the amount of water moving from the river to a particular groundwater take depends on the rate of take, the timing of the take and the duration of the take, all factors that are varying.
68. Turning pumps off will result in a delayed reduction in the river recharge, not an immediate reduction in river flow. By the time the effect of turning pumps off results in increased the river flow, the river flows could be substantially different.
69. In a shallow groundwater system, a substantial amount of the pumped water will return to the shallow groundwater system. This will be due to inefficiency in the application

50, implying that they need not to be turned off at any time?

system as no system applies water 100% efficiently. It will also be due to the increased rainfall recharge occurring on the irrigated area (the net use effect).

70. What this shows is that the overall effect of the groundwater takes on the river will be very much smaller than ECan has assumed.
71. If we ask ourselves a simple question, "will the proposed Meadowflower groundwater take in reality have any adverse effect on the Rakaia River and existing users if the take was restricted according to the NWCO minimum flows, the answer is clearly no. This is because the potential scale of the effect relative to the magnitude of the environment is trivial. If we take the period of highest irrigation demand (Dec, Jan) and compare a stream depletion of say 100 litres per second to the minimum flow in January of 124000 litres per second, it is clearly insignificant. Most people will admit that the Meadowflower take will not make any difference, but they bring up the notion that the cumulative effect of all hydraulically linked groundwater takes, including the Meadowflower take, will be significant. I disagree.

72. To put into perspective the cumulative effects of hydraulically linked groundwater, a search of the ECan consents database has identified 48 consents to take groundwater from shallow bores within 2 km of the Rakaia River. In fact, nearly all of them are within 1 km of the river, but we have selected 2 km because that is the distance ECan has traditionally used. Some of these are takes that would be most likely regarded by ECan to be hydraulically linked to the Rakaia River. Others will have provided evidence to show the effects of pumping groundwater on the Rakaia River through hydraulic linkage are minor.

73. There is a wide range of conditions applied to the groundwater takes that ECan has deemed to be hydraulically linked to the Rakaia River. They range from no restrictions at all through to cases of restrictions on band four.

74. Out of the 48 takes, 36 do not have any low flow conditions at all attached to them. One of the 12 with conditions (CRC961412.2 – Dolan) had the low flow conditions removed under a change of condition. Another (CRC040301.1 – Penno) has a reduction to 10 hours per day during NWCO low flow conditions. One consent (CRC030757.1 – Leferink) was granted without low flow conditions but is subject to appeal. That means that 9 out of 48 have low flow conditions requiring pumping to cease when the low flows are reached.

75. Of the 9 with low flow conditions, it is interesting to look at the flows at which pumping ceases. Five of them have Rakaia NWCO low flows (124 cumecs in January), one has 127.8 cumecs in January, one has 129.5 cumecs in January, one has 150.5 cumecs in January and the other two have 158.5 cumecs in January.

76. The takes that do have conditions have primarily occurred because the applicants acknowledged that there may be hydraulic linkages with the Rakaia River, so that the consent could be granted without public notification. In general, when applications have gone through a public hearing process, the consent has been granted without minimum flow conditions. One exception was CRC 990640 – Hayes, where a compromise to apply NWCO low flows was reached during mediation in the Environment Court.

77. The two consents with 158.5 cumec January minimum flows were granted in 1995 and

1996. I find it strange that such high minimum flows were imposed at that time. The 150.5 cumec January minimum flow consent was granted in 2001 and the lower flow ones (124-129.5 cumecs in January) were all granted from 2001-2004. At least 8 consents have been granted without low flow conditions since 2002.

78. There are some very important points that come out of this analysis. It tells me that ECan has not been consistently applying the same rules to all consents. It also tells me that ECan's expectation for applicants to now accept fourth band restrictions is also inconsistent with previous decisions. In addition, consents that have been through a hearing process have mostly been granted without low flow conditions, or on one occasion with NWCO conditions. It leads me back to the conclusion that the Meadowflower application must be judged on its merits, not on ECan's rules, which have been extremely inconsistent.
79. Ben Dingle, the General Manager of Meadowflower, was granted consents to take shallow groundwater for the Ngamarua and Terrace View properties (CRC030757) last year (2003) with NWCO low flow conditions. This was ECan's policy at the time. Because of that, the same conditions were proposed in the application for Meadowflower in February 2004 as that was understood to be the policy. In fact, a draft set of conditions including NWCO low flows was presented to Meadowflower by ECan in April 2004 and agreed to by Meadowflower. However, ECan then changed the policy and decided to place the take in the fourth band – again inconsistent with previous decisions.
80. There is an argument for not having any low flow conditions imposed on Meadowflower because the effect on the Rakaia River will be negligible. Given that Meadowflower have already proposed low flow conditions as a mitigating measure in the application and the application was publicly notified on that basis, Meadowflower will accept NWCO low flows as a condition of consent. *with about the cumulative effects - you are so good*
81. In previous consent hearings (eg CRC99640), ECan has argued that granting consents without low flow conditions could mean that if every adjacent land owner and surface water take converted to shallow groundwater, cumulative effects would be significant. There are two reasons why that is not a valid argument.
82. Firstly, granting of a particular consent does not require that future applications, which might never exist, be taken into account. Only the Meadowflower application, in conjunction with existing takes, needs to be taken into account.
83. Secondly, we have obtained information on all consents to take and use water within 2 km of each side of the Rakaia River. (See Figure 2). The most noticeable thing about the information presented in Figure 2 is that virtually all of the land on the north and south of the Rakaia River is already irrigated. The number of farms that are not irrigated along the river is very small indeed.
84. The consents are a mix of shallow groundwater takes (less than 20 m deep), direct surface takes and deep groundwater takes (greater than 20 m deep, usually operated on properties in conjunction with surface takes or shallow groundwater).
85. If we add up the flows for the groundwater takes with low flow conditions, they add up to approximately 3 cumecs, including Meadowflower and Leferink. Almost half of that total is for Turners on Rakaia Island. If we then take half of the 3 cumecs as an estimate

of hydraulic linkage, we get about 1.5 cumecs.

86. Taking another approach, if we assume a net use of 250 mm applied to 5000 ha (an estimate of irrigated area for the consents deemed to be hydraulically linked) over 150 days (to get an average for the irrigation season), we get a flow of about 1 cumec. If half of that comes from the Rakaia River, the effective take would be 0.5 cumecs.
87. Based on the above, the total cumulative effect will be in the range of 0.5-1.5 cumecs and I would say closer to 0.5 cumecs than 1.5 cumecs, because other recharge will be feeding into the system. The accuracy of measurement of flows at the measurement site (the Gorge or at Fighting Hill) is about 8%. This accuracy has been submitted at past hearings. So, at a flow of 124 cumecs (the January NWCO minimum), the accuracy of flow measurement is about 10 cumecs. The total cumulative effect for hydraulically linked groundwater is therefore somewhere between 5 and 15% of the accuracy of flow measurement and therefore is insignificant in terms of scale.
88. Operation of these consents has not resulted in any measurable adverse effects on Rakaia River flows. That means that the existing cumulative effect of operating these consents is less than minor.
89. The concern that there will be a "gold rush" on applications for groundwater at NWCO low flows is unfounded. Firstly, there is very little land left to irrigate alongside the Rakaia River. Secondly, the surface water takes are nearly all on low flow restrictions that are very similar or identical to the NWCO low flow conditions anyway, so why would they change! If they did, what real difference would it make?
90. In terms of applications made but not yet granted, ECan has already stated that small hydraulically linked groundwater takes such as Meadowflower will not affect the amount of water available for Central Plains Water/Ashburton Community Water Trust application of 40 cumecs.
91. So, in my opinion, the granting of the Meadowflower application with NWCO low flow conditions will not adversely affect the Rakaia River or existing users and is a rational and sensible decision.

EFFECTS OF USE ON WATER QUALITY

- Simon Johnson
Investigative Officer*
92. The IO has reviewed our assessment of the effect of the change in land use on water quality and agrees that the nitrate concentrations arising from the activity will be minor. In addition, Meadowflower, through their Environmental Policy will endeavour to minimise the effect of the activity on groundwater quality as far as is reasonably possible. Given the low concentrations of nitrate in groundwater in this area, concentrations will be well below Ministry of Health MAV values.

EFFECTS OF TAKE ON TANGATA WHENUA VALUES

93. Te Taumutu Runanga have been advised of the application and have submitted in opposition. However, they have visited the site and have been involved in discussions with Meadowflower. This will be commented on by Ben Dingle.

POSITIVE EFFECTS OF THE ACTIVITY

94. These are being presented by Ben Dingle, General Manager of Meadowflower.

MITIGATION MEASURES

95. In consultation with potentially affected parties, Meadowflower has prepared an environmental policy for the property. This will be mentioned by Ben Dingle.
96. The additional and recommended mitigation measures given in Section 7 of the IO's report require some comment, as some of the conditions differ from those offered by the applicant.
97. Condition 1 is as requested and is accepted by the applicant.
98. Condition 2 restricts the annual volume of water taken to 1,859,200 cubic metres per year. As explained in paragraphs 50-57, this may not be enough. If a seasonal volume is to be a condition of consent, the applicant asks that the volume be 1,992,000 cubic metres per year for the reasons given in paragraphs 50-57 of my evidence.
99. Condition 3 is accepted.
100. Condition 4 is included on the assumption that the take is treated in the same way as surface water takes and is not acceptable. After all, we are only talking about an effect that is part of 192 l/s and given the size of the Rakaia River, it is of no consequence. Condition 4 should not be included at all.
101. The minimum monthly flows given in Condition 5 are unacceptable, as there is no basis for imposing those conditions on a groundwater take. The applicant is prepared to accept minimum flows equal to the NWCO minimum flows as described in the application and restated in paragraph 6 (ii) of the IO's report. The reasons for this have been explained in my evidence.
102. Condition 6 is accepted.
103. Although the intent of Condition 7 is accepted, it needs to be rewritten to make it practical, useful and achievable. Meadowflower accepts the value of and the need for water metering. However, the proposed conditions are inadequately drafted and more suited to a surface water take, not a groundwater take. In a groundwater system, the volume of the take is of most importance. There is no point in measuring the rate of take and volume and recording it every 15 minutes as the effect on surface water flows will be days or weeks. In normal circumstances, monthly readings would be adequate, weekly readings more than required and daily readings overkill. However, as there is a probability of restrictions under NWCO minimum flows, daily readings would be useful to check on compliance, but that is all.
104. ECan still does not seem to realise that water meters fitted to piped systems are nearly all volumetric devices. They do not measure the rate at which water is taken. Meters fitted with pulse output send out a pulse after a fixed quantity of water has passed through

the meter. All a logger does is count pulses and record time. The conversion from pulse counts to flow rates can be done in some loggers but is also often processed later. There is also no need to time and record every pulse or store a reading every 15 minutes.

105. I have said many times that all ECan has to do is to specify the outputs they want with water take measurements, follow up with monitoring and let the consent holder get on with it. We had these issues resolved in the past, but once again we seem to have gone backwards. I am quite happy to work with ECan to obtain more appropriate wording for the condition again.
106. Condition 8 is accepted.
107. Condition 9 is acceptable to the point that backflow preventers will be installed if effluent or fertilizer is distributed through the mainline. Meadowflower has no intention at this time of distributing fertilizer or effluent through the lines. However, reduced pressure zone (RPZ) backflow preventers are totally unnecessary. They are expensive and burn up about 100 kPa of pressure, making them extremely energy inefficient. They are normally recommended on systems associated with municipal supplies where the consequences of contamination are severe.
108. A year or two ago, I researched backflow prevention to find out what was being used in NZ and the rest of the world. Nowhere else in New Zealand have RPZ valves been specified for agricultural systems. In Florida USA, the land of litigation, they are not specified for agricultural systems either. There is a standard set of recommendations for agricultural installations that should be implemented and they don't include RPZ valves. Even the gentleman who sold the concept and importance of backflow prevention to ECan agrees that the level of protection should be tailored to the risk and that RPZ valves are unnecessary in these agricultural situations.
109. ECan has essentially forced consent applicants into accepting conditions specifying RPZ valves to allow consents through non-notified, giving the reasons that unless an RPZ valve was installed, ECan could not be certain that effects would be minor. In order to get consents through non-notified, I have also advised clients to accept the condition, with the proviso that we would apply for a change of condition should they ever decide to inject fertilizer or effluent into the mainline.
110. I am quite happy to provide ECan with a set of standard requirements for agricultural systems. Meanwhile, if the words "reduced pressure zone" are removed from Condition 9, the condition will be acceptable.
111. Condition 10 needs to be reworded so that if this consent is operated concurrently with CRC042529, the total combined flow taken under both consents will not exceed 192 litres per second or 1,992,000 cubic metres per year. The reason for that is to provide flexibility in which source of water can be used, which could be important initially. It should be noted that CRC042592 has not been granted.
112. Conditions 11 and 12 are acceptable.

COMMENT ON SUBMISSIONS ON MEADOWFLOWER APPLICATION

113. Meadowflower's application was publicly notified and 11 submissions received. All are in opposition, with 5 asking to be heard. Comment on the submissions is given below.

114. Central Plains Water Trust

Central Plains Water has stated that the taking of groundwater from Te Pirita is non-sustainable and the resource consent should have a condition that states that the "consent should expire on the availability of supply from Central Plains Water." It is likely that Central Plains Water does not appreciate that Meadowflower proposes to take water from a shallow aquifer.

The decision about whether Meadowflower joins the Central Plains Water scheme, should the scheme eventuate, is an economic decision that will be taken at the appropriate time and is not related to this consent application.

115. Save the Rivers Mid-Canterbury

Save the Rivers Mid-Canterbury Inc have concerns that more water is being taken "from a region that is under pressure from other applications." Again, the concerns of Save the Rivers regarding cumulative effects have been dealt with when discussing cumulative effects above.

Save the Rivers Mid-Canterbury Inc have also stated that the consent duration is too long. The duration of consent is determined by ECan and 35 year consents have been granted in the past for the majority of groundwater consents. This provides the applicant with the knowledge they can plan their future operations. ECan consent conditions allow the consent to be reviewed if adverse effects occur.

116. Clover Nook Farm Ltd

They have stated that the decision should be "delayed until the results of the above Groundwater study are known." The study referred to is one being commissioned by the Dunsandel Groundwater User's Association, MAF Sustainable Farming Fund and ECan.

The groundwater study referred to by Clover Nook Farm Ltd will not be completed until later this year. This study is a regional investigation covering all aquifers - shallow and deep, rivers, springs, rainfall recharge, and irrigation recharge. Because the Meadowflower take is from shallow groundwater, it is unlikely that the study would provide any additional information that would be critical in deciding the outcome of this consent.

117. Mr S Inch

Mr S Inch is concerned that there may be "the possibility of nitrate contamination in the Rakaia River and our bore which we use for stock and house supply."

The nitrate-N contamination issues have been addressed in the Request for Further Information Report, dated 24/3/04, indicating that the proposed activities would not increase the nitrate-N concentration to levels considered significant and the overall effect would be considered minor.

Routine groundwater quality monitoring is carried out by ECan in bores immediately downstream of Meadowflower. Nitrate readings are very low – typically between 0.5 and 1 mg/L N. It is extremely unlikely that significant changes to readings will occur, particularly given the partial dilution of groundwater by river water in the shallow aquifer.

118. Te Runanga o Ngai Tahu Concerns

Te Runanga o Ngai Tahu has concerns that the cumulative effects have not been assessed fully. Again, the concerns of Ngai Tahu regarding cumulative effects have been dealt with when discussing cumulative effects above.

Te Runanga o Ngai Tahu “submits that it is inappropriate to grant 35-year duration for this application.” That is their position for water take consents in general and not specific to this application. We see no reason why this consent shouldn’t be granted for 35 years, as has occurred for most consents in the ECan region. There is nothing in particular with regard to potential adverse effects that would require a shorter duration.

Te Runanga o Ngai Tahu “is concerned that the applicant is seeking water for a land use that, in combination with additional irrigation, may encourage increased nitrate contamination of shallow groundwater and surface waters.” As described above, these issues have already been addressed.

“Te Runanga o Ngai Tahu also seek protection to hitherto unknown waahi tapu and/or waahi taonga that may be discovered through the drilling of new bores and/or galleries.” These concerns have been taken into account under the land use consent to install the three galleries, CRC041783, condition (3). All means possible will be taken to protect the unknown waahi tapu and/or waahi taonga.

Te Runanga o Ngai Tahu suggest that permanent fencing of drains, spring and other waterways to exclude stock and planting along these margins to provide a buffer zone. Meadowflower are already planting riparian margins and managing the property to minimise the nitrate effects on the environment, especially surface waterways.

An environmental management plan has been prepared by Meadowflower in consultation with potentially affected parties, including Ngai Tahu.

119. M Inch

Mr M Inch is concerned that there will be interference effects on his bore, L36/0479, that “yields only 45% of allowable take with maximum drawdown i.e. centimetres above the cut off probe.” He states “even 0.1 m interference would force further changes to the volume pumped and the efficiency of the system.”

The interference due to the three galleries abstracting water has been assessed in the AEE dated 23/2/04. 192 l/s is proposed to be abstracted from the three galleries, of which 92 l/s is sourced from the Rakaia River (Section 6.1 AEE). Therefore, 100 l/s is abstracted from the three bores from the shallow groundwater. Bore L36/0479 is 3.3 km from the closest gallery and 4.9 km from the furthest gallery. The interference at L36/0479 was calculated, using Theis, to be 0.01 m. The assumptions used in the calculations were very conservative. Therefore it is considered that the abstraction by Meadowflower from three galleries will have no adverse effect on L36/0479. The IO has checked the assessment and agrees.

It should also be noted that calculated interference effects less than 0.05 m are considered under the NRRP to be less than minor.

120. New Zealand Salmon Anglers Association Inc

New Zealand Salmon Anglers Association Inc have opposed the application on the basis that the take is "within 1000 metres of the river and is therefore a surface water take."

They have concerns that contaminants will leach into the river from the applicant property including discharge from drenched cattle.

As stated previously, the nitrate-N contamination issues have been addressed in the Request for Further Information Report, dated 24/3/04, indicating that the proposed activities would not increase the nitrate-N concentration to levels considered significant and the overall effect would be considered minor. It is unlikely there would be any contamination issues arising from drenched cattle.

Consent length was considered to be too long. This issue has already been addressed.

If the consent be granted, New Zealand Salmon Anglers Association Inc, requests "the taking of water must cease when the river flows reach a level at least 10 cumecs above the monthly minimum flows. There is no justification for setting such a limit.

121. JP & FJ Reardon Ltd

JP&FJ Reardon Ltd have concerns that the abstraction will adversely effect their water take. The assessment, which used very conservative parameters, has shown no significant interference on Mr Reardon's bore. The IO agreed with this assessment.

122. Canterbury Grassland Ltd

Canterbury Grassland Ltd have concerns that the abstraction is linked to the Rakaia River. Their concerns primarily relate to the effect that the surface water component of the take will have on the Central Plains Water/ Ashburton Community Water Trust application, which is on hold. ECan has given written assurance that small hydraulically connected groundwater takes such as that proposed by Meadowflower will not adversely affect that major application.

123. North Canterbury Fish and Game Council

The North Canterbury Fish and Game Council have concerns as stated in the IO report. These have been addressed above.

124. Farfield Ltd

Farfield Ltd have consents, as yet not exercised, to take deep groundwater from bores in their property above Meadowflower and have submitted sections of the RPS to support their case that existing consent holders should be given priority over new applications. They probably did not know that the Meadowflower proposed shallow groundwater take will not adversely affect their consented deep groundwater take. With this knowledge, their concerns should be alleviated.

They also make comment on the NWCO and potential adverse effects of effluent disposal on the Rakaia River. The consents to apply effluent are a different issue to the water take consent application. Also, Meadowflower has implemented an environmental policy and

has gone to significant effort to put in riparian plantings to protect the Rakaia River.

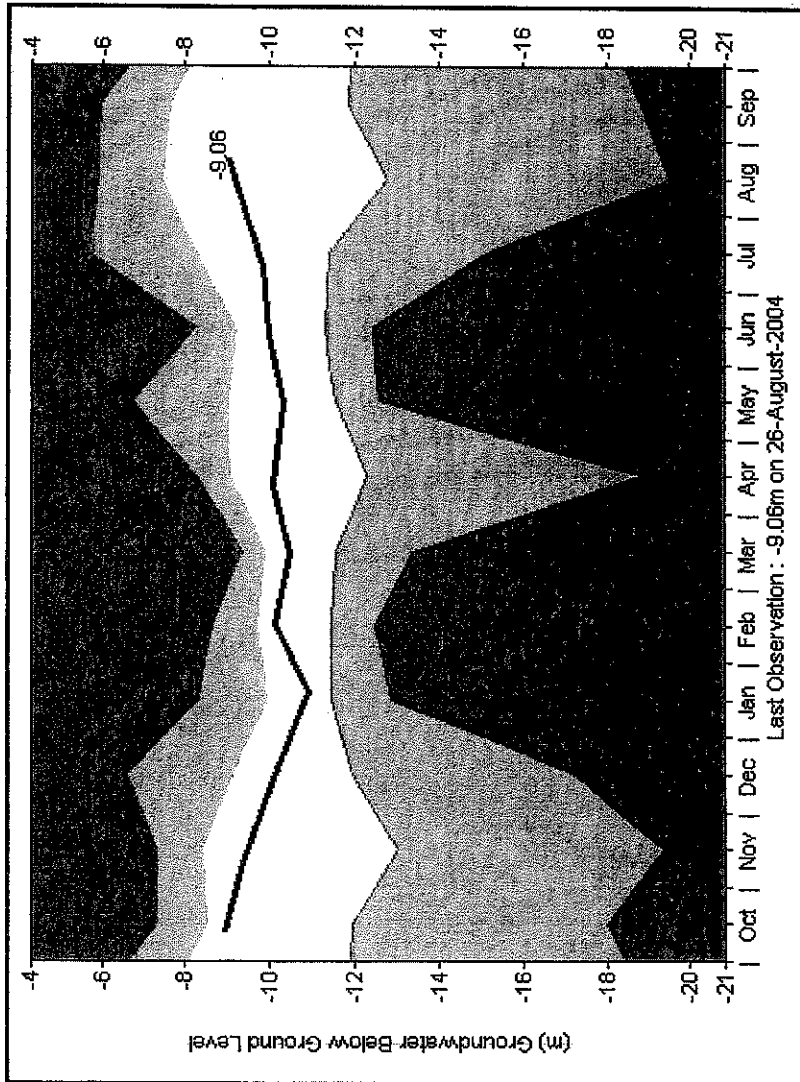
SUMMARY

125. I see no reason why Meadowflower's consent can't be granted and recommend that the hearing panel grant the consent accordingly. The adverse effect of take on surrounding groundwater users has been shown to be minor. The adverse cumulative effect of take on other groundwater users has been shown to be minor. The adverse effect of inefficient take on other groundwater users has been shown to be minor. The adverse effect of take on other users from seawater intrusion, on aquifer stability and from cross connection on groundwater quality has been shown to be minor. The adverse effect of take on surface water ecosystems and users, specifically those related to the Rakaia River has been shown to be minor. The adverse effect of use on water quality has been shown to be minor. The effect of take and use on Tangata Whenua values has been allowed for. The positive benefits of take and use are substantial.
126. Some of the conditions proposed by the IO in the Section 42A report are not acceptable to the applicant. Reasons have been given and alternatives provided. We believe that the alternative conditions will adequately protect existing users and the environment and request that the panel grant the consent with those alternative conditions.



Ian McIndoe

20 September 2004.



Well Details			
Well Number	L36/0010	Well Name	BURNS ROAD
Well Depth	24.3 m	Grid Reference	L36:2868-2206
Start Readings	11-Nov-1952	Ground Reference	130.01 +MSD
Comments			

Figure 1: Envelope plot for bore L36/0010

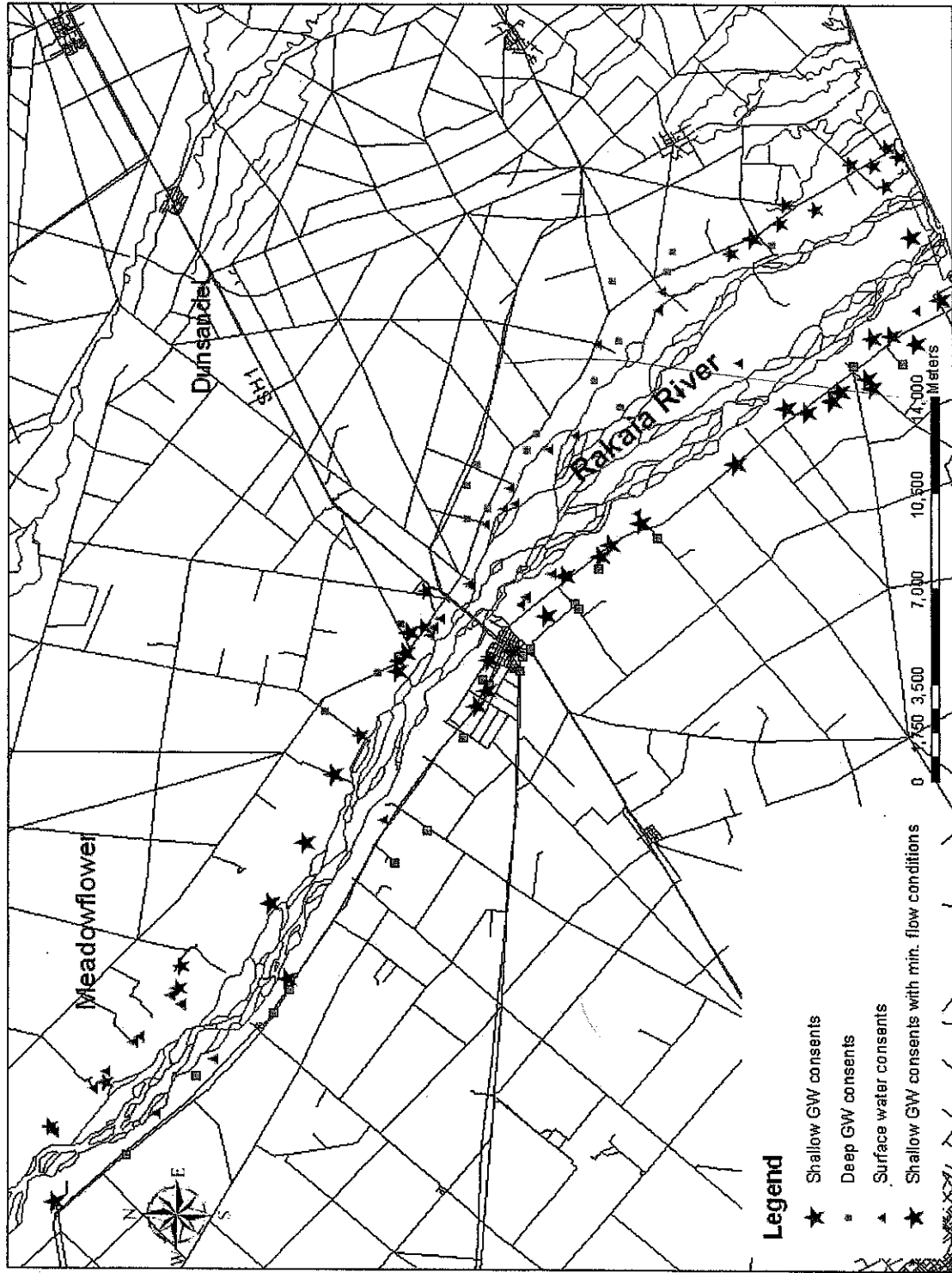


Figure 2: Consents within 2 km of the Rakaia River