BEFORE THE OTAGO REGIONAL COUNCIL

In the matter of the Resource Management Act 1991

And

In the matter of application **RM19.151** by **BSTGT Limited and Trustees of the A P McQuilkin Family Trust** for a permit to take and use water

STATEMENT OF EVIDENCE OF BAS VEENDRICK

11 MAY 2021

QUALIFICATIONS AND EXPERTISE

1. My name is Bas Veendrick and I am a Service Leader (Water Resources) with Pattle Delamore Partners Limited (PDP).

2. I hold a Master of Science (Hydrology) and Bachelor of Science (Physical Geography) from Utrecht University in the Netherlands. I am a member of the New Zealand Hydrological Society.

3. I have 15 years of professional work experience as a senior hydrologist and environmental scientist specialising in irrigation and hydropower projects, surface water assessments and hydrological and hydraulic modelling.

4. Since 2008, I have been employed by PDP, an environmental consulting firm specialising in surface water and groundwater investigations. During my employment with PDP I have carried out work and presented evidence for large scale irrigation schemes, individual irrigators, district and regional authorities and the Environmental Protection Agency. I have completed numerous technical hydrological reviews for resource consent applications on behalf of Otago Regional Council as well as for other regional councils throughout New Zealand.

5. I have been engaged by the Otago Regional Council to provide the following statement of evidence in relation to hydrology matters for consent application RM19.151 lodged by BSTGT limited and the Trustees of the A P McQuilkin Family Trust for a permit to take and use water.

6. I have read the Code of Conduct contained in the Environment Court's Practice Note for Expert Witnesses dated 1 December 2014 and agree to comply with it.

EXECUTIVE SUMMARY

7. Application RM19.151 has been lodged by BSTGT limited and the Trustees of the A P McQuilkin Family Trust for a permit to take and use surface water.

8. The applicant proposes to abstract surface water from two locations on the Royal Burn North Branch and one location on New Chums Creek.

9. The applicant proposes to abstract surface water at a rate not exceeding:

- 15 L/s for the upper take on the Royal Burn North Branch;
- 50 L/s for the lower take on the Royal Burn North Branch; and
- 24.5 L/s for New Chums Creek.

A visual residual flow for 50 metres past the respective points of take on both the Royal Burn North Branch and New Chums Creek is proposed. The applicant has also proposed that no water will be abstracted from the Royal Burn North Branch, for the purposes of irrigation, if the flow in the Royal Burn drops below 5 L/s at NZTM2000 1274996E 5011547N (a location upstream of the LOFTS water scheme). The applicant notes that water would still be abstracted for domestic and stockwater requirements. These key locations are presented in Figure 1, attached to my evidence.

10. The applicant has provided a longitudinal flow gauging for the Royal Burn North Branch and Royal Burn which demonstrates the location of gaining and losing reaches on 22 February 2021. The applicant has also provided flow statistics for mean flows and seven day mean annual low flows (7DMALF).

11. The applicant has recently amended the application and proposed a consent condition to cease taking water for irrigation purposes when the flow upstream of the existing LOFTS water scheme surface water take drops below 5 L/s. Further information has also been provided which supports the general pattern of losses and gains in the Royal Burn North Branch and Royal Burn although there is uncertainty in the magnitude of gains and losses at different flows and variability in the location of gaining and losing reaches will occur. Based on this information and the consent condition now proposed by the applicant I concur that the effects on other surface water users are less than minor. This is based on the assumption that the applicant's domestic and

stockwater take is small/negligible which should be confirmed by the applicant.

12. The proposed combined rate of take from the Royal Burn North Branch upper and lower intake and the take from New Chums Creek exceeds both the reported mean flow and 7DMALF of the waterbodies. The proposed abstractions represent a significant proportion of the flow in the waterbodies.

13. The applicant recognises that the proposed abstraction rate for both branches exceeds the mean flow and states that this will allow the applicant to store flood flows and ensure irrigation activities can continue during periods of low flow whilst reducing pressure on the creeks where possible. Given that the applicant is only proposing a visual residual flow condition for 50 m below the take points and the current amount of storage available on the applicant's property (less than 4 days at the estimated peak irrigation demand), it appears unlikely that these residual flow conditions will reduce pressure on the creeks at low flow.

14. I do not consider sufficient information has been provided to conclude that the Royal Burn North Branch is naturally drying or intermittent.

SCOPE OF EVIDENCE

15. The purpose of my evidence is to provide a technical review in relation to hydrology matters for consent application RM19.151 lodged by BSTGT limited and the Trustees of the A P McQuilkin Family Trust for a permit to take and use water. My evidence covers:

- an overview of the hydrological environment;
- a review of the hydrological assessment provided by the applicant;
- the potential effects of the activity related to hydrology;
- response to points raised in submissions; and
- measures to avoid, remedy and mitigate effects and recommendations.

INTRODUCTION

16. The proposed activity includes the abstraction of surface water at two locations from the Royal Burn North Branch and one location from New Chums Creek. The applicant currently holds deemed permits and one water permit which allows abstraction from these locations.

17. According to the application, the current rate of abstraction authorised under the deemed permits and current water permit is 319.5 L/s. The applicant has proposed that the total rate of abstraction (from all three locations) must not exceed 89.5 L/s with the following maximum rates at each abstraction point:

- The rate of take at the Upper Royal Burn North Branch point of take shall not exceed 15 L/s;
- The rate of take at the Lower Royal Burn North Branch point of take shall not exceed 50 L/s; and
- The rate of take at the New Chums Creek point of take shall not exceed 24.5 L/s.

18. The application seeks an annual volume of 1,214,683 m^3/yr (equivalent to a combined average continuous rate of take of 38.5 L/s), which is a reduction from the 5,266,200 m^3/yr stated to have been previously authorised.

19. The applicant proposes a residual flow condition where a visual residual flow shall be maintained for at least 50 m past each of the abstraction points at all times. The applicant also proposes a low flow cut off equal to 5 L/s for the Royal Burn, located just upstream of the LOFTS water scheme (Figure 1). The applicant notes that water will still be able to be taken as a permitted activity at both the applicants' take points from the Royal Burn North Branch for domestic and stock drinking water purposes.

20. The applicant acknowledges that a minimum flow for the Arrow River is expected to be set via a plan change and that this is expected to apply to existing consents via a plan change.

DESCRIPTION OF THE HYDROLOGICAL ENVIRONMENT

21. The Royal Burn North Branch and New Chums Creek are both tributaries of the Arrow River with mountainous catchments located predominantly within the Crown Range. Both surface water bodies produce relatively small flows.

22. The applicant has provided an assessment of the hydrology, reporting on some flow statistics, a spot gauging for each water body and a longitudinal gauging for the Royal Burn North Branch and Royal Burn.

23. The applicant reports that the Ministry for the Environment River flow database estimates the Royal Burn North Branch to have a mean flow of 33.7 L/s and a 7DMALF[1] of 10.7 L/s upstream of the upper point of take. New Chums Creek is estimated to have a mean flow of 19.8 L/s and a 7DMALF of 4.7 L/s.

24. I note that the flows provided above are based on NIWA regression models derived from catchment characteristics. Whilst they are the best information available for the Royal Burn and New Chums Creek, they are modelled flows and therefore may not provide an accurate estimate for the mean flow and 7DMALF. The flow characteristics have been derived for the reaches and the points of take represent a single location within a reach. It is noted that these reaches reportedly incur gains and losses and therefore the flow statistics derived from the NIWA regression model is unlikely to be representative of the flow in the entire reach.

25. The applicant provides a gauged flow obtained during a site visit on 31 January 2018. The flow, above the upper point of take was estimated at 13 L/s for the Royal Burn North Branch and 5 L/s for New Chums Creek. Only a trickle of water was observed downstream of the New Chums Creek weir structure. It was noted that the Royal Burn North Branch was dry at the lower intake site although it is unclear if abstractions were

[1] Seven Day Mean Annual Low Flow

occurring on the day of the site visit which may have modified the natural flow.

26. Mr Hickey provides some additional hydrological information in his memo (Fish Survey of the Royal Burn and New Chums Creek) derived from a stream survey conducted on 28 January 2020 for both the Royal Burn North Branch and New Chums Creek.

27. For New Chums Creek, Mr Hickey reports that there was a trickle passing the point of take. Between the take and the confluence with the Arrow River, Mr Hickey estimates the reach gains a flow in excess of 30 L/s.

28. For the Royal Burn North Branch (lower abstraction point), Mr Hickey reports that 1/3 of the flow was abstracted with the remaining 2/3 of the flow continuing down the Royal Burn North Branch. He does not report the flows. Mr Hickey reports the Royal Burn North Branch went dry and concludes that this downstream reach is naturally intermittent. However, it is not clear how this conclusion is supported given that the entire natural flow was not passing the intake.

29. NIWA were engaged by the applicant to undertake a longitudinal flow gauging assessment of the Royal Burn catchment. NIWA measured the flows at nine key locations along the Royal Burn on 22 February 2021. Figure 1, attached to my evidence show the gauging results. On the basis of this information, the applicant concludes that the Royal Burn North Branch experiences losses to ground between the lower point of take and the swamp (shown as approximate wetland area on Figure 1). The applicant further concludes that there are gains (to the flow in the Royal Burn) between the swamp and the Crown Range Road crossing. I concur with the applicants' conclusions in this regard although note that this pattern is expected to vary based on surface flows and groundwater levels.

30. In summary I agree with the general pattern of losses and gains in the Royal Burn North branch and the Royal Burn as described by the applicant but note that a limited amount of hydrological information has been provided as further detailed below.

ASSESSMENT OF ACTUAL AND POTENTIAL EFFECTS RELATED TO HYDROLOGY

31. The applicant proposes an abstraction rate that exceeds both the estimated mean flow and the 7DMALF. To recap, the proposed abstraction rate is: 15 L/s for the upper take on the Royal Burn North Branch, 50 L/s for the lower take on the Royal Burn North Branch, and 24.5 L/s for New Chums Creek. The reported mean flow and 7DMALF for the Royal Burn at the upper intake is 33.7 L/s and 10.7 L/s respectively. The reported mean flow and 7DMALF for New Chums Creek at the intake is 19.8 L/s and 4.7 L/s respectively.

32. The proposed annual volume of 1,214,683 m^3/yr is equivalent to a combined average continuous rate of take of 38.5 L/s. The magnitude of the maximum rate of take and average rate of take in comparison to the mean flow and 7DMALF is significant. The combined maximum proposed rate of take from the upper and lower intake in the Royal Burn North Branch of 65 L/s represents 607% of the estimated 7DMALF of 10.7 L/s. The maximum proposed rate of take for New Chums Creek of 24.5 L/s represents 521 % of the 7DMALF of 4.7 L/s.

33. The applicant recognises that the proposed abstraction rate for both branches exceeds the mean flow and states that this will allow the applicant to store flood flows and ensure irrigation activities can continue during periods of low flow whilst reducing pressure on the creeks where possible. Given that the applicant is only proposing a visual residual flow condition for 50 m below the point of take and the current amount of storage on the applicant's property (25,500 m^3, equivalent to less than four days of storage based on the peak daily demand outlined in Table 3 of the application) it appears unlikely that pressure on the creeks will be reduced at low flow.

34. Miss King from Otago Regional Council (ORC) provides further comments on the proposed allocation (proposed take rates) in relation to the water allocation framework in the Regional Plan: Water for Otago (RPW O).

35. The applicant has provided an assessment of effects on other users and has also proposed an additional consent condition to minimise and mitigate effects on other users. The proposed consent condition requires the applicant to cease taking water for irrigation purposes if the flow in the Royal Burn drops below 5 L/s just upstream of the LOFTS water scheme intake. This condition will help to mitigate effects on other users although the applicant should complete an assessment of how much water will be abstracted for domestic and stock water purposes to confirm that the take of water for this purpose is small/negligible.

36. Much of the assessment of effects on other users is dependent on the assumption of losing and gaining reaches. I conclude that this assumption is validated by one longitudinal gauging undertaken by NIWA which confirms that the Royal Burn is gaining a reasonable amount of flow between the swamp and the LOFTS intake (refer to Figure 1). A flow of 12.4 L/s was measured upstream of the swamp and a flow of 44.3 L/s was measured near the LOFTS intake during the NIWA gauging run on 22 February 2021 indicating a gain of 31.9 L/s on this day. It is noted that there is some uncertainty about the magnitude of gains and losses at flows lower than those during the longitudinal flow gauging run. However, based on the proposed consent condition and the proposed rates of take and annual volumes (in line with historic use), I concur with the applicant's statement that the effects on other surface water users (including consented take 97402) will be less than minor, in terms of flow availability, based on the information provided. This is based on the assumption that the quantities of water taken for domestic and stock water use are negligible. This should be confirmed by the applicant.

37. The applicant provides some further commentary on the residual flow (for ecological purposes) in their document "210312 Further amendments to the application" dated 03 March 2021. The applicant refers to recent monitoring which demonstrates losses to ground of at least 7.8 L/s and possibly as great as 13.2 L/s. The applicant goes on to state, that given a 7DMALF of 10.7 L/s, the reach is naturally drying with a 7DMALF that is closer to 0 L/s.

38. It is unclear how the figure of 13.2 L/s is derived. The longitudinal gauging study appears to indicate that losses to ground on the Royal Burn North Branch between the lower intake and Glencoe Road were 7.8 L/s on that day. This is derived by subtracting the gauged flow beneath the Glencoe Road Culvert (9.0 L/s) from the flow gauged below the lower abstraction point (16.8 L/s) (refer to Figure 1 attached to my evidence).

39. The NIWA longitudinal gauging run indicates a gain of around 5 L/s between the upper and lower intake. However, observations from the applicant in early 2018 indicate that at times of low flow (and/or groundwater levels) this reach of the waterway may experience losses rather than gains. The application states:

'*The RBNB was gauged above the upper point of take (associated with RM14.364.01 and 96285). Flow was estimated at 13 L/s, and therefore the conditions on the day likely reflected low flow conditions based on the estimated MALF for this reach of the stream. During the site visit, < 5 L/s of water was observed downstream of the upper point of take. It is likely water that this was water seeping through the small weir structure at the upper point of take. The lower point of take (associated with 97029 and 3073B) was dry at the time of the site visit, which shows that the water seeping through the weir structure was disappearing to ground before reaching the lower point of take.*'

40. In summary it is unknown what the loss rate is at flows greater or less than those measured during the longitudinal gauging run. If groundwater levels are significantly below the invert level (bottom) of the stream, then losses will be determined by the wetted width and hydraulic head in the stream. Both will decrease as flow decreases and therefore losses to ground would also be expected to decrease. If the stream is directly connected to groundwater, then the relationship will be dependent on groundwater levels relative to the water level in the stream.

41. The applicant also states that the conclusion of a naturally drying reach is supported by gauging work undertaken by Matt Hickey in 2018. As stated above, it is not clear how this conclusion is supported given that

Mr Hickey also states that 1/3 of the flow was being abstracted and therefore the reach was not in a natural flow state.

42. On the balance of the evidence available, I conclude that there is significant uncertainty regarding the reach in question and whether it is naturally drying. I do not consider that the applicant has provided sufficient evidence to conclude that the reach naturally goes dry.

43. My colleague Hilary Lough provides further information on the potential effects on groundwater users in her evidence via a reduction in surface water flow. A number of potentially affected downstream surface water takes, including permitted users, are identified in the evidence provided by Alexandra King of ORC.

44. Miss Bryony Miller, providing ecological evidence on behalf of ORC recommends a residual flow of 90% of the 7D MALF at the upper intake in order to protect instream values. Recognising the potential for losses to groundwater between the upper and lower intake she recommends a 50:50 flow-sharing regime for the lower intake. In addition, a 10 L/s residual flow is recommended just upstream of the LOFTS intake, immediately downstream of the wetland. The applicant proposed a residual flow of 5 L/s at this location. The recommended increase in residual flow at this location is to help ensure throughflow in the wetland.

NEW CHUMS CREEK

45. There are no identified surface water users downstream of the proposed abstraction point (up to the confluence with the Arrow River) and therefore an assessment of effects on existing surface water users is not required.

46. Limited flow information has been provided for New Chums Creek. On the day of his site visit on 31 January 2018, Mr Hickey reports an estimated flow of 5 L/s above the point of take and only a trickle of flow passing the proposed abstraction point.

47. On 28 January 2020 (when the fish survey was undertaken) Mr Hickey reports that only a seepage flow was passing the intake. This flow

increased to around 10 L/s in the middle reaches and an estimated flow in excess of 30 L/s at the confluence with the Arrow River. Neither the flow upstream of the take nor the rate of abstraction on this day was reported.

48. Given the magnitude of the proposed take (24.5 L/s) in comparison to the reported mean flow (19.8 L/s) and 7DMALF (4.7 L/s) at the intake, I consider that the proposed take has the potential to significantly decrease the flow downstream of the intake to a seepage flow for considerable periods of time.

49. Miss Miller recommends a residual flow of 90% of the 7D MALF at New Chums Creek intake in order to protect instream values.

RESPONSE TO SUBMISSIONS/MATTERS RAISED

50. A number of submitters, including downstream surface water and groundwater users have submitted in opposition to this application in relation to effects on hydrology. Many of their concerns reflect the potential effects identified above, whereby their ability to abstract water could be compromised. As detailed in my evidence, with the proposed residual flow condition of 5 L/s (or the recommended residual flow of 10 L/s by Miss Miller) I am satisfied that the water quantity effects of the take on downstream surface water users are less than minor, in terms of flow availability, based on the information provided by the applicant and subject to the applicant demonstrating that the abstraction for domestic and stock water use is small/negligible.

51. Te Rūnanga o Moeraki, Kāti Huirapa Rūnaka ki Puketeraki, Te Rūnanga o Ōtākou and Hokonui Rūnanga (Ngā Rūnanga) have submitted in opposition to this application on a number of matters including the effects of the altered hydrology on cultural values. They have noted that they would not oppose an amended application if the term of consent be no longer than six years, existing requirements for water meter(s) are retained and it is ensured that results continue to be recorded and reported via telemetry, and a minimum flow of 90% of the mean annual low flow (MALF) as calculated by the regional council

and an allocation limit of 30% of MALF as calculated by the regional council are applied.

52. In my evidence I have commented on the rate of take from the streams as a percentage of the 7DMALF estimates. I have also commented on the need for appropriate residual flows to avoid considerable periods of time with only a trickle of flow downstream of the takes. I consider a residual flow of 90% of 7DMALF (based on the NIWA national model) at the Royal Burn North Branch lower intake potentially very restrictive for the applicant due to the potential for losses to groundwater between the upper and lower intake.

MEASURES TO AVOID, REMEDY AND MITIGATE EFFECTS

53. The applicant is proposing a consent condition restricting the abstraction of water for irrigation purposes if the flow in the Royal Burn below the losing reach drops below 5 L/s. This condition will help to mitigate water quantity effects on other surface water users.

MONITORING

54. In addition to ORC's standard monitoring requirements for a water abstraction, the applicant has proposed monitoring of the flow to determine when abstraction for irrigation should cease. I concur with the proposed flow monitoring but note that it appears that this has not been included in the currently proposed consent conditions.

55. Monitoring of the residual flow at the Royal Burn North Branch upper intake and at Chums Creek can either be a notched weir as proposed by the applicant upstream of the LOFTS intake or an appropriately designed pipe through the weirs at these intakes as proposed by Ms Miller. This will ensure compliance with the recommended residual flow of 90% of 7DMALF at these locations. I recommend that consent conditions be included which require the applicant to monitor flows in the waterways. If a pipe is installed through the weirs then the draft design needs to be submitted to ORC for approval along with a requirement to submit 'as- builts' and photos following completion of the structure.

CONCLUSIONS

56. The applicant uses the NIWA national scale model to estimate the mean flow and 7DMALF for the Royal Burn North Branch and New Chums Creek. In the absence of site specific hydrological records I agree with these initial estimates but note that these estimates should be used as approximate estimates only which should be updated when further hydrological information becomes available for these waterways.

57. I concur with the general pattern of gaining and losing reaches in the Royal Burn North Branch and Royal Burn as described by the applicant. However, I note that only one longitudinal gauging run was undertaken and losses and gains may vary depending on flow and/or groundwater levels.

58. I concur with the applicant's statement that the effects on other surface water users will be less than minor in terms of flow availability, based on the information provided. This is based on the consent condition proposed by the applicant to cease taking water for irrigation purposes when the flow in the Royal Burn drops below 5 L/s (or 10 L/s as proposed by Miss Miller) upstream of the LOFTS intake and the applicant's proposal which ensures that rates of take and annual volumes are in line with historic use. This conclusion is based on the assumption that the quantities of water taken for domestic and stock water use are small/negligible. The amount taken for domestic and stockwater purposes should be confirmed by the applicant.

59. The magnitude of the proposed maximum rate of take and average rate of take in comparison to the mean flow and 7DMALF in the Royal Burn and Chums Creek are significant. I consider that the proposed takes have the potential to significantly decrease the flow downstream of the proposed abstractions. Without an appropriate residual flow condition this may result in a seepage flow for considerable periods of time.

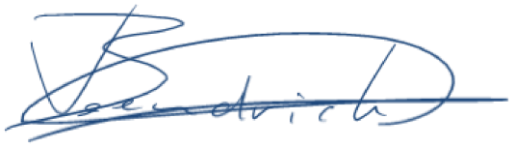
60. The applicant recognises that the proposed abstraction rate for both branches exceeds the mean flow and states that this will allow the

applicant to store flood flows and ensure irrigation activities can continue during periods of low flow whilst reducing pressure on the creeks where possible. Given that the applicant is only proposing a visual residual flow condition for 50 m below the take points and the current amount of storage on the applicant's property (less than four days of storage at the peak irrigation demand), it appears unlikely that these residual flow conditions will reduce pressure on the creeks at low flow.

61. I consider a residual flow of 90% of 7DMALF at the Royal Burn North Branch lower intake potentially very restrictive for the applicant due to the potential for losses to groundwater between the upper and lower intake, and therefore support the 50:50 flow sharing suggested by Miss Miller at that site, together with residual flows of 90% of 7DMALF at the Royal Burn North Branch upper intake and New Chums Creek.

62. I do not consider that sufficient evidence has been presented to conclude that the reach of the Royal Burn North Branch is naturally intermittent or drying.

Dated 25 May 2021



_____

Bas Veendrick

SOURCE:
1. AERIAL IMAGERY: LINZ

SCALE : 1:18,500 (A4)

0 50 100 200 300
METRES

FIGURE 1 : KEY LOCATIONS AND GAUGED FLOWS FOR THE ROYAL BURN 22 FEBRUARY 2021

C032635181_10/05/2021