HUNTER DOWNS IRRIGATION SCHEME

ADDITIONAL QUESTIONS AND ANSWERS ARISING FROM HUNTER DOWNS PRESENTATION DAY

Introduction

The following provides a summary of answers to the questions asked during the presentation day for the Hunter Downs Irrigation Scheme held in Waimate on 31 January 2007. These answers are based on subsequent information collated after the presentation day.

Questions and Answers

Question 1 – Bill Penno:

In terms of the viability and reliability of the proposed Hunter Downs Scheme has there been any research done on the appropriateness of applying a minimum cut off point for river flow between the 150 cumecs and 100 cumecs scenarios?

Glasson Potts Fowler have since modeled a further 6 scenarios (scenarios 5 to 10) in addition to the initial 4 (scenarios 1 to 4). The further scenarios model irrigation reliability at minimum river flows between 80 to 140 m^3/s. The complete set of scenarios now encompasses 10m^3/s minimum flow steps from 80 to 150 m^3/s.

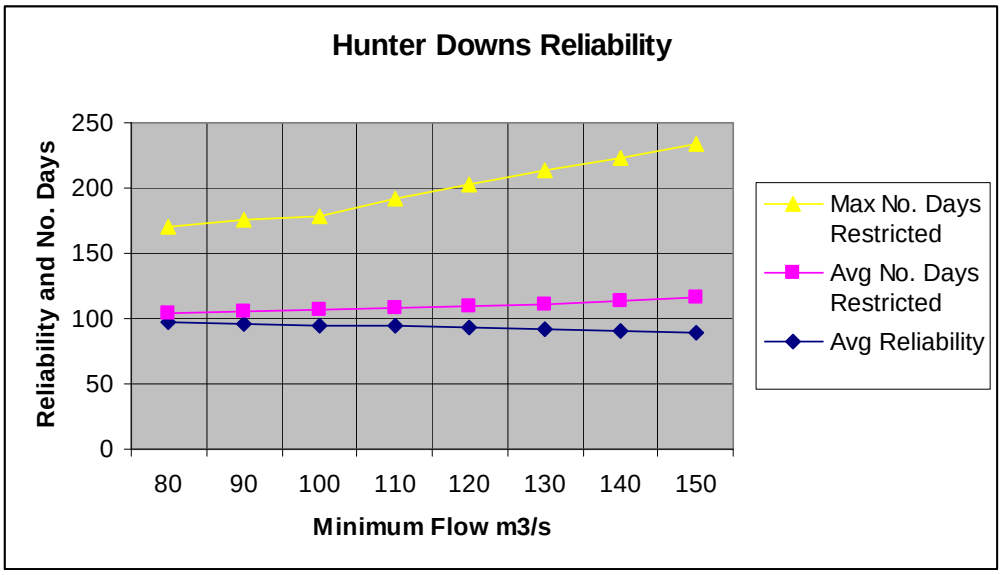
For simplicity, the further scenarios (scenarios 5 to 10) have been modeled on both future and existing irrigators abstracting up to the Waitaki Water Allocation plan allocation limit of 90 m3/s, all with the same level of priority and thus reliability. They are in essence the same set of assumptions as scenarios 1 and 2 but with varying minimum flows at the sea.

Table 1 below provides a summary.

Table 1: Summary of Reliabilities

Scenario	Avg Reliability	Avg No Days Restricted	Max No Days Restricted	Percent Irrigation Restriction in Cumec Range								
				0-10	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80+
5. Future 80	97.1	7.1	66	54	46	0	0	0	0	0	0	0
6. Future 90	96.1	9.5	70	51	10	39	0	0	0	0	0	0
1. Future 100	95.2	11.6	71	43	15	9	34	0	0	0	0	0
3. EX 100 - 157	95.2	11.7	71	43	14	8	35	0	0	0	0	0
7. Future 110	94.3	13.7	84	38	11	13	8	30	0	0	0	0
8. Future 120	93.3	16.2	93	35	10	10	11	7	26	0	0	0
9. Future 130	91.9	19.5	102	34	10	9	8	10	6	23	0	0
10. Future 140	90.6	22.7	110	31	12	9	8	7	9	5	20	0
2. Future 150	88.9	26.8	118	31	11	10	7	7	6	7	4	17
4. EX 157 – 207	88.7	27.3	120	30	11	10	7	7	6	7	4	17

Note that there is an 18% increase (13 days a season increase) in maximum number of days restricted when changing from 100 to 110 m^3/s minimum flow (see graph below).



Stuart Ford of The AgriBusiness Group has analysed these results and concludes that further modelling of reliability and calculation of economic impacts within the range of 100 to 150 m^3/s is not necessary. He notes the rate of decline in reliability is low for a change in minimum flow from 80 to 100 and then increases proportionally to the increase in minimum flow for the range 110 to 150. There is a small change in the reliability between 80 and 100 cumecs compared with the change between 100 and 110 cumecs. From this analysis we believe that 100 cumecs is the highest minimum flow with provides reasonable irrigation reliability.

Question 2 – Adrian Cogle:
What is the potential for the small, predicted, increase in nutrients ending up in the Wainono Lagoon having a significant impact on areas that are not sunlight limited, such as the Fenton margin?

It is possible that areas such as the Fenton margin are nutrient-limited rather than sunlight limited for algae growth. If this were the case, then any additional nutrients would be expected to produce increased algae growth. The response is likely (based on literature) to be somewhere between a 10% and 100% increase in biomass for a 100% increase (doubling) of nutrients. *The results of the summer 06/07-field study will provide a better understanding of the existing nutrient concentrations at several sites around the lagoon.*

The nutrient-spiked growth assays NIWA have set up in the lagoon will also allow an estimate of the extent to which additional nutrients may produce extra algae biomass under sunlight-limited (deep in turbid areas of lagoon) or non-limited (near the surface) conditions in this particular lagoon. The results and analysis from this work will be documented in a report for Meridian and will be included in future consultation meetings and in evidence presented in the consent process.

Question 3 – Warwick Pascoe:
Warwick would like an assessment of the sensitivity of the IFIM predictions of habitat change and suitability with a 150 to 100 cumec drop in the minimum flow. This is based on Warwick's perception that there was a lack of validation surveys for 'large' braided rivers. He wants to know how incorrect the predictions could be on this basis.

NIWA notes that there is no need to rely on general characteristics or understanding of a class of rivers such as 'large braided rivers' as work has been carried out specifically on, and for, the lower Waitaki River.

The sensitivity of the method can be described in three parts:

i) Predicting the relationship between flow and hydraulic conditions (depth, velocity)

The survey cross-sections for IFIM analysis were conducted during deliberately controlled (and measured) flows in the lower Waitaki River. The flows surveyed at representative reaches (Ferry Road and Priest Road) included nominal flows of 350, 150, 120 and 85 m3/s.

The model predictions of habitat change are based on hydraulic measurements taken at the actual flows of concern (110 – 150 m3/s) and there is little likelihood of error in this aspect of the method. The main source of potential error in this part of the method is the assumption that the survey reaches are representative of the whole lower river. NIWA believe that those reaches are representative of the NBTC- and HDI-affected braided section between Kurow and the sea for several reasons as described in the NBTC '*Instream habitat and flow regime requirements'* report. These reaches would not be representative of the short single channel section between Waitaki Dam and Kurow that is relevant for NBTC (but not relevant for HDI). For this reason, specific surveys were also carried out at three flows (320, 227 and 141 m3/s) and used to make habitat predictions for that section of the river.

NIWA believe that the method has appropriately minimized uncertainty regarding the relationship between flow and hydraulic conditions in the lower Waitaki River, to the extent that this is possible by sampling representative parts of the river instead of measuring the entire length of the river.

ii) Predicting the relationship between hydraulic conditions and habitat for biota

Instream habitat analysis relies on establishing a relationship between hydraulic conditions (e.g., depth, velocity) and the presence (i.e. suitability or preference) of instream organisms such as algae, invertebrates and fish. These relationships are produced by observations of organisms in rivers and recording the depth and velocity conditions at the location the organism is found.

The more measurements that can be made, the more confident scientists can be that the relationship between hydraulic conditions and suitable habitat is well established. The results of these measurements are produced as habitat suitability curves which are applied to the instream habitat analysis (e.g. IFIM). Such measurements (and the curves produced from them) have been made for many common aquatic species that exist in many types of rivers (including the Waitaki) throughout New Zealand and also in other countries. These curves are available as an information resource for scientists to use.

In the absence of specific measurements of the hydraulic conditions it is usually possible to use literature resource of habitat suitability curves from other rivers. This is a reasonable approach particularly when the type of the river of interest is well represented in the measurement data and where the uncertainty created by this approach is acceptable for the resource management decision being considered.

The significance of the aquatic biota values in the lower Waitaki combined with the significant size of the NBTC proposal and the HDI proposal, mean that it was considered appropriate to generate river-specific habitat suitability data for aquatic invertebrates, native fish and rainbow trout. River-specific suitability data for salmon angling has also been collated. This is described briefly in the HDI 'Assessment of ecological effects' report, and in detail in the NBTC 'Instream habitat and flow regime requirements' report.

These Waitaki-specific suitability curves were applied to instream habitat analysis, using expert judgement, along with other curves from the literature, to predict the relationships between hydraulic conditions (and thus also flow by virtue of step (i) above) and habitat for all biota commonly found in the Waitaki River. NIWA are confident about the reliability of these relationships and can find no logical reason why they would be significantly incorrect. NIWA believe that the method provides a reasonably accurate prediction of the magnitude of habitat loss that would occur as a result of the proposed minimum flow alteration from 150 to 100 m^3/s.

Note that the method described so far predicts the amount of suitable hydraulic conditions (habitat) available for different species at different flows. If hydraulic conditions are not suitable for a species they won't exist in the river. However, if habitat is available other factors will determine the extent to which species utilise it or not. These other factors therefore influence the size of populations the habitat can support. The sensitivity of this part of the method is discussed in (iii), below.

iii) Predicting the relationship between the amount of suitable habitat and populations that utilize it

Generally, recognition of the complexity of the relationship between habitat area and population size leads to the need for instream habitat methods (e.g. IFIM) to be applied using a sound understanding of the overall biology of the aquatic ecosystem. This provides an interpretation of the instream habitat method results presented in the HDI 'Assessment of ecological effects' report, and in more detail in the reports that provided base information for the HDI report. Specific information is contained in the NBTC 'Instream habitat and flow regime requirements' report and NBTC companion reports. Technical experts in each trophic level of the aquatic ecosystem (i.e. periphyton, invertebrates, native fish, trout, salmon and salmon angling) have applied their knowledge to the habitat area predictions for the lower Waitaki River.

Other factors that have been considered (using a variety of methods in addition to IFIM) including habitat quality and quantity, existing population sizes, limiting factors, the amount of time at low flow (i.e., the whole flow distribution curve), seasonal requirements, migratory and connectivity requirements, biological interactions, water quality and river geomorphology.

Overall, NIWA believe this comprehensive approach provides a reasonably accurate prediction of the magnitude of habitat loss that would occur as a result of the proposed minimum flow reduction from 150 to 100 m3/s and the magnitude of the biological response to this.

Question 4: Warwick Pascoe

Has consideration been given to the impact of the loss of small braids and marginal wetland areas, especially for native fish, and how this may offset the predicted improvement in habitat for small fish gained by reduction in the flow in the bigger braids, i.e. could there be a net loss / reduction in suitable habitat and biomass for native fish and invertebrates?

The instream habitat analysis described under Q2 above, implicitly considers the impact of the loss of small braids and marginal wetland areas (within the riverbed as covered by surveyed cross-sections). In making predictions about changes to habitat area Table 4.2 and 6.2 in the HDI 'Assessment of ecological effects' report annexure E reports net reductions or gains for each species considered.