Before the Canterbury Regional Council

TABLED AT HEARING

Date 23/4/2010

IN THE MATTER OF	the Resource Management Act 1991
AND	
IN THE MATTER OF	resource consent applications by various parties to take and use water from rivers, streams, canals and lakes in the Upper Waitaki Catchment.

Evidence in Reply of John Charles Bright

INTRODUCTION

1. My full name is John Charles Bright.

2. My qualifications and experience were outlined in my earlier evidence.

CODE OF CONDUCT

3. I acknowledge that I have read the code of conduct for expert witnesses contained in the Environment Court's Practice Note dated 31 March 2005. I have complied with it when preparing my written statement of evidence and agree to comply with it when giving oral evidence. This evidence is within my area of expertise.

SCOPE OF EVIDENCE

4. I have prepared this evidence at the request of Mackenzie Water Research Limited (MWRL).

5. The accompanying report (*Upper Waitaki Basin Groundwater – Proposed Monitoring Programme*) was prepared by Andrew Dark (Water Resource Engineer at Aqualinc Research Limited) at the request of MWRL, and under the direction of Ian McIndoe and myself. Andrew's qualifications are Master of Engineering (Civil) and he has almost five years experience.

6. My evidence has been prepared in response to:

   - The evidence of Mr Peter Callander, Mr Carl Hanson and Mr Tom Heller regarding the lack of clarity about sub-catchment water balances; the partitioning of water flow between deep groundwater, shallow groundwater and stream flow; and interactions between surface water and groundwater.

- The evidence of Mr Tom Heller regarding the efficacy of the groundwater modelling as a means of partitioning discharges to Lake Benmore between deep groundwater flow and surface water flow.

- The evidence of Mr Carl Hanson regarding the use of average annual values for predicting nitrate loadings to streams and of Mr Callander regarding de-nitrification.

- A proposed lock-step adaptive management process and monitoring programme to test the groundwater flow assumptions in the WQS.

7. My evidence addresses the concerns about water quantity and water flow paths matters by providing:

    - A review and summary of the key baseline assumptions (in terms of water flows) used by GHD in the groundwater modelling for the Water Quality Study (WQS).

    - An updated and clearer summary of the water inputs and mass balance estimates made by GHD at sub-catchment scale.

    - A proposed lock-step adaptive management process and monitoring programme to test the groundwater flow assumptions in the WQS, prior to the exercising of consents issued.

8. The details relating to each of these matters are included in the accompanying report (the Monitoring Report[1]).

REVIEW OF INFORMATION

9. In preparing this evidence and in directing the preparation of the accompanying report I have reviewed the following documents and information:

- The WQS reports (GHD, August 2009):
    - Groundwater Report
    - Rivers and Lakes Report
    - Summary Report
- The evidence of Douglas Mzila (of GHD).

[1] "Upper Waitaki Basin Groundwater – Proposed Monitoring Programme". Aqualinc Report Number C08088-02/1, prepared for Mackenzie Water Research Ltd, April 2010.

- Various spreadsheets, provided by Douglas Mzila, containing calculations for the groundwater model highland inputs and sub-catchment mass balances.

- The evidence of:

  - Dr. Jose Romero
  - Dr. David Horn
  - Dr. Melissa Robson
  - Dr. Brian Coffey
  - Mr John Kyle

10. Both Andrew Dark and I have had a number of phone and email communications with Douglas Mzila to clarify various aspects of the spreadsheet calculations.

SUMMARY OF BASELINE ASSUMPTIONS

11. Submitters and ECan officers have raised concerns during the hearing process about inconsistencies and errors in the WQS reports. I now respond to the concerns raised by outlining the work that was undertaken and describing the assumptions made in that work.

12. In the Monitoring Report that accompanies my evidence the sub-catchment and basin water mass balances have been summarised, based on information from the GHD spreadsheets. The numbers taken from the spreadsheets are considered to supersede those presented in the text, tables and figures of the WQS reports.

13. In the WQS, GHD considered four separate scenarios: existing level of irrigation, and proposed irrigation development, each with and without "highly developed" soils. The mass balance summaries in the Monitoring Report relate to the status quo.

14. Although the proposed irrigation will introduce additional land-surface recharge to the groundwater sub-catchments, which may change the total groundwater flux in each sub-catchment, the groundwater flow paths are not expected to change. The baseline assumptions used by GHD in the groundwater modelling are therefore appropriate for all scenarios.

15. Groundwater and surface water flows have been modelled on a steady-state mean-annual basis, with water flow results presented as annual volumes in millions of cubic metres.

16. In each of the groundwater sub-catchments there are two main sources of inflows: highland inflows and land-surface recharge from the basin (including dryland and irrigated areas).

17. As an initial assessment it was assumed by GHD that the infiltration from the highland catchment was 30% of the precipitation, with the remainder being surface runoff. It was then assumed that 20% of the infiltration recharged deep groundwater, with the remainder discharging from shallow groundwater to streams. These percentages were adjusted where necessary to achieve a match between modelled flows and measured data, or the "expected catchment yield" (i.e. catchments with similar characteristics such as land-cover, topography and climate should be expected to have a similar mean flow per unit area). Evaporation losses were calculated so that mass was conserved in the highland catchment.

18. Land-surface recharge from dryland and irrigated areas for the lower (non-highland) catchment areas was derived from soil moisture balance modelling (Aqualinc, 2008).

19. The outflows from each catchment were partitioned between surface water and groundwater using measured streamflows from the lower catchment and conservation of mass (i.e. total outflow = total inflow).

20. Two of the three components of the highland inflows (surface runoff, shallow groundwater that returns to streamflow) were not stated explicitly in the GHD spreadsheets. So that all components of the sub-catchment mass balance could be reported, these were calculated as follows:

    Shallow GW discharge to surface water = Highland infiltration – Highland GW outflux

    Highland surface runoff = Mean highland stream flow – Shallow GW discharge to surface water

21. Land-surface recharge was partitioned between groundwater and surface water in order to make up the difference between highland groundwater inflows and groundwater outflows from the catchment. This partitioning was not done in the GHD spreadsheets. If the land-surface recharge was insufficient to make up the catchment's groundwater outflows, the remainder was assumed to come from stream leakage.

22. The calculated stream leakage is the net loss of streamflow for the sub-catchment between the highland area and the sub-catchment outlet. Within the sub-catchment there may be areas of gains and losses.

23. Diagrams showing the components of the mass balance for each sub-catchment are included as an Appendix to the Monitoring Report. Schematic diagrams showing the contribution of each sub-catchment to surface water and groundwater flow are included in the Monitoring Report. Separate schematics have been prepared for the Ahuriri Arm of Lake Benmore, Lake Ruataniwha and Wairepo Arm, and the Haldon Arm of Lake Benmore (including the contribution from Lake Ruataniwha and the Wairepo Arm). These diagrams should be considered to supersede the schematic diagrams of the groundwater catchments in the WQS reports.

24. The major groundwater and surface water inflows to the Ahuriri Arm of Lake Benmore are from the Ahuriri River catchment. Surface water inflows from other small catchments

discharging directly into the Ahuriri Arm have been lumped together as a single input to the mass-balance model.

25. For the groundwater sub-catchments that drain to the Ahuriri Arm of Lake Benmore as part of the greater Ahuriri River catchment it was assumed that groundwater discharged from each sub-catchment contributes to deep groundwater flow for the catchment as a whole, and that all groundwater discharges directly to the Ahuriri Arm without re-surfacing. Surface flow gains in the lower Ahuriri River are assumed to be from shallow sub-surface flow in the river bed rather than discharge of deep groundwater.

26. The inflows to Lake Ruataniwha and Wairepo Arm are the Ohau A Canal and surface water and groundwater from the Ohau River and Wairepo Creek sub-catchments.

27. Surface water and groundwater flows from the Wairepo Creek catchment are assumed to discharge to the Wairepo Arm and, this being downstream of Lake Ruataniwha, are assumed to have no effect on Lake Ruataniwha water quality.

28. Downstream of Lake Ruataniwha and the Wairepo Arm the vast majority of surface flow is in the Ohau B Canal. The volume of canal flow was calculated from the Ohau B power station discharge record. Surface flows in the Lower Ohau River are negligible.

29. In order to conserve mass for Lake Ruataniwha (i.e. to make inflows and outflows balance), GHD have assumed that the remainder of the outflow from the lake is groundwater flow in the Lower Ohau River catchment, equivalent to 13.8 m^3/s. Leakage of this magnitude from Lake Ruataniwha is improbable. It is possible that measurement error in the canal flows, which dominate the water balance, is appearing in the model as groundwater flow in order to get inflows and outflows to balance.

30. The major inflows to the Northern Arm of Lake Benmore are the Ohau C power station outflow and groundwater and surface water from the Lower Ohau River, Pukaki River, Tekapo River and Stony River catchments. The Northern Arm also receives inflows from small catchments around the lake. Surface water flows from these minor catchments have been lumped together into a single input in the mass balance model.

31. Losses from the Ohau C canal (between the Ohau B and Ohau C power stations) were calculated from the power station discharge records. This water is assumed to contribute to groundwater flow in the Lower Ohau River catchment.

32. The Lower Ohau River catchment receives groundwater and surface water flows from the Twizel River. Groundwater from the Lower Ohau River catchment is assumed to discharge directly to the Northern Arm without re-surfacing.

33. The Tekapo River catchment contributes groundwater and surface water flows from the Upper Tekapo River, Mary Burn, Irishman's Creek and Grays River. It is assumed that all groundwater from the Tekapo River catchment discharges to the surface at a node point upstream of Lake Benmore.

34. The Pukaki catchment contributes groundwater to the Lower Ohau River catchment. The dominant source of groundwater flow is leakage from Lake Pukaki. There is also a small

(0.2 m^3/s) surface water contribution to flows in the Lower Tekapo River. It is believed that this is groundwater discharging during baseflow conditions.

35. The GHD groundwater model was built and calibrated using all of the limited amount of data available at the time. Since then Aqualinc staff have conducted a significant amount of field work in the Simons Hill – Simons Pass area to increase understanding of groundwater flow paths and interactions between surface water and groundwater.

36. Our analysis of this new data confirms that from a hydrological perspective the GHD groundwater analysis and modelling are consistent with field measurements. The model indicated that the contribution of Pukaki groundwater to flow in the Tekapo River is small and that the majority of the groundwater flows directly to Lake Benmore. Analysis of the new field data shows that gains in Tekapo River are actually less than modelled; i.e. the model predictions are conservative.

LOCK-STEP ADAPTIVE MANAGEMENT PROCESS

37. The lock-step adaptive management process has been designed to deal with uncertainties in the groundwater modelling by carrying out a monitoring programme to test the baseline assumptions before consents are exercised.

38. The process is illustrated by Figure 8 in the Monitoring Report, a copy of which is attached to this evidence as Annex 1. It consists of three phases: (1) determining the baseline assumptions and monitoring requirements, (2) baseline monitoring prior to exercising consents and (3) ongoing monitoring and adaptive management while the consents are exercised.

39. The tasks to be completed in each of these phases, as shown in Figure 8, are the practical steps to be taken to meet the Water Use Conditions (numbers 4 to 11) as set out in Appendix A of Mr Kyle's Evidence in Reply. These conditions, in turn, give effect to the lock-step approach described by Mr Kyle in paragraphs 3.6 to 3.13 of his Evidence in Reply.

40. In the first phase of the process the baseline modelling assumptions are identified in the groundwater sub-catchments for which submitters and ECan officers have raised concerns about groundwater flow paths (Task 1.1 in Figure 8). A groundwater and surface water monitoring network and programme is then designed to test the key groundwater flow assumptions for the sub-catchments of concern. Criteria for testing the assumptions and determining if any variance is minor or significant are pre-determined before monitoring starts (Task 1.2). The Monitoring Report contains details of the baseline modelling assumptions and the proposed monitoring programme.

41. It is envisaged that the monitoring programme and the acceptable level of variance from the expected outcomes will be subject to an independent peer review before it is finalised (Task 1.3).

42. The second phase of the lock-step process is the implementation of the monitoring programme. Monitoring results will be analysed to determine the level of variance (if any) from the baseline assumptions. The methods for analysing the data to quantify the

level of variance are specified in Mr Kyle's proposed consent conditions (his Appendix B)

43. Tasks 1.1, 1.2, 1.3 and 2.1 give effect to Consent Water Use Conditions 4 and 5.

44. The decision box identified by the question "Do initial results confirm baseline assumptions?" is the point at which it is decided whether Consent Water Use Condition 6 is met.

45. If the assumptions are confirmed by the monitoring results then the consents can be exercised (Task 3.1) following submission of a report to ECan (Task 2.5). These tasks give effect to Consent Water Use Condition 8.

46. If the monitoring results show that there is minor variance from the expected outcomes then the implications of this variance will be assessed (Task 2.2. The NDAs and FEMPs in the relevant sub-catchments will be adjusted if necessary to reflect the variance and consents can then be exercised following submission of a report to ECan.

47. If the monitoring shows significant variance from the baseline assumptions an independent Review Panel will be convened to determine whether the variance changes the overall conclusions of the WQS. If the Review Panel determines that the overall conclusions are not affected, the NDAs and FEMPs can then be adjusted in a similar manner to the minor variance case, and the consents exercised following reporting of these adjustments to ECan. If, however, the overall conclusions of the WQS are affected then further technical work will be required to determine whether the revised conclusions can be realistically addressed through adjustments to the NDAs and FEMPs. If this is possible then the adjustments will be made and consents can then be exercised following submission of a report to ECan. If not, the applicants will need to decide whether to stop the process or conduct further monitoring to support a revised proposal (Tasks 2.3, 2.4 2.6 and associated decision boxes). These tasks collectively give effect to Consent Water Use Conditions 9 and 10.

48. In the event that the monitoring results are inconclusive (i.e. neither the baseline assumptions nor any feasible alternative can be confirmed) the process loops back to the first phase. This allows for alternative monitoring to be proposed.

49. The third phase of the lock-step process involves ongoing monitoring and adaptive management while the consents are being exercised (Task 3.2). This gives effect to Consent Water Use Condition 11.

50. If the ongoing monitoring shows that the baseline assumptions confirmed in the second phase are still valid, then the process remains in the third phase.

51. If the ongoing monitoring indicates that the baseline assumptions can no longer be confirmed then there are two possible loops back to the second phase, depending on whether the variance from the baseline assumptions is minor or significant.

52. The initial monitoring programme should be integrated across all of the relevant catchments, as changes to the assumptions in one sub-catchment may have flow-on effects downstream or in neighbouring catchments. If, however, the initial monitoring indicates variance in a sub-catchment that will not have any influence beyond that sub-

catchment boundary then the monitoring programme for that sub-catchment could follow the appropriate loop in the lock-step process while other sub-catchments advance to the next stage.

53. The proposed lock-step monitoring programme is a robust approach to systematically testing the assumptions at the core of the WQS modelling. It will also provide an independent, measurement-based, view of the key hydrological and hydrogeological characteristics of subcatchments.

54. In my experience it is not uncommon for the data requirements of the models used to predict the effects of a proposed activity to exceed the data available for such purposes. Uncertainty in the predictions is inevitable.

55. What is uncommon, in my experience, is the systematic specification of both the assumptions made in such circumstances and the monitoring to be conducted to test the assumptions and reduce the uncertainty. Even less common is locking the exercising of consents to the completion of the monitoring and confirmation that the assumptions are valid.

56. In my opinion this is a very robust and practical approach to managing the uncertainty inherent in model-based assessments of effects.

THE MONITORING PROGRAMME

57. The monitoring programme proposed in the Monitoring Report focuses on groundwater sub-catchments for which submitters and ECan officers have raised specific concerns about groundwater flow. These sub-catchments are:

- The Lower Ahuriri River
- Wairepo Creek / Wairepo Arm
- Omarama Stream
- Quail Burn
- Willow Burn
- Grays River

58. In the Monitoring Report the specific key assumptions from the GHD modelling, possible alternatives and their implications, and recommended options for monitoring are presented for each sub-catchment of concern.

59. A separate monitoring programme has already been completed to test the baseline assumptions for the Pukaki Flats (see 35 and 36 above). Monitoring requirements for the Pukaki groundwater catchment are therefore not addressed in this evidence or in the Monitoring Report.

60. The concerns about the sub-catchments identified above primarily relate to groundwater flow paths. It has generally been assumed in the groundwater modelling for the WQS that deep groundwater flow generated within each sub-catchment discharges directly to the receiving catchment or lake without any discharge of groundwater to streams. If this assumption is not correct, there is potential for nitrate-N concentrations in surface water downstream of the area of groundwater discharge to be higher than those modelled by GHD.

61. Other assumptions that are identified for testing in the Monitoring Report relate to the location of groundwater catchment boundaries and hydraulic connection of streams to groundwater.

62. If the location of the groundwater catchment boundary is different to that assumed by GHD in areas where proposed irrigated areas straddle a catchment boundary, then the additional nutrient loading in the proposed scenario could be different to that modelled for each sub-catchment. In the case of the Wairepo and Quail Burn groundwater catchments, moving the divide between the two catchments potentially increases the nutrient loading to one arm Lake Benmore under the proposed scenario, while decreasing the loading to the other, depending on the direction in which the catchment divide moves.

63. Whether a stream is perched or hydraulically connected to groundwater will determine how much (if any) of the additional nutrients discharged due to proposed irrigation in a sub-catchment will appear in surface waterways.

64. The monitoring methods considered in the Monitoring Report are:

- Water level measurements from existing or proposed bores
- Aquifer testing
- Groundwater and surface water sampling and water chemistry analysis
- Streamflow gaugings

65. Water level measurements are likely to be the primary source of information used to confirm the baseline assumptions. Measurements of the water table elevation at various points in a sub-catchment will allow calculation of hydraulic gradients. This will contribute to understanding whether streams are hydraulically connected to groundwater, and the location of groundwater catchment divides. Measurement of the vertical hydraulic gradient using bores at multiple depths in close proximity will provide information about whether groundwater is discharging to the surface.

66. Aquifer testing of proposed or existing bores will allow aquifer parameters to be determined more accurately. This will enable some ground-truthing of the groundwater fluxes modelled by GHD.

67. If there are differences in the chemical markers of groundwater and surface water samples in the upper area of a particular sub-catchment, then comparison of water chemistry analysis results from samples taken in the lower catchment can potentially be used to indicate whether deep groundwater is discharging to surface water.

68. Detailed concurrent streamflow gaugings can be used to determine if a particular stream reach is gaining or losing. However, gauging results alone will not show if the gain or loss is due to interactions with deep groundwater or shallow sub-surface flow in the river bed. Therefore it is important to use a number of monitoring methods and consider all results together.

69. In the Monitoring Report acceptable ranges for monitoring results have been proposed for determining whether the baseline assumptions can be confirmed. For cases where the monitoring results fall outside of the acceptable range for confirmation, further ranges have been proposed to determine whether the variance from the baseline assumptions is minor or significant.

70. Where it is necessary to determine the location of a groundwater catchment divide, it is proposed that the assumed location will be considered confirmed if the location of the divide that is calculated from the monitoring results is less than 0.5 km in either direction from the location assumed in the WQS. If the location of the divide moves by 0.5 – 1.5 km in either direction it is proposed that the variance will be considered minor. A movement of greater than 1.5 km in either direction will be considered a significant variance.

71. Assumptions relating to stream / aquifer interactions will primarily be tested by comparing groundwater levels to stream free surface levels. In the Monitoring Report a decision process has been proposed that initially uses the ranges of groundwater levels relative to the stream free surface to determine whether the assumption is possibly confirmed, and if not whether the variance is possibly minor or significant.

72. Results from other monitoring, such as aquifer testing, streamflow gauging and water chemistry analysis can then be used to support the initial conclusion, or determine that the results are inconclusive. The four possible end-points (assumption confirmed, minor variance, significant variance, inconclusive) of this two-step evaluation process provide the answer to the decision points in the lock-step process that ask whether assumptions are confirmed.

73. The proposed baseline monitoring programme should be conducted over 12 months. This will allow data to be collected during all parts of the hydrological year without causing undue delay to the Applicants.

74. Groundwater levels in all proposed bores and piezometers should be recorded on installation and measured monthly thereafter. Groundwater levels in existing bores should be measured monthly.

75. Because the proposed monitoring programme is focussed on surface water / groundwater interactions, it is not considered necessary to do stream gaugings and water sampling more frequently than the groundwater level measemurents. Gaugings and sampling should be timed to coincide as closely as possible to groundwater level measurements so that a snapshot of surface water / groundwater interactions is provided. Where groundwater sampling has been recommended the samples could be taken at the same time as the level measurement is made. This sampling could be integrated with any water quality sampling that is required by consent conditions.

76. If the initial round of water chemistry analysis does not yield useful results (i.e. surface water and groundwater cannot be distinguished from their chemical markers) then this aspect of the monitoring could be discontinued or carried out less frequently.

77. For some assumptions, such as whether a stream is perched or hydraulically connected to groundwater, each monthly measurement over the twelve month baseline monitoring period will either confirm or disprove the baseline assumption. The situation might change from month to month, however, if groundwater levels vary significantly. In this case minor variance for the full set of measurements could be defined as the baseline assumption being confirmed in the majority of monthly measurements, for example 10 months out of 12.

78. Where aquifer testing has been recommended, this is a once-off activity. Aquifer parameters are not expected to vary seasonally.

79. A number of monitoring bores were proposed by GHD in the WQS Groundwater Report (Section 10). The purpose of these proposed bores is to monitor water quality in locations where there are no suitable existing bores, whereas the focus of the monitoring programme described in my evidence and the Monitoring Report is groundwater quantity and flow paths.

80. In the sub-catchments addressed in the Monitoring Report there is no need for duplication of monitoring bores for water quality and water quantity. Bores that have been proposed for water level monitoring can also be used for water quality sampling. Where water chemistry analysis has been proposed as a method of determining the water source, the same samples can also be used for water quality analysis.

81. In other sub-catchments for which groundwater quantity monitoring requirements have not been addressed in the Monitoring Report, water quality monitoring bores as identified by GHD may still be required.

Evidence of Mr Hanson regarding seasonal variation in nutrient loadings

82. Ideally, seasonal variation in nutrient loadings and concentrations would have been considered. However it was impractical to do so, given limitations in the field data available and the fact that Overseer estimates are average annual values. Under these circumstances it was reasonable to take an average annual approach. To attempt a seasonal analysis, given the data limitations, would have been speculative. These limitations will be overcome through implementing the proposed monitoring programme. Significant adverse effects on water quality during the irrigation development period will be avoided by applying a "lock-step" approach. Beyond the development period the proposed adaptive management will avoid the occurence of significant adverse effects.

Evidence of Mr Callander regarding de-nitrification assumptions

83. GHD's assumption that 30% of nitrate-nitrogen passing through gley soils to streams is removed via denitrification would result in a negligibly small reduction in N loads from the irrigation proposed in the Omarama Stream, Hen Burn and Quail Burn catchments.

Comparison of Figure 7 (Areas of Expected Denitrification) and Figure 13 (Proposed Irrigation Development) in GHD's WQS Summary Report shows that almost all of the proposed irrigation is either on the other side of the stream from the gley soils (Omarama) or downstream of the gley soils (Hen Burn and Quail Burn). Consequently if nitrate-nitrogen passes from drainage to groundwater to surface water, almost all of it will do so without passing through the gley soils and thus will not incur significant denitrification losses.

SUMMARY

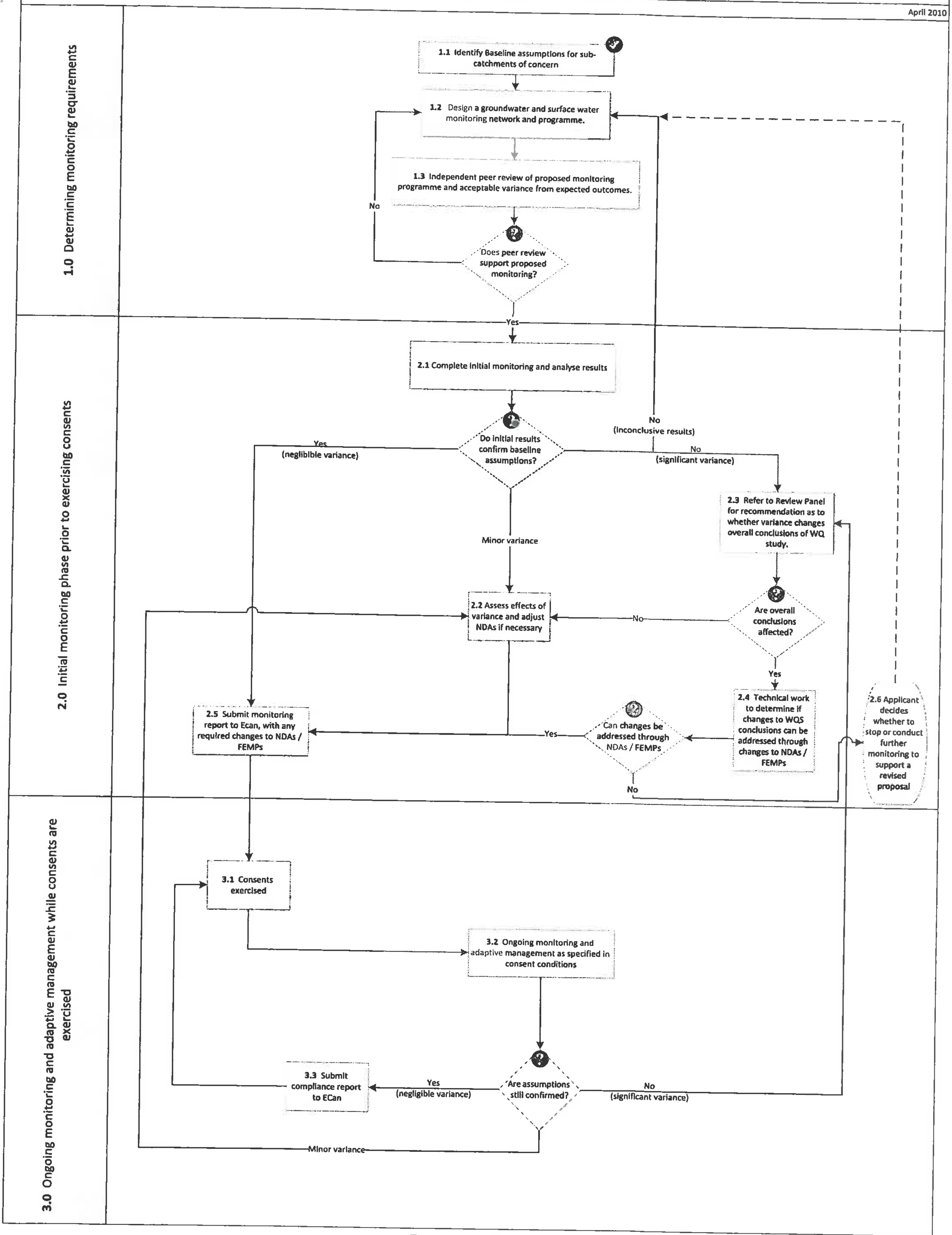
84. Concerns about inconsistencies in the groundwater flow results presented in the WQS reports have been addressed by reviewing the GHD spreadsheets and creating new mass balance diagrams.

85. There is some uncertainty in the groundwater flow paths, catchment boundary locations and stream / aquifer interactions assumed by GHD in the groundwater modelling. This uncertainty is primarily due to a lack of hydrogeological data in the relevant catchments.

86. I am confident that the modelling methodology and results are sufficiently robust that the proposed lock-step process and monitoring plan can be used to reduce uncertainty around the WQS modelling assumptions.

Dr John Bright
23 April 2010

ANNEX 1 LOCK-STEP PROCESS DIAGRAM


1.0 Determining monitoring requirements
1.1 Identify Baseline assumptions for sub-catchments of concern
1.2 Design a groundwater and surface water monitoring network and programme.
1.3 Independent peer review of proposed monitoring programme and acceptable variance from expected outcomes.
No
Does peer review support proposed monitoring?
Yes
2.0 Initial monitoring phase prior to exercising consents
2.1 Complete initial monitoring and analyse results
No (Inconclusive results)
Do initial results confirm baseline assumptions?
Yes (negligible variance)
No (significant variance)
Minor variance
2.3 Refer to Review Panel for recommendation as to whether variance changes overall conclusions of WQ study.
2.2 Assess effects of variance and adjust NDAs if necessary
No
Are overall conclusions affected?
Yes
2.4 Technical work to determine if changes to WQS conclusions can be addressed through changes to NDAs / FEMPs
Can changes be addressed through NDAs / FEMPs
Yes
No
2.5 Submit monitoring report to Ecan, with any required changes to NDAs / FEMPs
2.6 Applicant decides whether to stop or conduct further monitoring to support a revised proposal
3.0 Ongoing monitoring and adaptive management while consents are exercised
3.1 Consents exercised
3.2 Ongoing monitoring and adaptive management as specified in consent conditions
Are assumptions still confirmed?
Yes (negligible variance)
No (significant variance)
3.3 Submit compliance report to ECan
Minor variance