BEFORE THE HEARINGS PANEL

IN THE MATTER of hearings on submissions concerning the Proposed One Plan notified by the Manawatu-Wanganui Regional Council

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SECTION 42A REPORT OF MS RAELENE ELLEN HURNDELL ON BEHALF OF HORIZONS REGIONAL COUNCIL

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1. INTRODUCTION

1.1 My qualifications and experience

1. My name is Raelene Ellen Hurndell. I hold a Bachelor of Science degree (Geography and Environmental Science) and an Honours degree (1st Class) in Physical Geography. Both degrees were awarded by Victoria University of Wellington. I have more than seven years post-graduate experience, having been employed at Greater Wellington Regional Council (Environmental Monitoring Officer – field hydrology and water resources) and the Ministry for the Environment (advisor, Reporting and Review Group), prior to working for Horizons.

2. I have been employed at Horizons as Environmental Scientist – Water Quantity, in the Regional Planning and Regulatory group, since September 2006. Since beginning in this role, I have been involved in a number of projects. The most important of these is the development of the proposed Water Allocation Framework for the Proposed One Plan (POP) (Hurndell *et al*., 2007) and the completion of a number of projects supporting the framework.

3. I have completed a review of the minimum flows set for the Raparapawai and Oruakeretaki Streams, coordinated and participated in the field data collection for the Makotuku/Makara Instream Flow Incremental Methodology (IFIM) study, and worked with the National Institute of Water and Atmospheric Research (NIWA) on the development of rainfall isohyet rainfall maps for Horizons' Region. I am also involved in Horizons' water metering project, providing technical support to the water metering working group. A core aspect of my role is to provide technical assessment of resource consent applications, and the provision of technical advice to both the Consents and Compliance teams.

4. I have read the Environment Court's practice note, Expert Witnesses - Code of Conduct, and agree to comply with it.

1.2 My role in the Proposed One Plan

5. I have been a core part of the team working on the development of the water allocation framework and have led and co-ordinated the documentation of the development of the proposed Water Allocation Framework.

1.3 Scope of evidence

6. The following evidence describes the background and the development of water allocation methodologies at Horizons. It then explains the development of the water allocation framework used to derive the minimum flows and core allocation limits that are recommended in the revised version of Schedule B, including progress and updates, and revisions made since the POP was notified.

7. The setting of minimum flows and core allocation limits for the Region's streams and rivers is described for each Water Management Zone (WMZ) and Sub-zone. These descriptions briefly explain the proposed water allocation recommendation for each Zone and Sub-zone.

2. EXECUTIVE SUMMARY OF EVIDENCE

8. Management of the Region's freshwater resource is a high priority for Horizons. Until the mid-2000s, when several comprehensive Water Resource Assessments (WRAs) were completed, Horizons had little real knowledge about how much water was available for allocation, how much was already allocated, and what the potential effects of that allocation might be.

9. Since those WRAs were completed, Horizons has made considerable progress in terms of developing data collection networks, consent monitoring, identifying critical values for the Region's rivers and defining Water Management Zones (WMZs) across the Region. These advances have made it possible to develop a proposed Water Allocation Framework, setting out recommended minimum flows and core allocation limits that work together to provide a balance between instream requirements for eco-system health and the needs of out-of-stream water users.

10. The framework adopts a 'tiered' approach to water allocation, using Scenarios that are defined according to the level of information that is available about each WMZ or Sub-zone. A 'decision-support' flow diagram, included in this evidence, leads the reader through the minimum flow and core allocation setting process for each Scenario.

11. The original version of the framework described in this evidence was prepared prior to notification of the Proposed One Plan (POP) and provided recommendations for policy development through that notification process. In the time since that notification occurred, more hydrological information has been collected, and some of the methodologies used have been refined (these are discussed in the evidence of Dr Jon

Roygard). This has provided the opportunity to present a new iteration of the notified Water Allocation Framework.

12. Minimum flow and core allocation recommendations have been made for a number of Sub-zones that were previously unable to be solved, and many of the recommendations made in the original framework have been revised due to new MALF statistics being able to be derived using additional data. An overview of the review of the hydrological statistics is set out in the evidence of Mr Brent Watson.

13. This report sets out the background to the definition and application of the Scenarios and sub-scenarios used in the framework. It then steps through the minimum flow and core allocation recommendations, WMZ by WMZ, using summary tables to explain the recommendations that are made.

14. The summary tables show revised MALF statistics, where applicable, critical values identified in each Sub-zone, and notified minimum flows. Core allocation limits are listed beside revised recommendations. See the revised version of the Schedule B for detail.

15. **I recommend that the Hearing Panel adopt the minimum flows and core allocation limits that are set out in the revised Schedule B table, into the water allocation policy for the POP.**

3. EVIDENCE

3.1 Background

3.1.1 Development of a water allocation 'process'

16. The need for sustainable management of New Zealand's rivers and streams has long been recognised, and the need for a consistent process for achieving this was addressed by the Ministry for the Environment's (MfE) Flow Guidelines for Instream Management in 1998. While the decision-making process originally recommended by these guidelines was written more than 10 years ago, the basic concepts are still relevant to instream flow management today, and guide the thinking behind the Water Allocation Framework recommended for the Proposed One Plan (POP). Figure 1 illustrates the decision-making process as described by MfE (1998).

17. The key themes of this decision-making process are the identification of the values to be protected, determining the appropriate level of protection, and the selection of the

appropriate flow-setting methodologies to achieve the desired level of protection of the identified values. The step in the process that is the most often contested is the "Apply technical assessment methods" phase. The point of dispute is commonly about exactly which methods should be applied where and when.

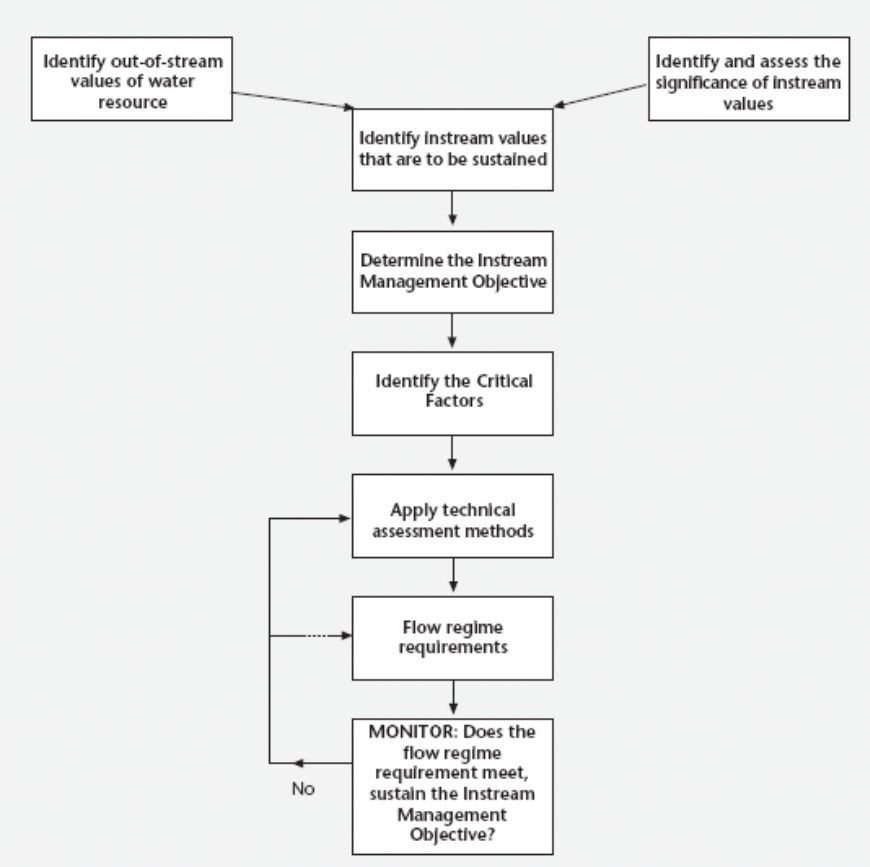


Figure 1. Decision-making process recommended by the Ministry for the Environment's Flow Guidelines for Instream Values (1998)

3.1.2 The 'tiered' approach to water allocation

18. A number of methods are available for use in setting minimum flows. These range in complexity and accuracy from map-based interpolative methods to mathematical and statistical methods, to integrated habitat assessment studies. The cost and level of effort associated with applying these methods also varies, as does the amount and type of information required to execute them. A desk-top interpolative assessment requires a small amount of general hydrological information, and could be done relatively quickly and cheaply, but will provide a relatively low level of certainty about the results. On the other hand, a holistic instream habitat assessment requires a large amount of specific

data, collected over a period of time. This is expensive, but provides a high level of certainty about the results obtained.

19. Ian Jowett and John Hayes (2004), completed a report for Environment Southland (Southland Regional Council) reviewing the concepts, methods, process and approach used by that organisation for defining instream values and developing water allocation policy for the Environment Southland Draft Regional Water Plan. The findings of the review stated that in order to "provide a transparent, equitable and consistent" framework (Jowett & Hayes, 2004), the selection of flow-setting methodologies should consider the values of the stream, the level of demand for out-of-stream water use, and the level of knowledge held about that stream.

20. Jowett & Hayes (2004) recommended a 'tiered' approach to defining minimum flows in Southland rivers. The first 'tier' in the approach is the use of a 'default' method, where resource consents to abstract water may be granted without further investigation, if the total allocation is a small proportion of river flow (eg. less than 10% of the mean annual low flow (MALF)) at any downstream point in the catchment. This method is the most conservative, and will sustain instream values without any field investigations or knowledge of the biological community (Jowett & Hayes, 2004).

21. The second tiered method is the application of generalised habitat models, by which resource consents can be granted with a minimum of site investigation in cases where allocation is moderate (eg. 10-30% of MALF), or where the instream values are low. This method has limited data requirements and is intended to retain flows above those that maintain a desired level of habitat retention (Jowett & Hayes, 2004).

22. The third, and most in-depth level of assessment recommended is a detailed instream habitat analysis and consideration of effects. This method is recommended to be used where total allocation, or demand for water, is high (ie. >30% of MALF), and where instream values are also high (Jowett & Hayes, 2004). Jowett & Hayes also suggest a fourth method for use in those streams where dissolved oxygen is the limiting factor for instream health.

23. While Horizons has not adopted the tiered approach in exactly the way that Jowett & Hayes recommended it be applied in the Southland Region, the general concept informed the basic framework for the POP Water Allocation Framework.

3.2 Horizons' approach to water allocation

3.2.1 Management objectives and concepts

24. Horizons has a common instream management objective for water allocation in all of the Region's Water Management Zones. This is:

> "*to maintain and enhance aquatic ecosystem biodiversity and productivity over time, compared to current levels, using trout, native fish, aquatic invertebrates, periphyton and ecosystem functioning as indicators of over ecosystem health*" (Roygard *et al*., 2006).

25. The overall objective of the Water Allocation Framework is to allocate water in a way that meets the needs of the community, the economy, and the environment.

26. The Water Allocation Framework for the POP is based on the concepts of:

i. A volume of water left in the river to maintain environmental values (sometimes called an 'environmental flow'). This is maintained by the setting of a minimum flow at which abstractions must cease.

ii. A core allocation limit – that volume of water that may be taken from the river at flows above the minimum flow.

iii. A 'management flow' that is the sum of the minimum flow and the core allocation volume.

27. The management flow is used during the core allocation setting process, to help determine what surety of supply is likely to be provided by a particular combination of minimum flow and core allocation limit. These concepts are illustrated in Figure 2.

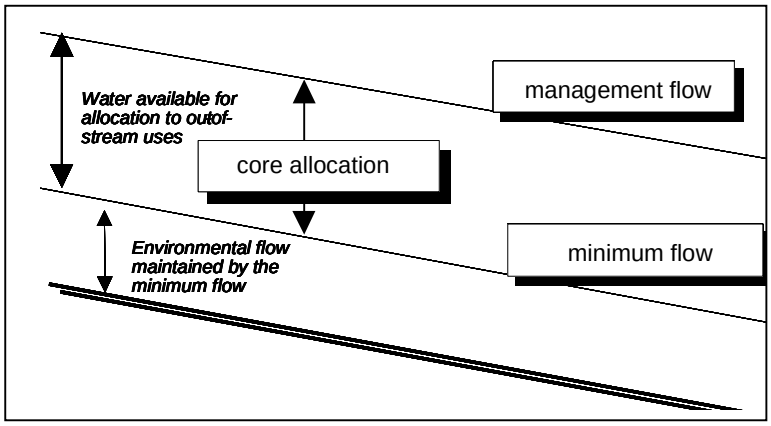


Figure 2. Conceptual approach to water allocation methodology. (Adapted from Wood, 1995)

3.2.2 'Classes' of allocation

28. The proposed Water Allocation Framework uses the Water Management Zones (and Sub-zones) framework and the values of the water bodies to establish six different categories of allocation takes and various flow thresholds where these takes can and cannot be abstracted. The details of these are set out in Dr Roygard's evidence and are listed here for reference only.

i. **Permitted takes** as defined by POP Policy 6-19 and Rule 15-1. These can abstract at all flows.

ii. **Essential takes** that may be consented to abstract (at reduced rates) at flows below the minimum flow, as defined by POP Policy 6-19.

iii. **Core allocation** takes that are within the core allocation, ie. may be consented to abstract at flows above the minimum flow, as in POP Policy 6-16 and Rule 15-5.

iv. **Supplementary allocation takes** that are within the supplementary allocation and are able to abstract at or above a specified (by consent) flow as defined by POP Policy 6-18 and Rule 15-6(b).

v. **Existing hydroelectricity takes that are not included in the core allocation limits.** These are addressed by POP Policy 6-16 and Rules 15-6 & 15-8.

vi. **Takes from lakes and wetlands,** which are addressed by POP Policy 6-20 and Rule 15-5.

3.2.3 The minimum flow

29. The minimum flow is a flow that is determined to provide an appropriate level protection for the environmental values of a particular river or stream. The instream conditions required to protect the identified values are maintained by specifying a minimum flow below which flows should not fall as a result of abstraction. The minimum flow defines the point in the flow recession at which abstractions become restricted in order to protect the instream values. Figure 3 demonstrates the minimum flow level overlain on the flow recession for one of the Region's streams.

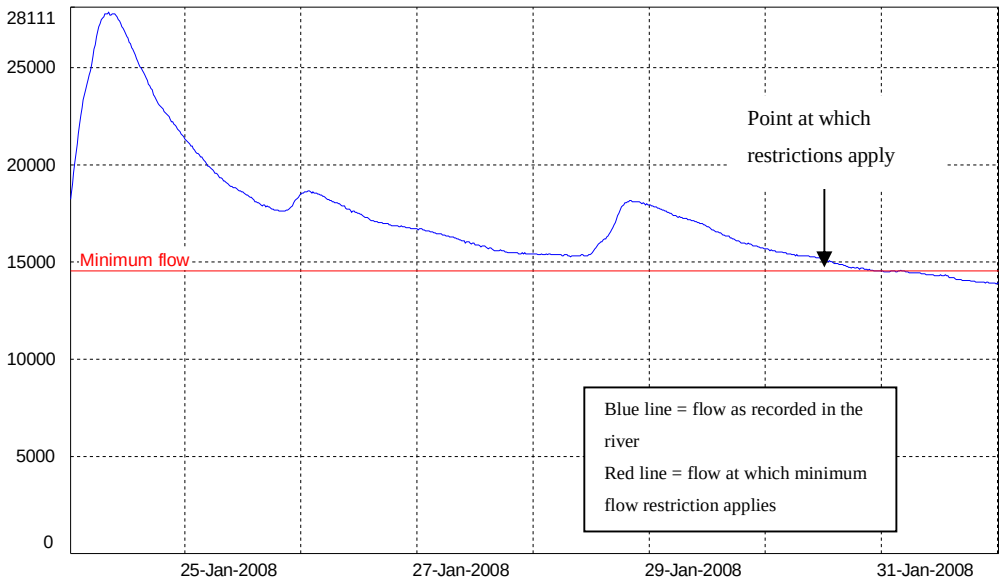


Figure 3. An example of the application of a minimum flow to the flow recession of a river

30. It is important to note that the application of restrictions on the abstraction of water does not necessarily prevent the river flow from decreasing below the minimum flow level, as this will happen naturally if low rainfall conditions persist. However, restrictions do reduce the stress that the instream values would be under if abstraction was allowed to continue while low flow conditions persist in the river.

3.2.4 Allocation effects on flow variability

31. The nature of the landscape and the hydrological characteristics of the water bodies in the Region (ie. relatively short, steep catchments) means that they respond rapidly to even relatively minor rainfall events and therefore show quite high flow variability.

32. The minimum flows that are proposed, and the volumes allocated for consented abstraction, are conservative enough that, above the minimum flow, the abstraction will have little or no effect on flow variability. Once the minimum flow is reached, abstractions, excluding “essential takes”, are switched off, allowing the stream’s natural flow recession to resume. Figure 4 demonstrates this principle.

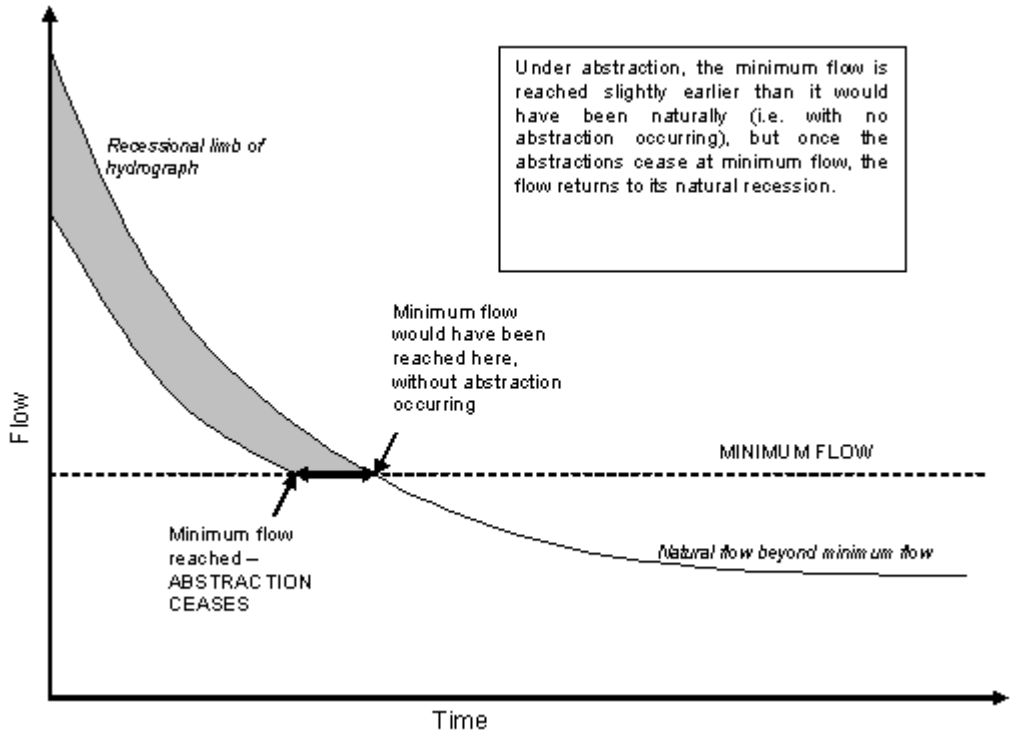


Figure 4. Diagram illustrating the effect of allocation on low flows in the Horizons region

33. Figure 4 shows the recessional limb of the hydrograph (or decreasing river flow during a period without rain) both under abstraction and as it would be naturally. Once the minimum flow is reached (shown by the dashed line), the abstractions cease. This allows the flow to return to its natural recession. Switching off non-essential abstractions in this manner avoids "flat-lining" of river flows and any artificial increase in the duration of low flow events. The effects of drawing down river flows for a prolonged period during summer months include, at a broad level, increasing the risk and magnitude of periphyton proliferation, reduction in available habitat and general reduction in water quality and life supporting capacity of the stream.

34. To demonstrate this principle further, here is a hypothetical example for a typical stream:

- MALF = 100 L/s;
- the core allocation is 10% of the MALF (10 L/s); and
- the minimum flow is 90% of the MALF (90 L/s).

The stream is fully allocated so at all times, with maximum consented abstraction occurring, 10 L/s are removed from the stream. As the flow approaches the minimum flow, this 10 L/s becomes a larger and larger proportion of the flow until the minimum flow is reached. At this point, >10% of the flow could potentially be abstracted.

35. The effect of this abstraction is that the MALF is reached earlier (by hours or days) than it would have been if there had been no abstraction. However, when the minimum flow is reached, consented abstraction must cease. This means that 10 L/s is returned to the stream. At this point, as long as the flow is below the minimum flow (ie. there is no abstraction occurring[1]), the variability of the flow is exactly as it would have been naturally.

36. Following a rainfall event significant enough to lift the flow above minimum flow, abstraction may be possible once more. Abstractors are encouraged to monitor their own water use, as well as the river flows, by logging into the WaterMatters website or by contacting Horizons.

37. I am confident that the proposed water allocation regime will maintain flow variability above the minimum flow in the Region's streams and rivers.

38. Figure 5 is an excerpt from the actual data record for the Raparapawai Stream (Mana 5e) in the Tamaki-Hopelands Water Management Zone (Mana 5) during low flow conditions from 5 January to 11 March 2006. The blue line is the actual recorded flow at the Jackson Rd flow monitoring station and the red line shows what the flow would have been had there been no abstraction from the stream. At high flows, the two hydrographs overlap, but at lower flows, the graph clearly shows the effect of abstraction. The point to take from this is that flow variability is retained throughout the flow record.

[1] Except for permitted takes and takes consented to continue below minimum flow – these would usually be for stock or human drinking water (as specified by Policy 6-19), and are a very small proportion of the flow, having a minimal effect of the instream health. See Paragraph 38 for more.

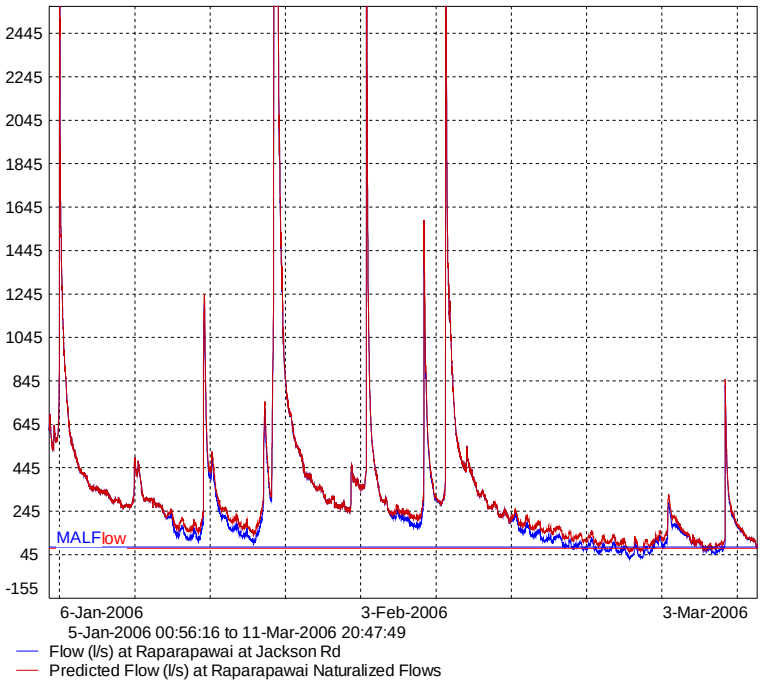


Figure 5. Excerpt from the actual flow record for the Raparapawai Stream at Jacksons Rd from 5 January to 11 March 2006, overlaid with the naturalised flow for the same time period.

39. The example of the Raparapawai catchment during 2006 shows the potential effect of an allocation regime where more than 50 L/s is allocated in a catchment where the MALF is 60 L/s and the minimum flow is 54 l/s. In this catchment in 2006 there were three consented users and all were telemetered. We know there were non-compliances, and action was taken in relation to these. In many ways, this catchment represents a "worst case" scenario for the effects of the proposed allocation regime on flow variability. The allocation regime detailed in the POP allocated a maximum of 20% of the MALF in the catchment.

3.2.5 Single "cut-off" flow

40. Previous frameworks for surface water management have used 'stepped' or multi-level restrictions. By comparison with these, the use of a single threshold in this proposed framework will make management of abstractions much easier for the water users and the monitoring of compliance against consent conditions will be more straightforward than previously.

41. Further detail on allocation regimes and effects on flow variability can be found in the Rangitikei and Ohau Water Resource Assessments (Roygard & Carlyon, 2004; and Horizons Regional Council, 2003).

3.2.6 Abstraction below minimum flow

42. The POP water allocation framework proposes that abstraction below minimum flows is limited to permitted takes, as provided for by Rule 15-1 of the POP, and consented takes for reasonable domestic water supply, reasonable stock water supply and essential takes as set out by POP Policy 6-19.

43. The provision to continue to allow abstraction for these purposes at flows below the minimum flow provides the opportunity to allocate water "in a way, or at a rate, which enables people and communities to provide for their social and cultural well-being"; the definition of the minimum flow is to safeguard "the life-supporting capacity of air, water, soil and ecosystems" as required by the Resource Management Act (1991).

3.3 Developing minimum flows for Horizons' Region

3.3.1 Establishing levels of available information

44. At the outset of the development of the water allocation framework for the POP, the team made an assessment of the current level of knowledge about the Region's streams and rivers. It is clear that much more is known about some streams and rivers than others, in terms of hydrology and instream values. The concept of a 'tiered' approach to minimum flow setting was adopted once the relative levels of available information were established.

45. Initially, four levels of information were identified. These are listed below, in descending order from the greatest level of available information to the least available information:

i. a Water Resource Assessment (WRA) has been completed.
ii. An Instream Flow Incremental Methodology (IFIM) study has been completed, but not carried through to a WRA.
iii. Horizons holds a long-term hydrological data record for the stream.
iv. Horizons has little or no hydrological data for the stream.

46. Following the identification of these four Scenarios, it was identified that National Water Conservation Orders (NWCOs) and Local Water Conservation Notices (LWCNs) should

be considered as a further two Scenarios. These are briefly described in the following sections and addressed in more detail in Section 3.3.2.1.

3.3.1.1 National Water Conservation Orders

47. National Water Conservation Orders (NWCO) are national policy instruments that prohibit the abstraction of water in two catchments within the Region. NWCOs were incorporated into the Regional Land and Water Plan as SW Rule 1. It was considered that protection by NWCO constituted another scenario regarding the allocation of water. These provide the highest level of information given that the NWCOs set out, among other things, that the quantity and rate of flow of water in the water bodies shall be maintained in or close to their natural state. This is interpreted to mean that little or no allocation can be allowed from these rivers.

3.3.1.2 Local Water Conservation Notices

48. Local Water Conservation Notices (LWCN) are regional policy instruments that once controlled the abstraction of water in three catchments within the Region. These LWCNs were incorporated into the Regional Land and Water Plan as SW Rule 2.

49. Water bodies that were protected by the LWCNs are classified by the Horizons "Values" project (Aussiel & Clark, 2007) as Regionally Significant Trout Fisheries. In the original iteration of the POP water allocation framework, it was considered that protection by LWCN constituted another scenario for water allocation.

50. Following the review of the proposed framework, it is proposed that water allocation in the LWCN Sub-zones be treated in the same manner as other Sub-zones that are classified as Regionally Significant Trout Fisheries. The details of this are set out in Dr Jon Roygard's evidence, but basically it is proposed that the minimum flows in these Sub-zones be set using the "hydrological statistics" method (Scenario 5 – see Paragraph 73).

3.3.2 Water allocation scenarios

51. In total, six basic scenarios that applied to the allocation of surface water in the were identified. These are set out, according to the level of information they provide, in Table 1.

Table 1. Table describing the level of information provided by each scenario identified for water allocation in Horizons' Region.

	Scenario	Level of information provided
1	National Water Conservation Orders apply (SW Rule 1)	Abstraction prohibited to protect very high instream values. Original intention of the NWCO to be maintained.
2	Water Resource Assessment has been completed	Values and appropriate minimum flows determined by integrated catchment study, including instream habitat assessment
3	IFIM studies have been completed	Values identified and appropriate minimum flows recommended by instream habitat assessment
4	Local Water Conservation Notices apply (SW Rule 2)	Abstraction controlled to protect high instream values - minimum flows set to reflect original intention of LWCNs
5	Robust hydrological record exists	Values not necessarily identified, but long-term hydrological record allows for statistical minimum flow to be derived
6	No hydrological or ecological data available	Little or no hydrological or ecological information exists – minimum flow can only be derived using interpolation methods. Referred to as the 'default' method in the original POP water allocation framework technical report (Hurndell *et al*., 2007).

52. Table 2 summarises each scenario, as carried through to this revised version of the proposed water allocation framework, with a brief description, when it might apply, and an example of how it informs the minimum flow setting process.

Table 2. Table summarising key points of water allocation methods applied in Horizons' revised proposed Water Allocation Framework

Scenario	Brief description	When applicable	Example
1	NWCO – minimum flows and core allocations set to achieve the original intention of the NWCO	When a NWCO applies within a Water Management Zone or Sub-zone	NWCO for the Upper Rangitikei (Rang 1) - "the quantity and rate of flow of natural water shall be retained in its natural state"; therefore the core allocation limit is 0 and no minimum flow is required.
2	WRA – minimum flows and core allocations determined as a result of a thorough resource assessment	When a WRA has been completed for a Water Management Zone or Sub-zone	Upper Manawatu Catchment Water Resource Assessment defines minimum flows and core allocations for Water Management Zones Mana 1 to Mana 6.
3	IFIM – minimum flow set at flow recommended based on an IFIM study and core allocation based on balance between instream requirements and surety of supply	When an IFIM study has been completed for water bodies within a Water Management Zone or Sub-zone and has not so far been incorporated into a WRA	IFIM results for the Oroua River (Mana 12a-12c) set the minimum flow at 1.05 m^3/s (to provide for habitat requirements of relevant trout life-stage) and the core allocation is determined by analysis of the flow distribution (surety of supply for water users).
4	LWCNs – minimum flows set to reflect relative value of fishery (Regionally Significant Trout Fishery)	When a LWCN has applied within a Water Management Zone or Sub-zone	Where a MALF is able to be established, the data is used to determine a recommended minimum flow, as for Scenario 5.
5	Hydrological statistics – minimum flow is set as a percentage of the MALF using a 3-tiered approach based on the relative size of the river	When Scenarios 1-4 are not applicable and a reliable actual or modelled hydrological record exists for the Water Management Zone or Sub-zone	A robust hydrological record exists for the Manawatu at Teachers College flow monitoring site – this data is used to determine the MALF (15.300 m^3/s) for the middle Manawatu River (Mana 10a) - minimum flow is MALF * 0.8 = 12.240 m^3/s.
6	MALF and minimum flow to be determined by some other method	When Scenarios 1-5 are not applicable	In the absence of a reliable actual or modelled hydrological record, other methods for the calculation of MALF statistics are employed, eg. catchment area extrapolation and specific yield calculations.

53. Through the process of using the six Scenarios to determine appropriate minimum flows and core allocation limits, it became evident that some "sub-scenarios" existed within the Scenarios. Table 3 lists the six main Scenarios with the relevant "sub-scenarios" and gives a brief description of their application. More detail on these revised Scenarios is presented in the following sections of this report.

Table 3. Table summarising water allocation Scenarios and sub-scenarios applied in Horizons' Water Allocation Framework as recommended to the POP Water Hearings.

	Scenario	Sub-scenario
1	National Water Conservation Orders apply (SW Rule 1)	No sub-scenario
2	Water Resource Assessment has been completed	No sub-scenario
3	IFIM studies have been completed	No sub-scenario
4	Local Water Conservation Notices/SW Policy 2	a) Local Water Conservation Notices applied/SW Rule 2
		b) Lakes and wetlands (POP Rule 15-5)
5	Robust hydrological record exists	a) Calculated MALF is ≤ 0.460 m^3/s – minimum flow set at 95% of MALF
		b) Calculated MALF is between 0.460 and 3.700 m^3/s – minimum flow set at 85% of MALF
		c) Calculated MALF is > 3.700 m^3/s – minimum flow set at 80% of MALF
6	No hydrological or ecological data available – MALF to be derived using other methods	a) MALF can be derived using gauging/flow recorder data relationship
		b) MALF can be derived using paired gauging relationship
		c) MALF can be derived using catchment area extrapolation and specific yield calculations
		d) Some of the Sub-zones in the Water Management Zone are impacted by the Tongariro Power Development (TPD) dams and diversions (Moawhango Sub-zones)
		e) The Whanganui Water Management Zone - Sub-zones are upstream and downstream of Whanganui at Te Maire and are affected by the TDP (default rule applies)
		f) Flow regime strongly influenced by storage in catchment, ie. no suitable hydrological record for MALF calculation
		g) Default rule applies – insufficient information available to enable MALF to be derived. Minimum flow to be set at MALF and core allocation limit to be set at 10% of MALF

3.3.2.1 Revised water allocation Scenarios in detail

54. Since the completion of the notified version of the proposed Water Allocation Framework, further development of the methodologies and approaches used has taken place. This section sets out the detail of the revised water allocation Scenarios as applied in this iteration of the proposed Water Allocation Framework.

Scenario 1: National Water Conservation Orders

55. There are several rivers, or reaches of rivers, in Horizons' Region that are protected by National Water Conservation Orders (NWCO). These were established under Section 20D of the Water and Soil Conservation Act 1967 and continue under the RMA.

56. These Orders take precedence over any other policy. They are designed to protect outstanding (nationally significant) recreational fisheries, wild and scenic characteristics and wildlife habitat for endangered or important native species. For specific detail refer to the Orders (Appendix 4).

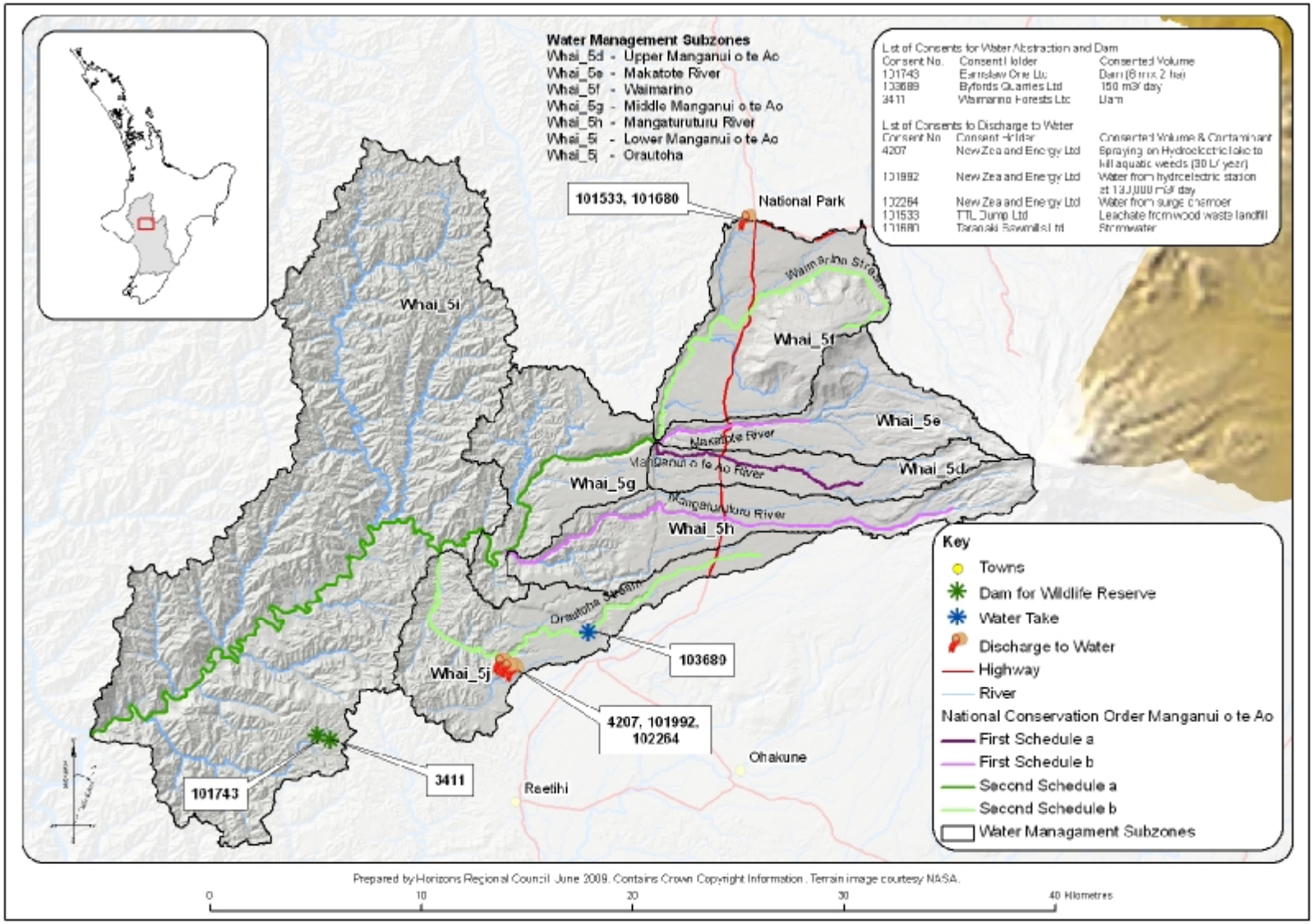
57. Where these Orders exist, the minimum flow and allocation limits are set based on the intention of the NWCO to ensure that the objectives of the Order are not compromised by consented water abstraction. The provisions of both NWCOs are set out in Table 4.

58. **The National Water Conservation (Manganui o te Ao River) Order 1988** divides the water bodies in the catchment into two Schedules. Changes to the Water Management Sub-zones (McArthur *et al*., 2007) in the Pipiriki Water Management Zone (Whai 5) are proposed in order to align with the division in the Schedules of the NWCO. These proposed changes are described in the evidence of Dr Roygard and the proposed Sub-zones are depicted in Map 1

59. The Manganui o te Ao NWCO defines the "normal flow" as:
"*the actual flow rate at that point, plus any abstractions or diversions from the river or stream and its tributaries upstream of that point, less any discharges into the river or stream or its tributaries upstream of that point (except that no account shall be taken of discharges into the Orautoha Stream at or about map reference NZMS 260 S20:057014 in accordance with the notified use authorising the Raetihi Power Scheme*)".

60. According to the Manganui o te Ao NWCO, the "minimum flow" at any point in a river or stream means:
"*the mean of the annual minima of the 7 day flow, as estimated by the Rangitikei-Wanganui catchment Board* (Horizons), *where "7 day flow" means the mean flow over any 7 day period*".

61. This is usually referred to as the seven-day mean annual low flow or seven-day MALF. Horizons typically uses a one-day MALF. For a comparison between the one-day MALF and the seven-day MALF, refer to Henderson (2008).



Map 1. Proposed Sub-zones for the Manganui o te Ao catchment

62. **The National Water Conservation (Rangitikei River) Order** applies to what the Order refers to as the middle and upper Rangitikei River. The division of the Rangitikei Water Management Zone (McArthur *et al*., 2007) into Sub-zones reflects the Order's reference to the "Middle River" and "Upper River".

Table 4. Flow requirements for rivers protected by National Water Conservation Orders in Horizons' Region

River	Flow Requirement
National Water Conservation (Manganui o te Ao River) Order 1988	First Schedule: Applies to: the Manganui o te Ao River upstream of its confluence with the Waimarino Stream; the Makatote Stream and the Mangaturuturu River. the quantity and rate of flow of natural water in these waterways shall be retained in their natural state.
	Second Schedule: Applies to: the Manganui o te Ao River downstream of its confluence with the Waimarino Stream, the Waimarino Stream, and the Orautoha Stream. Water abstraction shall not reduce the "normal flow"[2] by more than 5%, and in any case shall not reduce the rate of flow below the "minimum flow"[3]
National Water Conservation (Rangitikei River) Order	For the upper Rangitikei River, including— The Rangitikei River itself from its source (map reference U19:723-313) to its confluence with the Makahikatoa Stream (map reference U21:725-888), and All rivers and streams contributing water to the Rangitikei River upstream of that confluence— the quantity and rate of flow of natural water shall be retained in its natural state.
	For the middle Rangitikei River, including— The Rangitikei River from its confluence with the Makahikatoa Stream (map reference U21:725-888) to the Mangarere Bridge (map reference (T22:483-496), The Whakarekau River plus any or all of its tributaries, and The Kawhatau River or its tributaries, namely, the Pouranaki and Mangakokeke Stream— the rate of flow of the natural waters shall not be less than 95% of the river flow at that point.

Scenario 2: Water Resource Assessments

63. Water Resource Assessments (WRAs) are comprehensive studies that document a catchment (including geology, hydrology, land use, water quality and ecology); identify

[2] The term "normal flow" in rivers affected by the Water Conservation (Manganui o te Ao River) Order 1998 is defined in the Order and that definition is reproduced in Paragraph 59 of this evidence.

[3] The term "minimum flow" in rivers affected by the Water Conservation (Manganui o te Ao River) Order 1998 is defined in the Order and that definition is reproduced in Paragraph 60 of this evidence.

the values within the catchment; set out minimum flows and allocation limits for the catchment; and provide recommendations for ongoing water management within that catchment. The minimum flows set out in the WRAs are generally based on the results from Instream Flow Incremental Studies (IFIM) studies in the catchment, and the details of these are included in the WRA document. See the following section, on Scenario 3: Instream Flow Incremental Studies for more detail.

64. To date, Horizons has completed WRAs for the Rangitikei catchment, the Ohau catchment, and the Upper Manawatu catchment. The WRAs specifically set out minimum flows and allocation limits for the catchments and Water Management Zones addressed, so where a WRA exists, the minimum flows and allocation limits are set as stated in the WRA. Some amendments have been recommended following the notification of the POP in May 2007. These amendments are outlined in the following sections of this report.

Scenario 3: Instream Flow Incremental Methodology

65. Instream Flow Incremental Methodology (IFIM) is a habitat assessment method used where the instream management objective is the protection of particular aquatic values, making retention of appropriate habitat a key consideration. It uses models of the hydraulic and morphological characteristics of a stream to determine the amount of habitat available for various values, species, or life-stages at a range of flows. The hydrological statistic mean annual low flow (MALF) is a key input to the modelling. The model uses the statistic together with the field measurements to make a recommendation as to an optimal minimum flow to provide for a particular level of habitat to be retained.

66. The identification of values is key to applying an IFIM study to a water body. The identification of the values to be protected determines which “habitat preference curves” are to be used in making the minimum flow recommendation, and subsequently, the level of habitat reduction that is acceptable in that river, for that value or set of values.

67. IFIM studies have been carried out on a number of rivers and streams in Horizons’ Region. Some of the results from these studies have been incorporated into WRAs, where these have been completed. Where the IFIM results have not already been used in determining minimum flows and allocation limits through a WRA, they provide minimum flow recommendations for the water allocation process.

68. Dr John Hayes and Mr Joe Hay from the Cawthron Institute have been involved in most of the IFIM studies carried out in the Region and have provided analysis of the collected data and recommendations in the form of written reports. As part of the preparation of this evidence, Mr Hay was asked to revisit some of the previous studies in the light of revised MALF statistics produced by Horizons and to ensure that the latest information on habitat curves was included. Cawthron laso suggested that this would be an appropriate time to revisit some of the datasets used in the original surveys. Some changes to the minimum flow recommendations have come about as a result and the details are set out in Mr Hay's evidence. The most up-to-date recommendations are used in the analysis presented in this evidence, and in the revised recommendations for Schedule B of the POP.

Scenario 4: Local Water Conservation Notices/Regional Plan Rules

69. Local Water Conservation Notices were statutory instruments established under Section 20H of the Water and Soil Conservation Act 1967. The objective of the Notices was to protect the waters of specific rivers and their tributaries for regionally important fisheries and angling features. The Notices restricted or prohibited the granting of resource consents by Regional Councils to dam, take water from, and discharge contaminants to these rivers and streams. The RMA (s368) deemed that these LWCNs become provisions in Regional Plans and they are effectively replaced by the rules and policies in these Plans.

70. The LWCNs in Horizons Region were replaced by SW Policy 3 and SW Rule 2 of the Land and Water Regional Plan, 2003. This Plan, in turn, is proposed to be superseded by the POP.

71. In the original POP water allocation framework technical report (Hurndell *et al*., 2007), where a LWCN has applied in the Region, the minimum flows and allocation limits set out for those streams and rivers reflected an interpretation of the intention of those LWCNs, and of SW Policy 3 and SW Rule 2 of the Land and Water Regional Plan, 2003. Following the revision of same aspects of the proposed framework, this evidence puts forward that the LWCN water bodies be treated under the same minimum flow and core allocation methodologies as are applied to other water bodies in the Region identified by McArthur *et al.* (2007) as Regionally Significant Trout Fisheries. The details of this are set out in Dr Roygard's evidence.

72. For continuity from the originally proposed framework, a separate Scenario referring to LWCNs is retained.

Scenario 5: Robust hydrological record

73. Where Scenarios 1-4 are not applicable, but a long-term (ie. 10 years or more is considered to constitute a robust length of record by Henderson & Diettrich, 2007), good quality hydrological data record or flow series is available, actual or modelled, this is used to set the minimum flow.

74. Hay & Hayes (2007) recommended a tiered approach to instream flow assessment and minimum flow setting depending on demand for abstraction and the relative significance of instream values. Where total abstraction demand is a small proportion of river flow, they suggested using the MALF, or a proportion of it, to set minimum flows. On this basis, the MALF is the key statistic used where Scenario 5 applies.

75. Jowett (1990, 1992) found that the amount of instream habitat for adult brown trout at the MALF was correlated with adult brown trout abundance in New Zealand rivers. However, minimum flows recommended by IFIM studies[4] are usually lower than MALF by 5-30%. A comparison between the MALFs and the IFIM-recommended minimum flows (for 90% of habitat retention) for streams and rivers in the Region was undertaken. The details of this comparison are set out in Dr Roygard's evidence.

76. In brief, the results of the analysis show that the IFIM minimum flow recommendation for a stream may be predicted by the MALF statistic for that stream. The relationship between the IFIM recommended flow and the MALF changes depending on the relative size of the MALF. The analysis shows that the MALF statistic can be used to form three categories for minimum flow setting:
    a. MALF is < 0.460 m^3/s = recommended minimum flow is 95% of the MALF.
    b. MALF is between 0.460 m^3/s and 3.700 m^3/s = recommended minimum flow is 85% of the MALF.
    c. MALF is > 3.700 m^3/s = recommended minimum flow is 80% of MALF.

77. The use of these three categories for minimum flow setting differs from the methodology set out in Hurndell *et al*. (2007) and is considered to be more robust.

[4] Based on the retention of 90% of the adult brown trout habitat available at MALF.

Scenario 6: No hydrological or ecological data available – MALF to be derived by other methods

78. When there is sparse or no information available about a river or stream, and none of Scenarios 1-5 apply, the MALF statistic and subsequently, a minimum flow recommendation, may be able to be derived by some other method. These include:
    a. MALF can be derived using a gauging/flow recorder data relationship.
    b. MALF can be derived using a paired gauging relationship.
    c. MALF can be derived using a catchment area extrapolation and specific yield calculations.

79. Once a MALF has been derived through Scenario 6a), b) or c), then the relevant methodology under Scenario 5 may be applied to determine an appropriate minimum flow.

80. In some cases, no MALF and subsequent minimum flow can be determined. These include:
    a. Some of the Sub-zones in the Water Management Zone are impacted by the TPD dams and diversions (Moawhango Sub-zones)
    b. The Whanganui Water Management Zone - Sub-zones are upstream and downstream of Whanganui at Te Maire and are affected by the TDP (default rule applies)
    c. Flow regime strongly influenced by storage in catchment ie. no suitable hydrological record for MALF calculation
    d. Default rule applies – insufficient information available to enable MALF to be derived.
    e. The detail of each of these methods is set out in the evidence of Brent Watson.

81. Once a MALF statistic has been derived, if possible, the minimum flow setting methods described in Scenario 6 can then be applied, depending on the relative size of the river at low flow (MALF). The treatment of Sub-zones that fall into sub-scenarios d), e), f) and g) is discussed in Dr Roygard's evidence.

3.3.3 Decision support process diagram

82. A "decision support" diagram has been developed to demonstrate the process around minimum flow setting in the light of the six Scenarios described in Section 0.

83. This allows the process of method selection to be transparent, repeatable, and justified. The diagram is illustrated in Figure 6.

84. The diagram sets out the possible Scenarios on the left hand side. If the Scenario applies to the stream being considered, then the diagram sets out the steps to be taken in setting the minimum flow and core allocation limit. For example, if Scenario 1 applies (ie. there is a NWCO in place), then the minimum flows and core allocation limits set must give effect to the wording and original purpose of the NWCO. If Scenario 2 applies, the minimum flows and core allocation limits will already have been determined by the Water Resource Assessment, and therefore should be adopted through into the Water Allocation Framework.

85. Map 1 illustrates how the various minimum flow setting Scenarios have been applied across the Region.

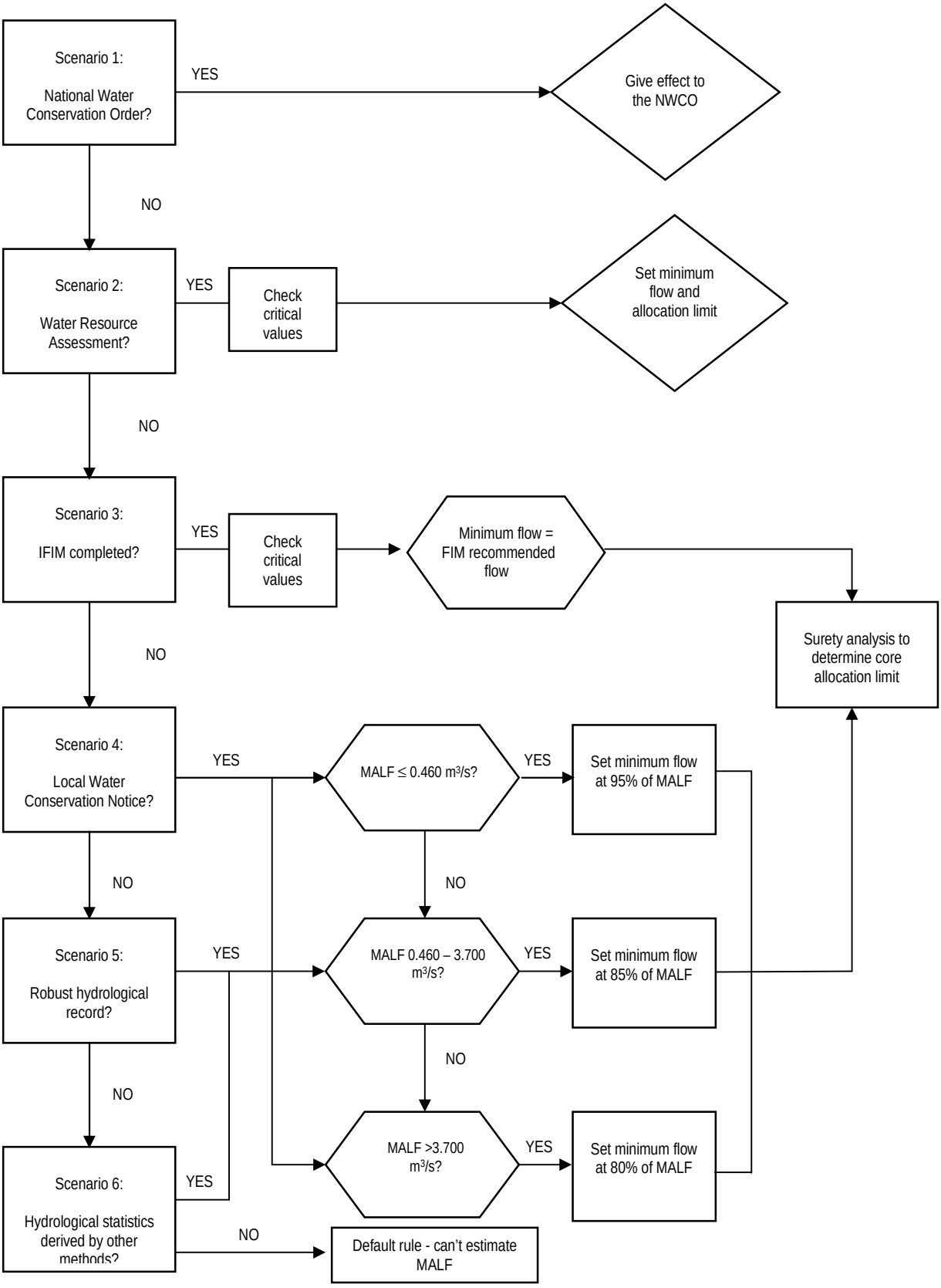
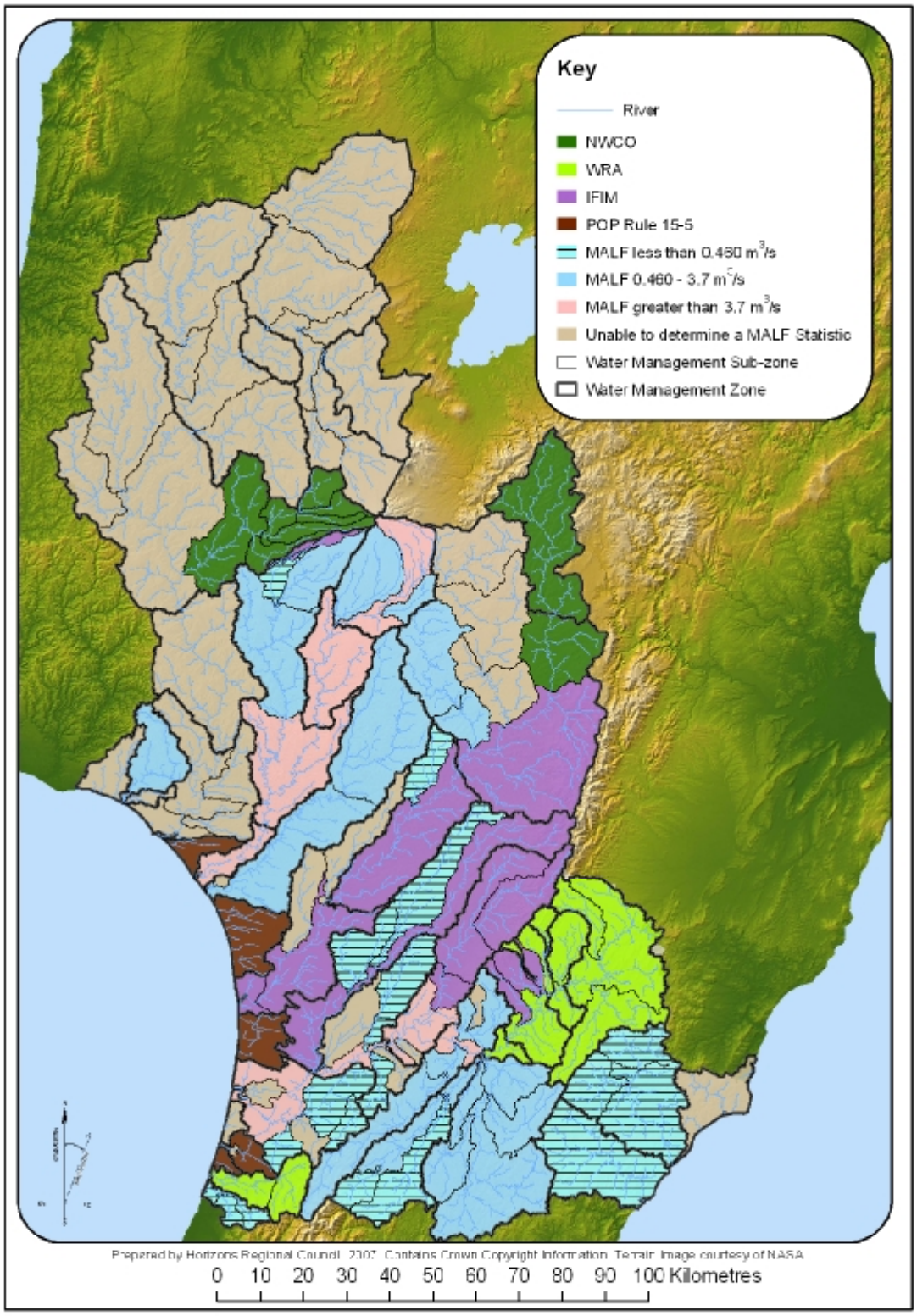


Figure 6. Decision-support flow diagram



Map 2. Minimum flow Scenario by Water Management Sub-zone

3.4 Setting the core allocation limits

86. Ensuring a balance between environmental protection and surety of supply for out-of-stream users are the key factors in establishing a Water Allocation Framework for surface water bodies. Water allocation really has two parts – the minimum flow setting, as discussed in the sections above, which provides the basic "environmental protection" for the stream; and the setting of core allocation limits. Setting appropriate core allocation limits has a dual purpose – they ensure that the instream health of the stream is not compromised by abstraction, by limiting the amount of time that a river will be artificially drawn down to the minimum flow by abstraction; and they also ensure that out-of-stream users have reasonable ability to utilise their consents.

87. As illustrated in Figure 2, the amount of water available for allocation, or the core allocation limit, is the difference between the minimum flow and the management flow, so effectively when the core allocation limit is set, the management flow is determined. The frequency with which the management flow is likely to be reached indicates the level of surety of supply that out-of-stream users can expect, as restrictions on abstractions will apply to consented takes when the management flow occurs. Where the core allocation limit is not fully allocated, the management flow equals the minimum flow plus the allocated volume. Where allocation is less than the core allocation limit, the management flow will be reached less often than under full allocation.

88. The greater the level of allocation from a stream, the more often the stream will reach its minimum flow. Also, it is generally recognised that minimum flows must be set in conjunction with appropriate allocation rules, to ensure that a degree of the natural flow variability is maintained. This is in order to maintain ecological function (ie. extensive periods of "flat lining" at the minimum flow should be avoided). This aspect is discussed in Section 3.2.4 of this evidence.

For this framework, the core allocation limits were set using estimates of the frequency with which a range of potential management flows would be likely to occur, or surety analysis. This is done using Microsoft Excel Visual Basic code. Basically, the code uses various proportions of the relevant MALF statistic are added to actual or modelled flow records to generate a range of possible management flows. The code analyses the flow records to determine how many days in a year[5] that each possible management flow occurs throughout the flow record. This gives an estimate of how many days that the stream is likely to be at or below the minimum flow. It also indicates the number of days that restrictions on abstraction could be expected to occur if the

[5] 1 July to 1 July, or a "water year"

core allocation limit was set at a particular percentage of MALF. The estimated number of days restriction are not necessarily consecutive.

89. Table 5 is an example of typical output from this analysis. It shows that at the selected minimum flow, and a core allocation limit of 5% of MALF (or a management flow of 13.005 m^3/s) at full allocation, the average number of days per year on which the management flow is likely to occur (based on past flow records) is 5.3, the maximum expected occurrence is 57.1 days, and the 90% percentile occurrence (90% of years) is 18.64 days. In this evidence, the frequency estimated is rounded to the nearest whole day for simplicity.

Table 5. Example of surety of supply analysis output table

	Site name	Start	End	Statistic	Flow (m3/s)	Average	90th percentile	Max
1	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations minimum flow	12.24	3.6	11.72	50.8
2	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations MALF	15.3	12.3	34.48	70
3	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations Min 5%	13.005	5.3	18.64	57.1
4	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations Min 10%	13.77	7.3	25.98	62.1
5	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations Min 15%	14.535	9.9	31.02	66.8
6	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations Min 20%	15.3	12.3	34.48	70
7	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations Min 25%	16.065	15	40.52	76.1
8	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations Min 30%	16.83	17.7	47.86	85.1
9	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations Min 35%	17.595	20.6	54	91.3
10	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations Minimum flow + Current Allocation SubZone	15.78813	14	37.42	73.3
11	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations Minimum flow + Current Allocation WMZone	15.92308	14.5	38.74	74.1
12	Manawatu at Palmerston North	1/07/1923	1/07/2008	Surety Calculations Minimum flow + Current Allocation WMZone Total Cumulative	19.11721	26.4	62.72	100.4

90. This surety analysis was completed for every relevant flow site for which sufficient flow record was available. The longer the flow record, the more representative the estimates

are likely to be. Dr Roygard's evidence gives detail on interpreting the surety analysis outputs.

91. The outputs of the surety analysis were used to determine the recommended core allocation limit for each Sub-zone in the framework, by making assessments as to whether a potential management flow would provide reasonable surety for, and not unreasonably restrict, the ability of out-of-stream users to exercise their consents to abstract water, and that a good level of flow variability for the river would be maintained.

92. NWCOs and WRAs state a predetermined core allocation, so no further work was required to establish core allocation limits when these Scenarios apply (ie. Scenarios 1 and 2).

3.5 Minimum flows and core allocation limits by Water Management Zone

93. This section details the recommended minimum flows and core allocation limits for each Water Management Zone. It is recommended that this section be read in conjunction with the document Development of Water Management Zones in the Manawatu-Wanganui Region (McArthur *et al*., 2006). Each sub-section is headed with the name of the Water Management Zone, and begins with a summary table which includes: the identified critical value; previous and revised MALF statistics; and the notified minimum flow and core allocation limit and the revised recommendations for these, for each Sub-zone. The critical value abbreviations used are:

- TF (Ostd) = trout fishery (outstanding)
- TF (RS) = trout fishery (regionally significant)
- TF (O) = trout fishery (other)
- TS = trout spawning
- LSC = life supporting capacity
- N(ND) = Native species (non-diadromous)

Other abbreviations in the tables are "n/a", meaning that it is not appropriate to set a minimum flow/core allocation limit for some reason; and "nil" which means that at the time of preparation, there was no MALF statistic available; "Rec'd", which is short for "recommended"; "alloc." which is short for "allocation" and "min." which is short for "minimum".

94. In the "Min. flow method" column of the summary tables, the number listed usually refers to the Scenario/sub-scenario applied. Where Scenario 3 applies, the relevant level of habitat retention for the IFIM recommendation is listed in brackets, eg. 3 (90%).

95. Each sub-section also explains any cumulative core allocation limits[6], where they apply and details, and additional information relevant to the allocation of water in that Water Management Zone. see Appendix 2 for more information on proposed cumulative allocation limits and current allocation.

96. Individual surety analysis outputs for the recommended minimum flow are also included. These show the management flow selected alongside the range of other possible core allocation levels.

97. The Ministry for the Environment has proposed a National Environmental Standard (NES) on Ecological Flows and Water Levels. The methodologies that they propose use the 7-day MALF to set minimum flows. In the surety of supply tables, where the 7-day MALF statistic is available, it has been used to calculate a minimum flow for comparison to Horiaon's proposed framework. More detail on the proposed NES can be found in Dr Roygard's evidence.

Table 6. Summary table: Recommended minimum flows and core allocation limits for the Upper Manawatu Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 1a	Upper Manawatu	TF (RS)	1.820	1.820	3 (90%)	1.600	1.600	0.204	0.205	Manawatu at Weber Road	Y
Mana 1b	Mangatewainui	TF (RS)	1.820	1.820	3 (90%)	1.600	1.600	0.063	0.065	Manawatu at Weber Road	N
Mana 1c	Mangatoro	TF (RS)	0.825	0.786	3 (90%)	0.702	0.700	0.204	0.120	Mangatoro at Mangahei Road	Y
Whole zone cumulative core allocation limit (Mana 1a + Mana 1b + Mana 1c)									0.205		Y

3.5.1 Upper Manawatu – Mana 1a and Mangatewainui – Mana 1b

[6] See Hurndell *et al*., 2007, p 51 for detail on understanding cumulative core allocation limits.

98. Water allocation in the Upper Manawatu Water Management Zone was addressed by the Upper Manawatu Water Resource Assessment (WRA), completed in 2006 by Jon Roygard, Jeff Watson and Maree Clark of Horizons Regional Council. The full details can be found in the document titled Water Allocation Project – Upper Manawatu Catchment Water Resource Assessment – Allocation Limits and Minimum Flows (Roygard *et al*., 2006), but the work is summarised here.

99. The Upper Manawatu WRA set out minimum flows and core allocation limits for all of the Water Management Zones and Sub-zones down the catchment to below Mana 6. The WRA presents a comprehensive summary of the water resources within these Water Management Zones. It brings together rainfall and river data, presents the latest flow statistics (as at 2006), assesses water use in the catchment, discusses the relationships between flow and water quality indicators, and proposes a minimum flow and core allocation framework for the catchment based on IFIM studies and the values identified for the catchment. The minimum flows for each Sub-zone are based on hydrological statistics from instantaneous flow data for the relevant river or stream, from the most relevant flow recorder (usually at the bottom of the Sub-zone).

100. The values selected to determine the level of habitat retention were based around habitat preference curves for brown trout, and included habitat requirements for adult brown trout, brown trout spawning and brown trout yearlings/small trout feeding requirements. This analysis was provided by Hay & Hayes (2005b). These recommended minimum flows are applied not only to maintain habitat for the "target" species, but also to provide for other instream species with lower flow requirements, maintaining general instream conditions that are appropriate for the ecological function and potential range of instream communities (Jowett & Hayes, 2004).

101. The minimum flow limits for the Sub-zones in Mana 1 were derived using IFIM and are set to maintain 90% of the habitat available for adult trout at mean annual low flow. This is deemed to be an appropriate level of habitat retention to provide for the instream requirements of a regionally significant trout fishery.

102. The only change to the minimum flows and core allocation limits for Mana 1a and 1b recommended here is a rounding of the core allocation limit to the nearest 0.005 m^3/s (for Mana 1a, from 0.204 to 0.205 m^3/s and for Mana 1b, from 0.063 to 0.065 m^3/s).

103. The current allocation in Mana 1a is within the proposed core allocation limit, but current allocation in Mana 1b exceeds the proposed limit for that sub-zone.

Table 7. Surety of supply analysis Manawatu at Weber Road

Manawatu at Weber Road (Data record: 1 July 1955 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	1.820	16	45	86
IFIM Minimum flow	1.600	7	27	51
Minimum flow plus 5% of MALF as core allocation	1.691	11	35	67
Minimum flow plus 10% of MALF as core allocation	1.782	14	42	81
Minimum flow plus 15% of MALF as core allocation	1.873	18	48	90
Minimum flow plus 20% of MALF as core allocation	1.964	22	59	95
Minimum flow plus 25% of MALF as core allocation	*2.055*	*26*	*67*	*97*
Minimum flow plus 30% of MALF as core allocation	2.146	30	75	104
Minimum flow plus 35% of MALF as core allocation	2.237	34	82	108
Minimum flow plus current allocation in Sub-zone	1.640	9	29	58
Minimum flow plus current allocation WMZ	1.739	13	37	76
Minimum flow plus current allocation WMZ Total Cumulative	1.805	15	44	85
7 Day MALF (NES)	1.953	22	58	95
7 Day MALF minimum flow (NES)	1.758	13	39	79
7 Day MALF minimum flow + core allocation (NES)	2.344	38	89	113

3.5.2 Mangatoro – Mana 1c

104. For Mana 1c, a change in the core allocation limit from 0.204 to 0.120 m^3/s is recommended. A revised MALF was derived for the flow monitoring site "Mangatoro at Mangahei Rd" as part of the review carried out in preparation for this evidence. This new MALF was used to estimate surety based on a range of possible core allocation limits, and a core allocation limit of 15% of the revised MALF was selected. As Table 9 shows, the number of days of likely restriction is greatly reduced under the recommended core allocation limit compared to that notified.

Table 8. Surety of supply analysis Mangatoro at Mangahei Road

Mangatoro at Mangahei Road	Flow	Average	90th	Maximum

(Data record: 1 July 2004 – 1 July 2008)	(m^3/s)	no. of days restriction	percentile no. of days restriction	no. of days restriction
MALF	0.786	4	12	17
Minimum flow IFIM	0.700	<1	<1	1
Minimum flow plus 5% of MALF as core allocation	0.739	2	5	7
Minimum flow plus 10% of MALF as core allocation	0.779	3	10	14
Minimum flow plus 15% of MALF as core allocation	*0.818*	*10*	*23*	*31*
Minimum flow plus 20% of MALF as core allocation	0.857	20	37	43
Minimum flow plus 25% of MALF as core allocation	0.897	32	48	50
Minimum flow plus 30% of MALF as core allocation	0.936	41	61	62
Minimum flow plus 35% of MALF as core allocation	0.975	48	72	75
Minimum flow plus current allocation in Sub-zone	0.715	1	2	3
Minimum flow plus current allocation WMZ	0.839	16	31	39
Minimum flow plus current allocation WMZ Total Cumulative	0.905	33	50	51

Table 9. Recommended changes to core allocation limit Mana 1c

	Mana 1c - Mangatoro	
Previous MALF	0.825 m^3/s	
Revised MALF	0.786 m^3/s	
Previous core allocation limit	30% of MALF	
Surety (based on revised MALF and previous core allocation limit)	Ave. no. of days restriction likely	Max. no. of days restriction likely
	41	61
Recommended core allocation limit	15% of MALF	
Surety (based on revised MALF and recommended core allocation limit)	Ave. no. of days restriction likely	Max. no. of days restriction likely
	10	31

3.5.2.1 Whole zone core allocation limit

105. The whole zone core allocation limit sets the maximum instantaneous volume of water that can be allocated out of the whole Mana 1 Water Management Zone. The water can be allocated in any Sub-zone, up to the individual limit of that Sub-zone, but the total allocation in the Sub-zone should not exceed the whole zone core allocation limit.

3.5.3 Weber-Tamaki – Mana 2

Table 10. Summary table: Recommended minimum flows and core allocation limits for the Weber-Tamaki Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 2a	Weber-Tamaki	TF (RS)	1.820	1.820	3 (90%)	1.600	1.600	0.204	0.250	Manawatu at Weber Rd	Y
Mana 2b	Mangatera	TS	1.820	1.820	3 (90%)	1.600	1.600	0.047	0.045	Manawatu at Weber Rd	Y
Catchment cumulative core allocation limit (Mana 1 + Mana 2)									0.250		Y

3.5.3.1 Mana 2a – Weber-Tamaki

106. Water allocation in the Weber-Tamaki Sub-zone was addressed by the Upper Manawatu Water Resource Assessment (WRA), completed in 2006 by Jon Roygard, Jeff Watson and Maree Clark of Horizons Regional Council. The full details can be found in the document titled Water Allocation Project – Upper Manawatu Catchment Water Resource Assessment – Allocation Limits and Minimum Flows (Roygard *et al*., 2006).

107. The only change to the minimum flow and core allocation limit for Mana 2a recommended here is a rounding of the core allocation limit to the nearest 0.005 m^3/s (0.204 to 0.205 m^3/s).

3.5.3.2 Mana 2b - Mangatera

108. Water allocation in the Mangatera Sub-zone was addressed by the Upper Manawatu Water Resource Assessment (WRA), completed in 2006 by Jon Roygard, Jeff Watson and Maree Clark of Horizons Regional Council. The full details can be found in the document titled Water Allocation Project – Upper Manawatu Catchment Water Resource Assessment – Allocation Limits and Minimum Flows (Roygard *et al*., 2006).

109. The only change to the minimum flow and core allocation limit for Mana 2b recommended here is a rounding of the core allocation limit to the nearest 0.005 m^3/s (0.047 to 0.045 m^3/s).

110. Table 11 gives an indication of the likely frequency of occurence of the minimum flow at Manawatu at Weber Road. The highlighted line is not the actual management flow, but is the closest example available.

111. The current allocation in the Mana 2 WMZ is within the proposed core allocation limit for the WMZ.

Table 11. Surety of supply analysis Manawatu at Weber Road

Manawatu at Weber Road (Data record: 1 July 1955 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	1.820	16	45	86
IFIM Minimum flow	1.600	7	27	51
Minimum flow plus 5% of MALF as core allocation	1.691	11	35	67
Minimum flow plus 10% of MALF as core allocation	1.782	14	42	81
Minimum flow plus 15% of MALF as core allocation	1.873	18	48	90
Minimum flow plus 20% of MALF as core allocation	1.964	22	59	95
Minimum flow plus 25% of MALF as core allocation	*2.055*	*26*	*67*	*97*
Minimum flow plus 30% of MALF as core allocation	2.146	30	75	104
Minimum flow plus 35% of MALF as core allocation	2.237	34	82	108
Minimum flow plus current allocation in Sub-zone	1.640	9	29	58
Minimum flow plus current allocation WMZ	1.739	13	37	76
Minimum flow plus current allocation WMZ Total Cumulative	1.805	15	44	85
7 Day MALF (NES)	1.953	22	58	95
7 Day MALF minimum flow (NES)	1.758	13	39	79
7 Day MALF minimum flow + core allocation (NES)	2.344	38	89	113

3.5.3.5 Catchment cumulative core allocation limit

112. The catchment cumulative core allocation limit is the maximum volume of water that can be allocated from the catchment above this point in the catchment (from Mana 1 and Mana 2). In this case, it is the same as the maximum volume able to be allocated from any of the Sub-zones above the end of Mana 2. The water can be allocated from any Sub-zone up to its individual limit, but the total allocation in the catchment, to the end of Mana 2, should not exceed 0.250 m^3/s.

3.5.4 Upper Tamaki – Mana 3

Table 12. Summary table: Recommended minimum flows and core allocation limits for the Upper Tamaki Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 3	Upper Tamaki	TS	0.260	0.260	3 (90%)	0.238	0.240	0.078	0.080	Tamaki at Water Supply Weir	N

113. Water allocation in the Upper Tamaki Water Management Zone was addressed by the Upper Manawatu Water Resource Assessment (WRA), completed in 2006 by Jon Roygard, Jeff Watson and Maree Clark of Horizons Regional Council. The full details can be found in the document titled Water Allocation Project – Upper Manawatu Catchment Water Resource Assessment – Allocation Limits and Minimum Flows (Roygard *et al*., 2006).

114. The only change to the minimum flow and core allocation limit for Mana 2b recommended here is a rounding of the core allocation limit to the nearest 0.005 m^3/s (0.078 to 0.080 m^3/s). The primary water abstraction in this WMZ is for the Dannevirke Water Supply.

115. The current allocation in the Mana 3 WMZ exceeds the proposed core allocation limit for the WMZ.

3.5.5 Upper Kumeti – Mana 4

Table 13. Summary table: Recommended minimum flows and core allocation limits for the Upper Kumeti Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 4	Upper Kumeti	N (ND)	0.059	0.060	3 (90%)	0.055	0.055	0.005	0.010	Kumeti at Te Rehunga	Y

116. Water allocation in the Upper Kumeti Water Management Zone was addressed by the Upper Manawatu Water Resource Assessment (WRA), completed in 2006 by Jon Roygard, Jeff Watson and Maree Clark of Horizons Regional Council. The full details can be found in the document titled Water Allocation Project – Upper Manawatu Catchment Water Resource Assessment – Allocation Limits and Minimum Flows (Roygard *et al*., 2006).

117. It is proposed that the core allocation limit be increased from 0.005 m^3/s, as recommended in the WRA and the notified version of the Water Allocation Framework, to 0.010 m^3/s. This is 20% of the MALF.

118. Under the proposed minimum flow and core allocation limit, at full allocation, the minimum flow is likely to occur on 22 days per year on average and on up to 79 days. In 90% of years, the maximum number of days of restriction likely is 66 (Table 14).

119. The current allocation in the Mana 4 WMZ is within the proposed core allocation limit for the WMZ.

Table 14. Surety of supply analysis Kumeti at Te Rehunga

Kumeti at Te Rehunga (Data record: 1 July 1980 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.060	18	57	71
Minimum flow IFIM	0.055	15	51	64
Minimum flow plus 5% of MALF as core allocation	0.058	16	55	68
Minimum flow plus 10% of MALF as core allocation	0.061	19	59	73
Minimum flow plus 15% of MALF as core allocation	0.064	20	62	75
Minimum flow plus 20% of MALF as core allocation	*0.067*	*22*	*66*	*79*
Minimum flow plus 25% of MALF as core allocation	0.070	24	69	83
Minimum flow plus 30% of MALF as core allocation	0.073	26	72	90
Minimum flow plus 35% of MALF as core allocation	0.076	28	75	98
Minimum flow plus current allocation in Sub-zone	0.055	15	51	64
Minimum flow plus current allocation WMZ	0.055	15	51	64
Minimum flow plus current allocation WMZ Total Cumulative	0.055	15	51	64

3.5.6 Tamaki-Hopelands – Mana 5

Table 15. Summary table: Recommended minimum flows and core allocation limits for the Tamaki-Hopelands Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 5a	Tamaki-Hopelands	TF (RS)	3.700	3.700	3 (90%)	2.980	2.980	0.971	0.970	Manawatu at Hopelands	Y
Mana 5b	Lower Tamaki	TS	0.460	0.460	3 (90%)	0.360	0.360	0.138	0.140	Tamaki at Stephensons	Y
Cumulative core allocation limit (Mana 3 + Mana 5b)									0.140		N
Mana 5c	Lower Kumeti	TS	0.059	0.060	3 (90%)	0.055	0.055	0.059	0.060	Kumeti at Te Rehunga	Y
Mana 5d	Oruakeretaki	TS	0.350	0.330	3 (70%)	0.293	0.208	0.105	0.090	Oruakeretaki at SH2 Napier	Y
Mana 5e	Raparapawai	TS	0.080	0.060	3 (70%)	0.074	0.035	0.024	0.015	Raparapawai at Jacksons Road	N
Cumulative core allocation limit (Mana 4 + Mana 5c)									0.060		Y
Catchment cumulative core allocation limit (Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5)									0.970		Y

120. Water allocation in the Tamaki Hopelands Water Management Zone was addressed by the Upper Manawatu Water Resource Assessment (WRA), completed in 2006 by Jon Roygard, Jeff Watson and Maree Clark of Horizons Regional Council. The full details can be found in the document titled Water Allocation Project – Upper Manawatu Catchment Water Resource Assessment – Allocation Limits and Minimum Flows (Roygard *et al*., 2006).

121. The only change to the minimum flows and core allocation limits for Mana 5a, 5b and 5c recommended here is a rounding of the core allocation limit to the nearest 0.005 m^3/s (for Mana 5a 0.971 to 0.970 m^3/s; for Mana 5b 0.138 to 0.140 m^3/s; and for Mana 5c 0.059 to 0.060 m^3/s).

3.5.6.1 Mana 5d – Oruakeretaki

122. The minimum flows for these Sub-zones were reviewed in 2008 at the request of consent holders in those Sub-zones. Since the WRA was completed, new continuous flow data has been collected. This allowed the calculation of more robust flow statistics and consequently the recommendation of revised minimum flows for both Sub-zones. This work is detailed in the document titled Raparapawai and Oruakeretaki Minimum Flow Review 2008 – Technical document to support policy development (Hurndell *et al*., 2008).

123. The core allocation limit for the Oruakeretaki is recommended to be set at the current level of allocation (0.090 m^3/s), as this is close to the calculated core allocation limit of 0.085 m^3/s (30% of MALF). Under the current consented volume (as core) and the revised minimum flow, the average number of days restriction is estimated to be 10, with restrictions likely to occur on up to 40 days (Hurndell *et al*., 2008) (Table 16).

Table 16. Number of days that a revised minimum flow, at 70% habitat retention, including the current level of allocation, is likely to occur at Oruakeretaki at Oringi (from Hurndell *et al*., 2007)

Flow Statistic	**70% habitat minimum flow + current**	**Flow**	**0.305**										
Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	TOTAL
2003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2
2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	6.9	0.2	1.8	2.1	17.0
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.3	15.4	16.8	7.4	0.0	0.0	39.8
2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.3	21.4	23.8	7.6	1.8	2.1	57.0
Average	0.0	0.0	0.0	0.0	0.0	0.0	0.1	3.6	4.0	1.3	0.3	0.4	**9.5**
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	0.0	0.0	0.0	0.0	0.0	0.0	0.3	15.4	16.8	7.4	1.8	2.1	**39.8**
Percentile 10%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentile 20%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentile 30%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Percentile 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Percentile 50%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.2
Percentile 60%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.2
Percentile 70%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	3.5	0.1	0.0	0.0	8.6
Percentile 80%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	6.9	0.2	0.0	0.0	17.0
Percentile 90%	0.0	0.0	0.0	0.0	0.0	0.0	0.2	10.7	11.9	3.8	0.9	1.1	28.4
Percentile 100%	0.0	0.0	0.0	0.0	0.0	0.0	0.3	15.4	16.8	7.4	1.8	2.1	39.8

3.5.6.2 Mana 5e – Raparapawai

124. The recommended core allocation limit for the Raparapawai Stream is 30% of the MALF. With no allocation, this management flow would be expected to occur on seven days on average and up to 21 days (Hurndell *et al*., 2008). The current allocation from the Raparapawai is greater than this proposed core, and under the current scenario, the minimum flow is expected to occur on 20 days on average and up to 64 days per year (Hurndell *et al*., 2008).

125. The Raparapawai Sub-zone is considered to be a special case, where historical allocation of water has exceeded what is ideal for both the instream health of the stream and for out-of-stream users, in terms of the number of days restriction that they currently experience. The consent holders in this Sub-zone are currently working together to ensure each is able to abstract for as long as possible before minimum flow restrictions are reached. The proposed core allocation limit recommended for this Sub-zone represents the ideal situation, and over time, with increased water efficiency measures and the installation of storage ponds, it is hoped that the instantaneous allocation in the Sub-zone will move towards the recommended limits. In the meantime, the Sub-zone will be operated as an over-allocated catchment. Horizons has worked with the irrigators in this Sub-zone regarding water use efficiency (Page Bloomer Associates Ltd, 2007a, b, c, d & e).

126. The revised minimum flows and core allocation limits for Mana 5d and 5e are recommended to be carried through to the POP Water Allocation Framework.

Table 17. Number of days that a revised minimum flow, at 70% habitat retention, including the current level of allocation, is likely to occur at Raparapawai at Jacksons Rd (from Hurndell *et al*., 2007)

Flow statistic	70% habitat minimum flow + current	Flow	0.086										
Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	TOTAL
2002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.1	10.8	0.0	0.0	0.0	27.8
2003	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0	0.0	0.0	0.0	4.1
2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.2	0.0	0.0	0.0	5.1
2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	10.7	0.0	0.0	0.0	11.8
2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.7	7.4	0.4	0.0	0.0	22.5
2007	0.0	0.0	0.0	0.0	0.0	8.3	15.4	20.2	15.2	4.6	0.0	0.0	63.6
2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	0.0	0.0	0.0	0.0	0.0	8.3	19.5	57.9	44.3	5.0	0.0	0.0	134.9
Average	0.0	0.0	0.0	0.0	0.0	1.2	2.8	8.3	6.3	0.7	0.0	0.0	**19.3**
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	0.0	0.0	0.0	0.0	0.0	8.3	15.4	20.2	15.2	4.6	0.0	0.0	**63.6**
Percentile 10%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5
Percentile 20%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	4.3
Percentile 30%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.2	0.0	0.0	0.0	4.9
Percentile 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	3.1	0.0	0.0	0.0	7.8
Percentile 50%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	7.4	0.0	0.0	0.0	11.8
Percentile 60%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	9.4	0.0	0.0	0.0	18.2
Percentile 70%	0.0	0.0	0.0	0.0	0.0	0.0	0.8	15.2	10.7	0.1	0.0	0.0	23.6
Percentile 80%	0.0	0.0	0.0	0.0	0.0	0.0	3.3	16.6	10.8	0.3	0.0	0.0	26.7
Percentile 90%	0.0	0.0	0.0	0.0	0.0	3.3	8.6	18.3	12.6	2.1	0.0	0.0	42.1
Percentile 100%	0.0	0.0	0.0	0.0	0.0	8.3	15.4	20.2	15.2	4.6	0.0	0.0	63.6

3.5.6.3 Cumulative core allocation limit Mana 3 + Mana 5a

127. The upper Tamaki River (Mana 3 – Upper Tamaki) flows into Mana 5a (Lower Tamaki), so the cumulative core allocation limit for the whole Tamaki catchment is set by combining these two parts of the catchment. This limit states that a maximum of 0.140 m^3/s can be allocated from the catchment – up to 0.080 m^3/s from Mana 3 (Mana 3's individual limit), and a further 0.060 m^3/s from Mana 5a.

128. Three consents in this WMZ have extra allocation that can be taken at flows above half-median flow. For the purpioses of assessing the current allocation, the volumes allocated below half-median have been used. The two of the three consents are for irrigation and the third is for a public water supply.

3.5.6.4 Cumulative core allocation limit Mana 4 + Mana 5c

129. The Kumeti catchment, like the Tamaki (as described above), is split into two Sub-zones. The Upper Kumeti (Mana 4) has an individual core allocation limit of 0.010 m^3/s. The Lower Kumeti (Mana 5c) has a core allocation limit of 0.060 m^3/s and this is also the maximum total allocation for the catchment – up to 0.010 m^3/s can be allocated from Mana 4 and further 0.050 m^3/s can be taken from Mana 5c (total of 0.060 m^3/s). If there is no allocation from Mana 4, then all of the cumulative volume (0.060 m^3/s) can be allocated from Mana 5c.

3.5.6.5 Catchment cumulative core allocation limit

130. The catchment cumulative core allocation limit is the maximum volume of water that can be allocated from the catchment above this point in the catchment (from Mana 1, Mana 2, Mana 3, Mana 4 and Mana 5). In this case, it is the same as the maximum individual volume able to be allocated from any of the Sub-zones above the end of Mana 5 (0.970 m^3/s). The water can be allocated from any Sub-zone up to its individual limit, but the total allocation in the catchment, to the end of Mana 5, should not exceed 0.970 m^3/s.

3.5.7 Hopelands-Tiraumea – Mana 6

Table 18. Summary table: Recommended minimum flows and core allocation limits for the Hopelands-Tiraumea Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 6	Hopelands-Tiraumea	TF (RS)	3.700	3.700	3 (90%)	2.980	2.980	1.049	1.050	Manawatu at Hopelands	Y
Catchment cumulative core allocation limit (Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6)									1.050		Y

131. Water allocation in the Tamaki Hopelands Water Management Zone was addressed by the Upper Manawatu Water Resource Assessment (WRA), completed in 2006 by Jon Roygard, Jeff Watson and Maree Clark of Horizons Regional Council. The full details can be found in the document titled Water Allocation Project – Upper Manawatu Catchment Water Resource Assessment – Allocation Limits and Minimum Flows (Roygard *et al*., 2006).

132. The only change to the minimum flows and core allocation limits for Mana 6 recommended here is a rounding of the core allocation limit to the nearest 0.005 m^3/s (1.049 to 1.050 m^3/s) (Table 19).

133. Table 19 gives an indication of the likely frequency of occurence of the minimum flow at Manawatu at Weber Road. The highlighted line is not the actual management flow, but is the closest example available.

Table 19. Surety of supply analysis Manawatu at Hopelands

Manawatu at Hopelands (Data record: 1 July 1991 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	3.700	16	51	67
IFIM Minimum flow	2.980	6	22	40
Minimum flow plus 5% of MALF as core allocation	3.165	8	27	45
Minimum flow plus 10% of MALF as core allocation	3.350	11	34	51
Minimum flow plus 15% of MALF as core allocation	3.535	14	43	60
Minimum flow plus 20% of MALF as core allocation	3.720	17	52	68
Minimum flow plus 25% of MALF as core allocation	3.905	20	59	73
Minimum flow plus 30% of MALF as core allocation	*4.090*	*23*	*65*	*80*
Minimum flow plus 35% of MALF as core allocation	4.275	26	69	88
Minimum flow plus current allocation in Sub-zone	3.959	21	61	74
Minimum flow plus current allocation WMZ	3.959	21	61	74
Minimum flow plus current allocation WMZ Total Cumulative	3.959	21	61	74
7 Day MALF (NES)	2.540	2	5	20
7 Day MALF minimum flow (NES)	2.286	1	0	8
7 Day MALF minimum flow + core allocation (NES)	3.048	7	23	42

3.5.7.1 Catchment cumulative core allocation limit

134. The catchment cumulative core allocation limit is the maximum volume of water that can be allocated from the catchment above this point in the catchment (from Mana 1, Mana 2, Mana 3, Mana 4, Mana 5 and Mana 6). In this case, it is the same as the maximum individual volume able to be allocated from any of the Sub-zones above the end of Mana 6 (1.050 m^3/s). The water can be allocated from any Sub-zone up to its individual limit, but the total allocation in the catchment, to the end of Mana 6, should not exceed 1.050 m^3/s.

3.5.8 Upper Tiraumea – Mana 7

Table 20. Summary table: Recommended minimum flows and core allocation limits for the Tiraumea Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 7a	Upper Tiraumea	TF (O)	2.380	2.400	5b	2.140	2.040	0.475	0.040	Tiraumea at Ngaturi	Y
Mana 7b	Lower Tiraumea	TF (O)	2.760	2.700	5b	2.140	2.040	0.550	0.270	Tiraumea at Ngaturi	Y
Mana 7c	Mangaone River	LSC	nil	0.100	5b	2.140	2.040	20% of MALF	0.020	Tiraumea at Ngaturi	Y
Mana 7d	Makuri	TF (RS)	2.156	2.000	5b	1.800	1.700	0.108	0.100	Makuri at Tuscan Hills	Y
Cumulative core allocation limit (Mana 7a + Mana 7c + Mana 7d)									0.100		Y
Mana 7e	Mangaramarama	LSC	nil	0.130	5b	1.580*	2.040	0.009	0.025	Tiraumea at Ngaturi	Y
Whole zone cumulative allocation limit (Mana 7a + Mana 7b + Mana 7c + Mana 7d + Mana 7e)									0.270		Y

* flow site changed due to reorganisation of Sub-zone from Mana 8 to Mana 7 Water Management Zone.

3.5.8.1 Upper Tiraumea – Mana 7a

135. The MALF for the Tiraumea at Ngaturi has been revised since the original version of the POP water allocation framework was completed. This revision is discussed in the evidence of Brent Watson. The revised MALF of 2.723 m^3/s is greater than that calculated by Henderson & Diettrich (2007) and used in the original version of the framework. However, because of the revised methodology applied to the MALF statistic to derive the minimum flow, the recommended minimum flow is lower than previously recommended.

136. The configuration of the Sub-zones in the Tiraumea Water Management Zone (Map 3) means that setting the core allocation limits is a little more difficult than in most of the other Manawatu catchments (see McArthur *et al*., 2007). The Tiraumea catchment itself is relatively low yielding, and the main inflow to it is from the Makuri River, which joins the Tiraumea near the bottom of Mana 7a, but above the main flow recording site in the Tiraumea catchment (Tiraumea at Ngaturi). This means that considerably more water is available for allocation in the Lower Tiraumea and Makuri Sub-zones than in the

Upper Tiraumea. Upon review of the original POP framework document, it is noted that there was an error in the way the core allocation limit for the Upper Tiraumea was determined, and this evidence provides a more appropriate core allocation figure for that Sub-zone.

137. The proposed core allocation limit for Mana 7a – Upper Tiraumea is 10% of the MALF at the bottom of the Sub-zone (which is above the flow recorder site Tiraumea at Ngaturi). This gives a recommended core allocation limit of 0.040 m^3/s.

138. Surety analysis suggests that the occurrence of the minimum flow (assuming full allocation) is likely to be 15 days per year on average, and up to 106 days. In 90% of years, the minimum flow is likely to occur on 47 days (Table 21).

Table 21. Surety of supply analysis Upper Tiraumea

Upper Tiraumea (Data record: 1 July 1980 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF (at bottom of Mana 7a Sub-zone)	0.377	19	51	117
Minimum flow (85% of MALF)	0.320	11	38	92
Minimum flow plus 5% of MALF as core allocation	0.339	13	42	96
Minimum flow plus 10% of MALF as core allocation	*0.358*	*15*	*47*	*106*
Minimum flow plus 15% of MALF as core allocation	0.377	19	51	117
Minimum flow plus 20% of MALF as core allocation	0.396	22	64	123
Minimum flow plus 25% of MALF as core allocation	0.415	25	76	126
Minimum flow plus 30% of MALF as core allocation	0.434	29	80	129
Minimum flow plus 35% of MALF as core allocation	0.452	32	83	132
Minimum flow plus current allocation in Sub-zone	0.335	12	40	96
Minimum flow plus current allocation WMZ	0.459	33	86	133
Minimum flow plus current allocation WMZ Total Cumulative	0.525	43	102	139

3.5.8.2 Lower Tiraumea – Mana 7b

139. See above for discussion regarding the minimum flow for this Sub-zone, as the same approach applies.

140. The core allocation limit for the Lower Tiramea Sub-zone was originally determined using a catchment area calculation from the Tiraumea at Ngaturi flow site. Since the completion of the original version of the framework, a MALF statistic for the bottom of the Lower Tiraumea Sub-zone has been derived (Tiraumea at Horopito) (see Brent Watson's evidence for details). The proposed core allocation limit for this Sub-zone is 10% of the MALF at Tiraumea at Horopito (2.720 m^3/s), which is 0.270 m^3/s. This core

allocation limit is considerably greater than that proposed for the Upper Tiraumea because the higher yielding Makuri River flows into this Sub-zone, boosting the base-flow.

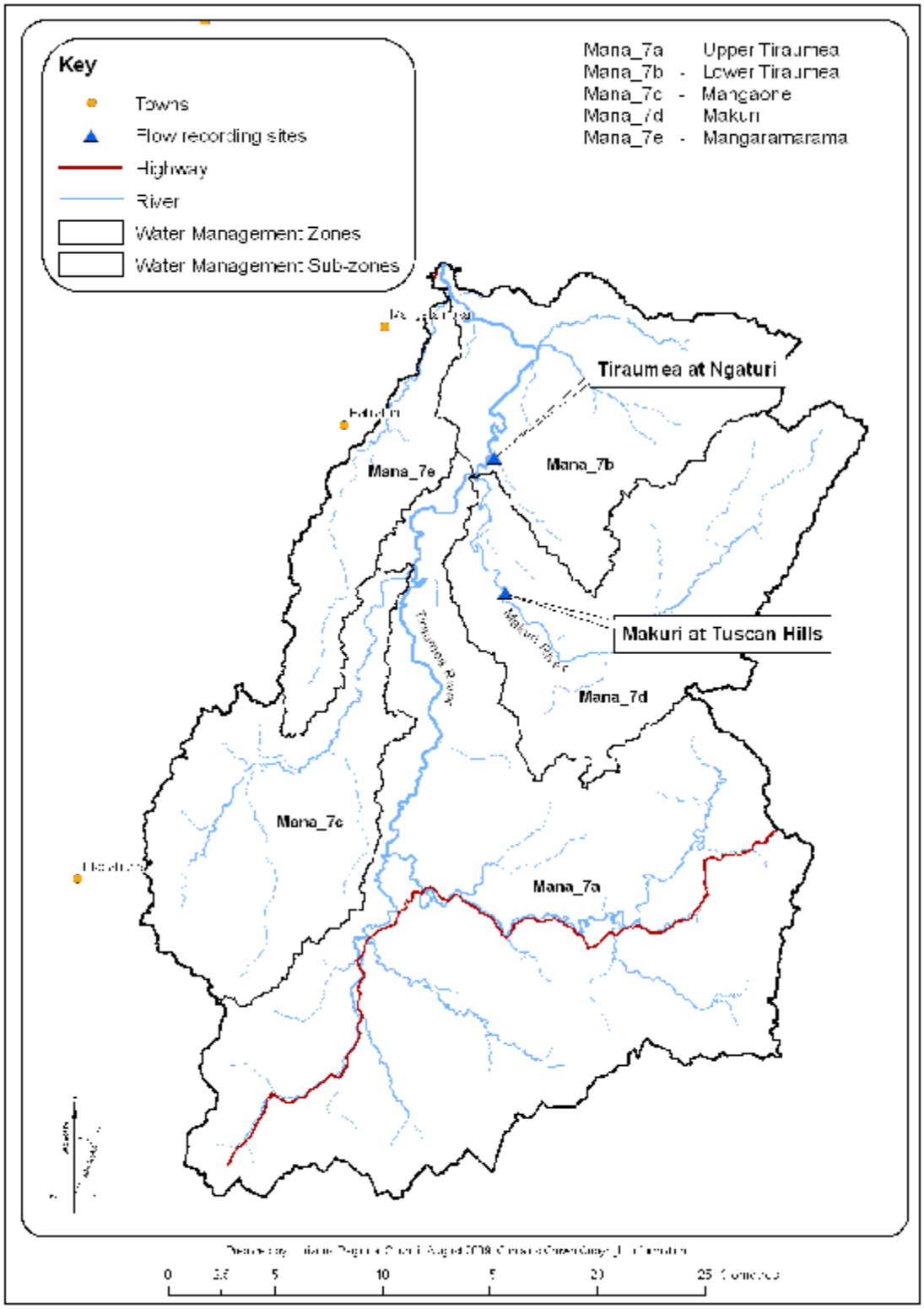
3.5.8.3 Mangaone River – Mana 7c

141. NOTE: There a number of water bodies in the region with the name "Mangaone", ie. three Sub-zones carry reference to "Mangaone" – the first is Mangaone River – Mana 7c; the second is Upper Mangaone Stream – Mana 11d; and the third is Lower Mangaone Stream – Mana 11e.

142. There is no continuous flow recorder on the Mangaone River, therefore the minimum flow for Sub-zone Mana 7c is set based on flow at the most appropriate adjacent recorder, ie. Tiraumea at Ngaturi.

143. When the original Water Allocation Framework document was completed (Hurndell *et al*., 2007), there were no flow statistics available for the Mangaone River Sub-zone. Brent Watson has calculated a MALF for the Sub-zone based on the flow gauging site Mangaone at East Rongomai. The calculated MALF is 0.100 m^3/s.

144. The calculation of a MALF for this Sub-zone means that a core allocation limit can be set. The proposed core allocation limit is 20% of the MALF or 0.020 m^3/s. There is no surety information available for this Sub-zone.



Map 3. The Tiraumea Water Management Zone – Mana 7

3.5.8.4 Makuri – Mana 7d

145. In the original version of the POP Water Allocation Framework, the minimum flow and core allocation limit for the Makuri were set based on an interpretation of the Local Water Conservation Notice (Makuri) 1990 and SW Rule 2 of the Regional Land and Water Plan.

146. As explained earlier in this evidence, it is considered that the instream values of the Makuri River will be adequately provided for by setting the minimum flow and core allocation limit under Scenario 5.

147. Following this Scenario, 85% of the MALF (2.000 m^3/s) at the flow recorder site Makuri at Tuscan Hills is proposed as the minimum flow (1.700 m^3/s) and the core allocation limit of 5% of the MALF (0.100 m^3/s) is proposed. This is the same core allocation limit as was proposed in the original framework document. Under full allocation, the minimum flow restriction is likely to apply for eight days on average and for a maximum of 43 days (Table 22).

Table 22. Surety of supply analysis Makuri at Tuscan Hills

Makuri at Tuscan Hills (Data record: 1 July 2000 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	2.000	19	61	85
Minimum flow (85% of MALF)	1.700	2	5	17
Minimum flow plus 5% of MALF as core allocation	*1.800*	*8*	*28*	*43*
Minimum flow plus 10% of MALF as core allocation	1.900	14	48	69
Minimum flow plus 15% of MALF as core allocation	2.000	19	61	85
Minimum flow plus 20% of MALF as core allocation	2.100	30	73	102
Minimum flow plus 25% of MALF as core allocation	2.200	45	90	118
Minimum flow plus 30% of MALF as core allocation	2.300	58	105	127
Minimum flow plus 35% of MALF as core allocation	2.400	70	122	142
Minimum flow plus current allocation in Sub-zone*	0.332	0	0	0
Minimum flow plus current allocation WMZ	0.332	0	0	0
Minimum flow plus current allocation WMZ Total Cumulative	0.332	0	0	0

* there is no current allocation in the Makuri Sub-zone

3.5.8.5 Mangaramarama – Mana 7e

148. In the original POP Water Allocation Framework, the Mangaramarama Sub-zone was included in the Mangatainoka Water Management Zone. It has since been transferred to

the Tiraumea Water Management Zone. The details of and reasons for this transfer are discussed in the evidence of Dr Roygard.

149. The lack of a continuous flow recorder in the Mangaramarama catchment means that the minimum flow restriction for this Sub-zone must be based on the most appropriate adjacent flow recorder. This is Tiraumea at Ngaturi, so the minimum flow is the same as for the other Sub-zones that also have minimum flows based on this site.

150. The proposed core allocation limit for the Mangaramarama Sub-zone is calculated as 20% of the MALF calculated for the Mangaramarama at Tawera (near the bottom of the Sub-zone) (0.130 m^3/s) and is 0.025 m^3/s.

3.5.8.6 Cumulative core allocation limit Mana 7a + Mana 7c + Mana 7d

151. The cumulative core allocation limit Mana 7a + Mana 7c + Mana 7d states the recommended cumulative core allocation limit for the upper Sub-zones of the Tiraumea catchment (refer to Map 3).

3.5.8.7 Whole zone core allocation limit

152. The whole zone core allocation limit sets the maximum instantaneous volume of water that can be allocated out of the whole Mana 7 Water Management Zone. The water can be allocated in any Sub-zone, up to the individual limit of that Sub-zone, but the total allocation in the Sub-zone should not exceed the whole zone core allocation limit.

3.5.9 Mangatainoka – Mana 8

Table 23. Summary table: Recommended minimum flows and core allocation limits for the Mangatainoka Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 8a	Upper Mangatainoka	TF (RS)	0.395	0.388	5a	0.400	0.370	0.060	0.020	Mangatainoka at Larsons Rd	Y
Mana 8b	Middle Mangatainoka	TF (RS)	nil	0.592	5b	1.580	1.305	0.105	0.060	Mangatainoka at Pahiatua Town Bridge	Y
Mana 8c	Lower Mangatainoka	TF (RS)	1.580	1.535	5b	1.580	1.305	0.289	0.305	Mangatainoka at Pahiatua Town Bridge	Y
Mana 8d	Makakahi	TF (RS)	0.345	0.335	3 (90%)	0.345	0.320	0.066	0.015	Makakahi at Hamua	Y
Cumulative core allocation limit (Mana 8a + Mana 8b + Mana 8d)									0.060		Y
Whole zone core allocation limit (Mana 8a + Mana 8b + Mana 8c + Mana 8d)									0.305		Y
Catchment cumulative core allocation limit (Mana 7 + Mana 8)									0.575		Y

3.5.9.1 Upper Mangatainoka – Mana 8a

153. In the original version of the POP Water Allocation Framework, the minimum flow and core allocation limits for the Mangatainoka were set based on an interpretation of the Local Water Conservation Notice and SW Rule 2 of the Regional Land and Water Plan.

154. As explained earlier in the evidence, it is considered that the instream values of the Mangatainoka River will be adequately provided for by setting the minimum flow and core allocation limit under Scenario 5.

155. Under Scenario 5, the proposed minimum flow for Sub-zone Mana 8a is 0.370 m^3/s at Mangatainoka at Larsons Road. This is 95% of the MALF at Larsons Road (0.388 m^3/s).

156. The proposed core allocation limit for Mana 8a is 5% of the MALF at Larsons Road or 0.020 m^3/s. Under full allocation, this is likely to result in restrictions taking effect on nine days per year on average, and up to 50 days.

Table 24. Surety of supply analysis Mangatainoka at Larsons Road

Mangatainoka at Larsons Road (Data record: July 1983 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.390	9	24	50
Minimum flow (95% of MALF)	0.371	7	18	42
Minimum flow plus 5% of MALF as core allocation	*0.390*	*9*	*24*	*50*
Minimum flow plus 10% of MALF as core allocation	0.410	10	32	56
Minimum flow plus 15% of MALF as core allocation	0.429	12	39	59
Minimum flow plus 20% of MALF as core allocation	0.449	14	43	65
Minimum flow plus 25% of MALF as core allocation	0.468	16	47	69
Minimum flow plus 30% of MALF as core allocation	0.488	19	51	74
Minimum flow plus 35% of MALF as core allocation	0.507	21	56	77
Minimum flow plus current allocation in Sub-zone*	0.371	7	18	42
Minimum flow plus current allocation WMZ	0.371	7	18	42
Minimum flow plus current allocation WMZ Total Cumulative	0.371	7	18	42

* there is no current allocation in the Upper Mangatainoka Sub-zone

3.5.9.2 Middle Mangatainoka – Mana 8b

157. As for Mana 8a, there is a change in approach recommended from the original version of the framework.

158. Scenario 5b is applied here. The proposed minimum flow is 85% of the MALF at Mangatainoka at Pahiatua Town Bridge (1.535 m^3/s), or 1.305 m^3/s.

159. The proposed core allocation limit is 10% of the MALF at Mangatainoka at Scarsborough Road (0.592 m^3/s) or 0.060 m^3/s. There is no surety information available for this Sub-zone.

3.5.9.3 Lower Mangatainoka – Mana 8c

160. As for Mana 8a and 8c, there is a change in approach recommended from the original version of the framework.

161. The minimum flow is the same as recommended for Middle Mangatainoka – Mana 8b.

162. The proposed core allocation limit for the Lower Mangatainoka Sub-zone is 20% of the MALF (1.535 m^3/s) at Mangatainoka at Pahiatua Town Bridge, or 0.305 m^3/s. At full allocation, restrictions are likely to apply for 16 days on average and for up to 80 days (Table 25).

Table 25. Surety of supply analysis Mangatainoka at Pahiatua Town Bridge

Mangatainoka at Pahiatua All (Data record: 1 July 1954 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	1.535	14	51	78
Minimum flow (85% of MALF)	1.305	10	38	70
Minimum flow plus 5% of MALF as core allocation	1.382	11	43	72
Minimum flow plus 10% of MALF as core allocation	1.458	13	47	75
Minimum flow plus 15% of MALF as core allocation	1.535	14	51	78
Minimum flow plus 20% of MALF as core allocation	*1.612*	*16*	*57*	*80*
Minimum flow plus 25% of MALF as core allocation	1.689	18	60	82
Minimum flow plus 30% of MALF as core allocation	1.765	20	63	87
Minimum flow plus 35% of MALF as core allocation	1.842	22	66	93
Minimum flow plus current allocation in Sub-zone	1.597	16	56	79
Minimum flow plus current allocation WMZ	1.597	16	56	79
Minimum flow plus current allocation WMZ Total Cumulative	1.597	16	56	79

3.5.9.4 Makakahi – Mana 8d

163. Since the original version of the Water Allocation Framework was completed, the MALF for the Makakahi at Hamua flow recorder site has been reviewed. The previous MALF estimate was 0.345 m^3/s, and this was recommended as the minimum flow under the interpretation of the LWCN. The revised MALF is 0.335 m^3/s.

164. As for Mana 8a, 8c and 8d, a change in approach is recommended from the original version of the framework. The proposed minimum flow is derived under Scenario 5 and because the MALF is calculated to less than 0.460 m^3/s, it is recommended to be 95% of the MALF or 0.320 m^3/s.

165. The recommended core allocation limit is 5% of the MALF at Makakahi at Hamua or 0.015 m^3/s. At full allocation, restrictions could be expected to occur on 15 days on average or on up to 78 days (Table 26).

Table 26. Surety of supply analysis Makakahi at Hamua

Makakahi at Hamua (Data record: 1 July 1980 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.335	15	54	78
Minimum flow (95% of MALF)	0.318	14	48	75
Minimum flow plus 5% of MALF as core allocation	*0.335*	*15*	*54*	*78*
Minimum flow plus 10% of MALF as core allocation	0.352	17	57	82
Minimum flow plus 15% of MALF as core allocation	0.369	18	59	85
Minimum flow plus 20% of MALF as core allocation	0.385	20	62	87
Minimum flow plus 25% of MALF as core allocation	0.402	21	65	89
Minimum flow plus 30% of MALF as core allocation	0.419	23	68	90
Minimum flow plus 35% of MALF as core allocation	0.436	24	70	91
Minimum flow plus current allocation in Sub-zone	0.331	15	52	77
Minimum flow plus current allocation WMZ	0.610	38	87	116
Minimum flow plus current allocation WMZ Total Cumulative	0.610	38	87	116
7 Day MALF (NES)	0.417	23	68	90
7 Day MALF minimum flow (NES)	0.375	19	61	86
7 Day MALF minimum flow + core allocation (NES)	0.500	29	77	103

3.5.9.5 Cumulative core allocation limit Mana 8a + Mana 8b + Mana 8d

166. This cumulative core allocation limit sets the maximum instantaneous volume of water that can be allocated out of the upper and middle Mangatainoka and the Makakahi Sub-zones. The water can be allocated in any of the three Sub-zones, up to the individual limit of that Sub-zone, but the total allocation in the Sub-zone should not exceed the cumulative core allocation limit to the end of Mana 8b/d.

3.5.9.6 Whole zone core allocation limit

167. The whole zone core allocation limit sets the maximum instantaneous volume of water that can be allocated out of the Mana 8 Water Management Zone. The water can be allocated in any of the Sub-zones, up to the individual limit of that Sub-zone, but the total allocation in the Water Management Zone should not exceed the cumulative core allocation limit to the end of Mana 8d. In this case, the whole Water Management Zone limit is the same as the maximum individual Sub-zone limit, and the cumulative limit to below Mana 8c.

3.5.9.7 Cumulative core allocation limit Mana 7 + Mana 8

168. The cumulative core allocation limit Mana 7 + Mana 8 states the recommended cumulative core allocation limit at the point below the confluence of these two Water Management Zones.

3.5.10 Upper Gorge – Mana 9

Table 27. Summary table: Recommended minimum flows and core allocation limits for the Upper Gorge Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 9a	Upper Gorge	TF (O)	11.703	11.470	5c	10.530	9.175	2.340	2.295	Manawatu at Upper Gorge	Y
Mana 9b	Mangapapa	TS			Existing consent conditions	0.023	0.024	0.008	0.015	Mangapapa at Troup Road	Y
Mana 9c	Mangaatua	SoS-A	nil	0.075	5a	MALF	0.070	20% of MALF	0.005	Mangaatua at Hutchinsons	Y
Mana 9d	Upper Mangahao	TF (O)	nil	1.665	5b	MALF	1.415	20% of MALF	0.085	Mangahao at Ballance	Y
Mana 9e	Lower Mangahao	TF (O)	nil	1.665	5b	MALF	1.415	20% of MALF	0.085	Mangahao at Ballance	Y
Cumulative allocation limit (Mana 9d + Mana 9e)									0.085		Y
Whole zone cumulative core allocation limit (Mana 9a + Mana 9b + Mana 9c + Mana 9d + Mana 9e)									2.295		Y
Catchment cumulative core allocation limit (Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9)									2.295		Y

3.5.10.1 Upper Gorge – Mana 9a

169. Since the original framework document was completed, the MALF statistic for the Upper Gorge flow site has been reviewed. The details of this are set out in Mr Watson's evidence. Previously, the MALF had been calculated as 11.703 m^3/s, and following the review it is now calculated to be 11.470 m^3/s.

170. The new MALF is greater than 3.700 m^3/s, so following the method for Scenario 5c, the revised minimum flow is calculated as 80% of the MALF, so is 9.175 m^3/s.

171. It is recommended that the core allocation limit be set at 20% of the revised MALF, or 2.295 m^3/s. At full allocation, restrictions would be expected to apply for 13 days on average and for up to 61 days (Table 28) .

Table 28. Surety of supply analysis Manawatu at Upper Gorge

Manawatu at Upper Gorge (Data record: 1 July 1979 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	11.470	13	43	61
Minimum flow (80% of MALF)	9.176	3	10	32
Minimum flow plus 5% of MALF as core allocation	9.750	6	17	43
Minimum flow plus 10% of MALF as core allocation	10.323	8	30	48
Minimum flow plus 15% of MALF as core allocation	10.897	10	36	53
Minimum flow plus 20% of MALF as core allocation	*11.470*	*13*	*43*	*61*
Minimum flow plus 25% of MALF as core allocation	12.044	15	52	70
Minimum flow plus 30% of MALF as core allocation	12.617	19	59	76
Minimum flow plus 35% of MALF as core allocation	13.191	22	65	82
Minimum flow plus current allocation in Sub-zone	9.277	4	11	35
Minimum flow plus current allocation WMZ	9.301	4	12	36
Minimum flow plus current allocation WMZ Total Cumulative	10.884	10	36	53
7 Day MALF (NES)	12.966	21	62	80
7 Day MALF minimum flow (NES)	10.373	8	30	49
7 Day MALF minimum flow + core allocation (NES)	14.263	29	73	95

3.5.10.2 Mangapapa – Mana 9b

172. An IFIM study was completed for the Mangapapa Stream in 2000 (Bee, 2000). This work was reviewed by Hay & Hayes in 2007. The minimum flow recommendation to maintain 90% of habitat at Mangapapa at Oxford Road, for brown trout yearlings, is 0.023 m^3/s.

173. To maintain a minimum flow of 0.023 m^3/s at Oxford Road, a flow of 0.033 m^3/s is required at Troup Road.

174. This was determined using the relationship between gaugings at the two sites. The following is an excerpt from Hurndell *et al*. (2007) describing the flow relationship between the Oxford Road and Troup Road flow sites.

"*The IFIM study on the Mangapapa was carried out on a reach of the river near Oxford Rd, upstream of the flow monitoring site for this water management Sub-zone, Mangapapa at Troup Rd. The minimum flow at Oxford Rd, recommended by the IFIM study is 0.023 m^3/s. This corresponds to a minimum flow at Troup Rd of 0.033 m^3/s.* The

figure below *illustrates the relationship between paired gaugings at the two sites used to estimate the appropriate minimum flow at Troup Rd."*

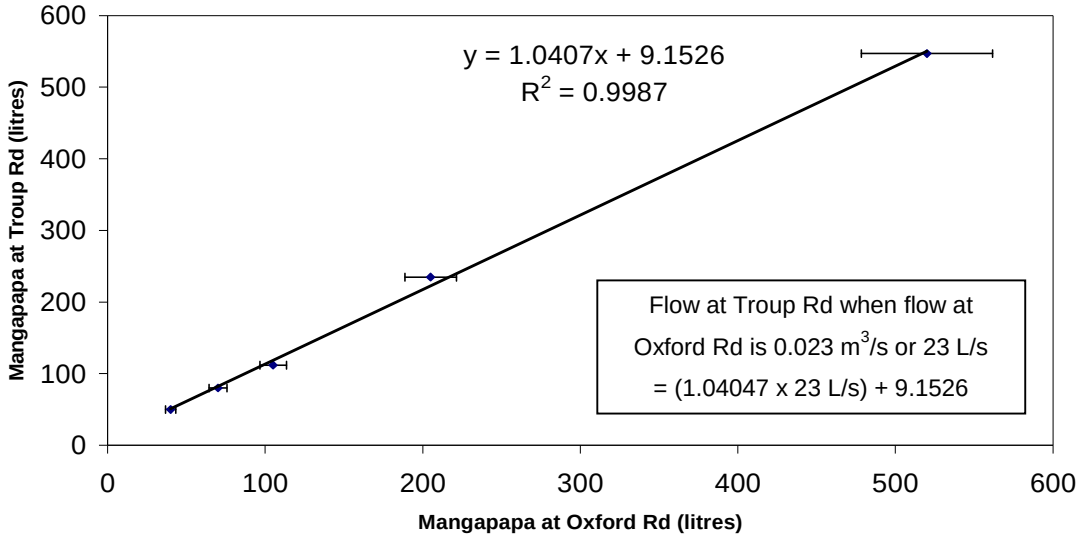


Figure 7. Graph illustrating the flow relationship between Mangapapa at Troup Road and Mangapapa at Oxford Road[7] (from Hurndell, *et al*., 2007 p 39)

175. The minimum flow specified in the POP is 0.023 m^3/s at Oxford Road, but because there is no permanent flow site at Oxford Road, the flows are to be monitored based on flows at Troup Road. Therefore, for the minimum flow to be in line with the IFIM recommended minimum flow for Oxford Road, it should be 0.033 m^3/s at Troup Road.

176. The Tararua District Council (TDC) abstraction for the Woodville water supply occurs in the upper reaches of the Mangapapa catchment (Resource Consent No. 102773). Through the consenting process, TDC have been permitted to abstract a maximum volume of 2,940 m^3/day at a maximum instantaneous rate of 0.034 L/s. This abstraction rate is required to decrease as the natural flow in the stream decreases, as measured at the Mangapapa at Troup Road flow monitoring site (Decision of Hearing Committee on application for variation to Consent 102773, 17 March 2009).

177. Based on the recommendations of the IFIM survey at Oxford Road, a minimum flow of at least 0.024 m^3/s should be maintained below TDC's weir at the point of abstraction, in order to maintain the recommended minimum flow at Troup Road.

[7] Error bars on gauging data indicate +/- 8%

178. The consent decision sets the minimum flow of the Mangapapa Stream at 0.024 m^3/s at Mangapapa at Troup Road, which is less than that recommended by the IFIM survey (Bee, 2000; Hay & Hayes, 2007). However, the residual flow required to be left below the TDC's intake weir should go some way to maintaining the recommended minimum flow at Oxford Road. The minimum flow and maximum instantaneous rate (at flows below 0.100 m^3/s) set by Consent No. 102773 is carried through to the minimum flow and core allocation recommendation made for the Mangapapa Sub-zone (Mana 9b). The following is an abstract from the 2009 Consent Variation for Consent 102773:

"*The Permit Holder shall comply at all times with the maximum rates of abstraction and residual flow (immediately downstream of the water intake dam) requirements set out in Table 1*".

Table 1:

Flow in Stream at Troup Road	*Maximum Abstraction Rate*	*Residual Downstream Flow Required*
<24 L/s	*0*	*n/a*
24-100 L/s	*1,296 m^3/d (15 L/s)*	*24 L/s*
101-125 L/s	*1.728 m^3/s (20 L/s)*	*24 L/s*
126-170 L/s	*2,160 m^3/d (25 L/s)*	*24 L/s*
>170 L/s	*2,940 m^3/d (34 L/s)*	*24 L/s*

3.5.10.3 Mangaatua – Mana 9c

179. At the time of the completion of the original version of the Water Allocation Framework, there were no flow statistics available for the Mangaatua Sub-zone. Since then, a MALF of 0.075 m^3/s at Mangaatua at Hutchinsons has been derived.

180. Because this new MALF is less than 0.460 m^3/s, the recommended minimum flow is 95% of the MALF, or 0.070 m^3/s.

181. A core allocation limit of 5% of the MALF is recommended. The Mangaatua is a small catchment with water quality issues, therefore keeping the core allocation limit low should avoid exacerbation of the poor water quality in the catchment. There is little irrigable land in the catchment, so future demand for abstraction is likely to be low.

3.5.10.4 Upper Mangahao – Mana 9d

182. "Scenario 6", previously known as "the default method", applied to these Sub-zones in the original POP water allocation framework, because at the time of writing, there were no flow statistics available. Prior to the preparation of this evidence, Mr Watson calculated MALF statistics for the Mangahao at Ballance flow recorder. A hydroelectricity abstraction in the headwaters of the Mangahao takes much of the water that would otherwise be available. The core allocation limit is assessed in accordance with POP Policy 6-16, ie. after the hydroelectricity abstraction. Naturalisation of the flow record for the hydroelectricity abstraction is not possible as no abstraction data is available. The the minimum flow, core allocation limit and surety of supply analysis are all based on flow record after abstraction by the hydroelectricity scheme.

183. The MALF at Mangahao at Ballance is calculated to be 1.665 m^3/s. The recommended minimum flow is 85% of this, following Scenario 5b, and is 1.415 m^3/s.

184. The core allocation limit of Mana 9d is proposed to be 5% of the MALF, ie. 0.085 m^3/s. (see below and

185. Table 27 for surety analysis).

3.5.10.5 Lower Mangahao – Mana 9e

186. The minimum flow and core allocation recommendations for the Lower Mangahao are the same as for the Upper Mangahao Sub-zone.

187. Under full allocation, restrictions could be expected to occur on 10 days per year on average, and on up to 78 days per year (

188. Table 27).

Table 29. Surety of supply analysis Mangahao at Ballance

Mangahao at Ballance (Data record: 1 July 1975 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	1.665	13	55	87
Minimum flow (85% of MALF)	1.415	9	36	72
Minimum flow plus 5% of MALF as core allocation	*1.499*	*10*	*45*	*78*
Minimum flow plus 10% of MALF as core allocation	1.582	11	51	82
Minimum flow plus 15% of MALF as core allocation	1.665	13	55	87
Minimum flow plus 20% of MALF as core allocation	1.748	15	57	91
Minimum flow plus 25% of MALF as core allocation	1.832	16	59	93
Minimum flow plus 30% of MALF as core allocation	1.915	19	61	97
Minimum flow plus 35% of MALF as core allocation	1.998	21	63	99
Minimum flow plus current allocation in Sub-zone	1.418	9	38	73
Minimum flow plus current allocation WMZ	1.418	9	38	73
Minimum flow plus current allocation WMZ Total Cumulative	1.418	9	38	73

3.5.10.6 Cumulative allocation limit Mana 9d + Mana 9e

189. The cumulative core allocation limit for Mana 9d and 9e is the total volume of water that should be allocated from both Sub-zones. In this case, it means that up to 0.085 m^3/s can be allocated from either Sub-zone, provided that the total allocation from both does not exceed 0.085 m^3/s.

3.5.10.7 Whole zone core allocation limit

190. The whole zone core allocation limit is the maximum volume that can be allocated from the Upper Gorge Water Management Zone. The water can be allocated from any Sub-zone up to its individual allocation limit, but the total allocation in the Water Management Zone should not exceed 2.295 m^3/s (also the core allocation limit for Mana 9a).

3.5.10.8 Catchment cumulative core allocation limit

191. The maximum volume that can be allocated out of the Manawatu catchment to the end of the Upper Gorge Water Management Zone is 2.295 m^3/s (also the whole zone core allocation limit for Mana 9). The water can be allocated from any Water Management Zone or Sub-zone up to those individual limits, providing that the whole zone and cumulative core allocation limits are not exceeded.

3.5.11 Middle Manawatu – Mana 10

Table 30. Summary table: Recommended minimum flows and core allocation limits for the Middle Manawatu Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 10a	Middle Manawatu	TF (O)	15.735	15.300	5c	14.160	12.240	3.150	3.060	Manawatu at Teachers College	Y
Mana 10b	Upper Pohangina	TF (O)	2.315	2.270	3 (90%)	2.315	1.960	0.460	0.115	Pohangina at Mais Reach	Y
Mana 10c	Middle Pohangina	TF (O)	2.315	2.270	3 (90%)	1.960	1.960	0.460	0.455	Pohangina at Mais Reach	Y
Cumulative core allocation limit (Mana 10b + Mana 10c)									0.455		Y
Mana 10d	Lower Pohangina	TF (O)	2.315	2.270	3 (90%)	1.960	1.960	0.525	0.455	Pohangina at Mais Reach	Y
Cumulative core allocation limit (Mana 10b + Mana 10c + Mana 10d)									0.455		Y
Mana 10e	Aokautere	LSC	nil	0.030	6c	MALF	12.240	20% of MALF	0.005	Manawatu at Teachers College	Y
Whole zone core allocation limit (Mana 10a + Mana 10b + Mana 10c + Mana 10d + Mana 10e)									3.060		Y
Catchment cumulative core allocation limit (Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 10)									3.060		Y

3.5.11.1 Middle Manawatu – Mana 10a

192. The recommended minimum flow for the Middle Manawatu Sub-zone is based on the MALF at Manawatu at Teachers College (also known as Palmerston North All). At the completion of the original POP Water Allocation Framework, the MALF was calculated to be 15.735 m^3/s. Following the review of the flow statistics for this site, the MALF has been recalculated as 15.300 m^3/s.

193. A minimum flow of 80% of the MALF is recommended, following the Scenario 5c methodology, ie. 12.240 m^3/s.

194. The proposed core allocation limit for this Sub-zone is 20% of the MALF, or 3.060 m^3/s. Under full allocation, the minimum flow could be expected to be reached on 12 days per year on average and on up to 70 days per year. In 90% of years, the maximum number of days restriction is likely to be 34 (Table 31).

Table 31. Surety of supply analysis Manawatu at Teachers College/Palmerston North

Manawatu at Palmerston North (1 July 1923 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	15.300	12	34	70
Minimum flow (80% of MALF)	12.240	4	12	51
Minimum flow plus 5% of MALF as core allocation	13.005	5	19	57
Minimum flow plus 10% of MALF as core allocation	13.770	7	26	62
Minimum flow plus 15% of MALF as core allocation	14.535	10	31	67
Minimum flow plus 20% of MALF as core allocation	*15.300*	*12*	*34*	*70*
Minimum flow plus 25% of MALF as core allocation	16.065	15	41	76
Minimum flow plus 30% of MALF as core allocation	16.830	18	48	85
Minimum flow plus 35% of MALF as core allocation	17.595	21	54	91
Minimum flow plus current allocation in Sub-zone	12.720	5	16	54
Minimum flow plus current allocation WMZ	12.859	5	17	55
Minimum flow plus current allocation WMZ Total Cumulative	14.567	10	31	67

3.5.11.2 Upper Pohangina – Mana 10b

195. When the original POP Water Allocation Framework (Hurndell *et al*., 2007) was completed, there was insufficient hydrological information available to set a minimum flow and core allocation limit for the Upper Pohangina Sub-zone based hydrological statistics (which was determined to be the appropriate method to use at the time).

196. It has since been determined that the IFIM recommended minimum flow (Hay & Hayes, 2006) for the Pohangina at Mais Reach should be carried back up to the Upper Pohangina Sub-zone. This is the recommended minimum flow for Mana 10b.

197. The core allocation limit is recommended to be set at 5% of the MALF at Pohangina at Mais Reach (2.270 m^3/s), or 0.115 m^3/s. In reality, because of the characteristics of the catchment in the Upper Pohangina Sub-zone (much is in native bush), the demand for water there is likely to remain relatively low.

198. At full allocation in this Sub-zone, the minimum flow restriction could be expected to apply on four days per year and on up to a maximum of 81 days; however, in 90% of years, the maximum number of days it is likely to occur is 10. (Table 32).

3.5.11.3 Middle Pohangina – Mana 10c

199. The IFIM recommended minimum flow for 90% habitat retention at Pohangina at Mais Reach is 1.960 m^3/s (Hay & Hayes, 2006). This is the minimum flow recommended to be adopted here.

200. The proposed core allocation limit for the Middle Pohangina Sub-zone is 20% of the MALF at Pohangina at Mais Reach (2.270 m^3/s), or 0.455 m^3/s.

201. At full allocation, the minimum flow could expected to be reached on eight days on average and for on a maximum of 93 days, although in 90% of years, the maximum number of days of restriction is likely to be 20 (Table 32).

3.5.11.4 Lower Pohangina – Mana 10d

202. It is recommended that the IFIM recommended minimum flow for Pohangina at Mais Reach also be applied to the Lower Pohangina Sub-zone, in order to protect the instream values of the river.

203. The proposed core allocation limit for this Sub-zone is 0.455 m^3/s and this is intended to be a cumulative allocation limit for the Middle and Lower Pohangina Sub-zones combined. The total allocation from both of these Sub-zones should be no more than 0.455 m^3/s.

204. The surety of supply analysis is the same as for Mana 10c above (Table 32).

Table 32. Surety of supply analysis Pohangina at Mais Reach

Pohangina at Mais Reach (Data record: 1 July 1969 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	2.270	6	14	88
IFIM Minimum flow	1.960	4	8	76
Minimum flow plus 5% of MALF as core allocation	*2.074*	*4*	*10*	*81*
Minimum flow plus 10% of MALF as core allocation	2.187	5	12	85
Minimum flow plus 15% of MALF as core allocation	2.301	7	16	89
Minimum flow plus 20% of MALF as core allocation	*2.414*	*8*	*20*	*93*
Minimum flow plus 25% of MALF as core allocation	2.528	10	23	97
Minimum flow plus 30% of MALF as core allocation	2.641	13	26	101
Minimum flow plus 35% of MALF as core allocation	2.755	16	29	105
Minimum flow plus current allocation in Sub-zone	2.004	4	9	78
Minimum flow plus current allocation WMZ	2.097	5	10	82
Minimum flow plus current allocation WMZ Total Cumulative	2.097	5	10	82
7 Day MALF (NES)	2.577	11	25	98
7 Day MALF minimum flow (NES)	2.319	7	17	89
7 Day MALF minimum flow + core allocation (NES)	3.092	25	45	120

3.5.11.5 Aokautere – Mana 10e

205. There were no flow statistics available for the Aokautere Sub-zone when the original version of this framework was completed, so it was listed as "default method". Since then, a MALF statistic has been found to have been estimated during consent reporting for an application in 2005. The calculated MALF is 0.030 m^3/s (M. Watson in Barnett, consent report for Danny Tsao, 2005).

206. Because there is no flow recorder in the Aokautere catchment, the nearest appropriate monitoring site is Manawatu at Teachers College; the recommended minimum flow for the Mana 10e Sub-zone is 12.240 m^3/s at Manawatu at Teachers College.

207. The core allocation limit recommended is 15% of the estimated MALF for the Aokautere Stream, or 0.005 m^3/s. Because the minimum flow is based on flow at the Manawatu at Teachers College flow site, the surety of supply is as for Mana 10a (nder full allocation, the minimum flow could be expected to be reached on 12 days per year on average and on up to 70 days per year. In 90% of years, the maximum number of days restriction is likely to be 34 (Table 31).

3.5.11.6 Cumulative core allocation limit Mana 10b + Mana 10c

208. The cumulative core allocation limit Mana 10b + Mana 10c is the combined maximum volume that can be abstracted from the Upper and Middle Pohangina Sub-zones. Up to 0.115 m^3/s can be allocated from the Upper Pohangina Sub-zone, leaving 0.340 m^3/s for allocation from the Middle Pohangina Sub-zone, if the Upper Pohangina Sub-zone should become fully allocated (cumulative allocation 0.455 m^3/s).

3.5.11.7 Cumulative core allocation limit Mana 10b + Mana 10c + Mana 10d

209. The cumulative core allocation limit Mana 10b + Mana 10c + Mana 10d is the combined maximum volume that can be abstracted from the Upper, Middle and Lower Pohangina Sub-zones. The water can be allocated from any of the Sub-zones up to their individual limits, providing that the cumulative core allocation limit is not exceeded.

3.5.11.8 Whole zone core allocation limit

210. The whole zone core allocation limit sets the maximum instantaneous volume of water that can be allocated out of the Mana 10 Water Management Zone. The water can be allocated in any of the Sub-zones, up to the individual limit of that Sub-zone, but the total allocation in the Water Management Zone should not exceed the cumulative core allocation limit to the end of Mana 10e. In this case, the whole Water Management Zone limit is the same as that recommended for Mana 10a (3.060 m^3/s).

3.5.11.9 Catchment cumulative core allocation limit

211. The catchment cumulative core allocation limit indicates the maximum allocation that may occur in the Manawatu catchment to the end of the Mana 10 Water Management Zone. The water can be allocated in any of the Sub-zones, up to the individual limit of that Sub-zone, but the total allocation in the catchment should not exceed the cumulative core allocation limit to the end of Mana 10e.

3.5.12 Lower Manawatu – Mana 11

Table 33. Summary table: Recommended minimum flows and core allocation limits for the Lower Manawatu Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 11a	Lower Manawatu	TF (O)	15.900	15.570	5c	14.160	12.240	3.180	3.890	Manawatu at Teachers College	Y
Mana 11b	Turitea	TF (O)	n/a	n/a	6f	0.050	0.050	0.264	0.265	Turitea at Ngahere Park	N
Mana 11c	Kahuterawa	TF (O)	nil	0.190	5a	MALF	0.180	20% of MALF	0.010	Kahuturawa at Johnsons Rata	Y
Mana 11d	Upper Mangaone Stream	TF (O)	nil	0.036	5s	MALF	0.035	20% of MALF	0.005	Mangaone at Milson Line	Y
Mana 11e	Lower Mangaone Stream	LSC	nil	0.036	5a	MALF	0.035	20% of MALF	0.010	Mangaone at Milson Line	Y
Cumulative core allocation limit (Mana 11d + Mana 11e)									0.015		Y
Mana 11f	Main Drain	LSC	nil	nil	6g	MALF	MALF	20% of MALF	10% of MALF	n/a	?
Whole zone cumulative core allocation limit (Mana 11a + Mana 11b + Mana 11c + Mana 11d + Mana 11e + Mana 11f)									3.890		Y
Catchment cumulative core allocation limit (Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 10 + Mana 11)									3.890		Y

3.5.12.1 Lower Manawatu – Mana 11a

212. The flow statistics for the Manawatu at Teachers College flow monitoring site have been revised since the completion of the original water allocation framework. The details of this are in Mr Watson's evidence.

213. The revised MALF at Manawatu at Teachers College is 15.300 m^3/s. The recommended minimum flow, calculated under Scenario 5c is 12.240 m^3/s.

214. The recommended core allocation limit for Mana 11a is 25% of the MALF at Manawatu at Teachers College, or 3.890 m^3/s. On average, the minimum flow is expected to be

reached on 15 days, and for a maximum of 76 days per year. In 90% of years, the minimum flow is likely to be reached on a maximum of 41 days (Table 34).

Table 34. Surety of supply analysis Manawatu at Teaches College/Palmerston North

Manawatu at Palmerston North (Data record: 1 July 1923 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	15.300	12	34	70
Minimum flow (80% of MALF)	12.240	4	12	51
Minimum flow plus 5% of MALF as core allocation	13.005	5	19	57
Minimum flow plus 10% of MALF as core allocation	13.770	7	26	62
Minimum flow plus 15% of MALF as core allocation	14.535	10	31	67
Minimum flow plus 20% of MALF as core allocation	15.300	12	34	70
Minimum flow plus 25% of MALF as core allocation	*16.065*	*15*	*41*	*76*
Minimum flow plus 30% of MALF as core allocation	16.830	18	48	85
Minimum flow plus 35% of MALF as core allocation	17.595	21	54	91
Minimum flow plus current allocation in Sub-zone	12.470	4	14	53
Minimum flow plus current allocation WMZ	12.609	4	16	53
Minimum flow plus current allocation WMZ Total Cumulative	14.318	9	30	66
7 Day MALF (NES)	12.966	21	62	80
7 Day MALF minimum flow (NES)	10.373	8	30	49
7 Day MALF minimum flow + core allocation (NES)	14.263	29	73	95

3.5.12.2 Turitea – Mana 11b

215. The Palmerston North City Council holds Consent No. 100744 for the Palmerston North City water supply in this Sub-zone. The maximum daily abstraction of surface water from the Turitea Stream, at approximate map reference T24:368-827, shall not exceed 37,000 cubic metres (37,000m^3).

216. A "policy call" was made, that the minimum flow in this Sub-zone should be 0.050 m^3/s and the core allocation limit should be set at the "efficient use" guideline of 300 L/head/day or 0.265 m^3/s.

3.5.12.3 Kahuterawa – Mana 11c

217. There was no MALF statistic available for the Kahuterawa Stream at the time of the development of the original POP Water Allocation Framework. Prior to the preparation of this evidence, Mr Watson calculated a MALF for the flow monitoring site Kahuterawa at Johnsons Rata. The details of this are in his evidence. This MALF statistic has been applied through Scenarios 6a and 5a (95% of MALF) to provide a minimum flow of 0.180 m^3/s for this Sub-zone.

218. The recommended core allocation limit for the Kahuturawa Sub-zone is 5% of MALF at Kahuterawa at Johnsons Rata, or 0.010 m^3/s.

219. Restrictions in this Sub-zone are likely to occur on 23 days per year on average and on up to 55 days, i.e 46 days in 90% of years (Table 35).

Table 35. Surety of supply analysis Kahuterawa at Johnsons Rata

Kahuterawa at Johnstons Rata (Data record: 1 July 2005 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.190	23	46	55
Minimum flow (95% of MALF)	0.181	20	41	49
Minimum flow plus 5% of MALF as core allocation	*0.190*	*23*	*46*	*55*
Minimum flow plus 10% of MALF as core allocation	0.200	26	50	61
Minimum flow plus 15% of MALF as core allocation	0.209	28	56	68
Minimum flow plus 20% of MALF as core allocation	0.219	31	61	74
Minimum flow plus 25% of MALF as core allocation	0.228	34	65	78
Minimum flow plus 30% of MALF as core allocation	0.238	38	71	84
Minimum flow plus 35% of MALF as core allocation	0.247	43	76	89
Minimum flow plus current allocation in Sub-zone	0.186	22	43	52
Minimum flow plus current allocation WMZ	0.181	20	41	49
Minimum flow plus current allocation WMZ Total Cumulative	0.181	20	41	49

3.5.12.4 Upper Mangaone Stream – Mana 11d

220. There was no MALF statistic available for the Mangaone Stream at the time of the development of the original POP Water Allocation Framework. Prior to the preparation of this evidence, Mr Watson calculated a MALF for the flow gauging site Mangaone at Milson Line. This MALF statistic has been used to determine a minimum flow for this Sub-zone. The MALF (0.035 m^3/s) is less than 0.460 m^3/s, so a minimum flow of 95% of the MALF is recommended. When rounded up to the nearest 0.005 m^3/s, this number is the same as the MALF (0.035 m^3/s).

221. The recommended core allocation limit for this Sub-zone is 10% of the MALF, or 0.005 m^3/s. Based on the minimum flow and core allocation limit recommended here, restrictions could be expected to apply on 56 days on average and for up to 177 days; however, in 90% of years the maximum is likely to be 148 days (Table 36).

Table 36. Surety of supply analysis Mangaone at Milson Line

Mangaone at Milson Line (Data record: 1 July 1978 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.035	54	141	172
Minimum flow (95% of MALF)	0.033	51	131	165
Minimum flow plus 5% of MALF as core allocation	0.035	54	141	172
Minimum flow plus 10% of MALF as core allocation	*0.037*	*56*	*148*	*177*
Minimum flow plus 15% of MALF as core allocation	0.039	59	156	184
Minimum flow plus 20% of MALF as core allocation	0.040	63	164	189
Minimum flow plus 25% of MALF as core allocation	0.042	65	171	193
Minimum flow plus 30% of MALF as core allocation	0.044	67	175	194
Minimum flow plus 35% of MALF as core allocation	0.046	72	179	198
Minimum flow plus current allocation in Sub-zone	0.033	51	131	165
Minimum flow plus current allocation WMZ	0.655	322	347	354
Minimum flow plus current allocation WMZ Total Cumulative	2.982	350	361	363

3.5.12.5 Lower Mangaone Stream – Mana 11e

222. The minimum flow recommendation for this Sub-zone is the same as for the Upper Mangaone Stream Sub-zone (Mana 11d), ie. 0.035 m^3/s at Mangaone at Milson Line.

223. The proposed core allocation limit is 0.010 m^3/s, or 15% of MALF (0.055 m^3/s) at the bottom of the Sub-zone. There is no surety information available for this Sub zone.

3.5.12.6 Main Drain – Mana 11f

224. No flow statistics are available for this Sub-zone, so it is recommended that the minimum flow and core allocation remain as "default" (ie. MALF plus 10% of MALF as core).

3.5.12.7 Cumulative core allocation limit Mana 11d + Mana 11e

225. The cumulative core allocation limit Mana 11d + Mana 11e is the combined maximum volume that can be abstracted from the Upper, and Lower Mangaone Sub-zones.

3.5.12.8 Whole zone core allocation limit

226. The whole zone core allocation limit is the maximum volume that can be allocated from the Lower Manawatu Water Management Zone. The water can be allocated from any

Sub-zone up to its individual allocation limit, but the total allocation in the Water Management Zone should not exceed 3.115 m^3/s (also the core allocation limit for Mana 11a).

3.5.13 Oroua – Mana 12

Table 37. Summary table: Recommended minimum flows and core allocation limits for the Oroua Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 12a	Upper Oroua	TF (O)	nil	1.320	3 (90%)	1.050	1.005	0.405	0.395	Oroua at Almadale	Y
Mana 12b	Middle Oroua	TF (O)	1.350	1.355	3 (90%)	1.050	1.030	0.430	0.405	Oroua at Kawa Wool	Y
Mana 12c	Lower Oroua	TF (O)	1.433	1.430	3 (90%)	1.050	1.085	0.530	0.430	Oroua at Awahuri Bridge	Y
Cumulative core allocation limit (Mana 12a + Mana 12b + Mana 12c)									0.430		Y
Mana 12d	Kiwitea	TS	0.161	0.160	5a	0.145	0.150	0.048	0.015	Kiwitea at Haynes Lines	Y
Mana 12e	Makino	TF (O)	0.083	0.080	5a	0.080	0.075	0.025	0.015	Makino at Boness Rd	Y
Whole zone core allocation limit (Mana 12a + Mana 12b + Mana 12c + Mana 12d + Mana 12e)									0.430		Y
Catchment cumulative core allocation limit (Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 10 + Mana 11 + Mana 12)									4.320		Y

3.5.13.1 Upper Oroua – Mana 12a

227. An IFIM survey of the Oroua River was completed by Hay (2006) and minimum flow recommendations were provided as a result of this. Since the completion of the original framework document, the MALF statistic for the Oroua River at Kawa Wool (flow site relevant to the IFIM survey) have been revised (the details of this are in Mr Watson's evidence). In preparation for the writing of this evidence, the revised MALF was provided to Mr Hay at Cawthron Institute for reanalysis of the IFIM data. The revised minimum flow recommendation is used to establish proposed minimum flows for the Oroua Water Management Zone.

228. The IFIM recommended minimum flow for Oroua at Kawa Wool is 1.030 m^3/s based on a MALF of 1.355 m^3/s. The Kawa Wool site is the relevant minimum flow monitoring site for Mana 12b (Middle Oroua), so the recommended minimum flow for that Sub-zone is 1.030 m^3/s as provided by the IFIM re-analysis.

229. In order to use that minimum flow recommendation to derive a minimum flow for the Sub-zones above (Mana 12a) and below (Mana 10c), some calculations were required.

230. The as-recorded MALF for Oroua at Almadale is 1.211 m^3/s (to naturalise for the Feilding water supply abstraction, add 0.083 m^3/s and for the Kiwitea rural water supply abstraction add 0.026 m^3/s: 1.211 + 0.083 + 0.026 = 1.320 m^3/s as a naturalised MALF for Oroua at Almadale.

231. The Oroua at Kawa Wool MALF is known (1.355 m^3/s), as is the IFIM recommended minimum flow for that site (1.030 m^3/s). The ratio between these two flows is: 1.355/1.030 = 1.315. This ratio is used to determine what the IFIM recommended flow should be for the Oroua at Almadale: MALF at Almadale 1.320/1.315 = recommended minimum flow of 1.003 m^3/s at Almadale.

232. The recommended minimum flow for the Upper Oroua Sub-zone is 1.003 m^3/s at Oroua at Almadale.

233. The proposed core allocation limit is 30% of the naturalised MALF (1.320 m^3/s) for Oroua at Almadale (as calculated above), or 0.395 m^3/s.

234. At full allocation, the minimum flow could be expected to be reached on 15 days on average, and on a maximum of 56 days, ie. 39 days in 90% of years (

Table 38).

Table 38. Surety of supply analysis Oroua at Almadale

Oroua at Almadale (Data record: 1 July 1992 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	1.320	4	12	24
IFIM Minimum flow	1.003	13	34	50
Minimum flow plus 5% of MALF as core allocation	1.069	5	16	28
Minimum flow plus 10% of MALF as core allocation	1.135	7	20	35
Minimum flow plus 15% of MALF as core allocation	1.201	9	24	40
Minimum flow plus 20% of MALF as core allocation	1.267	11	30	46
Minimum flow plus 25% of MALF as core allocation	1.333	13	35	51
Minimum flow plus 30% of MALF as core allocation	*1.399*	*15*	*39*	*56*
Minimum flow plus 35% of MALF as core allocation	1.465	17	43	59
Minimum flow plus current allocation in Sub-zone	1.386	15	38	55
Minimum flow plus current allocation WMZ	1.943	37	69	91
Minimum flow plus current allocation WMZ Total Cumulative	5.137	154	201	231
7 Day MALF (NES)	2.577	64	103	119
7 Day MALF minimum flow (NES)	2.319	53	89	107
7 Day MALF minimum flow + core allocation (NES)	3.092	85	129	142

3.5.13.2 Middle Oroua – Mana 12b

235. The recommended minimum flow for this Sub-zone is that recommended by the IFIM survey as described in paragraph 227 above.

236. The proposed core allocation limit is 30% of the MALF at Oroua at Kawa Wool (1.355 m^3/s).

237. Under full allocation, restrictions in this Sub-zone are likely to apply on 15 days per year on average, and on a maximum of 40 days. In 90% of years, the maximum is likely to be 30 days (

Table 39).

Table 39. Surety of supply analysis Oroua at Kawa Wool

Oroua at Kawa Wool (Data record: 1 July 1967 – 1 July 1992)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	1.355	4	11	17
IFIM Minimum flow	1.030	12	24	38
Minimum flow plus 5% of MALF as core allocation	1.098	5	12	25
Minimum flow plus 10% of MALF as core allocation	1.166	6	14	31
Minimum flow plus 15% of MALF as core allocation	1.233	8	17	34
Minimum flow plus 20% of MALF as core allocation	1.301	10	20	36
Minimum flow plus 25% of MALF as core allocation	1.369	12	25	38
Minimum flow plus 30% of MALF as core allocation	*1.437*	*15*	*30*	*40*
Minimum flow plus 35% of MALF as core allocation	1.504	17	35	42
Minimum flow plus current allocation in Sub-zone	1.109	5	12	26
Minimum flow plus current allocation WMZ	1.827	29	54	63
Minimum flow plus current allocation WMZ Total Cumulative	1.849	30	55	66
7 Day MALF (NES)	1.294	10	19	35
7 Day MALF minimum flow (NES)	1.165	6	14	31
7 Day MALF minimum flow + core allocation (NES)	1.553	19	40	46

3.5.13.3 Lower Oroua – Mana 12c

238. The recommended minimum flow for the Lower Oroua Sub-zone is based on a reanalysis of the IFIM survey data using a MALF of 1.435 m^3/s at Oroua at Boness Road. This is calculated by adding the Oroua at Kawa Wool MALF (1.355 m^3/s) plus the MALF of the Makino Stream (0.080 m^3/s), which is the only inflow between Kawa Wool and the bottom of Mana 12c.

239. The recommended minimum flow is 1.085 m^3/s at Awahuri Bridge. This is calculated by using 76% of MALF, which is the relationship between the IFIM recommended minimum flow and the MALF at Oroua at Kawa Wool.

240. The recommended core allocation limit for Mana 12c is 30% of the MALF at the bottom of the Sub-zone (1.435 m^3/s). The recommended core allocation limit is 0.430 m^3/s.

241. It is expected that the surety at this allocation limit will be similar to that for Mana 12b.

3.5.13.4 Kiwitea – Mana 12d

242. The proposed minimum flow for the Kiwitea Sub-zone is 95% of the MALF at Kiwitea at Haynes Line (0.160 m^3/s). This gives a recommended minimum flow of 0.150 m^3/s. This is slightly higher than the previously notified minimum flow that was based on an IFIM

study completed in 1999. It was decided not to use the recommendations of that IFIM study because the original survey data is unavailable for quality checking.

243. The proposed core allocation limit for the Kiwitea Sub-zone is 10% of the MALF at Haynes Line. At full allocation, flow restrictions are likely to occur on 23 days on average and for up to 93 days (53 days in 90% of years) (Table 40).

Table 40. Surety of supply analysis Kiwitea at Spur Road

Kiwitea All (Data record: 1 July 1977 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.160	20	48	88
Minimum flow (95% of MALF)	0.152	17	43	83
Minimum flow plus 5% of MALF as core allocation	0.160	20	48	88
Minimum flow plus 10% of MALF as core allocation	*0.168*	*23*	*53*	*93*
Minimum flow plus 15% of MALF as core allocation	0.176	26	57	97
Minimum flow plus 20% of MALF as core allocation	0.184	28	62	101
Minimum flow plus 25% of MALF as core allocation	0.192	31	66	104
Minimum flow plus 30% of MALF as core allocation	0.200	34	71	106
Minimum flow plus 35% of MALF as core allocation	0.208	37	79	109
Minimum flow plus current allocation in Sub-zone	0.161	20	49	89
Minimum flow plus current allocation WMZ	0.562	134	188	211
Minimum flow plus current allocation WMZ Total Cumulative	3.511	314	344	352
7 Day MALF (NES)	0.165	22	51	92
7 Day MALF minimum flow (NES)	0.149	16	40	79
7 Day MALF minimum flow + core allocation (NES)	0.198	33	70	105

3.5.13.5 Makino – Mana 12e

244. The proposed minimum flow for the Makino Sub-zone is 95% of the MALF at Makino at Boness Road Line (0.080 m^3/s). This gives a recommended minimum flow of 0.075 m^3/s. This is slightly higher that the previously notified minimum flow, which was based on an IFIM study completed in 1999. It was decided not to use the recommendations of that IFIM study because the original survey data is unavailable for quality checking.

245. The proposed core allocation limit for the Makino Sub-zone is 20% of the MALF at Boness Road. At full allocation, flow restrictions are likely to occur on 27 days on average and for up to 94 days (72 days in 90% of years) (Table 41).

Table 41. Surety of supply analysis Makino at Boness Road

Makino at Boness Road (Data record: 1 July 1992 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.080	15	47	67
Minimum flow (95% of MALF)	0.076	12	42	60
Minimum flow plus 5% of MALF as core allocation	0.080	15	47	67
Minimum flow plus 10% of MALF as core allocation	0.084	19	54	77
Minimum flow plus 15% of MALF as core allocation	0.088	23	61	83
Minimum flow plus 20% of MALF as core allocation	*0.092*	*27*	*72*	*94*
Minimum flow plus 25% of MALF as core allocation	0.096	32	80	98
Minimum flow plus 30% of MALF as core allocation	0.100	37	86	110
Minimum flow plus 35% of MALF as core allocation	0.104	41	91	116
Minimum flow plus current allocation in Sub-zone	0.091	25	70	86
Minimum flow plus current allocation WMZ	0.548	261	301	314
Minimum flow plus current allocation WMZ Total Cumulative	0.570	264	303	315

3.5.13.6 Cumulative core allocation limit Mana 12a + Mana 12b + Mana 12c

246. The cumulative core allocation limit Mana 12a + Mana 12b + Mana 12c is the maximum allocation that should be allowed from the Oroua River catchment. The water can be allocated from any of the Sub-zones up to their individual limits, but the total volume allocated should not exceed 0.430 m^3/s.

3.5.13.7 Whole zone core allocation limit

247. The whole zone core allocation is the maximum volume of water that should be allocated out of the Oroua Water Management Zone. The water may be allocated from any of the Sub-zones up to their individual core allocation limits, but the total allocation should not exceed the whole zone core allocation limit.

3.5.13.8 Catchment cumulative core allocation limit

248. The catchment cumulative core allocation limit indicates the maximum allocation that may occur in the Manawatu catchment to the end of the Mana 12 Water Management Zone. The water can be allocated in any of the Water Management Zones and Sub-zones, up to the individual allocation limits, but the total allocation in the catchment should not exceed the cumulative core allocation limit to the end of Mana 12e.

3.5.14 Coastal Manawatu – Mana 13

Table 42. Summary table: Recommended minimum flows and core allocation limits for the Coastal Manawatu Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Mana 13a	Coastal Manawatu*	TF (O)	17.661	17.325	5c	12.588	12.240	5.300	6.930	Manawatu at Teachers College	Y
Mana 13b	Upper Tokomaru	TF (O)	0.247	0.250	5a	12.588	0.240	0.050	0.015	Tokomaru at Riverland Farm	Y
Mana 13c	Lower Tokomaru	TS	nil	0.560	5a	0.220	0.240	20% of MALF	0.170	Tokomaru at Riverland Farm	Y
Cumulative core allocation limit (Mana 13b + Mana 13c)									0.170		Y
Mana 13d	Mangaore	SOS-A	nil	nil	6g	MALF	MALF	20% of MALF	10% of MALF	n/a	?
Mana 13e	Koputaroa	SOS-A	nil	0.030	5a	MALF	12.240	20% of MALF	0.005	Manawatu at Teachers College	Y
Mana 13f	Foxton Loop	LSC	nil	nil	6g	MALF	MALF	20% of MALF	Rule 15-5 applies	n/a	?
Catchment cumulative core allocation limit (Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 10 + Mana 11+ Mana 12 + Mana 13)									6.930		Y

* there was a Sub-zone Mana 13a1, which has been removed

3.5.14.1 Coastal Manawatu – Mana 13a

249. Because the Coastal Manawatu Sub-zone is affected by tidal fluctuations, the most appropriate minimum flow monitoring site is the Manawatu at Teachers College flow recorder. This is upstream of the tidal influence. The minimum flow recommended for the Mana 13a Sub-zone is 12.240 m^3/s at Manawatu at Teachers College.

250. The core allocation limit for the Coastal Manawatu Sub-zone is based on MALF calculated for the mainstem of the Manawatu River downstream of Opiki Bridge, including all inflows that occur below the Teachers College flow recorder. The calculation is set out in Table 43.

Table 43. MALF calculation for Mana 13a – Coastal Manawatu

Flow site	MALF (m^3/s)
Oroua at Kawa Wool	1.355
Makino at Boness Road	0.080
Koputaroa at Tavistock Road	0.030
Mangaore at d/s of powerstation	0.040
Tokomaru at SH57	0.250
Manawatu at Opiki Bridge	15.570
Calculated MALF for Mana 13a	17.325

251. The proposed core allocation limit for Mana 13a is 40% of the MALF as calculated above (17.325 m^3/s), or 6.930 m^3/s. This is less than what was proposed in the notified framework, but is considered appropriate given the relatively poor water quality experienced in the lower reaches of the Manawatu River, and the international significance of the Manawatu River estuary, which is listed as a RAMSAR site[8].

3.5.14.2 Upper Tokomaru – Mana 13b

252. The MALF statistic for the Tokomaru flow record has been revised since the original notification of the POP Water Allocation Framework, and is now 0.250 m^3/s (previous MALF was 0.220 m^3/s). The minimum flow for the Upper Tokomaru Sub-zone is propsed to be set at 95% of the revised MALF, or 0.240 m^3/s following Scenario 5a.

253. The recommended core allocation limit for this Sub-zone is 5% of the MALF, ie. 0.015 m^3/s. This Sub-zone is mainly in native bush, and water demand is low and is likely to remain so. At full allocation, flow restrictions could be expected to apply on 12 days on average and for up to 83 days. In 90% of years restrictions are likely to apply for a maximum of 45 days (

[8] http://www.wetlandtrust.org.nz/ramsar.html

Table 44).

Table 44. Surety of supply analysis Tokomaru at Riverland Farm

Tokomaru All (Data record: 1 July 1980 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.250	10	35	75
Minimum flow (95% of MALF)	0.238	9	30	71
Minimum flow plus 5% of MALF as core allocation	0.250	10	35	75
Minimum flow plus 10% of MALF as core allocation	0.263	11	41	78
Minimum flow plus 15% of MALF as core allocation	*0.275*	*12*	*45*	*83*
Minimum flow plus 20% of MALF as core allocation	0.288	14	49	85
Minimum flow plus 25% of MALF as core allocation	0.300	15	54	90
Minimum flow plus 30% of MALF as core allocation	0.313	17	58	93
Minimum flow plus 35% of MALF as core allocation	0.325	19	62	95
Minimum flow plus current allocation in Sub-zone	0.057	0	0	0
Minimum flow plus current allocation WMZ	0.057	0	0	0
Minimum flow plus current allocation WMZ Total Cumulative	0.057	0	0	0

3.5.14.3 Lower Tokomaru – Mana 13c

254. It is recommended that the minimum flow for the Lower Tokomaru Sub-zone be based on the same flow monitoring site and minimum flow as the Upper Tokomaru Sub-zone (Tokomaru at Riverland Farm).

255. The estimated MALF at the bottom of Mana 13c is estimated to be 0.560 m^3/s. This was calculated using a specific yield of 2 $L/s/km^2$. The catchment area of Mana 13b is 155.2, so 155.2 km^2 * 2 $L/s/km^2$ = 0.310 m^3/s. This is added to the known MALF at Riverland Farm: 0.310 + 0.250 = 0.560 m^3/s estimated MALF at the end of Mana 13c.

256. The recommended core allocation limit for Mana 13c is 30% of the estimated MALF, or 0.170 m^3/s. There is no surety analysis available for this Sub-zone.

3.5.14.4 Mangaore – Mana 13d

257. The flow regime in Mana 13d is strongly influenced by existing hydroelectricity generation in the catchment, and it is not possible to calculate a MALF statistic for the Sub-zone. It is recommended that the "default" method should apply to this Sub-zone (ie. MALF plus 10% of MALF as core).

3.5.14.5 Koputuroa – Mana 13e

258. When the original POP Water Allocation Framework was prepared, there was no MALF statistic available for the Koputaroa Sub-zone. Prior to the preparation of this evidence, Mr Watson calculated a MALF for the Koputaroa at Tavistock Road gauging site of 0.030 m^3/s.

259. The Manawatu at Teachers College is the most appropriate flow recorder from which to monitor the minimum flow of Mana 13e, therefore the minimum flow is 12.240 m^3/s at Manawatu at Teachers College.

260. The core allocation limit is recommended to be set at 20% of the MALF at Koputaroa at Tavistock Road gauging site.

3.5.14.6 Foxton Loop – Mana 13f

261. POP Rule 15-5 (abstraction from Lakes and Wetlands) applies in this Sub-zone.

3.5.14.7Cumulative core allocation limit Mana 13b + Mana 13c

262. Mana 13a and Mana 13c Sub-zones are the Upper and Lower Tokomaru River catchment. Each Sub-zone has its own core allocation limit, but the combined allocation for the whole Tokomaru catchment should not be greater than the cumulative limit of 0.170 m^3/s. For example, if the Upper Tokomaru Sub-zone becomes fully allocated (ie. 0.015 m^3/s), then 0.155 m^3/s is available for allocation in the Lower part of the catchment.

3.5.15 Upper Rangitikei – Rang 1

Table 45. Summary table: Recommended minimum flows and core allocation limits for the Upper Rangitikei Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Rang 1	Upper Rangitikei	TF (Ostd)	nil	nil	1	n/a	n/a	0.000	0.000	n/a	n/a

3.5.15.1 Upper Rangitikei – Rang 1

263. The critical value for the Upper Rangitikei Water Management Zone is indicated by the National Water Conservation (Rangitikei) Order 1993. Ausseil & Clark (2007) have identified the critical value for this part of the Rangitikei River as Outstanding Trout Fishery.

264. The NWCO prohibits the abstraction and use of water, beyond reasonable needs for domestic and stock water purposes, from reaches of the river identified in the Order, ie. the Rangitikei River from its source (approximate map reference U19: 723-313) to its confluence with the Makahikatoa Stream (approximate map reference (U21: 725-888) (Roygard & Carlyon, 2004).

265. The prohibition of abstraction under the jurisdiction of the NWCO means that no minimum flow needs to be set here, because the core allocation limit is 0.000 m^3/s, and no consents to abstract water, beyond reasonable needs for domestic and stock water purposes, will be granted from this Water Management Zone. Consents to abstract for domestic and stock watering requirements do not usually include minimum flow conditions.

3.5.16 Middle Rangitikei – Rang 2

Table 46. Summary table: Recommended minimum flows and core allocation limits for the Middle Rangitikei Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Rang 2a	Middle Rangitikei	TF (Ostd)	5.250	5.000	1	5.250	5.000	0.260	0.250	Rangitikei at Pukeokahu	Y
Rang 2b	Pukeokahu-Mangaweka	TF (Ostd)		15.600	3a	12.790	12.250	0.670	0.610	Rangitikei at Mangaweka	Y
Cumulative core allocation limit (Rang 2a + Rang 2b)									0.610		Y
Rang 2c	Upper Moawhango	TF (O)	nil	nil	6d	MALF	0.600	20% of MALF	0.000	Moawhango at Waiouru	Y
Rang 2d	Middle Moawhango	TF (O)	nil	nil	6d	MALF	0.600	0	0.000	Moawhango at Moawhango	Y
Rang 2e	Lower Moawhango	TF (O)	nil	nil	6d	MALF	0.600	5% of MALF	0.000	Moawhango at Moawhango	Y
Rang 2f	Upper Hautapu	TF (RS)	0.745	0.750	4a	0.745	0.640	0.112	0.115	Hautapu at Alabasters	Y
Rang 2g	Lower Hautapu	TF (RS)	0.835	0.981	6a	0.670	0.640	0.085	0.150	Hautapu at Alabasters	Y
Cumulative core allocation limit (Rang 2f + Rang 2g)									0.150		Y
Catchment cumulative core allocation limit (Rang 1 + Rang 2)									0.610		Y

* as required by Consent 101279 for Genesis Energy's Tongariro Power Development

3.5.16.1 Middle Rangitikei – Rang 2a

266. The National Water Conservation (Rangitikei) Order 1993 specifies the minimum flow and core allocation that is to apply in this Sub-zone. The recommended minimum flow is 5.000 m^3/s, which is the MALF at the Rangitikei at Pukeokahu flow monitoring site. This MALF estimate is slightly lower than that notified (ie. 5.250 m^3/s), as a result of the review of the hydrological statistics in preparation for this evidence.

267. The recommended core allocation limit is 0.250 m^3/s, i.e 5% of the MALF and, in combination with the conservative minimum flow, this should retain 95% of the "river flow" as specified by the NWCO.

3.5.16.2 Pukeokahu-Mangaweka – Rang 2b

268. The National Water Conservation (Rangitikei) Order 1993 also specifies the minimum flow and core allocation that is to apply in this Sub-zone.

269. The critical value for the Upper Rangitikei Water Management Zone is indicated by the National Water Conservation (Rangitikei) Order 1993. The revision of the MALF statistic (15.510 m^3/s) for the Rangitikei at Mangaweka site in 2009 (to 16.100 m^3/s), as described in Mr Watson's evidence, meant that the IFIM recommendation needed to be recalculated using the new MALF. The details of this process are discussed in the evidence of Mr Hay. The revised minimum flow recommendation for the Pukeokahu-Mangaweka Sub-zone is 12.530 m^3/s.

270. The recommended core allocation limit for this Sub-zone (0.610 m^3/s) is 5% of the recommended minimum flow, rather than 5% of the MALF, as this is in line with the requirements of the NWCO not to reduce the river flow by more than 5%.

3.5.16.3 Upper Moawhango – Rang 2c

271. The Upper Moawhango Sub-zone is dominated by the Genesis Energy Tongariro Power Development (TPD) retention dam. This dam is permitted by Consent 101279. The conditions of the consent require a minimum residual flow of no less than 0.600 m^3/s to be maintained below the dam. This, by default, becomes the minimum flow for the Sub-zone.

272. There is no water available for allocation over and above the TPD take, so the core allocation limit is 0.000 m^3/s.

3.5.16.4 Middle Moawhango – Rang 2d

273. The minimum flow for this Sub-zone is, by default, set by the consent conditions of the TPD Consent 101279, at 0.600 m^3/s.

274. The core allocation limit for this Sub-zone is 0.000 m^3/s, as all water that would be available for allocation to out-of-stream users is currently impounded by the TPD retention dam in the headwaters of the catchment. Applications to take water from the Moawhango River for irrigation, following the granting of the TPD consent, met with

significant public resistance. The local community did not wish to see any further water abstracted from the river below the TPD dam.

3.5.16.5 Lower Moawhango – Rang 2e

275. The minimum flow and core allocation limit for this Sub-zone are set as for the two Sub-zones above (Rang 2c and Rang 2d) due to the presence of the TPD dam in the headwaters of the river.

3.5.16.6 Upper Hautapu – Rang 2f

276. This Sub-zone includes the upper part of the Hautapu River, which is covered by the Local Water Conservation (Hautapu River) Notice. This is the part of the river above the Moawhango Dam, which is part of the Tongariro Power Development. This Sub-zone is classified as a regionally significant trout fishery (Ausseil & Clark, 2007), and this classification is in line with the original intention of the LWCN and the subsequent Land and Water Regional Plan SW Rule 2.

277. The recommended minimum flow is 85% of MALF at Hautapu at Alabasters (0.750 m^3/s), under Scenario 5b and is 0.640 m^3/s.

278. The proposed core allocation limit for the Upper Hautapu Sub-zone is 0.115 m^3/s, which is 15% of MALF at Hautapu at Alabasters. At full allocation, the minimum flow could expect to be reached on 21 days per year on average and for up to 99 days, but in 90% of years, the maximum number of days of restriction is likely to be 61 (Table 47).

Table 47. Surety of supply analysis Hautapu at Alabasters

Hautapu All (Data record: 1 July 1980 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.750	21	61	99
Minimum flow (85% of MALF)	0.638	10	32	76
Minimum flow plus 5% of MALF as core allocation	0.675	14	45	88
Minimum flow plus 10% of MALF as core allocation	0.713	17	55	93
Minimum flow plus 15% of MALF as core allocation	*0.750*	*21*	*61*	*99*
Minimum flow plus 20% of MALF as core allocation	0.788	23	67	104
Minimum flow plus 25% of MALF as core allocation	0.825	26	73	107
Minimum flow plus 30% of MALF as core allocation	0.863	29	79	112
Minimum flow plus 35% of MALF as core allocation	0.900	33	86	116
Minimum flow plus current allocation in Sub-zone	0.638	10	32	76
Minimum flow plus current allocation WMZ	0.638	10	32	76
Minimum flow plus current allocation WMZ Total Cumulative	0.638	10	32	76
7 Day MALF (NES)	0.802	17	62	105
7 Day MALF minimum flow (NES)	0.722	12	43	94
7 Day MALF minimum flow + core allocation (NES)	0.962	28	83	122

3.5.16.7 Lower Hautapu – Rang 2g

279. The proposed minimum flow for this Sub-zone is as for Rang 2f (0.640 m^3/s at Hautapu at Alabasters), as this is the only flow recorder in the catchment.

280. The recommended core allocation limit for the Rang 2g Sub-zone is based on the MALF at Toe Toe Road gauging site, at the end of the Sub-zone. The MALF is 0.981 m^3/s, and the recommended core allocation limit is 15% of this, or 0.150 m^3/s. The surety of supply is likely to be similar to that for Rang 2f.

3.5.16.8 Cumulative core allocation limit Rang 2a + Rang 2b

281. The cumulative limit to the end of Rang 2b is the total volume of water that should be taken from the two Sub-zones that form the upper section of the Rangitikei catchment. The water may be allocated from either zone, up to their individual core allocation limits, but the total allocation should not exceed the cumulative limit. For example, should Rang 2a become fully allocated, a maximum of 0.360 m^3/s would be available in Rang 2b (minus any current allocation in Rang 2b) to give a total possible allocation of 0.610 m^3/s in these two Sub-zones.

3.5.16.9 Cumulative core allocation limit Rang 2f + Rang 2g

282. The cumulative limit to the end of Rang 2g is the total volume of water that should be taken from the two Sub-zones that form the Hautapu catchment. The water may be allocated from either zone, up to each individual core allocation limit, but the total allocation should not exceed the cumulative limit. For example, if Rang 2f was fully allocated, a maximum of 0.035 m^3/s would be available in Rang 2g (minus any current allocation in Rang 2g).

3.5.16.10 Catchment cumulative core allocation limit

283. The catchment cumulative core allocation limit is the maximum recommended allocation from the catchment to the end of Rang 2g (Rang 1 + Rang 2). The water could be allocated from any of the Sub-zones, provided all other individual and cumulative allocation limits are met.

3.5.17 Lower Rangitikei – Rang 3

Table 48. Summary table: Recommended minimum flows and core allocation limits for the Lower Rangitikei Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Rang 3a	Lower Rangitikei	TF (O)	17.930	16.400	3b	14.550	12.100	1.510	1.640	Rangitikei at Onepuhi	Y
Rang 3b	Makohine	TF (O)	0.040	0.040	5a	0.036	0.040	0.008	0.010	Makohine at Viaduct	Y
Whole zone core allocation limit (Rang 3a + Rang 3b)									1.640		Y
Catchment cumulative core allocation limit (Rang 1 + Rang 2 + Rang 3)									1.640		Y

3.5.17.1 Lower Rangitikei – Rang 3a

284. An IFIM study was completed at the Rangitikei catchment in 2004 (Environmental Services Ltd, 2004). The analysis of the survey was later reviewed by the Cawthron Institute (Hayes, 2004), and subsequently, further analysis was completed (Hay & Hayes, 2004). The recommended flows from this further analysis were carried through to the WRA (Roygard & Carlyon, 2004) and recommended in the notified version of the

framework, but since that notification, the MALF statistics for the catchment have been reviewed. The MALF for the Rangitikei at Onepuhi flow site was revised from 15.510 m^3/s to 16.400 m^3/s. This new statistic was provided to Mr Hay at the Cawthron Institute and was used to generate a new recommended minimum flow for the IFIM reach Rangitikei at Onepuhi. The details of this re-analysis are set out in the evidence of Mr Hay.

285. The revised minimum flow recommendation for Rang 3a is 12.100 m^3/s. This is lower than the notified minimum flow of 14.550 m^3/s, but in line with the expected change given the refinement of the MALF statistic for this Sub-zone.

286. The appropriate core allocation limit was determined to be the 95th percentile of the flow distribution minus the minimum flow (Roygard & Carlyon, 2004). Since the revision of the MALF statistics, and the completion of the notified Water Allocation Framework, it has been decided that for consistency, the core allocation limit should be derived as for most of the Region's other Sub-zones, ie. as a percentage of MALF. The recommended core allocation limit for this Sub-zone is 10% of the MALF at Rangitikei at Onepuhi, or 1.640 m^3/s.

287. At full allocation, the minimum flow restrictions could be expected to apply on 12 days on average and on up to 51 days per year (Table 49).

Table 49. Surety of supply analysis Rangitikei at Onepuhi

Rangitikei at Onepuhi (Data record: 1 July 2002 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	16.400	30	65	73
IFIM Minimum flow	12.100	5	14	25
Minimum flow plus 5% of MALF as core allocation	12.920	8	24	41
Minimum flow plus 10% of MALF as core allocation	*13.740*	*12*	*30*	*51*
Minimum flow plus 15% of MALF as core allocation	14.560	17	41	58
Minimum flow plus 20% of MALF as core allocation	15.380	23	52	66
Minimum flow plus 25% of MALF as core allocation	16.200	29	63	72
Minimum flow plus 30% of MALF as core allocation	17.020	34	72	78
Minimum flow plus 35% of MALF as core allocation	17.840	38	79	84
Minimum flow plus current allocation in Sub-zone	12.645	7	20	36
Minimum flow plus current allocation WMZ	12.645	7	20	36
Minimum flow plus current allocation WMZ Total Cumulative	12.888	8	23	41

3.5.17.2 Makohine – Rang 3b

288. The proposed minimum flow for the Makohine Sub-zone is 95% of the MALF for Makohine at Viaduct (0.040 m^3/s); with rounding to the closest 0.005 m^3/s, this is the same as the MALF.

289. The recommended core allcoation limit for the Sub-zone is 20% of the MALF, or 0.010 m^3/s. At full allocation, the minimum flow is likely to be reached on 10 days per year on average and on up to 60 days, but in 90% of years, the maximum number of days restriction is estimated to be 28 (Table 50).

Table 50. Surety of supply analysis Makohine at Viaduct

Makohine at Viaduct (Data record: 1 July 1977 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.040	9	27	57
Minimum flow (95% of MALF)	0.038	8	26	54
Minimum flow plus 5% of MALF as core allocation	0.040	9	27	57
Minimum flow plus 10% of MALF as core allocation	*0.042*	*10*	*28*	*60*
Minimum flow plus 15% of MALF as core allocation	0.044	13	34	63
Minimum flow plus 20% of MALF as core allocation	0.046	14	39	68
Minimum flow plus 25% of MALF as core allocation	0.048	16	40	74
Minimum flow plus 30% of MALF as core allocation	0.050	19	47	78
Minimum flow plus 35% of MALF as core allocation	0.052	22	49	82
Minimum flow plus current allocation in Sub-zone	0.038	8	26	54
Minimum flow plus current allocation WMZ	0.583	238	274	300
Minimum flow plus current allocation WMZ Total Cumulative	0.826	266	299	317

3.5.17.3 Whole zone core allocation limit

290. The whole zone core allocation limit for Mana 3 is the total allocation recommended to be taken from Mana 3a and 3b, with only a small proportion of this able to be taken from the Makohine, in line with the core allocation limit for this Sub-zone.

3.5.17.4 Catchment cumulative core allocation limit

291. The catchment cumulative core allocation recommends the maximum total allocation to be allowed from the Rangitikei catchment to the end of Rang 3b. The water could be allocated from any Sub-zone, providing that no individual and cumulative core allocation limits are exceeded.

3.5.18 Coastal Rangitikei – Rang 4

Table 51: Summary table: Recommended minimum flows and core allocation limits for the Coastal Rangitikei Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Rang 4a	Coastal Rangitikei	TF (O)	18.580	16.500	3a	10.230	10.230	6.410	2.475	Rangitikei at McKelvies	Y
Rang 4b	Tidal Rangitikei	TF (O)	18.580	16.500	3a	10.230	10.230	6.410	3.300	Rangitikei at McKelvies	Y
Rang 4c	Porewa	TS	nil	nil	6a	MALF	12.100	20% of MALF	0	Rangitikei at Onepuhi	Y
Rang 4d	Tutaenui	SOS-A	nil	nil	6f	MALF	10.230	20% of MALF	0.077	Rangitikei at McKelvies	Y
Catchment cumulative core allocation limit (Rang 1 + Rang 2 + Rang 3 + Rang 4)									3.300		Y

3.5.18.1 Coastal Rangitikei – Rang 4a

292. As described for the Lower Rangitikei Water Management Zone, an IFIM survey was completed in the Rangitikei catchment in 2004 and reviewed in light of revised MALF statistics for the reaches by Hay (2009).

293. The minimum flow recommendation resulting from re-analysis of the IFIM survey data for Rangitikei at Hamptons (1 to 1 relationship with Rangitikei at McKelvies) is 10.230 m^3/s.

294. The proposed core allocation limit for this Sub-zone is 15% of the MALF at McKelvies (16.500m^3/s), or 2.475 m^3/s. At full allocation, the minimum flow is expected to be reached on 16 days per year on average and on up to 29 days per year (

Table 52).

Table 52. Surety of supply analysis Rangitikei at McKelvies

Rangitikei at McKelvies (Data record: 1 July 2006 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	16.500	48	70	76
IFIM Minimum flow	10.230	0	0	0
Minimum flow plus 5% of MALF as core allocation	11.055	0	0	0
Minimum flow plus 10% of MALF as core allocation	11.880	5	9	10
Minimum flow plus 15% of MALF as core allocation	*12.705*	*16*	*26*	*29*
Minimum flow plus 20% of MALF as core allocation	13.530	25	39	42
Minimum flow plus 25% of MALF as core allocation	14.355	31	49	53
Minimum flow plus 30% of MALF as core allocation	15.180	38	59	64
Minimum flow plus 35% of MALF as core allocation	16.005	45	67	72
Minimum flow plus current allocation in Sub-zone	11.155	0	0	0
Minimum flow plus current allocation WMZ	11.235	0	0	0
Minimum flow plus current allocation WMZ Total Cumulative	12.023	7	12	14

3.5.18.2 Tidal Rangitikei – Rang 4b

295. The recommended minimum flow for the Tidal Rangitikei Sub-zone is the same as for the Coastal Rangitikei Sub-zone (10.230 m^3/s), because McKelvies is the only relevant flow recorder in the lower catchment.

296. The proposed core allocation limit for this Sub-zone is 20% of the MALF at Rangitikei at McKelvies (16.500 m^3/s).

297. The likelihood of restriction occurring in this Sub-zone is expected to be similar to that of Rang 4a.

3.5.18.3 Porewa – Rang 4c

298. The MALF for this Sub-zone had not been calculated at the time of the original POP Water Allocation Framework was prepared. It has since been calculated to be 0.000 m^3/s as the stream dries up during the summer low flow season. This is due to the nature of the geology in the catchment. The recommended minimum flow specified would only be relevant if water was ever to be allocated from this Sub-zone.

3.5.18.4 Tutaenui – Rang 4d

299. It is not possible to calculate a MALF statistic for the Tutaenui Sub-zone because of the effect of the large storage dam for the Marton water supply in the headwaters.

300. It is recommended that the core allocation limit be set at the current level of consented abstraction (0.077 m^3/s).

3.5.18.5 Catchment cumulative core allocation limit

301. The catchment cumulative core allocation limit indicates the maximum volume of water that should be allocated from the Rangitikei Water Management Zone to the end of Rang 4. The water could be allocated from any Sub-zone in the catchment, providing that none of the individual or cumulative core allocation limits are exceeded.

3.5.18.6 The Wanganui catchment

302. Because of the impact of the Genesis Energy TPD in this Water Management Zone, it is recommended that the default rule (MALF as minimum flow and 10% of MALF as core allocation) should apply. POP Policy 6-16b also allies here.

3.5.19 Upper Whangaehu - Whau 1

303. The Genesis Energy TPD and NZ Energy hydroelectricity takes and diversions affect flows in this Water Management Zone so where possible, flow records have been naturalised to account for this.

304. The recommended core allocation limits for the Sub-zones are based on existing consents, excluding hydroelectricity takes. POP Policy 6-16b applies.

Table 53. Summary table: Recommended minimum flows and core allocation limits for the Upper Whangaehu Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Whau 1a	Upper Whangaehu	SOS-A	10.879	10.879	5c	9.790	8.700	2.175	0.550	Whangaehu at Karioi	Y
Whau 1b	Waitangi	TF (O)	0.526	0.550	6a	0.475	0.470	0.105	0.110	Waitangi at Tangiwai	Y
Whau 1c	Tokiahuru	TF (O)	4.821	4.800	5b	4.340	3.840	0.960	0.480	Tokiahuru at Whangaehu Junction	Y
Whole zone core allocation limit (Whau 1a + Whau 1b + Whau 1c)									0.550		Y

3.5.19.1 Upper Whangaehu – Whau 1a

305. The flow of the Whangaehu River is impacted by the diversion of water for the Genesis Energy Tongariro Power Development (TPD). In order to determine the appropriate minimum flow for this Sub-zone, the MALF statistic needs to be naturalised (the volume of diverted water added back in to the flow record).

306. The simulated natural MALF for the Whangaehu at Karioi (10.879 m^3/s) was used to determine the minimum flow for this Sub-zone (Henderson & Diettrich, 2007; p 182). The MALF is greater than 3.700 m^3/s, so Scenario 5c was applied. The recommended minimum flow is 80% of the naturalised MALF or 8.700 m^3/s.

307. The recommended core allocation limit is 5% of the non-naturalised MALF for the Whangaehu at Karioi. There is no surety information for this site.

3.5.19.2 Waitangi – Whau 1b

308. The previous MALF estimate for the Waitangi at Tangiwai flow monitoring site was 0.526 m^3/s and this was used in the original POP Water Allocation Framework. This MALF estimate has been revised to 0.550 m^3/s .

309. The minimum flow for the Waitangi Sub-zone is recommended to be 0.470 m^3/s. this is 85% of the MALF (0.550 m^3/s), under Scenario 5b.

310. The core allocation limit recommended for the Waitangi Sub-zone is 20% of the MALF at Waitangi at Tangiwai, or 0.110 m^3/s. There is no surety data available for this Sub-zone.

3.5.19.3 Tokiahuru – Whau 1c

311. The previous MALF estimate for the Tokiahuru at Whangaehu Junction flow monitoring site was 4.821 m^3/s and this was used in the original POP Water Allocation Framework. This MALF estimate has been revised to 4.800 m^3/s.

312. Under Scenario 5c, the proposed minimum flow for this Sub-zone is 3.840 m^3/s (80% of the MALF).

313. The proposed core allocation limit for the Tokiahuru Sub-zone is 10% of the MALF, or 0.480 m^3/s. At full allocation, the minimum flow and consequent restrictions could be expected to occur on two days per year on average and on a maximum of 39 days.

Table 54. Surety of supply analysis Tokiahuru at Junction

Tokiahuru at Junction Modelled (Data record: 1 July 1980 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	4.800	17	51	121
Minimum flow (80% of MALF)	3.840	0	0	0
Minimum flow plus 5% of MALF as core allocation	4.080	0	0	0
Minimum flow plus 10% of MALF as core allocation	*4.320*	*2*	*0*	*39*
Minimum flow plus 15% of MALF as core allocation	4.560	6	11	90
Minimum flow plus 20% of MALF as core allocation	4.800	17	51	121
Minimum flow plus 25% of MALF as core allocation	5.040	34	99	139
Minimum flow plus 30% of MALF as core allocation	5.280	53	123	152
Minimum flow plus 35% of MALF as core allocation	5.520	73	143	180
Minimum flow plus current allocation in Sub-zone	4.270	1	0	35
Minimum flow plus current allocation WMZ	4.376	3	1	49
Minimum flow plus current allocation WMZ Total Cumulative	4.376	3	1	49

3.5.19.4 Whole zone core allocation limit

314. The recommended core allocation limit for the Upper Whangaehu Water Management Zone is equal to the core allocation limit recommended for the Whau 1a Sub-zone. No more than 0.550 m^3/s should be allocated from this Water Management Zone.

3.5.20 Middle Whangaehu – Whau 2

Table 55. Summary table: Recommended minimum flows and core allocation limits for the Middle Whangaehu Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Whau 2	Middle Whangaehu	LSC	nil	12.066	5c	MALF	9.650	20% of MALF	0.605	Whangaehu at Aranui	Y
Catchment cumulative core allocation limit (Whau 1 + Whau 2)									0.605		Y

315. When the original version of the POP Water Allocation Framework was completed, there were no flow statistics available for the Middle Whangaehu Sub-zone. During the review of the framework, a non-naturalised MALF at Whangaehu at Aranui was derived (9.350 m^3/s).

316. In order to naturalise this MALF for the effect of the TPD diversion, the difference between the simulated natural MALF for Whangaehu at Karioi, ie. post-diversion, (10.960 m^3/s[9]) and the non-naturalised MALF for the same period (8.244 m^3/s[10]) was calculated, and the difference applied to the non-naturalised MALF for Whangaehu at Aranui. This gives a naturalised MALF for Whangaehu at Aranui of 12.066 m^3/s.

317. Scenario 5c was applied to give recommended minimum flow of 9.650 m^3/s.

318. The proposed core allocation limit is 5% of the naturalised MALF, or 0.605 m^3/s. There is no surety of supply information available for this Sub-zone.

[9] Henderson & Diettrich (2007); p 186
[10] Henderson & Diettrich (2007); p 180

3.5.21 Lower Whangaehu – Whau 3

Table 56. Summary table: Recommended minimum flows and core allocation limits for the Lower Whangaehu Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Whau 3a	Lower Whangaehu	TF (O)	14.710	14.710	5c	13.240	11.770	2.940	1.470	Whangaehu at Kauangaroa	Y
Whau 3b	Upper Makotuku	TF (O)	nil	nil	3	0.100	0.095	0.023	0.029	Makotuku at Below Race Intake	Y
Whau 3c	Lower Makotuku	TF (O)	nil	0.175	6b	MALF	0.165	20% of MALF	0.015	Mangawhero at Pakihi Road	Y
Whau 3d	Upper Mangawhero	TF (O)	nil	1.200	6a	MALF	1.020	20% of MALF	0.240	Makotuku at Raetihi	Y
Whau 3e	Lower Mangawhero	TF (O)	nil	2.830	5b	MALF	2.405	20% of MALF	0.285	Mangawhero at Ore Ore (NIWA)	Y
Whau 3f	Makara	TF (O)	n/a	0.060	3	n/a	0.047	n/a	0.000	Makara at d/s Airstrip	Y
Cumulative core allocation limit (Whau 3b + Whau 3f)									0.029		Y
Cumulative core allocation limit (Whau 3b + Whau 3f + Whau 3c)									0.044		Y
Catchment cumulative core allocation limit (Whau 1 + Whau 2 + Whau 3)									1.470		Y

3.5.21.1 Lower Whangaehu – Whau 3a

319. The simulated natural MALF at Whangaehu at Kauangaroa (14.710 m^3/s) was used to set the recommended minimum flow for this Sub-zone[11]. The MALF is greater than 3.700 m^3/s, so Scenario 5c applies. The proposed minimum flow is 11.770 m^3/s.

320. The proposed core allocation limit for this Sub-zone is 5% of the naturalised MALF, or 1.470 m^3/s.

[11] Henderson & Diettrich (2007); p 194

3.5.21.2 Upper Makotuku – Whau 3b

321. An IFIM survey was completed for the Makotuku River and the Makara Stream in 2007 (Hay, 2007). The recommendations of the study were reviewed by Mr Hay in 2009, in the light of a revised MALF statistic for the Makotuku River (the details of this are set out in his evidence).

322. The minimum flow recommendation for 70% habitat retention (Hay, 2009) for the Makotuku River below the NZ Energy race intake is 0.095 m^3/s.

323. The proposed core allocation limit is the sum of the water allocated from this Sub-zone, ie. 0.029 m^3/s (Raetihi District Council for Raetihi town water supply), excluding the 0.300 m^3/s for NZ Energy's diversion to the Makara Stream for hydroelectric power generation.

324. The NZ Energy consent currently allows the company to divert up to 0.300 m^3/s from the Makotuku Stream to the Makara Stream, via a diversion race, at flows above a minimum flow based on a correlation with the Makotuku at SH49a flow recorder site. This diversion is excluded from the core allocation limit, in line with Policy 6-16b of the POP.

325. The NZ Energy consent also currently allows a further volume of water (up to 0.300 m^3/s) to be taken from the Makara Stream, but the maximum combined abstraction from both Makotuku and Makara is capped at 0.450 m^3/s[12]. As stated above, the recommended core allocation limit excludes the NZ Energy diversions from both the Makotuku and the Makara Streams.

3.5.21.3 Lower Makotuku – Whau 3c

326. No MALF statistic had been calculated for the Lower Makotuku Sub-zone when the original version of the POP Water Allocation Framework was completed. A MALF at the flow recorder Makotuku at Raetihi is now available (Mr Watson's evidence explains the details of this).

327. The MALF at Makotuku at Raetihi is 0.175 m^3/s. Applying Scenario 5a to this MALF gives a recommended minimum flow of 0.165 m^3/s.

[12] A separate Sub-zone has been designated for the Makara Stream – the details of this are explained in Dr Roygard's evidence.

328. The current allocation in the Lower Makotuku Sub-zone itself totals 0.015 m^3/s, excluding the 0.155 m^3/s that NZ Energy is consented to take from the Makaraiti Stream and an unnamed tributary of the Mangaone Stream. This hydroelectricity abstraction is excluded from the core allocation limit, in line with POP Policy 6-16b.

329. The core allocation limit for the Lower Makotuku also needs to include the cumulative allocation from the Sub-zones above – the Upper Makotuku (Whau 3b) and the Makara (Whau 3f) Sub-zones. The cumulative current allocation from these three Sub-zones, excluding hydroelectricity abstractions, comprises a combined total of 0.029 m^3/s in the Upper Makotuku and 0.015 m^3/s from the Lower Makotuku, giving a cumulative current allocation of 0.044 m^3/s.

330. The proposed core allocation limit is set at 0.044 m^3/s, recognising that there is a high volume of water taken from the catchment for hydroelectricity generation and that allocating more water from it is likely to be unsustainable.

3.5.21.4 Upper Mangawhero – Whau 3d

331. When the original version of the framework was completed, there was no MALF statistic calculated for the Whau 3d. The MALF at the Mangawhero at Pakihi Road flow recorder has been calculated as 1.200 m^3/s.

332. The proposed minimum flow for the Upper Mangawhero Sub-zone is 85% of this (Scenario 5b), of 1.020 m^3/s.

333. The core allocation limit for the Upper Mangawhero Sub-zone is recommended as 0.240 m^3/s, which is 20% of the MALF at Mangawhero at Pakihi Road. At full allocation, restrictions could be expected to apply on 21 days per year on average, and for up to 57 days.

Table 57. Surety of supply analysis Mangawhero at Pakihi Bridge

Mangawhero at Pakihi Rd Bridge (Data record: 1 July 1999 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	1.200	16	42	45
Minimum flow (85% of MALF)	1.020	1	1	3
Minimum flow plus 5% of MALF as core allocation	1.080	5	15	16
Minimum flow plus 10% of MALF as core allocation	1.140	10	28	35
Minimum flow plus 15% of MALF as core allocation	1.200	16	42	45
Minimum flow plus 20% of MALF as core allocation	*1.260*	*21*	*55*	*57*
Minimum flow plus 25% of MALF as core allocation	1.320	26	64	69
Minimum flow plus 30% of MALF as core allocation	1.380	35	77	83
Minimum flow plus 35% of MALF as core allocation	1.440	43	86	93
Minimum flow plus current allocation in Sub-zone	1.239	19	51	52
Minimum flow plus current allocation WMZ	1.239	19	51	52
Minimum flow plus current allocation WMZ Total Cumulative	1.239	19	51	52

3.5.21.5 Lower Mangawhero – Whau 3e

334. When the original version of the framework was completed, there was no MALF statistic calculated for the Whau 3e. The MALF at the Mangawhero at Ore Ore flow recorder has been calculated as 2.830 m^3/s.

335. The proposed minimum flow for the Lower Mangawhero Sub-zone is 85% of this (Scenario 5b), or 2.405 m^3/s.

336. The core allocation limit for the Lower Mangawhero Sub-zone is recommended as 0.285 m^3/s, which is 10% of the MALF at Mangawhero at Ore Ore. At full allocation, restrictions could be expected to apply on 14 days per year on average, and for up to 122 days.

Table 58. Surety of supply analysis Mangawhero at Ore Ore

Mangawhero at Ore Ore (Data record: 1 July 1962 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	2.830	19	52	129
Minimum flow (85% of MALF)	2.406	6	14	107
Minimum flow plus 5% of MALF as core allocation	2.547	10	30	115
Minimum flow plus 10% of MALF as core allocation	*2.689*	*14*	*42*	*122*
Minimum flow plus 15% of MALF as core allocation	2.830	19	52	129
Minimum flow plus 20% of MALF as core allocation	2.972	23	61	134
Minimum flow plus 25% of MALF as core allocation	3.113	28	67	137
Minimum flow plus 30% of MALF as core allocation	3.255	33	74	140
Minimum flow plus 35% of MALF as core allocation	3.396	38	82	144
Minimum flow plus current allocation in Sub-zone	2.406	6	14	107
Minimum flow plus current allocation WMZ	2.685	14	42	122
Minimum flow plus current allocation WMZ Total Cumulative	2.685	14	42	122

3.5.21.6 Makara – Whau 3f

337. The Makara (Whau 3f) Sub-zone is new since the completion of the original version of the framework. The details of this are set out in the evidence of Dr Roygard.

338. The recommended minimum flow for the Makara Stream is based on the IFIM study results from the study completed in 2007 (Hay, 2007) and reviewed by Mr Hay in 2009 (Hay, 2009) using a MALF of 0.060 m^3/s at Makara above NZ Energy's Weir gauging site. The recommended minimum flow is 0.047 m^3/s.

339. The core allocation limit for the Makara Sub-zone is recommended to be set at the current level of allocation (0.000 m^3/s), because of the amount of water abstracted from the catchment for hydroelectricity generation.

3.5.22 Coastal Whangaehu – Whau 4

Table 59. Summary table: Recommended minimum flows and core allocation limits for the Coastal Whangaehu Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Whau 4	Coastal Whangaehu	LSC	14.710	14.710	5c	MALF	11.770	20% of MALF	1.470	Whangaehu at Kauangaroa	Y
Catchment cumulative core allocation limit (Whau 1 + Whau 2 + Whau 3 + Whau 4)									1.470		Y

340. The recommended minimum flow for the Coastal Whangaehu Sub-zone is the same as for Whau 3a, because the Whangaehu at Kaungaroa flow recorder is the most appropriate one to use for this Sub-zone.

341. The proposed core allocation limit is 5% of the MALF at Whangaehu at Kaungaroa, 0.735 m^3/s.

342. There is no surety of supply information available for this Sub-zone.

3.5.23 Turakina – Tura 1

Table 60. Summary table: Recommended minimum flows and core allocation limits for the Turkina Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Tura 1a	Upper Turakina	SOS-A	0.382	0.324	5b	0.345	0.340	0.075	0.035	Turakina at Otairi Road	Y
Tura 1b	Lower Turakina	LSC	0.925	0.950	5b	0.830	0.805	0.185	0.145	Turakina at O'Neills Bridge	Y
Tura 1c	Ratana	LSC	nil	nil	6g	MALF	MALF	20% of MALF	10% of MALF	n/a	?
Whole zone core allocation limit (Tura 1a + Tura 1b + Tura 1c)									0.145		Y

3.5.23.1 Upper Turakina – Tura 1a

343. The MALF statistic for the Turakina at Otairi Road has been revised from 0.382 m^3/s to 0.360 m^3/s since the original version of the framework was completed. The recommended minimum flow for this Sub-zone is 95% of the revised MALF, or 0.340 m^3/s.

344. It is proposed that the core allocation limit be set at 10% of the MALF, which is 0.035 m^3/s.

345. At full allocation, the minimum flow would be likely to occur on 16 days per year on average and for up to 73 days, but in 90% of years, the maximum number of days restriction is likely to be 38.

Table 61. Surety of supply analysis Turakina at Otairi

Turakina at Otairi (Data record: 1 July 1991 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.360	12	33	68
Minimum flow (95% of MALF)	0.342	10	26	61
Minimum flow plus 5% of MALF as core allocation	0.360	12	33	68
Minimum flow plus 10% of MALF as core allocation	*0.378*	*16*	*38*	*73*
Minimum flow plus 15% of MALF as core allocation	0.396	21	49	79
Minimum flow plus 20% of MALF as core allocation	0.414	25	58	84
Minimum flow plus 25% of MALF as core allocation	0.432	29	65	88
Minimum flow plus 30% of MALF as core allocation	0.450	32	72	91
Minimum flow plus 35% of MALF as core allocation	0.468	37	80	97
Minimum flow plus current allocation in Sub-zone	0.342	10	26	61
Minimum flow plus current allocation WMZ	0.404	23	53	82
Minimum flow plus current allocation WMZ Total Cumulative	0.404	23	53	82
7 Day MALF (NES)	0.422	27	62	85
7 Day MALF minimum flow (NES)	0.380	16	38	74
7 Day MALF minimum flow + core allocation (NES)	0.506	44	92	108

3.5.23.2 Lower Turakina – Tura 1b

346. The recommended minimum flow for the Lower Turakina is 85% of the MALF at Turakina at O'Neill's Bridge, or 0.805 m^3/s.

347. The proposed core allocation limit is 15% of the MALF, which is 0.145 m^3/s.

348. There is no surety of supply information available for this catchment.

3.5.23.2 Ratana – Tura 1c

349. No flow statistics are able to be calculated for the Ratana Sub-zone, so it is recommended that it remain under the "default" methodology.

3.5.23.3 Whole zone core allocation limit

350. The whole zone core allocation limit for Tura 1 recommends the total volume of water that should be abstracted from this Water Management Zone. The water can be taken from any Sub-zone up to the individual limit of that Sub-zone, but the cumulative allocation in the catchment should not exceed the whole zone core allocation limit of 0.145 m^3/s.

3.5.24 Ohau – Ohau 1

Table 62. Summary table: Recommended minimum flows and core allocation limits for the Ohau Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Ohau 1a	Upper Ohau	TF (O)	1.042	1.042	2	0.820	0.820	0.280	0.260	Ohau at Rongomatane	Y
Ohau 1b	Lower Ohau	TF (O)	1.042	1.042	2	0.820	0.820	0.280	0.260	Ohau at Rongomatane	Y
Whole zone core allocation limit (Ohau 1a + Ohau 1b)									0.260		Y

351. The Ohau Water Resource Assessment (Horizons, 2003) recommended a minimum flow for the Ohau River, and it is proposed that that minimum flow (ie. 0.820 m^3/s at Ohau at Rongomatane) be carried through to POP Water Allocation Framework for both the Upper and Lower Ohau Sub-zones.

352. The recommended core allocation limit for Ohau catchment is 0.260 m^3/s. This is 25% of the MALF at Ohau at Rongomatane. The allocation can be taken from either Sub-zone, but the total abstracted from both Sub-zones should not exceed 0.260 m^3/s (cumulative allocation limit).

353. At full allocation, restrictions are likely to apply on 13 days on average and on up to 72 days.

Table 63. Surety of supply analysis Ohau at Rongomatane

Ohau at Rongomatane (Data record: 1 July 1979 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	1.042	12	36	68
Minimum flow IFIM	0.820	4	9	51
Minimum flow plus 5% of MALF as core allocation	0.872	5	13	57
Minimum flow plus 10% of MALF as core allocation	0.924	7	20	61
Minimum flow plus 15% of MALF as core allocation	0.976	9	28	63
Minimum flow plus 20% of MALF as core allocation	1.028	11	35	67
Minimum flow plus 25% of MALF as core allocation	*1.081*	*13*	*40*	*72*
Minimum flow plus 30% of MALF as core allocation	1.133	16	48	80
Minimum flow plus 35% of MALF as core allocation	1.185	19	53	86
Minimum flow plus current allocation in Sub-zone	1.064	13	38	70
Minimum flow plus current allocation WMZ	1.064	13	38	70
Minimum flow plus current allocation WMZ Total Cumulative	1.064	13	38	70

3.5.24.1 Whole zone core allocation limit

354. The whole zone core allocation limit for Ohau 1 recommends the total volume of water that should be abstracted from this Water Management Zone. The water can be taken from any Sub-zone up to the individual limit of that Sub-zone, but the cumulative allocation in the catchment should not exceed the whole zone core allocation limit of 0.260 m^3/s.

3.5.25 Owahanga – Owha 1

Table 64. Summary table: Recommended minimum flows and core allocation limits for the Owahanga Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Owha 1	Owahanga	SOS-A	0.039	0.030	5a	0.040	0.030	0.010	0.005	Owahanga at Branscombe Bridge	Y

355. The revised MALF at Owahanga at Branscombe Bridge is 0.030 m^3/s. The proposed minimum flow for this Sub-zone is 95% of this. However, after rounding to the nearest 0.005 m^3/s, the recommended minimum flow is the same as the MALF.

356. The proposed core allocation limit is 20% of the MALF, or 0.005 m^3/s.

357. No surety analysis is available for this Water Management Zone.

3.5.26 East Coast – East 1

Table 65. Summary table: Recommended minimum flows and core allocation limits for the Owahanga Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
East 1	East Coast	SOS-A	nil	nil	6g	MALF	MALF	20% of MALF	10% of MALF	n/a	?

358. No flow statistics are able to be calculated for the East Coast Water Management Zone, so it is recommended that it remain under the "default" methodology.

3.5.27 Akitio – Akit 1

Table 66. Summary table: Recommended minimum flows and core allocation limits for the Akitio Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
Akit 1a	Upper Akitio	SOS-A	nil	nil	6c	MALF	0.045	20% of MALF	0.010	Akitio at Weber	Y
Akit 1b	Lower Akitio	SOS-A	nil	nil	6c	MALF	0.145	20% of MALF	0.030	Akitio at Mouth	Y
Akit 1c	Waihi	SOS-A	nil	nil	6c	MALF	0.050	20% of MALF	0.015	Waihi	Y
Whole zone cumulative (Akit 1a + Akit 1b + Akit 1c)									0.030		Y

3.5.27.1 Upper Akitio – Akit 1a

359. The recommended minimum flow for the Akit 1a Sub-zone is 95% of the MALF at Akitio at Weber, or 0.045 m^3/s. This MALF statistic was not available when the original version of this framework was completed, so the recommended minimum flow replaces the "default" originally stated in the framework.

360. The proposed core allocation limit for the Sub-zone is 25% of the MALF, ie. 0.010 m^3/s.

361. There is no surety analysis available for this catchment.

3.5.27.2 Lower Akitio – Akit 1b

362. The recommended minimum flow for the Akit 1b Sub-zone is 95% of the MALF at Akitio at Mouth (0.150 m^3/s), or 0.145 m^3/s. The MALF statistic for this Sub-zone was not available when the original version of this framework was completed, so the recommended minimum flow replaces the "default" originally stated in the framework.

363. The proposed core allocation limit for the Sub-zone is 20% of the MALF, or 0.030 m^3/s.

364. There is no surety analysis available for this catchment.

3.5.27.3 Waihi – Akit 1c

365. Horizons has a continuous water level/flow monitoring site on the Waihi Stream at SH52, but the data record from this site is not yet long enough to be used to calculate annual statistics for the stream.

366. Mitchell (1998) is the most comprehensive study on the area available to Horizons and includes specific yield maps and tables for the area at MALF.

367. Figure 8 is taken from Mitchell (1998). The red square on the map indicates the location of the Waihi Stream. This area is enlarged in Figure 9.

368. Mitchell (1998) describes the Akitio catchment as having very little sustained base flow with a large order of magnitude difference between low flows and flood flows because of lithology and climate. He also states that the greatest flow losses in the Akitio catchment occur in and around the Waihi Falls (see Figure 8). This is a result of a number of major

faults running directly through this area, many of which are active (Mitchell, 1998). The "lost" water reappears downstream between the Falls and the confluence with the Akitio (SH52).

369. Mitchell (1998) used actual gauging data from across the catchment to calculate that the MALF specific yield to Waihi Falls is 0.17 L/s/km^2. The catchment area to Waihi Falls is 122 km^2, so 122 km^2 * 0.17 L/s/ km^2 = 20.74 L/s. This is the estimated MALF of the Waihi Stream at Waihi Falls.

370. The estimated MALF for the Waihi Stream at SH52 (above Akitio River confluence), using the same method, is 49.78 L/s (131 km^2 * 0.38 L/s/km^2). This shows that the stream flows are generally much greater at the bottom end of the catchment than at Waihi Falls (ie. the MALF at SH52 is 2.4 times that at Waihi Falls).

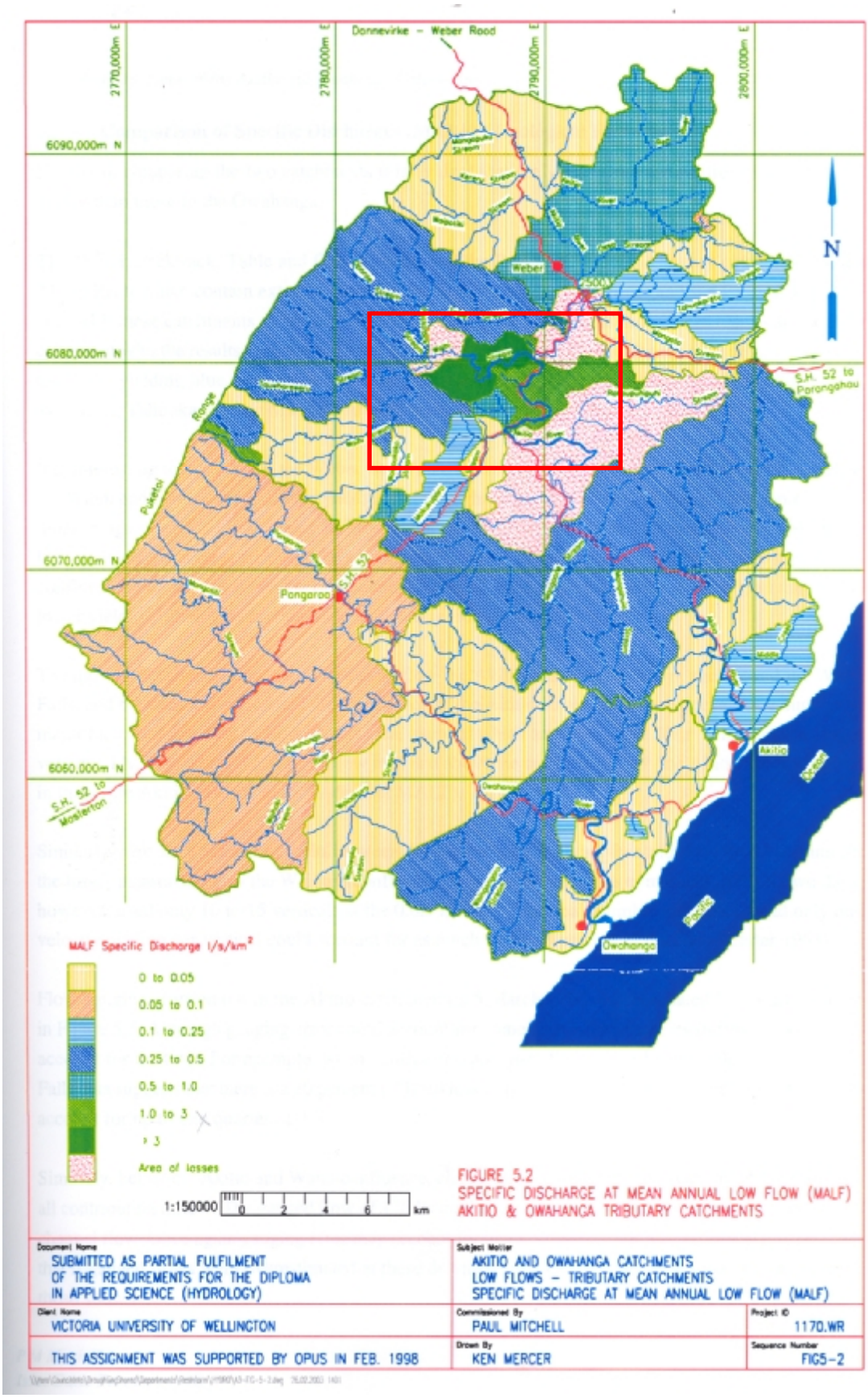


Figure 8. Specific discharge map for the Akitio catchment (from Mitchell,1998)

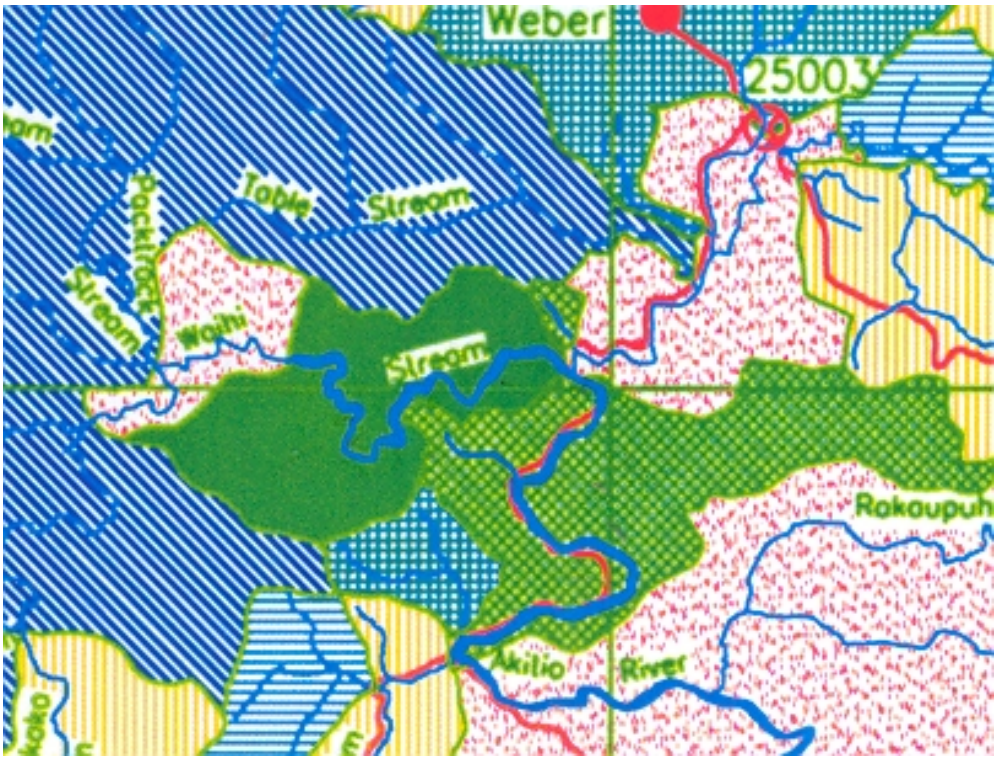


Figure 9. Enlargement of specific discharge map for the Waihi catchment

3.5.27.4 Whole zone core allocation limit

371. The whole zone core allocation limit for Akit 1 recommends the total volume of water that should be abstracted from this Water Management Zone. The water can be taken from any Sub-zone up to the individual limit of that Sub-zone, but the cumulative allocation in the catchment should not exceed the whole zone core allocation limit of 0.030 m^3/s.

3.5.28 Northern Coastal – West 1

372. Currently, there is insufficient data available to enable a minimum flow or core allocation limit to be set for this Water Management Zone.

3.5.29 Kai Iwi – West 2

Table 67. Summary table: Recommended minimum flows and core allocation limits for the Owahanga Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site
West 2	Kai Iwi	LSC	0.525	0.525	5b	0.470	0.445	0.105	0.055	Kai Iwi at Handley Road

373. The recommended minimum flow for this Sub-zone is 0.445 m^3/s. This is 85% of the MALF, because the MALF is between 0.460 and 3.700 m^3/s.

374. The recommended core allocation limit is 10% of the MALF, or 0.055 m^3/s. There is no surety information available for this Water Management Zone.

3.5.30 Mowhanau – West 3

375. Currently, there is insufficient data available to enable a minimum flow or core allocation limit to be set for this Water Management Zone.

3.5.31 Kaitoke Lakes – West 4

376. POP Rule 15-5 (abstraction from Lakes and Wetlands) applies in this Sub-zone.

3.5.32 Southern Wanganui Lakes – West 5

377. POP Rule 15-5 (abstraction from Lakes and Wetlands) applies in this Sub-zone.

3.5.33 Northern Manawatu Lakes – West 6

378. POP Rule 15-5 (abstraction from Lakes and Wetlands) applies in this Sub-zone.

3.5.34 Waitarere – West 7

379. Currently, there is insufficient data available to enable a minimum flow or core allocation limit to be set for this Water Management Zone.

3.5.35 Lake Papaitonga – West 8

380. POP Rule 15-5 (abstraction from Lakes and Wetlands) applies in this Sub-zone.

3.5.36 Waikawa – West 9

Table 68. Summary table: Recommended minimum flows and core allocation limits for the Waikawa Water Management Zone

Sub-zone code	Sub-zone name	Critical value	2007 MALF	Revised MALF	Min. flow method	Notified min. flow (m^3/s)	Rec'd min. flow (m^3/s)	Notified core alloc. limit (m^3/s)	Rec'd core alloc. limit (m^3/s)	Flow monitoring site	Current alloc. fits within rec'd core? Y/N
West 9a	Waikawa	SOS-A	nil	0.230	5a	MALF	0.220	20% of MALF	0.070	Waikawa at North Manakau Road	Y
West 9b	Manakau	SOS-A	n/a	0.040	5a	n/a	0.040	n/a	0.005	Manakau at S.H.1 Bridge	Y
Whole zone cumulative (West 9a + West 9b)									0.070		Y

3.5.36.1 Waikawa – West 9a

381. When the notified version of the Water Allocation Framework was completed, there was no MALF estimate available for the Waikawa Sub-zone. The MALF has since been determined to be 0.230 m^3/s. The minimum flow is recommended as 0.220 m^3/s (95% of MALF).

382. The proposed core allocation limit is 0.070 m^3/s, or 30% of MALF. Under the recommended minimum flow and core allocation limit, at full allocation, the minimum flow could be expected to occur on eight days on average and on up to 16 days per year (

Table 69).

Table 69. Surety of supply analysis Waikawa at North Manakau Road

Waikawa at North Manakau Road (Data record: 1 July 2006 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.230	2	3	3
Minimum flow (95% of MALF)	0.219	1	1	2
Minimum flow plus 5% of MALF as core allocation	0.230	2	3	3
Minimum flow plus 10% of MALF as core allocation	0.242	3	5	6
Minimum flow plus 15% of MALF as core allocation	0.253	4	7	7
Minimum flow plus 20% of MALF as core allocation	0.265	5	10	11
Minimum flow plus 25% of MALF as core allocation	0.276	6	12	13
Minimum flow plus 30% of MALF as core allocation	*0.288*	*8*	*14*	*16*
Minimum flow plus 35% of MALF as core allocation	0.299	9	16	18
Minimum flow plus current allocation in Sub-zone	0.219	1	1	2
Minimum flow plus current allocation WMZ	0.219	1	1	2
Minimum flow plus current allocation WMZ Total Cumulative	0.219	1	1	2

3.5.36.2 Manakau – West 9b

383. Manakau – West 9b is a new Sub-zone that has been added since the notification of the original Water Allocation Framework. The details of this are explained in Dr Roygard's evidence.

384. The proposed minimum flow for this Sub-zone is 95% of the MALF at Manakau at S.H.1 Bridge (0.040 m^3/s). This is calculated as 0.038 m^3/s, but when rounded to the nearest 0.005 m^3/s, it becomes 0.040 m^3/s.

385. The recommended core allocation limit is 10% of the MALF, or 0.005 m^3/s. Under the proposed limits, at full allocation, the minimum flow is expected to occur on eight days on average and on a maximum of 71 days per year; however, in 90% of years, the maximum occurrence is likely to be 23 days (

Table 70).

Table 70. Surety of supply analysis Manakau at S.H.1 Bridge

Manakau All (Data record: 1 July 1979 – 1 July 2008)	Flow (m^3/s)	Average no. of days restriction	90th percentile no. of days restriction	Maximum no. of days restriction
MALF	0.040	7	20	67
Minimum flow (95% of MALF)	0.038	6	15	62
Minimum flow plus 5% of MALF as core allocation	0.040	7	20	67
Minimum flow plus 10% of MALF as core allocation	*0.042*	*8*	*23*	*71*
Minimum flow plus 15% of MALF as core allocation	0.044	10	29	76
Minimum flow plus 20% of MALF as core allocation	0.046	11	33	79
Minimum flow plus 25% of MALF as core allocation	0.048	12	38	82
Minimum flow plus 30% of MALF as core allocation	0.050	13	42	87
Minimum flow plus 35% of MALF as core allocation	0.052	14	45	94
Minimum flow plus current allocation in Sub-zone	0.038	6	15	62
Minimum flow plus current allocation WMZ	0.038	6	15	62
Minimum flow plus current allocation WMZ Total Cumulative	0.038	6	15	62

3.5.36.3 Whole zone core allocation limit

386. The whole zone core allocation limit for West 9 recommends the total volume of water that should be abstracted from this Water Management Zone. The water can be taken from any Sub-zone up to the individual limit of that Sub-zone, but the cumulative allocation in the catchment should not exceed the whole zone core allocation limit of 0.070 m^3/s.

3.5.37 Lake Horowhenua – Hoki 1

387. POP Rule 15-5 (abstraction from Lakes and Wetlands) applies in this Sub-zone

3.6 Recommendation

388. **I recommend that the Hearing Panel adopt the minimum flows and core allocation limits that are set out in the revised Schedule B table into the water allocation policy for the Proposed One Plan.**

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GLOSSARY OF TERMS

Minimum flow	The flow, set to protect instream values, at which abstraction may be limited or required to cease in a defined water body, catchment, Water Management Zone, or Water Management Sub-zone.
Core allocation limit	The volume of water that is available for allocation to out-of-stream users, between the minimum flow set to protect instream values and the median flow, from a defined water body, catchment, Water Management Zone, or Sub-zone.
Management flow	The flow that is equal to the minimum flow plus the core allocation limit for a river. The management flow is used to determine the likely frequency of occurrence of a minimum flow, assuming full allocation (surety of supply analysis).
Supplementary allocation	The volume of water that is available for allocation above median flow, from a defined water body, catchment, Water Management Zone, or Sub-zone.
Surety analysis	The use of existing hydrological record to determine the likely frequency of occurrence of a particular flow in a river (eg. the management flow).
Instream Flow Incremental Methodology (IFIM)	A holistic method used to determine an appropriate flow regime by considering the effects of flow changes on instream values (Jowett & Mosley, 2004).
Mean Annual Low Flow (MALF)	The mean annual low flow (MALF) is the average of the lowest flow measured in each year of hydrological record. The MALF is a moving mean, which can be sampled over a range of averaging intervals (eg. one day, seven days or one month). In this report, MALF is the one-day mean annual low flow, unless stated otherwise (Henderson & Diettrich, 2007).

APPENDIX 1 – SUMMARY OF PROPOSED CORE ALLOCATION LIMITS WITH CURRENT ALLOCATION

This table sets out the current allocation in each Sub-zone and the cumulative allocation within each management zone and catchment against the proposed core allocation limits. It shows that there are four sub-zones that are over-allocated at the current level of allocation (Mangatewainui, Upper Tamaki, Raparapawai and Turitea) and one which is fully allocated (Upper Makotuku). The cumulative current allocation in the Tamaki catchment (upper Tamaki and Lower Tamaki) exceeds the cumulative allocation limits and the Makotuku/Makara catchment is fully allocated when compared to the cumulative allocation limit for that catchment.

WMZ	Sub-zone	Sub-zone name	Revised core allocation limit	Current allocation in sub-zone only	Current allocation in sub-zone only	Cumulative current allocation within WMZ	Cumulative current allocation within WMZ	Available allocation cumulative	Available allocation	Status
			m^3/s	m^3/day	m^3/s	m^3/day	m^3/s		m^3/s	
Mana 1	1a	Upper Manawatu	*0.205*	3429	*0.040*	3429	*0.040*	*0.165*	*0.165*	okay
	1b	Mangatewainui	*0.065*	7314	*0.085*	7314	*0.085*	*-0.020*	*-0.020*	over allocated
	1c	Mangatoro	*0.120*	1300	*0.015*	1300	*0.015*	*0.105*	*0.105*	okay
Whole zone cumulative cumulative Mana 1a + Mana 1b + Mana 1c			*0.205*	12043	*0.139*	12043	*0.139*	*0.066*	*0.066*	okay
Mana 2	Mana 2a	Weber-Tamaki	*0.250*	5533	*0.064*	5533	*0.064*	*0.186*	*0.186*	okay
	Mana 2b	Mangatera	*0.045*	743	*0.009*	743	*0.009*	*0.036*	*0.036*	okay
Catchment cumulative Mana 1 + Mana 2			*0.250*	18319	*0.212*	*18319*	*0.212*	*0.038*	*0.038*	okay
Mana 3	Mana 3	Upper Tamaki	*0.080*	7085	*0.082*	7085	*0.082*	*-0.002*	*-0.002*	over allocated
Mana 4	Mana 4	Upper Kumeti	*0.010*	0	*0.000*	0	*0.000*	*0.010*	*0.010*	okay
Mana 5	Mana 5a	Tamaki-Hopelands	*0.970*	34383	*0.398*	34383	*0.398*	*0.572*	*0.572*	okay
	Mana 5b	Lower Tamaki	*0.140*	5270	*0.061*	12355	*0.143*	*-0.003*	*0.079*	okay
Cumulative Mana 3 + Mana 5b			*0.140*	12355	*0.143*	12355	*0.143*	*-0.003*	*-0.003*	over allocated
	Mana 5c	Lower Kumeti	*0.060*	3041	*0.035*	3041	*0.035*	*0.025*	*0.025*	okay
Cumulative Mana 4 + Mana 5c			*0.060*	3041	*0.035*	3041	*0.035*	*0.025*	*0.025*	okay

WMZ	Sub-zone	Sub-zone name	Revised core allocation limit	Current allocation in sub-zone only	Current allocation in sub-zone only	Cumulative current allocation within WMZ	Cumulative current allocation within WMZ	Available allocation cumulative	Available allocation	Status
			m^3/s	m^3/day	m^3/s	m^3/day	m^3/s		m^3/s	
	Mana 5d	Oruakeretaki	*0.090*	7740	*0.090*	7740	*0.090*	*0.000*	*0.000*	okay
	Mana 5e	Raparapawai	*0.015*	6096	*0.071*	6096	*0.071*	*-0.056*	*-0.056*	over allocated
Catchment cumulative Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5			*0.970*	81934	*0.948*	81934	*0.948*	*0.022*	*0.022*	okay
Mana 6	Mana 6	Hopelands-Tiraumea	*1.050*	6366	*0.074*	6366	*0.074*	*0.976*	*0.976*	okay
Catchment cumulative Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6			*1.050*	88300	*1.022*	88300	*1.022*	*0.028*	*0.028*	okay
Mana 7	Mana 7a	Upper Tiraumea	*0.040*	2926	*0.034*	2926	*0.034*	*0.006*	*0.006*	okay
	Mana 7b	Lower Tiraumea	*0.270*	15574	*0.180*	18500	*0.214*	*0.056*	*0.090*	okay
	Mana 7c	Mangaone River	*0.020*	100	*0.001*	100	*0.001*	*0.019*	*0.019*	okay
	Mana 7d	Makuri	*0.100*	0	*0.000*	0	*0.000*	*0.100*	*0.100*	okay
Cumulative Mana 7a + Mana 7c + Mana 7d			*0.100*	3026	*0.035*	3026	*0.035*	*0.065*	*0.065*	okay
	Mana 7e	Mangaramarama	*0.025*	2070	*0.024*	2070	*0.024*	*0.001*	*0.001*	okay
Whole zone cumulative Mana 7a + Mana 7b + Mana 7c + Mana 7d + Mana 7e			*0.270*	20670	*0.239*	20670	*0.239*	*0.031*	*0.031*	okay
Mana 8	Mana 8a	Upper Mangatainoka	*0.020*	0	*0.000*	0	*0.000*	*0.020*	*0.020*	okay
	Mana 8b	Middle Mangatainoka	*0.060*	3386	*0.039*	3386	*0.039*	*0.021*	*0.021*	okay
	Mana 8c	Lower Mangatainoka	*0.305*	20741	*0.240*	20741	*0.240*	*0.065*	*0.065*	okay
	Mana 8d	Makakahi	*0.015*	1061	*0.012*	1061	*0.012*	*0.003*	*0.003*	okay
Cumulative Mana 8a + Mana 8b + Mana 8d			*0.060*	4447	*0.051*	4447	*0.051*	*0.009*	*0.009*	okay
Whole zone cumulative Mana 8a + Mana 8b + Mana 8c + Mana 8d			*0.305*	25188	*0.292*	25188	*0.292*	*0.013*	*0.013*	okay
Cumulative Mana 7 + Mana 8			*0.575*	45858	*0.531*	45858	*0.531*	*0.044*	*0.044*	okay

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			m^3/s	m^3/day	m^3/s	m^3/day	m^3/s		m^3/s	
Mana 9	Mana 9a	Upper Gorge	*2.295*	8701	*0.101*	8701	*0.101*	*2.194*	*2.194*	okay
	Mana 9b	Mangapapa	*0.015*	1728	*0.015*	1728	*0.015*	*0.000*	*0.000*	okay
	Mana 9c	Manga-atua	*0.005*	42	*0.000*	42	*0.000*	*0.005*	*0.005*	okay
	Mana 9d	Upper Mangahao	*0.085*	90	*0.001*	90	*0.001*	*0.084*	*0.084*	okay
	Mana 9e	Lower Mangahao	*0.085*	150	*0.002*	240	*0.003*	*0.082*	*0.083*	okay
Cumulative Mana 9d + Mana 9e			*0.085*	240	*0.003*	240	*0.003*	*0.082*	*0.082*	okay
Whole zone cumulative Mana 9a + Mana 9b + Mana 9c + Mana 9d + Mana 9e			*2.295*	10711	*0.124*	10711	*0.124*	*2.171*	*2.171*	okay
Catchment cumulative Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9			*2.295*	144869	*1.677*	*144869*	*1.677*	*0.618*	*0.618*	okay
Mana 10	Mana 10a	Middle Manawatu	*3.060*	41488	*0.480*	41488	*0.480*	*2.580*	*2.580*	okay
	Mana 10b	Upper Pohangina	*0.115*	168	*0.002*	168	*0.002*	*0.113*	*0.113*	okay
	Mana 10c	Middle Pohangina	*0.455*	3660	*0.042*	3828	*0.044*	*0.411*	*0.413*	okay
Cumulative Mana 10b + Mana 10c			*0.455*	3828	*0.044*	3828	*0.044*	*0.411*	*0.411*	okay
	Mana 10d	Lower Pohangina	*0.455*	8207	*0.095*	12035	*0.139*	*0.316*	*0.360*	okay
Cumulative Mana 10b + Mana 10c + Mana 10d			*0.455*	12035	*0.139*	12035	*0.139*	*0.316*	*0.316*	okay
	Mana 10e	Aokautere	*0.005*	0	*0.000*	0	*0.000*	*0.005*	*0.005*	okay
Whole zone cumulative Mana 10a + Mana 10b + Mana 10c + Mana 10d + Mana 10e			*3.060*	53523	*0.619*	53523	*0.619*	*2.441*	*2.441*	okay
Catchment cumulative Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 10			*3.060*	198392	*2.296*	*198392*	*2.296*	*0.764*	*0.764*	okay

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			m³/s	m³/day	m³/s	m³/day	m³/s		m³/s	
Mana 11	Mana 11a	Lower Manawatu	*3.890*	16300	*0.189*	16300	*0.189*	*3.701*	*3.701*	okay
	Mana 11b	Turitea	*0.428*	37000	*0.428*	*37000*	*0.428*	*0.000*	*0.000*	fully allocated
	Mana 11c	Kahuterawa	*0.010*	354	*0.004*	354	*0.004*	*0.006*	*0.006*	okay
	Mana 11d	Upper Mangaone	*0.005*	0	*0.000*	0	*0.000*	*0.005*	*0.005*	okay
	Mana 11e	Lower Mangaone	*0.010*	0	*0.000*	0	*0.000*	*0.010*	*0.010*	okay
Cumulative Mana 11d + Mana 11e			*0.015*	0	*0.000*	0	*0.000*	*0.015*	*0.015*	okay
	Mana 11f	Main Drain	*10% of MALF*	0	*0.000*	0	*0.000*	*?*	*?*	*?*
Whole zone cumulative Mana 11a + Mana 11b + Mana 11c + Mana 11d + Mana 11e + Mana 11f			*3.890*	53654	*0.621*	53654	*0.621*	*3.269*	*3.269*	okay
Catchment cumulative Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 10 + Mana 11			*3.890*	252046	*2.917*	*252046*	*2.917*	*0.973*	*0.973*	okay
Mana 12	Mana 12a	Upper Oroua	*0.395*	25924	*0.300*	25924	*0.300*	*0.095*	*0.095*	okay
	Mana 12b	Middle Oroua	*0.405*	6819	*0.079*	32743	*0.379*	*0.026*	*0.326*	okay
	Mana 12c	Lower Oroua	*0.430*	690	*0.008*	33433	*0.387*	*0.043*	*0.422*	okay
Cumulative Mana 12a + Mana 12b + Mana 12c			*0.430*	33433	*0.387*	33433	*0.387*	*0.043*	*0.043*	okay
	Mana 12d	Kiwitea	*0.015*	768	*0.009*	768	*0.009*	*0.006*	*0.006*	okay
	Mana 12e	Makino	*0.015*	1259	*0.015*	1259	*0.015*	*0.000*	*0.000*	okay
Whole zone cumulative Mana 12a + Mana 12b + Mana 12c + Mana 12d + Mana 12e			*0.430*	35460	*0.410*	35460	*0.410*	*0.020*	*0.020*	okay
Catchment cumulative Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 10 + Mana 11 + Mana 12			*4.320*	287506	*3.328*	*287506*	*3.328*	*0.992*	*0.992*	okay

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Mana 13	Mana 13a	Coastal Manawatu	*6.930*	42174	*0.488*	42174	*0.488*	*6.442*	*6.442*	okay
	Mana 13b	Upper Tokomaru	*0.015*	0	*0.000*	0	*0.000*	*0.015*	*0.015*	okay
	Mana 13c	Lower Tokomaru	*0.170*	8624	*0.100*	8624	*0.100*	*0.070*	*0.070*	okay
Cumulative Mana 13b + Mana 13c			*0.170*	8624	*0.100*	8624	*0.100*	*0.070*	*0.070*	okay
	Mana 13d	Mangaore	*10% of MALF*	3036	*0.035*	3036	*0.035*	*?*	*?*	
	Mana 13e	Koputaroa	*0.005*	0	*0.000*	0	*0.000*	*0.005*	*0.005*	okay
	Mana 13f	Foxton Loop	*Rule 15-5*	0	*0.000*	0	*0.000*	*?*	*?*	
Whole zone cumulative Mana 13a + Mana 13b + Mana 13c + Mana 13d + Mana 13e + Mana 13f			*6.930*	62458	*0.723*	62458	*0.723*	*6.207*	*6.207*	okay
Catchment cumulative Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 10 + Mana 11 + Mana 12 + Mana 13			*6.930*	349964	*4.051*	*349964*	*4.051*	*2.879*	*2.879*	okay
Rang 1	Rang 1a	Upper Rangitikei	*0.000*	0	*0.000*	0	*0.000*	*0.000*	*0.000*	okay
Rang 2	Rang 2a	Middle Rangitikei	*0.250*	0	*0.000*	0	*0.000*	*0.250*	*0.250*	okay
	Rang 2b	Pukeokahu-Mangaweka	*0.610*	10794	*0.125*	10794	*0.125*	*0.485*	*0.485*	okay
Cumulative Rang 2a + Rang 2b			*0.610*	10794	*0.125*	10794	*0.125*	*0.485*	*0.485*	okay
	Rang 2c	Upper Moawhango	*0.000*	0	*0.000*	0	*0.000*	*0.000*	*0.000*	okay
	Rang 2d	Middle Moawhango	*0.000*	0	*0.000*	0	*0.000*	*0.000*	*0.000*	okay
	Rang 2e	Lower Moawhango	*0.000*	0	*0.000*	0	*0.000*	*0.000*	*0.000*	okay
	Rang 2f	Upper Hautapu	*0.115*	8395	*0.097*	8395	*0.097*	*0.018*	*0.018*	okay
	Rang 2g	Lower Hautapu	*0.150*	1800	*0.021*	10195	*0.118*	*0.032*	*0.129*	okay
Cumulative Rang 2f + Rang 2g			*0.150*	10195	*0.118*	10195	*0.118*	*0.032*	*0.032*	okay

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			m^3/s	m^3/day	m^3/s	m^3/day	m^3/s		m^3/s	
Whole zone cumulative Rang 2a + Rang 2b + Rang 2c + Rang 2d + Rang 2e + Rang 2f + Rang 2g			*0.150*	10195	*0.118*	10195	*0.118*	*0.032*	*0.032*	okay
Catchment cumulative Rang 1 + Rang 2			*0.610*	10794	*0.125*	10794	*0.125*	*0.485*	*0.485*	okay
Rang 3	Rang 3a	Lower Rangitikei	*1.640*	47096	*0.545*	47096	*0.545*	*1.095*	*1.095*	okay
	Rang 3b	Makohine	*0.010*	0	*0.000*	0	*0.000*	*0.010*	*0.010*	okay
Whole zone cumulative Rang 3a + Rang 3b			*1.640*	47096	*0.545*	47096	*0.545*	*1.095*	*1.095*	okay
Catchment cumulative Rang 1 + Rang 2 + Rang 3			*1.640*	57890	*0.670*	57890	*0.670*	*0.970*	*0.970*	okay
Rang 4	Rang 4a	Coastal Rangitikei	*2.475*	79909	*0.925*	79909	*0.925*	*1.550*	*1.550*	okay
	Rang 4b	Tidal Rangitikei	*3.300*	300	*0.003*	80209	*0.928*	*2.372*	*3.297*	okay
	Rang 4c	Porewa	*0.000*	0	*0.000*	0	*0.000*	*0.000*	*0.000*	okay
	Rang 4d	Tutaenui	*0.077*	6647	*0.077*	6647	*0.077*	*0.000*	*0.000*	okay
Whole zone cumulative Rang 4a + Rang 4b + Rang 4c + Rang 4d			*3.300*	86856	*1.005*	86856	*1.005*	*2.295*	*2.295*	okay
Catchment cumulative Rang 1 + Rang 2 + Rang 3 + Rang 4			*3.300*	144746	*1.675*	144746	*1.675*	*1.625*	*1.625*	okay
Whai 1	Whai 1	Upper Whanganui	*10% of MALF*	517	*0.006*	517	*0.006*	*?*	*?*	*?*
Whole zone cumulative Whai 1			*10% of MALF*	517	*0.006*	517	*0.006*	*?*	*?*	*?*
Whai 2	Whai 2a	Cherry Grove	*10% of MALF*	7664	*0.089*	8181	*0.095*	*?*	*?*	*?*
	Whai 2b	Upper Whakapapa	*10% of MALF*	3937	*0.046*	3937	*0.046*	*?*	*?*	*?*
	Whai 2c	Lower Whakapapa	*10% of MALF*	1500	*0.017*	5437	*0.063*	*?*	*?*	*?*
	Whai 2d	Piopioteo	*10% of MALF*	80	*0.001*	80	*0.001*	*?*	*?*	*?*
	Whai 2e	Pungapunga	*10% of MALF*	0	*0.000*	0	*0.000*	*10% of MALF*	*?*	*?*

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	Whai 2f	Upper Ongarue	*10% of MALF*	990	*0.011*	990	*0.011*	*?*	*?*	*?*
	Whai 2g	Lower Ongarue	*10% of MALF*	152	*0.002*	1142	*0.013*	*?*	*?*	*?*
Whole zone cumulative Whai 2a + Whai 2b + Whai 2c + Whai 2d + Whai 2e + Whai 2f + Whai 2g			*10% of MALF*	14323	*0.166*	14840	*0.172*	*?*	*?*	*?*
Catchment cumulative Whai 1 + Whai 2			*10% of MALF*	14840	*0.172*	14840	*0.172*	*?*	*?*	*?*
Whai 3	Whai 3	Te Maire	*10% of MALF*	86	*0.001*	14925	*0.173*	*?*	*?*	*?*
Catchment cumulative Whai 1 + Whai 2 + Whai 3			*10% of MALF*	14925	*0.173*	14925	*0.173*	*?*	*?*	*?*
Whai 4	Whai 4a	Middle Whanganui	*10% of MALF*	0	*0.000*	15496	*0.179*	*?*	*?*	*?*
	Whai 4b	Upper Ohura	*10% of MALF*	571	*0.007*	571	*0.007*	*?*	*?*	*?*
	Whai 4c	Lower Ohura	*10% of MALF*	0	*0.000*	571	*0.007*	*?*	*?*	*?*
	Whai 4d	Retaruke	*10% of MALF*	0	*0.000*	0	*0.000*	*?*	*?*	*?*
Whole zone cumulative Whai 4a + Whai 4b + Whai 4c + Whai 4d			*10% of MALF*	571	*0.007*	15496	*0.179*	*?*	*?*	*?*
Catchment cumulative Whai 1 + Whai 2 + Whai 3 + Whai 4			*10% of MALF*	15496	*0.179*	15496	*0.179*	*?*	*?*	*?*
Whai 5	Whai 5a	Pipiriki	*10% of MALF*	0	*0.000*	15646	*0.181*	*10% of MALF*	*?*	*?*
	Whai 5b	Tangarakau	*10% of MALF*	0	*0.000*	0	*0.000*	*10% of MALF*	*?*	*?*
	Whai 5c	Whangamomona	*10% of MALF*	0	*0.000*	0	*0.000*	*10% of MALF*	*?*	*?*
	Whai 5d	Upper Manganui o te Ao	*N/A*	0	*0.000*	0	*0.000*	*?*	*?*	*?*
	Whai 5e	Makatote River	*N/A*	0	*0.000*	0	*0.000*	*?*	*?*	*?*
	Whai 5f	Waimarino	*5% of 7-day MALF*	0	*0.000*	0	*0.000*	*?*	*?*	*?*
	Whai 5g	Middle Manganui o Te Ao	*5% of 7-day MALF*	0	*0.000*	0	*0.000*	*?*	*?*	*?*
	Whai 5h	Mangaturuturu River	*N/A*	0	*0.000*	0	*0.000*	*?*	*?*	*?*
	Whai 5i	Lower Manganui o te Ao	*5% of 7-day MALF*	0	*0.000*	150	*0.002*	*?*	*?*	*?*

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	Whai 5j	Orautoha	*5% of 7-day MALF*	150	*0.002*	150	*0.002*	*?*	*?*	*?*
Whole zone cumulative Whai 5a + Whai 5b + Whai 5c + Whai 5d + Whai 5e + Whai 5f + Whai 5g + Whai 5h + Whai 5i + Whai 5j			*10% of MALF*	150	*0.002*	15646	*0.181*	*?*	*?*	*?*
Catchment cumulative Whai 1 + Whai 2 + Whai 3 + Whai 4 + Whai 5			*10% of MALF*	15646	*0.181*	15646	*0.181*	*?*	*?*	*?*
Whai 6	Whai 6	Paetawa	*10% of MALF*	0	*0.000*	15646	*0.181*	*10% of MALF*	*?*	*?*
Catchment cumulative Whai 1 + Whai 2 + Whai 3 + Whai 4 + Whai 5 + Whai 6			*10% of MALF*	15646	*0.181*	15646	*0.181*	*?*	*?*	*?*
Whai 7	Whai 7a	Lower Whanganui	*10% of MALF*	369	*0.004*	16015	*0.185*	*?*	*?*	*?*
	Whai 7b	Coastal Whanganui	*10% of MALF*	15	*0.000*	16030	*0.186*	*?*	*?*	*?*
	Whai 7c	Upokongaro	*10% of MALF*	0	*0.000*	0	*0.000*	*10% of MALF*	*?*	*?*
	Whai 7d	Matarawa	*10% of MALF*	0	*0.000*	0	*0.000*	*10% of MALF*	*?*	*?*
Whole zone cumulative Whai 7a + Whai 7b + Whai 7c + Whai 7d			*10% of MALF*	384	*0.004*	16030	*0.186*	*?*	*?*	*?*
Catchment cumulative Whai 1 + Whai 2 + Whai 3 + Whai 4 + Whai 5 + Whai 6 + Whai 7			*10% of MALF*	16030	*0.186*	16030	*0.186*	*?*	*?*	*?*
Whau 1	Whau 1a	Upper Whangaehu	*0.550*	0	*0.000*	46327	*0.536*	*0.014*	*0.550*	okay
	Whau 1b	Waitangi	*0.110*	9165	*0.106*	9165	*0.106*	*0.004*	*0.004*	okay
	Whau 1c	Tokiahuru	*0.480*	37162	*0.430*	37162	*0.430*	*0.050*	*0.050*	okay
Whole zone cumulative Whau 1a + Whau 1b + Whau 1c			*0.550*	46327	*0.536*	46327	*0.536*	*0.014*	*0.014*	okay
Whau 2	Whau 2	Middle Whangaehu	*0.605*	0	*0.000*	46327	*0.536*	*0.069*	*0.605*	okay
Catchment cumulative Whau 1 + Whau 2			*0.605*	46327	*0.536*	46327	*0.536*	*0.069*	*0.069*	okay

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Whau 3	Whau 3a	Lower Whangaehu	*1.470*	1326	*0.015*	69332	*0.802*	*0.668*	*1.455*	okay
	Whau 3b	Upper Makotuku	*0.029*	2506	*0.029*	2506	*0.029*	*0.000*	*0.000*	fully allocated
	Whau 3c	Lower Makotuku	*0.044*	1326	*0.015*	3832	*0.044*	*0.000*	*0.029*	okay
	Whau 3d	Upper Mangawhero	*0.240*	17847	*0.207*	17847	*0.207*	*0.033*	*0.033*	okay
	Whau 3e	Lower Mangawhero	*0.285*	0	*0.000*	21679	*0.251*	*0.034*	*0.285*	okay
	Whau 3f	Makara	*0.000*	0	*0.000*	0	*0.000*	*0.000*	*0.000*	okay
Cumulative Whau 3b + Whau 3f			*0.029*	2506	*0.029*	2506	*0.029*	*0.000*	*0.000*	fully allocated
Cumulative Whau 3b + Whau 3f+ Whau 3c			*0.044*	3832	*0.044*	3832	*0.044*	*0.000*	*0.000*	fully allocated
Whole zone cumulative Whau 3a + Whau 3b + Whau 3c + Whau 3d + Whau 3e + Whau 3f			*1.470*	23005	*0.266*	69332	*0.802*	*0.668*	*1.204*	okay
Catchment cumulative Whau 1 + Whau 2 + Whau 3			*1.470*	69332	*0.802*	69332	*0.802*	*0.668*	*0.668*	okay
Whau 4	Whau 4	Coastal Whangaehu	*1.470*	1320	*0.015*	70652	*0.818*	*0.652*	*1.455*	okay
Catchment cumulative Whau 1 + Whau 2 + Whau 3 + Whau 4			*1.470*	70652	*0.818*	70652	*0.818*	*0.652*	*0.652*	okay
Tura 1	Tura 1a	Upper Turakina	*0.035*	0	*0.000*	0	*0.000*	*0.035*	*0.035*	okay
	Tura 1b	Lower Turakina	*0.145*	0	*0.000*	0	*0.000*	*0.145*	*0.145*	okay
	Tura 1c	Ratana	*10% of MALF*	0	*0.000*	0	*0.000*	*10% of MALF*	*?*	*?*
Whole zone cumulative Tura 1a + Tura 1b + Tura 1c			*0.145*	0	*0.000*	0	*0.000*	*0.145*	*0.145*	okay
Catchment cumulative Tura 1			*0.145*	0	*0.000*	0	*0.000*	*0.145*	*0.145*	okay
Ohau 1	Ohau 1a	Upper Ohau	*0.280*	16000	*0.185*	16000	*0.185*	*0.095*	*0.095*	okay
	Ohau 1b	Lower Ohau	*0.280*	5075	*0.059*	21075	*0.244*	*0.036*	*0.221*	okay

WMZ	Sub-zone	Sub-zone name	Revised core allocation limit	Current allocation in sub-zone only	Current allocation in sub-zone only	Cumulative current allocation within WMZ	Cumulative current allocation within WMZ	Available allocation cumulative	Available allocation	Status
			m^3/s	m^3/day	m^3/s	m^3/day	m^3/s		m^3/s	
Whole zone cumulative Ohau 1a + Ohau 1b			*0.280*	21075	*0.244*	21075	*0.244*	*0.036*	*0.036*	okay
Catchment cumulative Ohau 1			*0.280*	21075	*0.244*	21075	*0.244*	*0.036*	*0.036*	okay
Owha 1	Owha 1	Owahanga	*0.005*	0	*0.000*	0	*0.000*	*0.005*	*0.005*	okay
East 1	East 1	East Coast	*10% of MALF*	0	*0.000*	0	*0.000*	*?*	*?*	*?*
Akit 1	Akit 1a	Upper Akitio	*0.010*	0	*0.000*	0	*0.000*	*0.010*	*0.010*	okay
	Akit 1b	Lower Akitio	*0.030*	1100	*0.013*	2204	*0.026*	*0.004*	*0.017*	okay
	Akit 1c	Waihi	*0.015*	1104	*0.013*	1104	*0.013*	*0.002*	*0.002*	okay
Whole zone cumulative Akit 1a + Akit 1b + Akit 1c			*0.030*	2204	*0.026*	2204	*0.026*	*0.004*	*0.004*	okay
West 1	West 1	Northern Coastal	*10% of MALF*	0	*0.000*	0	*0.000*	*10% of MALF*	*?*	*?*
West 2	West 2	Kai Iwi	*0.045*	132	*0.002*	132	*0.002*	*0.043*	*0.043*	okay
West 3	West 3	Mowhanau	*10% of MALF*	0	*0.000*	0	*0.000*	*10% of MALF*	*?*	*?*
West 4	West 4	Kaitoke Lakes	*POP Rule 15-5*	55	*0.001*	55	*0.001*	*0.000*	*?*	*?*
West 5	West 5	Southern Wanganui Lakes	*POP Rule 15-5*	0	*0.000*	0	*0.000*	*0.000*	*?*	*?*
West 6	West 6	Northern Manawatu Lakes	*POP Rule 15-5*	0	*0.000*	0	*0.000*	*0.000*	*?*	*?*
West 7	West 7	Waitarere	*10% of MALF*	0	*0.000*	0	*0.000*	*10% of MALF*	*?*	*?*
West 8	West 8	Lake Papaitonga	*POP Rule 15-5*	0	*0.000*	0	*0.000*	*0.000*	*?*	*?*
West 9	West 9a	Waikawa	*0.070*	3084	*0.036*	3084	*0.036*	*0.034*	*0.034*	okay
	West 9b	Manakau	*0.005*	0	*0.000*	0	*0.000*	*0.005*	*0.005*	okay
Whole zone cumulative West 9a + West 9b			*0.070*	3084	*0.036*	3084	*0.036*	*0.034*	*0.034*	okay
Hoki 1	Hoki 1a	Lake Horowhenua	*POP Rule 15-5*	0	*0.000*	0	*0.000*	*0.000*	*?*	*?*
	Hoki 1b	Hokio	*10% of MALF*	0	*0.000*	0	*0.000*	*10% of MALF*	*?*	*?*

APPENDIX 2 – SUMMARY TABLE OF NOTIFIED MINIMUM FLOWS VERSUS REVISED RECOMMENDED MINIMUM FLOWS

This table lists the revised minimum flow reconmmendations alongside the notified minimum flow recommendations.

Water Management Zone	Water Management Sub-zone	Notified minimum flow	Revised Minimum flow (m^3/s)	Flow monitoring site
Upper Manawatu (Mana 1)	Upper Manawatu (Mana 1a)	1.600	1.600	Manawatu at Weber Rd
	Mangatewainui (Mana 1b)	1.600	1.600	Manawatu at Weber Rd
	Mangatoro (Mana 1c)	0.702	0.700	Mangatoro at Mangahei Rd
Weber-Tamaki (Mana 2)	Weber-Tamaki (Mana 2a)	1.600	1.600	Manawatu at Weber Rd
	Mangatera (Mana 2b)	1.600	1.600	Manawatu at Weber Rd
Upper Tamaki (Mana 3)	Upper Tamaki (Mana 3)	0.238	0.240	Tamaki at Water Supply Weir
Upper Kumeti (Mana 4)	Upper Kumeti (Mana 4)	0.055	0.055	Kumeti at Te Rehunga
Tamaki-Hopelands (Mana 5)	Tamaki-Hopelands (Mana 5a)	2.980	2.980	Manawatu at Hopelands
	Lower Tamaki (Mana 5b)	0.360	0.360	Tamaki at Stephensons
	Lower Kumeti (Mana 5c)	0.055	2.980	Manawatu at Hopelands
	Oruakeretaki (Mana 5d)	0.293	0.208	Oruakeretaki at S.H.2 Napier
	Raparapawai (Mana 5e)	0.074	0.035	Raparapawai at Jacksons Rd
Hopelands-Tiraumea (Mana 6)	Hopelands-Tiraumea (Mana 6)	2.980	2.980	Manawatu at Hopelands
Tiraumea (Mana 7)	Upper Tiraumea (Mana 7a)	2.140	2.040	Tiraumea at Ngaturi
	Lower Tiraumea (Mana 7b)	2.140	2.040	Tiraumea at Ngaturi
	Mangaone River (Mana 7c)	MALF	2.040	Tiraumea at Ngaturi
	Makuri (Mana 7d)	2.160	1.700	Makuri at Tuscan Hills
	Mangaramarama (Mana 7e)	1.580[13]	2.040	Tiraumea at Ngaturi
Mangatainoka (Mana 8)	Upper Mangatainoka (Mana 8a)	0.400	0.370	Mangatainoka at Larsons Rd
	Middle Mangatainoka (Mana 8b)	1.580	1.305	Mangatainoka at Pahiatua Town Bridge
	Lower Mangatainoka (Mana 8c)	1.580	1.305	Mangatainoka at Pahiatua Town Bridge
	Makakahi (Mana 8d)	0.345	0.320	Makakahi at Hamua

[13] In the notified POP, this Sub-zone was in the Mangatainoka WMZ, and so was tied to the Mangatainoka at Pahiatua town Bridge flow monitoring site.

Water Management Zone	Water Management Sub-zone	Notified minimum flow	Revised Minimum flow (m^3/s)	Flow monitoring site
Upper Gorge (Mana 9)	Upper Gorge (Mana 9a)	10.530	9.175	Manawatu at Upper Gorge
	Mangapapa (Mana 9b)	0.023	0.035	Mangapapa at Troup Road
	Mangaatua (Mana 9c)	MALF	0.070	Mangaatua at Hutchinsons
	Upper Mangahao (Mana 9d)	MALF	1.415	Mangahao at Ballance
	Lower Mangahao (Mana 9e)	MALF	1.415	Mangahao at Ballance
Middle Manawatu (Mana 10)	Middle Manawatu (Mana 10a)	14.160	12.240	Manawatu at Teachers College
	Upper Pohangina (Mana 10b)	2.315	1.960	Pohangina at Mais Reach
	Middle Pohangina (Mana 10c)	1.960	1.960	Pohangina at Mais Reach
	Lower Pohangina (Mana 10d)	1.960	1.960	Pohangina at Mais Reach
	Aokautere (Mana 10e)	MALF	12.240	Manawatu at Teachers College
Lower Manawatu (Mana 11)	Lower Manawatu (Mana 11a)	14.160	12.240	Manawatu at Teachers College
	Turitea (Mana 11b)	0.050	0.050	Turitea at Ngahere Park
	Kahuterawa (Mana 11c)	MALF	0.180	Kahuterawa at Johnsons Rata
	Upper Mangaone Stream (Mana 11d	MALF	0.035	Mangaone at Milson Line
	Lower Mangaone Stream (Mana 11e)	MALF	0.035	Mangaone at Milson Line
	Main Drain (Mana 11f)	MALF	12.240	Manawatu at Teachers College
Oroua (Mana 12)	Upper Oroua (Mana 12a)	1.050	1.005	Oroua at Almadale
	Middle Oroua (Mana 12b)	1.050	1.030	Oroua at Kawa Wool
	Lower Oroua (Mana 12c)	1.050	1.085	Oroua at Awahuri Bridge
	Kiwitea (Mana 12d)	0.145	0.150	Kiwitea at Haynes Line
	Makino (Mana 12e)	0.080	0.075	Makino at Boness Road
Coastal Manawatu (Mana 13)	Coastal Manawatu Mana 13a	12.588	12.240	Manawatu at Teachers College
	Upper Tokomaru (Mana 13b)	12.588	0.240	Tokomaru at S.H.57
	Lower Tokomaru (Mana 13c)	0.220	0.240	
	Mangaore (Mana 13d)	MALF	MALF	
	Koputaroa (Mana 13e)	MALF	12.240	Manawatu at Teachers College
	Foxton Loop (Mana 13f)	MALF	Rule 15-5 applies	
Upper Rangitikei (Rang 1)	Upper Rangitikei (Rang 1)	N/A	N/A	

Water Management Zone	Water Management Sub-zone	Notified minimum flow	Revised Minimum flow (m^3/s)	Flow monitoring site
Middle Rangitikei (Rang 2)	Middle Rangitikei (Rang 2a)	5.250	5.000	Rangitikei at Pukeokahu
	Pukeohahu-Mangaweka (Rang 2b)	12.790	12.250	Rangitikei at Mangaweka
	Upper Moawhango (Rang 2c)	MALF	0.600	Moawhango at Waiouru
	Middle Moawhango (Rang 2d)	MALF	0.600	Moawhango at Moawhango
	Lower Moawhango (Rang 2e)	MALF	0.600	Moawhango at Moawhango
	Upper Hautapu (Rang 2f)	0.745	0.640	Hautapu at Alabasters
	Lower Hautapu (Rang 2g)	0.670	0.640	Hautapu at Alabasters
Lower Rangitikei (Rang 3)	Lower Rangitikei (Rang 3a)	14.550	12.100	Rangitikei at Onepuhi
	Makohine (Rang 3b)	0.036	0.040	Makohine at Viaduct
Coastal Rangitikei (Rang 4)	Coastal Rangitikei (Rang 4a)	10.230	10.230	Rangtikei at McKelvies
	Tidal Rangitikei (Rang 4b)	10.230	10.230	Rangtikei at McKelvies
	Porewa (Rang 4c)	MALF	12.100	Rangtikei at Onepuhi
	Tutaenui (Rang 4d)	MALF	10.230	Rangtikei at McKelvies
Upper Whanganui (Whai 1)	Upper Whanganui (Whai 1)	MALF	MALF	
Cherry Grove (Whai 2)	Cherry Grove (Whai 2a)	MALF	MALF	
	Upper Whakapapa (Whai 2b)	MALF	MALF	
	Lower Whakapapa (Whai 2c)	MALF	MALF	
	Piopioteo (Whai 2d)	MALF	MALF	
	Pungapunga (Whai 2e)	MALF	MALF	
	Upper Ongarue (Whai 2f)	MALF	MALF	
	Lower Ongarue (Whai 2g)	MALF	MALF	
Te Maire (Whai 3)	Te Maire (Whai 3)	MALF	MALF	
`Middle Whanganui (Whai 4)	Middle Whanganui (Whai 4a)	MALF	MALF	
	Upper Ohura (Whai 4b)	MALF	MALF	
	Lower Ohura (Whai 4c)	MALF	MALF	
	Retaruke (Whai 4d)	MALF	MALF	
Pipiriki (Whai 5)	Pipiriki (Whai 5a)	MALF	MALF	
	Tangarakau (Whai 5b)	MALF	MALF	

Water Management Zone	Water Management Sub-zone	Notified minimum flow	Revised Minimum flow (m^3/s)	Flow monitoring site
	Whangamomona (Whai 5c)	MALF	MALF	
	Upper Manganui o te Ao (Whai 5d)	N/A	N/A	
	Makatote (Whai 5e)	N/A	N/A	
	Waimarino (Whai 5f)	N/A	7-day MALF	
	Middle Manganui o te Ao (Whai 5g)	N/A	7-day MALF	
	Mangaturuturu (Whai 5h)	N/A	N/A	
	Lower Manganui o te Ao (Whai 5i)	N/A	7-day MALF	
	Orautoha (Whai 5j)	N/A	7-day MALF	
Paetawa (Whai 6)	Paetawa (Whai 6)	MALF	MALF	
Lower Whanganui (Whai 7)	Lower Whanganui (Whai 7a)	MALF	MALF	
	Coastal Whanganui (Whai 7b)	MALF	MALF	
	Upokongaro (Whai 7c)	MALF	MALF	
	Matarawa (Whai 7d)	MALF	MALF	
Upper Whangaehu (Whau 1)	Upper Whangaehu (Whau 1a)	9.790	8.700	Whangaehu at Karioi
	Waitangi (Whau 1b)	0.475	0.470	Waitangi at Tangiwai
	Tokiahuru (Whau 1c)	4.340	3.840	Tokiahuru at Whangaehu Junction
Middle Whangaehu (Whau 2)	Middle Whangaehu (Whau 2)	MALF	9.650	Whangaehu at Aranui
Lower Whangaehu (Whau 3)	Lower Whangaehu (Whau 3a)	13.240	11.770	Whangaehu at Kauangaroa
	Upper Makotuku (Whau 3b)	0.100	0.095	Makotuku at Below Race Intake
	Lower Makotuku (Whau 3c)	MALF	0.165	Makotuku at Raetihi
	Upper Mangawhero (Whau 3d)	MALF	1.020	Mangawhero at Pakihi Rd
	Lower Mangawhero (Whau 3e)	2.520	2.405	Mangawhero at Ore Ore (NIWA)
	Makara (Whau 3f)	N/A	0.045	Makara at d/s Airstrip
Coastal Whangaehu (Whau 4)	Coastal Whangaehu (Whau 4)	MALF	11.770	Whangaehu at Kauangaroa
Turakina (Tura 1)	Upper Turakina (Tura 1a)	0.345	0.340	Turakina at Otairi Rd
	Lower Turakina (Tura 1b)	0.830	0.805	Turakina at O'Neills Bridge
	Ratana (Tura 1c)	MALF	0.805	Turakina at O'Neills Bridge
Ohau (Ohau 1)	Upper Ohau (Ohau 1a)	0.820	0.820	Ohau at Rongomatane

Water Management Zone	Water Management Sub-zone	Notified minimum flow	Revised Minimum flow (m^3/s)	Flow monitoring site
	Lower Ohau (Ohau 1b)	0.820	0.820	Ohau at Rongomatane
Owahanga (Owha 1)	Owahanga (Owha 1)	0.040	0.030	Owahanga at Branscombe Bridge
East Coast (East 1)	East Coast (East 1)	MALF	MALF	
Akitio (Akit 1)	Upper Akitio (Akit 1a)	MALF	0.045	Akitio at Weber
	Lower Akitio (Akit 1b)	MALF	0.145	Akitio at Mouth
	Waihi (Akit 1c)	MALF	0.050	Waihi at SH52
Northern Coastal (West 1)	Northern Coastal (West 1)	MALF	MALF	
Kai Iwi (West 2)	Kai Iwi (West 2)	0.470	0.445	Kai Iwi at Handley Rd
Mowhanau (West 3)	Mowhanau (West 3)	MALF	MALF	
Kaitoke Lakes (West 4)	Kaitoke Lakes (West 4)	MALF	POP Rule 15-5 applies	
Southern Wanganui Lakes (West 5)	Southern Wanganui Lakes (West 5)	MALF	POP Rule 15-5 applies	
Northern Manawatu Lakes (West 6)	Northern Manawatu Lakes (West 6)	MALF	POP Rule 15-5 applies	
Waitarere (West 7)	Waitarere (West 7)	MALF	MALF	
Lake Papaitonga (West 8)	Lake Papaitonga (West 8)	MALF	POP Rule 15-5 applies	
Waikawa (West 9)	Waikawa (West 9a)	MALF	0.220	Waikawa at North Manakau Rd
	Manakau (West 9b)	MALF	0.040	Manakau at S.H.1 Bridge
Lake Horowhenua (Hoki 1)	Lake Horowhenua (Hoki 1a)	MALF	POP Rule 15-5 applies	
	Hokio (Hoki 1b)	MALF	MALF	

APPENDIX 3 – SUMMARY WATER ALLOCATION FRAMEWORK TABLE WITH MINIMUM FLOW AND CORE ALLOCATION LIMIT EXPLANATIONS

This table sets out the WMZs and Sub-zones with some detail explaining the definition of minimum flows and core allocation limits. It is very similar to the revised Schedule B table, but has added detail.

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Upper Manawatu *(Mana 1)*	Upper Manawatu (Mana 1a)	2	1.600	Upper Manawatu Catchment Water Resource Assessment 90% of habitat at MALF	0.205	Q_{92} (1.804 m^3/s) – minimum flow (1.6 m^3/s) at Manawatu at Weber Rd (Roygard *et al*., 2006)	Manawatu at Weber Rd
	Mangatewainui (Mana 1b)	2	1.600	Upper Manawatu Catchment Water Resource Assessment 90% of habitat at MALF	0.065	30% of MALF at the confluence with the Manawatu River (Roygard *et al*., 2006)	Manawatu at Weber Rd
	Mangatoro (Mana 1c)	2	0.700	Upper Manawatu Catchment Water Resource Assessment 90% of habitat at MALF	0.120	15% of MALF at Mangatoro at Mangahei Rd 0.15 * 0.786 = 0.118 m^3/s	Mangatoro at Mangahei Rd
Whole zone allocable volume *(Mana 1)*					0.205	No more than 0.205 m^3/s may be allocated from this Water Management Zone Q_{92} (1.804 m^3/s) – minimum flow (1.6 m^3/s) at Manawatu at Weber Rd (Roygard *et al*., 2006)	
Weber-Tamaki *(Mana 2)*	Weber-Tamaki (Mana 2a)	2	1.600	Upper Manawatu Catchment Water Resource Assessment 90% of habitat at MALF	0.250	Core allocation for Mana 1 * 1.23 = 0.251 m^3/s (Roygard *et al*., 2006)	Manawatu at Weber Rd
	Mangatera (Mana 2b)	2	1.600	Upper Manawatu Catchment Water Resource Assessment 90% of habitat at MALF	0.045	Core allocation for Mana 1 * 1.23 – core allocation for Mana 1 (0.205 m^3/s *1.23) – 0.205 m^3/s = 0.047 m^3/s (Roygard *et al*., 2006)	Manawatu at Weber Rd
Catchment cumulative allocable volume *(Mana 1 + Mana 2)*					0.250	Mana 1 flows into Mana 2 – no more than 0.250 m^3/s may be allocated above this point in the catchment (Roygard *et al*., 2006)	

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Upper Tamaki (Mana 3)	Upper Tamaki (Mana 3)	2	0.240	Upper Manawatu Catchment Water Resource Assessment 90% of habitat at MALF	0.080	30% of the naturalized MALF for Tamaki at Water Supply Weir (Roygard *et al*., 2006)	Tamaki at Water Supply Weir
Upper Kumeti (Mana 4)	Upper Kumeti (Mana 4)	2	0.055	Upper Manawatu Catchment Water Resource Assessment 90% of habitat at MALF	0.010	15% of MALF at Kumeti at Te Rehunga 0.15 * 0.061 = 0.009 m^3/s	Kumeti at Te Rehunga
Tamaki-Hopelands (Mana 5)	Tamaki-Hopelands (Mana 5a)	2	2.980	Upper Manawatu Catchment Water Resource Assessment 90% of habitat at MALF	0.970	Q_{92} (3.951 m^3/s) – minimum flow (2.980 m^3/s) = 0.971 m^3/s) (Roygard *et al*., 2006)	Manawatu at Hopelands
	Lower Tamaki (Mana 5b)	2	0.360	Upper Manawatu Catchment Water Resource Assessment 90% of habitat at MALF	0.140	Mana 3 flows into Mana 5b (Upper and Lower Tamaki catchment) so the cumulative allocation limit for this point in the Tamaki catchment = 0.138 m^3/s. This is derived by adding the core allocation limit for Mana 3 to the core allocation limit for Mana 5a. (0.078 + 0.060 = 0.138). No more than 0.138 m^3/s can be allocated above this point in the Tamaki River catchment.	Tamaki at Stephensons
	Cumulative allocable volume Mana 3 + Mana 5b				0.140		
	Lower Kumeti (Mana 5c)	2	2.980	Upper Manawatu Catchment Water Resource Assessment 90% of habitat at MALF	0.060	(Roygard *et al*., 2006)	Manawatu at Hopelands
	Cumulative allocable volume Mana 4 + Mana 5c				0.060		
	Oruakeretaki (Mana 5d)	3	0.208	IFIM 70% of habitat at MALF	0.090	Set at current allocation level	Oruakeretaki at S.H.2 Napier
	Raparapawai (Mana 5e)	3	0.035	IFIM 70% of habitat at MALF	0.015	30% of MALF	Raparapawai at Jacksons Road

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Catchment cumulative allocable volume *(Mana 1 + Mana 2 + Mana 3 + Mana 4 + Mana 5)*					0.970	The cumulative allocable volume stated for the downstream point of Mana 5 includes the cumulative allocable volume from the downstream point of Mana 2 and the volumes from Mana 3, 4 and 5 – no more than 0.970 m^3/s may be allocated above this point in the catchment	
Hopelands-Tiraumea (Mana 6)	Hopelands-Tiraumea (Mana 6)	2	2.980	Upper Manawatu Catchment Water Resource Assessment 90% of habitat at MALF	1.050	(Manawatu upstream Tiraumea confluence Q_{92}) - minimum flow) – upstream allocation (Roygard *et al*., 2006)	Manawatu at Hopelands
Catchment cumulative allocable volume *(Mana 1+ Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6)*					1.050	Cumulative allocable volume at the downstream point of Mana 6 includes the cumulative allocable volume from downstream point of Mana 5 plus volume from Mana 6 – no more than 1.049 m^3/s may be allocated above this point in the catchment	Manawatu at Hopelands
Tiraumea (Mana 7)	Upper Tiraumea (Mana 7a)	5b	2.040	MALF 0.460 – 3.700 m^3/s 0.85 * MALF at Tiraumea at Ngaturi 0.85 * 2.400 = 2.040 m^3/s	0.040	10% of MALF at bottom of Mana 7a 0.10 * 0.377 = 0.038 m^3/s	Tiraumea at Ngaturi
	Lower Tiraumea (Mana 7b)	5b	2.040	MALF 0.460 – 3.700 m^3/s Minimum flow to be controlled upstream by Tiraumea at Ngaturi due to lack of appropriate minimum flow monitoring site at the bottom of this Sub-zone 0.85 * MALF at Tiraumea at Ngaturi 0.85 * 2.400 = 2.040 m^3/s	0.270	15% of MALF at Tiraumea at Horopito 0.10 * 2.700 = 0.270 m^3/s	Tiraumea at Ngaturi

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
	Mangaone River (Mana 7c)	5b	2.040	MALF 0.460 – 3.700 m^3/s Minimum flow to be controlled upstream by Tiraumea at Ngaturi due to lack of appropriate minimum flow monitoring site at the bottom of this Sub-zone 0.85 * MALF at Tiraumea at Ngaturi 0.85 * 2.400 = 2.040 m^3/s	0.020	20% of MALF at Mangaone East at Rongomai 0.2 * 0.100 = 0.020 m^3/s	Tiraumea at Ngaturi
	Makuri (Mana 7d)	5b	1.700	MALF 0.460 – 3.700 m^3/s 0.85 * MALF at Makuri at Tuscan Hills 0.85 * 2.000 = 1.700 m^3/s	0.100	0.05 * MALF at Makuri at Tuscan Hills 0.05 * 2.000 = 0.100 m^3/s	Makuri at Tuscan Hills
	Cumulative allocable volume Mana 7a + Mana 7c + Mana 7d				0.100		
	Mangaramarama (Mana 7e)	5b	2.040	MALF 0.460 – 3.700 m^3/s Minimum flow to be controlled upstream by Tiraumea at Ngaturi due to lack of appropriate minimum flow monitoring site at the bottom of this Sub-zone 0.85 * MALF at Tiraumea at Ngaturi 0.85 * 2.400 = 2.040 m^3/s	0.025	20% of MALF at Mangaramarama at Tawera 0.2 * 0.130 = 0.026 m^3/s	Tiraumea at Ngaturi
Whole zone allocable volume *(Mana 7)*					0.270	Cumulative allocation limit of Mana 7b - no more than 0.270 m^3/s may be allocated from this Water Management Zone	Tiraumea at Ngaturi
Mangatainoka (Mana 8)	Upper Mangatainoka (Mana 8a)	5a	0.370	MALF 0.460 – 3.700 m^3/s MALF < 0.460 m^3/s 0.95 * MALF at Mangatainoka at Larsons Rd 0.9 * 0.388 = 0.369 m^3/s	0.020	5% of MALF at Mangatainoka at Larsons Rd 0.5 * 0.388 = 0.019 m^3/s	Mangatainoka at Larsons Rd

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
	Middle Mangatainoka (Mana 8b)	5b	1.305	MALF 0.460 – 3.700 m^3/s 0.85 * MALF at Mangatainoka at Pahiatua Town Bridge 0.85 * 1.535 = 1.305 m^3/s	0.060	10% of MALF at Mangatainoka at Scarsborough Road 0.10 * 0.592 = 0.059 m^3/s	Mangatainoka at Pahiatua Town Bridge
	Lower Mangatainoka (Mana 8c)	5b	1.305	MALF 0.460 – 3.700 m^3/s 0.85 * MALF at Mangatainoka at Pahiatua Town Bridge 0.85 * 1.535 = 1.305 m^3/s	0.305	20% of MALF for Mangatainoka at Pahiatua Town Bridge 0.2 * 1.535 = 1.307 m^3/s	Mangatainoka at Pahiatua Town Bridge
	Makakahi (Mana 8d)	3	0.320	MALF < 0.460 m^3/s 0.95 * MALF at Makakahi at Hamua 0.95 * 0.335 = 0.318 m^3/s	0.015	5% of MALF at Makakahi at Hamua 0.05 * 0.335 = 0.017 m^3/s	Makakahi at Hamua
	Cumulative allocable volume Mana 8a + Mana 8b + Mana 8d				0.305		
Whole zone allocable volume *(Mana 8)*					0.305	Core allocation limit of Mana 8c - no more than 0.305 m^3/s may be allocated from this Water Management Zone	
Catchment cumulative allocable volume *(Mana 7 + Mana 8)*					0.575	Mana 7 and 8 are grouped together to give a cumulative allocable volume at the downstream point of Mana 7 (Mana 8 flows into Mana 7 just above the confluence of the Tiraumea and Mangatainoka with the Manawatu River) – no more than 0.839 m^3/s may be allocated above this point in the catchment	
Upper Gorge (Mana 9)	Upper Gorge (Mana 9a)	5c	9.175	MALF > 3.700 m^3/s 0.8 * MALF for Manawatu at Upper Gorge 0.8 * 11.470 = 9.175 m^3/s	2.295	20% of MALF for Manawatu at Upper Gorge 0.2 * 11.470 = 2.294 m^3/s	Manawatu at Upper Gorge

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
	Mangapapa (Mana 9b)	Existing consent conditions	0.024	IFIM – An instream flow assessment for the Upper Manawatu tributaries[14] (Mangapapa at Oxford Rd of IFIM flow 0.023) Translated downstream to Troup Rd monitoring site	0.015	Existing consent for Woodville water supply	Mangapapa at Troup Road
	Mangaatua (Mana 9c)	5a	0.070	MALF < 0.460 m^3/s 0.95 * MALF at Mangaatua at Hutchinsons 0.95 * 0.075 = 0.072 m^3/s	0.005	5% of MALF at bottom of catchment 0.05 * 0.093 = 0.005 m^3/s (small catchment with no irrigation and has water quality issues)	Mangaatua at Hutchinsons
	Upper Mangahao (Mana 9d)	5b	1.415	MALF 0.460 – 3.700 m^3/s 0.85 * MALF at Mangahao at Ballance 0.85 * 1.665 = 1.415 m^3/s	0.085	5% of MALF at Mangahao at Ballance 0.05 * 1.665 = 0.083 m^3/s	Mangahao at Ballance
	Lower Mangahao (Mana 9e)	5b	1.415	MALF 0.460 – 3.700 m^3/s 0.85 * MALF at Mangahao at Ballance 0.85 * 1.665 = 1.415 m^3/s	0.085	5% of MALF at Mangahao at Ballance 0.05 * 1.665 = 0.083 m^3/s	Mangahao at Ballance
	Cumulative allocable volume Mana 9d + Mana 9e				0.085		
Whole zone allocable volume *(Mana 9)*					2.295	Core allocation limit of Mana 9a - no more than 2.295 m^3/s may be allocated from this Water Management Zone	
Catchment cumulative allocable volume *(Mana 1+ Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9)*					2.295	The cumulative allocable volume at the downstream point of Mana 9 includes all those cumulative allocable volumes for the Water Management Zones upstream – no more than 2.295 m^3/s may be allocated above this point in the catchment	

[14] Bee, 2000

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Middle Manawatu (Mana 10)	Middle Manawatu (Mana 10a)	5c	12.240	MALF > 3.700 m^3/s 0.8 * MALF at Manawatu at Teachers College 0.8 * 15.300 = 12.240 m^3/s	3.060	20% of MALF at Manawatu at Teachers College 0.2 * 15.300 = 3.060 m^3/s	Manawatu at Teachers College
	Upper Pohangina (Mana 10b)	3	1.960	IFIM - Instream flow assessment for the Pohangina River IFIM minimum flow applied to the upper reach of the catchment as discussed by John Hayes and Jon Roygard 90% habitat retention	0.115	5% of MALF at Pohangina at Mais Reach 0.05 * 2.270 = 0.113 m^3/s	Pohangina at Mais Reach
	Middle Pohangina (Mana 10c)	3	1.960	IFIM - Instream flow assessment for the Pohangina River IFIM minimum flow applied to the upper reach of the catchment as discussed by John Hayes and Jon Roygard 90% habitat retention	0.455	20% of MALF for Pohangina at Mais Reach 0.2 * 2.270 = 0.454 m^3/s	Pohangina at Mais Reach
	Lower Pohangina (Mana 10d)	3	1.960	IFIM - Instream flow assessment for the Pohangina River[15]	0.455	Allocation limit carried down the catchment (20% of MALF at Pohangina at Mais Reach)	Pohangina at Mais Reach
	Cumulative allocable volume Mana 10b + Mana 10c + Mana 10d				0.455		
	Aokautere (Mana 10e)	6c	12.240	Monitored from Manawatu at Teachers College as no suitable flow recorder in Aokautere catchment	0.005	15% of MALF at bottom of catchment 0.15 * 0.030 = 0.005 m^3/s (see Consent report for application 102853 Tsao for calculation of MALF statistic)	Manawatu at Teachers College
Whole zone allocable volume *(Mana 10)*					3.060	Core allocation limit of Mana 10a - no more than 3.060 m^3/s may be allocated from this Water Management Zone	

[15] Hay & Hayes, 2006

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Catchment cumulative allocable volume *(Mana 1+ Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 10)*					3.060	Cumulative allocable volume at the downstream point of Mana 10 includes all of those cumulative allocable volumes for the Water Management Zones upstream – no more than 3.060 m^3/s may be allocated above this point in the catchment	
Lower Manawatu (Mana 11)	Lower Manawatu (Mana 11a)	5c	12.240	Managed from Manawatu at Teachers College. MALF > 3.700 m^3/s 0.8 * MALF at Manawatu at Teachers College 0.8 * 15.300 = 12.240 m^3/s	3.890	25% of MALF for Manawatu at Opiki Bridge 0.2 * 15.570 = 3.890 m^3/s	Manawatu at Teachers College
	Turitea (Mana 11b)	6f	0.050	Existing consent conditions for Palmerston North city water supply	0.265	Palmerston North city water supply - 300 l/h/day for 76,000 people – fits within efficient use guidelines (Stewart, 2006)	Turitea at Ngahere Park
	Kahuterawa (Mana 11c)	5a	0.180	MALF < 0.460 m^3/s 0.95 * MALF at Johnsons Rata 0.95 * 0.190 = 0.180 m^3/s	0.010	5% of MALF at bottom of Sub-zone 0.05 * 0.190 = 0.010 m^3/s	Kahuterawa at Johnsons Rata
	Upper Mangaone Stream (Mana 11d	5a	0.035	MALF < 0.460 m^3/s 0.95 * MALF at Mangaone at Milson Line 0.95 * 0.036 = 0.033 m^3/s	0.005	10% of MALF at Mangaone at Milson Line 0.1 * 0.036 = 0.004 m^3/s	Mangaone at Milson Line
	Lower Mangaone Stream (Mana 11e)	5a	0.035	MALF < 0.460 m^3/s 0.95 * MALF at Mangaone at Milson Line 0.95 * 0.036 = 0.033 m^3/s	0.010	15% of MALF at bottom of Sub-zone 0.15 * 0.055 = 0.008 m^3/s	Mangaone at Milson Line
	Cumulative allocable volume Mana 11d + Mana 11e				0.015		
	Main Drain (Mana 11f)	6g	12.240	Default method applies	10% of MALF	Default method applies	Manawatu at Teachers College
Whole zone allocable volume *(Mana 11)*					3.890	No more than 3.890 m^3/s may be allocated from this Water Management Zone	

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Catchment cumulative allocable volume *(Mana 1+ Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 10 + Mana 11)*					3.890	Cumulative allocable volume at the downstream point of Mana 11 includes all of those cumulative allocable volumes for the Water Management Zones upstream – no more than 3.890 m^3/s may be allocated above this point in the catchment	
Oroua (Mana 12)	Upper Oroua (Mana 12a)	3	1.005	IFIM – Instream flow assessment for the Oroua River (80% habitat retention) (Hay, 2009 review update)	0.395	30% of MALF Oroua at Almadale 0.3 * 1.320 = 0.396 m^3/s.	Oroua at Almadale
	Middle Oroua (Mana 12b)	3	1.030	IFIM – Instream flow assessment for the Oroua River (80% habitat retention) (Hay, 2009 review update)	0.405	30% of MALF at Oroua at Kawa Wool 0.3 * 1.355 = 0.406 m^3/s.	Oroua at Kawa Wool
	Lower Oroua (Mana 12c)	3	1.085	IFIM – Instream flow assessment for the Oroua River (80% habitat retention) (Hay, 2009 review update). (Based on 76% of the MALF, as in IFIM/Kawa Wool MALF relationship)	0.430	30% of total of MALF at Oroua at Kawa Wool + MALF at Makino at Boness Road 0.3 * (1.355+ 0.080) = 0.430 m^3/s	Oroua at Awahuri Bridge
	Cumulative allocable volume Mana 12a + Mana 12b + Mana 12c				0.430		
	Kiwitea (Mana 12d)	5a	0.150	MALF < 0.460 m^3/s 0.95 * MALF at Kiwitea at Haynes Line 0.95 * 0.160 = 0.150 m^3/s	0.015	10% of MALF at Kiwitea at Haynes Line 0.1 * 0.160 = 0.016 m^3/s	Kiwitea at Haynes Line
	Makino (Mana 12e)	5a	0.075	MALF < 0.460 m^3/s 0.95 * MALF at Makino at Boness Rd 0.95 * 0.080 = 0.076 m^3/s	0.015	20% of MALF at Makino at Boness Rd 0.2 * 0.080 = 0.016 m^3/s	Makino at Boness Road
Whole zone allocable volume *(Mana 12)*					0.430	Core allocation limit of Mana 12c - no more than 0.430 m^3/s may be allocated from this Water Management Zone	

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Catchment cumulative allocable volume *(Mana 1+ Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 10 + Mana 11 + Mana 12)*					4.320	Cumulative allocable volume at the downstream point of Mana 12 includes all of those cumulative allocable volumes for the Water Management Zones upstream – no more than 3.710 m^3/s may be allocated above this point in the catchment.	
Coastal Manawatu (Mana 13)	Coastal Manawatu Mana 13a	5c	12.240	MLAF > 3.700 m^3/s 0.8 * MALF at Manawatu at Teachers College 0.8 * 15.300 = 12.240 m^3/s	6.930	(MALF of Manawatu at Opiki Bridge 15.570 + MALF of Oroua at Kawa Wool 1.355 + MALF of Makino at Boness Rd 0.080 + Koputaroa at Tavistock Rd 0.030 + Mangaore at d/s of powerstatiuon 0.040 + Tokomaru at SH57 0.250 = 17.325) * 0.40 = 6.930 m^3/s	Manawatu at Teachers College
	Upper Tokomaru (Mana 13b)	5a	0.240	MALF < 0.460 m^3/s 0.95 * MALF at Tokomaru at State Highway 57 Bridge 0.95 * 0.250 = 0.238 m^3/s	0.015	5% of MALF at Tokomaru All 0.05 * 0.250 = 0.015 m^3/s	Tokomaru at SH57
	Lower Tokomaru (Mana 13c)	5a	0.240	MALF < 0.460 m^3/s 0.95 * MALF at Tokomaru at State Highway 57 Bridge 0.95 * 0.250 = 0.238 m^3/s	0.170	catchment area extrapolation using specific yield of 2 $l/s/km^2$ Area Lower Tokomaru = 155.2 km^2: 155.2 * 0.002 = 0.310 m^3/s. This is added to the MALF for the Upper Tokomaru Sub-zone (0.250) 0.310 + 0.250 = 0.560 estimated MALF at bottom of Lower Tokomaru Sub-zone 30% of MALF at bottom of Lower Tokomaru Sub-zone 0.3 * 0.560 = 0.170 m^3/s	
	Cumulative allocable volume Mana 13b + Mana 13c				0.170		

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
	Mangaore (Mana 13d)	6g	MALF	influenced by hydro take – can't get a number	10% of MALF	default method applies	
	Koputaroa (Mana 13e)	5a	12.240	0.8 * MALF at Manawatu at Teachers College 0.8 * 15.300 = 12.240 m^3/s	0.005	20% of MALF at Koputaroa at Tavistock Rd 0.2 * 0.030 = 0.006 m^3/s	Manawatu at Teachers College
	Foxton Loop (Mana 13f)	6g	Rule 15-5 applies	Rule 15-5 applies	Rule 15-5 applies	Rule 15-5 applies	
Whole zone allocable volume *(Mana 13)*					6.930		
Catchment cumulative allocable volume *(Mana 1+ Mana 2 + Mana 3 + Mana 4 + Mana 5 + Mana 6 + Mana 7 + Mana 8 + Mana 9 + Mana 11 + Mana 12 + Mana 13)*					6.930	Cumulative allocable volume at the downstream point of Mana 13 includes all of those cumulative allocable volumes for the Water Management Zones upstream – no more than 7.065 m3/s may be allocated above this point in the catchment.	
Upper Rangitikei (Rang 1)	Upper Rangitikei (Rang 1)	1	N/A	Rangitikei Catchment Water Resource Assessment/NWCO	0.000	NWCO	
Middle Rangitikei (Rang 2)	Middle Rangitikei (Rang 2a)	1	5.000	Rangitikei Catchment Water Resource Assessment/NWCO	0.250	5% of MALF for Rangitikei at Pukeokahu 0.05 * 5.000 = 0.250 m^3/s	Rangitikei at Pukeokahu
	Pukeohahu-Mangaweka (Rang 2b)	3a	12.250	Rangitikei Catchment Water Resource Assessment/NWCO 90% habitat at MALF IFIM (Hay, 2009 review)	0.610	5% of minimum flow (natural flow – NWCO) at Rangitikei at Mangaweka 0.05 * 12.250 = 0.610 m^3/s	Rangitikei at Mangaweka
	cumulative allocable volume (Rang 2a + Rang 2b)				0.610		
	Upper Moawhango (Rang 2c)	6d	0.600	Minimum flow based on residual flow required by conditions of Consent 101279 for Genesis Energy	0.000	No further allocation available after Genesis Energy take	Moawhango at Waiouru

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
	Middle Moawhango (Rang 2d)	6d	0.600	Minimum flow based on residual flow required by conditions of Consent 101279 for Genesis Energy	0.000	No further allocation available after Genesis Energy take	Moawhango at Moawhango
	Lower Moawhango (Rang 2e)	6d	0.600	Minimum flow based on residual flow required by conditions of Consent 101279 for Genesis Energy	0.000	No further allocation available after Genesis Energy take	Moawhango at Moawhango
	Upper Hautapu (Rang 2f)	4	0.640	MALF 0.460 – 3.700 m^3/s 0.85 * MALF at Hautapu at Alabasters 0.85 * 0.750 = 0.638 m^3/s	0.115	15% of MALF at Hautapu at Alabasters 0.15 * 0.750 = 0.113 m^3/s	Hautapu at Alabasters
	Lower Hautapu (Rang 2g)	6a	0.640	MALF 0.460 – 3.700 m^3/s 0.85 * MALF at Hautapu at Alabasters 0.85 * 0.750 = 0.638 m^3/s	0.150	15% of MALF at Hautapu at Toe Toe Rd 0.15 * 0.981 = 0.147 m^3/s	Hautapu at Alabasters
	cumulative allocable volume *(Rang 2f + Rang 2g)*				0.150		
Catchment cumulative allocable volume *(Rang 1 + Rang 2*)					0.610	Rang 1 flows into Rang 2 so a cumulative allocable volume is stated for the downstream point of Rang 2 - no more than 0.670 m^3/s may be allocated above this point in the catchment.	
Lower Rangitikei (Rang 3)	Lower Rangitikei (Rang 3a)	3b	12.100	Rangitikei WRA/IFIM (Hay, 2009) 90% of habitat	1.640	10% of MALF at Rangitikei at Onepuhi 0.10 * 16.400 = 1.640 m^3/s	Rangitikei at Onepuhi
	Makohine (Rang 3b)	5a	0.040	MALF < 0.460 m^3/s 0.95 * MALF at Makohine at Viaduct 0.95 * 0.040= 0.038 m^3/s	0.010	20% of MALF for Makohine at Viaduct 0.2 * 0.040 = 0.008 m^3/s	Makohine at Viaduct
Whole zone allocable volume *(Rang 3)*					1.640	Core allocation limit for Rang 3a - no more than 1.510 m^3/s may be allocated from this Water Management Zone	

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Catchment cumulative allocable volume *(Rang 1 + Rang 2 + Rang 3)*					1.640	Rang 2 flows directly into Rang 3 so the cumulative allocable volume at the downstream point of Rang 3 includes the cumulative allocable volume at the downstream point of Rang 2 plus the volume from Rang 3 - no more than 1.150 m3/s may be allocated above this point in the catchment	
Coastal Rangitikei (Rang 4)	Coastal Rangitikei (Rang 4a)	3a	10.230	IFIM (Hay, 2009) recommended 10.200 m^3/s but current number of existing consents in this Sub-zone means it is appropriate to retain the original WRA recommendation. Rangtikei at McKelvies	2.475	15% of MALF at Rangitikei at McKelvies 0.15 * 16.500 = 2.475 m^3/s	Rangtikei at McKelvies
	Tidal Rangitikei (Rang 4b)	3a	10.230	IFIM (Hay, 2009) recommended 10.200 m^3/s but current number of existing consents in this Sub-zone means it is appropriate to retain the original WRA recommendation. Rangtikei at McKelvies	3.300	20% of MALF at Rangitikei at McKelvies 0.20 * 16.500 = 3.300 m^3/s	Rangtikei at McKelvies
	Porewa (Rang 4c)	6a	12.100	Rangitikei WRA/IFIM (Hay, 2009) 90% of habitat Rangitikei at Onepuhi	0.000	20% of MALF at Porewa at Onepuhi Rd 0.2 * 0.000 = 0.000 m^3/s	Rangtikei at Onepuhi
	Tutaenui (Rang 4d)	6f	10.230	Based on nearest relevant flow recorder – Rangitikei at McKelvies	0.077	water supply dam in headwaters. Core allocation limit set at current allocation, which includes some small takes.	Rangtikei at McKelvies
Whole zone allocable volume *(Rang 4)*					3.300		
Catchment cumulative allocable volume *(Rang 1 + Rang 2 + Rang 3 + Rang 4)*					3.300	Rang 4's cumulative allocable volume includes the volume from Rang 3 plus the volume from Rang 4 - no more than 6.410 m3/s may be allocated above this point in the catchment	

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Upper Whanganui (Whai 1)	Upper Whanganui (Whai 1)	6e	MALF	Genesis Energy (TPD) Env. Court consent conditions	10% of MALF	Default method applies	
Whole zone allocable volume *(Whai 1)*					10% of MALF		
Cherry Grove (Whai 2)	Cherry Grove (Whai 2a)	6e	MALF	Genesis Energy (TPD) Env. Court consent conditions	10% of MALF	Default method applies	
	Upper Whakapapa (Whai 2b)	6e	MALF	Genesis Energy (TPD) Env. Court consent conditions	10% of MALF	Default method applies	
	Lower Whakapapa (Whai 2c)	6e	MALF	Genesis Energy (TPD) Env. Court consent conditions	10% of MALF	Default method applies	
	Piopioteo (Whai 2d)	6e	MALF	Genesis Energy (TPD) Env. Court consent conditions	10% of MALF	Default method applies	
	Pungapunga (Whai 2e)	6e	MALF	Genesis Energy (TPD) Env. Court consent conditions	10% of MALF	Default method applies	
	Upper Ongarue (Whai 2f)	6e	MALF	Genesis Energy (TPD) Env. Court consent conditions	10% of MALF	Default method applies	
	Lower Ongarue (Whai 2g)	6e	MALF	Genesis Energy (TPD) Env. Court consent conditions	10% of MALF	Default method applies	
Whole zone allocable volume *(Whai 2)*					10% of MALF		
Catchment cumulative allocable volume *(Whai 1 + Whai 2)*					10% of MALF		
Te Maire (Whai 3)	Te Maire (Whai 3)	6e	MALF	Genesis Energy (TPD) Env. Court consent conditions	10% of MALF	Default method applies	
Catchment cumulative allocable volume *(Whai 1 + Whai 2 + Whai 3)*					10% of MALF		
`Middle Whanganui (Whai 4)	Middle Whanganui (Whai 4a)	6e	MALF	Default method applies	10% of MALF	Default method applies	
	Upper Ohura (Whai 4b)	6e	MALF	Default method applies	10% of MALF	Default method applies	
	Lower Ohura (Whai 4c)	6e	MALF	Default method applies	10% of MALF	Default method applies	

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
	Retaruke (Whai 4d)	6e	MALF	Default method applies	10% of MALF	Default method applies	
Whole zone allocable volume *(Whai 3)*					10% of MALF		
Catchment cumulative allocable volume *(Whai 1 + Whai 2 + Whai 3 + Whai 4)*					10% of MALF		
Pipiriki (Whai 5)	Pipiriki (Whai 5a)	6e	MALF	Default method applies	10% of MALF	Default method applies	
	Tangarakau (Whai 5b)	6e	MALF	Default method applies	10% of MALF	Default method applies	
	Whangamomona (Whai 5c)	6e	MALF	Default method applies	20% of MALF	Default method applies	
	Upper Manganui o te Ao (Whai 5d)	1	N/A	NWCO – First Schedule (a)	0.000		
	Makatote (Whai 5e)	1	N/A	NWCO – First Schedule (b)	0.000		
	Waimarino (Whai 5f)	1	7-day MALF	NWCO – Second Schedule (b)	5% of 7-day MALF	5% of 7-day MALF	
	Middle Manganui o te Ao (Whai 5g)	1	7-day MALF	NWCO – Second Schedule (a)	5% of 7-day MALF	5% of 7-day MALF	
	Mangaturuturu (Whai 5h)	1	N/A	NWCO – First Schedule (b)	0.000		
	Lower Manganui o te Ao (Whai 5i)	1	7-day MALF	NWCO – Second Schedule (a)	5% of 7-day MALF	5% of 7 day MALF	
	Orautoha (Whai 5j)	1	7-day MALF	NWCO – Second Schedule (b)	5% of 7-day MALF	5% of 7 day MALF	
Whole zone allocable volume *(Whai 5)*					10% of MALF		
Catchment cumulative allocable volume *(Whai 1 + Whai 2 + Whai 3 + Whai 4 + Whai 5)*					10% of MALF		

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Paetawa (Whai 6)	Paetawa (Whai 6)	6e	MALF	Default method applies	10% of MALF	Default method applies	
Catchment cumulative allocable volume *(Whai 1 + Whai 2 + Whai 3 + Whai 4 + Whai 5 + Whai 6)*					10% of MALF		
Lower Whanganui (Whai 7)	Lower Whanganui (Whai 7a)	6e	MALF	Default method applies	10% of MALF	Default method applies	
	Coastal Whanganui (Whai 7b)	6e	MALF	Default method applies	10% of MALF	Default method applies	
	Upokongaro (Whai 7c)	6e	MALF	Default method applies	10% of MALF	Default method applies	
	Matarawa (Whai 7d)	6e	MALF	Default method applies	10% of MALF	Default method applies	
Whole zone allocable volume *(Whai 7)*					10% of MALF		
Catchment cumulative allocable volume *(Whai 1 + Whai 2 + Whai 3 + Whai 4 + Whai 5 + Whai 6 + Whai 7)*					10% of MALF		
Upper Whangaehu (Whau 1)	Upper Whangaehu (Whau 1a)	5c	8.700	MALF > 3.700 m^3/s 0.8 * MALF at Whangaehu at Karioi (naturaised)[16] 0.8 * 10.879 = 8.703 m^3/s	0.550	5% of MALF (non-naturalised) at Whangaehu at Karioi 0.05 * 10.960 = 0.548 m^3/s	Whangaehu at Karioi
	Waitangi (Whau 1b)	6a	0.470	MALF 0.460 – 3.700 m^3/s 0.85 * MALF at Waitangi at Tangiwai 0.85 * 0.550 = 0.468 m^3/s	0.110	20% of MALF at Waitangi at Tangiwai 0.2 * 0.550 = 0.110 m^3/s	Waitangi at Tangiwai
	Tokiahuru (Whau 1c)	5b	3.840	MALF > 3.700 m^3/s 0.8 * MALF Tokiahuru at Whangaehu Junction 0.8 * 4.800 = 3.840 m^3/s	0.480	10% of MALF at Tokiahuru at Whangaehu Junction 0.1 * 4.800 = 0.480 m^3/s	Tokiahuru at Whangaehu Junction

[16] Henderson & Diettrich, 2007 p. 182

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Whole zone allocable volume *(Whau 1)*					0.550	Core allocation limit for Whau 1a – no more than 0.550 m^3/s may be allocated above this point in the catchment	
Middle Whangaehu (Whau 2)	Middle Whangaehu (Whau 2)	5c	9.650	MALF > 3.700 m^3/s 0.8 * MALF at Whangaehu at Aranui (naturalised)[17] 0.8 * 12.066 = 9.650 m^3/s	0.605	5% of naturalised MALF at Whangaehu at Aranui 0.05 * 12.066 = 0.603 m^3/s	Whangaehu at Aranui
Catchment cumulative allocable volume *(Whau 1 + Whau 2)*					0.605	Whau 1 flows into Whau 2, so a cumulative allocable volume applies for the downstream point of Whau 2 - no more than the core allocation limit for Whau 2 may be allocated above this point in the catchment	
Lower Whangaehu (Whau 3)	Lower Whangaehu (Whau 3a)	5c	11.770	MALF > 3.700 m^3/s 0.8 * MALF at Whangaehu at Kaungaroa 0.8 * 14.710[18] = 11.770 m^3/s	1.470	10% of naturalised MALF at Whangaehu at Kaungaroa 0.10 * 14.710 = 1.470 m^3/s	Whangaehu at Kauangaroa
	Upper Makotuku (Whau 3b)	3	0.095	IFIM (Hay update 2009) based on MALF of 0.116 m^3/s at Makotuku at SH49a 70% habitat retention	0.029	Based on existing allocation in the Sub-zone excluding NZ Energy diversion (Policy 6-16b)	Makotuku at Below Race Intake
	Lower Makotuku (Whau 3c)	6b	0.165	MALF < 0.460 m^3/s 0.95 * MALF at Makotuku at Raetihi 0.95 * 0.175 = 0.165 m^3/s	0.044	Based on existing allocation in the Sub-zone excluding NZ Energy diversion (Policy 6-16b)	Makotuku at Raetihi
	Upper Mangawhero (Whau 3d)	6a	1.080	MALF 0.460 – 3.700 m^3/s 0.9 * MALF at Mangawhero at Pakihi Rd 0.9 * 1.200 = 1.080 m^3/s	0.240	20% of MALF at Mangawhero at Pakihi Rd 0.2 * 1.200 = 0.240 m^3/s	Mangawhero at Pakihi Rd

[17] Simulated natural MALF at Whangaehu at Karioi for post-TPD diversion = 10.960 m^3/s (Henderson & Diettrich, 2007) (data record July-1979 – July 2003); non-naturalised MALF for same period of data record = 8.244 m^3/s (Henderson & Diettrich, 2007); 10.960 minus 8.244 = 2.716 m^3/s. This is added to the non-naturalised MALF at Whangaehu at Aranui (9.350 m^3/s) to estimate a naturalised MALF for the site; 9.350 + 2.716 = 12.066 m^3/s.

[18] Henderson & Diettrich (2007); p 194

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
	Lower Mangawhero (Whau 3e)	5b	2.545	MALF 0.460 – 3.700 m^3/s 0.9 * MALF at Mangawhero at Ore Ore 0.9 * 2.830 = 2.547 m^3/s	0.285	10% of MALF at Mangawhero at Ore Ore 0.1 * 2.830= 0.283 m^3/s	Mangawhero at Ore Ore (NIWA)
	Makara (Whau 3f)	3	0.047	Based on naturalised MALF for Makara above NZ Energy weir of 0.060 m^3/s IFIM 70% habitat retention	0.000	Based on existing allocation in the Sub-zone excluding NZ Energy diversion (Policy 6-16b)	Makara at d/s Airstrip
	cumulative allocable volume *(Whau 3b + Whau 3f)*				0.029		
	cumulative allocable volume *(Whau 3b + Whau 3f + Whau 3c)*				0.044		
Whole zone allocable volume (Whau 3)					1.470	Core allocation limit for Whau 3a – no more than 1.470 m^3/s may be allocated above this point in the catchment	
Catchment cumulative allocable volume *(Whau 1 + Whau 2 + Whau 3)*					1.470	Whau 2 flows into Whau 3 so the cumulative allocable volume stated at the downstream point of Whau 3 includes the volume stated for the downstream point of Whau 2 plus the allocable volume of Whau 3 - no more than 1.470 m^3/s may be allocated above this point in the catchment	
Coastal Whangaehu (Whau 4)	Coastal Whangaehu (Whau 4)	5c	12.195	MALF 0.460 – 3.700 m^3/s 0.9 * MALF at Whangaehu at Kauangaroa 0.9 * 13.550 = 12.195 m^3/s	1.470	10% of naturalised MALF at Whangaehu at Kaungaroa 0.10 * 14.710 = 1.470 m^3/s	Whangaehu at Kauangaroa

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Catchment cumulative allocable volume *(Whau 1 + Whau 2 + Whau 3 + Whau 4)*					1.470	Whau 4's cumulative allocable volume includes the volume from the downstream point of Whau 3 plus the volume for Whau 4 - no more than the core allocation limit for Whau 4 may be allocated above this point in the catchment	
Turakina (Tura 1)	Upper Turakina (Tura 1a)	5b	0.325	MALF 0.460 – 3.700 m^3/s 0.9 * MALF at Turakina at Otairi Rd 0.9 * 0.360 = 0.324 m^3/s	0.035	10% of MALF at Turakina at Otairi Rd 0.1 * 0.370 = 0.037 m^3/s	Turakina at Otairi Rd
	Lower Turakina (Tura 1b)	5b	0.805	MALF 0.460 – 3.700 m^3/s 0.85 * MALF at Turakina at O'Neills Bridge 0.85 * 0.950 = 0.805 m^3/s	0.145	15% of MALF at Turakina at O'NeillsBridge 0.15 * 0.950 = 0.143 m^3/s	Turakina at O'Neills Bridge
	Ratana (Tura 1c)	6g	0.805	Turakina at O'Neills Bridge nearest flow recorder for monitoring	10% of MALF	Default method applies	Turakina at O'Neills Bridge
Whole zone allocable volume *(Tura 1)*					0.145	Core allocation limit for Tura 1b - no more than 0.145 m^3/s may be allocated from this Water Management Zone	
Ohau (Ohau 1)	Upper Ohau (Ohau 1a)	2	0.820	Ohau Catchment Water Resource Assessment	0.280	Ohau Catchment Water Resource Assessment	Ohau at Rongomatane
	Lower Ohau (Ohau 1b)	2	0.820	Ohau Catchment Water Resource Assessment[19]	0.280	Ohau Catchment Water Resource Assessment	Ohau at Rongomatane
Whole zone allocable volume *(Ohau 1)*					0.280	Core allocation limit for Ohau 1b - no more than 0.260 m^3/s may be allocated from this Water Management Zone	
Catchment cumulative allocable volume *(Ohau 1)*					0.280		

[19] Horizons Regional Council Environmental Information Team (2003)

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Owahanga (Owha 1)	Owahanga (Owha 1)		0.030	MALF < 0.460 m^3/s 0.95 * MALF at Owahanga at Branscombe Bridge 0.95 * 0.030 = 0.030 m^3/s	0.005	0.2 * MALF at Owahanga at Branscombe Bridge 0.2 * 0.029 = 0.006 m^3/s	Owahanga at Branscombe Bridge
East Coast (East 1)	East Coast (East 1)	6g	MALF	default method applies	10% of MALF	10% of MALF	
Akitio (Akit 1)	Upper Akitio (Akit 1a)	5a	0.045	MALF < 0.460 m^3/s 0.95 * MALF at Akitio at Weber 0.95 * 0.047 = 0.045 m^3/s	0.010	0.25 * MALF at Akitio at Weber 0.25 * 0.047 = 0.009 m^3/s	Akitio at Weber
	Lower Akitio (Akit 1b)	6c	0.145	MALF < 0.460 m^3/s 0.95 * MALF at Akitio at Mouth 0.95 * 0.150 = 0.143 m^3/s	0.030	0.20 * MALF at Akitio at Mouth 0.05 * 0.150 = 0.030 m^3/s	Akitio at Mouth
	Waihi (Akit 1c)	6c	0.050	MALF < 0.460 m^3/s 0.95 * MALF at Waihi at SH52 0.95 * 0.050 = 0.048 m^3/s	0.015	0.25 * MALF at Waihi at SH52 0.25 * 0.050 = 0.013 m^3/s	Waihi at SH52
Whole zone allocable volume *(Akit 1a + Akit 1b + Akit 1c)*					0.030		
Northern Coastal (West 1)	Northern Coastal (West 1)	6g	MALF	Default method applies	10% of MALF	Default method applies	
Kai Iwi (West 2)	Kai Iwi (West 2)	5b	0.400	MALF 0.460 – 3.700 m^3/s 0.85 * MALF at Kai Iwi at Handley Road 0.85 * 0.470 = 0.400 m^3/s	0.045	0.1 * MALF Kai Iwi at Handley Road 0.1 * 0.470 = 0.047 m^3/s	Kai Iwi at Handley Rd
Mowhanau (West 3)	Mowhanau (West 3)	6g	MALF	Default method applies	10% of MALF	Default method applies	
Kaitoke Lakes (West 4)	Kaitoke Lakes (West 4)	4b	POP Rule 15-5 applies	POP Rule 15-5 applies	POP Rule 15-5 applies	POP Rule 15-5 applies	
Southern Wanganui Lakes (West 5)	Southern Wanganui Lakes (West 5)	4b	POP Rule 15-5 applies	POP Rule 15-5 applies	POP Rule 15-5 applies	POP Rule 15-5 applies	

Water Management Zone	Water Management Sub-zone	Scenario	Minimum flow (m^3/s)	Minimum flow explanation	Core allocation limit (m^3/s)	Core allocation limit explanation	Flow monitoring site
Northern Manawatu Lakes (West 6)	Northern Manawatu Lakes (West 6)	4b	POP Rule 15-5 applies	POP Rule 15-5 applies	POP Rule 15-5 applies	POP Rule 15-5 applies	
Waitarere (West 7)	Waitarere (West 7)	6g	MALF	Default method applies	10% of MALF	Default method applies	
Lake Papaitonga (West 8)	Lake Papaitonga (West 8)	4b	POP Rule 15-5 applies	POP Rule 15-5 applies	POP Rule 15-5 applies	POP Rule 15-5 applies	
Waikawa (West 9)	Waikawa (West 9a)	6a	0.220	MALF < 0.460 m^3/s 0.95 * MALF at Waikawa at North Manakau Rd 0.95 * 0.230 = 0. 0.218 m^3/s	0.070	30% of MALF at Waikawa at North Manakau Rd 0.3 * 0.230 = 0.069 m^3/s	Waikawa at North Manakau Rd
	Manakau (West 9b)	5a	0.040	MALF < 0.460 m^3/s 0.95 * MALF at Manakau at S.H.1 Bridge 0.95 * 0.040 = 0.038 m^3/s	0.005	10% of MALF at Manakau at S.H.1 Bridge 0.1 * 0.040 = 0.004 m^3/s	Manakau at S.H.1 Bridge
Whole zone allocable volume *(West 1a + West 1b)*					0.070		
Lake Horowhenua (Hoki 1)	Lake Horowhenua (Hoki 1a)	4b	POP Rule 15-5 applies	POP Rule 15-5 applies	POP Rule 15-5 applies	POP Rule 15-5 applies	
	Hokio (Hoki 1b)	6g	MALF	Default method applies	10% of MALF	Default method applies	

APPENDIX 4 – NATIONAL WATER CONSERVATION ORDERS

THE NATIONAL WATER CONSERVATION (MANGANUI O TE AO RIVER) ORDER 1988

1. Title and Commencement

(1) This order may be cited as the National Water Conservation (Manganui o te Ao River) Order 1988.

(2) This order shall come into force on the 14th day after the date of its notification in the Gazette.

2. Interpretation

In this order, unless the context otherwise requires:

"Act" means the Water and Soil Conservation Act 1967;

"normal flow" at any point in a river or stream means:

- the actual flow rate at that point, plus
- any abstractions or diversions from the river or stream and its tributaries upstream of that point, less
- any discharges into the river or stream or its tributaries upstream of that point, except that no account shall be taken of discharges into the Orautoha Stream at or about map reference NZMS 260 S20:057014 in accordance with the notified use authorising the Raetihi Power Scheme;

"minimum flow" at any point in a river or stream means the mean of the annual minima of the 7 day flow, as estimated by the Rangitikei-Wanganui Catchment Board, where "7 day flow" means the mean flow over any 7 day period.

3. Outstanding Characteristics and Features

It is hereby declared that the Manganui o te Ao River and its tributaries, the Mangaturuturu and Makatote Rivers and the Waimarino and Orautoha Streams, include and provide for:

a. outstanding wild and scenic characteristics;

b. an outstanding wildlife habitat for the blue duck or whio (Hymenolaimus malacorhynchos);

c. and outstanding recreational fishery.

4. Retention of Natural Waters in a Natural State

Because of the outstanding characteristics and features specified in clause 3 of this order, the quantity and rate of flow of natural water in the waters described in the First Schedule to this order shall be retained in their natural state.

5. Partial Retention of Natural Waters

Because of the outstanding characteristics and features specified in clause 3 of this order the rate of flow of the natural waters in the waters described in the Second Schedule to this order shall not:

a. differ from the normal flow by more than 5 percent;

b. fall below the minimum flow.

6. Right to Dam not to be Granted

A right to dam any of the bodies of water specified in the First and Second Schedules to this order shall not be granted under Sections 21 or 23 of the Act.

7. Water Rights and General Authorisations for Discharges

(1) No water rights under Sections 21 or 23 of the Act shall be granted by the National Water and Soil Conservation Authority or by the Regional Water Board (as appropriate) and no general authorisations under Section 22 of the Act shall be made by the Regional Water Board for any discharge into any part of the catchment of the Manganui o te Ao River if the effect of the discharge would be either to cause the waters described in the First and Second Schedules of this order to breach the provisions and standards set out below or (should those waters fail to meet these provisions and standards), to cause the water condition in those waters to deviate further from compliance with these provisions and standards.

After allowing for reasonable mixing of the discharge with the receiving water:

i. the water temperature shall be less than 25 degrees Celsius in the months of October to April inclusive, and shall be less than 13 degrees Celsius in the months of May to September inclusive, and within that range the natural water temperature shall not be changed by more than 3 degrees Celsius;

ii. the acidity or alkalinity of the water as measured by the pH shall be within the range 6.0 to 9.0, and within that range the natural pH of the water shall not be changed by more than 1.0 unit;

iii. the water shall not be tainted so as to be unpalatable or unsuitable for consumption by humans or farm animals;

iv. the water shall not emit an objectionable odour;

v. there shall be no adverse effect on the aquatic community attributable to pollutants;

vi. aquatic organisms shall not be rendered unsuitable for human consumption by accumulation of excessive concentrations of pollutants;

vii. the natural colour and clarity of the waters shall not be changed to a conspicuous extent;

viii. there shall be no visible oil or grease films or conspicuous floating or suspended waste materials;

ix. the concentration of dissolved oxygen shall exceed 80 percent of saturation concentration;

x. there shall be no undesirable biological growths attributable to pollutants.

(2) No water rights under Sections 21 or 23 of the Act shall be granted by the National Water and Soil Conservation Authority or by the Regional Water Board (as appropriate), and no general authorisations under Section 22 of the Act shall be made by the Regional Water Board in respect of any part of the catchment of the Manganui o te Ao River where the effect of such rights or authorisations would be that the provision of this order cannot remain without change or variation **provided that** water rights may be made in respect of any part of those waters for any of the following purposes:

i. research into, and enhancement of, fisheries and wildlife habitats;

ii. the maintenance or protection of roads, bridges and other necessary public utilities;

iii. soil conservation works undertaken pursuant to the Soil Conservation and Rivers Control Act 1941.

8. Scope of this Order

Nothing in this order shall be construed as limiting the effect of the second proviso to Section 21(1) of the Act relating to the use of water for domestic needs, for the needs of animals and for or in connection with firefighting purposes.

FIRST SCHEDULE

a. The Manganui o te Ao River upstream of its confluence with the Waimarino Stream.

b. The Makatote River and the Mangaturuturu River.

SECOND SCHEDULE

a. The Manganui o te Ao River downstream of its confluence with the Waimarino Stream.

b. The Waimarino and Orautoha Streams.

THE WATER CONSERVATION (RANGITIKEI RIVER) ORDER 1993

1. Title and Commencement

(1) This order may be cited as the Water Conservation (Rangitikei River) Order 1993.

(2) This order shall come into force on the 28th day after the date of its notification in the Gazette.

2. Interpretation

In this order, unless the context otherwise requires:

"Act" means the Resource Management Act 1991:

"Middle River" means-

a. The Rangitikei River itself from its confluence with the Makahikatoa Stream (approximate map reference Infomap 260 U21:725-888) to the Mangarere Bridge (approximate map reference Infomap 260 T22:483-496); and

b. The Whakaurekau River plus all its tributaries and the Kawhatau River plus its following tributaries, namely, the Pouranaki River and the Mangakokeke Stream:

"River flow" means for any given point on the Middle River and Upper River-

a. The mean daily flow occurring at that point; plus

b. The sum of abstractions from the Upper and Middle River upstream of that given point expressed as a daily mean, but not including any abstraction from the Moawhango River at the Moawhango Dam (approximate map reference Infomap 260 T20:471-962) for hydro-electric power generation purposes:

"Upper River" means-

a. The Rangitikei River itself from its source (approximate map reference Infomap 260 U19:723-313) to its confluence with the Makahikatoa Stream (approximate map reference Infomap 260 U21:725-888); and

b. All rivers and streams contributing water to the Rangitikei River upstream of that confluence.

3. Outstanding Characteristics and Features

(1) It is hereby declared that the Upper River includes and provides for-

a. Outstanding wild and scenic characteristics; and
b. Outstanding recreational, fisheries, and wildlife habitat features.

(2) It is hereby declared that the Middle River includes and provides for-

a. Outstanding scenic characteristics; and
b. Outstanding recreational and fisheries features.

4. Waters to be Protected

Because of the outstanding characteristics and features specified in clause 3 of this order, the waters of the Upper River and Middle River are, subject to clause 5 of this order, to be protected as follows:

a. The quantity and rate of flow of natural water in the Upper River shall be retained in its natural state;

b. The rate of flow of the natural waters at any point in the Middle River shall not be less than 95% of the river flow at that point;

c. Resource consents under the Act shall not be granted to dam the Upper River or the Middle River;

d. Resource consents under the Act shall not be granted to construct any dam downstream of the Middle River, which has the effect of impounding water in the Middle River upstream of the confluence with the Hautapu River.

e. In granting any resource consents under the Act or making a rule in a regional plan, in respect of the Upper River or the Middle River, the regional council shall ensure that, after allowing for reasonable mixing of the discharge with the receiving water-

i. The natural water temperature shall not be changed by more than 3 degrees Celsius; and
ii. The acidity or alkalinity of the water as measured by the pH shall be within the range of 6.0 to 9.0; and within that range the natural pH of the water shall not be changed by more than 1.0 unit; and
iii. The concentration of dissolved oxygen shall be not less than 80 percent of saturation concentration; and
iv. There shall be no undesirable biological growths attributable to contaminants.

5. Scope of Order

(1) Nothing in this order shall be construed as limiting any right to the use of water for domestic needs, for the needs of animals, and for or in connection with fire-fighting purposes.

(2) Nothing in this order shall prevent the renewal of any general authorisation granted under Section 22 of the Water and Soil Conservation Act 1967 and deemed to be a provision of a regional plan under Section 368 of the Act, or any resource consent under the Act which is current on the commencement of this order, or the granting of resource consents under the Act in substitution for existing use rights which are current on the commencement of this order.

(3) Nothing in this order shall prevent the granting of resource consents under the Act, or the making of rules in regional plans, in respect of the Upper River or the Middle River, for the purposes of-

a. Research into, and enhancement of, fisheries and wildlife habitats; or
b. Maintenance and protection of roads, bridges, and other necessary public utilities; or
c. Soil conservation, rivers control, or other activities undertaken pursuant to the Soil Conservation and Rivers Control Act 1941.

(4) Nothing in this order shall prevent the granting of resource consents under the Act for the construction of any dam downstream from the Middle River which has the effect of impounding water in the Middle River as far upstream as the confluence with the Hautapu River.

Explanatory Note
This note is not part of the order, but is intended to indicate its general effect.

This order, which comes into force 28 days after its notification in the Gazette, declares-

a. The waters of the Upper Rangitikei River-

i. To have outstanding wild and scenic characteristics; and
ii. To have outstanding recreational, fisheries, and wildlife habitat features; and

b. The waters of the Middle Rangitikei River-

i. To have outstanding scenic characteristics; and
ii. To have outstanding recreational and fisheries features.

The order specifies how the waters are to be protected and the limitations of the protection.